Who's Paying Attention? Measuring Common Ownership and Its Impact on Managerial Incentives[*†]

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Abstract

We derive a measure that captures the extent to which overlapping ownership structures shift managers' incentives to internalize externalities. A key feature of the measure is that it allows for the possibility that not all investors are attentive to whether a manager's actions benefit the investor's overall portfolio. Empirically, we find that measures of ownership overlap have increased far more than managers' motive to internalize how their choices affect other firms' valuations. We also show that potential drivers of ownership overlap, including mergers in the asset management industry and the growth of indexing, could in fact diminish managerial motives. Our findings illustrate the importance of accounting for investor inattention and cast doubt on the possibility that the growth of common ownership in recent years has had a significant impact on managerial incentives.

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There is a growing sense among academics and practitioners that common ownership—where two firms are at least partially owned by the same investor—is on the rise among publicly-held U.S. firms and that this could have important implications for acquisitions, executive pay, governance, among numerous other outcomes (e.g., see Antón et al., 2016; Harford et al., 2011; He and Huang, 2017; He et al., 2018; Kempf et al., 2016). Such common ownership might affect firms' strategic choices since common owners have an incentive to internalize how each firm's actions will affect the value of other firms in the portfolio (Easterbrook and Fischel, 1982; Hansen and Lott, 1996; Rubin, 2006). This observation has led some to argue that common ownership by institutions may contribute to anticompetitive behaviors by firms (e.g., Azar et al., 2016, forthcoming) and that legal and regulatory actions are needed to limit institutions' ability to offer index funds and hold significant stakes in some industries (e.g., Posner et al, 2016).[1]

Despite the recent attention such common ownership has received, there is little discussion of when, if at all, managers will have an incentive to internalize the preferences of common investors, and more importantly, how one should quantify the extent to which common ownership affects managers' incentives. For example, while there is a sense that the rise of common ownership is driven, in part, by the merger of asset managers (e.g., see Azar et al., 2016, forthcoming) and the increasing popularity of index investing (e.g., see Harford et al., 2011), there is little discussion of whether we should expect such mergers and index-induced overlapping ownership structures to increase managers' motives to internalize how their actions might affect the value of other firms. If index fund investors or asset managers with larger, more diversified holdings are less informed or attentive to firm-specific actions, then managers would have little incentive to internalize the impact of their actions on the holdings of such investors. In this paper, we attempt to fill this void by quantifying the extent to which common owners shift managerial incentives.

To quantify common ownership and its impact on managerial incentives, we proceed in two steps. First, we discuss existing measures that capture the extent to which two stocks' ownership structures overlap. While these measures are typically used to study the effects of common ownership, we refer to them as measures of "overlap" because there is no sense in which they necessarily capture the effect

[1] A condensed version of the argument made in Posner et al. (2016) was published as an op-ed article on *The New York Times* on December 7, 2016. See Posner, E., F.S. Morton, and G. Weyl. (2016) "A Monopoly Donald Trump Can Pop," *The New York Times*, December 7th, which is available at http://nyti.ms/2gRQKhH. Similarly, Elhauge (2016) argues that existing antitrust law can and should be used to undo horizontal shareholdings that have led to anti-competitive levels of common ownership.

common investors may have on managerial motives. To address this weakness, we proceed to our second step, which is to derive a model-based measure that quantifies the impact of common owners on managerial motives. In other words, for a given pair of stocks, we quantify the impact ownership overlap will have on a manager's incentive to internalize how their actions might affect the value of the other firm. The measure is general in that it does not depend on the nature, sign, or magnitude of the externality and is best seen as a relative measure of how important common ownership is for manager incentives *per unit* of externality.

The resulting model-driven measure is simple and has some appealing properties. In particular, our model shows that the impact of each common investor on managerial incentives will be the product of three inputs: the extent to which the manager cares about that investor's preferences (which is proportional to the investor's ownership stake), the importance that investor places on the externality (which is proportional to their ownership stake in the other firm), and the likelihood that investor is informed about whether the manager's actions have improved the value of their overall portfolio (which, among other things, is related to the importance of the firm in the investor's portfolio). Intuitively, our measure predicts that investors that are less affected by the externality or less attentive to firm-specific policy choices should not contribute as much to managers' incentive to internalize how their choices affect other firms.

A key feature of our measure is that it accounts for the possibility that not all investors are attentive. This differs from other measures of common ownership, which implicitly assume that all investors are fully informed about the externalities that firms impose on each other [e.g., see the MHHI measure that was developed by Bresnahan and Salop (1986) and O'Brien and Salop (2000) and implemented by Azar et al., (forthcoming)]. In particular, our model accounts for the fact that managers' choices will only be influenced by the preferences of attentive investors. Our model-driven measure also differs from existing measures of common ownership in that it is invariant to the specific nature of externalities. Therefore, one can use our measure to study the effects of common ownership in a wider range of contexts.

We then take our measure of ownership overlap and its impact on incentives to the data to illustrate the importance of accounting for investor attention. In doing so, we must make specific modeling choices, including how managers ascribe importance weights to each investor, but we show that our subsequent findings are not sensitive to these choices. And, for illustrative purposes, we begin by assuming that an investor's likelihood of being attentive is increasing in how important the stock is in the overall investor's

portfolio, which is both theoretically micro-founded (e.g., Veldkamp and Van Nieuwerberg, 2010) and supported by empirical evidence (Fich et al., 2015; Iliev et al., 2018).

Accounting for investor attention can lead to very different conclusions about the recent rise of common ownership and its importance for managerial motives. For the average stock pair, we find that ownership overlap increased between 1980 and 2012 by 1,527% to 4,669% depending on the measure used. However, our base measure for the impact of this overlap on managerial incentives only increased, on average, by 284%. The smaller shift in managerial incentives is robust to how one models investor attention and to modifying the weights managers place on different investors' preferences. Only when one assumes fully attentive investors do we observe an increase in incentives that is similar to the larger increase in overlap. These results highlight that the rise of ownership overlap has coincided with the average investor becoming increasingly diverse in their holdings, and hence, potentially less attentive as an owner.

Further highlighting the importance of investor attention, we find that managerial motives to internalize externalities can actually be lower following asset manager mergers once one accounts for possible shifts in investor attention. Calculating the predicted changes in managerial incentives resulting from the merger of BGI and Blackrock in 2009, we find that 56% of stock-pairs would experience a decline in incentives to internalize externalities following the merger. This occurs because some stocks become less important in the larger, more diversified portfolio of the merged entity, which can reduce the likelihood the larger common investor is as attentive as the two previously unmerged common investors. Only when one assumes full attention does the merger necessarily lead to an increase in managerial incentives.

The importance of index investing for a possible shift in managerial motives is also unclear. When measuring managerial incentives to internalize externalities, the relative contribution of institutions that primarily offer index funds depends heavily on how one models investor attention. Moreover, while ownership overlap for a stock pair increases, on average, when both firms are in the same index (e.g., the S&P 500, 400 and 600 indexes, or the Russell 1000 and 2000 indexes), we find that managers' incentive to internalize externalities actually decreases in many circumstances. For example, we find that ownership overlap increases by 31% to 58% relative to the sample average if both firms are members of the Russell 2000 index, but that managers' incentive to internalize externalities decreases, on average, by 12% to 30%. Because these latter estimations control for pair-level fixed effects, the estimates are not due to time-

invariant features of stock pairs and are instead driven by within-pair changes in index assignment. Moreover, these divergent findings are not sensitive to how one models investor attention; only when we assume full attention do we fail to find a mixed association between index inclusion and incentives.

The findings with respect to index inclusion and managerial motives highlight a key aspect of our model; ownership overlap is a necessary but insufficient condition for shifting managerial incentives. Two stocks' inclusion in the same index, combined with the growing popularity of low-cost index funds, naturally leads to an increase in overlapping ownership, which can enhance managerial motives to internalize externalities. However, if these new common investors are less attentive than previous non-indexing common investors, then managers' incentives to internalize externalities can decline. Because index investing reduces the importance of each stock in investors' overall portfolios, it has the potential to decrease investors' likelihood of being attentive enough to evaluate whether managers are taking actions to improve the overall value of their increasingly diverse portfolios.[2]

Interestingly, we also find little association between industry concentration and managers' incentive to internalize how their actions might affect other firms in the industry. Common owners might have an incentive to enhance the value of their investments by softening the competition between industry rivals in their portfolios (e.g., see Hansen and Lott, 1996; Rubin, 2006). Given that, one might expect investors driven by such motives to hold common positions among companies where anti-competitive behaviors are easier to facilitate (e.g., among two firms operating in the same concentrated industry). However, we find no evidence that our measure of managerial incentives is different for stock pairs where both firms are in the same industry, and we find only weak evidence of an increase in incentives for such stock pairs as the industry becomes more concentrated, as measured by the Herfindahl-Hirschman index (HHI).

Overall, our model and empirical findings illustrate the importance of accounting for investor attention and cast doubt on the idea that overlapping ownership structures, including those driven by asset manager mergers and the growth of indexing, significantly shift managers' incentives. The use of naïve measures of ownership overlap and a failure to account for investor attention, can significantly overstate the impact of

[2] While there is evidence that index funds and the institutions that offer them successfully influence firms' governance structures using low-cost monitoring techniques, like developing proxy-voting guidelines that encapsulate their view on best governance practices and voting accordingly for all firms (e.g., see Appel et al., 2016, forthcoming), it is an open question whether index funds possess the resources or incentives necessary to monitor more firm-specific policy choices, like investment and pricing choices, that might in turn affect the value of other stocks in their large portfolios.

common ownership on managers' incentive to internalize externalities.

Our findings contribute to the growing literature on common ownership by providing a framework for understanding when common ownership is and is not likely to shift managerial incentives. Quantifying the impact of overlapping ownership structures on incentives is important both for those seeking to make policy recommendations and for those attempting to study the impact of common ownership, and our findings provide important context for recent work on common ownership and firms' strategic choices.[3] To our knowledge, we are also the first to document time series and cross-sectional patterns of common ownership and its impact on managerial incentives across the entire universe of U.S. publicly-traded firms.

By deriving a measure of common ownership that captures three components through which common ownership is likely to impact managerial motives, we also provide a general way to measure common ownership that can be used in future studies. While we make specific modeling choices when taking our proposed measure of common ownership to the data, our model is flexible in that future researchers can easily change the importance weights that managers assign to different investors (e.g., by instead assuming that managers only care about their largest five investors) or how one models investor attention (e.g., by instead assuming economies of scale in monitoring and adding investors' assets under management (AUM) as another input for an investor's likelihood of being attentive). Additionally, we show that it is possible to construct versions of our measure that capture a manager's incentive to internalize the impact of their actions on an entire set of firms (e.g. all product-market competitors) rather than just one other firm, which may be useful in studying whether common ownership induces anti-competitive behaviors.[4]

Finally, our paper contributes to the theoretical literature on common ownership (e.g., see Azar, 2017; Edmans et al., forthcoming; Hansen and Lott, 1996; Lopez and Vives, forthcoming; O'Brien and Salop, 2000; Rubin, 2006). Similar to these papers, we study how common ownership might affect corporate outcomes by shifting managerial incentives. The key distinction between our model and these papers is our

[3] E.g., recent work evaluates the impact common ownership might have on firm competitiveness (Azar et al., 2016, forthcoming; Dennis et al., 2017; Gramlich and Grundl, 2017; O'Brien and Waehrer, 2017), governance (Azar, 2012; He et al., forthcoming; Jung, 2013; Kang et al., 2013; Kempf et al., 2016), corporate outcomes (Matvos and Ostrovsky, 2008; Gompers and Xuan, 2009; Harford et al., 2011; Masulis and Nahata, 2011; Cici et al., 2015; He and Huang, 2016), executive pay (Antón et al., 2016; Kwon, 2016), stock price movements (Jotikasthira et al., 2012; Anton and Polk, 2014; Bartram et al., 2015; Hau and Lai, 2016), credit risks (Massa and Žaldokas, 2016) and weekly return predictability (Gao et al., 2016).

[4] To facilitate future research in this area, our goal is to post versions of our proposed measure and code online so that other researchers can more readily study the potential determinants and effects of common ownership.

assumption that investors may not pay full attention to actions taken by managers. As a consequence, managers in our model do not fully internalize the preferences of their inattentive investors, which can have important implications for understanding of the importance of common ownership.

1. Measuring common ownership

Common ownership reflects scenarios where two firms are at least partially owned by the same investor, and in this section, we approach the issue of how to measure common ownership from two different perspectives. First, we discuss measures that capture the extent of ownership overlap between any two pairs of stocks. These measures, all of which are used in the existing literature, are useful in documenting how prevalent common ownership is and how it has changed over time. In many regards, however, these measures of ownership overlap are naïve measures of common ownership in that there is no reason to believe they capture the impact of common investors on managers' incentive to internalize externalities. To address this weakness, we construct a simple model that captures key features that are likely important for how investors affect managerial motives and use it to propose a novel measure of common ownership that captures the impact of ownership overlap on managers' incentives. A key feature of the model is an assumption that not all investors are fully attentive to managers' actions. Finally, we compare our proposed measure against other measures of common ownership used in the literature.

