Do takeover defenses deter takeovers?*

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Abstract: The G-index and E-index are used extensively in the literature to measure firms' takeover defenses. Yet almost no empirical evidence exists that quantifies whether, or how much, various takeover defenses, or combinations of defenses, actually affect a firm's acquisition likelihood. In simple tests that do not account for endogeneity, we find no evidence that the G-index and E-index are related to takeover likelihood. Using instruments for a firm's use of takeover defenses based on the firm's geography and IPO cohort, however, we find that both the G-index and E-index are negatively and significantly related to takeover likelihood. The relation between takeover likelihood and the G-index is driven by a subset of 14 provisions, many of which are not captured by the E-index, and three of which have signs opposite to how they are counted in the G-index. We propose that this empirically-driven subset of 14 takeover defenses better reflects a firm's takeover defense posture.

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1. Introduction

The G-index and E-index are workhorses of empirical corporate finance research. Each counts the number of takeover defenses a firm has and is often used as a summary measure of the firm's protection from unsolicited takeover bids (see Gompers, Ishii, and Metrick, 2003; and Bebchuk, Cohen, and Ferrell, 2009). But do these indices actually measure takeover deterrence?

This is an important question because a substantial number of empirical findings and their interpretations are based on the assumption that takeover defense indices indeed measure takeover deterrence. For example, researchers have used the G-index and E-index to examine whether takeover defenses are associated with various firm outcomes including low stock returns (e.g., Gompers, Ishii, and Metrick, 2003; Cremers, Nair, and John, 2009; Cremers and Ferrell, 2013), firm value (Bebchuk, Cohen, and Ferrell, 2009; Cremers and Ferrell, 2014), acquisition returns (Masulis, Wang, and Xie, 2007), takeover premiums (Sokolyk, 2011; Kadyrzhanova and Rhodes-Kropf, 2011), internal capital markets (Duchin and Sosyura, 2013), credit risk and pricing (Cremers, Nair, and Wei, 2007; Klock, Mansi and Maxwell, 2005), operating performance (Core, Guay, and Rusticus, 2006; Giroud and Mueller, 2011), the value and use of cash holdings (Dittmar and Mahrt-Smith, 2007; Harford, Mansi and Maxwell, 2008), and corporate innovation (Atanassov, 2013). Researchers also have used takeover indices to examine whether takeover defenses serve primarily to entrench managers at shareholders' expense (Masulis, Wang, and Xie, 2007), or to increase firm value through bargaining or contractual bonding (Chemmanur and Jiao, 2012; Cen, Dasgupta, and Sen, 2011; Johnson, Karpoff, and Yi, 2014; Humphery-Jenner, 2014). The common basis for the interpretations of all of these tests is the foundational assumption that the G-index and/or E-index measure takeover deterrence. Even

conclusions that takeover defenses increase firm value are based on the assumption that they deter unsolicited acquisitions (e.g., Chemmanur and Jiao, 2012; Humphery-Jenner, 2014).

For such a foundational assumption, however, the notion that takeover defenses deter takeovers has surprisingly little empirical support. If anything, the available evidence indicates that there is no meaningful relation between takeover frequencies and the G-index (see Core, Guay, and Rusticus, 2006; Bates, Becher, and Lemmon, 2008; Kadyrzhanova and Rhodes-Kropf, 2011; Sokolyk, 2011). There is some evidence that isolated provisions in these indices, e.g., classified boards are associated with lower takeover likelihood (e.g., see Bates, Becher, and Lemmon, 2008; Kadyrzhanova and Rhodes-Kropf, 2011; Sokolyk, 2011), but this evidence also is mixed (e.g., see Comment and Schwert, 1995). Some researchers focus on small subsets of takeover defenses (e.g., Cremers, Nair, and John, 2009; Kadyrzhanova and Rhodes-Kropf, 2011; Harford, Humphery-Jenner, and Powell, 2012), but such individualized choices only underscore the absence of systematic evidence on whether certain takeover defenses do, in fact, deter takeovers, and if so, which ones.

The issue is, of course, endogeneity. Firms that deploy takeover defenses may do so precisely because they are likely to receive unsolicited takeover bids. The absence of an empirical correlation between takeover defenses and firm independence cannot rule out the hypothesis that takeover defenses do in fact deter takeovers, but tend to be deployed by firms with high acquisition likelihoods. Stated differently, the lack of an empirical correlation between defenses and takeover frequencies might simply indicate that the defenses are endogenous, not ineffective.

The purpose of this paper is to examine whether takeover defenses, and particularly the G-index and E-index, do in fact measure takeover deterrence. Before controlling for

endogeneity and using standard acquisition likelihood models, we find that acquisition likelihood is significantly related to firm characteristics and performance, but not to a firm's G-index or E-index. This result for the overall G-index is consistent with previous findings (e.g., see Core, Guay, and Rusticus, 2006; Bates, Becher, and Lemmon, 2008; Kadyrzhanova and Rhodes-Kropf, 2011). We then account for the endogenous adoption of defenses by deploying two instrumental variables that induce arbitrary variations in firms' use of defenses. The first instrument is based on the defenses deployed by firms with headquarters in the same geographical area as the subject firm, but not in the same industry. The rationale for this instrument is twofold: First, managers of firms in geographical proximity are likely to interact and influence each others' decisions on a broad range of corporate matters, including takeover defenses. Second, firms from the same area are also more likely to share law firms who do business in their area. Law firms are known to influence their client firms' use of takeover defenses (see Coates, 2001), so this geographical overlap also indicates that firms from the same area tend to use takeover defenses in similar ways for reasons that are not directly related to their specific takeover likelihoods. A similar argument for the importance of geographical network effects is made by Davis and Greve (1997) regarding golden parachutes.

Our second instrument is the number of takeover defenses adopted by firms that went public within one year of the subject firm. Daines and Klausner (2001) and Field and Karpoff (2002) document a strong time component to the adoption of takeover defenses by IPO firms, and Hannes (2006) documents that a firm's use of takeover defenses is sticky over time. These results imply that a firm's use of takeover defenses are strongly influenced by the year it went public. We therefore use the provisions adopted by unrelated firms in a subject firm's IPO

cohort to measure arbitrary variation in a firm's takeover defenses that is not directly related to the firm's specific takeover likelihood.

Using these instruments has a large effect on our empirical results, as we find that acquisition likelihood is negatively and significantly related to both the G-index and E-index. Using both instruments, a one-standard deviation increase in the instrumented value of a firm's G-index is associated with a 9.5% reduction in the probability that the firm will be acquired within one year, and a 22.0% reduction in the probability the firm will be acquired within five years. Using both instruments, a one-standard deviation increase in the instrumented value of a firm's E-index is associated with a 13.6% reduction in the probability that the firm will be acquired within one year, and a 28.3% reduction in the probability the firm will be acquired within five years. These results are robust to several methodological approaches to modeling the relation between takeover likelihood and provision use.

To compare the ability of the G-index or E-index to characterize a firm's takeover deterrence, we conduct several additional tests. First, we document that an index constructed from the provisions that are included in the G-index but excluded from the E-index – which Straska and Waller (2014) label the Other Index or O-index – are significantly and negatively related to takeover likelihood. In fact, the predictive power of the O-index is more than half as large as that of the E-index, as a one-standard deviation increase in the instrumented value of a firm's O-index is associated with a 7.5% reduction in the probability that the firm will be acquired within one year, and a 17.7% reduction in the probability the firm will be acquired within five years. These results indicate that the provisions included in the G-index but excluded from the E-index are, as a group, associated with takeover deterrence.

Next, we use our approach to dealing with endogeneity to investigate the effects of each individual provision on takeover likelihood. For each provision, we use a firm's non-industry geographic peer firms' incidence of that provision as one instrument as well as that firm's IPO-year cohorts' incidence of that provision as a second instrument. These instruments identify variation in the use of these provisions that is strongly correlated with the incidence of the provision at the subject firm but that is not related to the anticipated takeover likelihood for that specific firm. Using this approach, we then test for the relation between each provision and takeover likelihood while controlling for the rest of the provisions. We find that 14 of the original 24 provisions in the G-index are indeed related to takeover deterrence. Of these, eleven have the expected sign suggesting they deter takeovers while three have the opposite sign, indicating that they are positively affect takeover likelihood.

The eleven provisions found to deter takeovers after controlling for endogeneity include poison pills, anti-greenmail, classified boards, director indemnification, limitations on director liability, director duty provisions, director contracts, fair price restrictions, cashout laws, supermajority requirements, and unequal voting rights. The provisions that are positively related to takeover likelihood include compensation plans with change-in-control provisions, golden parachutes, and the absence of cumulative voting. The results for the two compensation related provisions have intuitively appealing interpretations: if offered generous payouts if their firm is acquired, managers are more likely to seek acquirers and/or agree to be acquired.

Finally, we use our results for the individual provisions to construct a new index of takeover defenses and show that it is strongly related to takeover deterrence. We construct this new index by adding 1 to the index total for each of the 10 provisions that have a negative relation to takeover incidence. Unlike the G-index and E-index, however, we *add* 1 to the index

for each of the three provisions that is positively related to takeover incidence if the provision is absent. We call the resulting subset of strong takeover defenses the Deterrence index or D-index, and show that the D-index strongly predicts takeover likelihood with or without corrections for endogeneity. Furthermore, of the 24 provisions in the G-index (or the six provisions in the E-index), the only subsets of provisions that are statistically related to takeover incidence are those that are included in the D-index. After correcting for endogeneity, all of the predictive power in the G-index and E-index (as well as two other indices used in several papers) for takeover deterrence is attributable to only those provisions that overlap with the D-index.

This paper makes several contributions to the literature. We call attention to the lack of direct statistical evidence for the widespread assumption that the G-index and E-index are measures of takeover deterrence. Consistent with several existing papers, we find that the raw correlation between takeover incidence and G-index (and E-index) is not significant. Our paper adds to this literature by proposing two instruments that allow for a direct empirical investigation of the relation between each of the 24 provisions used in the G-index (and those in the E-index) and takeover likelihood.[1] Our paper adds to the literature by not only suggesting an alternative identification approach with these two instruments, but also in examining the direct relation between each of the provisions and takeover likelihood rather than relying on an indirect link between Q and the provisions to then infer whether the provisions affect takeover likelihood.

[1] Several other papers have used alternative strategies. For example, Goktan and Kieschnick (2012) use a Heckman probit model approach with a selection equation to try to address selection issues. Straska and Waller (2010), Bebchuk and Cohen (2005), and Bebchuk, Cohen, and Ferrell (2009) use anti-takeover provisions from several years before the year of analysis in an attempt to address simultaneity concerns. Cremers and Ferrell (2014) focus on differences in the relation between firm value and anti-takeover provisions before and after the 1985 Moran v. Household case to achieve identification. Kadyrzhanova and Rhodes-Kropf (2011) use age-at-IPO as an instrument in a two-step estimation approach aimed at estimating the relation between governance provisions and takeover premiums. Our paper, in contrast, examines all 24 of the G-index provisions and their relations to takeover likelihood, as opposed to the indices' relations with other outcome variables like Tobin's q or takeover premiums.

And finally, we propose a new index based on the empirical relations between provisions and takeover likelihood.

The paper proceeds as follows. In section 2 we describe the data, discuss endogeneity issues in our empirical approach, and motivate our specific instruments. In section 3 we report the relation between takeover likelihood and both the G-index and E-index. We report these results first without correcting for endogeneity and then after correcting for endogeneity. In section 4 we investigate how each individual takeover defense relates to takeover likelihood. In section 5 we use the section 4 results to create the D-index and demonstrate how it compares to the G-index, E-index, and other subsets of provisions within these indices in explaining takeover incidence. Section 6 concludes.

2. Descriptive information, endogeneity concerns, and instruments

2.1 Data and sample descriptive information

To address the question of whether the anti-takeover provisions from the G-index and E-index do, in fact, relate to takeover deterrence we require information on firm acquisitions, firm- and industry-level control variables known from prior research to relate to takeover likelihood, as well as information on which provisions existed at each firm each year. Our acquisition data come from the Thomson's Securities Data Company (SDC) database,[2] the firm- and industry-level information is from Compustat and CRSP, and the provision-level data are from the Investor Responsibility Research Center (IRRC) database.

Riskmetrics purchased IRRC and in 2007 changed the format and scope of the governance data collected each year such that only 18 of the original 24 components of the G-index are available via Riskmetrics after 2007. Additionally, IRRC changed the exact

[2] The following SDC Filters were used in identifying IRRC targets: US Targets with deal form AR, M, AM, or AA and a completed status.

information collected and/or the manner of reporting the information. To be able to directly relate our results to earlier G-index research and to maintain continuity in the data, we focus on the IRRC data through 2006 and assume that the provisions constituting the G-index in 2006 carry forward for for two years. Projecting the data forward in time is consistent with the the standard approach to previous years in which the IRRC did not report firm-level data. From 1990-2006, IRRC published governance data for 1990, 1993, 1995, 1998, 2000, 2002, 2004, and 2006, with each volume including corporate governance information for between 1,400 and 2,000 firms. Like previous studies, we fill in data from missing years by projecting forward from the most recent IRRC data. For example, the IRRC governance data from 1993 is used in 1994, the 1995 data is used for 1996 and 1997, etc.

