TECHNICAL SUPPLEMENT FOR "INFERENCE WITH DEPENDENT DATA IN ACCOUNTING AND FINANCE APPLICATIONS"

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In this supplement, we provide a detailed description of the data generating process used in the simulations in the main paper and some additional results from the simulation.

1. Data

To try to make the data used in the simulations as similar to actual data that might be faced in empirical accounting, we started our exercise with data that reproduce Tables 2 and 5 of Balakrishnan et al. (2014). For our implementation, we focus on the specification given in the final column in Table 2 ("FRQ_INDEX1"). Relative to a data set and model specification that exactly reproduces the results printed in the final column of Table 2 in Balakrishnan et al. (2014), we make two small modifications. First, we drop all firms that are in the sample for less than three years. Second, we do not estimate exactly the model given in equation (5) in Balakrishnan et al. (2014) which applies the within transformation to all variables except the measure of financial reporting quality and then includes the raw financial reporting quality measure and the interaction of the raw measure with the within-transformed measure of real estate value. Rather, we estimate a standard additive fixed effects model

$$y_{it} = x_{it}'\beta + \alpha_i + \delta_t + \varepsilon_{it} \tag{1}$$

where y_{it} is the outcome variable used in Balakrishnan et al. (2014) (capital expenditure scaled by lagged assets), x_{it} is a vector of nine variables measured at date $t-1$ whose identities and definitions are given in Balakrishnan et al. (2014) and not restated here for brevity, α_i represent firm-specific unobserved effects, and δ_t represent time specific unobserved effects.

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With these changes, our results differ somewhat from those in Balakrishnan et al. (2014). The sample we use has 21,290 observations (as opposed to 21,749 in the last column of Table 2 in Balakrishnan et al. (2014)) spread across 2159 firms. The number of observations per firm ranges from 2 to 17 with an average of 9.9. Note that the presence of firms with only two time series observations results from missing values in the other variables included in the model as we drop any observation that has a missing value in any of the model variables after deletion of firms with less than three time series observations in the raw data. For comparison, we present the result given in column "FRQ_INDEX1" in Table 2 of Balakrishnan et al. (2014) and results obtained in our sample with our variation on the model Table A1 below. t-statistics, provided in parentheses, are based on standard errors that are two-way-clustered (Cameron et al., 2011) at the state and year level exactly as in Balakrishnan et al. (2014). The results are broadly similar. We also note that the goal of our exercise is to provide simulation results on dependent-data inference procedures in data that mimic the type of firm-level panel data typical to accounting, so the results themselves in the original data are tangential to the point of our exercise. We simply wish to illustrate that the results are not drastically different from those using the original specification and data from which our exercise is drawn.

2. Simulation Model (DGP)

Each simulation replication is based on data generated according to

$$y_{it}^b = x_{it}'\widehat{\beta} + \widehat{\alpha}_i + \widehat{\delta}_t + \varepsilon_{it}^b \tag{2}$$

where $\widehat{\beta}$, $\widehat{\alpha}_i$, and $\widehat{\delta}_t$ are the point estimates of the model parameters obtained from estimating model (1) in the actual data. Outcomes for each simulation replication, $b = 1, ..., 1000$, (y_{it}^b) are then generated by setting x_{it}, the firm indices, and the time indices equal to the actual values of these variables in the real data to compute the index $v_{it}^b = x_{it}'\widehat{\beta} + \widehat{\alpha}_i + \widehat{\delta}_t$ associated with observation (i, t) in simulated data set b. We then complete the model by simulating a new error term for each observation in simulation replication b, ε_{it}^b, from a model that allows complicated spatial and temporal correlation that is based on patterns in the estimated residuals from the actual data. In the remainder of this section, we detail specification and estimation of the model for ε_{it} as this drives the simulation results.

