Do takeover defense indices measure takeover deterrence?*

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Abstract: Many researchers use the G-index and E-index to measure firms' takeover defenses. Others argue that these indices are not related to firms' takeover likelihoods. We develop predetermined instruments for a firm's use of takeover defenses and report the first direct evidence that the G-index and E-index – as constituted and used in the literature – are negatively related to acquisition likelihood. The evidence is robust to a variety of specifications and methodologies. These results support studies that use the G-index and E-index to measure firms' takeover defenses. We also provide data on new and plausibly exogenous instruments for firms' takeover defenses.

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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 takeovers (see Gompers, Ishii, and Metrick, 2003; and Bebchuk, Cohen, and Ferrell, 2009). But do these indices actually measure takeover deterrence?

This question highlights a schism among researchers. On one hand, a large number of established findings in the corporate finance literature are based on the assumption that takeover defense indices measure takeover deterrence. As examples, researchers have used the G-index and E-index to examine whether takeover defenses are associated with 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), increased risk taking (John, Litov and Yeung, 2008), 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 (Cen, Dasgupta, and Sen, 2011; Johnson, Karpoff, and Yi, 2015). A common basis of all of these papers is the foundational assumption that the G-index and/or E-index measure takeover deterrence. Even inferences 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).[1]

[1] As of July 2016, Google scholar reports 6,421 papers citing Gompers et al. (2003) and 2,490 papers citing Bebchuk et al. (2009). A list of more than 300 papers using the E-index is available at http://www.law.harvard.edu/faculty/bebchuk/studies.shtml. It is important to recognize that Gompers, Ishii, and Metrick (2003) formulate the G-index to measure shareholder rights and not takeover deterrence per se. Many researchers, however, including those cited in this paragraph, use the G-index to measure takeover deterrence. Bebchuk, Cohen, and Ferrell (2009) explicitly formulate the E-index to measure managerial entrenchment via takeover

On the other hand, many researchers argue that the G-index and E-index are conceptually flawed and perhaps even meaningless as measures of a firm's takeover defense. These researchers criticize the specific provisions each index includes or excludes, the equal weighting of all provisions that are included, as well as data and measurement problems.[2] More broadly, Klausner (2013) argues that researchers generally misunderstand governance indices, "… and they make the common mistake of assuming that the number of takeover defenses is a relevant measure of exposure to takeovers." Citing the ubiquity of shadow poison pills, Catan and Kahan (2016) argue that most takeover defenses offer no incremental takeover protection and that most empirical findings that use takeover defenses to measure takeover deterrence are unfounded. Reflecting the skeptics' view, Bates, Becher, and Lemmon (2008) argue that their findings regarding the G-index "…challenge the common perception that these factors, independently or as indexed, provide a reliable proxy for managerial entrenchment or a firm's exposure to the market for corporate control."

For such a foundational assumption, the notion that the G-index or E-index measure takeover deterrence has surprisingly little empirical support. Most available evidence supports the skeptics' arguments, as there appears to be 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; Goktan, Kieschnick, and Moussawi, 2014). 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

deterrence. It also is important to note that takeover deterrence is not necessarily an indication of poor governance quality, as defenses can be associated with increases in firm value (e.g., Johnson et al., 2015.)

[2] For examples, see Cremers and Nair (2005), Brown and Caylor (2006), Romano, Bhagat, and Bolton (2008), Bebchuk, Cohen, and Ferrell (2009), Daines, Gow, and Larcker (2010), Brown, Beekes, and Verhoeven (2011), and Larcker, Reiss, and Xiao (2015).

absence of systematic evidence on whether the overall G-index or E-index are useful measures of takeover deterrence.

The purpose of this paper is to examine the widespread assumption that the G-index and E-index measure takeover deterrence using tests that account for firms' endogenous use of the takeover defenses in these indices. Evidence that high G-index or E-index values are associated with a lower likelihood of takeover would support the intuition and widespread use of these indices as proxies for a firm's takeover defense. In contrast, evidence that these indices do not relate to takeover likelihoods would support the skeptics' view and undermine the conclusions from many finance papers that rely on this assumption. Most researchers use the G-index and E-index in their empirical analyses exactly as constructed by Gompers et al. (2003) and Bebchuk et al. (2009), and make inferences based on those results. We do not engage in the debate over whether the indices are constructed optimally or without error. Rather, our tests focus on whether the indices, as constructed and used in the literature, relate to takeover likelihood.

2. Overview of approach and contribution

2.1. Endogeneity and treatments

It is difficult to test whether the G-index or E-index measure takeover deterrence because a firm's use of takeover defenses is endogenous. On one hand, the G-index and E-index might be uncorrelated with takeover likelihood because they are poor measures of a firm's takeover defenses. On the other hand, the absence of an empirical correlation between the G-index (or E-index) and firm independence cannot rule out the hypothesis that the indices do in fact measure takeover deterrence, but that the defenses in these indices tend to be deployed by firms with high takeover likelihoods. Stated differently, the lack of an empirical correlation between the G-index (or E-index) and takeover likelihood could indicate either that the defenses in these indices are ineffective, or that they are effective but endogenous.

We begin our analysis by estimating standard acquisition likelihood models without accounting for endogeneity, and 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 without accounting

for endogeneity is consistent with previous findings (e.g., see Core, Guay, and Rusticus, 2006; Bates, Becher, and Lemmon, 2008; Kadyrzhanova and Rhodes-Kropf, 2011).

To account for the endogenous adoption of defenses, we use three empirical approaches: (1) two-stage least squares (2SLS) models, (2) limited information maximum likelihood (LIML) models, and (3) recursive bivariate probit (RBP) models. We achieve identification in these models using two types of instrumental variables that isolate exogenous variation in each firm's use of takeover defenses. The first type of instrument is based on the takeover defenses deployed in previous years at geographically proximate firms that are not in the same industry as the focus firm, and the second type of instrument uses the takeover defenses deployed in previous years by firms that went public within one year of the focus firm but that are not in the same industry.

To bolster the likelihood that the instruments are predetermined and plausibly exogenous relative to the focus firm's takeover likelihood in the year of analysis, we construct each type of instrument three different ways by measuring the peer firms' defenses at different prior points in history. Table 1 summarizes our two types of instruments (i.e., geography-based and IPO cohort-based) and the three approaches used to construct each instrument. These approaches are described in more detail below.

[Insert Table 1]

The rationale for the geography-based instruments is three-fold. First, managers and directors of firms in geographical proximity are likely to interact and influence each other's decisions on a broad range of corporate matters, including takeover defenses.[3] Second, firms from the same area are 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 in later years. Third, firms are slow to change their takeover defenses during our

[3] Similar arguments for the importance of geographical network effects are made by Davis and Greve (1997) regarding golden parachutes, Kedia and Rajgopal (2009) regarding the adoption of stock option plans, and Parsons, Sulaeman, and Titman (2014) regarding financial misconduct. Hochberg and Lindsey (2010) and Chang, Fu, Low, and Zhang (2015) also use geographical cohorts of firms from other industries to construct instrumental variables.

sample period (see Hannes 2006; Karpoff, Johnson, and Yi 2016). Consistent with these arguments, we find a strong correlation between a firm's takeover provisions and those of its geographically proximate non-industry peers, a correlation that persists for years. This persistence over time is important because it allows us to instrument for a given firm's defenses using the defenses at non-industry peer firms that were in place several, or many, years before the year of analysis and, hence, are predetermined with respect to the takeover likelihood of the focus firm in the year of analysis.

The rationale for the IPO cohort-based instruments is provided by Daines and Klausner's (2001) finding of a strong time component to the adoption of takeover defenses by IPO firms, and Hannes' (2006) finding that a firm's use of takeover defenses is sticky over time. Supporting this rationale, Johnson, Karpoff, and Yi (2016) find that IPO firms have an average E-index of 2.4 when they go public; 87% of these firms never remove any takeover defenses during the 15 years after their IPOs, yet the average E-index 15 years after the IPO grows only to 2.7. Together, these results imply that a firm's use of takeover defenses is strongly influenced by the year it went public. Accordingly, we use the provisions adopted by the firms in a focus firm's IPO cohort, but that are not in the same industry, to identify arbitrary variation in the firm's takeover defenses that is not directly related to that firm's specific takeover likelihood many years after its IPO. As with the geography-based instruments, the non-industry IPO cohort information is predetermined because it is from many years before the year of analysis.

To ensure that our geography-based and IPO cohort-based instruments are predetermined and therefore plausibly meet the exclusion requirement, we report parallel tests using the three different approaches to constructing the two types of instruments summarized in Table 1. Our *five-year lagged* instruments are based on peer firms' takeover defenses five years before the year of analysis. Our *static-1990* instruments are based on peer firms' takeover defenses in the earliest year information appears about the cohort firms in the IRRC data (typically 1990). And our *static pre-1990* instruments (available for the G-index only) are based on peer firms' takeover defenses in the earliest year cohort firm information appears in either the IRRC data or the Cremers-Ferrell (2014) data, which tracks G-index values for some firms back to 1978. The five-year lagged instruments have an advantage of using relatively recent data to

construct instruments, thereby incorporating widespread secular changes in firms' uses of takeover defenses that are not firm-specific.[4,5] A disadvantage of the rolling five-year lagged instruments, however, is that they are more likely than the static instruments to violate the exclusion restriction because changes in the peer firms' takeover defenses could be related to the focus firm's takeover likelihood. We partially mitigate this concern by calculating the instruments using only data from firms in different industries than the focus firm, and also by requiring a five-year lag between the year the instruments are calculated and the year of analysis. The static-1990 and static pre-1990 instruments further address this issue by using instrumental variable values that are fixed many years before the year of analysis and that do not update over time.

Following the guidelines discussed in the literature, we test and confirm that all three versions of both the geography-based and IPO cohort-based instruments meet the necessary conditions for strong instruments (e.g., see Staiger and Stock, 1997; Stock and Yogo, 2005). Using these instruments to account for endogeneity has an important effect on our empirical results, as we find that takeover likelihood is negatively and significantly related to both the G-index and E-index as well as to the provisions included in the G-index but not in the E-index. This central result is robust across the 2SLS, LIML, and RBP methods, using the geography-based and IPO cohort-based instruments in overidentified models, using either type of instrument separately, and using either the five-year lagged, static-1990, or static pre-1990 versions of the instruments. In our baseline model, a one-standard deviation increase in the instrumented value of a firm's G-index (E-index) corresponds to a 1.8% (3.3%) reduction in the probability that the firm

[4] Another potential advantage of the five-year lagged instruments is that they tend to be calculated across larger cohorts of firms than the other instruments. The reason for this is that firms are added to the IRRC data across the sample period. Many of the new additions to the IRRC data were in fact public for many years before being covered by IRRC. Calculating a rolling five-year lagged instrument allows for a more complete representation of the full set of cohort firms inasmuch as new IRRC additions that are part of pre-existing geographical and IPO cohorts are automatically incorporated into the lagged calculations year-by-year as the data become available. In contrast, for the static-1990 or static pre-1990 versions of the instruments, later additions to the database are not included in the construction of the instruments, thus causing the cohorts to be smaller than for the five-year lagged instruments.

[5] Several of the 24 G-index provisions are based on state laws that did not become popular until the mid-to-late 1980s. For example, as described in Cremers and Ferrell (2014) 0% of firms had state-based business combination law statutes in 1985 whereas over 80% did by 1990; this simply reflects the passage of such laws in multiple states during this period. In contrast to our sample period (1990-2008), a time when all the G-index provisions are available and rarely change, the 1980s marked a period of more innovation in defenses. For our purposes, as long as these changes are widespread rather than firm-specific, and because they are in place years before the year of analysis – and hence predetermined with respect to the year of analysis – the intuition for the creation of our instruments is unaffected.

will be acquired within the next year, and to a 9.9% (18.2%) reduction in the probability that the firm will be acquired within five years. These results provide the first direct empirical support for the widespread assumption that takeover defenses, as measured by these indices, do in fact deter takeovers.

2.2. Related literature and contribution

Our investigation is related to several papers that use various identification strategies to examine the relation between takeover defenses and such outcome variables as Tobin's q and takeover premiums. 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. Goktan and Kieschnick (2012) use a Heckman probit model approach with a selection equation to address selection issues. Straska and Waller (2010), Bebchuk and Cohen (2005), and Bebchuk, Cohen, and Ferrell (2009) use antitakeover provisions from several years before the year of analysis in an attempt to address simultaneity concerns. Cremers and Ferrell (2014) use the 1985 *Moran v. Household International, Inc.* decision to identify the relation between firm value and takeover defenses. And Cuñat, Gine, and Guadalupe (2015) use a regression discontinuity design to examine the effect of specific shareholder governance-related proposals on takeover probabilities and premiums. In contrast to such prior research, our paper uses instrumental variables to examine whether the overall G-index or E-index measures are statistically related to takeover likelihoods, to examine the widespread assumption that these indices measure a firm's takeover defense.

This paper makes several contributions to the literature. First, we propose that the absence of an empirical correlation between takeover likelihood and the G-index or E-index could reflect the endogenous adoption of takeover defenses. Second, we propose two types of instruments using information from predetermined choices at peer firms that isolate plausibly exogenous variation in the level of a firm's takeover defenses. The online data appendix for this paper provides the values for these instruments for both the G-index and E-index for each firm-year in our sample. Third, using these instruments, we show that the G-index and E-index are each negatively and significantly related to takeover likelihood. These

results are robust to using various versions of both the geography and IPO cohort-based instruments and in different empirical models that further help to address concerns about identification. They provide an empirical basis for the widespread assumption that the G-index and E-index, as constructed and used in the literature, do in fact proxy for takeover deterrence, and support the large body of empirical inferences that are based on this assumption. Fourth, we show that the set of G-index provisions not included in the E-index are negatively and significantly related to takeover likelihood, implying that not all of the G-index's effect on takeover likelihood is coming from the E-index provisions.

3. Data and sample descriptive information

To address the question of whether the G-index or E-index 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, and information on the G-index and E-index. Our acquisition data come from the Thomson's Securities Data Company (SDC) database, 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.[6]

Institutional Shareholder Services (ISS) acquired IRRC in 2005. Riskmetrics then acquired ISS and starting in 2007 made significant changes to the format and scope of the governance data collected each year. As a result, only about half of the original 24 components of the G-index are available in some form via Riskmetrics after 2006. Riskmetrics not only changed the exact information collected but also the manner of collecting and reporting the information such that even for the subset of variables collected by both IRRC and Riskmetrics there is a large structural change in 2006, despite the focus that both data sets have on S&P 1500 firms. For example, both the IRRC and Riskmetrics data sets include a binary variable named "labylw," which indicates restrictions on shareholders' ability to amend bylaws. The IRRC file

[6] The following SDC Filters were used in identifying IRRC targets: US Targets with deal form M, AM, or AA and a completed status. The IRRC data have been acquired and alternatively controlled by ISS, Riskmetrics, and MSCI, and have been listed on the WRDS platform alternatively under the Riskmetrics and ISS names. In this paper we refer to the 1990-2006 data on takeover defenses as the IRRC data.

reports that 22.4% of firms have such restrictions in 2006, while Riskmetrics reports that 85.0% of firms have such restrictions in 2007.[7] Given such changes and the lack of available data for many of the provisions after 2006 via Riskmetrics, we focus only on the IRRC data through 2006 and assume that the provisions constituting the G-index and E-index in 2006 carry forward for two more years. This approach ensures that our analysis directly relates to the large body of existing research, which relies extensively on the IRRC data.[8]

Projecting the data forward in time is consistent with the standard approach used in the literature for previous years in which 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 are used in 1994 and the 1995 data are used for 1996 and 1997.

Following the procedure in Gompers et al. (2003), we distill the 45 IRRC data elements into 24 corporate governance provisions, and report the G-index as the sum of the constituent provisions. (See Gompers et al. (2003) for a detailed discussion of the 24 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, but includes only 6 of the 24 G-index provisions. The 18 G-index provisions not included in the E-index are called the "O-index" by Straska and Waller (2014). We calculate each firm's O-index as the difference between each firm's G-index and E-index levels. Table A.1 in the Appendix reports on the annual frequencies of each provision in our sample.

Firm-specific financial and operating control variables are from Compustat and CRSP and are

[7] We emphasize that the intent of this paper is not to document problems in the IRRC and Riskmetrics data. Rather, we seek to examine whether the actual index measures as used by many researchers are related to takeover deterrence, and therefore, whether results from the papers that use these indices yield meaningful inferences. For a discussion of coding errors in the IRRC data, see Larcker, Reiss, and Xiao (2015).