1.1 Measuring common ownership from the perspective of "overlap"

While there are numerous ways one might measure ownership overlap across two stocks, we focus on four measures of ownership overlap at the investor level that are currently used in the literature. To facilitate this discussion, we employ the following notation: $\alpha_{i,n}$ is the fraction of company *n* owned by investor *i,* $I^{A,B}$ is the set of institutional investors who own a strictly positive stake in firm *A* and in firm *B*, and $\bar{v}_A$ and $\bar{v}_B$ are the market values of firms *A* and *B*, respectively. We then construct four variables:

$$Overlap_{Count}(A,B) = \sum\nolimits_{i \in I^{A,B}} 1,$$

$$Overlap_{Min}(A,B) = \sum\nolimits_{i \in I^{A,B}} min\{\alpha_{i,A}, \alpha_{i,B}\},$$

$$Overlap_{AP}(A,B) = \sum\nolimits_{i \in I^{A,B}} \alpha_{i,A} \frac{\bar{v}_A}{\bar{v}_A + \bar{v}_B} + \alpha_{i,B} \frac{\bar{v}_B}{\bar{v}_A + \bar{v}_B}.$$

$$Overlap_{HL}(A,B) = \sum\nolimits_{i \in I^{A,B}} \alpha_{i,A} \times \sum\nolimits_{i \in I^{A,B}} \alpha_{i,B}.$$

Each variable approaches the measurement of ownership overlap from a different angle. The first measure simply counts the number of common investors in stocks *A* and *B*, which is similar to He and Huang (2017) and He, Huang, and Zhao (forthcoming), which count the number of common blockholders a firm has with other firms in the industry, where a common blockholder is defined as an investor that owns at least 5% of the outstanding shares in both the firm and one of its industry peers. Our measure instead counts all common investors and does this at the stock-pair level rather than at the industry level.[5] To better capture the extent of common ownership across the two firms, the second measure, which is used by Newham et al., (2018), instead calculates the minimum ownership stake of each common investor and sums up these minimum stakes across common investors. The third measure of ownership overlap was proposed in Anton and Polk (2014) in their study of stock price movements, and unlike the second measure, it uses market capitalization to weigh the relative importance of investors' ownership in each of the two firms before aggregating across investors. The fourth measure of ownership overlap was proposed in Hansen and Lott (1996). This measure instead sums the total fraction of shares held by common investors in firm *A* and firm *B* and then multiples the two together. Each of the last two measures has also been used in recent studies of common ownership (e.g., see Freeman, 2017).

While intuitive as measures of ownership overlap, all four measures have number of downsides as measures of common ownership. In particular, it isn't clear any of these measures represent an economically meaningful measure of common ownership's impact on managerial incentives. Additionally, both $Overlap_{Count}$ and $Overlap_{AP}$ are invariant to the decomposition of ownership between the two firms, which leads to some unappealing properties. For example, if a common investor sells all but one share in firm *B* and uses the proceeds to buy shares in firm *A*, the values of $Overlap_{Count}$ and $Overlap_{AP}$ would not change although common ownership for that investor, for all intents and purposes, has effectively dropped to zero. To address these concerns, we now turn to describing our model-driven measure of common ownership.

1.2 Measuring common ownership from the perspective of "managerial incentives"

In this section, we develop a simple model to capture the effects of common ownership on managerial incentives. The main premise of the model is that firms impose externalities on one another, and managers

[5] He and Huang (2017) also construct and use an indicator for having a common blockholder with another firm in the industry, while Azar (2012, 2016) constructs an indicator for having any common investor at the pair-level. Our subsequent findings are not sensitive to instead using an indicator measure of overlap.

have an incentive to internalize these externalities if their shareholders benefit from this *and* if these shareholders are attentive to whether the manager has done so. In the model, managers will care about these attentive common investors since a decline in shareholder support (e.g. via voting, negative public statements, or the selling of shares) is assumed to adversely affect managers' utility. Since the magnitude of externalities and how their internalization would affect the likelihood of shareholder support is not observed, the measure we develop for common ownership captures the relative effect of the ownership overlap on managerial incentives *per unit* of the unobserved externality.

Preliminaries: We consider an economy with $N \geq 2$ public firms, indexed by *n*, where each firm has its own manager. The manager of firm *n* chooses a policy $x_n \in \{0,1\}$, and the value of firm *n* is given by $V_n(\boldsymbol{X}) = \bar{v}_n + \Delta_n(\boldsymbol{X})$ where $\bar{v}_n > 0$ and $\boldsymbol{X} = (x_1, \dots, x_N)$. Parameter $\bar{v}_n$ can be considered the market value of firm *n* absent the effect of policy choices, while $\Delta_n(\boldsymbol{X})$ captures the effect of policy choices (from that both manager *n* and the managers of all other firms) on firm *n*'s value.

The externalities from managerial actions are given by $\Delta_n(\boldsymbol{X}) = \sum_{m=1}^{N} \Delta_{n,m}(x_m)$. If $\Delta_{n,m}(x_m) > 0$ ($\Delta_{n,m}(x_m) < 0$) then firm *m* imposes a positive (negative) externality on firm *n* by adopting policy x_m. We do not make any restrictions on $\Delta_{n,m}(x_m)$, and the externalities can be asymmetric between two firms, such that $\Delta_{n,m}(\cdot) \neq \Delta_{m,n}(\cdot)$. To ensure that we only measure the direct effect of common ownership on managers' incentives, we assume that there are no complementarities or substitution effects across firms with respect to the externality, which implies that there are no strategic interactions between managers (i.e., the optimal decision of manager *n* is independent of actions taken by other managers).[6]

Ownership structure: We assume there are $I \geq 1$ large investors in the economy, where the fraction of firm *n*'s shares held by investor i is given by $\alpha_{i,n} \in [0,1]$. Short sales are not allowed (because $\alpha_{i,n}$ is non-negative), and we allow for the possibility that $\sum_{i=1}^{I} \alpha_{i,n} < 1$, since shares that are not owned by any of the large investors can be owned by retail/noise investors. The value of investor *i*'s portfolio is given

[6] While it might also be interesting to measure the indirect effect of common ownership, this would introduce additional complications. An indirect effect of common ownership on firm *n* means that common ownership changes the incentives of manager $m \neq n$, and because of the strategic interaction between firm *n* and firm *m*, a change in the incentives of manager *m* also changes the incentives of manager *n*. Through this channel, which we shut down, common ownership can have an indirect effect on the incentives of manager *n*. But clearly, this effect depends on the strategic environment (e.g., are actions by different managers taken simultaneously or sequentially) and on the solution concept that is adopted (the notion of equilibrium). The indirect effect also requires shareholders to be aware of the nature of the strategic environment. Given these complications, we focus on the direct effect.

by $W_i(\boldsymbol{X}) = Y_i + \sum_{n=1}^{N} \alpha_{i,n} V_n(\boldsymbol{X})$, where the term $Y_i \geq 0$ captures non-traded assets, T-bills, or any other asset which has no externalities with any of the other N firms. The weight of firm n in the portfolio of investor i before policies are chosen can then be defined as $\beta_{i,n} = \frac{\alpha_{i,n}\bar{v}_n}{Y_i + \sum_{m=1}^{N} \alpha_{i,m}\bar{v}_m}$.

Voting and shareholder voice: We assume one share one vote, where each investor casts her votes either for or against the manager of each of her portfolio companies. This can be interpreted literally as a vote during director elections or on a given proposal, or it can simply be an expression of discontent or support of the incumbent manager. In other words, while we model shareholders as expressing their views to managers and exerting influence via votes, one can view our model more generally as capturing any influence that shareholders might exert that is proportional to their ownership share. Such influence might occur through a variety of channels including public statements or the threat to exit one's position.

There are two types of investors: investors that are attentive to the manager's policy choices and investors that are inattentive to such choices. An investor is attentive with probability $g \in [0,1]$ and inattentive with probability $1 - g$. This assumption captures the limited attention of investors and that some investors are more likely pay attention to a firm (and its manager's actions). An inattentive investor votes for management with probability $\gamma_i \in [0,1]$, which is an investor specific parameter and unaffected by manager policy choices. An attentive investor, however, votes with management with probability $\rho w_{i,n}(\boldsymbol{X})$, where $w_{i,n}(\boldsymbol{X})$ is defined as the improvement in the value of an investor i's portfolio from manager n's policy choice relative to the worst possible policy that manager could have chosen and parameter $\rho > 0$ ensures $\rho w_{i,n}(\boldsymbol{X}) \in [0,1]$. Specifically, $w_{i,n}(\boldsymbol{X}) = W_i(x_n, \boldsymbol{X}_{-n}) - min_x\, W_i(x_n, \boldsymbol{X}_{-n})$, where $\boldsymbol{X}_{-n}$ is the policy choices of all managers, except manager n. Intuitively, an attentive investor is more likely to support the manager if the action taken by the manager increases her portfolio value.

The function used to capture an investor's likelihood of being attentive, g, is quite flexible and could conceivably depend on a number of factors. For illustrative purposes, we begin by assuming that g only depends on how important a stock is the overall portfolio of the investor. Specifically, we assume g is an increasing function in $\beta_{i,n}$, such that investors are more likely to be attentive for stocks that comprise a larger proportion of their overall portfolio, which is both theoretically micro-founded (e.g., Veldkamp and Van Nieuwerberg, 2010) and supported by empirical evidence (Fich et al., 2015; Iliev et al., 2018). However, as discussed later, it will be easy for future researchers to modify our proposed common

ownership measure by putting more structure on the functional form of g or by adding inputs into the g function to capture other potentially important factors (e.g., see Iliev et al., 2018).

Given this setup, the probability $p_{i,n}(\boldsymbol{X})$ that investor *i* votes in support of manager *n* is given by

$$p_{i,n}(\boldsymbol{X}) = \left(1 - g\left(\beta_{i,n}\right)\right)\gamma_i + g\left(\beta_{i,n}\right)\rho w_{i,n}(\boldsymbol{X}).$$

And, assuming retail investors vote for manager *n* with probability $\gamma_{retail,n} \in [0,1]$ and all votes are conditionally independent across investors, the total expected fraction of votes in support of manager *n* is

$$P_n(\boldsymbol{X}) = \gamma_{retail,n}\left(1 - \sum_{i=1}^{I} \alpha_{i,n}\right) + \sum_{i=1}^{I} \alpha_{i,n}\, p_{i,n}(\boldsymbol{X}).$$

Managerial objective and decisions: Manager *n* maximizes

$$U_n(\boldsymbol{X}) = B_n(x_n) + \lambda_n P_n(x_n, \boldsymbol{X}_{-n}).$$

Intuitively, when the manager chooses a policy for his firm, she trades off the expected support from the shareholders of her firm, $P_n(x_n, \boldsymbol{X}_{-n})$, with the private benefits (if $B_n(x_n) > 0$) or costs (if $B_n(x_n) < 0$) from choosing policy x_n. Parameter $\lambda_n \geq 0$ is the weight the manager puts on getting shareholder support, which reflects the strength of the corporate governance in firm *n*.

Model solution: Manager *n* chooses $x_n = 1$ if and only if $U_n(1, \boldsymbol{X}_{-n}) \geq U_n(0, \boldsymbol{X}_{-n})$. Letting $\boldsymbol{\alpha_n} = \{\alpha_{i,n}\}_{\boldsymbol{i=1}}^{\boldsymbol{I}}$ and $\boldsymbol{\beta_n} = \{\beta_{i,n}\}_{\boldsymbol{i=1}}^{\boldsymbol{I}}$, we show in the Appendix that this inequality holds whenever $\Pi_n(\boldsymbol{\alpha_1}, \ldots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \ldots, \boldsymbol{\beta_N}) \geq 0$, where

$$\Pi_n(\boldsymbol{\alpha_1}, \ldots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \ldots, \boldsymbol{\beta_N}) \equiv \sum_{i=1}^{I} \alpha_{i,n}\, g\left(\beta_{i,n}\right)\left[\sum_{m=1}^{N} \alpha_{i,m}\rho\left[\Delta_{m,n}(1) - \Delta_{m,n}(0)\right]\right] + \frac{B_n(1) - B_n(0)}{\lambda_n}.$$

Intuitively, the incentive of manager *n* to choose policy $x_n = 1$ depends on the expected increase in the shareholder support, as given by $\sum_{i=1}^{I} \alpha_{i,n}\, g\left(\beta_{i,n}\right)\left[\sum_{m=1}^{N} \alpha_{i,m}\rho\left[\Delta_{m,n}(1) - \Delta_{m,n}(0)\right]\right]$, and on the normalized change in the manager's private benefits, as given by $[B_n(1) - B_n(0)]/\lambda_n$.

