# Newsweek's Environmental Impact Disclosure Scores of the US S&P 500: Trials and Tribulations

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# Introduction

Policy literature often cites information disclosure as an efficacious vehicle for environmental corporate responsibility.[1] Companies that inform citizens of environmental degradation are motivated to practice good environmental stewardship in the face of citizen mobilization. A good example of institutionalized disclosure policy is the Toxics Release Inventory program in which firms are legally obligated to disclose what kinds of chemicals are released into the nearby environment. The information is collected in an online database where citizens can see what kinds of chemicals are released in a particular zip code, and in what concentrations. In many cases, firms will voluntarily disclose aspects of environmental harm they have caused, either formally on a website or informally as per request. Providing the public with this information equips a firm with the motivation to continuously hone in on the best possible environmental practices.

The goal of this project is to parse out the effects of various firm attributes on information disclosure. Using data collected on firm size, capitalization, environmental management, environmental impact, and industry type, a tobit model is used to assess the effects of these attributes on disclosure score given by Newsweek Green Rankings for companies in the U.S. Standard and Poor's 500.

# Data & Variables

To measure the correlation between a company's environmental disclosure and its environmental impact, management and other variables, we used Newsweek's 2012 Green Rankings of the US S&P 500 companies and supplementary information from Mergent Online Database.[2] Disclosure, impact, and management ratings are explained below, followed by the other explanatory variables included in our model. The company profile information from Mergent is from year 2011 to capture the state of the company before the Green Scores were calculated. Each of the three former variables from Newsweek's ratings are calculated using data from the third-party environmental research consultants Trucost and Sustainalytics. Short descriptions of the rank calculations are provided here while more detailed descriptions are outlined in Appendix A. Our other variables: number of employees, total assets, firm age, net income, and stockholders' equity all come from the Mergent Online Database for the S&P 500.[3] All variables are discussed in more detail below, including the expected sign and magnitude for each of the explanatory variables.

**Environmental Disclosure Score:** The dependent variable is measured on a 100-point scale with higher numbers indicating higher rates of disclosure. Newsweek describes the process for calculation as follows:

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[1] Kraft et al. 2011

[2] Newsweek Green Rankings.
http://www.thedailybeast.com/newsweek/2012/10/22/newsweek-green-rankings-2012-u-s-500-list.html

[3] Mergent Online Database. http://www.mergentonline.com/basicsearch.php.

> Trucost's component of the Environmental Disclosure Score reflects the proportion of environmental impacts a company is disclosing out of those which are relevant to its business operations. Nuclear waste, for example, would be among those considered material for some utility companies, but would not be directly relevant to companies in other sectors. Disclosure for each type of impact is weighted by its corresponding environmental-damage cost to determine the degree to which a company is reporting on its most material environmental impacts.
>
> Sustainalytics' component of this score assesses the breadth and quality of company environmental reporting, as determined by the level of involvement in key transparency initiatives. These include the Global Reporting Initiative and Carbon Disclosure Project.[4]

**Environmental Impact Score:** A company's Impact Score is measured on a 100-point scale with higher numbers indicating a higher environmental impact, i.e. a larger "footprint". It is based on data compiled by Trucost, and is measured based on more than 700 metrics, including emissions of nine greenhouse gases, water use, solid-waste disposal, and emissions that contribute to acid rain and smog. These scores are normalized for sector since some sectors are inherently more emissive and wasteful than others. Newsweek describes the calculation process below:

> Trucost uses publicly disclosed environmental data to evaluate company performance for each impact metric whenever possible, and uses a proprietary economic input-output model to calculate direct-company and supply-chain impacts in cases where data is unavailable. Also, Equity investment under management is also considered for each company: if a firm owns a percentage of an oil-and-gas company, for example, they are apportioned the impact associated with that percentage, consistent with the latest accounting and reporting standards.[5]

We expect the coefficient on impact to be negative, perhaps strongly so. Theoretically, a company with a higher environmental impact is less likely to voluntarily disclose environmental impact information in order to avoid mobilization from informed parties and thus a recommended or dictated change to their emissions or management practices.

**Environmental Management Score:** A company's Environmental Management Score is measured on a 100-point scale with a higher rating indicating that its company-wide policies, management systems and certifications are better aligned with best practices for its industry. The management of environmental performance is measured by policies, programs, targets, certifications, etc. Sustainalytics focuses on three distinct spheres of influence: company operations, contractors and suppliers, and products and services. An

[4] Newsweek Green Rankings Full Methodology (see Appendix A)
[5] Newsweek Green Rankings Full Methodology (see Appendix A)

analysis of positive performance-related criteria is counterbalanced by a detailed assessment of environmental controversies and incidents, which often indicate the extent to which management systems are effectively implemented. The calculations are based on a dozen core environmental indicators supplemented by more than 40 sector-specific indicators addressing issues like biodiversity protection, water use, hazardous-waste reduction, supply-chain initiatives, etc.

We expect this variable to have a strong positive coefficient because a firm that engages in good environmental management is more likely to disclose that information to maintain positive public relations.

I**ndustry sectors:** We include twenty different intercept dummies for industry sector. It is difficult to assess the impact of each specific industry in turn since there are twenty. Additionally, there is probably not much variation between firms within certain industries in terms of environmental stewardship and disclosure (like telecommunications, transport and logistics, vehicles and components, financials, aerospace and defense) while others, like consumer goods, food and beverage, hotels and restaurants, retailers, and textiles, may exhibit great variation between firms in terms of disclosure, environmental management, and environmental impact. We thus leave the interpretation of these open in terms of the sign and magnitude, but we generally expect that industries that are resource intensive and produce a lot of waste (manufacturing, materials, industrial goods, utilities), are less likely to report than industries that don't. However, industries that aren't resource intensive or waste producing (financials, media and publishing, real estate) may not report as much merely because they don't feel that reporting is necessary for public relations or that it applies to their operations. Finally, consumer good industries (food and beverage, hotel and restaurant, apparel, and retailers) are also more likely to disclose environmental impact because they are more visible to the public and thus more likely to be held accountable for environmental transgressions.

We omit industry sector 5: Food, Beverage, and Tobacco from our regression to use as our baseline sector because the impact, management and disclosure scores for this sector all lie near the average for all the sectors. The industry dummies are defined below:

1. Aerospace and Defense
2. Consumer Goods
3. Energy
4. Financials
5. Food, Beverage & Tobacco
6. Healthcare
7. Hotels and Restaurants
11. Media and Publishing
12. Professional Services
13. Real Estate
14. Retailers
15. Technology Equipment
16. Telecommunications
17. Textiles Apparel and Luxury Goods

8. Industrial Goods
9. Information Technology & Services
10. Materials
18. Transportation and Logistics
19. Utilities
20. Vehicles and Components

**Number of employees:** These data were obtained for each S&P 500 company from the Mergent Online Database. Although we do expect considerable variation, we suspect that larger companies may have higher disclosure scores because they are more visible to the public eye and are therefore more likely to be held accountable. We use this variable as a level in the first regression but as a ratio over total assets in the second regression. We do this because we expect a somewhat high degree of collinearity between number of employees (a rough measure of firm size) to the three capitalization variables: total assets, stockholders' equity, and net income (also rough measures of firm size). Expressing the employees variable as a ratio over total assets transforms the variable into a labor to capital ratio rather than the proxy for firm size we expect it serves as a level. Included as a ratio in the regression, we still expect a positive relationship--a company with a high percentage of labor to capital may be more exposed to scrutiny from employees in terms of environmental stewardship.