[8] The Appendix, which is attached to this paper, reports on tests in which the 2006 data are extended through 2010. The results (Table A.10) are similar to those reported in the paper for Table 6.

motivated by prior work on takeover likelihood.[9] These variables include firm size (AT), leverage (DLTT/AT), the market-to-book ratio ((CSHO*PRC + DLTT)/AT), return on assets (OIADP/AT), the property ratio (PPEGT/AT), the liquidity ratio ((ACT-LCT)/AT), average sales growth over three years (average(($SALE_t$ - $SALE_{t-1}$)/$SALE_{t-1}$)), the prior one-year market-adjusted return, and industry concentration as measured year-by-year using the Herfindahl-Hirschman index based on sales.[10] Industry controls are based on the Fama-French 49 industries.

As summarized in Table 1 and detailed below in Section 4, our tests use three different versions of both the geography-based and IPO cohort-based instruments. One approach uses rolling five-year lagged data and the other two approaches use the earliest data available. The data requirements vary for these approaches, so the sample sizes differ slightly. For the five-year lagged instrumental variables, the sample consists of the intersection of firms in the IRRC, Compustat, and CRSP databases for each year from 1990-2008 for which geographic and IPO-cohort non-industry peers also exist five years before the year of analysis. (Section 4.3 describes the specific calculation of the instrumental variables based on the peer firms.) The five-year lag requirement eliminates all observations from 1990-1994 from the sample because the IRRC data start in 1990, as well as some observations from later years. Finally, because we track takeovers of sample firms for up to five years after each focus year, we require Thomson's SDC acquisition data from 1990-2013. These data requirements result in 16,949 firm-year observations that serve as the basic sample for our tests using five-year lagged instruments.

The static-1990 instruments use information on peer firms' takeover defenses from the first year in the IRRC database in which three or more cohort firms appear. For most firms in the sample this occurs in 1990.[11] For all firms in the sample, the static-1990 instrument is calculated once for a given focus firm and

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

[10] If PPEGT is missing but PPENT is not, we use PPENT to calculate the property ratio. ACT and LCT are not reported in Compustat for banks, so requiring these variables eliminates banks from our sample.

[11] The geography-based instrument can be calculated using 1990 data even for firms that go public after 1990 provided the IRRC 1990 coverage includes at least three cohort firms. Thus for the vast majority of the sample the *static-1990* geography instrument is calculated using 1990 IRRC data. In contrast, the firms in the IPO cohort, by definition, are not public and are not identifiable as a cohort until after the year of the IPO. Thus, the static-1990 IPO-based instrument is calculated using the earliest available data from the first year in which three or more non-industry cohort firms

remains constant for all sample years. The static-1990 instrument does not employ a five year lag, so our base sample size for this approach increases to 20,902 firm years. The static pre-1990 instrument is constructed in the same year as the static-1990 instrument except, in the calculations, the IRRC G-index values are replaced with the earliest available (pre-1990) Cremers-Ferrell G-index values for those firms that also appear in the Cremers-Ferrell database.[12] The pre-1990 data was hand-collected and graciously provided by Martijn Cremers and Allen Ferrell. Both the static-1990 and the static pre-1990 samples include the same number of firm years but they differ in the instrument values for a given focus firm because we use different underlying data for the cohort firms that appear in the pre-1990 Cremers-Ferrell data.[13] Tables 2 and 3 report summary statistics based on the union of the available data from these three approaches (22,846 observations).

[Insert Table 2]

Using this comprehensive sample, Table 2 reports the number of firms and takeovers and the mean G-index and E-index values by year. The mean G-index ranges from 8.74 to 9.31 during our sample period of 1990-2008 with a standard deviation across all firm-years of 2.69 provisions.[14] Gompers et al. (2003) report similar G-index values during the 1990-1998 period. The mean E-index ranges from 2.37 to 2.79 during our sample period with a standard deviation across all firm-years of 1.18 provisions, 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 2, with peaks in the late 1990s and mid-2000s, are similar to those documented by Masulis, Wang and Xie (2007). Table 3 provides additional descriptive information for the firms in the comprehensive sample of 22,846 firm-year observations. Most of the sample characteristics are

appear in the IRRC database. This is 1990 for most firms in the sample but occurs later for firms that go public in later years.

[12] For information on the pre-1990 data see Cremers and Ferrell (2014). As explained in their paper, they could not find information on all 24 G-index provisions for many firm-years. In constructing our instruments we limited our use of their data to those observations for which they have information on all 24 G-index provisions.

[13] Table A.3 of the Appendix details sample sizes, by year, for each instrumental variable approach.

[14] Some variation in the mean G-index and E-index values occurs across adjacent years because firms drop from the sample. For example, consider the 1993 and 1994 values. The 1993 G-index values are used to populate 1994, but the table above reports a slightly different annual mean in 1993 and 1994. The difference arises because not all of the firms that were included in 1993 still exist in IRRC in 1994.

standard for research in this area, and the summary statistics are similar to those of other samples based on IRRC data (e.g., see Core, Guay, and Rusticus, 2006; Sokolyk, 2011).

[Insert Table 3]

4. Endogeneity concerns and motivation of instrumental variables

4.1. Takeover tests without accounting for endogeneity

Our research question is whether the antitakeover provisions, as measured by 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) and control variables (x_1-x_k), as in equation (1). Given the potentially endogenous nature of y_2, this approach would result in biased and inconsistent estimates of ∂ because E(u |$y_2, x_1 \ldots x_k$) ≠ 0.

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

Table 4 reports the results from such an approach that does not consider endogeneity. Columns 1-2 of Table 4 report coefficients from probit models and columns 3-4 report results from linear probability models. In none of the models are the G-index or E-index negatively and significantly related to takeover likelihood. 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 insignificant E-index results are consistent with a result reported but not tabulated in Bates, Becher, and Lemmon (2008). Again, these results are potentially biased because these tests do not account for endogeneity.

[Insert Table 4]

4.2. Endogeneity concerns and treatments

Intuitively, endogeneity arises in this setting if managers' use of takeover defenses is affected by their assessment of the likelihood the firm will receive a takeover bid or if the adoption of the defenses is correlated with managers' underlying openness to being acquired. We address endogeneity in our tests

using three types of models: (1) two-stage least squares (2SLS) models, (2) limited information maximum likelihood (LIML) models, and (3) recursive bivariate probit (RBP) models. In addition to these approaches we employ a series of robustness tests reported in the paper but tabulated in the Appendix. We describe the rationale for these empirical approaches in this section and then describe the instrumental variables in Section 4.3.

Our first and baseline approach for identification is to estimate 2SLS models using instrumental variables for the takeover defense index variable y_2. Identification is achieved by directly modeling the endogenous variable as a function of instrumental variables (z) as shown in equation (2) and then using the fitted values from equation (2), which capture exogenous variation in firms' index values, in a modified takeover equation similar to equation (1).[15]

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

Our second identification approach is to estimate the same models but using a LIML approach. As noted by Stock and Yogo (2005) and Hayashi (2000, page 542), 2SLS and LIML estimators have the same asymptotic distributions but LIML is more robust to both finite sample bias and to weak instruments. Angrist and Pischke (2009, pages 209-213) suggest using a LIML model to corroborate inference from overidentified 2SLS models – as in our main application – specifically because the LIML estimates tend to be less biased than the 2SLS estimates. We obtain similar results using either methodology.

Both 2SLS and LIML approaches rely on variation in the instrument to identify exogenous variation in y_2. For identification, an instrument must meet both relevance and exclusion conditions (e.g., see Roberts and Whited, 2012). The relevance condition is testable, and we report the first-stage F-statistic and the R-squared value for each of our tests. Staiger and Stock (1997) suggest a rule-of-thumb that the F-statistic be at least 10 for a strong instrument in a 2SLS setting and Stock and Yogo (2005) note that the F-

[15] Using 2SLS with a linear probability model (LPM) is consistent with the approach discussed in econometrics texts such as Angrist and Pischke (2009, page 198) and Cameron and Trivedi (2010, page 485). Cameron and Trivedi note that using a 2SLS approach with a LPM provides consistent estimates but that heteroskedasticity-robust standard errors must be used for inference.

statistic can be even smaller than 10 for strong instruments in comparable LIML models. As reported in our tables, all of our 2SLS and LIML tests have first-stage F-statistics greater than 10.

The exclusion condition requires cov(z, u) = 0 and can be thought of as the requirement that the instrument only affect whether a specific 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 4.3 and argue that the exclusion condition is plausibly met. However, as is true of all empirical papers using instrumental variables, it is impossible to rule out all conceivable channels through which the instruments might be correlated with the error term. So, although the discussion in Section 4.3 supports the argument that the exclusion condition is satisfied in our analysis, there is always the possibility that the exclusion condition is violated. We address this possibility in four ways.

First, we note that the strength of our instruments help to mitigate concerns about the exclusion condition. Previous research shows that, even with small violations of the exclusion condition, the 2SLS approach often yields estimates that are close to the true parameter values if the instruments are sufficiently strong (e.g., see the discussion in Conley, Hansen, and Rossi, 2012; Kiviet and Niemczyk, 2013; and Murray, 2006). As we report in detail below, our instruments are strong relative to the established guidelines in the literature. Also, given the strategic manner in which the instruments are constructed, using only non-industry-related firms' predetermined data from years in the past, large violations of the exclusion condition are unlikely. Second, we note that the inference from our analysis is qualitatively the same using either of the two instruments in isolation. This is important because the two instruments are based on fundamentally different types of peer effects and are not highly correlated (e.g., the five-year lagged geography-based G-index instrument and the five-year lagged IPO-year-based G-index instrument have a correlation coefficient of 0.124). It is unlikely that a pathway by which the exclusion condition is violated for the geography-based instruments would also operate on the IPO-cohort based instruments, or vice-versa.

Our third approach to address the possibility of a violation of the exclusion condition is to estimate takeover likelihood using RBP models. The RBP approach allows for, and models, the correlation in errors

across equations. This means that correlation between the omitted variables in both equations can exist without creating potential bias in the RBP estimates. Also, different from the 2SLS models, the exclusion condition is not necessarily required for identification in RBP models (e.g., Wilde, 2000; Greene, 2003, pp. 714-717) although it helps (e.g., Wooldridge, 2010, pp. 598-599). Greene specifically notes that "the endogenous nature of one of the variables on the right-hand side of the first equation can be ignored in formulating the log-likelihood…." for the RBP model, and that we "can ignore the simultaneity in this model and we cannot in the linear regression model…" (Greene, 2003, pp. 715-716). Thus, the RBP model represents a way to probe our conclusions from the 2SLS and LIML models using an empirical approach that depends less on the (non-testable) exclusion condition for identification and instead relies more on the assumed nonlinear distribution. A potential drawback with using a RBP model is that, without an excluded instrument, identification and inference can be sensitive to whether the assumed distribution is correct.[16] However, this concern applies less to our application because we include the geography-based and IPO cohort-based instruments in our RBP tests. We derive similar inferences using approaches that achieve identification primarily through our predetermined instruments (2SLS and LIML), as well as the RBP approach that achieves identification via either the assumed functional form or via the exclusion condition. As described in more detail in the Appendix, the RBP results also help to address a potential concern regarding index measurement error in a 2SLS setting.[17]

RBP models are specific to settings in which both the endogenous variable and the final outcome

[16] Wilde (2000) shows that identification is possible in a recursive bivariate probit model even without an excluded instrument as long as the data matrix is full rank and sufficient variability exists in the included regressors. Others (e.g., Mondfardini and Radice (2008), Marra and Radice (2011), Mourifie and Meango (2014), and Wooldridge (2010, pages 595-599)) note that while this conclusion is correct, identification can be fragile in practice if the existing variation in the included regressors is small and also that inference can be problematic if the assumed functional form is not correct. For our purposes, we note that our included regressors provide substantial variation and that we include the predetermined instruments as part of the system of equations. Hence, in our setting identification can come from either the functional form or the exclusion condition.

[17] We thank Daniel Ferreira for bringing this point to our attention. Intuitively, the measurement error arises when different components of the index have different effects on takeover likelihood. An implicit assumption in the literature behind the use of the G-index and E-index as measures of takeover defenses is that every component in the index has equal and interchangeable effects on takeover likelihood. If this assumption is true, the measurement error disappears. Even if this assumption is not true, the discussion in the Appendix associated with Table A.15 provides reasons why the measurement-error-induced violation of the exclusion condition is likely to be small.

variable are binary. We therefore map the index variables to binary outcomes. This mapping is consistent with the general intuition in a RBP model in which the two left-hand side variables in equations (1) and (2) are considered latent variables (y_1^*, y_2^*). By assumption, y_1 and y_2 are observed to equal 1 when their underlying respective latent variables are above a certain threshold. We assume that firms with G-index values above the mean each year are firms whose latent measures of defenses are above the cutoff threshold, and use the same approach to map E-index and O-index values to binary measures.[18]

As a fourth approach to addressing concerns about the exclusion condition, we use reduced form models of takeover likelihood. We report this additional robustness test in the Appendix Table A.15. Angrist and Krueger (2001), Murray (2006), and Chernozhukov and Hansen (2008) suggest that reduced form models of the dependent variable of interest (y_1) regressed directly on the instrument can offer corroborating evidence for inference taken from 2SLS models particularly in settings with potential 2SLS bias. We apply the same approach here to help mitigate potential bias-related concerns associated with measurement error when instrumenting the G-index or E-index in a 2SLS setting. Our main results are qualitatively similar using 2SLS, LIML, RBP, or reduced form approaches, using either type of instrument in isolation, or when using both types of instruments together.

4.3. Instrumental variables motivation and calculation

To satisfy the relevance and exclusion requirements described above, our instruments for the 2SLS and LIML tests should (1) strongly correlate with the index values for the firm in that year, and (2) not

[18] Mapping an index of multiple provisions to a binary outcome potentially throws away information, but is necessary to implement an RBP in our setting. Following the notation in Greene (2003) the RBP model can be written as $Prob[y_1 = 1, y_2 = 1 | \boldsymbol{x}_1, \boldsymbol{x}_2] = \Phi_2(\boldsymbol{x}_1'\boldsymbol{\beta}_1 + \delta y_2, \boldsymbol{x}_2'\boldsymbol{\beta}_2, \rho)$ where in our application y_1 is set to 1 if the firm is acquired in the next year, y_2 is set to 1 if the G-index or other indices are above the mean, $\boldsymbol{x}_1$ represents the set of 71 control variables included in the takeover equation, $\boldsymbol{x}_2$ represents both the set of 71 control variables included in the takeover equation as well as the predetermined geography-based and IPO-based instruments, $\boldsymbol{\beta}_1, \boldsymbol{\beta}_2$ represent the coefficients on the variables included in $\boldsymbol{x}_1$, and $\boldsymbol{x}_2$, Φ_2 represents the bivariate normal cumulative distribution function, and ρ is the correlation between the error terms in the two equations where the error terms are assumed to be distributed as bivariate normal with mean zero and unit variance. The coefficients are estimated using maximum likelihood. The RBP model is one way to account for an endogenous binary variable in a probit model. The assumption of bivariate normality is common but untestable. For more information see the discussion in Green (2003, pp. 715-716).

relate to the likelihood of takeover of that firm in that year in other ways. We use two types of peer effects to construct instruments. The first is based on the incidence of provisions at geographically-proximate firms that are not in the same industry as the focus firm. The second is based on the incidence of provisions at firms that went public within one year of the firm in question but that are not in the same industry. For each type of peer effect, we construct three specific instrumental variables for each index.

For the geography-based instruments, we first use zip codes to identify all firms within a 100-mile radius of the focus firm's headquarters. We then eliminate firms within this group if they (1) have the same Fama-French 49 industry classification as the focus firm or (2) are located in a different state. If fewer than three peer firms are found using this approach then a statewide net is used instead of a 100-mile radius.[19]

Geographic proximity could explain takeover defenses if there are shared legal or consulting services by region or a spillover of management ideas at the local level (e.g., via university-sponsored CEO forums or local chapters of the National Association of Corporate Directors). Importantly, the geographic proximity instrument is based on headquarter locations and not state of incorporation, so the instrument does not pick up the tendency for firms to select Delaware, Nevada, or other specific states due to their laws, as examined by Bebchuk and Cohen (2003) and Dyreng, Lindsey, and Thornock (2014). It is important to repeat that the geography-based instrument is based on the spillover of management ideas years before the year of analysis and that takeover defense decisions, once made, are rarely updated during our sample period (for evidence, see Hannes, 2006; Johnson et al., 2016). Thus the correlation in defenses observed among geographically proximate but non-industry peers during our sample period exists for reasons that occurred years before and that are not specific to the current takeover likelihood of the firms during our sample period. Figure 1 plots the headquarter locations for firms in our sample and shows that these headquarters are distributed widely across the US.