Definition of common ownership's effect on incentives: We define the effect of common ownership between firms *A* and *B* on manager *A*'s incentives as

$$CO(A,B) = \Pi_A(\boldsymbol{\alpha_1}, \ldots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \ldots, \boldsymbol{\beta_N}) - \Pi_A(\boldsymbol{\alpha_1}, \ldots, \boldsymbol{\alpha_B} = \boldsymbol{0}, \ldots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \ldots, \boldsymbol{\beta_B} = \boldsymbol{0}, \ldots, \boldsymbol{\beta_N}).$$

That is, $CO(A,B)$ is the change in manager *A*'s utility when choosing $x_n = 1$ over $x_n = 0$ under the existing ownership structure relative to a counterfactual in which no investor of firm *A* owns shares in firm *B* ($\boldsymbol{\alpha_B} = \boldsymbol{0}$) and investors' portfolio weights for all firms other than firm *B* do not change. In other words, $CO(A,B)$

captures how manager *A*'s incentives to adopt policy $x_n = 1$ would change if each common investor in firms *A* and *B* sold their shares in *B* and reinvested them in Y_i. It can be shown that

$$CO(A,B) = \rho\left[\Delta_{B,A}(1) - \Delta_{B,A}(0)\right] \sum_{i=1}^{I} \alpha_{i,A}\, g\left(\beta_{i,A}\right)\alpha_{i,B}.$$

Several remarks are in order. First, $CO(A,B)$ does not assume $x_n = 1$ is optimal; it only measures the effect of shareholder overlap between firms *A* and *B* on the incentives of the manager *A* to adopt this policy. Second, $CO(A,B)$ need not equal $CO(B,A)$ since externalities between firms can be asymmetric and because the weight of firm *A* in investors' portfolios, $\beta_{i,A}$, which contributes to investor attention, can be different from the weight of firm *B*, $\beta_{i,B}$. Third, the change in managers' utility only depends on the change in shareholder support since the change in private benefits from choosing $x_n = 1$ does not depend on common ownership. And finally, the sign of $CO(A,B)$ is determined by the sign of $\Delta_{B,A}(1) - \Delta_{B,A}(0)$.

The expected shift in manager *A*'s incentives, $CO(A,B)$, has some intuitive properties. If both policies of firm *A* exert the same externality on firm *B,* then $CO(A,B) = 0$, and as expected, manager *A* has no reason to factor in the effect of her policy choice on firm *B*. Additionally, investor *i* contributes more to $CO(A,B)$ in absolute terms when she (1) holds more shares in firm *A* (because the manager cares more about the investor's opinion if the investor holds more shares), (2) holds more shares in firm *B* (because the investor cares more about the externalities imposed on firm *B* when she holds more shares of firm *B*), and (3) when firm *A* receives a larger weight in her portfolio (because the manager understands that the investor is more likely to be an informed and attentive to firm *A*'s actions).

Proposed Measure and Intuition: Since researchers cannot typically observe the sign or magnitude of the externalities in the data, let alone how they might change the probability an informed common investor supports the manager (as captured by the parameter ρ), the measure we propose is invariant to these factors and only accounts for the absolute change in shareholder support that stems from changes in the ownership structure. Specifically, we drop the term $\rho\left[\Delta_{B,A}(1) - \Delta_{B,A}(0)\right]$ from $CO(A,B)$, and use

$$GGL(A,B) = \sum_{i=1}^{I} \alpha_{i,A}\, g\left(\beta_{i,A}\right)\alpha_{i,B}$$

as our measure of common ownership and its impact on managerial incentives to internalize externalities.

Defined as such, *GGL* is a relative measure of how common ownership affects managerial incentives *per unit* of the externality. In other words, a doubling of $GGL(A,B)$ reflects a 100% increase in

manager *A*'s incentive to internalize externalities on firm *B*. This interpretation holds because $\rho GGL(A,B)$ reflects the marginal change in shareholder support (expressed as a proportion) due to common ownership per unit of the externality that manager *A*'s action has on firm *B*. For example, if $\rho GGL(A,B) = 0.0002$ and the absolute change in value of firm *B* because of manager *A*'s action choice, $|\Delta_{B,A}(1) - \Delta_{B,A}(0)|$, is \$100, then manager *A*'s action choice will swing shareholder support by 100×0.0002=2 percentage points because of common ownership. However, because we do not observe the intensity by which externalities map into the likelihood of an investor's support, ρ, we use $GGL(A,B)$, which is proportional to this per unit effect of the externality on shareholder support and allows one to analyze the relative importance of common ownership across stock pairs and over time. To facilitate the interpretation of $GGL(A,B)$ as a relative measure of how common ownership affects managerial incentives per unit of the externality, our subsequent analyses rescale $GGL(A,B)$ by its sample average so that a value of one indicates the average level of incentives, a value of two represents twice the average level of incentives, and so on.

The proposed measure, *GGL*, has a number of appealing and intuitive properties. Common investors that are completely inattentive, such that $g = 0$, will not shift managers' incentives to internalize externalities, whereas a doubling in each common investor's likelihood of being attentive, holding all else equal, would double a manager's incentive to internalize externalities. Moreover, the partial derivative of $GGL(A,B)$ with respect to $\alpha_{i,B}$ is given by $\alpha_{i,A} g(\beta_{i,A})$, indicating that an increase in common investor *i*'s holding of stock *B* increases manager *A*'s incentive to internalize the externalities of her actions on firm *B* more when investor *i* is more attentive (i.e., g is higher) and holds a larger proportion of shares in firm *A* (i.e., $\alpha_{i,A}$ is higher). Likewise, all else equal, an increase in a common investor's holding in firm *A*, $\alpha_{i,A}$, has a bigger impact on manager *A*'s incentive to internalize externalities on firm *B* when that investor is more attentive or holds a larger ownership stake in firm *B*.

Flexibility and other possible modeling choices: Our model and the resulting measure of common ownership is quite flexible. For example, our model can be easily augmented to allow managers to ascribe importance weights to the votes of different investors. In the baseline measure, managers assign importance weights to investors based on the proportion of they own. But, if one wishes to instead assume that managers only care about the support of investors that hold at least 5% of the firm, then our model indicates that one should only aggregate over investors that own at least 5% of firm *A* when constructing $GGL(A,B)$.

Alternatively, if one wishes to assume that managers only care about the preferences of their largest five investors, then one would construct $GGL(A, B)$ using the five investors with the largest $\alpha_{i,A}$. A solution for the more general model that accounts for these possibilities is provided in the Appendix.

Our measure can also be adjusted to reflect differing views regarding the importance of various governance mechanisms. As noted earlier, our model captures any influence that shareholders might exert that is proportional to their ownership share. Therefore, if one believes that shareholders threat to exit is the relevant governance mechanism, then no adjustment is needed; the investor's economic ownership is the only factor that matters. On the other hand, if one views shareholder voice is the only relevant governance mechanism, then managers would only care about the opinion of investors who own voting rights. In this case, $\alpha_{i,A}$ should only include the voting shares of the investor *i* in firm *A*. In our baseline measure, we choose to measure influence by ownership shares since they will capture both the influence of exit and of voice and because of known difficulties in accurately measuring voting rights (Dennis et al., 2017).

Because of how an investor's likelihood of being attentive enters the measure, one can also easily change how one models investor attention. For example, if one believes that there are economies of scale in monitoring, one could add investors' assets under management (AUM) as another input to g.[7] Likewise, if one believes investors' monitoring intensity varies with firm-specific characteristics, like size or past profitability, one could add these as additional inputs. The model and measure can also be easily augmented to capture differences in monitoring across types of investors. For example, if one believes that index funds and the institutions that offer them are completely uninformed, one could set $g = 0$ for such investors.

One can also vary the functional form of g to create different assumptions on how attention is allocated across portfolio companies. For example, if $g(\beta_{i,A})$ is convex (concave), then firms representing a larger share of an investor's portfolio get proportionally more (less) attention from the investor relative to their portfolio weight. To create a measure that assumes all investors are perfectly informed, one would set $g = 1$ for all investors. Because theory gives us no clear guidance regarding the proper functional form for *g*, we begin by assuming that $g(\beta_{i,A})$ is linear such that $g(\beta_{i,A}) = \beta_{i,A}$, but for robustness, we also show how our subsequent empirical findings change under different functional form assumptions.

[7] Notice that AUM already plays an important role in the baseline version of our measure: Common investors with a larger AUM own larger stakes, and as a result, managers internalize their preferences to a larger extent.

Finally, the *GGL* measure can easily be aggregated to capture how common ownership affects the incentives of manager *A* to internalize the externalities her firm imposes on an entire group of firms (e.g., industry). Such an aggregated measure might be useful when studying whether common ownership is likely to shift the incentives of managers to consider the valuations of product market competitors (e.g., Azar et al., 2016, forthcoming; Dennis et al., 2017; Gramlich and Grundl, 2017; O'Brien and Waehrer, 2017). Specifically, we show in the Appendix that if $\Delta_{m,A}(1) - \Delta_{m,A}(0)$ is the same across all firms in a reference set Γ, then the group level measure is given by $GGL(A, \Gamma) = \sum_{m \in \Gamma} GGL(A, \mathrm{m})$. Note that this assumption does not require the externality that firm *A* imposes on any other firm in set Γ to be the same; it only requires the differential impact to be the same, which is a weaker assumption.

1.3 Comparing *GGL* to existing measures in the literature

To better understand the advantages and disadvantages of our proposed measure of common ownership, *GGL*, it is useful to compare it to measures used in previous studies of common ownership.

Harford et al. (2011) propose a measure to account for the incentives of common investors during the merger of two firms. Harford et al. (2011) note that shareholders of a bidding firm are more likely to internalize the effect of paying a lower takeover premium on the target firm if they also own shares of the target. To capture this externality of common ownership, they estimate each investor's relative ownership stake in the target (B) to that of the acquirer (A) and aggregate these relative weights, $\alpha_{i,B}/(\alpha_{i,A} + \alpha_{i,B})$, across investors in the bidding firm. Specifically, one such aggregation would be:

$$HJL(A, B) = \sum_{i \in I^{A,B}} \frac{\alpha_{i,B}}{\alpha_{i,A} + \alpha_{i,B}}.$$

While the *HJL* measure is similar to *GGL* in that it is a bi-directional, pair-level measure of common ownership and its potential impact on managerial incentives, there are several key differences. First, the *HJL* measure only accounts for an investor's relative holdings in the bidding and the target firms. Therefore, it ignores the possibility that other firms in investors' portfolios could be affected by the merger and that investors' might be inattentive when both the bidding firm and the target firms constitute a small part of their portfolio. While these assumptions might be appropriate in the context of M&A, they may not apply more generally. Second, the $GGL_i^{A,B}$ measure increases when the relative ownership of firm *A* increases, while this does not occur for $HJL_i^{A,B}$. This is because *GGL* assumes that managers care about shareholder

support, and hence, pay more attention to action consequences for investors that constitute a larger part of the firm's ownership. Third, Harford et al. (2011) aggregated the relative weights across investors in many different ways. By contrast, the *GGL* measure uses a model as the guideline for how to aggregate.

Another measure is the modified Herfindahl-Hirschman Index (MHHI) that was developed by Bresnahan and Salop (1986) and O'Brien and Salop (2000) and implemented by Azar et al., (2016 and forthcoming). The MHHI is a measure of product market concentration, like the HHI, but also accounts for the effect of overlap in the shareholder base on market concentration.

There are three important differences between the MHHI and *GGL*. First, the MHHI is tailored to capture a specific type of externality arising from common ownership – those that arise in oligopolistic product market. As such, it makes stronger assumptions on the nature of externalities (e.g., the type of competition) and requires more information than *GGL* (e.g., market shares), which can introduce additional endogeneity concerns (Dennis et al., 2017). Since the *GGL* measure is invariant to the specific nature of externalities, it also has a wider scope and can account for externalities that stem from vertical relationships, innovation, M&A transactions, financial transactions, human capital, etc. Second, the MHHI is measured at the industry level, while the baseline *GGL* measure is a bi-directional, pair-level measure. As such, the baseline *GGL* measure is not sensitive to the scope of an industry or product market, which are not always well defined. However, as noted in the previous section, a simple aggregation of *GGL* can be used to capture a manager's incentive to internalize externalities on an entire industry or product market, if so desired. Third, and most importantly, the MHHI assumes that investors are fully informed about the externalities firms impose on each other, and therefore, that managers fully internalize those externalities. By contrast, *GGL* explicitly accounts for the possibility that some investors may not be as attentive.

To conclude, the innovation behind the *GGL* measure is as follows: (i) it is a model-driven measure of the effect of common ownership on the incentives of managers to internalize externalities between two given companies; (ii) the measure is invariant to the specific nature of externalities between the firms; (iii) the measure explicitly accounts for the limited attention that investors can pay to their portfolio companies. This last feature is key, since managers have incentives to internalize externalities only if their shareholders require them to do so. In other words, overlap in the shareholder base is a necessary but insufficient condition for common ownership to affect managers' incentives.

2. Determinants of ownership overlap and the incentives arising from common ownership

While there is a large theoretical literature on the potential implications of common ownership, there is relatively little discussion regarding the determinants of common ownership. In this section, we briefly discuss the factors that might contribute to either higher or lower common ownership for any given pair of firms. While it is not the goal of this paper to study the determinants of common ownership, it is useful to discuss what these potential determinants might be before looking at cross-sectional and times-series variation in the various measures of overlap and managerial incentives arising from common ownership.

The determinants of ownership overlap across any two stocks can be broadly categorized into those driven by the presence of externalities and those that are not. Externality-driven explanations involve investors obtaining ownership stakes in both companies so as to induce managers to account for these externalities (e.g., Easterbrook and Fischel, 1982; Hansen and Lott, 1996; Rubin, 2006). The types of externalities that might facilitate ownership overlap include those related to product market collusion and synergies (e.g., firms with complementary technologies, business strategies, or customer-supplier links). Non-externality explanations instead involve investors creating portfolios that contain multiple companies for reasons unrelated to any desire for managers to internalize the externalities. For example, if two companies belong to the same index, then they are more likely to be jointly owned by institutions that offer passive mutual funds or ETFs that follow the index, and therefore, have more ownership overlap. Likewise, when two asset managers merge for synergistic reasons, ownership overlap will increase.