Following the procedures of Gompers et al. (2003), we distill the 45 IRRC data elements into 24 corporate governance provisions, and report the G-index as a simple sum of the constituent provisions. The E-index described in Bebchuk et al. (2009) is calculated in the same manner as the G-index, by adding one for each provision in effect. The E-index is comprised of six governance provisions: poison pills, golden parachutes, classified boards, limits to shareholder amendments of the bylaws, supermajority requirements for mergers, and supermajority requirements for charter amendments. Appendix A contains a detailed discussion of the 24 provisions in the G-index, and Appendix B, Table B1 reports on the annual frequencies of each provision.

Firm-specific financial and operating control variables are from Compustat and CRSP and are motivated by prior work on acquisition likelihood.[3] These variables include firm size (AT), leverage (DLTT/AT), the market-to-book ratio ((CSHO*PRC + DLTT)/AT), industry-

[3] For examples, see Palepu (1986), Ambrose and Megginson (1992), Song and Walkling (1993), Comment and Schwert (1995) and Field and Karpoff (2002).

adjusted operating return on assets (ROA = OIADP/AT), the property ratio (PPEGT/AT), the liquidity ratio ((ACT-LCT)/AT), average sales growth over 3 years (average(($SALE_{t0}$ - $SALE_{t-1}$)/ $SALE_{t-1}$)), the prior one-year market-adjusted return, and industry concentration as measured by the Herfindahl-Hirschman index using sales. Industry adjustments are made using the Fama-French 49 industries.

Our initial sample consists of 29,183 firm-years, from the intersection of firms in the IRRC and Compustat databases from 1990-2008. Missing control variables in Compustat cause us to drop 5,308 firm-years. We also require that each firm have at least 1 non-industry geographic peer firm within its state for the calculation of the geography-based instrument described in more detail in section 2.3. This additional requirement causes an additional 432 firm-years to drop from the sample, resulting in the 23,443 firm-year observations that serve as our basic sample for all tests.

[Insert Table 1]

Using this basic sample, Table 1 reports the number of firms and takeovers and the mean G-index and E-index values by year. The mean G-index ranges from 8.7 to 9.3 during our sample period of 1990-2008, and is relatively stable across time.[4] For comparison, Gompers et al. (2003) report an annual average G-index of 8.9 to 9.3 during the 1990-1998 period. The E-index ranges from 2.4 to 2.8 during our sample period, again largely comparable to the figures reported for the 1990-2002 sample in Bebchuk et al. (2009). The trends in takeover frequency shown in Table 1, with peaks in the late 1990s and mid-2000s, are similar to those documented

[4] The variation in the mean G-index and E-index values across proximate years is due to firms dropping from the sample. For example, consider the 1990 and 1991 values. The 1990 G-index values are used to populate 1990 through 1992, but the table above reports a slightly different annual mean in 1990 and 1991. The difference arises because not all of the firms that were included in 1990 still exist in 1991.

by Masulis, Wang and Xie (2007). Table 2 provides additional descriptive information for the firms in the final sample of 23,443 firm-year observations. Most of the sample characteristics are standard for research in this area, and the summary statistics for them are similar to those of other samples based on IRRC data (e.g., see Core, Guay, and Rusticus, 2006; Sokolyk, 2011).

[Insert Table 2]

2.2 Endogeneity concerns

Our research question is whether the takeover provisions as constituted within the G-index or E-index affect takeover likelihood. A naïve approach to this question would involve estimating a simple regression of a binary variable for being acquired (y_1) on the takeover index variable (y_2) as well as whatever control variables (x_1-x_k) appear in the model as shown in equation (1) below.

$$y_1 = y_2\partial \quad + x_1\beta_1 + \cdots x_k\beta_k + u \qquad (1)$$

Given the endogenous nature of (y_2), this approach would result in inconsistent estimates of ∂ because $\mathrm{E}(u \mid y_2, x_1 \ldots x_k) \neq 0$. Intuitively, endogeneity arises if managers' use of takeover defenses is affected by their assessment of the likelihood the firm will receive a takeover bid. In this paper, we achieve identification by using two instrumental variables (z) for y_2 and modeling the endogenous variable as a function of the instrument(s) and the other exogenous variables as shown in equation (2).

$$y_2 = \gamma_1 z + \gamma_2 x_1 + \cdots + \gamma_k x_k + e \qquad (2)$$

A valid instrument must meet both relevance and exclusion conditions (see Roberts and Whited (2012)). For the relevance condition, for each of our tests we report both the first-stage

F-statistic and the R-squared values to provide information about the strength of the instruments. Staiger and Stock (1997) suggest a rule-of-thumb that the F-statistic be at least 10 for a strong instrument. Stock and Yogo (2005) tabulate various guidelines for identifying weak instruments depending on (1) the estimation bias and test statistic size distortion that the researcher is willing to accept relative to OLS estimation, (2) the number of endogenous variables involved, and (3) the number of instruments. Since we have one endogenous variable and up to two instruments, only the size guidelines apply (the tabulated bias guidelines require three or more instruments). The Stock and Yogo (2005) size distortion guidelines for our application, assuming less than 10% size distortion (10% is the smallest category they consider) thus imply that the 2SLS (LIML) first-stage F-statistics should be at least 19.9 (8.7) for a strong instrument.

The exclusion condition requires that $\text{cov}(z, u) = 0$ and can be thought of as the requirement that the instrument only affect whether a firm is acquired (y_1) via its relation with the endogenous index (y_2) and not via some other pathway captured in the error term. Because the exclusion condition is not directly testable we discuss the creation of our instruments in detail in section 2.3 and argue that the exclusion condition is met.

Most of our empirical tests will focus on systems of equations like those described in (1) and (2) above. In Tables 4 and 6 the endogenous variable is an index of provisions (i.e., G-index, E-index) that is treated as a pseudo-continuous variable. In Table 5, the endogenous variable is a single binary provision. Given that the dependent variable in (1) is binary we have the option to either impose a cumulative distribution function on the outcome or estimate a linear probability model (LPM). Given that 2SLS in a LPM context allows for either binary or continuous endogenous regressors (both of which we use) we choose to use 2SLS with a LPM. This approach is similar to that discussed in such econometrics texts as Angrist and Pischke

(2009, page 198) and Cameron and Trivedi (2010, page 485). Cameron and Trivedi specifically note that using a 2SLS approach with a LPM results in consistent estimates but that heteroskedasticity-robust standard errors must be used for inference. As alternatives to the 2SLS approach, for robustness we also employ a recursive bivariate probit model and a limited-information maximum likelihood (LIML) approach to estimate ∂ and obtain qualitatively similar results. As noted in Stock and Yogo (2005) and in Hayashi (2000, page 542), 2SLS and LIML estimators have the same asymptotic distributions but LIML is more robust to small samples and to weak instruments.

2.3 Instrumental variables

Given the relevance and exclusion requirements described above, our instruments at the index level should (1) strongly correlate with index values at the firm, and (2) not relate to the likelihood of takeover at the firm in other ways. We use two instruments in this paper. The first instrument is based on the incidence of provisions at geographically-proximate firms that are not in the same industry as the subject firm. The second instrument is based on the incidence of provisions at firms that went public within one year of the firm in question.

To create the first instrument we first identify all firms within a 100-mile radius of the subject firm's headquarters using zip codes. We then eliminate firms within this group if they (1) have the same Fama-French 49 industry classification as the subject firm or (2) are located in a different state. If no peer firms are found using this approach then a statewide net is used instead of a 100-mile radius. To illustrate the construction of the geography-based instrument assume that the anti-takeover index has 2 provisions (provisions A and B). Assume the firm in question has four geographically-proximate peer firms identified using the process described above and that the presence of provision A using binary variables at these four firms is (0,0,1,1),

and the presence of provision B at these four firms is (1,1,0,1). Using these numbers, 50% of the geographically-proximate firms have provision A and 75% have provision B. Thus the instrument at the index level for this firm would be 0.50 + 0.75 = 1.25. At the provision level, the instrument for provision A would be 0.50 and the instrument for provision B would be 0.75.

In creating this instrument we purposely purge the peer group of within-industry peers to isolate geographic-peer effects in takeover provisions that are not industry effects. We argue that this process will pick up commonalities in takeover provisions that are driven by geographical proximity and that these (non-industry) trends arguably are not related to the specific takeover likelihood of the firm in question. As described in the introduction, geographic proximity could explain takeover defenses if there is a spillover of management ideas at the local level (e.g., university-sponsored CEO forums) and/or shared legal or consulting services. Figure 1 plots the headquarters in our sample and shows that these headquarters are in fact distributed widely across the US.[5]

[Insert Figure 1]

To create the second instrument we follow a similar approach but identify peer firms from all firms in the sample that went public within one year of the subject firm. Using this approach results in IPO-year cohorts for all but one firm. Given the size of firms covered in IRRC, many of the firms in our sample went public years before our sample period (1990-2008). To capture variation in takeover defenses over time we define IPO-year cohorts starting in 1950 and moved forward year-by-year through 2007. All firms that went public before 1950 are included as part of the 1950 cohort. Using this approach results in most years having 10 or more peer firms, with some years in the 1980s and 1990s having more than 100 peer firms per year.

[5] Although not depicted, Hawaii and Alaska are both in our sample and have multiple firms located in them.

Following the logic introduced with the geography-based instrument, the provision-level instrument for a given firm is the percent of IPO-year cohort firms that have the same provision. The index-level instrument is the sum of the provision-level instruments. Appendix B Table B2 provides the numbers of IPOs in each year for our sample.

As with the geography-based instrument, we argue that whatever sets of provisions a firm's IPO-year cohort of firms chose to have years in the past should have no direct relation with the specific takeover likelihood of the firm in question in year t+1 and hence the exclusion requirement is met. The two instruments are calculated using two different peer effects – one geographic in nature, and the other year-based in nature. The correlation between the two instruments for the G-index and E-index is .11 and .04, respectively.

3. Governance indices, individual provisions, and takeover deterrence

3.1 Takeover deterrence and the G-index and E-index

In Table 3, we begin our investigation of the relation between the indices and takeover deterrence in a traditional setting without regard to endogeneity. Columns 1-4 report coefficients from probit models, and columns 5-8 report results from linear probability models (for comparison purposes with subsequent tables). In all cases, the G-index and E-index are not significantly related to takeover likelihood in year t+1 or in the following five years. The G-index results are consistent with earlier findings (Core, Guay, and Rusticus, 2006; Bates, Becher, and Lemmon, 2008; Kadyrzhanova and Rhodes-Kropf, 2011; Sokolyk, 2011), and the E-index result consistent with a result reported in Bates, Becher, and Lemmon (2008) that is not tabulated. Again, these results are difficult to interpret because these tests do not attempt to control for endogeneity.

[Insert Table 3]

Table 4 reports on comparable (overidentified) test results that use both the geography-based and IPO-based instruments.[6] In Table 4, columns 1-3 (4-6) the dependent variable is set to 1 if the subject firm was acquired in year t+1 (years t+1 through t+5). The last two columns report the standardized coefficients for the G-index, E-index, and O-index from columns 1-6.[7] The standardized results imply that a standard deviation increase in the G-index is associated with a 9.5% reduction in the likelihood of being acquired in year t+1 and a 22% reduction over the next 5 years. A standard deviation increase in the E-index is associated with a 13.6% reduction in the likelihood of being acquired in year t+1 and a 29.3% reduction over the next 5 years. These results suggest that variations in takeover likelihood are slightly more sensitive to changes in the E-index than the G-index. However, the results for the O-index indicate that the provisions left out of the E-index but included in the G-index are, as a group, significantly related to acquisition likelihood. Indeed, the marginal effect on acquisitions within one year is 55% as large as that for the E-index, and the effect for acquisitions within five years is 63% of that for the E-index.

[Insert Table 4]

The bottom of Table 4 reports F-statistics from the first-stage regressions associated with the second-stage regressions in the first six columns. In all cases, the F-statistic is above 20 and reaches relatively high values of 85 and 133 for the G-index and O-index specifications, indicating that the instruments meet the relevance criterion.[8][9] Furthermore, the Staiger and Stock

[6] The just-identified results are qualitatively similar for the G-index using either instrument in isolation, but are significant for the E-index only with the geography-based instrument. The just-identified results are tabulated in Appendix B. Tables B3 and B4.

[7] Following Straska and Waller (2014) we call the provisions outside the E-index but in the G-index the "O-index".