[Insert Figure 1]

[19] In robustness tests, we repeat our main analysis using the 24 broader industry groups associated with GICs instead of the Fama-French industries and relax the requirement that comparison firms be located in the same state as the focus firm. These tests, which are reported in Appendix Tables A.8 and A.9, yield similar results to those in main analysis.

To illustrate the construction of the geography-based instruments, assume that the antitakeover index has two provisions (provisions A and B). Assume the firm in question has four geographically-proximate non-industry peer firms; 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. The instrument value for the index at this firm would be 0.50 + 0.75 = 1.25. (Note that our actual instruments use non-industry peer firm data from *many years before the year of analysis* to construct the instrument, as discussed below.)

We construct the instruments in this manner to address two potential concerns about the exclusion condition for a geography-based instrument. The first potential concern arises because merger waves (and hence takeover likelihoods) are known to be a function of industry-level shocks and trends through time (e.g., see Harford, 2005; and Mitchell and Mulherin, 1996). To the extent that firms from the same industry locate in the same region there could be correlations in takeover defenses and takeover likelihoods in a given year between the focus firm and its geographically-proximate peer firms. We address this concern by excluding from the peer group any firm from the same industry as the focus firm. This allows us to isolate geographic peer effects in takeover provisions that are not related to the firm's industry. As noted above, our results are not sensitive to using narrowly defined (Fama-French 49 industries) versus more broadly defined industry groups (24 industry groups based on GICs).

The second potential concern is that unobservable local geographic factors might explain both takeover defenses and takeover likelihoods at both the focus firm and its cohort firms in any given year. To address this concern we examine the timing of firms' location decisions and the size and geographic scope of these firms' operations. Most firms in our sample made their headquarter location decisions many years before the year of analysis, and most firms in a given location chose their headquarters and takeover provisions in different years. Indeed, the headquarter locations for most firms in our sample were likely chosen by their respective founders for personal reasons when their firms were considerably smaller and private, and hence not subject at that time to the same takeover environment as the large public peer firms in our sample. Hence, we argue that because these location decisions are made in different years for

different firms for diverse reasons that may or may not apply to public firms, and because economic and takeover conditions vary widely over time for different locations, it is unlikely that the focus firm and its non-industry peers would all have chosen the same headquarter location for common reasons (in different prior years), which then in later years still explain both their takeover defense choices and their takeover likelihoods. This is especially true given that the cohort set purposely excludes firms from the same industry as the focus firm and because we use cohort information from many years in the past.

Next, consider that our sample consists of large S&P 1500 firms. As large firms, their operations and sales are widespread and thus affected by economic trends beyond the narrow locale of their headquarters. Indeed, it is unlikely that any local geographic characteristic that is specific to the narrow locale of such a large firm's headquarters would materially affect its takeover likelihood. Thus, because our sample consists of national and multi-national firms, we argue that the firms' takeover likelihoods are primarily a function of their overall fundamentals (for which we control), and not the narrow locales where their headquarters are located. Whatever the reasons that led both the focus firm and its geographic non-industry peers to locate their headquarters in the same area in the past, these reasons are not driven by a common industry trend (since we exclude same-industry firms from our peer cohorts), and are not driven by common timing in the location decision. Rather, we contend that large firms with proximal headquarters, but from different industries, exhibit similar takeover defenses during our sample period because of local information spillovers that occurred years, if not decades in the past, when the takeover provisions were being selected.

For these reasons, we argue that the exclusion condition is satisfied because the past takeover defense decisions of non-industry, physically-proximal peer firms are not directly related to the specific and current takeover likelihood of the focus firm years (or decades) later in our sample. To further strengthen this argument, not only is the peer set limited to non-industry peer firms, but all measures of the peer firms' takeover defenses in our analysis are lagged by at least five years or are fixed and do not change over time. In addition, robustness tests show qualitatively similar results using differing formulations of our instruments, as discussed later in this section and in Section 6.

For the second type of peer effect, we identify firms that went public within one year of the focus firm but that are not in the same industry. This type of instrument is based on evidence that a firm's use of takeover defenses is strongly influenced by the year it went public. In particular, Daines and Klausner (2001) and Field and Karpoff (2002) show that IPO firms' use of takeover defenses varies systematically over time. Furthermore, Hannes (2006) and Johnson et al. (2016) report that firms' use of takeover defenses is extremely sticky after the IPO. For example, Johnson et al. (2016) report that firms go public, on average, with 2.4 of the six E-index provisions, that 87% of all firms never remove any defenses during the 15 years after the IPO, and that the mean E-index rises to only 2.7 provisions 15 years after the IPO. Coates (2001) argues that defenses are sticky because a power conflict between managers – who favor more defenses – and institutional shareholders – who typically favor fewer defenses – results in a draw.

The fact that takeover defenses are extremely sticky by itself helps to identify our tests, as stickiness induces arbitrary deviations from firms' optimal use of defenses as firms age (see Bebchuk 2003, Johnson et al., 2016). But our instruments go further to achieve identification, as it seems extremely unlikely that the provisions adopted by a firm's non-industry IPO-year cohort would have any direct relation with the focus firm's takeover likelihood many years later. As with the geography-based instrument, we further strengthen the argument that the exclusion condition is met by lagging all measures of IPO-year non-industry peer firms' takeover provisions by at least five years, or by creating static instruments.

Given the size of firms covered in IRRC, many of the firms in our sample went public years before our sample period (1990-2008). We define IPO-year cohorts starting in 1950 and move forward year-by-year through 2008. All firms that went public before 1950 are included as part of the 1950 cohort.[20] Using this approach results in most years having 10 or more peer firms, with some years having more than 100 peer firms per year. Following the logic introduced with the geography-based instrument, the IPO instrument for a given firm is calculated as the sum of the incidences of the index provisions at the set of non-industry IPO-year cohort firms. Table A.2 in the Appendix provides the number of IPOs in each year

[20] The IPO dates are based on Compustat information. If Compustat does not report the year of the IPO we use the first year the firm appears in CRSP as a proxy for the year of the IPO.

for our sample.

As noted in Section 4.2, identification using instrumental variables requires that the instrument in the year of analysis strongly correlates with the focus firm's index values, but that the instrument does not directly explain the current likelihood of takeover at the focus firm in other ways. Based on the arguments above, we propose that both types of instruments satisfy the relevancy and exclusion conditions. The two types of instruments are based on different peer effects – one geographic in nature, and the other year-based in nature. The differences in approaches are reflected in the relatively low correlation the instruments have with each other (e.g., the five-year lagged geography-based G-index instrument has a correlation of 0.124 with the five-year lag IPO-year-based G-index instrument, and the static-1990 G-index instruments have a correlation of .062). Although the two types of instruments are based on fundamentally different peer effects, our main qualitative conclusions are not sensitive to whether we use only the geography-based, only the IPO-year-based, or both instruments together. The corroboration of our results across instruments suggests that each instrument does, in fact, identify exogenous and independent variation in the endogenous variables of interest.

For each type of peer effect (geography or IPO cohort), we construct three versions of the instrumental variables: the five-year lagged instrument and the static-1990 instrument can be calculated for the G-, E-, and O-index, while the static pre-1990 instrument is limited to the G-index. Each of these three versions has different advantages and drawbacks. The five-year lagged instruments use relatively recent information on non-industry peer firms' takeover defenses and thus account for gradual widespread changes in firms' use of takeover defenses that is not directly related to the focus firm's current takeover likelihood. However, the five-year lagged instrument values can change from year to year in ways that could possibly violate the exclusion restriction. For example, it is possible that the peer firms' choices of takeover defenses could be related to the underlying takeover environment for the focus firm even five years later. To address this possibility, the static-1990 and static pre-1990 instruments are calculated using only the earliest data available and are fixed across time for each focus firm. This procedure, along with year- and industry-fixed effects, mitigates the possibility of omitted time-varying factors driving the results.

Gormley and Matsa (2014) identify a problem with using group averages of an independent variable as an instrument that arises when unobserved heterogeneity exists at the group-level that is correlated with the outcome of interest. For example, if the instrument for a firm's takeover defenses is calculated as the average number of defenses among firms in the same industry, unobserved heterogeneity among firms in that industry might be correlated with the use of takeover defenses and the ultimate takeover likelihoods of those firms, and hence lead to inconsistent estimates even with industry fixed effects in the 2SLS equations. Similarly, if the same geography-based or IPO-year-based peer influence that results in long-lasting correlation in takeover defenses between the focus firm and its cohorts also affects other policy choices, and if these other policy choices affect takeover likelihood, then persistent group-level heterogeneity causes a violation of the exclusion condition. Our conclusions are unlikely to be affected by this type of problem, for several reasons. First, we use the firm's non-industry peers – not the firm's industry group – to create the instruments. Second, we construct all of our instruments using predetermined cohort information and obtain qualitatively similar results using either the rolling five-year lagged or static instruments. Third, we control for a multitude of firm-, industry-, and time effects known from the literature to explain takeover likelihoods, thus further decreasing the likelihood of a hidden channel through which some unobserved characteristics drive both firms' defenses and takeover likelihoods, especially some years after the match. Fourth, we obtain qualitatively similar results using an RBP model, which allows for correlation in the error structures across equations and hence would allow for such omitted variables. Fifth, we obtain the same results using either the geography- or IPO-based instruments – which capture fundamentally different types of peer effects – in just-identified models.

Putting these observations together, if omitted group-level heterogeneity is driving our results it would have to (1) exist across industries (given the non-industry matches in the cohorts), (2) be persistent across time across different industries (given the five-year lags and use of static instruments), and (3) exist in both geography-based and IPO-year-based cohorts. In addition, it (4) would have to explain the focus firm's takeover likelihood over and above the many controls already included in the takeover model, and

(5) the similar results in the RBP model would have to be coincidental. We argue that such a confluence of assumptions is improbable, making it unlikely that our results reflect group-level heterogeneity.

5. Takeover tests accounting for endogeneity

If firms with greater ex-ante exposure to unsolicited takeover bids deploy and maintain defenses, or if takeover defenses are related to managers' underlying willingness to accept takeover overtures, the models in Table 4 yield biased estimates. This section reports the results of our tests that address the potential endogeneity of defenses and takeover likelihood. Tables 5 and 6 report the results of our 2SLS tests, and Table 7 reports the results using the LIML and RBP tests.

Table 5 begins by reporting the first stage results corresponding with equation (2) from Section 4.2. For each model, the F-statistic for the joint test of significance of the instruments in the first-stage regression is reported at the bottom of the table along with the R-square value. The F-statistics are large and exceed the guidelines outlined in Staiger and Stock (1997) and Stock and Yogo (2005) for the identification of strong instruments, as discussed in Section 4.2.[21] Although the geography-based and IPO year-based instruments rely on distinctly different peer effects, both are positively and significantly related to firms' G-index, E-index, and O-index.

[Insert Table 5]

Table 6 reports the corresponding second-stage results using both the geography-based and IPO-year-based instruments for each of the three distinct versions of each type of instrument.[22] The column

[21] The Stock and Yogo (2005) test statistics were derived in a setting with homoskedastic errors. Consistent with the discussion in Cameron and Trivedi (2010, 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, and thus reject the null of weak instruments.

[22] Roberts and Whited (2012) discuss common problems with tests regarding overidentification and the exclusion criterion. Following this discussion, we rely more on our arguments in Section 4 for instrument validity than on specification tests. Nonetheless, we take advantage of having two instruments by using a robust version of the Hausman overidentification test to test for instrument validity. The null hypothesis in this test is a joint null of both (1) correct model specification, and (2) instrument validity. Using this test, we fail to reject the joint null for the models in Table 6. We interpret the test results as providing corroborating evidence that our instruments are valid. The just-identified results are tabulated in Appendix Tables A.4 and A.5. The just-identified results are similar to those in Table

headers identify which version of the instrument is used in each specification. In all models, the dependent variable is set to 1 if the focus firm is acquired in year t+1. Columns 1-3 report results using the five-year lagged instruments; columns 4-6 report results using the static-1990 instruments, and column 7 reports results using the static pre-1990 instrument (which is available only for the G-index). In Appendix Table A.6 we repeat the analysis in Table 6 using a five-year, rather than a one-year, takeover horizon for the dependent variable and obtain similar, and typically stronger, results. For all of these models the indices are negatively and significantly related to takeover likelihood. Standardized coefficients for the five-year lag instruments, reported in Appendix Tables A.16 and A.17, estimate that a one standard deviation increase in the G-index results in a 1.8% (9.9%) reduction in the likelihood of being acquired within the next year (five years). A one standard deviation increase in the E-index results in a 3.3% (18.2%) reduction in the likelihood of being acquired within the next year (five years). The instrumented O-index also is negatively and significantly related to takeover likelihood.

A potential concern with the E-index and O-index tests in Table 6 is that they exclude the other provisions in the G-index, which our results indicate have an effect on takeover likelihood. Thus, even though our intent is to examine whether each index, as constructed, explains takeover likelihood, the specific estimates based on only the E-index or O-index could be affected by omitted variable bias. To address this concern, Table A.12 in the Appendix reports on tests that are similar to those in Table 6 while controlling for the other provisions. The results are qualitatively similar to those shown in Table 6.[23]

[Insert Table 6]

The LIML and RBP results are reported in Panels A and B of Table 7. As noted previously, the instruments use two distinct peer effects, are based on non-industry peers, and are based on lagged values that pre-date any contemporaneous influences on the focus firm's takeover likelihood and use of takeover

6, although somewhat weaker for the E-index when using the static-1990 geography-based instrument or the IPO-year-based instrument alone.

[23] The Table 6 conclusions also are not sensitive to including all 71 firm, industry, and year controls (as shown in Table 6) or to dropping all of these controls. The estimated 2SLS coefficients for the G-index, E-index, and O-index remain negative and significant even in specifications without any other control variables.

defenses. Should any concerns nevertheless remain about identification, the RBP models are helpful because, as Wilde (2000) and Greene (2003) point out, the RBP estimator is less dependent on the exclusion condition for identification. For the RBP results we report the average marginal effect of above-average G-index, E-index, and O-index values rather than the probit coefficients. Following Greene (2003, p. 716), the RBP marginal effects are calculated as the difference in the predicted probability of observing a takeover conditional on being above or below the index average in that year while holding all other characteristics at the firm constant.

The results in Table 7 confirm that takeover likelihood is negatively related to the G-index, E-index, and O-index values. For example, the estimate reported in column 1 of Panel B implies that firms with above-average G-index values are significantly less likely to be acquired over a one-year horizon when compared to firms with below-average G-index values even after controlling for firm-, industry-, and year-effects. Thus, the LIML and RBP results in Table 7 strongly corroborate the 2SLS results in Table 6. The reduced form tests, tabulated in Table A.15 in the Appendix, are also consistent with these results.

[Insert Table 7]

Based on our argument that the instruments meet the exclusion restriction and the similarity of results across different versions of the instruments and across 2SLS, LIML, and RBP models, we interpret the results in Tables 5–7 as providing evidence that the G-index and E-index, as measured and used in the literature, are negatively related to takeover likelihood after accounting for endogeneity. This evidence supports the widespread use of the G-index and E-index as proxies for a firm's takeover defense. The O-index results indicate that some provisions in the G-index but excluded from the E-index also work to deter takeovers.[24]

[24] Note that, because they are endogenous, the G-index and E-index reflect both the firm's takeover defense and managers' perception of the likelihood of receiving a takeover bid. Researchers who desire measures of a firm's takeover defenses that are stripped of this latter effect could use our instrumental variables to identify plausibly exogenous variation in firms' takeover defenses. Data on these instrumental variable values are available in an online data appendix.

6. Instrument validity and robustness tests

The results in Tables 5–7 show that, after accounting for endogeneity, the G-index, E-index, and O-index are each negatively related to takeover likelihood. While the RBP tests are not as dependent on the exclusion condition for identification, our inferences from the 2SLS and LIML tests depend on the validity of our instrumental variables. In this section we discuss tests that address potential concerns about instrument validity and examine the robustness of our results.