The determinants of managers' incentive to internalize the externalities of their choices because of common ownership are more complex. While externality-based explanations for the creation of ownership overlap also apply to the creation of ownership structures that induce managers to internalize externalities, the same is not true for the non-externality-based explanations of ownership overlap. For example, while indexing might create more ownership overlap, it might also reduce managers' incentives to internalize externalities if such investors are less likely to be informed about whether an individual manager's actions affected the value of another stock in the investor's portfolio. And, if the merger of two asset managers results in a new common owner that is less attentive to some stocks in the merged portfolio, then ownership overlap might increase but some managers' incentives could be diminished.

This potential tension between overlap and managerial incentives that arises because of investor

attention is captured by our *GGL* measure, while it is not captured by other measures of common ownership. We would expect asset manager mergers and indexing to be positively associated with measures of overlap, but there is no clear prediction on how they might be associated with manager's incentives when investors can be inattentive. We now turn to the data and analyze the relevance of accounting for investor attention when quantifying the importance of common ownership and its possible determinants.

3. Data construction

We start our data construction by creating a sample of firm-pair-year observations that includes the universe of U.S.-listed firm pairings between 1980 and 2012.[8] For each year, we include all publicly traded firms from the Compustat-CRSP universe of firms. We then construct a sample of firm pairs each year based on these public firms as of December 31 of that year. For n firms in a given year, our pair construction yields $n*(n-1)/2$ distinct pairs, and each stock is paired with each other stock only once. We end up with a total of 671,012,403 pair-year observations when calculating our pair-level measures of ownership overlap, and twice as many observations when calculating our bi-directional, pair-level measure, *GGL*.

We construct measures of common ownership for each pair from the Institutional 13F Holdings that have been tabulated and aggregated by Thomson Reuters, which we access via Wharton Research Data Services. We calculate investors' ownership stakes using total reported shares,[9] and following Ben-David et al. (2018), we combine the holdings of Blackrock's various subsidiaries to the parent level.[10] Some firms may have multiple classes of publicly traded stock; in these instances, we aggregate ownership by the value of the share classes (e.g., an institution needs to only be an owner of one of the class of shares in a stock to

[8] We do not use any post-2012 data in our current analysis because of known data problems with Thomson Reuters' 13F ownership data after 2012. While inaccuracies also exist in Thomson's data prior to 2013, we make the standard corrections for these, including adding the missing year end filings of Barclays in 2003 and JP Morgan in 2003.

[9] As noted earlier, we use total shares for two reasons. One, total shares likely better capture the potential influence of each investor, and two, it is unclear whether the reported 13F data on voting rights is meaningful. When filing a 13F, institutions delineate their shares based on voting rights as "sole," "shared," and "none". But as discussed in Dennis et al. (2017), it is unclear what "shared" means, and some institutions, like Vanguard, report all their holdings under "none" despite that they clearly maintain and exercise voting rights.

[10] Blackrock reports its holdings under seven different entities, and the Thomson data aggregates these to six different manager numbers. We follow Ben-David et al. (2018) and aggregate these holdings since Blackrock exercises its influence and votes these shares at the parent level. Our model implicitly assumes that each investor exerts influence independently, which is clearly not the case for Blackrock's various entities. A spot check of MGRNAMEs did not reveal any further obvious examples of other large institutions reporting their holdings in a disaggregated way similar to Blackrock. While one could argue that the influence of other institutions (e.g., smaller institutions that follow the vote recommendations of proxy advisory firms like ISS), are also not independent, we do not aggregate these holdings since it is unclear how to identify these more nuanced violations of non-independence.

have an ownership stake, and this overall ownership stake is reduced based on the proportion of ownership the share class has across all publicly traded classes of the firm). The result of the merge with 13F data is that for each pair we have a list of all institutions which own both stocks and their ownership stakes in each stock. With these data, we then compute the ownership measures as outlined above in Section 1.

To examine the robustness of our findings, we construct numerous permutations of the *GGL* measure. Our baseline measure assumes investors' likelihood of being informed as being given by $g(\beta_{i,A}) = \beta_{i,A}$. However, we also construct versions of *GGL* with different assumptions on how attention is allocated across portfolio companies based on portfolio weights. In particular, we construct GGL_{Convex} and $GGL_{Concave}$ which change the investor attention function to $g(\beta_{i,A}) = \beta_{i,A}^2$ and $g(\beta_{i,A}) = \beta_{i,A}^{0.5}$, respectively. We also construct versions of *GGL* that ascribe different managerial weightings to the importance of investors. In particular, with $GGL_{5\%}$, we assume that managers only care about investors that own at least 5% of their outstanding shares, and with GGL_{Top5}, we assume that managers only care about their five largest shareholders (in terms of proportion of outstanding stock held). While this is by no means an exhaustive list of potential permutations, it does provide a reasonable foundation from which to study how managerial incentives to internalize externalities have changed over time, what factors are correlated with common ownership, and whether these particular modeling choices are important for answering these questions.

4. Empirical importance of accounting for investor attention

In this section, we document recent levels of ownership overlap and its impact on managerial incentives to internalize externalities, as measured using *GGL*, and the extent by which ownership overlap and managers' motives have shifted over the last 30+ years. These summary statistics highlight the importance of accounting for investor attention when measuring common ownership. To further highlight the importance of investor attention, we then illustrate how the merger of two asset managers need not result in an increase in managers' incentives to internalize externalities. Finally, we provide evidence on the relative importance of index versus activist investors in contributing to managerial motives.[11]

[11] Notice that we do not attempt to empirically validate *GGL* as a measure of common ownership and its impact on managerial incentives; we rely on the theory instead. A proper validation exercise would require not only isolating an exogenous source of common ownership, but also identifying a setting where the impact of common investors on a particular outcome is known with certainty (i.e., there is a known benchmark the proposed measure should uncover empirically). The former is beyond the scope of this paper, and the latter, at least to best of our knowledge, does not

4.1 Summary statistics, 1998-2012

Table 1 reports summary statistics for our overlap and *GGL* measures. For brevity, we restrict these summary statistics to the more recent sample period of 1998-2012, which, because of data limitations on index constituents, is the same sample period we use in our latter regressions that analyze cross-sectional variation in common ownership. Beyond giving us a better sense of how prevalent common ownership is in recent years, these summary statistics are more useful in interpreting the economic magnitudes of our later estimates. We discuss earlier trends in common ownership in the next subsection.

Between 1998 and 2012, there is considerable ownership overlap for the average stock-pair but substantial heterogeneity across stock pairs. As shown in Table 1, the median number of common owners, $Overlap_{Count}$, during this time period is eight, but the sample is highly skewed. More than 10% of pairs do not have common owners, and the mean number of common owners is 20.5. The median percent of shares held by common investors depends on how one weights their holdings. Using $Overlap_{Min}$, which sums the minimum ownership stake of each common investor across all common investors, 2.2% of shares are held by common investors for the median stock pair, but using, $Overlap_{AP}$, which instead sums a weighted average of each common investor's ownership stakes, the median ownership share rises to 6.3%. But again, there is a considerable cross-sectional variation; for example, at the 90th percentile, 15.9% and 32.6% of outstanding shares are held by common investors, as measured by $Overlap_{Min}$ and $Overlap_{AP}$ respectively.

The summary statistics in Table 1 show that there is also substantial heterogeneity across stock pairs in the importance of common ownership for managerial incentives. As discussed in Section 1, *GGL* reflects a relative measure of managers' incentives to internalize externalities per unit of any externality, and because we rescale each *GGL* measure by its sample average, a value of one reflects the average level of incentives to internalize externalities during the sample period. This rescaling allows us to see that there is considerable skewness in the distribution of *GGL*. For example, for our baseline *GGL* measure, the median stock pair has just 1.1% of the average level of incentives to internalize externalities. Moreover, for the more than 10% of stock pairs with no common investors, each *GGL* measure equals zero, reflecting no incentive for managers to internalize externalities. At the other end of the spectrum, however, managers of

exist since theory gives no guidance on what levels of common ownership should matter empirically. The latter explanation is also why other proposed measures, like MHHI, have never been empirically validated.

the 99th percentile stock pair have 2.86 to 15.6 times the average incentive to internalize externalities, depending on the functional form assumptions one makes when calculating *GGL*.

4.2 Trends in common ownership since 1980

We next analyze how ownership overlap and our proposed measure of common ownership, *GGL,* have varied over time for the average pair of stocks. For this analysis, we extend our sample back to 1980.

Consistent with anecdotal evidence, we find that ownership overlap increased significantly over time. This can be seen in Figure 1, which plots the average percent increase for each of the different ownership overlap measures since 1980. All four measures of overlap have increased dramatically over the last 30+ years, ranging between increases of 1,527% to 4,669%. Other papers, using different measures of overlap have also documented large increases. For example, Azar (2016) finds that the probability that two firms selected at random from the S&P 1500 index have a shareholder in common with at least 5% ownership in both firms increased by 450% over the period 1999 to 2014, and Harford et al. (2011) document large increases in cross-holdings among S&P 500 stocks between 1985 and 2005.

However, the observed increase in managerial incentives to internalize externalities, as measured by *GGL*, tends to be far less than the increase in ownership overlap. This is seen in Figure 2, which plots the percent change (using the same scale as in Figure 1) in average *GGL* for all versions of *GGL*. Managers' incentive to internalize externalities, as measured by our baseline version of *GGL*, has increased by 285% for the average stock pair between 1980 and 2012 (Figure 2), which is nowhere near as large as the observed changes in overlap (Figure 1). The increase in our other measures of *GGL* range from 162% to 835%, with the largest increase being observed for $GGL_{Concave}$, which makes the assumption that firms representing a smaller share of an investor's portfolio get proportionally more investor attention relative to their portfolio weight, and the smallest increase being observed for GGL_{Convex}, which makes the assumption that firms representing a larger share of an investor's portfolio get proportionally more investor attention.

Our assumption that not all investors are perfectly informed plays a key role in dampening the measured growth of managerial incentives. This is seen in Figure 3, where we separately plot our baseline *GGL* measure that assumes investors are informed with probability $g = \beta_{i,A}$ and when we instead assume investors are perfectly informed, such that $g = 1$. Since 1980, the average *GGL* for a pair of US stocks has increased by 285%, but if one instead assumes all investors are fully informed, there is a 2,938% increase.

Combined, these findings cast doubt on the possibility that the growth of common ownership in recent years has had a significant impact on managerial motives. A focus on trends with respect to ownership overlap (Figure 1) significantly overstates the potential impact of common ownership on managerial incentives once one accounts for potential shifts in investor attention (Figure 2).

These findings also highlight that the rise of ownership overlap over the last 30 years has coincided with the average institutional investor becoming increasingly diverse in their holdings. This diversification and the resulting average reduction in portfolio weights is consistent with investors paying less attention to their portfolio companies (Veldkamp and Van Nieuwerberg, 2010; Fich et al., 2015; Iliev et al., 2018) and hence, managers having weaker incentives to internalize the preferences of investors. Measures of overlap and other measures of common ownership that assume full attention among investors (e.g., *MHHI*), overlook this potentially important countervailing trend in ownership structures.

4.3 Impact of assets manager mergers on managerial motives

The importance of accounting for investor attention can also be seen by calculating how the merger of two large asset management firms affects our measure of managerial incentives, *GGL*. Some existing papers that study the impact of common ownership on corporate policies use the merger of large asset managers as a positive shock to common ownership; for example, the merger of BGI and Blackrock in 2009 is argued to have increased common ownership and managers' incentives to internalize externalities (e.g., see Azar et al., 2016, forthcoming). Conceptually, however, it is unclear whether we should expect such mergers to shift managers' incentives to internalize externalities. While the mergers likely increase ownership overlap, they might also reduce investor attention, and hence managers' incentive to internalize the preferences of their investors, if the larger, more diversified portfolio of the merged entity makes it less likely the new common owner is as attentive to managers' actions.

To illustrate the potential for asset manager mergers to reduce managers' incentives to internalize externalities, we calculate the changes in *GGL* and $GGL_{Full\ Attention}$ that would be predicted by the merger of BGI and Blackrock in 2009 across stock pairs if all institutions had maintained their same stock holdings after the merger. Specifically, we recalculate the two *GGL* measures in 2008 under the assumption that the portfolios of BGI and BlackRock are now owned by the same investor, the merged entity. Obviously, this calculation changes both the size of the stake that the merged entity owns in each company, but also the

weight that each company receives in the merged entity portfolio. We then plot the histogram of the predicted changes for both *GGL* and $GGL_{Full\ Attention}$ in Figure 4.

As shown in Figure 4, an asset manager merger is only guaranteed to increase managerial incentives to internalize externalities when one assumes that all investors are fully attentive. When assuming full attention, all stock-pairs experience an increase in managerial incentives to internalize externalities. This is not surprising since, by construction, the merger increases the extent of overlap in the ownership structure of stock pairs, and when all investors are attentive, this necessarily increases managers' incentive to internalize externalities. Moreover, even when overlap already existed, the higher AUM of the merged entity increases *GGL* by increasing the importance of the of the externality in the combined portfolio (via a higher $\alpha_{i,B}$) and the manager's incentive to internalize the merged entity's preferences (via a higher $\alpha_{i,A}$). However, as shown in Figure 4, many stock pairs experience a decline in managerial incentives, as measured by *GGL*; in fact, about 56.2% of stock pairs experience a decline. This decline for *GGL* occurs because the relative importance of some stocks in the portfolio of the merged firm is lower than their importance in the individual portfolios of BGI and Blackrock before the merger. This drop in portfolio weights can result in a bigger, but less attentive, common owner following the merger.[12]

4.4 Relative importance of indexing versus activist investors

In addition to asset manager mergers, the rise of common ownership is also often attributed to the increasing popularity of index investing. We next analyze how much the growth of managerial incentives to internalize externalities since 1980 is being driven by the growth of index funds versus activist investors.