**Total assets:** This variable, also taken from the Mergent Online database, is a measure of firm capitalization. While we expect some degree of collinearity with number of employees (larger firms tend to be more capitalized), we expect there to be enough difference in capital to labor ratios between sectors to justify including both variables. In other words, there are likely many companies that are highly capitalized but do not require much human labor to operate, and vice versa. We expect this variable to have a weakly positive coefficient for the same reasons expressed above. Highly capitalized firms are more exposed to public scrutiny. We expect the coefficient to be small because disclosure as a function of firm size is probably dependent on sector (for reasons mentioned above), and probably subject to a high degree of variation.

**Firm age:** We expect firm age (in years) to have a negative coefficient because younger firms may be more likely to want to build and maintain good public relations while more established firms may feel less threatened by the prospect of bad publicity in the form of poor management, impact, and disclosure ratings from Newsweek.

**Net income:** We run two regressions with net income expressed as a level in the first and net income expressed as a ratio over total assets in the second. Again, we do this because we expect a high degree of collinearity between net income, stockholders' equity, and total assets. Expressing net income as a ratio of total assets establishes a measure of rate of return, or, how profitable are investments in the firm, which is a more differentiated measure from the other capitalization variables than net income as a level. We expect this variable to have a weakly negative coefficient because in general, firms with a higher rate of return on investment may be less concerned with their environmental reputation if they can command

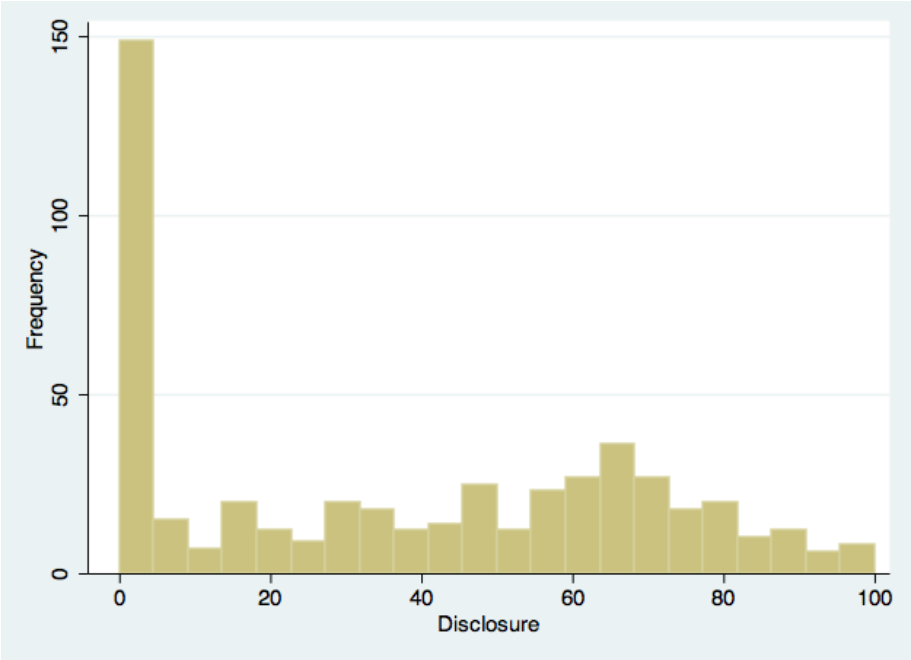
a high level of investment anyway. The strength of this effect is ambiguous, however, and likely subject to variation, so the magnitude of the coefficient may not be very high.

**Stockholders' equity:** Stockholders equity is also expressed as a level in the first regression and as a ratio over total assets in the second regression for the same reason mentioned above. Since equity is the total value of a firm less the debt owed on it, then the equity to total asset ratio is an inverse measure of debt: if the equity to total assets ratio is 1/4, then 3/4 of the firms total assets is debt to external parties. The coefficient on stockholders' equity could go either way, but we have reason to believe it will be positive. A company with a lower amount of debt (and thus a higher stockholders' equity ratio) has fewer shareholders to answer to in terms of environmental responsibility. If shareholders are interested in environmental responsibility, than a higher amount of debt (i.e. lower equity) would mean stockholders equity would have a negative coefficient. However, it is more likely that shareholders are interested in their rates of return rather than environmental stewardship. Since profitability often comes at the expense of environmental preservation, it is more likely that higher levels of equity over total assets (and thus lower amounts of debt) would result in higher levels of environmental stewardship and disclosure.

## Choosing a Model

Our original instinct was to use an ordered probit model given our assumptions that the disclosure score metric was discrete and ordinal. A closer look at the observations lead us to believe otherwise. Below is a histogram depicting the frequency of observations:

```
. histogram Disclosure, frequency
(bin=22, start=0, width=4.5454545)
```




Well over one hundred observations have disclosure scores of zero, meaning that these companies are not at all transparent about their practices and environmental impact. There are only a few firms in each integer bin, and only one firm with a disclosure score of 100. This sparse distribution poses problems for the estimation of coefficients of an ordered probit model. We simply do not have enough information for higher disclosure ratings to yield accurate coefficients.

Furthermore, upon a closer look at individual observations disclosure scores using Stata's `tabulate` command, we find that the scores are expressed as numbers ranging from 0 to 100, but are not integer values as originally expected; scores take values to the tenths place. We therefore take the data to be sufficiently continuous for our purposes. We conclude that the tobit estimator may be more appropriate given the censored and relatively continuous disclosure score data. There is little theory to inform further transformations of explanatory variables (quadratic, log-linearized, etc.). The choice of a tobit estimator, in any case, limits these modifications relative to using ordinary least squares. As for the consideration of an ordered probit estimator, a sample regression has been included in Appendix B.

Another aspect worth mentioning is that since the Newsweek Green Rankings describes the management score as "an assessment of how a company manages its environmental performance through policies, programs, targets, certifications, and the like," we are concerned that the disclosure scores and the management scores may be contingent upon similar factors. However, the fact that Newsweek uses these three scores to calculate their overall Green Score gives us some confidence that there is not so much overlap between these three categories that including Impact and Management as regressors will cause problems of endogeneity. We considered tackling the endogeneity problem by solving for the three scores separately in a simultaneous reduced form system. However, since we do not have any quantitative information that informs one of the equations but not the other two, the system is unidentified and we cannot proceed to a solution. This issue is considered further in our discussion as a substantial roadblock to accurate results.