6.1. Peer influence on bid receptivity

Both sets of instruments are based on the notion that predetermined peer effects – via either geographic proximity or IPO cohort – identify arbitrary variation in firms' use of takeover defenses that is not directly related to each focus firm's current takeover likelihood. A potential concern for the instruments is that these peer effects might simultaneously affect both takeover defenses and takeover likelihood. For example, it is possible that a manager's willingness to accept a takeover bid is affected by other nearby firms, just as her willingness to adopt takeover defenses is.

Our instruments are unlikely to be affected by such a concern because they use peer firms' takeover defenses from years in the past and they are based on firms in different industries than the focus firm. The five-year lagged instruments capture the non-industry peer firms' use of takeover defenses five years before the period in which takeover likelihood is measured for the focus firm. So, even in the unlikely case that the peer firms simultaneously affect the focus firm's takeover defenses and takeover likelihood (despite being from different industries), it is much less likely that the peer firms' use of defenses from five years before could directly relate to the focus firm's current takeover likelihood – especially after controlling for current firm-level characteristics as well as year- and industry-fixed effects. This implies that any remaining relation between the lagged instrument and any current peer influence on a manager's receptivity to a takeover bid is likely to be negligible.

This argument applies even more strongly to the static-1990 and static pre-1990 instruments. This is because the peers' influence on the focus firm's use of takeover defenses comes from their use of takeover

defenses many years before and is unlikely to be correlated with any current peer influence on the focus firm's attitude toward acquisition bids, especially because the peer firms are not in the same industry as the focus firm.[25] Finally, we note that any remaining concern that the geography-based instruments are affected by contemporaneous influence from nearby peer firms does not apply to the IPO-cohort-based instruments. The IPO cohort is not based on geographical proximity and it purposely excludes firms from the same industry as the focus firm. It would be a stretch to argue that this cohort of unrelated firms, created by having a common IPO year many years in the past, would exert ongoing influence on the focus firm's willingness to be acquired years later, especially since the cohort firms are from different industries and different locations than the focus firm. This argument is even stronger given that we also use predetermined information (i.e., from five or more years previously) from the IPO cohort.

In summary, ongoing local information spillovers are extremely unlikely to explain our results given the use of information predetermined by five or more years, the use of non-industry firms in creating the cohorts, the fact that the IPO-cohort instrument is not a function of common location, and the fact that we obtain the same qualitative results using either the geography-based or the IPO-cohort instruments.

6.2. Persistent IPO cohort influence on takeover likelihood

A second possible concern focuses on the validity of the IPO year cohort-based instrument. Although unlikely, it is possible that time-variation in takeover likelihood induces a simultaneous correlation between peers' takeover defenses and both the focus firm's and its cohorts' takeover defenses and takeover likelihoods. For example, firms going public in 1995 may have takeover defenses that are influenced by the defenses used by other firms going public at the same time, but all of these defenses might reflect these firms' joint acquisition likelihoods at the time. Such an effect could violate our exclusion

[25] We also examine a related question of whether the G-index and E-index are negatively related to takeover likelihood because they deter bids or they increase a firm's likelihood of remaining independent once it has received a takeover bid. In Appendix Table A.7 we report the results of tests that examine the relation between the G-index (and E-index) and the likelihood of receiving a bid, as opposed to the likelihood of acquisition. The results are similar to our main results, albeit slightly weaker.

restriction for the IPO cohort-based instrument if the correlation in both takeover likelihoods and defenses for the focus firm and its cohort continues dynamically over time. Our tests using five-year lagged instruments address this concern by (1) constructing the instruments using takeover defense information only from firms that are not in the focus firm's industry and (2) using only predetermined takeover provision data from those firms. In addition, our tests using the static-1990 and static pre-1990 instruments use data from peer firms as of a pre-set fixed moment in time and do not update in response to changing takeover likelihoods.

Focusing for a moment solely on the possibility of ongoing correlation in takeover likelihoods across time for the focus firm and its IPO cohort, we note that merger activity is known to cluster by industry, but time clustering across industries is less pronounced. For example, as discussed in Harford (2005), periods of heightened merger activity (and hence heightened takeover likelihoods) occurred within industries during our sample period but these periods tended to last for less than two years for each industry and tended to occur at different times for different industries. Thus, it is unlikely that two different industries would experience a merger wave at the exact same time, and even more unlikely that the focus firm together with the collective set of cohort firms from other industries would all be experiencing heightened takeover likelihoods at the same time in a way that is not already dealt with by the inclusion of year and industry controls in the takeover model. Thus, by constructing the instrument using only non-industry peers it is unlikely that correlated changes in takeover likelihoods between the focus firm and its cohort drive our results using data from years after the IPO. To strengthen this argument, we further address this potential concern by using predetermined data from the peer firms. Reaching back five or more years at peer firms to calculate the instruments ensures the data is predetermined relative to any merger wave that might affect the focus firm in the year of analysis.

A third reason that an ongoing correlation of takeover likelihoods and defenses across the focus firm and its IPO cohort during our sample period is unlikely to explain our results is that each firm's takeover likelihood each year is primarily determined by that firm's individual characteristics – including size, age, profitability, return performance, and leverage – and these characteristics differ substantially

across firms in the same IPO cohort starting even in the years before the IPO. For example, Ross Stores, Microsoft, and Harley-Davidson are all in the same IPO cohort in our sample. At the time of their IPOs these firms had been in existence for at least 28, 11, and 83 years, respectively. They differed significantly in terms of size, profitability, location, and industry in the year of the IPO and those differences became even more pronounced over time. It seems plausible to argue that some years after their IPOs (say in 1995 during our sample period), that the 1990 takeover provisions at Microsoft and Ross Stores could be used to instrument Harley-Davidson's takeover provisions in 1995 without concern that the incidence of defenses at Microsoft and Ross Stores from five or more years before the analysis somehow has some other direct, but unknown, effect on Harley-Davidson's takeover likelihood in 1995 – especially after controlling explicitly for Harley-Davidson's own firm fundamentals in 1995 in the takeover model as well as including industry and year fixed effects. In short, these considerations support the argument that the IPO cohort-based instruments meet both the relevance and exclusion restrictions for good instruments.

6.3. Endogeneity of state of incorporation

A third potential concern arises from the fact that firms choose the state in which to incorporate, and states offer different levels of takeover defense via state antitakeover laws. This raises the possibility that firms cluster in states according to their takeover likelihood and desire for takeover protection, thus creating a direct link between a firm's takeover likelihood and its peer firms' takeover defenses. Such a direct link would not affect our IPO cohort-based instruments, but conceivably could invalidate our geography-based instrumental variable.

Fortunately, this concern does not apply to our tests because state takeover laws apply to firms incorporated in the state. Our peer-based instruments, in contrast, are based on the location of the firm's headquarters. As documented by Cremers and Sepe (2015), a majority of large, publicly-traded firms are incorporated and headquartered in different states, largely because a majority of firms incorporate in Delaware.[26] Furthermore, most firms' headquarters are the result of decisions made long before the firm

[26] Cremers and Sepe (2015) report a total of 470 firms reincorporated from one state to another during the 16 year period from 1996-2011. Most (331) are reincorporations into Delaware from other states.

became publicly traded and long before managers would be considering takeover defenses. While there is some movement in firms' states of incorporation, it is unlikely that firms' headquarters decisions have much to do with the antitakeover laws of the headquarters state.

Nonetheless, we conduct several tests to examine whether our results are sensitive to additional controls for either the state of incorporation or headquarters state. Appendix Table A.13 repeats the analysis in Table 6 focused on the G-index, E-index, and O-index but includes an additional control variable for Delaware incorporation. Appendix Table A.14 includes an indicator for firms that are headquartered in the same state in which they incorporate. The results from these tests are similar to the main results in the paper.

6.4. Reverse causality

If managers deploy defenses now in anticipation of future takeover likelihoods, could reverse causality explain our results? We address this concern in two ways. First, we note that the use of data lagged by five or more years to construct the instruments, and the use of static instruments, mitigates this concern substantially. Second, we note that in a 2SLS setting, a linear projection of the endogenous variable is used in the second stage. In the second stage, the coefficient on this projection captures the effects of only the portion of the variation in the endogenous variable that also exists in the instrument after netting out the effect of the control variables. In our application this means that only the exogenous variation in the focus firms' G-index (E-index, or O-index) values is used in estimating the second stage result. For reverse causality to explain our results, it would have to be the case that both the geography-based and IPO-year-based cohorts of firms – constructed using only firms outside the focus firm's industry – collectively anticipate the same future takeover likelihood as would be relevant for the focus firm at horizons exceeding five years into the future, and collectively have the same response to this anticipated likelihood by employing similar defenses. Such extended foresight also would need to occur early in the firms' lifecycles when they are selecting takeover defenses, given how infrequently takeover defenses change during our sample period. Finally, this unlikely scenario also would have to apply to both the geography and IPO-year-

based cohorts separately, given that we obtain the same qualitative results using either instrument in isolation. These observations make a reverse causality explanation unlikely.

6.5. Additional robustness tests

In addition to the tests reported above, we examine whether our results are sensitive to other decisions we made in implementing our main tests. Our test results are robust to the following changes: (1) different approaches to creating the instruments (see Tables 6, A.8, and A.9); (2) using a takeover horizon of one or five years (see Tables 6, 7, A.6, and A.17); (3) using the 49 Fama-French industries or the 24 GIC industry classifications (see Tables 6 and A.9); (4) calculating the geography-based instrument using geographically-proximate firms either with or without the requirement that they be in the same state (see Tables 6 and A.8).

There are several exceptions to our overall finding that the results are robust to a wide range of test specifications, particularly in the just-identified models using one instrument alone. However, in these models the coefficients on the indices remain negative, and the majority of robustness tests yield significant results.

7. Conclusion

The G-index and E-index lie at the center of a puzzling development in finance research. Hundreds of research papers use these indices and derive inferences based on the assumption that these indices measure firms' takeover defenses. Yet many researchers are skeptical about whether the G-index and E-index measure firms' takeover defenses. Some theoretical discussions conclude that these indices may even yield meaningless results. The lack of empirical evidence on whether the G-index and E-index correlate with takeover defense undermines the large literature that is based on the presumption that they do.

This paper investigates whether the G-index and E-index, as constituted and used in many research papers, are correlated with a firm's takeover likelihood. In simple tests that do not account for endogeneity, we find no evidence of an empirical relation between a firm's G-index or E-index and its takeover

likelihood. However, in tests that account for endogeneity, we find that both the G-index and E-index are negatively related to takeover likelihood.

Together, these results are consistent with the inference that firms' takeover defenses partly reflect their expected takeover likelihoods – hence, the absence of a significant relation between takeover likelihood and the G-index or E-index in tests that do not account for endogeneity. However, there remains variation in firms' takeover defenses that is not driven by expected takeover likelihoods and that is captured by our predetermined geography-based and IPO cohort-based instruments. This variation identifies the underlying relation between takeover likelihood and the G-index and E-index, which our tests indicate is negative and significant both statistically and economically.

The key to our tests are our treatments for endogeneity. We address endogeneity in several ways and in several types of models, but our baseline tests use two types of instruments to achieve identification in 2SLS models of the relation between counts of takeover defenses and takeover likelihood. The first instrument is based on the predetermined use of takeover defenses by geographically proximate firms that are not in the same industry as the focus firm, and the second instrument is based on the predetermined use of takeover defenses by firms in the same IPO cohort as the focus firm but not in the same industry. Previous findings indicate that a firm's headquarter locations and IPO year have strong and enduring effects on its use of takeover defenses that are related to prior networking and law firm influence rather than a direct concern about current takeover vulnerability. Given that firms are slow to update their defenses over time, the ongoing correlation observed in defenses between the focus firm and its non-industry cohort firms during our sample period are for reasons that occurred years, if not decades, in the past and hence are not related to the focus firm's current takeover likelihood during our sample period. The fact that the cohorts are created only using firms from outside the focus firm's industry further helps to ensure there is no direct relation between the cohorts' use of defenses and the focus firm's current takeover likelihood. And the fact that we use past information about the cohort firms helps to ensure that the instruments are predetermined with respect to the focus firm's takeover likelihood in a given year. These instruments therefore identify

plausibly exogenous variation in a firm's use of takeover defenses that allows us to identify the relation between the G-index (or E-index) and takeover likelihood.

Using these instruments to account for endogeneity, in our baseline 2SLS model we find that a one-standard deviation increase in the instrumented value of a firm's G-index results in a 1.8% (9.9%) reduction in the likelihood of being acquired within the next year (five years). A one standard deviation increase in the E-index results in a 3.3% (18.2%) reduction in the likelihood of being acquired within the next year (five years). To probe possible concerns about these results, we conduct several robustness tests and also examine the direct relation between takeover likelihood and our instruments. Limited information maximum likelihood, recursive bivariate probit, and reduced form tests help mitigate concerns about potential 2SLS bias. The results from these tests, along with additional robustness tests reported in the Appendix, work together to corroborate our main findings using 2SLS.

Concerns about the endogenous nature of the G-index and E-index have prompted many researchers to use coverage by state antitakeover laws to identify plausibly exogenous variation in firms' takeover vulnerability (e.g., see Bertrand and Mullainathan, 2003; Cain, McKeon, and Solomon, 2015). Such identification strategies, however, are subject to their own weaknesses (see Catan and Kahan, 2016; Karpoff and Wittry, 2016). Our results show that, after taking endogeneity into account, higher values of both the G-index and E-index have a negative causal effect on takeover likelihood. These results provide empirical support for the large body of research that draws inferences from tests that use these indices.

Although these results support the interpretation of the G-index and E-index as proxies for a firm's takeover defenses, it is important to point out that they do not support the interpretation of these indices as proxies for governance quality. Previous research indicates that there is not a monotonic mapping between a firm's takeover defenses and the quality of its governance. For example, a high level of takeover defense could increase firm value and can be consistent with strong governance.[27]

[27] For examples, see Humphrey-Jenner (2014), Smith (2015), Cen, Dasgupta, and Sen (2011), Johnson, Karpoff, and Yi (2015), and Cremers, Litov, and Sepe (2016).

Finally, our results indicate that a firm's specific G-index and E-index levels are endogenously related to takeover likelihood. We propose two new instrumental variables based on a firms' geographic and IPO cohort firms as alternative, and plausibly exogenous, measures of a firm's takeover defenses. Whether a researcher seeks to measure a firm's endogenously determined G-index or E-index, or only the portion of a firm's index that is plausibly exogenous, depends on the research question. For researchers seeking measures of the exogenous component of a firm's takeover defenses, the data appendix to this paper contains the five-year lagged, static-1990, and static pre-1990 instruments for both the G-index and E-index for the firms and years in our sample.

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Figure 1: Firm headquarters in our sample

The figure below shows the headquarters of firms in our sample, used to create geography-based instruments for indices of takeover defenses. Our sample was created as the intersection of firms in both the IRRC and Compustat databases from 1990-2008. Although not depicted in the figure, firms from both Hawaii and Alaska are included in the sample.