To quantify this, we construct two additional versions of our baseline *GGL* measure, $GGL_{Indexer}$ and $GGL_{Activist}$. For $GGL_{Indexer}$, we only include the holdings of BGI, Blackrock, State Street, and Vanguard. We focus on the latter three institutions because in 2016 they alone accounted for 80% of all indexed mutual fund and ETF assets in the U.S., and indexed assets accounted for about 80% of each institution's overall assets under management. And, we include BGI since it was one of the largest purveyors of index funds and ETFs prior to its acquisition by Blackrock in 2009. For $GGL_{Activist}$, we instead only include hedge funds that have engaged in some form of activism, as identified in the hedge fund activism dataset constructed by

[12] Allowing for economies of scale in monitoring, by including AUM as an input for *g*, could mitigate this effect. However, our analysis illustrates that this mitigating factor would need be significant in order to offset this effect and increase managerial incentives to internalize externalities for all stock pairs.

Brav, Jiang, Partnoy, and Thomas (2008) and Brav, Jiang, and Kim (2010).[13]

At first blush, it looks like both activists and indexers have contributed to the growth in managerial incentives to internalize externalities. This is seen in the top panel of Figure 5. If one plots the average yearly proportion of our baseline *GGL* that is attributable to index and activist hedge fund holdings, as done in the top panel of Figure 5, both index and activist institutions appear important for the upward trend documented in Figure 2. In 1980, index holdings accounted for just 0.05% of a manager's incentives to internalize externalities but accounted for 25% by 2012. Activist hedge funds increased their proportion from 2.2% in 1980 to about 11.7% in 2008 and fell to about 8.5% after that. (The remaining proportion of *GGL* each year is driven by the non-index and non-activist institutions that are not plotted.)

However, the relative importance of index and activist investors for the growth of *GGL* depends heavily on how one models investor attention. This is shown in the second and third panels of Figure 5, where we break out the relative contribution of indexers and activists to both GGL_{Convex} and $GGL_{Concave}$. When using a convex function to model an investor's likelihood of being informed about a particular stock, indexers contribute almost nothing to the growth in *GGL* (see Figure 5, middle panel), and when using a concave function for modeling attention, the pattern flips (bottom panel). The reason why index investors contribute less when *g* is convex is that they are more diversified, such that the average weight of a firm in the portfolio is low, and a convex function gives relatively less weight to firms which contribute less to an investor's portfolio. The opposite is true for the concave function.

Overall, the modeling choice for investor attention is important for determining the relative importance of index and activist investors for aggregate trends in managerial incentives, and this finding illustrates that the link between indexing and managerial incentives to internalize externalities is not obvious. Our later findings of how managerial incentives shift with index inclusion, which further emphasize this point, are not sensitive to this modeling choice. We now turn to that analysis.

5. Factors correlated with ownership overlap and *GGL*

In this section, we regress our measures of overlap and *GGL* onto possible determinants using pair-

[13] We do not use the Bushee (2001) classification of "quasi-indexer" to designate passive institutions since this is not a meaningful classification of passive versus active since nearly two-thirds of institutions are classified as "quasi-indexers," while some obvious indexers, like Blackrock are not classified as a quasi-indexer.

level panel regressions. Because we lack an exogenous source of variation for our explanatory variables, we do not seek to identify the causal effect of any given explanatory variable on ownership overlap or managerial incentives. Rather we simply seek to establish and quantify basic correlations between potential determinants of common ownership and the various measures of common ownership discussed in Section 2. For example, we seek to answer questions like: "If a pair of stocks goes from both being included in the S&P 500 index to not both being in that index, what is the average change in observed ownership overlap (as measured by $Overlap_{Count}$, $Overlap_{Min}$, $Overlap_{AP}$, *and* $Overlap_{HL}$) and managerial incentives arising from this ownership overlap (as measured by *GGL*) and how economically large are the observed changes?"

5.1 Empirical specification

To analyze what stock-pair characteristics are correlated with ownership overlap, we begin by estimating the following pair-level panel regression,

$$Overlap_{it} = \beta X_{it} + \alpha_i + \delta_t + \varepsilon_{it},$$

where $Overlap_{it}$ is our measure of ownership overlap for pair i in year t, and X_{it} is our time-varying explanatory variables of interest. For example, X_{it} might be an indicator equal to 1 if both firms in pair i are listed in the S&P 500 index in year t and 0 otherwise. We also include pair-level fixed effects, α_i , to control for time-invariant differences in ownership overlap across pairs and to ensure we only make use of within-pair variation for this analysis. In other words, we are interested in how a change X_{it} for a given pair of firms i is associated with the observed change in ownership overlap for that pair, $Overlap_{it}$. We also include year fixed effects, δ_t, to absorb the secular trend in common ownership. To account for potential covariance across pairs over time, we cluster the standard errors at the pair level.

To analyze what stock-pair characteristics are correlated with of managerial incentives arising from ownership overlap, as measured by *GGL*, we estimate a similar bi-directional pair-level panel regression,

$$GGL_{ijt} = \beta X_{ijt} + \alpha_{ij} + \delta_t + \varepsilon_{ijt},$$

where GGL_{ijt} is our measure of manager *i's* incentive to internalize the impact of her choices on firm j in year t, and X_{ijt} is our time-varying explanatory variables of interest. We include bi-directional, pair-level fixed effects, α_{ij} , to control for time-invariant differences in manager i's incentives with respect to firm j and to ensure we only make use of within bi-directional pair variation for this analysis. To account for potential covariance across pairs over time, we cluster the standard errors at the bi-directional pair level.

5.2 Index inclusion

We begin our regression analysis by focusing on the potential importance of index inclusion. We focus on indexing since it is often associated with the rise of common ownership (e.g., Harford et al., 2011) and the target of policy recommendations related to common ownership (e.g., Posner et al, 2016).

To analyze indexing, we construct a number of pair-level dummy variables that indicate whether the two firms in a particular pairing are both included in a certain market index or not. We construct six such indicators, one for each of the following indexes: S&P 500, S&P 400, S&P 600, Russell 1000, Russell 2000, and Nasdaq. Because of a lack of data on Russell index inclusions prior to 1998 and the absence of some S&P indexes prior to the mid-1990s, we restrict our sample to post-1997 data. In addition to pair fixed effects (bi-directional pair fixed effects), we control for the average share of equity held by institutions across the two stocks, which will be positively associated with our measures since the 13F filings data only covers institutional investors. We also include a few other explanatory variables, including whether the two stocks are in the same industry. We discuss these other explanatory variables and their coefficients in the next subsection, but their inclusion has little impact on the estimates. Likewise, controlling for additional stock characteristics, like market-to-book ratio or momentum of the pair, has little impact on our estimates.

As one might expect, index inclusion is positively associated with measures of ownership overlap. This is shown in Table 2. For all measures of ownership overlap, inclusion of both stocks in the same index (S&P 400, S&P 500, S&P 600, Russell 1000, Russell 2000, or Nasdaq) is associated with increases in ownership overlap. The estimates are all statistically significant at a level of at least 1% (with some *t*-stats exceeding 1,000) and economically large (Table 2, Columns 1-4). For example, moving from both stocks not being in the S&P 500 to both stocks being included in the S&P 500 is associated with a 43% to 346% increase in the ownership overlap depending on how one measures ownership overlap, which corresponds to a 37% to 212% standard deviation increase in ownership overlap. The magnitudes are similarly large for inclusion of both stocks in other popular indexes, including the Russell 2000.

However, we find no clear association between index inclusion and managerial incentives to internalize externalities. This is shown in Table 3. Using the baseline version of *GGL*, inclusion in some indices (e.g., S&P 500, Russell 1000, and Nasdaq) is associated with increases in managerial incentives to internalize externalities, while inclusion in other indexes (e.g., Russell 2000 and S&P 600) is associated with decreases

in incentives (Table 3, Column 1). For example, relative to the sample average, inclusion of both stocks in the Russell 2000 is associated with a 26% decline in our baseline *GGL*, while inclusion in the Russell 1000 is associated with a 94% increase. Relative to the sample standard deviation for *GGL*, however, these magnitudes only correspond to -0.5% and 1.8% of a standard deviation, respectively. The divergent association between index inclusion and managerial incentives is robust to alternative versions of *GGL,* including when we change the functional form used for attention, g, (Columns 2-3), or restrict our analysis to the largest five shareholders (Column 4) or shareholders holding at least 5% of shares (Column 5).

The unclear association between being in the same index and *GGL* again highlights the importance of accounting for investor attention. A key difference between *GGL* and measures of overlap is that *GGL* accounts for the likelihood that investors are informed, g, which has a direct effect on a manager's incentive to internalize the overlapping ownership structure. The positive association between index inclusion and overlap (Table 2), but negative association between some index inclusions and *GGL* (Table 3), suggests that being in some indexes is associated with a shift in the composition of owners towards less attentive investors (as measured using a lower $\beta_{i,A}$) with larger overlapping positions (as measured by the product of $\alpha_{i,A}$ and $\alpha_{i,B}$). This is shown formally in Table 4 where we separately regress $GGL_{Full\ Attention}$ (i.e., $g = 1$) and the sum of $\beta_{i,A}$ across investors, β_A^{SUM}, onto the index indicators; index inclusion exhibits a consistent positive correlation with the version of *GGL* where full attention is assumed (Table 4, Column 1) but often exhibits a negative correlation with the sum of $\beta_{i,A}$ for a stock pair's common investors (Column 2).

5.3 Industry structure and competition

Given the potential for anti-competitive behavior by firms that have common owners, we also assess how ownership overlap and *GGL* may be linked with industry structure and characteristics. To do this we regress both type of measures onto the average HHI of the industries of the two companies in the pair and on an interaction variable between the average HHI and whether or not the two companies are in the same 3-digit SIC industry. Under this specification, a positive coefficient on the interaction variable would suggest that the ownership overlap and *GGL* of two companies that are in the same industry is larger when the industry is more concentrated, as measured by the HHI.

Interestingly, we find evidence that the measures of ownership overlap are higher among pairs of companies operating in the same industry as their industry becomes more concentrated, but little such

evidence for *GGL*. The interaction between average HHI and our indicator for being in the same industry is always positive and statistically significant for measures of overlap [Table 2, Columns 1-4], but when looking at our *GGL* measures of managerial incentives, the interaction coefficient is only statistically different from zero for $GGL_{Concave}$ [Table 3, Columns 1-5]. These findings provide little evidence that managerial incentives to internalize externalities tends to be higher as industry concentration rises. We also find no difference in the incentive to internalize externalities among stock pairs from the same industry.

6. Concluding remarks

Common ownership across US stock-pairs has been on the rise over the last few decades, but its determinants and implications for economic outcomes are still not well understood. For example, attempts to study whether common ownership results in anti-competitive behaviors is ongoing; some empirical work suggests that it is linked to anti-competitive behavior by firms (e.g., Azar et al., 2016, forthcoming), while others argue otherwise (e.g., Dennis et al., 2017; Gramlich and Grundl, 2017; O'Brien and Waehrer, 2017). Despite these inconclusive findings, some have already begun discussing possible policy responses (e.g., Elhauge, 2016; Posner et al., 2016), many of which have the potential to significantly reshape corporate ownership structures and the asset management industry.

One challenge with studying common ownership is the difficulty in measuring its level and impact on managers' incentive to internalize how their actions might affect the value of other stocks held by their investors. Existing measures of common ownership used in the literature tend to either be measures of ownership overlap that lack any theoretical connection to managerial incentives or measures that make strong assumptions about the nature of externalities and assume that all common investors are fully attentive to managers' actions and the implications of these actions for their overall portfolio. Our paper addresses these measurement concerns by deriving a general measure of common ownership that quantifies how overlapping ownership structures influence managerial incentives in a setting where not all investors are fully attentive and does so without making strong assumptions about the structure of externalities.

By allowing for the possibility that not all investors are attentive and incorporating known determinants of investor attention, we illustrate that the rise of common ownership may be far less important than claimed and that assumed drivers of its rise may have little impact on managerial incentives. Assuming all investors are fully informed can lead to estimates regarding the increase in managers' incentives to internalize

externalities over the last 30+ years that are orders of magnitude more than when one allows for the possibility that not all investors are attentive. Moreover, one can show that index investing and asset manager mergers, both of which have been associated with increases in common ownership, have no clear association with changes in managerial incentives because both can reduce the attentiveness of a firm's investors. Together, these findings illustrate that one should not assume that asset manager mergers and the growth of index investing necessarily increase managers' incentives to internalize externalities.

Overall, our findings provide important context for recent empirical and theoretical work that has suggested common ownership is important for competitiveness, corporate governance, firm outcomes, etc. We show that accounting for investor attention can have important implications for the impact of overlapping ownership structures on managerial incentives, and hence, possible policy responses.