[8] One advantage of having two instruments is the ability to test for instrument validity using overidentification tests. The null hypothesis in these tests is a joint null of both (1) correct model specification, and (2) instrument validity. Given our models correct for heteroskedastic errors and cluster by firm, we use the robust version of the Hausman overidentification test (see Wooldridge 2002, page 123). For the models shown in Table 4, using this test we reject the joint null for columns 1 and 2 at the 5% level. But then, using the same test, we obtain p-values greater than

(1997) and Stock and Yogo (2005) guidelines discussed in Section 2.1 imply that these instruments meet the criteria for "strong" instruments. Based on our economic argument that these instruments are not directly related to takeover likelihood, we interpret the results in Table 4 as providing evidence that the G-index and E-index are negatively related to takeover likelihood after controlling for endogeneity. This evidence supports the literature's widespread use of the G-index and E-index as proxies for a firm's takeover vulnerability. Furthermore, the O-index results indicate that some provisions in the G-index but excluded from the E-index also are negatively related to takeover likelihood.

4. Individual anti-takeover provisions as measures of takeover deterrence

In this section we move our attention from the index level to the individual provisions from which the indices are constituted. Our empirical strategy is the same as before: we rely on two equations in which one equation (the "structural" or "takeover" equation) models takeover likelihood as a function of the provision and other firm- and industry-level control variables while the other equation (the "first stage" in a 2SLS context) models the potentially endogenous presence of a given provision as a function of the instruments and other exogenous variables.

Table 5 reports the marginal effect that each provision has on takeover likelihood. A challenge that arises in these tests is how best to control for the other 23 provisions when examining the specific effect that any one provision might have on takeover likelihood.

0.20 for columns 3-6 indicating that for these columns we fail to reject the joint null hypothesis. Given that the only difference between columns 1 and 4 and columns 2 and 5 is the use of t+1 versus t+1 to t+5 time horizons for the dependent variable (i.e., a slight change in specification – not a change in instruments) and that the qualitative conclusions are the same, we interpret the test results as providing corroborating evidence that our instruments are valid. See Roberts and Whited (2012) for a discussion of common problems with overidentification tests. Consistent with that discussion we rely more on our arguments in Section 2 for instrument validity than on these specification tests.

[9] The Stock and Yogo (2005) test statistics were derived in a setting with homoskedastic errors. Consistent with the discussion in Cameron and Trivedi (page 199) and the lack of published guidelines on how to relate the test statistics to F-statistics in the context of heteroskedastic-robust errors, we follow Cameron and Trivedi and note that our F-statistics using robust standard errors greatly exceed the published guidelines and hence likely satisfy the test thus rejecting the null of weak instruments.

Columns 1 and 2 of Table 5 present two approaches to this challenge. In column 1, the results come from a single takeover equation that includes 24 separate binary variables included together at the same time. In column 2, the results come from 24 separate takeover equations, estimated one at a time, in which a single provision is included as the binary variable of interest. In the column 2 models, we include as a control variable an index that sums up the remaining 23 provisions (i.e., an index that could range in value from 0 to 23). Although not tabulated, all specifications in Table 5 also include the 75 firm-level and industry-level control variables from Table 4.

Neither of the approaches in columns 1 or 2 deal with endogeneity, but the results are presented in this way to show that the signs, sizes, and significance of the coefficients in columns 1 and 2 are generally similar using either approach. This result indicates that that we can control for the net effect of the remaining 23 provisions collectively while parsimoniously looking at the specific effect that each provision has on takeover likelihood, considered in isolation.[10] The marginal effects reported in columns 7, 8, and 9 follow the approach in column 2 but are estimated using both the takeover and provision equations together, thus identifying exogenous variation in each provision's incidence using the provision-level instruments.

[Insert Table 5]

Column 7 of Table 5 reports the marginal effects of the 24 provisions as estimated using 2SLS with a linear probability model (LPM) with 24 separate regressions in which each provision is treated, in turn, as the binary variable of interest. Columns 3-6 report diagnostic

[10] In untabulated results we re-estimate all specifications in Table 5 using the same two equations that appear in the Table 5 heading but in each case without the index of 23 provisions (i.e., the $index_{23}$ variable) to ensure that this modeling assumption is not driving our results. Doing this we find that the same coefficients that are significant in Table 5 are significant and they have the same signs. The one difference using this alternative approach is that the negative marginal effects of poison pills on takeover likelihood become significant in the 2SLS and LIML results in addition to the RBPB results suggesting that poison pills are significant in explaining takeover likelihood.

information related to these same 24 regressions. Column 3 reports the first-stage R-square value. Column 4 reports the F-statistic from the first-stage of each specification to provide information about the strength of the provision-level instrument. Column 5 summarizes this information by highlighting which provisions have strong instruments using the rule-of-thumb from Staiger and Stock (1997), which focuses on whether the F-statistic is greater than 10. (For most cases in which the F-statistic is above 10 it is above 30). Column 6 reports a "Yes" if the p-value from Wooldridge's (1995) robust score test for endogeneity is smaller than 5% and hence provides supporting evidence that the variable in question is actually endogeneous.[11]

For robustness, columns 8 and 9 report the marginal effects of the 24 provisions on takeover likelihood using two alternative estimation approaches that are based on the same two underlying equations but that use different modeling assumptions and hence are not subject to the same weaknesses as 2SLS. The column 8 results are estimated using a recursive bivariate probit model (RBPM). Under this approach, the two equations are estimated as simultaneous equations using maximum likelihood techniques that allow for correlation between the errors in the two equations. As discussed in Greene (2003, pages 715-716), this type of approach can be used to consistently estimate the marginal effects of an endogeneous binary regressor in a system of equations like the one we are using in which both equations in the system have binary outcomes. Given that the correlation in errors is allowed and modeled, this approach is not as sensitive to some of the assumptions needed to motivate the 2SLS approach. Following Greene (2003, page 716) we estimate the marginal effects in Column 8 as the difference in the predicted probability of observing a takeover conditional on having or not having the provision in place

[11] Given that we are using a LPM the errors are known to be heteroskedastic. Hence, the test for endogeneity is not done using the traditional Hausman approach. See Wooldridge (2002, pages 118-121) for a discussion of the traditional approach. Wooldridge (1995) shows how the test for regressor endogeneity can be made robust to heteroskedasticity. Cameron and Trivedi discuss the robust test (page 190) as the "robustified" Durbin-Wu-Hausman test.

while holding all other characteristics at the firm constant. A comparison of the results in columns 7 and 8 reveal that the signs and significance of the RBPM marginal effects are for the most part similar to the 2SLS results.

As an additional robustness test, in column 9 we report the marginal effects from a limited-information maximum likelihood (LIML) estimation of the two underlying equations. As noted in Stock and Yogo (2005) and in Hayashi (2000, page 542), 2SLS and LIML estimators have the same asymptotic distributions but LIML is more robust to small samples and to weak instruments. A comparison of the marginal effects using the 2SLS, RBPM, and LIML approaches show a few differences, but all of the significant results from the 2SLS approach are confirmed significant by both robustness approaches, with only one result lacking unanimous support.

Column 10 displays the estimated sign of each provision's marginal effect on acquisition likelihood, using the signs and significance (10% p-value cutoff) of the 2SLS LPM results shown in column 7 if there is evidence of a strong instrument. If a provision lacks evidence of a strong instrument and lacks evidence of endogeneity, then the signs and significance of the LPM model are used from Column 2. The signs of the marginal effects for poison pills and director contracts are also included in column 10 given the results of robustness tests shown in Appendix B, Tables B5 and B6 indicating that these provisions are likely related to takeover likelihood. In the case of poison pills, the RBPM results are significant in Table 5 and, as shown in Appendix B Table B6, both the 2SLS and LIML results become significant in specifications that omit a variable summarizing the remaining 23 provisions. In the case of director contracts, given that there is no evidence of endogeneity we rely on the LPM results, and also note that director contracts become significant in robustness tests tabulated in Appendix B Table B5.

The results in column 10 reveal 11 provisions that have the expected relation with takeover outcomes given their treatment in the literature. The 11 provisions include anti-greenmail provisions, classified boards, director indemnification, director contracts, limitations on director liability, director duty provisions, fair price provisions, cashout laws, poison pills, supermajority vote requirements, and unequal voting rights.

The F-statistics in Table 5 reveal that our approach to creating instruments does not result in strong instruments for all provisions. Indeed, nine of the 24 provisions do not have strong instruments. It is also the case that for these nine provisions, the test for endogeneity fails to reject the null of exogeneity. For this reason in column 10, we focus on the column 2 results in the cases where the instrument is weak and there is no evidence of endogeneity. The weak instruments likely explain some of the differences between the 2SLS and RBPM results. For example, several provisions that appear significant in the RBPM results with negative signs but that are not significant in the 2SLS results (but that do have negative signs) include poison pills, charter limits, as well as silver and pension parachutes. For all of these provisions, the first-stage F-statistics indicate that the instruments are weak, possibly leading to large errors in the second stage model. Given the weakness in the instruments in these tests, we cannot draw strong conclusions about whether these specific provisions affect takeover likelihood. The RBPM results, however, do support the inference that these provisions do affect takeover likelihood.

As summarized in column 10, three provisions have the opposite effect on takeover likelihood as assumed in the construction of the G-index: compensation plans with change-in-control provisions, golden parachutes, and the lack of cumulative voting. A plausible interpretation of the compensation-related variables seems clear: if offered a generous payout

conditional on their firm being acquired, managers will be more likely to seek acquirers and/or to agree to be acquired if an unsolicited bid arises. But here again, these two variables do not have strong instruments and the results are not supported by the robustness checks, suggesting that this interpretation of the data for these two provisions is speculative. The last variable, Not Cumulative Voting, does have a strong instrument as well as support from the LIML results. One argument for why cumulative voting would facilitate takeovers is that allowing shareholders to cumulate their votes would facilitate their election of the director of their choice. This explanation for why allowing cumulative voting is conducive to takeovers seems to assume that only the parties in favor of the takeover would cumulate their votes; it seems plausible in some instances that management, blockholders aligned with management, and/or employees could also control sizeable amounts of shares, suggesting that they too could cumulate their votes to deter takeover bids.[12]

5. Creating a new and improved deterrence index

The results in Tables 4 and 5 imply the following six conclusions:

(1) After dealing with endogeneity using either a geography-based or IPO-year-based instrument, or both instruments together, higher levels of the G-index are indeed associated with lower takeover likelihood. The F-statistics for these 2SLS tests are well above the literature's guidelines for identifying strong instruments. These results

[12] The Table 5 2SLS LPM results are based on an overidentified model using both the geography-based and IPO-year-based instruments together. The just-identified version of the 2SLS LPM results for Table 5 are tabulated in Appendix B in Table B5. In all but one case if a variable is found to be significant using the 2SLS LPM approach with an overidentified model (Table 5) then it also appears significant in at least one of the just-identified models shown in Table B5. The F-statistics in Table B5 show how for certain provisions the IPO-based instrument is better while for others the geography-based instrument is better. Using the instruments together in Table 5 generally leads to results for each provision that mirror the just-identified results for whichever instrument has the higher F-statistic for that provision. The one exception involves the Not Cumulative Voting variable which is not significant in either of the just-identified models. This suggests that this result may not be robust.

corroborate the assumption used in many studies, that the G-index is a measure of takeover deterrence.

(2) After dealing with endogeneity using a geography-based (but not IPO-year-based) instrument (tabulated in Appendix B Tables B3 and B4), higher levels of the E-index are associated with a lower takeover likelihood. Here again, at the index level the F-statistics for our 2SLS equations indicate that the instruments are strong. The mixed results for the E-index may reflect their relatively strong reliance on golden parachutes, as in subsequent tests we find that golden parachutes, by themselves, are positively related to takeover likelihood.

(3) Accounting for endogeneity, an index based on the provisions that are included in the G-index but excluded from the E-index is negatively and significantly related to takeover likelihood.

(4) Accounting for endogeneity, there is strong evidence that several individual antitakeover provisions have negative marginal effects on takeover likelihood. These include: anti-greenmail provisions, director indemnification, limitations on director liability, director duty provisions, fair price provisions, cashout laws, and supermajority vote requirements.

(5) Weaker evidence indicates that several other provisions also likely deter takeovers. These findings are less robust due to either a lack of a strong instrument or a lack of consensus across alternative estimation approaches. These provisions include: classified boards, poison pills, director contracts, and unequal voting rights.

(6) Weak evidence indicates that change-in-control compensation plans, golden parachutes, and the absence of cumulative voting have a positive marginal effect on takeover likelihood.

In this section we use these results to construct a new index that best reflects a firm's takeover defense posture. We call this index the Deterrence Index, or D-index. In creating the D-index we draw from Table 5 and add 1 for each of the 11 provisions that have significant negative marginal effects on takeover likelihood, and add 1 for the absence of each of the three provisions that have significant positive effects. Given the set of strong results and plausible

results discussed in conclusions (5) and (6) above there is some question as to which provisions to include in the D-index. As a base case we include those provisions whose signs appear in column 10 that correspond broadly with the 2SLS LPM results ("D-index").