To define the generating process for ε_{it}, it will be useful to define a number of quantities. Let $s_{it} = \mathbf{1}(\text{firm } i \text{ observed at time } t)$, and note $s_{it} = 0$ for all $t < 1$. Define categorical variables $q(x(i))$ which are formed by first taking the within firm mean of variable x, then finding the quintiles of the within firm means, and finally assigning each firm to the quintile category to which its mean belongs. For example, if firm i has mean value of LN_MVE between the 20^{th} and 40^{th} percentiles of the within firm means of LN_MVE, $q(LN\_MVE(i)) = 2$. Finally, for categorical variable g where $g(i)$ denotes the category to which firm i belongs, define

$$\bar{\varepsilon}_{g(i),t} = \begin{cases} \frac{\sum_{j \in g(i)} s_{jt}\varepsilon_{jt}}{\sum_{j \in g(i)} s_{jt}} & \text{if } \sum_{j \in g(i)} s_{jt} > 0 \\ 0 & \text{if } \sum_{j \in g(i)} s_{jt} = 0 \end{cases}.$$

Then, our model for ε_{it} is

$$\begin{aligned} \varepsilon_{it} = {} & \rho s_{it-1}\varepsilon_{it-1} + \theta_1 \bar{\varepsilon}_{state(i),t-1} + \theta_2 \bar{\varepsilon}_{sic(i),t-1} + \theta_3 \bar{\varepsilon}_{q(LN\_MVE(i)),t-1} \\ & + \theta_4 \bar{\varepsilon}_{q(CASHFLOW(i)),t-1} + \theta_5 \bar{\varepsilon}_{q(RE\_VALUE(i)),t-1} + \theta_6 \bar{\varepsilon}_{q(FRQ(i)),t-1} \\ & + \theta_7 \bar{\varepsilon}_{q(FRQ \times RE\_VALUE(i)),t-1} + v_{it} \end{aligned} \tag{3}$$

where *state* are state categories, *sic* are two-digit SIC code categories, v_{it} is a cross-sectionally correlated but inter-temporally independent random variable defined below, and other variables are as defined in Balakrishnan et al. (2014). We note that this structure alters the covariance structure at every time period through an ad hoc combination of imputing necessary lagged missing values to 0 and alteration of the spatial covariance structure to accommodate the differing number of observations to bypass potential complications for imputing missing values due to entry and exit from the panel. We also note that this structure allows correlation not only between firms within a given time period and between time periods within a given firm but also between different firms in different time periods. For example, it allows that the shock to IBM in 2000 is associated to the shock for Dell in 2001.

To define the model for v_{it}, let $N_t = \sum_j s_{jt}$, and let v_t denote the $N_t \times 1$ vector formed by stacking all of the v_{it} within time period t. Define distance matrices $D_{LN\_MVE,t}$, $D_{CASHFLOW,t}$, and $D_{FRQ \times RE\_VALUE,t}$ with (i, j) entries given by

$$[D_{LN\_MVE,t}]_{[i,j]} = |LN\_MVE_{i,t} - LN\_MVE_{j,t}|,$$

$$[D_{CASHFLOW,t}]_{[i,j]} = |CASHFLOW_{i,t} - CASHFLOW_{j,t}|,$$

and

$$[D_{FRQ*RE\_VALUE,t}]_{[i,j]} = \|(RE\_VALUE_{i,t}, FRQ_{i,t}, FRQ \times RE\_VALUE_{i,t}) - (RE\_VALUE_{j,t}, FRQ_{j,t}, FRQ \times RE\_VALUE_{j,t})\|_2$$

and associated spatial weight matrices

$$W_{LN\_MVE,t} = (\iota_{N_t}\iota'_{N_t} - c_t D_{LN\_MVE,t}) \circ \mathbf{1}(c_t D_{LN\_MVE,t} < 1) - I_{N_t},$$

$$W_{CASHFLOW,t} = (\iota_{N_t}\iota'_{N_t} - D_{CASHFLOW,t}) \circ \mathbf{1}(D_{CASHFLOW,t} < 1) - I_{N_t},$$

and

$$W_{FRQ\times RE\_VALUE,t} = (\iota_{N_t}\iota'_{N_t} - c_t D_{FRQ\times RE\_VALUE,t}) \circ \mathbf{1}(c_t D_{FRQ\times RE\_VALUE,t} < 1) - I_{N_t},$$