We are also concerned with collinearity between net income, stockholders' equity, total assets, and number of employees because these can all be interpreted as measures of a firm's size, we obtained a correlation matrix as well as a VIF table. The correlation matrix is shown below while the more detailed VIF tables for both these variables in both levels and ratios is provided in Appendix C.

```
. corr Net_Income Stockholders_Equity Total_Assets No__of_employees
(obs=480)
```

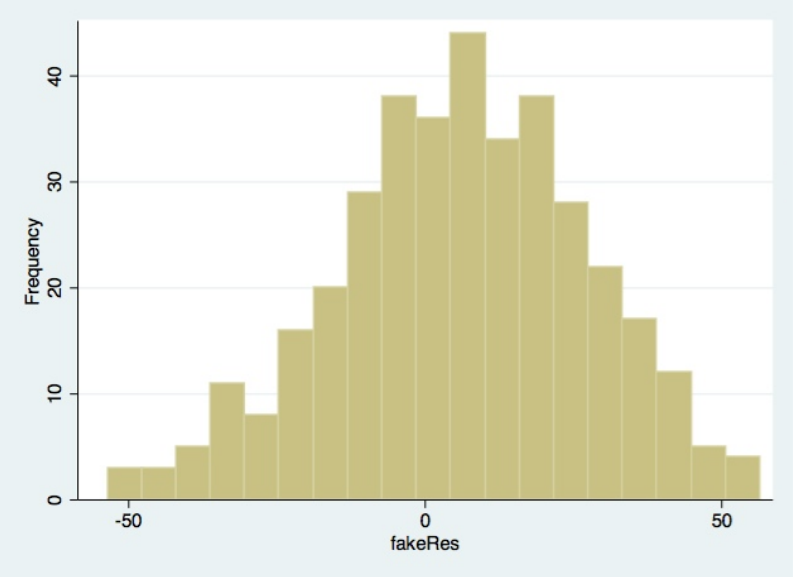
| | Net_In~e | Stockh~y | Total_~s | No__of~s |
|---|---|---|---|---|
| Net_Income | 1.0000 | | | |
| Stockholde~y | 0.7110 | 1.0000 | | |
| Total_Assets | 0.4282 | 0.8292 | 1.0000 | |
| No__of_emp~s | 0.3760 | 0.3372 | 0.2337 | 1.0000 |

There is a high degree of collinearity between stockholders' equity and net income, and between total assets and stockholders' equity. In light of this result, we conclude that modifying equity and net income and number of employees as ratios to total assets is an appropriate measure. Indeed, running the VIF table for number of employees, stockholders' equity, and net income all expressed as ratios over total assets indicates that transforming the variables into ratios corrects for this high level of correlation.

An additional concern is potential bi-directional causality between disclosure, impact, and management. To explore this, we also run two additional tobit regressions using impact and management as dependent variables with disclosure as an independent variable.

Once we have settled on a functional form, we plot the frequency distribution of our

residuals to check that they are normally distributed:




```
. histogram fakeRes if Disclosure > 0, frequency
(bin=19, start=-53.535019, width=5.7905645)

. sktest fakeRes if Disclosure > 0
```

Skewness/Kurtosis tests for Normality

| | | | | joint | |
|---|---|---|---|---|---|
| Variable | Obs | Pr(Skewness) | Pr(Kurtosis) | adj chi2(2) | Prob>chi2 |
| fakeRes | 373 | 0.1147 | 0.4653 | 3.03 | 0.2196 |

Our residuals appear to be evenly distributed and pass the skewness and kurtosis tests for normality, so we proceed with our tobit model.

## Results

We were interested in whether the coefficients differed with and without the addition of the industry sector dummies because we were mostly concerned that their omission (or inclusion) would affect the number of employees, assets, equity, and net income variables. These variables expressed either as a level or as a ratio over total assets are likely to vary *between* sectors but not much *within* sectors, so we are interested in whether the addition or omission of the industry dummies affects the coefficients that we expect to be similar for firms within a given sector. We are also interested in how our results change when we express net income, stockholder equity, and number of employees as levels or as ratios to total assets. We expect these coefficients to be more significant when expressed as ratios since they become more differentiated metrics rather than all being proxies for firm size when they are expressed as levels. With these two considerations in mind, we ran four regressions. The first expresses the aforementioned variables expressed as levels and includes the industry sector dummies. The second model uses the levels but omits the industry dummies. The third model uses the relevant variables expressed as ratios and includes the sector dummies. The fourth model expresses the aforementioned variables as ratios and omits the sector dummies. The fifth model removes the net income, stockholders' equity, total assets, and number of employees from the regression. The results are shown on the following page.

| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Impact Score | -0.348 | -0.735 | -0.327 | -0.685 | -0.247 |
| | (0.098)** | (0.069)** | (0.100)** | (0.070)** | (0.094)** |
| Management Score | 1.666 | 1.406 | 1.721 | 1.473 | 1.759 |
| | (0.098)** | (0.092)** | (0.097)** | (0.091)** | (0.095)** |
| Age | 0.062 | 0.049 | 0.084 | 0.066 | 0.095 |
| | (0.030)* | (0.031) | (0.031)** | (0.031)* | (0.030)** |
| # Employees | 1.711 | 0.808 | | | |
| | (1.109) | (1.125) | | | |
| Net Income | 0.629 | 0.648 | | | |
| | (0.509) | (0.530) | | | |
| Stockholders' Equity | 0.084 | 0.172 | | | |
| | (0.123) | (0.127) | | | |
| Total Assets | -0.011 | -0.003 | 0.005 | 0.015 | |
| | (0.012) | (0.012) | (0.007) | (0.006)* | |
| Employee to Assets Ratio | | | -21.208 | -47.474 | |
| | | | (28.499) | (25.091) | |
| Income to Assets Ratio | | | -14.916 | -39.235 | |
| | | | (23.488) | (24.003) | |
| Equity to Assets Ratio | | | 0.254 | -4.514 | |
| | | | (6.779) | (6.534) | |
| Aerospace & Defense | 6.395 | | 7.821 | | 7.341 |
| | (9.412) | | (9.524) | | (9.553) |
| Consumer Goods | -7.707 | | -7.751 | | -8.344 |
| | (7.850) | | (7.987) | | (7.986) |
| Energy | 20.288 | | 23.431 | | 25.436 |
| | (7.155)** | | (7.189)** | | (6.984)** |
| Financials | 12.515 | | 10.375 | | 11.098 |
| | (7.154) | | (7.382) | | (6.621) |
| Healthcare | -8.597 | | -8.261 | | -8.800 |
| | (6.951) | | (7.113) | | (6.914) |
| Hotels & Restaurants | 3.270 | | 8.653 | | 5.675 |
| | (8.705) | | (9.610) | | (8.757) |
| Industrial Goods | -6.703 | | -6.786 | | -6.828 |
| | (6.639) | | (6.822) | | (6.663) |
| IT & Services | -14.093 | | -11.711 | | -14.129 |
| | (8.397) | | (8.623) | | (8.380) |
| Materials | 14.724 | | 14.291 | | 16.736 |
| | (6.427)* | | (6.537)* | | (6.451)** |
| Media & Publishing | -17.031 | | -17.040 | | -18.255 |
| | (8.871) | | (8.972) | | (8.909)* |
| Professional Services | -15.464 | | -15.099 | | -17.931 |
| | (10.260) | | (10.602) | | (10.411) |
| Real Estate | -15.921 | | -17.849 | | -17.839 |
| | (12.527) | | (12.760) | | (12.839) |
| Retailers | -13.828 | | -10.926 | | -11.769 |
| | (7.275) | | (7.435) | | (7.113) |
| Technology Equipment | -16.471 | | -15.980 | | -19.385 |
| | (7.241)* | | (7.482)* | | (7.209)** |
| Telecommunications | -0.626 | | -1.430 | | -1.010 |
| | (11.035) | | (11.104) | | (10.907) |
| Textiles/Apparel/Luxury | -13.682 | | -11.284 | | -12.279 |
| | (9.537) | | (9.968) | | (9.368) |
| Transportation & Logistics | 11.775 | | 11.464 | | 13.812 |
| | (8.065) | | (8.197) | | (7.898) |
| Utilities | 16.846 | | 16.033 | | 19.471 |
| | (6.760)* | | (6.948)* | | (6.848)** |
| Vehicles & Components | -20.586 | | -18.462 | | -26.300 |
| | (9.739)* | | (9.822) | | (9.606)** |
| Constant | -39.908 | -6.238 | -42.210 | -5.212 | -50.548 |
| | (8.877)** | (6.887) | (9.383)** | (7.116) | (8.664)** |
| Constant (*sigma*) | 23.506 | 25.607 | 23.795 | 25.752 | 24.174 |
| | (0.889)** | (0.974)** | (0.901)** | (0.980)** | (0.898)** |
| *N* | 476 | 476 | 476 | 476 | 495 |
| *Pseudo* $R^2$ | 0.1065 | 0.0871 | 0.1038 | 0.0862 | 0.0993 |