Our empirical approach is to model takeover likelihood as a function of the sets of provisions identified not only by popular anti-takeover indices (e.g., G-index and E-index) but also as a function of the D-index provisions. We employ the same index-level instruments in this test that are used in Table 4 for the G-index and E-index; for the D-index we calculate D-index-specific geography-based and IPO-year-based instruments by summing the provision-level instruments for the set of provisions included in the D-index. Table 6 reports the marginal effect of each index of provisions both with and without controls for endogeneity. To facilitate comparison across indices both raw and standardized coefficients are reported. Importantly, for our tests we also create indices based on subsets of provisions that appear in the G-index (and E-index) but that do not overlap with the D-index, to see if when aggregated they still help to explain takeover outcomes. If all of the predictive power from the G-index and E-index come from those provisions that also appear in the D-index then we would not expect these sets of provisions outside the D-index to be significantly related to takeover likelihood.

[Insert Table 6]

Column 1 of Table 6 reports the marginal effect of each set of provisions on takeover likelihood without correcting for endogeneity. As noted before, neither the G-index nor the E-index correlates with takeover likelihoods in these types of specifications. In rows 3 and 4 we also look at the predictive power of two other anti-takeover indices used in the literature. The ATI refers to the Alternative Takeover Index described in Cremers and Nair (2005), and the FK index refers to the index used in Field and Karpoff (2002), Chemmanur et al. (2011), and

Johnson et al. (2014). Column 2 reports the marginal effect of each set of provisions as estimated from the takeover equation after correcting for endogeneity using a 2SLS approach. Rows 1-3 show that after correcting for endogenity the G-index, the E-index, and the FK index all have some power to explain takeover likelihood.

The results in Columns 1 and 2 for rows 5 and 6 show that the D-index has predictive power for takeover outcomes with or without correcting for endogeneity. The results in rows 7-9 reveal that the subsets of provisions within the G-index, E-index, ATI, and FK indices that are not also part of the D-index have no statistical relation with takeover likelihood with or without correcting for endogeneity. This result indicates that the predictive power that these popular indices have for takeover likelihood is wholly accounted for by the provisions that are in the D-index. The results in rows 10 – 11 support this interpretation and show that the subsets of provisions within the E-index and FK index that also appear within the D-index (and using the signs from Table 5) do have predictive power for takeover outcomes with or without controlling for endogeneity. We conclude from these results that, although the G-index and E-index are negatively related to takeover likelihood after controlling for endogeneity, these relations are wholly attributable to the set of provisions that constitute the D-index. Figure 2 depicts how the various anti-takeover indices relate to each other.

[Insert Figure 2]

6. Conclusion

The G-index and E-index are used extensively in the literature as proxies for takeover vulnerability. Yet, because of endogeneity, almost no empirical evidence exists that quantifies whether, or how much, various takeover defenses, or combination of defenses, actually affect a firm's likelihood of being acquired. Indeed, we find that, in simple tests that do not account for

endogeneity, there is no empirical relation between a firm's G-index or E-index and its acquisition likelihood.

In this paper we use two instruments to identify tests of the relation between takeover defenses and acquisition likelihood. The first instrument is based on the use of takeover defenses by geographically proximate firms that are not in the same industry as the subject firm, and the second instrument is based on the use of takeover defenses by firms in the same IPO cohort as the subject firm. Previous findings indicate that a firm's geography and IPO year have strong effects on its use of takeover defenses that are related to networking and law firm influence rather than a direct concern about takeover vulnerability. These instruments thus help us simulate arbitrary variations in a firm's use of takeover defenses to test for the relation between the use of such defenses and takeover likelihood.

Using these controls for endogeneity, we find that a one-standard deviation increase in the instrumented value of a firm's G-index (E-index) is associated with a 9.5% (13.6%) reduction in the probability that the firm will be acquired within one year. At the provision level we find strong evidence that several provisions negatively affect takeover likelihood: anti-greenmail provisions, director indemnification, limitations on director liability, director duty provisions, fair price provisions, cashout laws, and supermajority vote requirements. We also find weaker evidence that several other provisions negatively affect takeover likelihood, including classified boards, poison pills, director contracts, charter limitations, and unequal voting rights. Three provisions counted as takeover deterrents in the G-index are positively and significantly related to takeover likelihood: change-in-control compensation plans, golden parachutes, and the absence of cumulative voting.

Overall, our results provide empirical support for the widespread use of the G-index and E-index as measures of takeover deterrence because – even taking endogeneity into account – both indices are negatively related to takeover likelihood. However, we also show that the relation between takeover likelihood and the G-index is driven by a subset of provisions that, collectively, we call the Deterrence Index or D-index. The D-index is a purely empirically-based collection of 14 provisions that, we propose, best reflects a firm's takeover defense posture. Many of these provisions are excluded from the E-index, and three of them are counted with the opposite sign from how they are included in the G-index.

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Figure 1: Firm headquarters in our sample

The figure below shows the headquarters of firms in our sample. Our sample was created as the intersection of firm in both the IRRC and Compustat databases from 1990-2008.

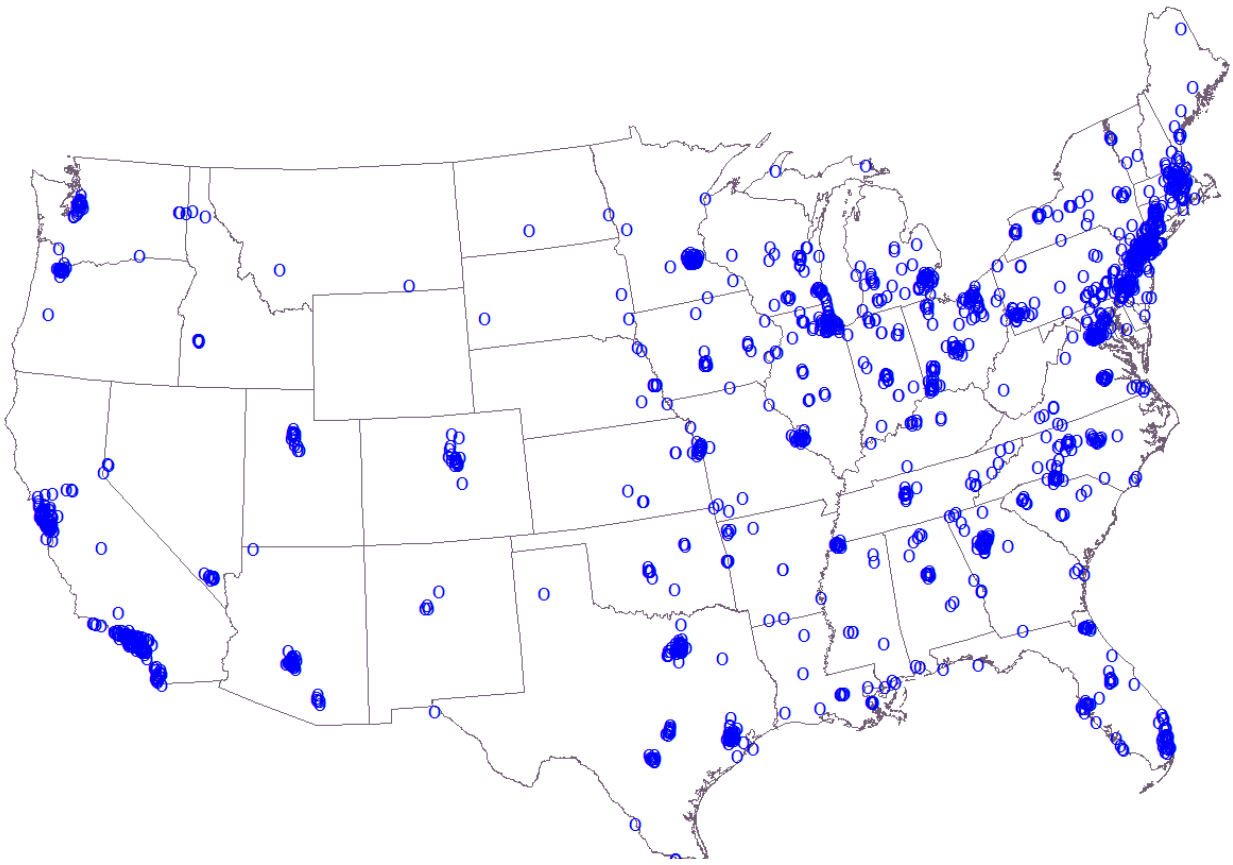

Figure 2: Venn Diagram For Takeover Indices

In the figure below the 24 provisions covered in the G-index are represented visually by the largest circle. Each of the shapes within the circle represent other takeover indices used in the literature to proxy for takeover vulnerability. The shaded regions identify which provisions are shared between indices. The figure visually highlights the differences in opinions that exist in the finance literature about which provisions relate to takeover likelihood, and helps motivate the empirical measures used in Table 6. The G-index, E-index, ATI, and FK index are respectively described in Gompers, Ishii, and Metrick (2003), Bebchuk, Cohen, and Ferrell (2009), Cremers, Nair, and John (2009), and Field and Karpoff (2005). The O-index includes the G-index provisions minus the E-index provisions and is shown in the figure using the circular hatch marks. The three provisions shown with negative signs indicate that based on Table 5 the presence of these provisions is empirically linked to higher likelihood of takeover.

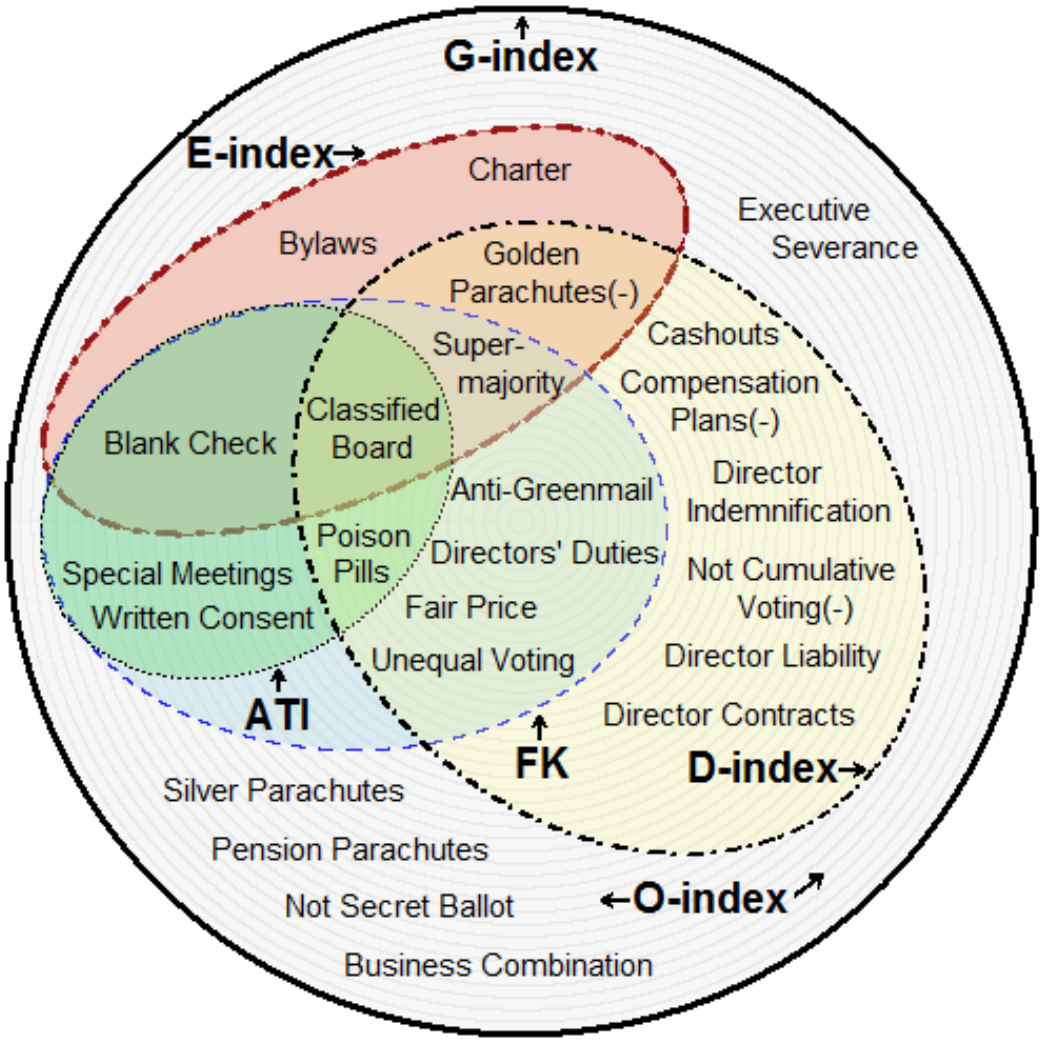

Table 1: Sample information across years

The table reports each year the number of firms (year t) and the number of takeovers (year t+1) in our sample. The last two columns report the mean G-index, and E-index values for the firms in the sample. The sample is based on the intersection of the IRRC and Compustat databases for these years.