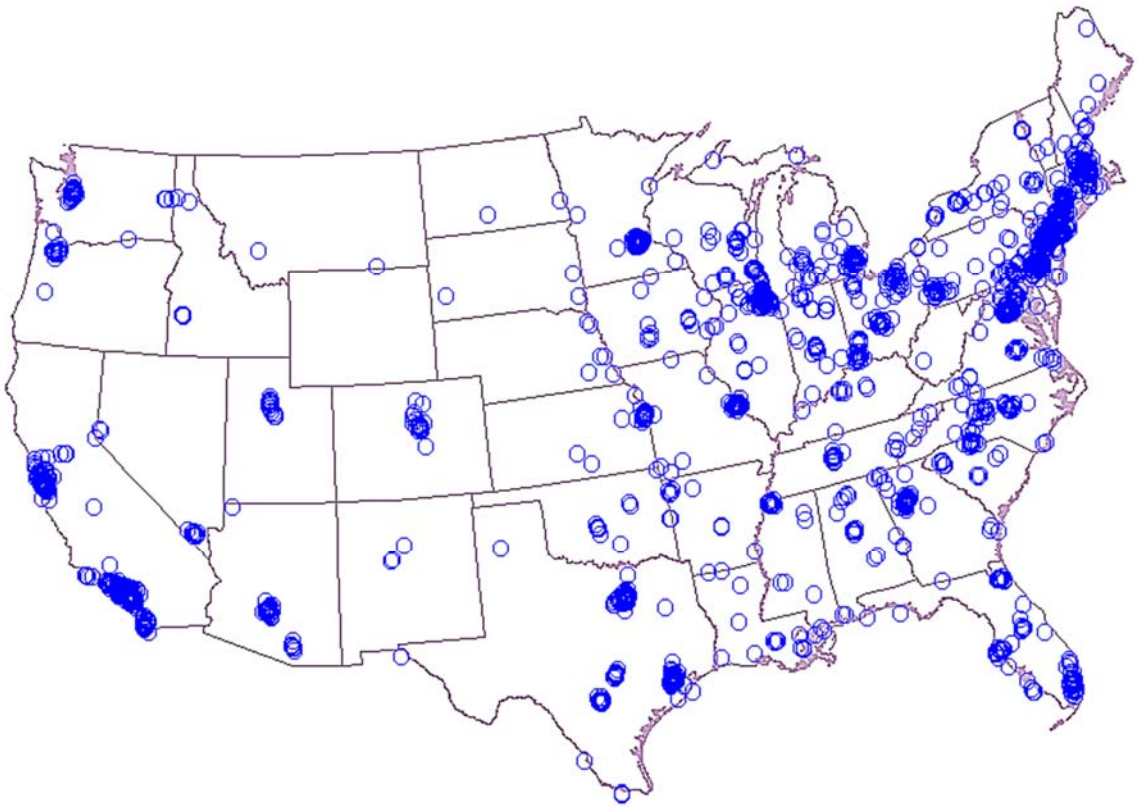

Table 1: Description of the instrumental variables used in the empirical analysis

The main tests of the relation between takeover likelihood and the G-index (or E-index) reported in this paper rely on two types of instrumental variables constructed either using a geography-based cohort or an IPO-year-based cohort of non-industry matched firms. Each type of instrument is constructed in three ways with each approach using a different lag structure when measuring the cohort firms' takeover defense information. All three approaches use predetermined information relative to the year of analysis. Each type of instrument using each of the three lagged structures is constructed separately for the G-index and E-index (except the third lag structure type, which uses the Cremers-Ferrell (2014) G-index data and is available only for the G-index). The analysis in the main tables (Table 6-7) tabulates the results for the three versions of the two types of instruments in parallel for comparison purposes. Table 6 reports results using both geography-based and IPO-based instruments for all three types of lag structures in (overidentified) 2SLS models. Table 7 reports analogous results using limited information maximum likelihood and recursive bivariate probit models.

Specific instruments based on three different ways to identify peer firms' predetermined defenses:	Two types of peer-based instruments:	
	Geography-based	IPO year cohort-based
Five-year lagged instruments (using rolling values)	IV is computed from takeover defenses at geographically proximate firms (that are not in the same industry as the focus firm) five years before the year of analysis.	IV is computed from takeover defenses at firms that went public within one year of the focus firm (and that are not in the same industry as the focus firm) using data from five years before the year of analysis.
Static-1990 instruments (values for each firm are constant over time)	IV is computed from takeover defenses at geographically proximate firms (that are not in the same industry as the focus firm) in the earliest year data are available in the IRRC data (typically 1990).	IV is computed from takeover defenses at firms that went public within one year of the focus firm (and that are not in the same industry as the focus firm) using data from the earliest year data are available in the IRRC database (typically 1990).
Static pre-1990 instruments (constant values, using earliest available data)	IV is computed from takeover defenses at geographically proximate firms (that are not in the same industry as the focus firm) in the earliest year data are available using both the IRRC and the Cremers-Ferrell (2014) G-index data that date back to 1978.	IV is computed from takeover defenses at firms that went public within one year of the focus firm (and that are not in the same industry as the focus firm) using data from the earliest year data are available using both the IRRC and the Cremers-Ferrell (2014) G-index data that date back to 1978.

Table 2: Sample information across years

The table reports the number of firms (year t) and the number of takeovers (year t+1) in each year of 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, Compustat, and CRSP databases each year from 1990 through 2008. As described in Section 4, we use three different approaches to creating the instrumental variables used in Tables 5–7. Each of the three approaches requires different data resulting in similar but slightly different samples depending on which approach is used. In this table all observations—from any of the three approaches—are included. (Table A.3 of the Appendix details sample sizes, by year, for each instrumental variable approach.)

Year	Number of Firms	Number of Takeovers	G-index	E-index
1990	1,002	23	8.97	2.37
1991	971	19	9.00	2.38
1992	944	18	9.02	2.40
1993	1,028	23	9.19	2.46
1994	991	35	9.22	2.47
1995	1,112	35	9.28	2.53
1996	1,078	59	9.29	2.53
1997	1,012	55	9.31	2.54
1998	1,367	119	8.74	2.51
1999	1,261	101	8.75	2.50
2000	1,231	58	9.01	2.63
2001	1,188	28	9.01	2.64
2002	1,503	51	9.05	2.71
2003	1,461	42	9.08	2.73
2004	1,479	70	9.13	2.78
2005	1,409	73	9.16	2.79
2006	1,366	102	9.10	2.79
2007	1,260	56	9.10	2.79
2008	1,183	29	9.12	2.79

Table 3: Descriptive statistics

The mean and median values of the variables described below are shown for all firm-years in the sample from 1990–2008. The sample is based on the intersection of IRRC, Compustat, and CRSP firms. Firm size is measured as the book value of assets. Leverage is measured as long-term debt divided by the 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. 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 for Fama-French 49 industries.

Variable	Mean	Median	Observations
G-index	9.07	9.00	22,846
E-index	2.61	3.00	22,846
Firm size ($ millions)	4,628.79	1208.22	22,846
Market value of equity ($ millions)	5,624.93	1169.01	22,846
Leverage	0.21	0.19	22,846
Market to book	1.55	1.14	22,846
ROA	0.09	0.09	22,846
Property ratio	0.61	0.54	22,846
Liquidity ratio	0.2	0.17	22,846
Sales growth	0.1	0.07	22,846
3-year sales growth	0.03	0.02	22,846
Market-adjusted return	0.02	-0.03	22,846
Industry concentration	6.37	5.03	22,846

Table 4: Takeover likelihood modeled as a function of takeover indices without accounting for endogeneity

Coefficients from probit and linear probability models are shown in columns 1–2 and 3–4, respectively. The dependent variable in all columns is set to one if the firm is acquired over the next year. The control variables are described in Table 3 and in Section 3. The sample is constructed from the intersection of the IRRC, Compustat, and CRSP databases from 1990–2008. The number of observations drops slightly in models 1 and 2 because some industry-year groups do not contain observations with variation in the dependent variable (i.e., both 1 and 0). *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 heteroskedasticity and clustered at the firm level.

	Probit Models		Linear Probability Models	
	(1)	(2)	(3)	(4)
G-index	0.004		0.000	
	(0.545)		(0.712)	
E-index		0.021		0.002
		(0.131)		(0.163)
Firm size	-0.120***	-0.119***	-0.011***	-0.011***
	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.208**	0.205**	0.017	0.017
	(0.018)	(0.020)	(0.111)	(0.116)
Market to book	-0.086***	-0.085***	-0.002	-0.002
	(<.001)	(<.001)	(0.112)	(0.112)
Property ratio	-0.129**	-0.130**	-0.013**	-0.013**
	(0.030)	(0.028)	(0.030)	(0.029)
Liquidity ratio	-0.436***	-0.435***	-0.054***	-0.053***
	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.127*	-0.127*	-0.016**	-0.016**
	(0.061)	(0.061)	(0.017)	(0.017)
ROA	-0.219	-0.224	-0.046**	-0.046**
	(0.200)	(0.189)	(0.013)	(0.013)
Market-adjusted return	0.004	0.004	-0.000	-0.000
	(0.909)	(0.923)	(0.904)	(0.893)
Industry concentration	-0.001	-0.001	-0.000	-0.000
	(0.905)	(0.935)	(0.621)	(0.666)
Constant	-1.072***	-1.094***	0.119***	0.117***
	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes
Observations	22,699	22,699	22,846	22,846
Pseudo R-square	0.068	0.068		
Chi-square	574.002	576.895		
R-square			0.025	0.025

Table 5: First-stage coefficients

The table below shows the first-stage coefficients from models that regress the G-index, E-index, and O-index on the predetermined geography-based and IPO-year-based instruments described in Section 4.3. The second-stage coefficients are reported in Table 6. As described in Section 4.3, we use three approaches to create the instruments. For both the first and second approaches we have data sufficient to calculate the instruments for the G-index, E-index, and O-index. Columns 1-6 report the first stage coefficients for the first two approaches. For the third approach we have access to the pre-IRRC data (pre-1990) only at the aggregate G-index level. The F-statistic for the joint test of significance of the instruments in the first-stage regression is reported at the bottom of the table along with the R-square value. p-values are shown in parentheses 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)	(7)
Dependent variable:	G-index	E-index	O-index	G-index	E-index	O-index	G-index
G-index geography-based 5-yr lagged instrument	0.312***						
	(<.001)						
G-index IPO-year-based 5-yr lagged instrument	0.320***						
	(<.001)						
E-index geography-based 5-yr lagged instrument		0.258***					
		(<.001)					
E-index IPO-year-based 5-yr lagged instrument		0.386***					
		(<.001)					
O-index geography-based 5-yr lagged instrument			0.379***				
			(<.001)				
O-index IPO-year-based 5-yr lagged instrument			0.239***				
			(<.001)				
G-index geography-based static-1990 instrument				0.261***			
				(<.001)			
G-index IPO-year-based static-1990 instrument				0.373***			
				(<.001)			
E-index geography-based static-1990 instrument					0.238***		
					(<.001)		
E-index IPO-year-based static-1990 instrument					0.409***		
					(<.001)		
O-index geography-based static-1990 instrument						0.353***	
						(<.001)	
O-index IPO-year-based static-1990 instrument						0.304***	
						(<.001)	
G-index geography-based static pre-1990 instrument							0.213**
							(0.023)
G-index IPO-year-based static pre-1990 instrument							0.0869
							(0.135)

Firm size	0.159***	-0.00641	0.170***	0.192***	0.00648	0.190***	0.246***
	(<.001)	(0.746)	(<.001)	(<.001)	(0.745)	(<.001)	(<.001)
Leverage	0.263	0.149	0.111	0.259	0.181*	0.0682	0.217
	(0.230)	(0.149)	(0.486)	(0.247)	(0.082)	(0.675)	(0.337)
Market to book	-0.0643**	-0.0590***	-0.00557	-0.0259	-0.0204	-0.00543	-0.0308
	(0.048)	(<.001)	(0.822)	(0.206)	(0.168)	(0.554)	(0.162)
Property ratio	0.221	0.0744	0.140	0.428**	0.167**	0.260*	0.429**
	(0.233)	(0.383)	(0.303)	(0.021)	(0.049)	(0.055)	(0.021)
Liquidity ratio	-0.954***	-0.371***	-0.588***	-0.912***	-0.413***	-0.508***	-0.953***
	(<.001)	(0.003)	(0.002)	(<.001)	(<.001)	(0.003)	(<.001)
Sales growth	-0.213**	-0.0771**	-0.137**	-0.176*	-0.0556	-0.122*	-0.248***
	(0.012)	(0.049)	(0.031)	(0.056)	(0.179)	(0.072)	(0.007)
ROA	0.136	0.170	-0.0568	-0.535	-0.119	-0.437	-0.532
	(0.749)	(0.370)	(0.854)	(0.193)	(0.547)	(0.132)	(0.199)
Market-adjusted return	0.110***	0.0593***	0.0499*	0.0885***	0.0422***	0.0463*	0.0833**
	(0.004)	(<.001)	(0.085)	(0.009)	(0.006)	(0.063)	(0.015)
Pre 1987 IPO indicator	1.077***	0.0258	1.124***	1.458***	0.179**	1.289***	1.402***
	(<.001)	(0.633)	(<.001)	(<.001)	(0.011)	(<.001)	(<.001)
Industry concentration	-0.0257**	-0.0150**	-0.0108	-0.0334***	-0.0197***	-0.0135*	-0.0300**
	(0.048)	(0.020)	(0.247)	(0.004)	(0.001)	(0.096)	(0.012)
Constant	1.295	1.135***	0.164	0.429	0.738*	-0.535	3.660***
	(0.277)	(0.005)	(0.860)	(0.736)	(0.079)	(0.556)	(0.004)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150
F-statistic (1st stage)	66.008	14.805	107.657	48.541	13.480	86.468	40.893

Table 6: Takeover likelihood modeled as a function of takeover indices accounting for endogeneity

Second-stage coefficients from linear probability 2SLS models are reported below after instrumenting the G-index, E-index, and O-index variables using the three different sets of predetermined geography-based and IPO-year-based instruments described in Section 4.3. The first-stage results are reported in Table 5. The dependent variable in all models is set to one if the firm is acquired in the next year. The analysis focuses on years 1990-2008 and the instruments are constructed using predetermined data relative to those years. In columns 1-3 the instruments are constructed using non-industry peer firms' takeover defense information from five years prior. In columns 4-6 the instruments are constructed using non-industry peer firms' takeover defense information from the earliest available data in IRRC which is 1990 for most firms in the sample. In column 7 the instrument is constructed using non-industry peer firms' takeover defense information from the earliest year the data is available subsequent to the IPO using the combined IRRC and Cremers and Ferrell data dating back to 1978. The control variables are described in Table 3 and in Section 3. *p*-values are shown in parentheses below the marginal effects 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)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.007***			-0.006**			-0.006**
	(0.005)			(0.012)			(0.048)
E-index		-0.028**			-0.024**		
		(0.024)			(0.019)		
O-index			-0.006**			-0.005**	
			(0.011)			(0.039)	
Firm size	-0.010***	-0.012***	-0.010***	-0.008***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.027**	0.022*	0.012	0.016	0.011	0.012
	(0.074)	(0.043)	(0.087)	(0.284)	(0.171)	(0.322)	(0.285)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.120)	(0.132)	(0.119)	(0.121)
Property ratio	0.000	-0.001	-0.000	-0.008	-0.007	-0.009	-0.008
	(0.973)	(0.934)	(0.954)	(0.209)	(0.249)	(0.127)	(0.199)
Liquidity ratio	-0.057***	-0.063***	-0.055***	-0.053***	-0.058***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.018***	-0.018***	-0.020***	-0.019**	-0.019**	-0.020**
	(0.006)	(0.008)	(0.008)	(0.009)	(0.012)	(0.011)	(0.010)
ROA	-0.002	-0.000	-0.004	-0.056***	-0.059***	-0.056***	-0.056***
	(0.942)	(0.995)	(0.867)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001

	(0.237)	(0.172)	(0.277)	(0.828)	(0.743)	(0.885)	(0.835)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.816)	(0.575)	(0.908)	(0.655)	(0.320)	(0.844)	(0.671)
Constant	0.176***	0.214***	0.156***	0.163***	0.182***	0.145***	0.161***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	378.5	338.5	411.3	931.8	840.2	958.6	935.7
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150

Table 7: Limited information maximum likelihood (LIML) and recursive bivariate probit (RBP) model robustness tests

Panel A reports limited information maximum likelihood (LIML) estimates (∂) for the Index variable shown in the equations below and discussed in Section 4. The dependent variable (y_1) in all columns is set to 1 in a given year if the firm is acquired within the next year. The Index variable represents the G-index, E-index, or O-index depending on the specification.

$$y_1 = \alpha + \partial\ \text{Index} + \sum_{j=1}^{71} x_j\beta_j + e$$

$$\text{Index} = \gamma_0 + \pi\ z_{Geography} + \theta\ z_{IPO-year} + \sum_{j=1}^{71} x_j\gamma_j + u$$

The same 71 firm, industry and year-based controls used in Table 6 are included but not tabulated in Table 7. The geography-based and IPO-cohort-based instruments are described in Section 4.3. The analysis focuses on years 1990-2008 and the instruments are constructed using predetermined data relative to those years. As noted in the column headers, the results are reported using the three approaches to creating the instruments as described in Table 1. Panel B reports the recursive bivariate probit (RBP) average marginal effects. The underlying equations (shown above for the LIML model) are similar for the RBP model but the two left-hand side variables are considered latent variables (y_1^*, Index*) in the RBP model and by assumption y_1 and Index are observed to equal 1 when their underlying respective latent variables are above a certain threshold. In the RBP models, we set Index = 1 if a firm's G-index (E-index, O-index) value is above the mean index value. In the RBP model, the two errors are allowed to correlate across equations and are assumed to have a bivariate normal distribution. The RBP marginal effects are estimated as the difference in the predicted probability of observing a takeover conditional on having or not having above-mean index values while holding all other characteristics at the firm constant following Greene (5 ed., page 716). *p*-values are shown in parenthesis below the marginal effects with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively.