* $p<0.05$; ** $p<0.01$ | Sector Reference Group: Food, Beverage & Tobacco

There are several things to note. Most interestingly, the energy and utilities dummies are significant and positive, meaning they differ significantly from the reference industry sector Food, Beverage, and Tobacco. The materials sector dummy, among others, is also weakly significant and positive.

That the energy, utilities, and materials sectors have strongly positive intercepts is likely the result of the high degree of regulation and public scrutiny. Energy companies are specifically targeted because of the large amounts of negative publicity they receive surrounding global warming and resource extraction. Chemical/materials companies are on the public radar due to major focusing events like The Love Canal and various other highly publicized chemical poisoning incidents in surrounding communities that have lead to policies like the Toxics Release Inventory, in which case they are legally obligated to disclose which probably also influences the positive coefficient (Layzer, 2002).

The technology and equipment sector dummy, as well as the vehicles and components sector dummies, are negative and weakly significant. Negative coefficients for the sector dummies indicates that the average firm in this sector is likely to have a lower Disclosure score than the average firm in the Food, Beverage, and Tobacco industry. These sorts of manufacturing industries are perfect examples of firms that produce a lot of waste and are resource intensive, but are not as visible to the public radar as energy and chemical companies. Without a high degree of public pressure, resource and waste intensive industries have little incentive to disclose information about their environmental impact.

Age is positive and significant for Models 1, 3, 4, and 5. This is contrary to our expectations that younger firms are more likely to practice good environmental stewardship and thus more readily disclose environmental impact. Perhaps older, more established firms are not as threatened by the prospect of bad publicity from poor environmental practices so they more freely disclose impact information. An alternative explanation is that since they have been subject to public pressure or formal requests for information disclosure, this has influenced disclosure practices in the long run.

The impact and management variables are always significant and are robust to changes in functional form. They also have the expected signs and reasonable magnitudes. An increase in impact score corresponds to a decrease in disclosure scores across all four models (although with varying magnitudes). An increase in management score corresponds to an increase in disclosure score by greater than one point across all four models. This makes sense since theoretically, firms that spend more on environmental management want to express this environmental responsibility as much as possible to the public for good publicity. While the significance of impact and management could indicate that these effects actually do have an effect on disclosure rates, it should be noted that disclosure, impact, and management are all three variables calculated by Trucost and Sustainalytics. It is possible

that the manner in which these variables are calculated influences their correlation. We address this endogeneity further in the Discussion.
Secondly, when stockholders' equity, number of employees, total assets, and net income expressed as levels, they are not individually significant in any model (except for total assets in Model 4), but F-tests indicate that they are jointly significant in Models 1, 2, and 4, meaning that while they are not individually significant in affecting disclosure rates, at least one is significantly different from zero, or that the combined effect captures something that is not expressed in a single variable.

Expressed as ratios, these variables are also not individually significant for any model, but they are jointly significant when sector dummies are omitted. This outcome supports our suspicion that these variables vary *between* sectors but not *within* sectors. Thus, the sector dummies account for these "fixed effects" which is why the ratio coefficients are significant only when the sector dummies are omitted. More detailed summaries of each model are given below.

Finally, it should be noted that assets, equity, and net income are expressed in units of billions of dollars, and employees are expressed in increments of hundred thousands.

**Model 1: Levels with industry dummies**
The tobit using our levels of income, equity, and number of employees and including the industry sector dummy variables does not produce significant individual p-values for the leveled variables. An F-test confirms that we reject the joint hypothesis at the 5% level that these stock variables are significantly different from zero (Prob > F = 0.0149).

```
. test No__of_employees Net_Income Stockholders_Equity Total_Assets

 ( 1)  [model]No__of_employees = 0
 ( 2)  [model]Net_Income = 0
 ( 3)  [model]Stockholders_Equity = 0
 ( 4)  [model]Total_Assets = 0

       F(  4,   450) =    3.12
            Prob > F =    0.0149
```

In order to determine whether the inclusion of industry sector dummy variables is of value, we conduct a F-test, with the following results:

```
F( 19,   450) =    4.28
     Prob > F =    0.0000
```

We reject the null hypothesis that industry sector coefficients are all zero at the 1% level of significance and thus proceed under the assumption that at least one of the industry dummies is different from the reference Food, Beverage, and Tobacco sector.

**Model 2: Levels without industry dummies**

We are interested in seeing how the exclusion of the industry sector dummy variables affects the significance of the firm size variables. As discussed in the previous model, we are suspicious that much of the variation might be captured by the industry sector dummies. We ran the tobit regression without sector dummies, used an F-test to see if there might be multicollinearity between our measures of size: net income, stockholders' equity, number of employees, and total assets. We can reject the null hypothesis of the F-test that these coefficients are all zero. This gives us reason to believe that these measures should be included in the regression even if the effects are too closely related to see the individual impact. The results of our previous VIF tables indicate that transforming these variables into ratios might yield higher individual t-statistics since they become less collinear.

```
. test No__of_employees Net_Income Stockholders_Equity Total_Assets

 ( 1)  [model]No__of_employees = 0
 ( 2)  [model]Net_Income = 0
 ( 3)  [model]Stockholders_Equity = 0
 ( 4)  [model]Total_Assets = 0

       F(  4,   469) =    6.09
            Prob > F =    0.0001
```

**Model 3: Ratio variables with industry dummies**

Using ratios (all with total assets as the denominator) instead of levels corrects for the collinearity we saw before. Instead of multiple redundant measures of firm size, *ratio_income* now measures the profitability of investments in the firm, *ratio_equity* now measures the proportion of total assets that are not liability (i.e. inverse leverage), and *ratio_employ* now measures the labor intensiveness of the firm relative to total assets. We can't reject the null joint hypothesis that the coefficients of the ratio measures of labor-intensity, inverse leverage, and profitability are equal to zero. We suspect that the industry variables take explanatory power from these measures. This aligns with our assumption that industry sector matters, i.e. that firms have Disclosure scores similar to the other firms in their industry. In contrast to results from Model 2, this gives us reason to include the industry dummies but omit the three ratios and the total assets variables since neither the t-statistics nor the F-statistics are significant.

```
. test ratio_employ ratio_equity ratio_income Total_Assets

 ( 1)  [model]ratio_employ = 0
 ( 2)  [model]ratio_equity = 0
 ( 3)  [model]ratio_income = 0
 ( 4)  [model]Total_Assets = 0

       F(  4,   450) =    0.46
            Prob > F =    0.7685
```