where ι_{N_t} is a $N_t \times 1$ vector of ones, $\circ$ is the Hadamard product, and $c_1 = c_2 = c_3 = c_4 = c_5 = .5$, $c_6 = .6$, $c_7 = .7$, $c_8 = .8$, $c_9 = .9$, $c_{10} = .1$, $c_{11} = .11$, $c_{12} = .12$, $c_{13} = .13$, $c_{14} = .14$, $c_{15} = .15$, $c_{16} = .16$, and $c_{17} = .17$. We then define v_t according to

$$v_t = (a_1 * W_{LN\_MVE,t} + a_2 * W_{CASHFLOW,t} + a_3 * W_{FRQ\times RE\_VALUE,t})v_t + u_t$$

which implies

$$(I_{N_t} - (a_1 * W_{LN\_MVE,t} + a_2 * W_{CASHFLOW,t} + a_3 * W_{FRQ\times RE\_VALUE,t}))v_t = Q_t v_t = u_t$$

so that

$$v_t = Q_t^{-1} u_t.$$

Finally, u_t is defined as

$$u_t = \Omega_t^{1/2}\eta_t$$

where

$$\Omega_t = \sigma^2_{state} WSt_t + \sigma^2_{sic1} WS1_t + \sigma^2_{sic2} WS2_t + \sigma^2_{sic3} WS3_t + diag(\sigma_t^2)$$

with $WSt_t = DSt_t DSt_t'$ with DSt_t denoting the block of a matrix of state $\times$ time dummies corresponding to time period t, $WS1_t = DS1_t DS1_t'$ where $DS1_t$ is the block of a matrix of one-digit SIC code $\times$ time dummies corresponding to time period t, $WS2_t = DS2_t DS2_t'$ where $DS2_t$ is the block of a matrix of two-digit SIC code $\times$ time dummies corresponding to time period t, $WS3_t = DS3_t DS3_t'$ where $DS3_t$ is the block of a matrix of three-digit SIC code $\times$ time dummies corresponding to time period t,

and $diag(\sigma_t^2)$ a diagonal matrix with entries on the diagonal equal to $\exp\{z'_{i,t}\kappa\}$ where $z_{i,t}$ includes a full set of time dummies, a full set of dummies for one-digit SIC code, and the nine variables included in the results provided in Table A1. Putting all of this together defines covariance matrix of υ_t as

$$\Sigma_t = Q_t^{-1}\Omega_t Q_t^{-1}.$$

$\eta_{i,t}$ is then taken to be iid draws over i and t of an EGB2(d,s,p,q) random variable constrained to have mean 0 and variance 1. We choose the EGB2 as it captures the mild skewness and kurtosis seen in the residuals obtained from the actual data.

To obtain the parameters for the model used in the simulation, we use the residuals from the linear regression model (1), $\{\widehat{\varepsilon}_{it}\}_{i=1,...,n,t=1,...,T}$ (where values for missing (i,t) combinations are imputed to 0 as previously outlined) to estimate all of the parameters of the covariance structure,

$$\gamma = (\rho, \theta_1, ..., \theta_7, a_1, a_2, a_3, \sigma^2_{state}, \sigma^2_{sic1}, \sigma^2_{sic2}, \sigma^2_{sic3}, \kappa', d, s, p, q)',$$

with a two step procedure. We first estimate the parameters of (3) by linear regression using residuals from (1). We then obtain

$$\begin{aligned}\hat{\upsilon}_{it} = \hat{\varepsilon}_{it} - (&\hat{\rho} s_{it-1}\hat{\varepsilon}_{it-1} + \hat{\theta}_1\bar{\hat{\varepsilon}}_{state(i),t-1} + \hat{\theta}_2\bar{\hat{\varepsilon}}_{sic(i),t-1} \\ &+ \hat{\theta}_3\bar{\hat{\varepsilon}}_{q(LN\_MVE(i)),t-1} - \hat{\theta}_4\bar{\hat{\varepsilon}}_{q(CASHFLOW(i)),t-1} + \hat{\theta}_5\bar{\hat{\varepsilon}}_{q(RE\_VALUE(i)),t-1} \\ &+ \hat{\theta}_6\bar{\hat{\varepsilon}}_{q(FRQ(i)),t-1} + \hat{\theta}_7\bar{\hat{\varepsilon}}_{q(FRQ\times RE\_VALUE(i)),t-1})\end{aligned}$$

and estimate the remaining parameters by Gaussian QML. We then plug in the estimated parameter values to obtain $(\hat{\Sigma}_1, ..., \hat{\Sigma}_{17})$ and obtain $\hat{\eta}_t = \hat{\Sigma}_t^{-1/2}\hat{\upsilon}_t$. Finally, we estimate (d, s, p, q) by MLE using $\hat{\eta}_t$. Figure 1 illustrates a kernel density estimate of the density of $\hat{\eta}_t$ and the EGB2 fit.