Panel A: LIML	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.007***			-0.006**			-0.006**
	(0.005)			(0.012)			(0.048)
E-index		-0.029**			-0.024**		
		(0.024)			(0.019)		
O-index			-0.006**			-0.005**	
			(0.011)			(0.039)	
Table 6 control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	378.4	338.1	411.3	931.8	838.0	958.6	935.6
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150

Panel B: RBP model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.036***			-0.034***			-0.026*
	(0.004)			(0.007)			(0.056)
E-index		-0.033			-0.042		
		(0.103)			(0.154)		
O-index			-0.028**			-0.023**	
			(0.011)			(0.035)	
Table 6 control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square	2,772.766	1,815.255	3,175.549	3,118.470	2,115.566	3,514.920	4,242.391
Prob > Chi-square	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Appendix for "Do takeover defense indices measure takeover deterrence?"

by Jonathan M. Karpoff, Robert Schonlau, and Eric Wehrly

August 2, 2016

This appendix contains descriptive information about the sample as well as multiple tests that probe the robustness of the results reported in Tables 6 and 7 of the main paper.

List of Appendix Tables:

- **A.1:** Percent of sample firms with each provision during the sample period.
- **A.2:** Number of firms in the sample going public each year.
- **A.3**: Summary of the sample based on the three approaches to creating the instruments described in Section 4.3.
- **A.4:** Takeover likelihood as a function of index values after accounting for endogeneity using only the geography-based instrument.
- **A.5**: Takeover likelihood as a function of index values after accounting for endogeneity using only the IPO-year-based instrument.
- **A.6**: Takeover likelihood over a five-year horizon as a function of index values after accounting for endogeneity using three different sets of instruments. This table corresponds to Table 6 in the main body of the paper. However, in Table A.6 the dependent variable is set to 1 in a given year if the firm is acquired over the next five years instead of the next year.
- **A.7**: This table models the receipt of a takeover bid as a function of antitakeover indices. This table is similar to Table 6 from the main body of the paper but uses a different dependent variable (receipt of bid vs. being acquired).
- **A.8**: This table repeats the analysis from Table 6 in the main body of the paper using a different version of the geography-based instrument where the geographically-proximate peer group is identified strictly on distance (but not in the same industry) without consideration of state boundaries. Like Table 6 this table reports the overidentified results.
- **A.9**: This table repeats the analysis from Table 6 in the main body of the paper but uses the 24 industry groups based on GICs instead of Fama-French industry classifications when identifying geographically-proximate and IPO-year-proximate firms when calculating the instruments.
- **A.10**: This table repeats the analysis from Table 6 in the main body of the paper but extends the 2006 IRRC data through 2010 instead of 2008.
- **A.11**: This table repeats the analysis from Table 6 in the main body of the paper but without including industry fixed effects.
- **A.12**: This table repeats the analysis from columns 2, 3, 5, and 6 from Table 6 in the main body of the paper but includes and instruments both the E-index and O-index at the same time.
- **A.13**: This table repeats the analysis from Table 6 in the main body of the paper, but includes an indicator variable for Delaware incorporation.
- **A.14**: This table repeats the analysis from Table 6 in the main body of the paper, but includes an indicator variable if the state of incorporation is the same as the state where the headquarters are located.
- **A.15**: This table repeats the analysis using five-year lagged instruments from Table 6 in the main body of the paper, but rather than reporting 2SLS estimates, reports OLS coefficients from a linear probability reduced form model.

- **A.16**: This table repeats the analysis for Table 6 in the main body of the paper, but reports standardized coefficients for takeover likelihood over a one-year horizon.
- **A.17**: This table repeats the analysis for Table 6 in the main body of the paper, but reports standardized coefficients for takeover likelihood over a five-year horizon.

Table A.1: Percent of firms in our sample with each provision during the sample period.

Each year's data is used in the subsequent year(s) until the next IRRC volume becomes available. In the G-index, 1 was added to the index if the firm did not allow cumulative voting or 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	76.8	79.5	84.7	86.7	88.2	90.2	90.4	91.5
Classified board	57.0	57.8	59.6	57.1	57.4	59.1	58.6	55.4
Special meeting	24.5	28.0	30.2	30.1	35.3	47.7	50.6	52.0
Written consent	25.0	28.4	31.0	29.8	33.8	44.3	46.1	48.2
Compensation plans	42.4	64.1	71.1	62.0	72.0	73.9	76.3	75.9
Director contracts	17.7	15.6	13.2	11.8	10.2	8.5	7.8	7.8
Golden parachutes	49.3	51.7	53.1	54.4	62.4	67.3	73.4	78.0
Director indemnification	41.2	38.7	37.4	23.8	24.0	18.2	17.4	18.1
Director liability	74.6	69.0	65.7	47.4	45.1	32.9	31.6	30.5
Executive severance	13.9	5.4	10.3	12.1	10.6	7.0	6.4	3.7
Bylaws	13.2	15.0	14.8	15.4	17.6	21.1	21.9	20.9
Charter	2.6	2.8	2.6	2.8	2.7	2.0	2.0	2.1
Cumulative vote	18.2	16.8	15.5	12.4	11.5	9.2	9.1	8.7
Secret ballot	2.6	8.8	11.7	9.4	10.6	10.1	11.8	13.1
Supermajority	38.0	38.9	37.9	35.0	34.5	31.7	31.6	31.2
Unequal voting	2.1	2.0	1.9	1.7	1.1	1.0	0.7	0.6
Antigreenmail	7.0	6.6	6.7	5.0	4.8	3.4	3.2	3.5
Directors' duties	5.3	6.3	6.5	5.9	6.3	6.3	7.0	6.8
Fair price	33.3	35.2	33.3	26.3	25.8	20.4	19.9	19.5
Pension parachutes	4.4	5.3	4.0	2.3	1.5	1.0	0.9	0.7
Poison pill	53.0	54.7	54.4	52.7	56.5	57.3	58.1	54.2
Silver parachutes	4.3	5.2	3.6	2.7	1.9	1.5	1.1	1.2
Recapture of profits law	18.4	18.0	17.1	14.6	15.5	13.9	13.7	13.8
Business combination law	86.5	89.3	89.8	91.0	92.3	92.9	92.4	92.9
Cash out law	4.1	4.1	4.0	3.1	3.2	3.0	3.0	3.0
Director's duties law	5.6	5.6	5.4	4.3	4.0	3.9	4.1	4.2
Fair price law	34.3	36.1	34.3	31.7	32.0	28.5	28.8	29.4
Control share acquisition law	28.1	28.9	28.1	27.1	26.7	24.7	24.9	25.2

Table A.2: Number of firms in the sample going public each year. All IPO years before 1950 are assigned a 1950 IPO date when compiling the firm's IPO year cohort.

IPO year	Firms	IPO year	Firms	IPO year	Firms	IPO year	Firms
1950	239	1964	23	1978	13	1992	118
1951	6	1965	21	1979	17	1993	141
1952	5	1966	15	1980	20	1994	90
1953	6	1967	27	1981	50	1995	113
1954	7	1968	35	1982	28	1996	119
1955	5	1969	44	1983	87	1997	83
1956	5	1970	29	1984	47	1998	76
1957	8	1971	28	1985	41	1999	114
1958	6	1972	240	1986	95	2000	69
1959	7	1973	17	1987	106	2001	39
1960	11	1974	5	1988	59	2002	33
1961	9	1975	12	1989	42	2003	9
1962	75	1976	12	1990	54	2004	4
1963	13	1977	11	1991	107	2005	1

Table A.3: Sample information by instrumental variable approach

As described in detail in Sections 3 and 4.3 of the main paper, we use three different approaches to create the geography-based and IPO-year-based instruments. The five-year lagged approach to creating instruments requires different data each year than the static-1990 and static pre-1990 instruments causing the overall sample to differ for the 1st compared to 2nd and 3rd approaches. Our main results are robust to the specific sample used. The table below reports the number of firms in the sample each year after imposing the data requirements associated with each approach to calculating the instruments and the control variables.

Year	sample using five-year lagged instruments	sample using static-1990 and static pre-1990 instruments
1990		1,002
1991		971
1992		944
1993		1,028
1994		991
1995	1,037	1,040
1996	1,030	998
1997	984	933
1998	1,252	1,280
1999	1,187	1,157
2000	1,181	1,129
2001	1,143	1,044
2002	1,336	1,301
2003	1,338	1,255
2004	1,400	1,279
2005	1,372	1,215
2006	1,284	1,195
2007	1,241	1,105
2008	1,164	1,035

Table A.4: Takeover likelihood as a function of index values after accounting for endogeneity – using only the geography-based instrument.

This table corresponds to Table 6 in the main body of the paper. Table 6 tabulates the overidentified results using both instruments. This table 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 4.3 of the paper. The dependent variable in columns 1-7 is set to one if the firm was acquired in the next year. The analysis focuses on years 1990-2008 and the instruments are constructed using predetermined data relative to those years. In columns 1-3 the instruments are constructed using non-industry peer firms' anti-takeover information from five years prior. In columns 4-6 the instruments are constructed using non-industry peer firms' anti-takeover information from the earliest available IRRC data for the cohorts, generally 1990. In column 7 the instruments are constructed using non-industry peer firms' anti-takeover information from the earliest year the data is available subsequent to the IPO using the combined IRRC and Cremers and Ferrell data dating back to 1978. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.006**			-0.005**			-0.005*
	(0.018)			(0.036)			(0.060)
E-index		-0.036**			-0.026		
		(0.044)			(0.111)		
O-index			-0.006**			-0.005*	
			(0.028)			(0.066)	
Firm size	-0.010***	-0.012***	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.028**	0.022*	0.012	0.016	0.011	0.012
	(0.074)	(0.040)	(0.085)	(0.285)	(0.175)	(0.320)	(0.285)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.121)	(0.139)	(0.120)	(0.122)
Property ratio	-0.000	0.000	-0.001	-0.008	-0.007	-0.009	-0.008
	(0.995)	(0.998)	(0.925)	(0.197)	(0.306)	(0.121)	(0.188)
Liquidity ratio	-0.057***	-0.066***	-0.054***	-0.052***	-0.059***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.019***	-0.018***	-0.020**	-0.019**	-0.019**	-0.019**
	(0.007)	(0.007)	(0.009)	(0.010)	(0.012)	(0.012)	(0.011)
ROA	-0.002	0.002	-0.004	-0.056***	-0.059***	-0.056***	-0.056***
	(0.921)	(0.930)	(0.851)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001
	(0.244)	(0.150)	(0.281)	(0.835)	(0.730)	(0.889)	(0.840)
Industry concentration	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.826)	(0.503)	(0.910)	(0.672)	(0.338)	(0.849)	(0.683)
Constant	0.172***	0.237***	0.153***	0.161***	0.187***	0.144***	0.159***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	380.3	325.6	415.0	936.5	823.9	960.3	939.2
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	85.7	9.7	153.1	64.8	6.5	126.1	61.0
R-square (1st stage)	0.179	0.100	0.214	0.154	0.102	0.189	0.149

Table A.5: Takeover likelihood as a function of index values after accounting for endogeneity – using only the IPO-year-based instrument.

This table corresponds to Table 6 in the main body of the paper. Table 6 tabulates the overidentified results using both instruments. This table 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 4.3 of the paper. The dependent variable in columns 1-7 is set to one if the firm was acquired in the next year. The analysis focuses on years 1990-2008 and the instruments are constructed using predetermined data relative to those years. In columns 1-3 the instruments are constructed using non-industry peer firms' anti-takeover information from five years prior. In columns 4-6 the instruments are constructed using non-industry peer firms' anti-takeover information from the earliest available IRRC data for the cohorts, generally 1990. In column 7 the instruments are constructed using non-industry peer firms' anti-takeover information from the earliest year the data is available subsequent to the IPO using the combined IRRC and Cremers and Ferrell data dating back to 1978. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.005**			-0.006**			-0.005*
	(0.034)			(0.024)			(0.064)
E-index		-0.022			-0.022*		
		(0.218)			(0.088)		
O-index			-0.005*			-0.005**	
			(0.051)			(0.043)	
Firm size	-0.011***	-0.012***	-0.011***	-0.008***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.026*	0.022*	0.012	0.015	0.011	0.012
	(0.074)	(0.051)	(0.085)	(0.285)	(0.182)	(0.324)	(0.285)
Market to book	-0.006***	-0.007***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.120)	(0.134)	(0.119)	(0.122)
Property ratio	-0.000	-0.001	-0.001	-0.008	-0.008	-0.009	-0.008
	(0.956)	(0.881)	(0.905)	(0.203)	(0.227)	(0.138)	(0.197)
Liquidity ratio	-0.056***	-0.060***	-0.054***	-0.053***	-0.057***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.018***	-0.018**	-0.018***	-0.020***	-0.019**	-0.019**	-0.019**
	(0.008)	(0.011)	(0.010)	(0.010)	(0.013)	(0.011)	(0.011)
ROA	-0.003	-0.002	-0.004	-0.056***	-0.059***	-0.056***	-0.056***
	(0.895)	(0.935)	(0.839)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.005	0.004	0.001	0.001	0.001	0.001
	(0.252)	(0.205)	(0.283)	(0.831)	(0.762)	(0.881)	(0.837)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.839)	(0.653)	(0.912)	(0.663)	(0.377)	(0.839)	(0.676)
Constant	0.167***	0.196***	0.151***	0.162***	0.176***	0.147***	0.160***
	(<.001)	(0.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	385.2	347.2	418.3	934.0	858.5	956.1	937.3
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	85.6	12.9	137.4	67.5	13.7	118.0	58.8
R-square (1st stage)	0.177	0.100	0.204	0.157	0.106	0.181	0.147

Table A.6: Takeover likelihood as a function of index values after accounting for endogeneity using a five-year takeover horizon.