**Model 4: Ratio variables without industry dummies**

Pulling the industry sector dummies out of the tobit regression with the ratios in lieu of level measures (as in Model 3.), also yields statistically weak coefficients for the ratio variables, although the individual t-statistics do improve relative to the model that includes the industry dummies (which coincides with our expectation that industry sector dummies take explanatory power away from these variables since we expect them to vary between industries but not within industries). We reject the joint null hypothesis of the F-test at the 1% level that the coefficients of the three ratio measures and Total Assets proxies for the size of the firm are all equal to zero (Prob > F = 0.0005).

```
. test ratio_employ ratio_equity ratio_income Total_Assets

 ( 1)  [model]ratio_employ = 0
 ( 2)  [model]ratio_equity = 0
 ( 3)  [model]ratio_income = 0
 ( 4)  [model]Total_Assets = 0

       F(  4,   469) =    5.06
            Prob > F =    0.0005
```

**Model 5: Industry sector dummies**

Based on the results of Model 3, we also ran a regression that excluded the employee, income, equity, and total assets variables entirely. In this model, Impact and Management are statistically significant as they are in every other model. Age of the firm is significant at the 1% level as well.

## Discussion and Concluding Remarks

There is one glaring problem with endogeneity in our model that deserves considerable discussion. We suspect that there exists bi-directional causality between disclosure, management, and impact. Indeed, if we run regressions using any one as the dependent variable and the others as independent variables (as well as the sector dummy variables and we find that disclosure significantly affects impact but not management, and that disclosure

also affects management but not impact. In short, disclosure exhibits bi-directional causality with both impact and management but impact and management (surprisingly) don't affect each other. We would ideally correct for this endogeneity by identifying the equations within a simultaneous equation system and running a two stage probit regression, but our equations are not identified: there are no variables that describe any one of the three endogenous variables that aren't also included in the equations for our other endogenous variables. Had we more time, we would collect observations for all 500 units of data to construct strong instruments with which to identify our simultaneous system of three equations. This is the most important next step. Until then, we must conclude that the effects of management and impact on disclosure are ambiguous at best, and must be taken with ample quantities of salt.

Another problem with the disclosure regression is that the error term is not expected to be constant for each sector. Some sectors might have more flexibility in the amount they can or typically disclose in terms of environmental practices by law. In addition, the management score is calculated on a variety of sector-specific metrics, contributing to the variance of each sector is inherently different. Thus further analysis of the model would entail a test for heteroskedasticity of the error term, and using robust standard errors if necessary to correct for the inefficiency, which would require knowledge of what the analogous robustness corrections for tobit are. Preliminary research on this topic did not yield productive results, and so we have decided to leave investigations of a robust tobit model to further research. Included in Appendix B is an ordered probit regression with robust standard errors. We also included the tobit model with the "robust" option, although we were not able to find the theoretical derivation for how the standard errors are calculated, and so did not run this option in our results for this paper.

The results of our research otherwise would have interesting political implications. Most interestingly, it appears that industries intensive in waste and resources (which are theoretically subject to higher degrees of regulation and public scrutiny, like materials, energy, and utilities companies) are more likely to disclose environmental impact information than resource and waste intensive industries that are not subject to as much regulation and bad publicity. This implies that public mobilization has a positive effect on disclosure ratings which in turn provide the incentive for firms to improve their environmental management. In light of this, it would be an interesting area of further study to explore the lagged effects of disclosure rates on environmental management to see if disclosure effectively mobilizes interest groups to pressure firms into minimizing their environmental impact. In this study, management and disclosure scores are calculated in the same year but there is still worry about bi-directional causality between management, impact, and disclosure because company behavior would tend to move all in the same direction.

## References

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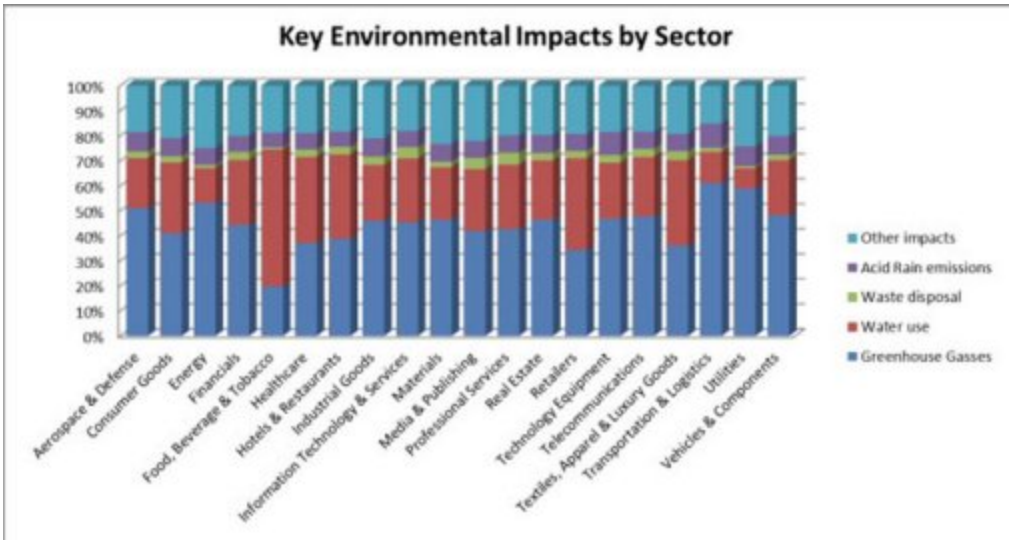
Newsweek Green Rankings Full Methodology. http://www.thedailybeast.com/newsweek/2012/10/22/newsweek-green-rankings-2012-full-methodology.html

# Appendix A: Detailed Green Score Descriptions[6]

**Impact:**

Based on data compiled by Trucost, the Environmental Impact Score (EIS) is a comprehensive, quantitative, and standardized measurement of the overall environmental impact of a company's global impacts. This score includes hundreds of metrics—covering greenhouse gas emissions, water use, solid waste disposal, and emissions that contribute to acid rain and smog, among others. The figure below highlights the contribution of each impact category to the total environmental footprint of each industry sector.




To calculate the EIS, the quantity of each environmental impact is first established using high quality global data, when available, from public reports or directly from the company. In the absence of comprehensive provided data, the environmental impacts are calculated using Trucost's economic input/output model (described further here).

Each impact is then multiplied by an environmental cost, and all the costs are summed to establish a total environmental cost for the company.

For the Green Rankings, the environmental costs used are average global values that reflect the marginal damage cost from each environmental input or output (i.e. for each gallon of water consumed or ton of carbon emitted) established by Trucost from valuation studies in the professional and academic literature. Typically, Trucost would apply more specific damage costs that reflect local geographies (higher environmental costs in areas that are more water scarce, for example). However, since many companies do not provide the geographical distribution for their operations we cannot apply them consistently across the research universe.