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Appendix

In this Appendix we offer two generalizations to the GGL measure. Under the first generalization we allow the manager to weigh the votes of investors differently. Specifically, let

$$P_n(\boldsymbol{X}) = \gamma_{retail,n}\left(1 - \sum_{i=1}^{I} \alpha_{i,n}\right) + \sum_{i=1}^{I} \eta\left(\alpha_{i,n}\right) p_{i,n}(\boldsymbol{X})$$

The key difference from the expression in main text is in the second term: $\eta\left(\alpha_{i,n}\right)$ replaces $\alpha_{i,n}$, where $\eta(\cdot) > 0$ and $\eta'(\cdot) > 0$. Intuitively, the function η measures the importance that managers ascribe to a block of votes. If managers just care about whether a proposal is passed or voted down, then η would be the identity function as in the main text. However, generally, managers might overweight the importance of large blocks and underweight the importance of small blocks.[14]

Using this formulation, $U_n(1, \boldsymbol{X}_{-n}) \geq U_n(0, \boldsymbol{X}_{-n})$ holds if and only if

$$P_n(1, \boldsymbol{X}_{-n}) - P_n(0, \boldsymbol{X}_{-n}) + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0 \Leftrightarrow$$

$$\sum_{i=1}^{I} \eta(\alpha_{i,n}) \left[p_{i,n}(1, \boldsymbol{X}_{-n}) - p_{i,n}(0, \boldsymbol{X}_{-n})\right] + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0 \Leftrightarrow$$

$$\sum_{i=1}^{I} \eta(\alpha_{i,n})\, g(\beta_{i,n}) \rho\left[w_{i,n}(1, \boldsymbol{X}_{-n}) - w_{i,n}(0, \boldsymbol{X}_{-n})\right] + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0 \Leftrightarrow$$

$$\sum_{i=1}^{I} \eta(\alpha_{i,n})\, g(\beta_{i,n}) \rho[W_i(1, \boldsymbol{X}_{-n}) - W_i(0, \boldsymbol{X}_{-n})] + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0 \Leftrightarrow$$

$$\sum_{i=1}^{I} \eta\left(\alpha_{i,n}\right) g\left(\beta_{i,n}\right) \left[\sum_{m=1}^{N} \alpha_{i,m} \rho[\Delta_m(1, \boldsymbol{X}_{-n}) - \Delta_m(0, \boldsymbol{X}_{-n})]\right] + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0 \Leftrightarrow$$

$$\sum_{i=1}^{I} \eta(\alpha_{i,n})\, g(\beta_{i,n}) \left[\sum_{m=1}^{N} \alpha_{i,m} \rho[\Delta_{m,n}(1) - \Delta_{m,n}(0)]\right] + \frac{B_n(1) - B_n(0)}{\lambda_n} \geq 0$$

[14] The function η can also be applied to the noise/retail votes, but it will not change any of the results.

Applying the same logic as in the main text, results in the following generalized GGL measure:

$$GGL \quad (A,B) = \sum_{i=1}^{I} \eta\left(\alpha_{i,A}\right) g\left(\beta_{i,A}\right) \alpha_{i,B}$$

For example, if

$$\eta\left(\alpha_{i,A}\right) = \begin{cases} \alpha_{i,A} & if\ \alpha_{i,A} > z \\ 0 & else, \end{cases}$$

then the manager of firm A is affected by the votes of his investors only if the investor's ownership in firm A is larger than z. In this case, the generalized GGL measure will only aggregate across common owners of firm A and B who owns at least z percentage of the equity of firm A.[15]

Under the second generalization, we consider the effect of common ownership on the incentives of the manager of firm A to internalize externalities on a group of firms (e.g., industry), rather than a single firm. Let Γ denote the set of firms with respect to which we seek to measure the effect of common ownership. Following the same logic as in the main text, we measure this effect by the difference in the manager's incentives to take action $x_n = 1$ under the existing ownership structure relative to a counterfactual in which investors in firm A have no ownership in any of the Γ firms (assuming the weights of all other firms in their portfolios remain unchanged). Recall

$$\Pi_n(\boldsymbol{\alpha_1}, \dots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \dots, \boldsymbol{\beta_N}) = \sum_{i=1}^{I} \eta(\alpha_{i,n})\, g\left(\beta_{i,n}\right) \left[\sum_{m=1}^{N} \alpha_{i,m} \rho\left[\Delta_{m,n}(1) - \Delta_{m,n}(0)\right]\right],$$

Then the generalized group-level measure is

$$CO(A,\Gamma) = \sum_{m \in \Gamma} [\Pi_A(\boldsymbol{\alpha_1}, \dots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \dots, \boldsymbol{\beta_N}) - \Pi_A(\boldsymbol{\alpha_1}, \dots, \boldsymbol{\alpha_m} = \mathbf{0}, \dots, \boldsymbol{\alpha_N}; \boldsymbol{\beta_1}, \dots, \boldsymbol{\beta_m} = \mathbf{0}, \dots, \boldsymbol{\beta_N})].$$

Therefore,

$$CO(A,\Gamma) = \sum_{i=1}^{I} \eta(\alpha_{i,A})\, g\left(\beta_{i,A}\right) \left[\sum_{m \in \Gamma} \alpha_{i,m} \rho\left[\Delta_{m,A}(1) - \Delta_{m,A}(0)\right]\right],$$

which can be rewritten as

[15] Notice that $\eta\left(\alpha_{i,A}\right) \neq \alpha_{i,A}$ is another reason why in general $GGL(A,B) \neq GGL(B,A)$.

$$CO(A,\Gamma) = \sum_{m\in\Gamma}\left[\rho\left[\Delta_{m,A}(1) - \Delta_{m,A}(0)\right]\sum_{i=1}^{I}\eta(\alpha_{i,n})\, g\left(\beta_{i,A}\right)\alpha_{i,m}\right],$$

If $\rho[\Delta_{m,A}(1) - \Delta_{m,A}(0)]$ is the same across all firms in the set Γ, then we can normalize $CO(A,\Gamma)$ by the term $\rho[\Delta_{m,A}(1) - \Delta_{m,A}(0)]$ and get the following group-level unit-free measure

$$GGL \quad (A,\Gamma) = \sum_{m\in\Gamma} GGL_{\%}(A,\mathrm{m}).$$

Notice that assuming that $\rho\ [\Delta_{m,A}(1) - \Delta_{m,A}(0)]$ is the same across all firms in the set Γ does not require the externalities that firm A imposes on each of these firms to be the same. It only requires the *difference* between the externalities that are imposed by firm A when $x_A = 1$ and the externalities when $x_A = 0$ and its impact on the likelihood of shareholder support to be the same. This is a much weaker assumption. For example, under this assumption, the product market strategy employed by firm A can have different effect on each of its competitors. However, a change in that strategy should have the same differential effect on each competitor. Without this assumption, group-level measure cannot be unit free.

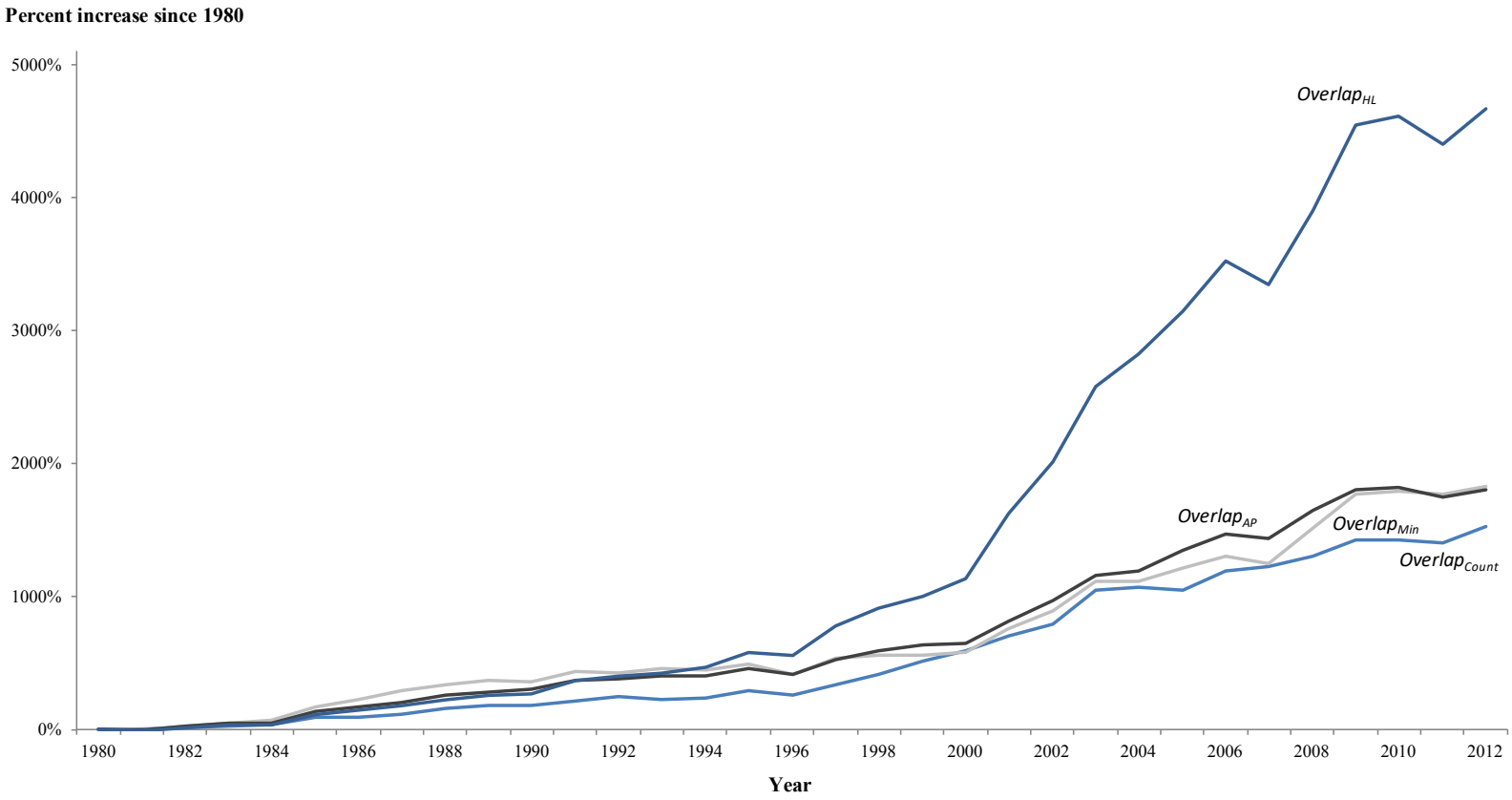

Figure 1: Percent change in average stock pair ownership overlap since 1980

This figure plots the percent change in the average stock pair ownership overlap since 1980. Details on how each measure is constructed can be found in Section 1.

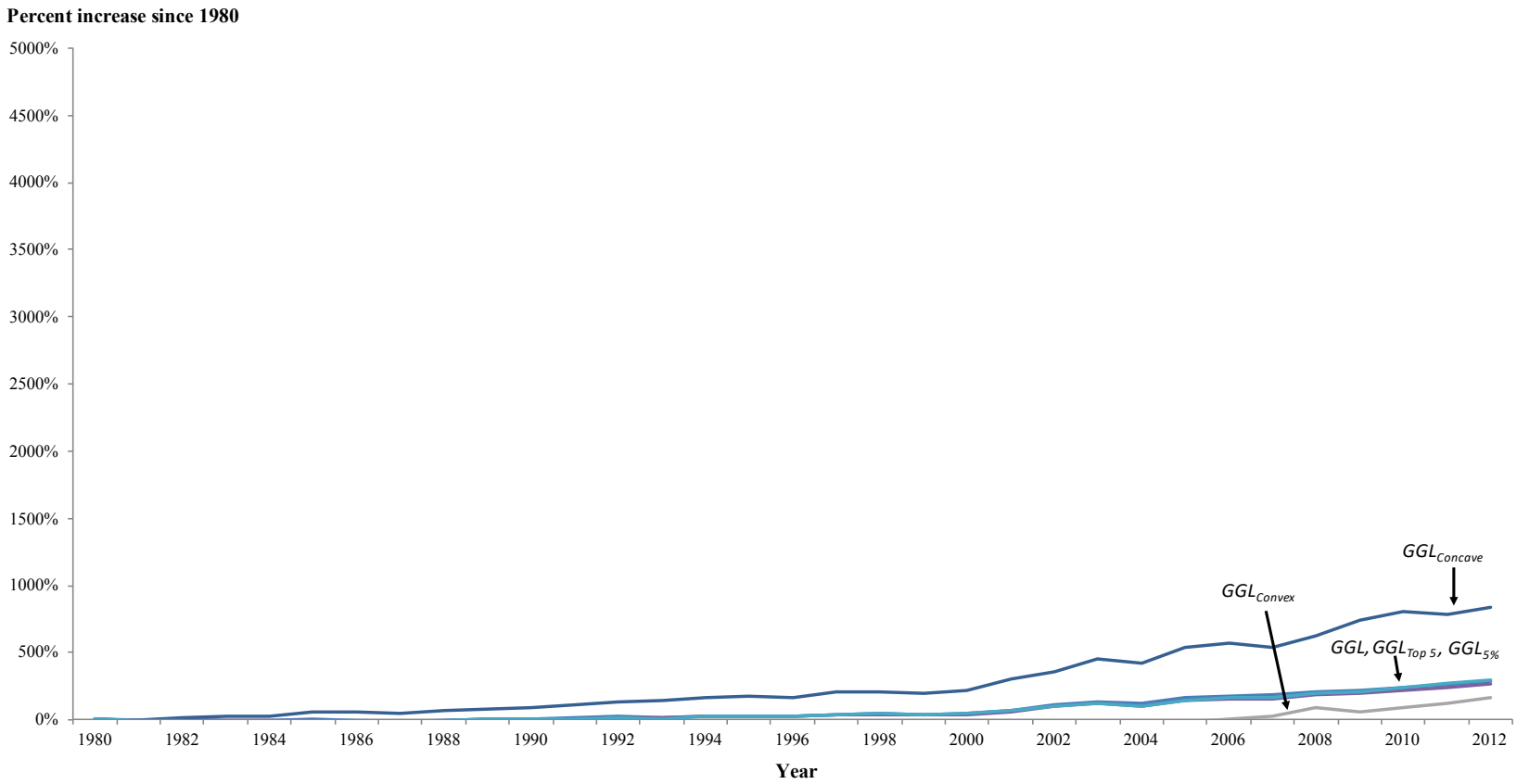

Figure 2: Percent change in managers' incentive to internalize externalities, as measured by *GGL*, since 1980

This figure plots the percent change in the average stock pair *GGL* since 1980 for different versions of *GGL*. Details on how each measure is constructed can be found in Section 1.