This table corresponds to Table 6 in the main body of the paper. In Table 6 the dependent variable is focused on a one-year takeover horizon. In this table the dependent variable is set equal to 1 in a given year if the firm is acquired over the next five years. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.037***			-0.029***			-0.032***
	(<.001)			(0.002)			(0.003)
E-index		-0.155***			-0.086**		
		(0.001)			(0.039)		
O-index			-0.036***			-0.026***	
			(<.001)			(0.007)	
Firm size	-0.029***	-0.039***	-0.029***	-0.027***	-0.035***	-0.028***	-0.026***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.155***	0.176***	0.149***	0.127***	0.140***	0.122***	0.127***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Market to book	-0.027***	-0.033***	-0.024***	-0.010*	-0.010	-0.009*	-0.010*
	(<.001)	(<.001)	(<.001)	(0.094)	(0.109)	(0.090)	(0.094)
Property ratio	0.010	0.006	0.007	0.005	0.001	-0.001	0.008
	(0.678)	(0.833)	(0.769)	(0.821)	(0.959)	(0.961)	(0.751)
Liquidity ratio	-0.154***	-0.184***	-0.139***	-0.125***	-0.139***	-0.111***	-0.127***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(0.001)	(<.001)
Sales growth	-0.036**	-0.032*	-0.032**	-0.047***	-0.042***	-0.044***	-0.049***
	(0.025)	(0.052)	(0.040)	(0.003)	(0.010)	(0.005)	(0.003)
ROA	-0.045	-0.037	-0.055	-0.210***	-0.220***	-0.208***	-0.210***
	(0.506)	(0.605)	(0.410)	(0.001)	(0.001)	(0.001)	(0.001)
Market-adjusted return	0.010	0.015**	0.008	-0.006	-0.005	-0.008	-0.006
	(0.116)	(0.046)	(0.204)	(0.333)	(0.427)	(0.235)	(0.359)
Industry concentration	-0.005**	-0.007**	-0.005*	-0.003*	-0.004**	-0.003	-0.003*
	(0.037)	(0.016)	(0.055)	(0.085)	(0.040)	(0.146)	(0.079)
Constant	0.792***	0.998***	0.682***	0.648***	0.663***	0.567***	0.672***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	1087.2	702.9	1048.4	4649.0	4214.7	4953.1	4527.1
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150

Table A.7: Takeover bid likelihood and takeover indices accounting for endogeneity

This table corresponds with Table 6 from the main body of the paper. Unlike in Table 6 where the dependent variable was set to one if the firm was acquired in a given year, in this table the dependent variable is set to one if the firm received a bid. Bid dates were estimated as the announcement dates for completed and withdrawn deals from SDC. 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 4.3 of the main paper. The control variables are described in Table 3. *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)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.005*			-0.004			-0.004
	(0.065)			(0.121)			(0.217)
E-index		-0.031**			-0.022*		
		(0.035)			(0.067)		
O-index			-0.004			-0.003	
			(0.137)			(0.231)	
Firm size	-0.008***	-0.010***	-0.009***	-0.008***	-0.009***	-0.008***	-0.008***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.029**	0.033**	0.028**	0.016	0.019	0.015	0.016
	(0.043)	(0.023)	(0.048)	(0.200)	(0.125)	(0.219)	(0.200)
Market to book	-0.008***	-0.010***	-0.008***	-0.003	-0.003	-0.003	-0.003
	(<.001)	(<.001)	(<.001)	(0.106)	(0.116)	(0.105)	(0.107)
Property ratio	-0.002	-0.002	-0.003	-0.014*	-0.013*	-0.015**	-0.014*
	(0.792)	(0.810)	(0.729)	(0.057)	(0.082)	(0.037)	(0.058)
Liquidity ratio	-0.047***	-0.055***	-0.045***	-0.056***	-0.062***	-0.054***	-0.056***
	(0.002)	(0.001)	(0.003)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.024***	-0.025***	-0.024***	-0.026***	-0.026***	-0.026***	-0.026***
	(0.004)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)
ROA	-0.004	-0.000	-0.006	-0.070***	-0.072***	-0.070***	-0.070***
	(0.876)	(0.998)	(0.815)	(0.002)	(0.002)	(0.002)	(0.002)
Market-adjusted return	0.001	0.002	0.001	-0.002	-0.002	-0.002	-0.002
	(0.787)	(0.598)	(0.844)	(0.602)	(0.688)	(0.567)	(0.600)
Industry concentration	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.905)	(0.646)	(0.964)	(0.503)	(0.283)	(0.586)	(0.509)
Constant	0.188***	0.245***	0.170***	0.197***	0.221***	0.183***	0.196***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	397.3	345.0	506.8	1261.5	1164.3	1276.6	1262.0
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150

Table A.8: Takeover likelihood and takeover indices accounting for endogeneity using a variation of the geography instrument

This table corresponds with Table 6 from the main body of the paper. Different than those in Table 6, the results in this table are based on an alternative calculation of the geography-based instrument (the IPO-year instrument is the same as in Table 6). In Table 6 the geographically-proximate peer set of firms are selected from the same state as the focus firm. In this table the geographically proximate firms are allowed to cross state boundaries. If insufficient cohort members are found within a 100-mile radius then a 500-mile radius is used. 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 4.3. The control variables are described in Table 3. *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)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.006***			-0.006**			-0.005*
	(0.006)			(0.019)			(0.064)
E-index		-0.029**			-0.023**		
		(0.024)			(0.018)		
O-index			-0.006**			-0.005*	
			(0.016)			(0.058)	
Firm size	-0.010***	-0.012***	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.027**	0.022*	0.012	0.016	0.011	0.012
	(0.074)	(0.042)	(0.086)	(0.285)	(0.173)	(0.321)	(0.290)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.120)	(0.132)	(0.119)	(0.121)
Property ratio	0.000	-0.001	-0.001	-0.008	-0.008	-0.009	-0.008
	(0.985)	(0.936)	(0.942)	(0.199)	(0.236)	(0.124)	(0.189)
Liquidity ratio	-0.057***	-0.063***	-0.054***	-0.052***	-0.058***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.018***	-0.018***	-0.020***	-0.019**	-0.019**	-0.019**
	(0.006)	(0.008)	(0.008)	(0.010)	(0.012)	(0.012)	(0.011)
ROA	-0.002	-0.000	-0.004	-0.056***	-0.059***	-0.056***	-0.056***
	(0.934)	(0.997)	(0.860)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001
	(0.239)	(0.171)	(0.278)	(0.833)	(0.749)	(0.887)	(0.800)
Industry concentration	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.820)	(0.574)	(0.909)	(0.666)	(0.330)	(0.847)	(0.623)
Constant	0.175***	0.214***	0.154***	0.162***	0.180***	0.145***	0.160***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,766
Chi-square (2nd stage)	379.4	338.0	413.0	935.2	847.0	959.6	933.5
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.5	14.1	107.9	48.7	13.7	84.4	41.3
R-square (1st stage)	0.187	0.107	0.216	0.162	0.113	0.188	0.151

Table A.9: Takeover likelihood and takeover indices accounting for endogeneity using alternative industry groups in instrument calculation

This table corresponds with Table 6 from the main body of the paper. In Table 6 the geographically-proximate and IPO-year cohorts of peer firms eliminated within-industry matches using Fama-French industry classifications. For the analysis in this table the within industry peer firms were eliminated using the 24 industry groups classified using GICs. 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 4.3 of the main paper. The control variables are described in Table 3. *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)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.007***			-0.006**			-0.005*
	(0.005)			(0.015)			(0.060)
E-index		-0.028**			-0.024**		
		(0.036)			(0.021)		
O-index			-0.006**			-0.005**	
			(0.011)			(0.046)	
Firm size	-0.010***	-0.012***	-0.010***	-0.008***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.027**	0.022*	0.012	0.016	0.011	0.012
	(0.075)	(0.044)	(0.088)	(0.289)	(0.173)	(0.325)	(0.267)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.121)	(0.133)	(0.120)	(0.121)
Property ratio	0.000	-0.001	-0.001	-0.008	-0.007	-0.009	-0.008
	(0.999)	(0.905)	(0.931)	(0.203)	(0.254)	(0.123)	(0.178)
Liquidity ratio	-0.058***	-0.063***	-0.055***	-0.053***	-0.059***	-0.050***	-0.051***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.019***	-0.019***	-0.020***	-0.019**	-0.019**	-0.020**
	(0.006)	(0.008)	(0.007)	(0.009)	(0.011)	(0.011)	(0.010)
ROA	-0.002	-0.001	-0.004	-0.057***	-0.060***	-0.057***	-0.055***
	(0.906)	(0.967)	(0.831)	(0.003)	(0.003)	(0.003)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001
	(0.239)	(0.176)	(0.279)	(0.830)	(0.741)	(0.886)	(0.824)
Industry concentration	-0.000	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.797)	(0.568)	(0.886)	(0.649)	(0.312)	(0.834)	(0.684)
Constant	0.177***	0.214***	0.157***	0.163***	0.183***	0.145***	0.157***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,929	16,929	16,929	20,891	20,891	20,891	20,682
Chi-square (2nd stage)	379.1	339.3	411.7	933.3	837.8	959.4	928.9
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	64.7	13.2	106.3	48.5	12.9	86.6	41.7
R-square (1st stage)	0.187	0.106	0.218	0.163	0.111	0.194	0.152

Table A.10: Takeover likelihood as a function of index values after accounting for endogeneity – using data extended through 2010
This table corresponds to Table 6 in the main body of the paper using data where the 2006 IRRC data has been extended through 2010 instead of 2008. This table shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.008***			-0.007***			-0.007**
	(<.001)			(0.002)			(0.012)
E-index		-0.031**			-0.026**		
		(0.010)			(0.011)		
O-index			-0.007***			-0.006***	
			(0.002)			(0.010)	
Firm size	-0.010***	-0.013***	-0.010***	-0.009***	-0.011***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.022*	0.027**	0.021*	0.013	0.017	0.011	0.012
	(0.066)	(0.033)	(0.082)	(0.237)	(0.127)	(0.285)	(0.238)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.003	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.112)	(0.124)	(0.111)	(0.112)
Property ratio	-0.004	-0.005	-0.005	-0.010*	-0.011*	-0.012**	-0.010*
	(0.551)	(0.446)	(0.479)	(0.079)	(0.081)	(0.038)	(0.077)
Liquidity ratio	-0.057***	-0.063***	-0.053***	-0.055***	-0.061***	-0.052***	-0.055***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.020***	-0.019***	-0.020***	-0.021***	-0.020***	-0.020***	-0.021***
	(0.002)	(0.004)	(0.003)	(0.004)	(0.007)	(0.006)	(0.005)
ROA	0.004	0.004	0.001	-0.050***	-0.053***	-0.050***	-0.050***
	(0.853)	(0.829)	(0.950)	(0.008)	(0.006)	(0.007)	(0.008)
Market-adjusted return	0.004	0.005	0.003	0.001	0.001	0.000	0.001
	(0.301)	(0.224)	(0.359)	(0.846)	(0.762)	(0.922)	(0.852)
Industry concentration	-0.001	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.503)	(0.284)	(0.605)	(0.427)	(0.169)	(0.632)	(0.438)
Constant	0.240***	0.281***	0.214***	0.177***	0.193***	0.155***	0.175***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,171	19,171	19,171	22,842	22,842	22,842	22,842
Chi-square (2nd stage)	391.1	357.1	399.0	1011.1	906.0	1050.4	1013.9
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	64.0	15.1	105.6	48.4	13.9	86.7	40.2
R-square (1st stage)	0.187	0.109	0.219	0.164	0.115	0.195	0.150

Table A.11: Takeover likelihood as a function of index values after accounting for endogeneity – without industry fixed effects

This table corresponds to Table 6 in the main body of the paper but does not include industry fixed effects. This table shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index variables. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.008***			-0.009***			-0.008***
	(<.001)			(<.001)			(0.002)
E-index		-0.037***			-0.033***		
		(0.001)			(0.001)		
O-index			-0.008***			-0.009***	
			(0.001)			(<.001)	
Firm size	-0.009***	-0.012***	-0.009***	-0.007***	-0.009***	-0.007***	-0.007***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.030**	0.021*	0.015	0.022**	0.013	0.015
	(0.059)	(0.019)	(0.078)	(0.165)	(0.048)	(0.220)	(0.161)
Market to book	-0.004***	-0.006***	-0.004***	-0.001	-0.002	-0.001	-0.001
	(<.001)	(<.001)	(0.002)	(0.121)	(0.133)	(0.149)	(0.132)
Property ratio	-0.007	-0.007	-0.007	-0.009**	-0.009*	-0.010**	-0.010**
	(0.222)	(0.239)	(0.186)	(0.049)	(0.084)	(0.023)	(0.038)
Liquidity ratio	-0.060***	-0.072***	-0.056***	-0.057***	-0.068***	-0.052***	-0.056***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.016**	-0.016**	-0.015**	-0.015**	-0.014*	-0.014*	-0.014*
	(0.018)	(0.025)	(0.024)	(0.046)	(0.065)	(0.068)	(0.060)
ROA	-0.031	-0.023	-0.036*	-0.074***	-0.072***	-0.077***	-0.075***
	(0.113)	(0.267)	(0.063)	(<.001)	(<.001)	(<.001)	(<.001)
Market-adjusted return	0.005	0.006	0.005	0.001	0.002	0.001	0.001
	(0.210)	(0.128)	(0.255)	(0.695)	(0.591)	(0.757)	(0.708)
Industry concentration	-0.000**	-0.001**	-0.000*	-0.000	-0.000*	-0.000	-0.000
	(0.038)	(0.010)	(0.075)	(0.308)	(0.096)	(0.450)	(0.308)
Constant	0.193***	0.243***	0.166***	0.179***	0.192***	0.153***	0.170***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	No	No	No	No	No	No	No
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	258.0	235.8	259.1	303.8	285.6	309.2	302.2
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	76.0	18.3	115.2	54.7	16.1	90.3	47.2
R-square (1st stage)	0.139	0.062	0.179	0.112	0.064	0.150	0.094

Table A.12: Takeover likelihood as a function of index values after accounting for endogeneity – controlling for and instrumenting both the E-index and O-index at the same time

This table corresponds to Table 6 (columns 2, 3, 5, and 6) in the main body of the paper but it combines Table 6 columns 2 and 3, and 5 and 6 into columns 1 and 2 below by including both the E-index and O-index variables in the same model and instrumenting both variables at the same time. For example in Table 6 column 2 (column 3) the E-index (O-index) was included as the main variable of interest (and instrumented) but the other remaining provisions from the G-index were not included. In column 1 below that same analysis is repeated, but instead includes and instruments both the E-index and O-index at the same time. This table reports the second stage coefficients from a linear probability model after instrumenting the E-index and O-index variables. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1) 5-year lag instruments	(2) static-1990 instruments
E-index	-0.018	-0.016*
	(0.128)	(0.057)
O-index	-0.005*	-0.005**
	(0.052)	(0.039)
Firm size	-0.011***	-0.008***
	(<.001)	(<.001)
Leverage	0.025*	0.014
	(0.059)	(0.226)
Market to book	-0.007***	-0.002
	(<.001)	(0.124)
Property ratio	0.001	-0.006
	(0.933)	(0.330)
Liquidity ratio	-0.061***	-0.057***
	(<.001)	(<.001)
Sales growth	-0.020***	-0.020***
	(0.005)	(0.008)
ROA	0.001	-0.057***
	(0.977)	(0.004)
Market-adjusted return	0.005	0.001
	(0.192)	(0.752)
Industry concentration	-0.000	-0.000
	(0.674)	(0.417)
Constant	0.205***	0.186***
	(<.001)	(<.001)
Year controls	Yes	Yes
Industry controls	Yes	Yes
Observations	16,949	20,902
Chi-square (2nd stage)	352.3	870.9
Prob > Chi-square (2nd stage)	<.001	<.001
F-statistic (1st stage)	9.8	12.0
R-square (1st stage)	0.108	0.118

Table A.13: Takeover likelihood as a function of index values after accounting for endogeneity – including an indicator for incorporation in Delaware.

This table corresponds to Table 6 in the main body of the paper but also includes a control for Delaware incorporation. This table 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 4.3 of the paper. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		5-year lag instruments			Static-1990 instruments		Static pre-1990 IV
G-index	-0.006**			-0.006**			-0.006*
	(0.013)			(0.020)			(0.070)
E-index		-0.026*			-0.022**		
		(0.075)			(0.048)		
O-index			-0.006**			-0.005*	
			(0.025)			(0.057)	
Firm size	-0.010***	-0.012***	-0.010***	-0.008***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.026**	0.021*	0.012	0.016	0.011	0.012
	(0.080)	(0.048)	(0.097)	(0.284)	(0.172)	(0.333)	(0.286)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.120)	(0.131)	(0.120)	(0.121)
Property ratio	0.000	-0.001	-0.000	-0.008	-0.008	-0.009	-0.008
	(0.974)	(0.906)	(0.961)	(0.209)	(0.211)	(0.129)	(0.199)
Liquidity ratio	-0.057***	-0.062***	-0.054***	-0.053***	-0.058***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.018***	-0.018***	-0.020***	-0.019**	-0.019**	-0.020**
	(0.006)	(0.009)	(0.008)	(0.009)	(0.013)	(0.011)	(0.011)
ROA	-0.001	-0.001	-0.002	-0.056***	-0.059***	-0.055***	-0.056***
	(0.961)	(0.962)	(0.910)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001
	(0.243)	(0.187)	(0.283)	(0.828)	(0.755)	(0.888)	(0.835)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.816)	(0.609)	(0.899)	(0.655)	(0.356)	(0.846)	(0.673)
Delaware	0.002	-0.000	0.004	-0.000	-0.002	0.002	0.000
	(0.548)	(0.943)	(0.240)	(0.968)	(0.589)	(0.572)	(0.977)
Constant	0.172***	0.206***	0.151***	0.164***	0.179***	0.143***	0.161***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	382.5	344.9	417.8	932.2	853.9	960.3	936.5
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	57.5	12.1	100.9	42.6	11.8	82.0	34.9
R-square (1st stage)	0.191	0.115	0.220	0.167	0.119	0.195	0.153

Table A.14: Takeover likelihood as a function of index values after accounting for endogeneity – including an indicator for headquarter state being the same as state of incorporation.