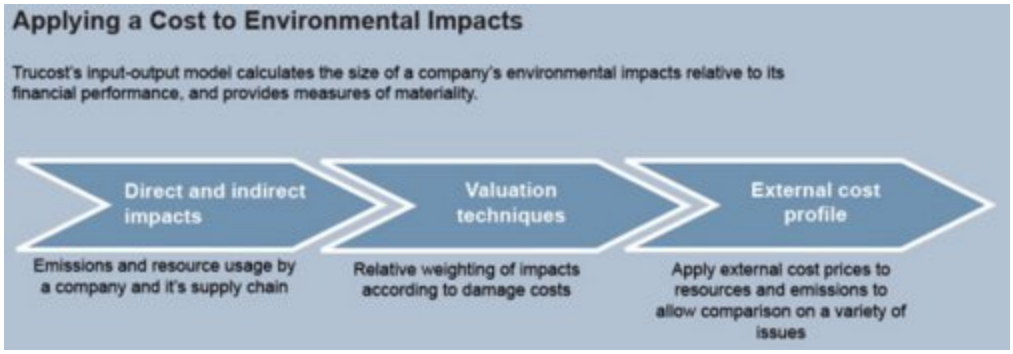
This total cost is then normalized by revenue to account for the company's size. Finally, this

[6] Newsweek Full Methodology

cost/revenue ratio is placed on a placed on logarithmic scale so that a company's EIS is 0 when its total environmental cost is equal to or greater than the revenue it generates or 100 when the cost/revenue reaches 0.1 percent.

Thus, if all companies scored a perfect EIS of 100 (or close thereto), we would be well on our way to global sustainability in the corporate world. If all the companies in the Green Rankings scored a perfect 100 on their EIS, this would require that the greenhouse gas emissions associated with their operations and full cradle-to-gate supply chains would be reduced to 6 percent of their current level while maintaining the same level of economic activity. For example, Wal-Mart would have to reduce its emissions to a tenth of what they are currently while maintaining current revenue to achieve an EIS of 100.

Below, we diagram how company environmental impacts are used to calculate the EIS and provide specific detail for IBM, the top-ranked U.S. company in the 2011 and 2012 Green Rankings.




**IBM**
**FY 2010**
*Revenue $99,120 mUSD*

| *Impact* | *Quantity (tons or cubic meters)* | *Source* | *Cost per metric ton or cubic meter* | *Total Environmental Cost (mUSD)* | *Contribution (reductions from score of 100)* |
|---|---|---|---|---|---|
| Scope 1 Carbon Dioxide | 276,721 | Exact Value from Environmental/CSR | $35.3 | $9.76 | -0.5 |
| Scope 2 Carbon Dioxide | 2,091,887 | Value derived from data in Environmental/CSR | $35.3 | $73.75 | -3.6 |
| Direct Water Use | 4,093,869 | Value derived from data in Environmental/CSR | $0.5 | $2.05 | -0.1 |
| Purchased Water Use | 7,806,102 | Value derived from data in Environmental/CSR | $0.5 | $3.91 | -0.2 |
| Direct SOx | 40 | Exact Value from Environmental/CSR | $1,345.3 | $0.05 | 0.0 |
| | | | *Plus all other environmental impacts...* | | |
| | | | Total cost | $428.63 | |
| | | | Cost/Revenue | 0.43% | |
| | | | Environmental Impact Score | 78.8 | |

**Management:**

The Environmental Management Score is an assessment of how a company manages its environmental performance through policies, programs, targets, certifications, and the like. To account for a company's overall environmental footprint, Sustainalytics focuses on three distinct spheres of influence: company operations, contractors and suppliers, and products and services. An analysis of positive performance-related criteria is counterbalanced by a detailed assessment of environmental controversies and incidents, which often indicate the extent to which management systems are effectively implemented.

Approximately a dozen core environmental indicators are assigned to all sectors, addressing environmental policies and management systems, as well as certifications, programs and targets to reduce emissions, increase the use of renewables, and the like. These core indicators are supplemented by over 40 sector-specific indicators addressing issues such as biodiversity protection, water use, hazardous waste reduction, supply-chain initiatives and a range of sustainability-related products and services. As such, the composition of indicators and weightings used to evaluate a company vary by industry, on the basis of industry-specific impact and exposure. This methodology is underpinned by Sustainalytics' best-of-sector approach to benchmarking company performance relative to industry peers (note that the sector breakdown Sustainalytics uses is at a more granular level than the 20 industry groupings displayed with the Green Rankings results).

For a company to score a perfect 100 on the EMS, it would have to disclose company-wide policies, management systems and certifications that are aligned with best practices for its industry. Additionally, the company would not be implicated in any environmental controversies in recent years, indicating effective implementation of its environmental policies and programs. Moreover, in sectors where meaningful sustainable alternatives exist—that is, products and services which are not merely environmentally-preferable, but innovative responses to key global challenges—companies are assessed on related revenue thresholds. For example, 20 percent of an Information Technology & Services company's EMS score is based on an assessment of its sustainability product and service offerings and revenues derived thereof.

The table on the next page details the indicators and weights assigned for the Environmental Management score of companies in the Information Technology & Services sector, including IBM. It shows our full list of indicators, with those used for Information Technology & Services highlighted in orange. The table also highlights the weight assigned to each sphere of influence, which varies from one industry to the next based on degree of exposure and impact.

We assign at minimum 50 percent weight to operations for each industry, with the remaining 50 percent allocated to supply chain and products and services depending on the sector's exposure and impact. Whereas Information Technology & Services has its environmental operations indicators weighted at roughly 63 percent, Oil and Gas companies, for example, are closer to 75 percent.

| Information Technology & Services Industry | | | |
|---|---|---|---|
| Operations | Formal Environmental Policy | 63.33% | 100.00% |
| | Environmental Management System | | |
| | Programmes and Targets to Protect Biodiversity | | |
| | Guidelines and Reporting on Closure and Rehabilitation of Sites | | |
| | Environmental and Social Impact Assessments | | |
| | Percentage of Certified Forests Under Own Management | | |
| | External Certification of EMS | | |
| | Programmes & Targets to Reduce Hazardous Waste Generation | | |
| | Programmes & Targets to Reduce Air Emissions | | |
| | Programs & Targets to Reduce Water Use | | |
| | Other Programmes to Reduce Key Environmental Impacts | | |
| | Environmental Fines and Non-monetary Sanctions | | |
| | Programmes and Targets to Reduce Direct GHG Emissions | | |
| | Programmes and Targets to Improve the Environmental Performance of C | | |
| | Programmes and Targets to Phase out CFCs and HCFCs in Refrigeration E | | |
| | Programmes and Targets to Increase Renewable Energy Use | | |
| | % Primary Energy Use from Renewables | | |
| | Operations Related Controversies or Incidents | | |
| Contractors & Supply Chain | Formal Policy or Programme on Green Procurement | 16.67% | |
| | Programmes and Targets for Environmental Improvement of Suppliers | | |
| | External Environmental Certification Suppliers | | |
| | Programmes and Targets to Stimulate Sustainable Agriculture | | |
| | Programmes and Targets to Stimulate Sustainable Aquaculture/Fisheries | | |
| | Food Beverage & Tobacco Industry Initiatives | | |
| | Programmes and Targets to Reduce GHG Emissions from Outsourced Log | | |
| | Data on Percentage of Recycled/Re-used Raw Material Used | | |
| | Data on Percentage of FSC Certified Wood/Pulp as Raw Material | | |
| | Programmes and Targets to Promote Sustainable Food Products | | |
| | Food Retail Initiatives | | |
| | Contractors & Supply Chain Related Controversies or Incidents | | |
| Products & Services | Sustainability Related Products & Services | 20.00% | |
| | Revenue from Clean Technology or Climate Friendly Products | | |
| | Automobile Fleet Average CO2 Emissions | | |
| | Trend Automobile Fleet Average Fleet Efficiency | | |
| | Products to Improve Sustainability of Transport Vehicles | | |
| | Systematic Integration of Environmental Considerations at R&D Stage (Ec | | |
| | Programmes and Targets for End-of-Life Product Management | | |
| | Organic Products | | |
| | Policy on Use of Genetically Modified Organisms (GMO) in Products | | |
| | Environmental & Social Standards in Credit and Loan Business | | |
| | Assets Under Management in Responsible Investment | | |
| | Use of Life-Cycle Analysis (LCA) for New Real Estate Projects | | |
| | Programmes and Targets to Increase Investments in Sustainable Building | | |
| | Share of Property Portfolio Invested in Sustainable Buildings | | |
| | Sustainability Related Financial Services | | |
| | Products with Important Environmental/Human Health Concerns | | |
| | Carbon Intensity of Energy Mix | | |
| | Products & Services Related Controversies or Incidents | | |