Year	Number of Firms	Number of Takeovers	G-Index	E-index
1990	1,036	24	8.97	2.39
1991	1,018	20	8.99	2.40
1992	1,002	19	9.01	2.41
1993	1,100	24	9.19	2.48
1994	1,076	40	9.21	2.49
1995	1,137	40	9.27	2.53
1996	1,103	60	9.28	2.54
1997	1,030	58	9.29	2.54
1998	1,420	126	8.73	2.52
1999	1,311	111	8.76	2.52
2000	1,296	63	9.02	2.65
2001	1,202	29	9.04	2.65
2002	1,518	49	9.06	2.72
2003	1,467	42	9.08	2.73
2004	1,484	71	9.14	2.78
2005	1,412	72	9.17	2.79
2006	1,373	103	9.11	2.80
2007	1,270	59	9.11	2.79
2008	1,188	52	9.12	2.79

Table 2: Descriptive statistics

The mean and median values of the variables described below are shown for all firms in the sample from 1990-2008. The sample is based on the intersection of IRRC and Compustat. Firm size is measured as the book value of assets. Leverage is measured as long-term debt divided by book value of assets. Market to book is the sum of the book value of debt and the market value of equity all divided by the book value of assets. ROA is calculated as operating income after depreciation divided by the book value of assets. It is adjusted by subtracting the median industry ROA each year using Fama-French 49 industries. The property ratio is calculated as the gross property, plant, and equipment divided by the book value of assets. The Liquidity ratio is the difference between current assets and liabilities divided by the book value of assets. Sales growth is the average annual sales growth calculated over years t, t-1, and t-2. Market-adjusted returns are the buy-and-hold returns at the firm over the prior calendar year minus the buy-and-hold return on the CRSP value-weighted index over the same time period. Industry concentration is measured as the Herfindahl-Hirshman index using Compustat sales information.

Variable	Mean	Median	Observations
G-index	9.08	9	23,443
E-index	2.62	3	23,443
Target	0.05	0	23,443
Firm size ($ millions)	4566.37	1199.8	23,443
Market value of equity ($ millions)	5469.1	1150.17	23,443
Leverage	0.21	0.2	23,443
Market to book	1.53	1.13	23,443
Industry-adjusted ROA	0.05	0.03	23,443
Property ratio	0.61	0.55	23,443
Liquidity ratio	0.19	0.17	23,443
Sales growth	0.1	0.07	23,443
3-year sales growth	0.03	0.02	23,443
Market-adjusted return	0.01	-0.03	23,443
Industry concentration	6.35	5.01	23,443

Table 3: Likelihood of being acquired as a function of index values

Coefficients from a probit and a linear probability model are shown in columns 1-4 and 5-8, respectively. In columns 1-2 and 5-6 (3-4 and 7-8) the dependent variable is set to 1 if the firm was acquired over the next year (five years). The control variables are described in Table 2. P-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. The errors are robust to heteroskedasticy and clustered at the firm-level.

	Probit Models				Linear Probability Models			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(t+1)	(t+1)	(t+1,t+5)	(t+1,t+5)	(t+1)	(t+1)	(t+1,t+5)	(t+1,t+5)
G-index	-0.003		0.004		-0.000		0.001	
	(0.635)		(0.654)		(0.404)		(0.746)	
E-index		0.003		0.018		-0.000		0.005
		(0.827)		(0.335)		(0.911)		(0.374)
Firm size	-0.108***	-0.109***	-0.091***	-0.090***	-0.010***	-0.010***	-0.023***	-0.023***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Leverage	0.218**	0.218**	0.286***	0.284***	0.019*	0.019*	0.071**	0.071**
	(0.010)	(0.010)	(0.004)	(0.004)	(0.065)	(0.064)	(0.013)	(0.014)
Market to book	-0.088***	-0.087***	-0.107***	-0.106***	-0.006***	-0.006***	-0.023***	-0.022***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Property ratio	-0.149***	-0.152***	-0.096	-0.097	-0.015***	-0.016***	-0.025	-0.025
	(0.009)	(0.008)	(0.215)	(0.210)	(0.009)	(0.008)	(0.250)	(0.245)
Liquidity ratio	-0.447***	-0.445***	-0.261**	-0.257**	-0.052***	-0.052***	-0.073**	-0.071**
	(<0.001)	(<0.001)	(0.016)	(0.018)	(<0.001)	(<0.001)	(0.020)	(0.023)
Sales growth	-0.150**	-0.149**	-0.041	-0.041	-0.017***	-0.017***	-0.014	-0.014
	(0.021)	(0.021)	(0.381)	(0.378)	(0.008)	(0.009)	(0.299)	(0.298)
Industry-adjusted ROA	-0.302*	-0.305*	-0.074	-0.078	-0.036**	-0.036**	-0.028	-0.028
	(0.060)	(0.058)	(0.707)	(0.696)	(0.047)	(0.046)	(0.610)	(0.602)
Market-adjusted return	0.013	0.013	0.009	0.009	0.001	0.001	0.002	0.002
	(0.712)	(0.726)	(0.633)	(0.657)	(0.692)	(0.703)	(0.645)	(0.671)
Industry concentration	-0.003	-0.003	-0.014*	-0.014*	-0.000	-0.000	-0.003*	-0.003*
	(0.679)	(0.688)	(0.053)	(0.056)	(0.390)	(0.403)	(0.084)	(0.092)
Constant	-0.977***	-1.003***	-0.266	-0.283	0.128***	0.125***	0.350***	0.343***
	(0.001)	(0.001)	(0.455)	(0.426)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,351	23,351	23,436	23,436	23,443	23,443	23,443	23,443
Pseudo R-square	0.067	0.067	0.066	0.066				
Chi-square	595.831	595.824	846.313	847.676				
R-square					0.026	0.025	0.062	0.062

Table 4: Takeover likelihood as a function of index values after correcting for endogeneity

The table below shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index variables using both the geography-based and IPO-year-based instruments described in section 2.3. In columns 1-3 (4-6) the dependent variable is set to 1 if the firm was acquired in the next year (five years). The control variables are described in Table 2. The last 2 columns report the second stage coefficients from 6 regressions that mirror those in columns 1-3, and 4-6, respectively, but using standardized versions of the G-index, E-index, and O-index variables where a 1 unit increase in the standardized variable represents a standard deviation increase in the underlying index. To save space only the main variables of interest are reported (and stacked) in the last 2 columns from 6 separate regressions that in each case included the same control variables as shown in columns 1-6. P-values are shown in parenthesis below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)	Columns	Columns
Dependent Variable:	(t+1)	(t+1)	(t+1)	(t+1,t+5)	(t+1,t+5)	(t+1,t+5)	1-3, Std	4-6, Std
G-index	-0.007***			-0.033***			-0.095***	-0.220***
	(<0.001)			(<0.001)			(<0.001)	(<0.001)
E-index		-0.024***			-0.097***		-0.136***	-0.283***
		(0.006)			(0.007)		(0.006)	(0.007)
O-index			-0.008***			-0.035***	-0.075***	-0.177***
			(0.001)			(<0.001)	(0.001)	(<0.001)
Firm size	-0.008***	-0.010***	-0.008***	-0.013**	-0.023***	-0.013**		
	(<0.001)	(<0.001)	(<0.001)	(0.013)	(<0.001)	(0.017)		
Leverage	0.019*	0.022**	0.018*	0.069**	0.084***	0.065**		
	(0.076)	(0.039)	(0.092)	(0.021)	(0.008)	(0.029)		
Market to book	-0.007***	-0.007***	-0.006***	-0.027***	-0.029***	-0.025***		
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)		
Property ratio	-0.010*	-0.012*	-0.011*	-0.001	-0.009	-0.005		
	(0.086)	(0.061)	(0.057)	(0.957)	(0.713)	(0.812)		
Liquidity ratio	-0.058***	-0.063***	-0.055***	-0.100***	-0.117***	-0.086***		
	(<0.001)	(<0.001)	(<0.001)	(0.002)	(0.002)	(0.006)		
Sales growth	-0.020***	-0.018***	-0.019***	-0.026*	-0.020	-0.025*		
	(0.003)	(0.005)	(0.003)	(0.061)	(0.155)	(0.072)		
Industry-adjusted ROA	-0.033*	-0.031*	-0.034*	-0.011	-0.006	-0.017		
	(0.074)	(0.093)	(0.061)	(0.849)	(0.918)	(0.755)		
Market-adjusted return	0.002	0.003	0.002	0.007	0.009	0.005		
	(0.509)	(0.420)	(0.593)	(0.212)	(0.151)	(0.354)		
Industry concentration	-0.001	-0.001*	-0.000	-0.004**	-0.005**	-0.003*		
	(0.221)	(0.099)	(0.345)	(0.039)	(0.014)	(0.075)		
Constant	0.177***	0.187***	0.160***	0.588***	0.603***	0.515***		
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)		
Year controls	Yes	Yes	Yes	Yes	Yes	Yes		
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes		
Observations	23,443	23,443	23,443	23,443	23,443	23,443		
Chi-square (2nd stage)	502.8	471.7	506.0	961.8	902.6	983.7		
Prob < Chi-square (2nd stage)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
F-statistic (1st stage)	85.3	27.9	133.4	85.3	27.9	133.4		
R-square (1st stage)	0.171	0.108	0.196	0.171	0.108	0.196		

Table 5: Takeover likelihood as a function of individual provisions after correcting for endogeneity

Columns 1, 2, 7, 8, and 9 report the marginal effects related to the ∂_i's shown in the takeover equation below where p_i is an indicator variable for each of the 24 takeover provisions considered in the paper. In all specifications the dependent variable (y_1) is set to 1 in year t if the firm in question is acquired in t+1. In all specifications the same 75 control variables used in Table 4 are also included (but not tabulated) controlling for various firm, industry and year effects.

$$y_1 = \propto_0 + p_i\partial_i + index_{23}\vartheta_{23} + \sum_{j=1}^{75} x_j\beta_j + e \qquad \text{(takeover equation, columns 2-9)}$$

$$p_i = \alpha_0 + z\_p_{geo,i}\pi_i + z\_p_{ipo,i}\theta_i + index_{23}\alpha_{23} + \sum_{j=1}^{75} x_j\gamma_j + u \qquad \text{(first stage equation, columns 3-9)}$$

The results in columns 1 and 2 are estimated using only the takeover equation whereas the results in the other columns are estimated using both equations. In column 1 the marginal effects are all from a single linear probability regression model (LPM) that includes all 24 provisions together each as separate indicator variables in addition to the control variables. Hence for column 1, unlike the other columns, the takeover equation does not include an index_{23} variable and instead includes 24 p_i's. In contrast, the marginal effects in column 2 (and in each of the other columns) are from 24 separate regressions where for each regression one provision at a time is included as an indicator variable (p_i) while simultaneously controlling collectively for the other 23 provisions using an index (index_{23}). The results in columns 3-7 all come from a 2SLS LPM that includes both the geography- and IPO-year-based instruments (z_p_{geo} and z_p_{ipo}) in the first stage. The instruments are described in section 2.3. Columns 3 and 4 report the R-square and F-statistic from the first-stage equation and provide a sense as to the strength of the instruments. Column 5 indicates whether there is evidence of a strong instrument using the F-statistic rule-of-thumb cutoff of 10 as advocated in Staiger and Stock (1997). Column 6 indicates whether the p-value from Wooldridge's (1995) robust score test is less than 5%. For this test the null hypothesis is that the provision is exogenous, so a p-value < 5% provides evidence that the variable in question needs to be treated as endogenous. Column 7 reports the marginal effect of each provision on being acquired as estimated in the second stage (takeover) equation. For robustness, columns 8 and 9 are based on alternative modeling approaches and report the marginal effects from a recursive bivariate probit model (RBPM) and a limited-information maximum likelihood (LIML) model, respectively. The underlying equations (shown above) are similar for the 2SLS LPM, RBPM, and LIML models but different key assumptions are made in each approach. For the RBPM the two left-hand side variables in the equations above are considered latent variables (y_1^*, p_i^*) that are not directly observed. By assumption, y_1 and p_i are observed to equal 1 when their underlying respective latent variables are above a certain threshold. In the RBPM the errors are assumed to have a bivariate normal distribution with a modeled correlation of ρ: $\binom{u}{e} \sim N\left\{\binom{0}{0}, \binom{1\ \rho}{\rho\ 1}\right\}$. RBPM marginal effects are estimated as the difference in the predicted probability of observing a takeover conditional on having or not having the provision while holding all other characteristics at the firm constant following Greene (5 ed., page 716). For both the RBPM and LIML approaches, maximum likelihood estimation techniques are used to estimate both equations. Column 10 summarizes the sign of each provision's marginal effect on the likelihood of being acquired using a 10% p-value cutoff. Column 10 uses the signs and significance of the 2SLS LPM results if there is evidence of a strong instrument. If the instrument is weak and there is no evidence of endogeneity then the LPM results from column 2 are used. As summarized in Appendix B table B7, Poison pills and Director contracts are also included in the D-index based on robustness tests discussed in the paper. Significance of the 2SLS, RBPM, and LIML marginal effects is shown using asterisks with significance at the 10%, 5% and 1% shown using *, **, and ***, respectively. Errors are corrected for heteroskedasticiy and clustered by firm.