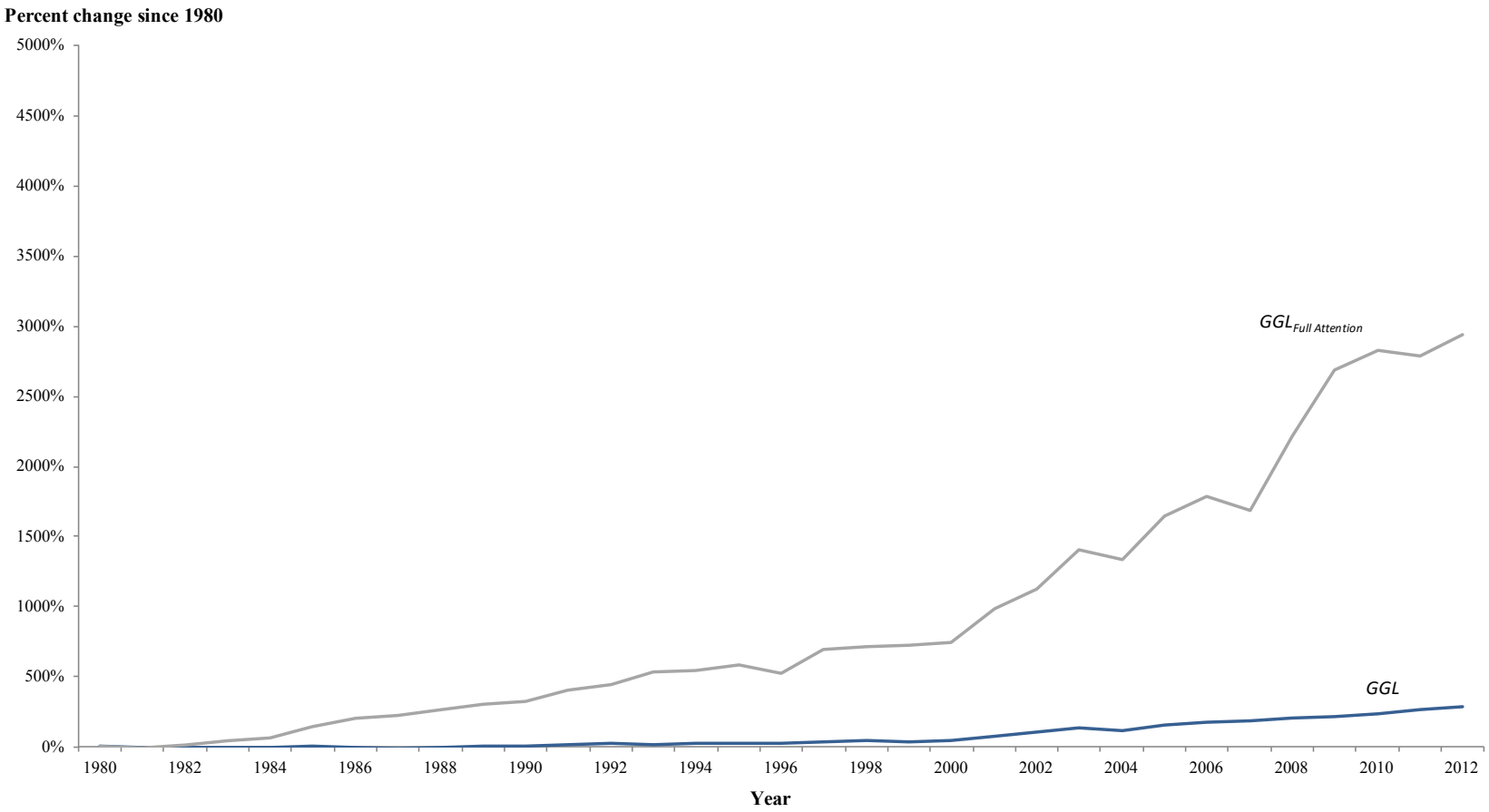

Figure 3: Percent change in managers' incentive to internatlize externalites when assuming full attention, as measured by *GGL* $_{Full\ Attention}$, since 1980

This figure plots the percent change in average *GGL* and average *GGL* $_{Full\ Attention}$ since 1980. Details of how each measure is constructed is provided in Section 1.

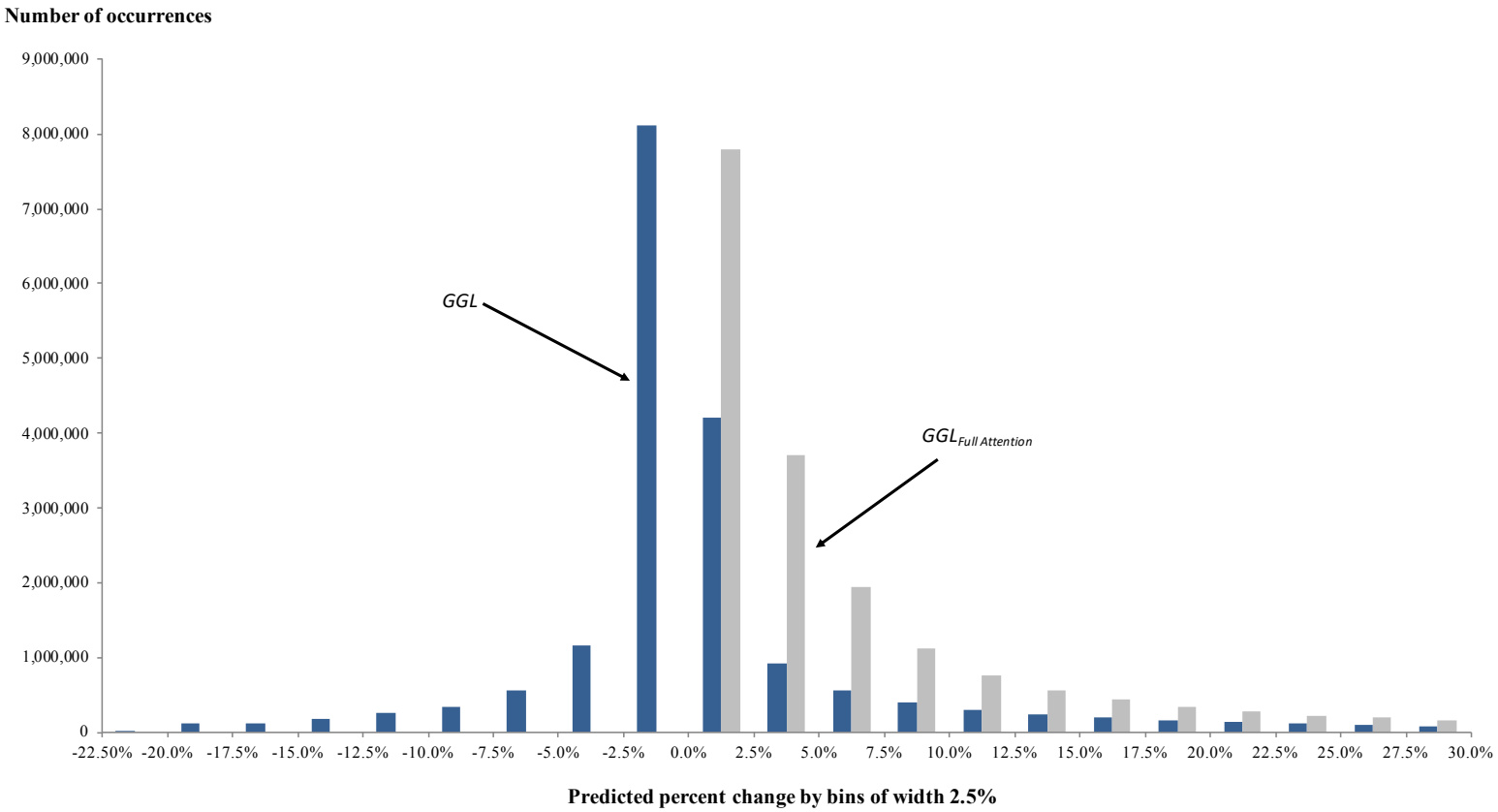

Figure 4: Histogram of predicted changes in managers' incentives to internalize externalities following the BGI/Blackrock merger in 2009

This figure plots a histogram of the predicted percentage change in *GGL* versus the predicted percentage change in $GGL_{Full\ Attention}$ due to the 2009 merger between BlackRock and BGI. The predicted change is calculated by holding the ownership stakes of all institutional investors constant and recalculating the two *GGL* measures in 2008 under the assumption that the portfolios of BGI and BlackRock are now owned by the same investor, the merged entity.

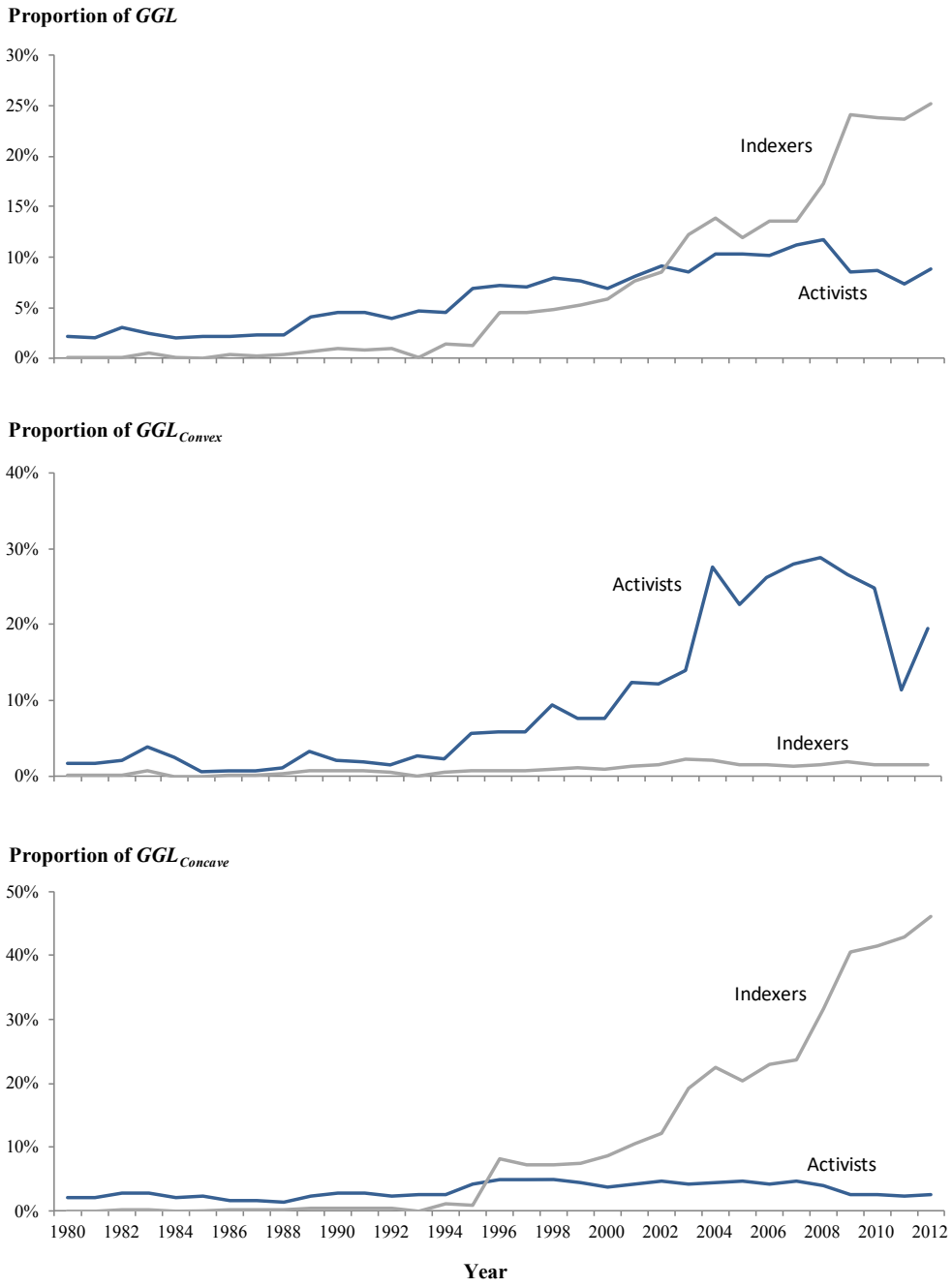

Figure 5: Proportion of GGL attributable to index and activist investors by year

This figure plots the proportion of *GGL* (top panel), GGL_{Convex} (middle panel), and $GGL_{Concave}$ (bottom panel) that can be attributed to investors classified as either an activist investor or an index investor. The remaining proportion, which is not plotted, is all other institutions. For indexers, we only use the holdings of BGI, Blackrock, State Street, and Vanguard, while for activists, we only include the holdings of hedge funds that have engaged in some form of activism, as identified in Brav et al., 2008 and 2010.