**Disclosure:**

The Environmental Disclosure Score (EDS) assesses the transparency of each company with regard to its environmental performance. The EDS accounts for 10 percent of each company's Green Score. Half of the EDS is based on an assessment provided by Trucost of the breadth and quality of company environmental reporting on its material environmental impacts. This is calculated by establishing the percent of the companies' direct environmental footprint that is disclosed by the company. If the company discloses its direct GHG emissions, and those emissions represent 50 percent of the total direct environmental cost of the company, for example, then the company will receive 50 points toward the maximum of 100 on Trucost's contribution to the EDS. This is then added to the environmental costs of all the other impacts the company discloses. The total is weighted as 50 percent of the EDS.

Sustainalytics calculates the remaining 50 percent of the EDS by evaluating a company's level of involvement in key transparency initiatives such as the Global Reporting Initiative (GRI) and Carbon Disclosure Project (CDP). To receive full points, a company must have released a corporate sustainability report in the most recent accounting year which is both in line with GRI Level-A criteria and is externally verified, in full, to a global standard. Additionally, the company must have publicly responded to the 2012 CDP survey. While strong sustainability reporting may not translate directly into sustainable performance, it is a key means to determine the level of a company's commitment to its environmental performance and ongoing improvement.

# Appendix B: Considering the Ordered Probit Model

The following two Stata regression outputs show the equivalents of Models 1 and 3 run with ordered probit. As addressed in the report, our initial hunch was to use the ordered probit estimator as we believed the dependent variable to be discrete and ordinal. Upon further analysis of disclosure score observations, we concluded that there was a large censoring problem for which tobit might serve as a better estimator. The results of ordered probit and tobit regressions, for both levels and ratios of the three variables bolded below, are similar enough and we considered the censoring problem to be significant enough that our final choice of estimator was the tobit.

```
. oprobit Disclosure Impact Management No__of_employees Stockholders_Equity Net_Income
Total_Assets age sector1 sector2 sector3 sector4 sector6 sector7 sector8 sector9
sector10 sector11 sector12 sector13 sector14 sector15 sector16 sector17 sector18
sector19 sector20

Iteration 0:   log likelihood = -2159.2975
Iteration 1:   log likelihood = -1952.7753
Iteration 2:   log likelihood = -1949.4107
Iteration 3:   log likelihood = -1949.4038
Iteration 4:   log likelihood = -1949.4038

Ordered probit regression                       Number of obs   =        476
                                                LR chi2(26)     =     419.79
                                                Prob > chi2     =     0.0000
Log likelihood = -1949.4038                     Pseudo R2       =     0.0972

------------------------------------------------------------------------------
  Disclosure |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      Impact |  -.0156222   .0042326    -3.69   0.000    -.0239178   -.0073265
  Management |   .0688183   .0046256    14.88   0.000     .0597523    .0778843
No__of_emp~s |   .0000842   .0000473     1.78   0.075    -8.58e-06     .000177
Stockholde~y |   3.02e-06   5.26e-06     0.57   0.566    -7.28e-06    .0000133
  Net_Income |    .000029   .0000217     1.33   0.183    -.0000136    .0000716
Total_Assets |  -3.57e-07   5.15e-07    -0.69   0.488    -1.37e-06    6.52e-07
         age |   .0025164   .0012972     1.94   0.052    -.000026    .0050588
     sector1 |   .0462009   .4026902     0.11   0.909    -.7430574    .8354592
     sector2 |  -.3933848   .3360803    -1.17   0.242     -1.05209    .2653206
     sector3 |   .7340432   .3064225     2.40   0.017     .1334661     1.33462
     sector4 |   .4023085   .3057043     1.32   0.188    -.1968608    1.001478
     sector6 |  -.4267574   .2971512    -1.44   0.151    -1.009163    .1556482
     sector7 |  -.0074602   .3729663    -0.02   0.984    -.7384607    .7235403
     sector8 |  -.3272032   .2839683    -1.15   0.249    -.8837709    .2293645
     sector9 |  -.6311731   .3592048    -1.76   0.079    -1.335201    .0728554
    sector10 |   .6424982   .2750704     2.34   0.020     .1033701    1.181626
    sector11 |  -.7799347   .3798769    -2.05   0.040     -1.52448   -.0353897
    sector12 |  -.6022433   .4383244    -1.37   0.169    -1.461343    .2568567
    sector13 |  -.7720304   .5364864    -1.44   0.150    -1.823524    .2794636
    sector14 |  -.6407577   .3112249    -2.06   0.040    -1.250747   -.0307682
    sector15 |  -.7978568   .3102941    -2.57   0.010    -1.406022   -.1896915
    sector16 |  -.1997025   .4752251    -0.42   0.674    -1.131127    .7317216
    sector17 |  -.7117923   .4107492    -1.73   0.083    -1.516846    .0932613
    sector18 |   .6327003   .3445131     1.84   0.066    -.042533    1.307934
    sector19 |    .636032   .2892184     2.20   0.028     .0691742     1.20289
    sector20 |  -.8527988   .4157232    -2.05   0.040    -1.667601   -.0379963
------------------------------------------------------------------------------
```

```
. oprobit Disclosure Impact Management ratio_income ratio_equity ratio_employ
Total_Assets age sector1 sector2 sector3 sector4 sector6 sector7 sector8 sector9
sector10 sector11 sector12 sector13 sector14 sector15 sector16 sector17 sector18
sector19 sector20

Iteration 0:   log likelihood = -2159.2975
Iteration 1:   log likelihood = -1958.6419
Iteration 2:   log likelihood = -1955.5565
Iteration 3:   log likelihood = -1955.5506
Iteration 4:   log likelihood = -1955.5506

Ordered probit regression                       Number of obs   =        476
                                                LR chi2(26)     =     407.49
                                                Prob > chi2     =     0.0000
Log likelihood = -1955.5506                     Pseudo R2       =     0.0944
```