Table 5, continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	LPM Marginal Effects (all together)	LPM Marginal Effects (one at a time)	LPM 2SLS First-stage R-Square	LPM 2SLS First-stage F-Statistic	Evidence of Strong IV?	Evidence of endog-eneity?	LPM 2SLS Marginal Effects	Recursive Bivariate Probit Marginal Effects	LIML Marginal Effects	Proposed D-index
Anti-greenmail	-0.004	-0.006*	0.25	156.03	yes	yes	-0.027***	-0.005***	-0.027***	-
Blank check	-0.006	-0.004	0.11	38.12	yes		0.031	0.004	0.031	
Classified board	-0.007**	-0.005*	0.16	3.10			-0.063	-0.008	-0.066	-
Compensation plans	0.004	0.006*	0.14	1.33			-0.116	0.015	-0.134	+
Not cumulative voting	0.003	0.005	0.13	39.83	yes		0.037**	0.016	0.037**	+
Director indemnification	0.002	-0.004	0.21	115.39	yes	yes	-0.029***	-0.007***	-0.029***	-
Director contracts	-0.008*	-0.009**	0.07	21.56	yes		-0.046	-0.003	-0.046	-
Director liability	-0.008**	-0.007**	0.44	438.89	yes		-0.016**	-0.007***	-0.016**	-
Directors' duties	-0.002	-0.005	0.14	36.65	yes	yes	-0.037**	-0.004**	-0.037**	-
Fair price	-0.003	-0.006**	0.26	108.21	yes	yes	-0.043***	-0.018***	-0.043***	-
Golden parachutes	0.016***	0.016***	0.14	0.58			-0.248	-0.01	-0.258	+
Bylaws	-0.001	0.001	0.08	28.71	yes		0.010	0.000	0.010	
Charter	0.019	0.019	0.05	2.84			-0.067	-0.010***	-0.072	
Cashouts	0.002	-0.004	0.30	29.36	yes	yes	-0.032**	-0.001**	-0.032**	-
Special meeting	-0.004	0.001	0.17	60.74	yes		0.004	0.002	0.004	
Written consent	0.009***	0.009***	0.18	95.22	yes		0.024	0.007	0.024	
Pension parachutes	-0.003	0.003	0.06	4.64			-0.072	-0.004***	-0.072	
Business combination	0.002	0.003	0.17	85.35	yes		0.000	0.002	0.000	
Poison pill	0.001	0.005	0.15	4.26			-0.094	-0.032**	-0.094	-
Not secret ballot	-0.004	-0.003	0.17	16.66	yes		-0.020	0.006	-0.020	
Executive severance	0.000	-0.007	0.04	1.35			0.269	-0.001	0.271	
Silver parachutes	0.003	0.002	0.06	1.00			-0.519	-0.003**	-0.556	
Supermajority	-0.008**	-0.010***	0.20	149.16	yes	yes	-0.038***	-0.015***	-0.038***	-
Unequal voting	-0.021**	-0.024**	0.03	1.78			0.566	-0.002	0.567	-

Table 6: Which sets of provisions explain takeover likelihood?

The table below reports the regression coefficients in columns 1 and 2 from limited probability models (LPM) where in each row a different set of provisions is included as the key variable of interest. In all cases the same 75 control variables shown in Table 4 for various firm, industry and year effects are included in these regressions but not tabulated. The dependent variable (y_1) is set to 1 in year t if the firm was acquired in year t+1. The ∂'s in column 1 were estimated without correcting for endogeneity using just the takeover model shown below.

$$y_1 = \propto_0 + set_i\partial_i + \sum_{j=1}^{75} x_j\beta_j + e \text{ (takeover equation)}$$

$$set_i = \delta_0 + set_i geo\_IV_i\pi_i + set_i ipo\_IV_i\vartheta_i + \sum_{j=1}^{75} x_j\omega_j + \mu \text{ (first stage equation)}$$

In the equations, set_i refers to each of the 19 sets of provisions listed in Table 6. These particular sets of provisions correspond with either (1) the anti-takeover indices used in the literature, or (2) subsets of these indices that either do or do not overlap with the provisions found to be significant in explaining takeover likelihood in Table 5. For example, row 1 corresponds with the G-index as discussed in Gompers, Ishii, and Metrick (2003) and row 9 corresponds with the set of provisions in the E-index that are not also in D-index. The D-index refers to the sets of provisions identified in column 10 of Table 5. The ∂'s in column 2 were estimated after correcting for endogeneity using a 2SLS approach with the geography- and IPO-year-based instruments ($set_i geo\_IV_i, set_i ipo\_IV_i$) described in section 2.3. The ∂'s in column 3 are standardized versions of those in column 2. The last 2 columns report the F-statistic and R-square values form the 1st stage equation used when estimating the ∂'s in columns 2 and 3. The significance of the ∂'s is shown at the 10%, 5%, and 1% levels using *, **, ***, respectively. The errors are robust to heteroskedasticity and clustered at the firm-level. The sets of provisions with a "(-)" indicate that those sets of provisions were aggregated using the signs from Table 5 meaning that the absence of golden parachutes and compensation plans and the presence of cumulative voting were added to these sets.

	Sets of Provisions	(1) LPM ∂'s	(2) 2SLS LPM ∂'s	(3) 2SLS LPM std ∂'s	(4) 1st Stage F-statistic	(5) 1st Stage R-Square
	Anti-takeover indices used in literature					
1	All provisions in G-index	< 0.001	-0.007***	-0.095***	85.300	0.171
2	All provisions in E-index	< 0.001	-0.024***	-0.136***	27.861	0.108
3	All provisions in O-index	-0.001	-0.008***	-0.075***	133.353	0.196
4	All provisions in KF	-0.001*	-0.015***	-0.130***	46.736	0.129
5	All provisions in ATI	< 0.001	0.002	0.012	41.271	0.109
	New takeover deterrence index					
6	All provisions in D-index(-)	-0.004***	-0.007***	-0.070***	249.385	0.351
7	All provisions in D-index	-0.001	-0.007***	-0.073***	207.263	0.280
	Sets of provisions that do not overlap with D-index					
8	G-index provisions not in D-index	0.001	0.003	0.020	59.587	0.097
9	E-index provisions not in D-index	< 0.001	0.015	0.043	34.056	0.074
10	O-index provisions not in D-index	0.001	0.003	0.016	44.812	0.080
11	ATI and KF provisions not in D-index	0.001	0.009	0.041	84.150	0.156
	Sets of provisions that overlap with D-index					
12	E-index provisions also in D-index(-)	-0.010***	-0.033***	-0.130***	38.757	0.102
13	E-index provisions also in D-index	< 0.001	-0.033***	-0.146***	55.020	0.137

14	O-index provisions also in D-index(-)	-0.005***	-0.008***	-0.072***	218.687	0.321
15	O-index provisions also in D-index	-0.002*	-0.007***	-0.059***	263.180	0.310
16	KF provisions also in D-index	-0.003***	-0.014***	-0.099***	130.107	0.222
17	ATI provisions also in D-index	-0.001	-0.042*	-0.158*	8.970	0.062
	Sets of provisions in D-index not in other indices					
18	D-index provisions not in E-index ATI or KF(-)	-0.004***	-0.008***	-0.046***	265.443	0.342
19	D-index provisions not in E-index ATI or KF	-0.001	-0.009***	-0.050***	236.840	0.262

Appendix A. Corporate governance provisions

This appendix describes the governance provisions used throughout this paper, as well as how their associated binary variables are computed. The appendix discusses each provision's role in the calculation of the corporate governance indices. The shorthand title of each provision, as used in the text and tables of this paper, is provided first in italics. The descriptions are in alphabetical order and draw extensively from Rosenbaum [1998]. For some provisions, the impact on shareholder rights is discussed, or the logic behind their inclusion in the index established by Gompers, Ishii, and Metrick (2003) ("GIM").

(1) *Antigreenmail:* Greenmail refers to a target firm's tactical response to a takeover bid, wherein the target repurchases its own shares from a potential acquirer (or blockholder) holding a large block of shares. The target usually pays a premium over the market price, in exchange for the blockholder's promise not to seek control of the company for a specified period of time. The payment is called "greenmail" and the promise it buys is the "standstill agreement." Thus, these provisions prevent a blockholder from acquiring a target's stock and then sell it back at an above-market price.

Five states have special anti-greenmail laws**,** and two other states have "recapture of profits" laws, which enable firms to recapture raiders' profits earned in the secondary market. GIM argue that recapture of profits laws can be considered as a version of anti-greenmail laws (albeit a stronger one). To properly construct G-index, we follow their custom here, and these laws, along with anti-greenmail provisions, are categorized together in the variable "Anti-greenmail."

The Anti-greenmail variable is positively correlated with 17 out of the other 23 provisions, is significantly positive in 16 of these cases, and is significantly negative for 4 of them. According to Pinnell (2000), states with anti-greenmail laws tend to pass them in conjunction with laws more clearly designed to prevent takeovers. GIM find similar correlations, and cite these facts in their assertion that "it seems likely that most firms and states perceive Antigreenmail as a takeover 'defense'". Therefore, the G-index includes anti-greenmail as a decrease in shareholder rights.

(2) *Blank Check:* Blank check preferred stock is authorized preferred stock for which the board of directors has broad discretion to determine voting, dividend, conversion, and other rights. Blank check stock can be used to enable a company to meet changing financial needs, or to prevent takeover. Blank check preferred stock can be issued to parties friendly to management to block unwanted hostile bids. A primary use, however, is as a vehicle to implement a poison pill. Companies that have this type of preferred stock but require shareholder approval before it can be used as a takeover defense are *not* coded as having this provision in the data.

(3) *Business Combination:* Business combination laws (also known as "freeze-out" laws) impose a moratorium on certain kinds of transactions (e.g., asset sales, mergers) between a large shareholder and the firm, unless the board of directors approves the transaction. Depending on the state, this moratorium (or "freeze-out period") ranges between two and

five years after the shareholder's stake passes a pre-specified (minority) threshold. These laws were in place in 25 states in 1990 and two more by 1998. The Delaware business combination law was adopted in 1988, two years before our sample begins. The Delaware law requires a 3-year waiting period, although it permits business combinations during the freeze-out period that are approved by two-thirds of the voting stock not held by the interested shareholder. During the sample in this paper, it is the only explicit state takeover law in Delaware, the state of incorporation for about half of the sample.

(4) *Bylaws:* Bylaw amendment limitations constrain shareholders' ability to amend the governing documents of the corporation. These limitations can take the form of a supermajority vote requirement for bylaw amendments; total elimination of the ability of shareholders to amend the bylaws; or the ability of directors (beyond the provisions of state law) to amend the bylaws without shareholder approval.

(5) *Cash-out Laws:* Cash-out laws require any person who acquires a large stake (e.g., 20%) in a firm to notify all other shareholders of the acquisition. All other shareholders are then entitled to sell their shares to the acquirer at a price at least as high as the highest price the acquirer paid in the period over which the large shareholder acquired its shares.

(6) *Charter Amendment:* Charter amendment limitations limit shareholders' ability to amend the governing documents of the corporation. A common limitation requires a supermajority vote for charter amendments; this requirement is also referred to as a "lock-in" provision.

(7) *Classified Board:* A classified board (or staggered board) is one in which the board of directors are divided, for the purpose of election, into separate classes. In an ordinary, non-classified board, every director stands for election each year. The most common arrangement in classified boards provides for three equally-sized classes, with the directors in each class serving overlapping three-year terms. Staggering directors' terms in this way makes it more difficult for dissidents to seize control of a target company immediately, even if they control a majority of the company's stock, since only one third of the directors stand for election in any one year. As a result, the shareholders must wait at least two elections to replace a majority of the board.

(8) *Compensation Plan:* Compensation plans with changes-in-control provisions allow participants in incentive bonus plans to cash out options or accelerate the payout of bonuses if there is a change in control. The details may be a written part of the compensation agreement, or discretion may be given to the compensation committee.

(9) *Cumulative Voting:* Cumulative voting is a provision that permits shareholders to apportion the total number of votes they are entitled to cast in the election of directors in any fashion they desire. The total number of votes is the product of the number of shares owned and the number of directors to be elected. By allowing them to concentrate their votes, this practice helps minority shareholders to elect directors.

The use of cumulative voting enables holders of a minority stake to elect one or more directors if they are able to muster sufficient support; for example, the owners of 11 percent of the voting shares in a corporation with 10 open board seats is assured of electing one director if they vote all their shares cumulatively for a single nominee. The greater the number of directors to be elected, the lower the level of ownership needed to elect directors cumulatively.