Finally, we use the estimated covariance structure from the actual data in simulating the ε_{it}^b for the simulation. Specifically, we simulate ε_{it}^b from the model defined above using the estimated values $\hat{\gamma}$ obtained from the sample. We then add the simulated ε_{it}^b to υ_{it}^b to obtain the outcomes for simulation replication b.

3. Additional Simulation Results

In Table A2, we present size of 5% level tests based on one- and two-ways clustered standard errors with different fixed effects structures. These results are obtained

exactly as described in Section 4.1 of the main text with the sole difference that we use the conventional Gaussian critical value (1.96) rather than the more appropriate t-critical value. We see that there are essentially uniformly large size distortions across all the structures in this case. The sole exception is when using clusters made from two-year-time-block with firm cross two-year-time-block fixed effects. This finding is likely special to this setting and is a result of the firm cross two-year-time-block fixed effects structure removing most sources of dependence from the data and inducing sufficient negative dependence to offset the fact that the critical values being used are too small. We caution against generalizing this result, though it again points to the potential robustness available from including rich fixed effects structures in linear models.

We report results from the *ad hoc* homogeneity assessment discussed in Section 4.1 of the main text in Table A3. Specifically, for each of the covariates x_j in the Balakrishnan et al. (2014) data, we first partial out a potential fixed effects structure to obtain $\tilde{x}_j^{FE_k}$ where FE_k denotes one of the potential fixed effects structures we consider. For each covariate and fixed effects structure, we then estimate the model

$$\tilde{x}_{j,it}^{FE_k} = d_{G,it}'\gamma_{Gjk} + v_{Gjk,it}$$

where $d_{G,it}$ is a vector of group membership dummies for observation it based on grouping structure G. We then test the hypothesis that $\gamma_{Gjk} = 0$ using a standard Wald test assuming that the regression errors $v_{Gjk,it}$ are iid. We repeat this exercise for each combination of fixed effect and grouping structures given in the first two rows of Appendix Table 2. Note that if $\gamma_{Gjk} = 0$, it means that knowledge of group membership does not provide information that is useful for forecasting the squared value of the covariate which is an implication of the homogeneity condition maintained in using clustered standard errors with a small number of groups and t-critical values. Rejecting this hypothesis thus indicates a rejection of the homogeneity condition. We note that the above procedure is *ad hoc* at least in the sense that the assumption that the $v_{Gjk,it}$ are iid is incredibly hard to believe, that the test is only looking at an implication of homogeneity, and that there are potentially important multiple testing issues given that more than one covariate is available. However, we think it might be useful as a quick way to gauge how much heterogeneity there is across groups. We also think that in many cases, including the one we consider, there are more than enough intuitive reasons to suspect a lack of homogeneity that it is not clear that one needs a formal homogeneity test. Regardless, in our particular example, we see that this *ad hoc*

exercise clearly suggests a large degree of heterogeneity as evidenced by the generically tiny p-values in Table A2.

In Tables A4 and A5, we report additional bootstrap results. Specifically, Table A4 contains size of 5% level tests when the moving blocks bootstrap with a block length of 2 is used to generate critical values. The qualitative conclusions are the same as for the moving blocks bootstrap with a block size of 3, so we do not provide further discussion but refer the reader to the discussion in the main text. We then present results from the wild bootstrap using the same balanced panel as we use in the moving blocks bootstrap in Table A5. Again, the results are qualitatively similar to those reported for the wild bootstrap in the main text suggesting that the difference between the wild bootstrap and moving blocks bootstrap is not simply due to the difference in sample composition.