This table corresponds to Table 6 in the main body of the paper but also includes an indicator variable for a firm having its headquarters in the same state in which it was incorporated. This table shows the second stage coefficients from a linear probability model after instrumenting the G-index, E-index, and O-index variables using both instruments described in Section 4.3 of the paper. The control variables are described in Table 3 in the paper. *p*-values are shown in parentheses below the coefficients with significance at the 10%, 5%, and 1% levels noted using *, **, ***, respectively. Errors are robust to heteroskedasticity and are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index	-0.006**			-0.005**			-0.005
	(0.022)			(0.034)			(0.108)
E-index		-0.024*			-0.021*		
		(0.092)			(0.053)		
O-index			-0.005**			-0.004*	
			(0.040)			(0.088)	
Firm size	-0.011***	-0.012***	-0.011***	-0.009***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.021*	0.025*	0.020	0.011	0.015	0.010	0.011
	(0.096)	(0.060)	(0.112)	(0.326)	(0.204)	(0.371)	(0.328)
Market to book	-0.007***	-0.007***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.124)	(0.135)	(0.125)	(0.126)
Property ratio	0.000	-0.001	-0.000	-0.008	-0.008	-0.009	-0.008
	(0.971)	(0.928)	(0.971)	(0.208)	(0.230)	(0.135)	(0.195)
Liquidity ratio	-0.056***	-0.060***	-0.053***	-0.052***	-0.057***	-0.049***	-0.051***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.018***	-0.018***	-0.020***	-0.019**	-0.019**	-0.019**
	(0.006)	(0.008)	(0.008)	(0.009)	(0.012)	(0.011)	(0.011)
ROA	0.000	0.000	-0.001	-0.055***	-0.057***	-0.054***	-0.054***
	(0.989)	(0.982)	(0.963)	(0.005)	(0.004)	(0.005)	(0.005)
Market-adjusted return	0.005	0.005	0.004	0.001	0.001	0.001	0.001
	(0.250)	(0.196)	(0.285)	(0.837)	(0.763)	(0.888)	(0.846)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.782)	(0.599)	(0.850)	(0.651)	(0.357)	(0.811)	(0.670)
Same state indicator	-0.008**	-0.006	-0.010***	-0.006*	-0.004	-0.007**	-0.006*
	(0.034)	(0.287)	(0.008)	(0.089)	(0.383)	(0.026)	(0.082)
Constant	0.172***	0.202***	0.155***	0.160***	0.176***	0.144***	0.157***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)

Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	395.0	358.7	432.1	941.5	862.3	964.3	946.2
Prob > Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	60.1	12.5	103.2	44.7	12.3	83.4	37.1
R-square (1st stage)	0.190	0.113	0.219	0.165	0.116	0.194	0.151

Table A.15: Takeover likelihood and takeover indices using reduced form models

The 2SLS coefficients reported in Table 6 of the main paper are estimates of the structural coefficients from the takeover equation (equation 1 in main paper). The ability to instrument an overall index using 2SLS requires the assumption that each provision within the index be of equal importance in explaining takeover likelihood. This assumption is implicit in the construction of the G-index and E-index, as used throughout the literature, where each provision is simply added to the overall total index value. Despite the widespread use of the indices, as constructed, it is likely that different provisions have different effects on takeover likelihood.

The violation of this assumption (viz., if each provision has a different marginal effect on takeover likelihood instead of equal effects) in a 2SLS model that estimates a single marginal effect for an overall index calls into question the exclusion condition. This is because the error term in such a model is a function of the differences between the true (unobserved) marginal effects of each of the provisions and the estimated marginal effect of the overall index. Hence, even if each instrument were calculated at the provision level and met the exclusion condition at the provision level there is a possibility that the instrument at the overall index level violates the exclusion condition. This type of measurement error is specific to using an index and unlike most types of measurement error is not necessarily addressed using 2SLS.

We address the above concern in four specific ways. First, there are reasons to expect the measurement error-induced violation of the exclusion condition is small. These reasons include (a) the idea that the marginal effects for many of the 24 provisions individually may not be statistically different from zero in explaining takeover likelihood (e.g., Bebchuk, Cohen, and Ferrell (2009) argued that only 6 of the 24 provisions mattered), and (b) the estimated marginal effect on the overall index mechanically must be larger than some, while being smaller than others, of the marginal effects of the individual provisions because the overall effect is in some sense an average of the individual effects. Thus, since the problematic portion of the error is a weighted sum of the differences between the overall and individual marginal effects, this sum tends toward zero and hence the violation of the exclusion condition is unlikely to be large.

Second, we note the strength of our instruments—particularly in the models focused on the overall G-index. Previous research shows that, even with small violations of the exclusion condition, the 2SLS approach often yields estimates that are close to the true parameter values if the instruments are sufficiently strong, (e.g., see the discussion in Conley, Hansen, and Rossi, 2012; Kiviet and Niemczyk, 2013; and Murray, 2006). Thus given the strength of our instruments and the discussion above suggesting that the measurement error-induced violation of the exclusion condition is likely small, we argue that our main empirical conclusions are reasonably identified even in the possible presence of slight violations of the exclusion condition.

Third, we corroborate our 2SLS results in the main paper using both LIML and RBP methodologies. LIML results are known to be less susceptible to finite sample and weak instrument-related bias than 2SLS estimates. RBP models do not necessarily require the exclusion condition for identification (Wilde, 2000; Greene, 2003, pp. 714-717).[28] Thus the 2SLS results are corroborated using methodologies less dependent on the exclusion condition, supporting our conclusion that the 2SLS results are not being driven by violations of the exclusion condition.

As a fourth way to address this concern we also examine the reduced form equations rather than the 2SLS formulations. Angrist and Krueger (2001), Murray (2006), and Chernozhukov and Hansen (2008) suggest that reduced form models of the dependent variable of interest (y_1) regressed directly on the instrument can offer corroborating evidence for inference taken from 2SLS models particularly in settings with potential 2SLS bias. We apply the same approach here

[28] Greene specifically notes that "the endogenous nature of one of the variables on the right-hand side of the first equation can be ignored in formulating the log-likelihood…." for the RBPM, and that we "can ignore the simultaneity in this model and we cannot in the linear regression model…" (Greene, 2003, pp. 715-716). Wilde (2000) notes that in RBPMs no exclusion condition is needed for identification as long as there is sufficient variation in the variables. Mourifie and Meango (2010) note that partial identification is possible without the exclusion condition but that point identification in some cases requires more information. Han and Vytlacil (2013) show that although the exclusion restriction is sufficient, it is not necessary for identification in these types of models as long as there are common exogenous variables included as controls across the two equations.

to help mitigate bias-related concerns associated with measurement error when instrumenting an index. In the reduced form model, takeover likelihood (y_1) is modeled as a direct function of (plausibly) exogenous proxy measures (z) for the firm's takeover defense, y_2, as shown in the equation below:

$$y_1 = \partial z + \beta_1 x_1 + \cdots \beta_k x_k + e$$

The intuition for this approach is similar to 2SLS but the proxy for y_2 in the equation above is the instrument itself rather than a linear projection of y_2 on the instrument and control variables as in 2SLS. As noted in the main paper, if we use an OLS model and an endogenous measure of the firm's own takeover defenses (y_2), as in equation (1) in the main paper, the coefficient estimate will be biased and inconsistent. If, instead of y_2, we use a proxy for y_2 that is itself plausibly exogenous to the firm's own takeover likelihood, then the OLS coefficient is an unbiased estimate of the effect exogenous variation (at least as measured by the proxy) in takeover defenses has on takeover likelihood. In Section 4.3 in the main paper, we argue that our measures for z in the equation above are exogenous not only because they are based on cohorts of unrelated firms from other industries, but also because the cohort information used to create z is lagged by multiple years before the year of analysis and hence predetermined relative to the takeover likelihood at the firm in any given year.[29] One limitation of this approach is that even if z is exogenous (or at least predetermined) with respect to the firm's own takeover likelihood, it represents only a very noisy proxy for the firm's own defenses. But as a robustness test, and as noted in the literature (e.g., see Chernozhukov and Hansen, 2008), the signs and significance of the reduced form coefficients can help corroborate inference from the 2SLS models. We tabulate the reduced form coefficients on the next page for the instruments lagged by five years and find qualitatively similar results as in the 2SLS, LIML, and RBP results reported in the main paper.

[29] One way to motivate the reduced form tests is to decompose the firm's current G-index ($y_{2,it}$ - using the y_2 notation form equation (1)) into a predetermined component (subscript "pred") and an endogenous component as follows: $y_{2,it} = z_{pred} + v_{it}$. We measure z_{pred} with the firm's cohorts' lagged average G-index (or E-index or O-index) and not with the firm's own G-index. The lagged information is based on predetermined information from five years in the past. The logic for, and details about the construction of, the cohorts are described in more detail in Section 4.3 of the main paper but relevant for our current discussion of the plausible exogeneity of z_{pred} we note here that the cohort is constructed to exclude firm *i* and all firms in the same industry as firm *i*, using the cohorts' G-index values from years before year t. This construction ensures that z_{pred} is predetermined and hence not correlated with v_{it} or the structural error (u_{it}), which are both firm-year-specific quantities in the year of analysis. Substituting the expression for $y_{2,it}$ into equation (1) in the main paper yields the reduced form model shown above with the error term $e = u_{it} + \partial v_{it}$. OLS estimates of ∂ are consistent in this equation if $E(e|z_{pred}, x_1, \ldots, x_k) = 0$, i.e., if $cov(z_{pred}, u_{it}) = 0$ and $cov(z_{pred}, v_{it}) = 0$. Stated differently, the reduced form model directly measures the relation between takeover likelihood and takeover defenses by using noisy but plausibly exogenous proxies for the firm's takeover defenses in an OLS regression.

Table A.15, continued: Takeover likelihood and takeover indices using reduced form models

The table below shows OLS coefficients from a linear probability reduced form model based on the equation shown above. The control variables are described in Table 3 in the main paper. The geography-based and IPO-year-based cohort variables are described in Section 4.3. *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)
G-index geography-based instrument	-0.005***					
	(0.008)					
G-index IPO-year-based instrument		-0.004**				
		(0.018)				
E-index geography-based instrument			-0.009**			
			(0.030)			
E-index IPO-year-based instrument				-0.007		
				(0.294)		
O-index geography-based instrument					-0.006**	
					(0.024)	
O-index IPO-year-based instrument						-0.005**
						(0.011)
Firm size	-0.012***	-0.011***	-0.012***	-0.012***	-0.012***	-0.011***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.022*	0.023*	0.022*	0.023*	0.021*
	(0.073)	(0.091)	(0.071)	(0.079)	(0.076)	(0.094)
Market to book	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Property ratio	-0.002	-0.002	-0.003	-0.003	-0.002	-0.002
	(0.748)	(0.721)	(0.713)	(0.667)	(0.738)	(0.744)
Liquidity ratio	-0.052***	-0.052***	-0.052***	-0.052***	-0.052***	-0.051***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.016**	-0.017**	-0.016**	-0.016**	-0.016**	-0.017**

	(0.017)	(0.014)	(0.018)	(0.018)	(0.017)	(0.013)
ROA	-0.003	-0.007	-0.004	-0.008	-0.005	-0.007
	(0.869)	(0.738)	(0.843)	(0.703)	(0.812)	(0.753)
Market-adjusted return	0.004	0.004	0.004	0.004	0.004	0.004
	(0.320)	(0.320)	(0.324)	(0.321)	(0.318)	(0.318)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.931)	(0.968)	(0.909)	(0.942)	(0.945)	(0.970)
Constant	0.174***	0.165***	0.154***	0.147***	0.166***	0.162***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	16,949	16,949	16,949
R-squared	0.023	0.023	0.023	0.023	0.023	0.023

Table A.16: This table repeats the analysis for Table 6 in the main body of the paper, but reports standardized coefficients for the indices.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	5-year lag instruments			Static-1990 instruments			Static pre-1990 IV
G-index (standardized)	-0.018***			-0.016**			-0.015**
	(0.005)			(0.012)			(0.048)
E-index (standardized)		-0.033**			-0.028**		
		(0.024)			(0.019)		
O-index (standardized)			-0.013**			-0.010**	
			(0.011)			(0.039)	
Firm size	-0.010***	-0.012***	-0.010***	-0.008***	-0.010***	-0.009***	-0.009***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.023*	0.027**	0.022*	0.012	0.016	0.011	0.012
	(0.074)	(0.043)	(0.087)	(0.284)	(0.171)	(0.322)	(0.285)
Market to book	-0.007***	-0.008***	-0.006***	-0.002	-0.002	-0.002	-0.002
	(<.001)	(<.001)	(<.001)	(0.120)	(0.132)	(0.119)	(0.121)
Property ratio	0.000	-0.001	-0.000	-0.008	-0.007	-0.009	-0.008
	(0.973)	(0.934)	(0.954)	(0.209)	(0.249)	(0.127)	(0.199)
Liquidity ratio	-0.057***	-0.063***	-0.055***	-0.053***	-0.058***	-0.050***	-0.052***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Sales growth	-0.019***	-0.018***	-0.018***	-0.020***	-0.019**	-0.019**	-0.020**
	(0.006)	(0.008)	(0.008)	(0.009)	(0.012)	(0.011)	(0.010)
ROA	-0.002	-0.000	-0.004	-0.056***	-0.059***	-0.056***	-0.056***
	(0.942)	(0.995)	(0.867)	(0.004)	(0.003)	(0.004)	(0.004)
Market-adjusted return	0.005	0.006	0.004	0.001	0.001	0.001	0.001
	(0.237)	(0.172)	(0.277)	(0.828)	(0.743)	(0.885)	(0.835)
Industry concentration	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.816)	(0.575)	(0.908)	(0.655)	(0.320)	(0.844)	(0.671)
Constant	0.115***	0.140***	0.114***	0.110***	0.119***	0.113***	0.111***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	378.5	338.5	411.3	931.8	840.2	958.6	935.7
Prob < Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150

Table A.17: This table repeats the analysis for Table 6 in the main body of the paper, but reports standardized coefficients for the indices measuring takeovers over a five-year horizon for the dependent variable, instead of a one-year horizon.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		5-year lag instruments			Static-1990 instruments		Static pre-1990 IV
G-index (standardized)	-0.099***			-0.078***			-0.087***
	(<.001)			(0.002)			(0.003)
E-index (standardized)		-0.182***			-0.102**		
		(0.001)			(0.039)		
O-index (standardized)			-0.073***			-0.053***	
			(<.001)			(0.007)	
Firm size	-0.029***	-0.039***	-0.029***	-0.027***	-0.035***	-0.028***	-0.026***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Leverage	0.155***	0.176***	0.149***	0.127***	0.140***	0.122***	0.127***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Market to book	-0.027***	-0.033***	-0.024***	-0.010*	-0.010	-0.009*	-0.010*
	(<.001)	(<.001)	(<.001)	(0.094)	(0.109)	(0.090)	(0.094)
Property ratio	0.010	0.006	0.007	0.005	0.001	-0.001	0.008
	(0.678)	(0.833)	(0.769)	(0.821)	(0.959)	(0.961)	(0.751)
Liquidity ratio	-0.154***	-0.184***	-0.139***	-0.125***	-0.139***	-0.111***	-0.127***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(0.001)	(<.001)
Sales growth	-0.036**	-0.032*	-0.032**	-0.047***	-0.042***	-0.044***	-0.049***
	(0.025)	(0.052)	(0.040)	(0.003)	(0.010)	(0.005)	(0.003)
ROA	-0.045	-0.037	-0.055	-0.210***	-0.220***	-0.208***	-0.210***
	(0.506)	(0.605)	(0.410)	(0.001)	(0.001)	(0.001)	(0.001)
Market-adjusted return	0.010	0.015**	0.008	-0.006	-0.005	-0.008	-0.006
	(0.116)	(0.046)	(0.204)	(0.333)	(0.427)	(0.235)	(0.359)
Industry concentration	-0.005**	-0.007**	-0.005*	-0.003*	-0.004**	-0.003	-0.003*
	(0.037)	(0.016)	(0.055)	(0.085)	(0.040)	(0.146)	(0.079)
Constant	0.459***	0.592***	0.450***	0.386***	0.437***	0.398***	0.378***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,949	16,949	16,949	20,902	20,902	20,902	20,902
Chi-square (2nd stage)	1087.2	702.9	1048.4	4649.0	4214.7	4953.1	4527.1
Prob < Chi-square (2nd stage)	<.001	<.001	<.001	<.001	<.001	<.001	<.001
F-statistic (1st stage)	66.0	14.8	107.7	48.5	13.5	86.5	40.9
R-square (1st stage)	0.188	0.107	0.219	0.164	0.112	0.194	0.150