Cumulative Voting and Secret Ballot (see below) are different from the other provisions in that the presence of these provisions increases shareholder rights. Conversely, the absence of one of these provisions tends to insulate management from the control market. In order to ease interpretation, the two variables are coded with a "1"—indicating a decrease in governance, or shareholders' rights—when a firm does *not* have this provision in place.

(10) *Director Contracts:* Director indemnification contracts are contracts between the company and particular officers and directors indemnifying them from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. Some firms have both director indemnification provisions (see 12, below) in their bylaws or charter and these additional indemnification contracts.

(11) *Directors' Duties:* Directors' duties provisions allow directors to consider constituencies other than shareholders when considering a possible change in control. These constituencies may include, for example, employees, host communities, or suppliers. This provision provides boards of directors with a legal basis for rejecting takeovers that benefit shareholders. Thirty-one states have *Directors' Duties laws* allowing similar expansions of constituencies, but in only two of these states (Indiana and Pennsylvania) are the laws explicit that the claims of shareholders should not be held above those of other stakeholders (Pinnell (2000)). Firms in these two states are coded as though they have an expanded directors' duty provision unless the firm has explicitly opted out of coverage under the law.

(12) *Director Indemnification:* Director indemnification uses the bylaws, charter, or both to indemnify officers and directors from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. In practice, the corporation adopts a provision in which it promises to reimburse its directors or top officers for legal damages or expenses. Some firms have both this indemnification clause in their bylaws or charter and additional indemnification contracts (detailed above). In most cases, a firm that adopts such a provision purchases indemnity insurance to cover its risk. The cost of such protection can be used as a market measure of the quality of corporate governance (e.g., see Chalmers, Dann and Harford (2002), Core (2000)).

(13) *Fair-Price:* Fair-price provisions limit the range of prices a bidder can pay in two-tier offers. They typically require a bidder to pay to all shareholders the highest price paid to any during a specified period of time before the commencement of a tender offer. Most fair price provisions are accompanied by a backstop provision requiring a supermajority vote to circumvent the pricing guidelines. The goal of this provision is to prevent

pressure on the target's shareholders to tender their shares in the front end of a two-tiered tender offer, and they have the result of making such an acquisition more expensive. In 1990, 25 states had *Fair-Price laws* in place, and two more states passed such laws in 1991. The laws work similarly to the firm-level provisions.

(14) *Golden Parachutes:* Golden parachutes are severance agreements that provide cash and noncash compensation to senior executives upon an event such as termination, demotion, or resignation following a change in control. They do not require shareholder approval.

The net impact on managerial entrenchment and shareholder wealth is ambiguous. However, in the construction of the G-index, GIM consider the effect of golden parachutes as a decrease in shareholder rights. In their interpretation, the "right" is the ability of a controlling shareholder to fire management without incurring an additional cost. GIM further assert that Golden Parachutes are positively correlated with all the other takeover defenses in their sample, and thus are treated as a restriction of shareholder rights.

(15) *Director Liability:* Limitations on director liability are charter amendments that limit directors' personal liability to the extent allowed by state law. They often eliminate personal liability for breaches of the duty of care, but not for breaches of the duty of loyalty or for acts of intentional misconduct or knowing violation of the law.

(16) *Pension Parachute:* Pension parachutes prevent an acquirer from using surplus cash in the pension fund of the target to finance an acquisition. Surplus funds are required to remain the property of the pension fund and to be used for plan participants' benefits.

(17) *Poison Pill:* Poison pills, also known as shareholder rights plans, are among the most complicated takeover defenses. Although their terms and conditions vary considerably, their purpose is to force potential bidders to negotiate with a target company's board of directors. Poison pills provide their holders with special rights in the case of a triggering event such as a hostile takeover bid. If the board of directors approves a deal, the poison pill may be revoked, but if the deal is not approved and the bidder proceeds, the pill is triggered. Typical poison pills give the holders of the target's stock, other than the bidder, the right to purchase stock in the target or the bidder's company at a steep discount (usually 50%). The pill, if triggered, dilutes both the potential acquirer's voting power and the economic value of their investment in the target firm.

(18) *Secret Ballot*: Under a secret ballot (also called confidential voting), either an independent third party or employees sworn to secrecy are used to count proxy votes, and the management usually agrees not to look at individual proxy cards. This can help eliminate potential conflicts of interest for fiduciaries voting shares on behalf of others, and can reduce pressure by management on shareholder-employees or shareholder-partners. As mentioned above, Cumulative Voting and Secret Ballots are the only two provisions whose presence is coded as an *increase* in shareholder rights, with an additional point added to the G-index if the provision is absent.

(19) *Severance:* Executive severance agreements assure high-level executives some income protection in the event of losing their positions, and are not contingent upon a change in control (unlike Golden or Silver Parachutes).

(20) *Silver Parachute:* Silver parachutes are similar to Golden Parachutes in that they provide severance payments upon a change in corporate control, but differ in that a large number of a firm's employees are eligible for these benefits.

(21) *Special Meeting:* Special meeting limitations either increase the level of shareholder support required to call a special meeting beyond that specified by state law or eliminate the ability to call one entirely. Such provisions add extra time to proxy fights, since bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defenses. This delay is especially potent when combined with limitations on actions by written consent (see below).

(22) *Supermajority:* Supermajority requirements for approval of mergers are charter provisions that establish voting requirements for mergers or other business combinations that are higher than the minimum requirements of state law. They typically require 66.7, 75, or 85 percent or more of the outstanding shares for actions that otherwise would require simple majority approval. The required proportion often exceeds attendance at the annual meeting. GIM maintain that in practice, these provisions are similar to Control-Share Acquisition (CSA) laws, described below. As a result, if a firm has either a supermajority provision or is covered under a CSA law, the Supermajority variable is assigned a value of 1.

Control-share Acquisition laws**:** These laws require a majority of "disinterested shareholders" to vote on whether a newly qualifying large shareholder has voting rights. If a bidder obtains a sufficiently large block of stock in another firm, the bidder is barred from voting shares unless a majority of "disinterested shares" vote in favor restoring the bidder's voting rights. Here, "disinterested shares" refers to shares not owned or controlled by the bidder, an officer of the target, or an employee who is also a director of the target. A control share acquisition refers to a large shareholder's accumulation of shares to above a threshold level, for example, to one-fifth the outstanding shares of a covered corporation. Control share laws can prevent an acquirer from obtaining effective control of a target firm even if the acquirer owns a majority of the target's shares.

(23) *Unequal Voting:* Unequal voting rights refers to when common shares do not all have the same voting rights. Unequal voting rights can limit the voting rights of some shareholders or expand those of others. Under time-phased voting, shareholders who have held the stock for a given period of time are given more votes per share than recent purchasers. Another variety is the substantial-shareholder provision, which limits the voting power of shareholders who have exceeded a certain threshold of ownership.

The Unequal Voting rights characteristic in this study excludes those firms with a dual-class capitalization structure, wherein two classes of stock exist, one with voting rights

superior to the other. As discussed in the paper, dual-class companies are entirely excluded from our sample.

(24) *Written Consent:* Limitations on action by written consent can take the form of the establishment of majority thresholds beyond the level of state law, the requirement of unanimous consent, or the elimination of the right to take action by written consent. Such requirements add extra time to many proxy fights, since bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defenses. As related above, this delay is especially potent when combined with limitations for calling special meetings.

Appendix B

Table B1: Percent of firms with each provision during sample period. As noted in the paper each year's data is used in the following year(s) until the next IRRC volume becomes available. The 2006 data is used in both 2007 and 2008. In the G-index, 1 was added to the index if the firm did not allow cumulative voting and did not allow secret ballots. In this table Cumulative vote is set equal to 1 if the firm had a cumulative vote, and secret ballot is set equal to 1 if the firm allowed secret ballots.

Provision	1990	1993	1995	1998	2000	2002	2004	2006
Blank check	77.1	79.8	84.5	87	88.8	90.3	90.5	91.5
Classified board	57.9	58.9	60.4	58.1	58.6	59.7	59.4	55.8
Special meeting	24.9	28.8	31	31.7	36.8	47.9	50.8	52.1
Written consent	25	28.7	31.5	31	35.3	44.6	46.8	48.6
Compensation plans	42.5	63.6	71.2	61.1	71.1	73.8	75.9	75.6
Director contracts	18	16.3	13.5	11.6	10	8.7	8	7.8
Golden parachutes	50.3	53	53.9	55	62.8	67.4	73.5	78.1
Director indemnification	40.8	38.4	37.1	23	23.4	18.5	17.3	18
Director liability	73.4	68.4	65.1	46.1	43.6	32.8	31.1	30.3
Executive severance	13.2	5.2	10.2	11.9	10.5	7	6.6	3.8
Bylaws	13.4	15.2	15.2	16.7	18.8	21.4	21.9	21.2
Charter	2.5	2.6	2.5	2.5	2.4	2	2	2.2
Cumulative vote	18.8	16.9	15.6	12.3	11.1	9.3	9.2	8.8
Secret ballot	2.5	9.3	11.7	9.1	10.3	10	11.7	12.9
Supermajority	38.5	39	38.3	34.3	34	31.6	31.5	31.6
Unequal voting	2.2	1.9	1.9	1.7	1.1	1	0.7	0.6
Anti-greenmail	7	6.8	6.5	5	4.7	3.4	3.2	3.5
Directors' duties	5.9	6.9	6.7	6.2	6.6	6.7	7.3	7.1
Fair price	33.6	35.3	33.2	26.4	25.7	20.8	20.2	19.6
Pension parachutes	4.2	5	3.9	2.4	1.2	0.9	0.8	0.6
Poison pill	53.4	55.4	54.9	53.1	56.7	57.2	58	54.5
Silver parachutes	4.2	5	3.5	2.6	1.9	1.5	1.1	1.2
Anti-greenmail law	17.8	17.1	16.6	13.9	14.7	13.6	13.6	13.9
Business combination law	86.2	89.2	89.4	90.4	91.9	92.6	91.4	92.4
Cash-out law	4.2	4.1	4	3	3	2.9	3	3.2
Directors' duties law	5.2	5.1	5.2	4.2	3.8	3.9	4.1	4.3
Fair price law	34.3	34.8	34	31	31.2	28.5	28.8	29.7
Control-share acquisition law	28.2	28.2	27.9	26.6	26.4	24.8	25	25.5

Table B2: Number of firms in sample going IPO each year. All IPO years prior to 1950 were assigned a 1950 value for programming purposes.

IPO year	Firms	IPO year	Firms	IPO year	Firms	IPO year	Firms
1950	242	1964	24	1978	13	1992	119
1951	6	1965	22	1979	18	1993	143
1952	6	1966	15	1980	20	1994	92
1953	6	1967	28	1981	50	1995	114
1954	7	1968	35	1982	27	1996	137
1955	6	1969	46	1983	91	1997	83
1956	5	1970	30	1984	46	1998	78
1957	8	1971	28	1985	40	1999	113
1958	6	1972	243	1986	96	2000	67
1959	7	1973	18	1987	107	2001	37
1960	11	1974	7	1988	59	2002	31
1961	10	1975	12	1989	42	2003	9
1962	73	1976	13	1990	55	2004	4
1963	14	1977	11	1991	108	2005	3
						2007	1

Table B3: Takeover likelihood as a function of index values after correcting for endogeneity – using the geography-based instrument.

The table below corresponds with Table 4 in the main body of the paper. Table 4 in the main body of the paper presents the overidentified results. In contrast, the table below shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index variables using only the geography-based instrument described in section 2.3. In columns 1-3 (4-6) the dependent variable is set to 1 if the firm was acquired in the next year (five years). The control variables are described in Table 2 in the main body of the paper. P-values are shown in parenthesis below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	(t+1)	(t+1)	(t+1)	(t+1,t+5)	(t+1,t+5)	(t+1,t+5)
G-index	-0.015***			-0.054***		
	(0.001)			(0.003)		
E-index		-0.047***			-0.152**	
		(0.003)			(0.012)	
O-index			-0.012***			-0.047**
			(0.006)			(0.011)
Firm size	-0.006***	-0.010***	-0.007***	-0.007	-0.023***	-0.010
	(0.002)	(0.000)	(0.000)	(0.352)	(0.000)	(0.176)
Leverage	0.018	0.025**	0.017	0.068**	0.091***	0.063**
	(0.100)	(0.032)	(0.116)	(0.034)	(0.008)	(0.039)
Market to book	-0.008***	-0.009***	-0.006***	-0.029***	-0.033***	-0.025***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Property ratio	-0.005	-0.008	-0.009	0.014	0.000	0.001
	(0.499)	(0.268)	(0.170)	(0.600)	(0.991)	(0.974)
Liquidity ratio	-0.064***	-0.073***	-0.056***	-0.117***	-0.142***	-0.089***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.005)
Sales growth	-0.022***	-0.020***	-0.021***	-0.033**	-0.023	-0.028*
	(0.001)	(0.004)	(0.002)	(0.031)	(0.121)	(0.056)
Industry-adjusted ROA	-0.028	-0.026	-0.033*	0.000	0.006	-0.014
	(0.133)	(0.187)	(0.076)	(0.996)	(0.917)	(0.804)
Market-adjusted return	0.003	0.004	0.002	0.010	0.012*	0.006
	(0.343)	(0.244)	(0.530)	(0.112)	(0.080)	(0.299)
Industry concentration	-0.001	-0.001**	-0.000	-0.004**	-0.006***	-0.003*
	(0.126)	(0.040)	(0.319)	(0.029)	(0.010)	(0.075)
Constant	0.234***	0.244***	0.181***	0.740***	0.743***	0.566***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23443	23443	23443	23443	23443	23443
R-square(2nd stage)	.	.	0.014	.	.	0.013
Chi-square(2nd stage)	452.0	411.1	487.7	884.8	819.8	948.9
Prob < Chi-square(2nd stage)	0.000	0.000	0.000	0.000	0.000	0.000
F-statistic(1st stage)	37.2	20.2	61.1	37.2	20.2	61.1
R-square(1st stage)	0.118	0.095	0.126	0.118	0.095	0.126

Table B4: Takeover likelihood as a function of index values after correcting for endogeneity – using the IPO-year-based instrument.