Finally, we provide tabulations of power from the simulation study for the eight covariates not discussed explicitly in the main text in Tables A6-A13. These power curves are for the 16 procedures that did a reasonable job controlling size in the simulation. Specifically, power curves are given for 5% level tests based on (i) standard errors clustered by 8 year time block with firm cross 8 year time block and year fixed effects with t-critical value, (ii) standard errors clustered by 2 year time block with firm cross 2 year time block and year fixed effects with t-critical value, (iii) standard errors clustered by 8 year time block with firm and year fixed effects with moving blocks bootstrap critical value, (iv) standard errors clustered by 8 year time block with firm cross 8 year time block and year fixed effects with moving blocks bootstrap critical value, (v) standard errors clustered by 6 year time block with firm cross 6 year time block and year fixed effects with moving blocks bootstrap critical value, (vi) standard errors clustered by 4 year time block with firm cross 4 year time block and year fixed effects with moving blocks bootstrap critical value, (vii) standard errors clustered by 2 year time block with firm cross 2 year time block and year fixed effects with moving blocks bootstrap critical value, (viii) FM by state, (ix) FM by one-digit SIC code, (x) FM by 8 year time block, (xi) FM by 6 year time block, (xii) FM by 4 year time block, (xiii) FM by 2 year time block, (xiv) Canay-Romano-Shaikh by 2 year time block, (xv) sensitivity analysis, and (xvi) *ad hoc* group selection.

The results in Tables A6-A13 are broadly in line with the discussion in the main text and the qualitative conclusions are thus roughly the same as looking at the main

text. In terms of power, there are broadly two classes of procedures. The first class of procedures are all of the clustering procedures with moving blocks bootstrap critical values, clustering by 8-year time block with t-critical values, and FM by state, one-digit SIC code, and eight year time block. These procedures tend to be relatively low-powered in this example, though there are some exceptions. The other class of procedures are clustering by two-year time blocks with firm cross two-year-time-block fixed effects and year fixed effects; FM with groups made by 6, 4, and 2 year time blocks; Canay-Romano-Shaikh by 2 year time block; sensitivity analysis; and *ad hoc* group selection. Relative to the first group, this second group of procedures tends to have better power. There is, of course, some variation in performance, with some members from the first group occasionally performing well in terms of power. Overall, we believe the evidence is sufficient to point to a preference for one of the procedures in the second broad group, though it is not strong enough to produce a strong ordering among all of the procedures. We prefer Canay-Romano-Shaikh on theoretic grounds, but the simulations certainly suggest that there are many reasonable competitors.

References

Balakrishnan, K., J. E. Core, and R. S. Verdi (2014): "The Relation Between Reporting Quality and Financing and Investment: Evidence from Changes in Financing Capacity," *Journal of Accounting Research*, 52, 1–36.

Cameron, A. C., J. B. Gelbach, and D. L. Miller (2011): "Robust Inference with Multiway Clustering," *Journal of Business and Economic Statistics*, 29, 238–249.

TABLE A1. Baseline Results

	Balakrishnan et al. (2014)	Data Used in Simulation
RE_VALUE	2.20	2.20
	(5.54)	(5.22)
STATE_INDEX	-0.11	-0.13
	(-0.33)	(-0.37)
FRQ	-0.01	0.05
	(-0.13)	(1.16)
FRQ × RE_VALUE	-0.62	-0.25
	(-3.12)	(-2.13)
CASH FLOW	0.09	0.09
	(2.14)	(2.14)
Q	1.11	1.11
	(12.39)	(12.30)
LN_MVE	0.33	0.32
	(3.06)	(3.00)
LN_AGE	-0.75	-0.77
	(-3.03)	(-3.22)
LEVERAGE	-4.68	-4.70
	(-10.40)	(-10.38)

The first column of this table reproduces column "FRQ_INDEX1" in Table 2 of Balakrishnan et al. (2014). The second column provides results using the additional sample restriction we impose and the additive fixed effects specification given in equation (1).