Table 1: Summary Statistics

This table reports summary statistics from 1998-2012 for overlapping and common ownership variables and variables that are later used as explanatory variables. The ownership variables are defined in Section 1 of the paper, and as discussed in Section 1, all *GGL* variables are scaled by their sample average. The explanatory variables are composed of index indicator variables (coded 1 if both firms are in an index and 0 otherwise), average institutional ownership across the pair, and average size (average log assets of the two firms). Average Industry HHI is the average HHI of the industries, based on a 3 digit SIC code industry classification, of each of the firms in a pair. The industry dummy is 1 if both firms in a pair belong to the same 3-digit SIC industry and is 0 otherwise.

Common Ownership Variables	*N*	Mean	Std Dev	P1	P10	P25	P50	P75	P90	P99
$Overlap_{Count}$	223,679,199	20.51	33.51	0	0	2	8	26	56	152
$Overlap_{Min}$	223,679,199	0.052	0.072	0	0	0.002	0.022	0.073	0.159	0.305
$Overlap_{AP}$	223,679,199	0.116	0.135	0	0	0.010	0.063	0.182	0.326	0.533
$Overlap_{HL}$	223,679,199	0.032	0.062	0	0	0.0001	0.003	0.029	0.107	0.295
GGL	447,358,398	1	52.61	0	0	0.00004	0.011	0.196	1.247	15.593
$GGL_{Concave}$	447,358,398	1	5.85	0	0	0.001	0.078	0.683	2.547	13.008
GGL_{Convex}	447,358,398	1	518.06	0	0	3.30E-09	0.00002	0.002	0.040	2.859
$GGL_{5\%}$	447,358,398	1	84.55	0	0	0	0	0.022	0.647	14.515
$GGL_{Top\ 5}$	447,358,398	1	65.21	0	0	0	0.002	0.117	0.956	15.557
$GGL_{Full\ Attention}$	447,358,398	1	1.83	0	0	0.009	0.241	1.199	3.059	7.984
$Beta^{Sum}$	447,358,398	1	9.10	0	0	0.0005	0.018	0.229	1.343	16.506
Explanatory Variables	*N*	Mean	Std Dev	P1	P10	P25	P50	P75	P90	P99
Both S&P 500 Dummy	447,358,398	0.008	0.089	0	0	0	0	0	0	0
Both Russell 2000 Dummy	447,358,398	0.101	0.302	0	0	0	0	0	1	1
Both Russell 1000 Dummy	447,358,398	0.029	0.167	0	0	0	0	0	0	1
Both S&P 400 Dummy	447,358,398	0.005	0.067	0	0	0	0	0	0	0
Both S&P 600 Dummy	447,358,398	0.010	0.098	0	0	0	0	0	0	0
Both Nasdaq Index Dummy	447,358,398	0.0003	0.017	0	0	0	0	0	0	0
Average Institutional Ownership	447,358,398	0.420	0.218	0.014	0.125	0.255	0.415	0.572	0.725	0.898
Average Size	447,358,398	6.003	1.649	2.522	3.917	4.842	5.942	7.092	8.160	10.092
Both in Same Industry Dummy	447,358,398	0.026	0.158	0	0	0	0	0	0	1
Average HHI of Industries	447,358,398	0.027	0.046	0.001	0.003	0.006	0.013	0.029	0.061	0.225

Table 2: Overlapping Ownership, Index Inclusion, and Industry HHI

This table reports regression estimates of the relationship between overlapping ownership and index inclusion, industry concentration, and average institutional ownership. The unit of observation is at the stock-pair-year level. The dependent variables measure the extent of ownership overlap for stock pair *i* in year *t*. A definition for each measure of overlap is provided in the text. Index dummy variables are coded 1 if both stocks are in that particular index and 0 otherwise, and average institutional ownership is the average share of equity held by institutional investors across the two stocks. Average size is the average of the log assets of the two stocks. Average Industry HHI is the average HHI of the industries, based on a 3-digit SIC code industry classification, for the two stocks in the pair. The industry dummy is 1 if stocks firms in a pair belong to the same industry and is 0 otherwise. These regressions are based on data from 1998 through 2012. All specifications include pair fixed effects. Standard errors are clustered by pair, and *t*-statistics are reported in brackets below the coefficient estimates. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	$Overlap_{Count}$	$Overlap_{Min}$	$Overlap_{AP}$	$Overlap_{HL}$
	(1)	(2)	(3)	(4)
Both S&P 500 $Dummy_{it}$	70.97***	0.07***	0.05***	0.06***
	[517.87]	[482.61]	[234.71]	[318.05]
Both Russell 2000 $Dummy_{it}$	7.63***	0.03***	0.04***	0.01***
	[1334.73]	[1441.80]	[1237.83]	[459.91]
Both Russell 1000 $Dummy_{it}$	26.80***	0.02***	0.04***	0.04***
	[787.21]	[401.23]	[499.03]	[489.16]
Both S&P 400 $Dummy_{it}$	13.27***	0.04***	0.04***	0.03***
	[283.53]	[292.08]	[212.67]	[177.95]
Both S&P 600 $Dummy_{it}$	11.66***	0.06***	0.06***	0.04***
	[578.11]	[574.46]	[456.28]	[402.74]
Both Nasdaq Index $Dummy_{it}$	31.90***	0.03***	0.04***	0.04***
	[84.22]	[58.29]	[56.83]	[52.48]
Average Institutional $Ownership_{it}$	38.77***	0.15***	0.32***	0.14***
	[1568.91]	[2348.05]	[2814.91]	[2050.09]
Average $Size_{it}$	8.61***	0.01***	0.02***	0.01***
	[1127.37]	[724.55]	[803.42]	[565.08]
Average of Industry HHI_{it}	-1.992***	-0.00002	-0.006***	0.003***
	[-56.71]	[-0.21]	[-44.72]	[32.16]
Both in Same Industry $Dummy_{it}$	0.017	0.001***	0.001***	0.001***
	[0.35]	[7.91]	[4.31]	[4.19]
Average of Industry HHI_{it} * Both in Same Industry $Dummy_{it}$	4.299***	0.005***	0.011***	0.004***
	[10.50]	[5.08]	[7.13]	[3.62]
Pair FE_i	Yes	Yes	Yes	Yes
Time FE_t	Yes	Yes	Yes	Yes
R^2	0.927	0.874	0.889	0.841
N	223,679,199	223,679,199	223,679,199	223,679,199

Table 3: Managerial Incentives Arising from Common Ownership, as Measured by *GGL*, Index Inclusion, and Industry HHI
This table reports regression estimates of the relationship between our model-derived measure of common ownership that accounts for the impact on managerial incentives, *GGL*, and index inclusion, average institutional ownership, industry, and industry concentration. The unit of observation is at the stock-pair-year direction level. The dependent variable, *GGL*, reflects the relative incentive of the manager of stock i to internalize the impact of externalities on the value of stock j in year t. Definitions of the different versions of *GGL* are provided in the text, and each *GGL* measure is scaled by its sample average. Index dummy variables are coded 1 if both stocks i and j are in that particular index in year t and 0 otherwise, and average institutional ownership is the average share of equity held by institutional investors across the two stocks in year t. Average size is the average of the log assets of the two stocks in year t. Average Industry HHI is the average HHI of the industries, based on a 3-digit SIC code industry classification, for the two stocks in the pair. The industry dummy is 1 if stocks firms in a pair belong to the same industry and is 0 otherwise. These regressions are based on data from 1998 through 2012. All specifications include pair-direction fixed effects. Standard errors are clustered by pair direction, and t-statistics are reported in brackets below the coefficient estimates. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	GGL	GGL_{Convex}	$GGL_{Concave}$	$GGL_{Top\ 5}$	$GGL_{5\%}$
	(1)	(2)	(3)	(4)	(5)
Both S&P 500 $Dummy_{ijt}$	2.71***	0.82	2.58***	2.50***	2.03***
	[23.49]	[0.70]	[178.52]	[17.51]	[11.00]
Both Russell 2000 $Dummy_{ijt}$	-0.26***	-0.30**	-0.12***	-0.27***	-0.28***
	[-16.73]	[-2.32]	[-69.03]	[-13.83]	[-11.21]
Both Russell 1000 $Dummy_{ijt}$	0.94***	-0.19	1.06***	0.84***	0.79***
	[38.99]	[-0.91]	[251.23]	[28.45]	[20.89]
Both S&P 400 $Dummy_{ijt}$	0.03	-0.26	0.43***	-0.02	0.03
	[1.00]	[-0.80]	[57.39]	[-0.49]	[0.47]
Both S&P 600 $Dummy_{ijt}$	-0.12***	-0.87***	0.42***	-0.17***	-0.13***
	[-4.78]	[-4.40]	[94.09]	[-5.67]	[-3.36]
Both Nasdaq Index $Dummy_{ijt}$	2.61***	0.43	1.91***	2.35***	2.24***
	[25.01]	[1.53]	[46.32]	[19.80]	[16.12]
Average Institutional $Ownership_{ijt}$	5.50***	7.87***	4.76***	5.71***	6.67***
	[59.45]	[8.94]	[467.11]	[49.75]	[44.75]
Average $Size_{it}$	0.16***	-0.19	0.20***	0.11***	-0.03
	[11.78]	[-1.47]	[138.81]	[6.58]	[-1.19]
Average of Industry HHI_{ijt}	0.21***	1.72**	0.05***	0.24***	0.35***
	[3.38]	[2.32]	[7.13]	[3.12]	[3.43]
Both in Same Industry $Dummy_{ijt}$	0.22	1.05	0.03	0.21	0.25
	[1.24]	[0.69]	[1.48]	[0.95]	[0.89]
Avg. of Industry HHI_{ijt} * Both in Same $Industry_{ijt}$	4.22	31.76	0.65**	5.68	7.24
	[1.19]	[1.07]	[2.08]	[1.29]	[1.27]
Pair Direction FE	Yes	Yes	Yes	Yes	Yes
Time FE_t	Yes	Yes	Yes	Yes	Yes
R^2	0.652	0.605	0.639	0.651	0.651
N	447,358,398	447,358,398	447,358,398	447,358,398	447,358,398

Table 4: *GGL* with Full Attention and Common Investor Portfolio Weights

This table reports regression estimates of the relationship between $GGL_{Full\ Attention}$ and the sum of the Betas, $Beta^{Sum}$, and index inclusion, average institutional ownership, industry, and industry concentration. The unit of observation is at the stock-pair-year direction level. The dependent variable in Column 1, $GGL_{Full\ Attention}$ reflects the relative incentive of the manager of stock *i* to internalize the impact of externalities on the value of stock *j* in year *t* when g = 1. The dependent variable in Column 2 is the sum of portfolio weights of stock *i* in common investors' portfolios in year *t* across all common investors in stocks *i* and *j* in year *t*. Index dummy variables are coded 1 if both stocks are in that particular index and 0 otherwise, and average institutional ownership is the average share of equity held by institutional investors across the two stocks. Average size is the average of the log assets of the two stocks in year *t*. Average Industry HHI is the average HHI of the industries, based on a 3-digit SIC code industry classification, for the two stocks in the pair. The industry dummy is 1 if stocks firms in a pair belong to the same industry and is 0 otherwise. These regressions are based on data from 1998 through 2012. All specifications include pair fixed direction effects. Standard errors are clustered by pair direction, and *t*-statistics are reported in brackets below the coefficient estimates. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	$GGL_{Full\ Attention}$	$Beta^{Sum}$
	(1)	(2)
Both S&P 500 $Dummy_{ijt}$	0.89***	10.55***
	[282.21]	[194.48]
Both Russell 2000 $Dummy_{ijt}$	0.39***	-0.23***
	[737.13]	[-460.44]
Both Russell 1000 $Dummy_{ijt}$	0.36***	2.60***
	[262.23]	[262.50]
Both S&P 400 $Dummy_{ijt}$	0.58***	-0.18***
	[180.19]	[-35.66]
Both S&P 600 $Dummy_{ijt}$	1.08***	-0.15***
	[439.47]	[-128.88]
Both Nasdaq Index $Dummy_{ijt}$	0.39***	7.87***
	[33.47]	[39.70]
Average Institutional $Ownership_{ijt}$	4.18***	1.41***
	[1997.96]	[235.59]
Average $Size_{it}$	0.09***	0.76***
	[223.73]	[308.93]
Average of Industry HHI_{ijt}	0.08***	-0.14***
	[36.57]	[-13.96]
Both in Same Industry $Dummy_{ijt}$	0.02***	-0.01
	[4.97]	[-0.36]
Average of Industry HHI_{ijt} * Both in Same Industry $Dummy_{ijt}$	0.13***	0.25
	[4.93]	[1.51]
Pair Direction FE	Yes	Yes
Time FE	Yes	Yes
R^2	0.692	0.841
N	447,358,398	447,358,398