The table below corresponds with Table 4 in the main body of the paper. Table 4 in the main body of the paper presents the overidentified results. In contrast, the table below shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index variables using only the IPO-year-based instrument described in section 2.3. In columns 1-3 (4-6) the dependent variable is set to 1 if the firm was acquired in the next year (five years). The control variables are described in Table 2 in the main body of the paper. P-values are shown in parenthesis below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	(t+1)	(t+1)	(t+1)	(t+1,t+5)	(t+1,t+5)	(t+1,t+5)
G-index	-0.005**			-0.028***		
	(0.011)			(0.003)		
E-index		-0.011			-0.065	
		(0.303)			(0.144)	
O-index			-0.006***			-0.032***
			(0.009)			(0.002)
Firm size	-0.009***	-0.010***	-0.009***	-0.015***	-0.023***	-0.014**
	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.014)
Leverage	0.019*	0.021**	0.018*	0.070**	0.080***	0.065**
	(0.072)	(0.050)	(0.086)	(0.019)	(0.009)	(0.027)
Market to book	-0.006***	-0.006***	-0.006***	-0.026***	-0.027***	-0.025***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Property ratio	-0.012*	-0.014**	-0.012**	-0.005	-0.014	-0.007
	(0.052)	(0.024)	(0.043)	(0.838)	(0.554)	(0.757)
Liquidity ratio	-0.056***	-0.057***	-0.054***	-0.096***	-0.103***	-0.084***
	(0.000)	(0.000)	(0.000)	(0.003)	(0.007)	(0.007)
Sales growth	-0.019***	-0.018***	-0.019***	-0.024*	-0.018	-0.024*
	(0.004)	(0.007)	(0.004)	(0.080)	(0.192)	(0.083)
Industry-adjusted ROA	-0.033*	-0.034*	-0.034*	-0.013	-0.013	-0.018
	(0.066)	(0.063)	(0.058)	(0.813)	(0.818)	(0.743)
Market-adjusted return	0.002	0.002	0.002	0.006	0.007	0.005
	(0.556)	(0.567)	(0.611)	(0.257)	(0.282)	(0.374)
Industry concentration	-0.000	-0.001	-0.000	-0.004**	-0.004**	-0.003*
	(0.259)	(0.239)	(0.354)	(0.043)	(0.033)	(0.076)
Constant	0.164***	0.153***	0.154***	0.553***	0.522***	0.501***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23443	23443	23443	23443	23443	23443
R-square(2nd stage)	0.022	0.022	0.023	0.029	0.024	0.038
Chi-square(2nd stage)	507.3	504.2	506.0	968.2	938.9	983.9
Prob < Chi-square(2nd stage)	0.000	0.000	0.000	0.000	0.000	0.000
F-statistic(1st stage)	148.0	36.1	219.7	148.0	36.1	219.7
R-square(1st stage)	0.160	0.101	0.180	0.160	0.101	0.180

Table B5: Takeover likelihood as a function of individual provisions after correcting for endogeneity

This table corresponds with Table 5 in the main body of the paper. See the Table 5 heading for a detailed explanation of the two equations and variables used in the 2SLS equations. The 2SLS LPM results presented in Table 5 were for the over-identified models using both the geography-based and IPO-year-based instruments. In the table below the just identified results are presented for comparison. Significance is shown using asterisks with significance at the 10%, 5% and 1% shown using *, **, and ***, respectively. Errors are corrected for heteroskedasticiy and clustered by firm

	just-identified model (Geography IV)		just-identified model (IPO-year IV)		over-identified model (both IVs)	
provision	LPM 2SLS First-stage F-Statistic (Geography IV)	LPM 2SLS Marg. Eff. (Geography IV)	LPM 2SLS First-stage F-Statistic (IPO year IV)	LPM 2SLS Marg. Eff. (IPO-year IV)	LPM 2SLS First-stage F-Statistic (Geography and IPO-year IV)	LPM 2SLS Marg. Eff.
Anti-greenmail	270.140	-0.023***	40.277	-0.077***	156.025	-0.027***
Blank check	3.353	0.101	73.905	0.028	38.124	0.031
Classified board	0.194	-0.799	6.000	-0.049	3.103	-0.063
Compensation plans	1.055	-0.383	1.612	-0.003	1.327	-0.116
Not Cumulative voting	65.733	0.030	16.612	0.084	39.827	0.037**
Director indemnification	67.157	-0.023	165.220	-0.032**	115.389	-0.029***
Director contracts	9.570	0.017	38.406	-0.065*	21.557	-0.046
Director liability	86.500	-0.016	692.482	-0.016**	438.885	-0.016**
Directors' duties	73.076	-0.038**	0.401	0.228	36.650	-0.037**
Fair price	133.455	-0.043***	74.172	-0.042**	108.211	-0.043***
Golden parachutes	0.488	-0.374	0.655	-0.163	0.581	-0.248
Bylaws	4.503	-0.096	53.249	0.022	28.706	0.010
Charter	2.760	-0.441	4.390	0.180	2.838	-0.067
Cashouts	58.573	-0.031**	3.199	-0.290	29.362	-0.032**
Special meeting	25.582	-0.007	97.452	0.007	60.742	0.004
Written consent	14.432	0.107**	174.141	0.016	95.224	0.024
Pension parachutes	3.400	0.003	7.070	-0.093	4.638	-0.072
Business combination	166.986	0.002	5.839	-0.104	85.349	0.000
Poison pill	2.361	-0.110	6.027	-0.089	4.262	-0.094
Not secret ballot	0.407	-0.217	32.985	-0.019	16.658	-0.020
Executive severance	0.068	0.830	2.653	0.261	1.349	0.269
Silver parachutes	1.150	-0.022	0.830	-0.798	0.995	-0.519
Supermajority	225.385	-0.035***	65.833	-0.048**	149.156	-0.038***
Unequal voting	2.449	0.485	0.849	0.648	1.777	0.566

Table B6: Table 5 specifications without the $index_{23}$ variable

This table relates to Table 5 in the main paper. As described in the heading to Table 5, most of the results in Table 5 were estimated while controlling for the remaining 23 provisions using the variable $index_{23}$. The table below shows the key results from Table 5-like specifications that were estimated without including the other 23 provisions. The results shown in Columns 4-6 below are duplicates of columns 7-9 of Table 5 from the main paper and included here for comparison. Columns 1-3 below report the estimates from the same specifications as used in Table 5 but estimated without the $index_{23}$ variable. Column 7 indicates cases where the inferences from Table 5 might be affected if the modeling was done without the $index_{23}$ variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Table 5 results			
	LPM 2SLS Marg. Eff.	Bivariate Probit Marg. Eff.	LIML Marg. Eff.	LPM 2SLS Marg. Eff.	Bivariate Probit Marg. Eff.	LIML Marg. Eff.	New Inference
Anti-greenmail	-0.027***	-0.005***	-0.027***	-0.027***	-0.005***	-0.027***	
Blank check	0.036	0.004	0.036	0.031	0.004	0.031	
Classified board	-0.050	-0.008	-0.052	-0.063	-0.008	-0.066	
Compensation plans	-0.065	0.014	-0.071	-0.116	0.015	-0.134	
Not Cumulative voting	0.040**	0.017	0.040**	0.037**	0.016	0.037**	
Director indemnification	-0.027***	-0.007***	-0.027***	-0.029***	-0.007***	-0.029***	
Director contracts	-0.044	-0.003	-0.044	-0.046	-0.003	-0.046	
Director liability	-0.015***	-0.007***	-0.015***	-0.016**	-0.007***	-0.016**	
Directors' Duties	-0.038**	-0.004**	-0.038**	-0.037**	-0.004**	-0.037**	
Fair price	-0.037***	-0.017***	-0.037***	-0.043***	-0.018***	-0.043***	
Golden parachutes	-0.126	-0.015	-0.131	-0.248	-0.010	-0.258	
Bylaws	0.010	0.000	0.010	0.010	0.000	0.010	
Charter	-0.078	-0.010***	-0.083	-0.067	-0.010***	-0.072	
Cashouts	-0.033**	-0.001**	-0.033**	-0.032**	-0.001**	-0.032**	
Special meeting	0.005	0.003	0.005	0.004	0.002	0.004	
Written consent	0.028	0.007*	0.028	0.024	0.007	0.024	Written consent limitation might matter
Pension parachutes	-0.074	-0.004***	-0.074	-0.072	-0.004***	-0.072	
Business combination	0.000	0.002	0.000	0.000	0.002	0.000	
Poison pill	-0.051*	-0.036**	-0.051*	-0.094	-0.032**	-0.094	Poison pills matter
Not secret ballot	-0.019	0.006	-0.019	-0.020	0.006	-0.02	
Executive severance	0.232	-0.001	0.233	0.269	-0.001	0.271	
Silver parachutes	-0.442	-0.003**	-0.454	-0.519	-0.003**	-0.556	
Supermajority	-0.036***	-0.014***	-0.036***	-0.038***	-0.015***	-0.038***	
Unequal voting	0.627	-0.002	0.637	0.566	-0.002	0.567	

Table B7: Summary information for inclusion or elimination of provisions from D-index

This table draws on the information from Table 5 in the paper as well as from Tables B5 and B6 in Appendix B and summarizes the statistical evidence used to decide which provisions to include in the D-index. LPM refers to linear probability models. 2SLS refers to two-stage-least squares. RBPM refers to recursive bivariate probit models. And, LIML refers to limited-information maximum likelihood models. Robustness tests refer to the tests done in Tables B5 and B6.

	Marginal Effect	**Decision for inclusion in D-index?**	**Evidence for inclusion (exclusion) in D-index based on Table 5 and appendix Tables B5 and B6**
Anti-greenmail	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, LPM results, robust in appendix tests
Blank check		Exclude	Not significant in tests
Classified board	-	Weak Include	Lacking strong IV but no evidence of endogeneity and significant in LPM results
Compensation plans	+	Weak Include	Lacking strong IV but no evidence of endogeneity and significant in LPM results
Not cumulative voting	+	Weak Include	Strong IV and 2SLS results, LIML results, LPM results, but not robust in appendix tests
Director indemnification	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, robust in appendix tests
Director contracts	-	Weak Include	Strong IV but not significant in 2SLS using overidentified model but significant in just-identified model, no evidence of endogeneity and significant in LPM results
Director liability	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, LPM results, robust in appendix tests
Directors' duties	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, robust in appendix tests
Fair price	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, LPM results, robust in appendix tests
Golden parachutes	+	Weak Include	Lacking strong IV but no evidence of endogeneity and significant in LPM results
Bylaws		Exclude	Not significant in tests
Charter		Weak Exclude	Lacking strong IV, not significant in LPM results, not significant in LIML results. Only significant in RBPM results.
Cashouts	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, robust in appendix tests
Special meeting		Exclude	Not significant in tests
Written consent		Weak Exclude	Strong IV but no evidence of endogeneity and non-significant 2SLS results, significant in LPM results, becomes significant in 1 appendix robustness test
Pension parachutes		Weak Exclude	Lacking strong IV, not significant in LPM results, not significant in LIML results. Only significant in RBPM results.
Business combination		Exclude	Not significant in tests
Poison pill	-	Weak Include	Lacking strong IV but no evidence of endogeneity, not significant in LPM results, but significant in RBPM and becomes significant in appendix robustness tests
Not secret ballot		Exclude	Not significant in tests
Executive severance		Exclude	Not significant in tests
Silver parachutes		Weak Exclude	Lacking strong IV, not significant in LPM results, not significant in LIML results. Only significant in RBPM results.
Supermajority	-	Include	Strong IV and 2SLS results, RBPM results, LIML results, LPM results, robust in appendix tests
Unequal voting	-	Weak Include	Lacking strong IV but no evidence of endogeneity and significant in LPM results, loses significance in appendix tests