| Disclosure | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Impact | -.0144486 | .0042378 | -3.41 | 0.001 | -.0227546 | -.0061426 |
| Management | .0704598 | .0045864 | 15.36 | 0.000 | .0614706 | .079449 |
| ratio_income | -.3844117 | .9900955 | -0.39 | 0.698 | -2.324963 | 1.55614 |
| ratio_equity | .0289252 | .2863089 | 0.10 | 0.920 | -.53223 | .5900804 |
| ratio_employ | -.7637992 | 1.198127 | -0.64 | 0.524 | -3.112085 | 1.584487 |
| Total_Assets | 3.01e-07 | 2.79e-07 | 1.08 | 0.280 | -2.45e-07 | 8.48e-07 |
| age | .0033935 | .0012912 | 2.63 | 0.009 | .0008628 | .0059242 |
| sector1 | .1184029 | .4023595 | 0.29 | 0.769 | -.6702072 | .907013 |
| sector2 | -.391157 | .3376811 | -1.16 | 0.247 | -1.053 | .2706858 |
| sector3 | .8612577 | .3044168 | 2.83 | 0.005 | .2646117 | 1.457904 |
| sector4 | .3233716 | .3113887 | 1.04 | 0.299 | -.286939 | .9336822 |
| sector6 | -.4075247 | .3002664 | -1.36 | 0.175 | -.996036 | .1809866 |
| sector7 | .2113487 | .4063854 | 0.52 | 0.603 | -.585152 | 1.007849 |
| sector8 | -.32517 | .2881686 | -1.13 | 0.259 | -.88997 | .23963 |
| sector9 | -.5312073 | .3641758 | -1.46 | 0.145 | -1.244979 | .1825641 |
| sector10 | .6196301 | .2763304 | 2.24 | 0.025 | .0780324 | 1.161228 |
| sector11 | -.7639372 | .3794736 | -2.01 | 0.044 | -1.507692 | -.0201827 |
| sector12 | -.5834196 | .447228 | -1.30 | 0.192 | -1.45997 | .2931311 |
| sector13 | -.8355222 | .5395193 | -1.55 | 0.121 | -1.892961 | .2219162 |
| sector14 | -.5015244 | .3139383 | -1.60 | 0.110 | -1.116832 | .1137834 |
| sector15 | -.7743264 | .3166302 | -2.45 | 0.014 | -1.39491 | -.1537426 |
| sector16 | -.2100156 | .4716294 | -0.45 | 0.656 | -1.134392 | .714361 |
| sector17 | -.6213799 | .4235446 | -1.47 | 0.142 | -1.451512 | .2087523 |
| sector18 | .6219666 | .3459548 | 1.80 | 0.072 | -.0560923 | 1.300026 |
| sector19 | .6055181 | .2935277 | 2.06 | 0.039 | .0302143 | 1.180822 |
| sector20 | -.7425317 | .4139055 | -1.79 | 0.073 | -1.553771 | .0687081 |

# Appendix C: Addressing Collinearity

In designing the model, we expect some of these variables to move together as a function of the company size. As collinearity using the `estat vif` command is not compatible with the tobit estimator we have chosen, we ran an ordinary least squares regression to explore collinearity amongst the variables. We discuss variance inflation factor for these suspect capitalization variables (WHICH?) expressed as both levels and ratios.

## VIF with Capitalization Variables as Levels

```
. reg Disclosure Impact Management sector1 sector2 sector3 sector4 sector6 sector7
sector8 sector9 sector10 sector11 sector12 sector13 sector14 sector15 sector16 sector17
sector18 sector19 sector20 age Stockholders_Equity Net_Income No__of_employees
Total_Assets
```

```
. estat vif
```

| Variable | VIF | 1/VIF |
|---|---|---|
| Stockholde~y | 7.13 | 0.140195 |
| Total_Assets | 4.53 | 0.220758 |
| sector4 | 3.82 | 0.262063 |
| sector6 | 3.77 | 0.265002 |
| sector14 | 3.34 | 0.299329 |
| sector9 | 3.06 | 0.326358 |
| sector15 | 2.96 | 0.338292 |
| sector8 | 2.94 | 0.340499 |
| Net_Income | 2.84 | 0.352550 |
| Impact | 2.61 | 0.383341 |
| sector3 | 2.46 | 0.406724 |
| sector11 | 2.26 | 0.442443 |
| sector10 | 2.20 | 0.454390 |
| sector19 | 2.08 | 0.479756 |
| sector18 | 1.77 | 0.563889 |
| sector17 | 1.76 | 0.568590 |
| sector2 | 1.76 | 0.568619 |
| sector7 | 1.75 | 0.570450 |
| sector16 | 1.68 | 0.595736 |
| sector12 | 1.67 | 0.600015 |
| sector1 | 1.53 | 0.653348 |
| sector20 | 1.44 | 0.696416 |
| Management | 1.40 | 0.714073 |
| No__of_emp~s | 1.38 | 0.722107 |
| sector13 | 1.27 | 0.786119 |
| age | 1.25 | 0.797967 |
| Mean VIF | 2.49 | |

The variance inflation factors given above show that stakeholders' equity is collinear with a company's total assets, and to a lesser extent with a company's net income. Although all

VIFs but stockholders' equity are within a threshold where we need to be concerned about collinearity, this adds evidence to our suspicion that our model contains multiple measures for the size of a firm. We also note that different sectors will have different capital and labor needs--for example, service sectors are expected to be labor-intensive. This variation is likely being captured in industry sector dummies.

## VIF with Capitalization Variables as Ratios

```
. reg Disclosure Impact Management Total_Assets sector1 sector2 sector3 sector4 sector6
sector7 sector8 sector9 sector10 sector11 sector12 sector13 sector14 sector15 sector16
sector17 sector18 sector19 sector20 age ratio_income ratio_equity ratio_employ, robust
```

```
. estat vif
```

| Variable | VIF | 1/VIF |
|---|---|---|
| sector4 | 3.96 | 0.252642 |
| sector6 | 3.85 | 0.259652 |
| sector14 | 3.40 | 0.293900 |
| sector9 | 3.15 | 0.317805 |
| sector15 | 3.06 | 0.326560 |
| sector8 | 3.03 | 0.330288 |
| Impact | 2.61 | 0.382790 |
| sector3 | 2.42 | 0.413188 |
| sector11 | 2.26 | 0.441842 |
| sector10 | 2.22 | 0.449796 |
| sector19 | 2.14 | 0.466266 |
| sector7 | 2.03 | 0.491957 |
| sector17 | 1.88 | 0.531927 |
| sector18 | 1.79 | 0.558643 |
| sector2 | 1.77 | 0.564330 |
| sector12 | 1.77 | 0.565830 |
| sector16 | 1.68 | 0.594554 |
| ratio_employ | 1.59 | 0.628264 |
| sector1 | 1.53 | 0.653400 |
| ratio_equity | 1.52 | 0.658362 |
| sector20 | 1.42 | 0.701805 |
| ratio_income | 1.39 | 0.717848 |
| Total_Assets | 1.36 | 0.733530 |
| Management | 1.35 | 0.741561 |
| sector13 | 1.28 | 0.779012 |
| age | 1.23 | 0.810382 |
| Mean VIF | 2.14 | |

Assessing the above variance inflation factors, we find that using income/asset, equity/asset and employee/asset ratios considerably decreases the collinearity seen above where these variables are expressed as levels. Instead of all proxying for size, we suspect that the income/asset ratio now acts as a measure for profitability of investments, equity/asset ratio measures inverse leverage (the proportion of total assets that are not owed as total liability, or debt) and the employment/asset ratio acts as a measure of labor intensiveness of the firm.