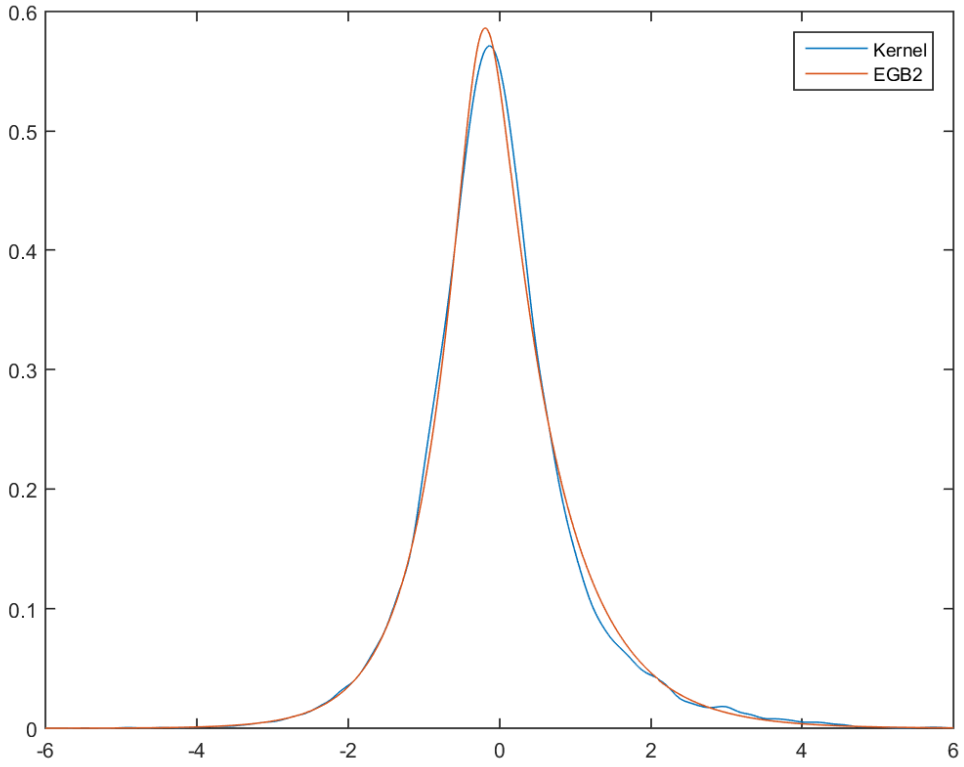

FIGURE 1. This figure illustrates a kernel density estimate of the density of $\hat{\eta}_t$ and the EGB2 fit.

Table A2. Size of 5% Level Tests Based on Clustered Standard Errors from Simulation Experiment using Standard Normal Critical Values

Clusters	Fixed Effects	RE_VALUE	STATE_INDEX	FRQ	FRQ x RE_VALUE	CASH FLOW	Q	LN_MVE	LEVERAGE	LN_AGE
					A. One-Way Clustering					
firm	firm, year	0.12	0.30	0.41	0.22	0.09	0.17	0.27	0.06	0.35
state	firm, year	0.13	0.32	0.43	0.25	0.14	0.21	0.29	0.08	0.40
one-digit SIC	firm, year	0.20	0.35	0.44	0.28	0.20	0.25	0.33	0.13	0.39
two-digit SIC	firm, year	0.15	0.30	0.39	0.23	0.14	0.20	0.28	0.08	0.35
size category	firm, year	0.21	0.33	0.41	0.27	0.20	0.25	0.21	0.14	0.32
8 year time block	firm, year	0.40	0.44	0.26	0.35	0.32	0.43	0.46	0.37	0.52
6 year time block	firm, year	0.29	0.33	0.23	0.30	0.18	0.32	0.35	0.27	0.49
4 year time block	firm, year	0.25	0.30	0.17	0.21	0.17	0.26	0.30	0.21	0.44
2 year time block	firm, year	0.22	0.28	0.12	0.16	0.11	0.20	0.26	0.16	0.39
state	firm, state x year	0.11	0.11	0.42	0.24	0.13	0.18	0.28	0.08	0.35
one-digit SIC	firm, one-digit SIC x year	0.20	0.31	0.46	0.26	0.19	0.25	0.33	0.12	0.40
two-digit SIC	firm, one-digit SIC x year	0.18	0.20	0.43	0.24	0.18	0.22	0.31	0.12	0.38
two-digit SIC	firm, two-digit SIC x year	0.14	0.14	0.38	0.18	0.14	0.17	0.26	0.07	0.30
size category	firm, size category x year	0.16	0.34	0.44	0.26	0.21	0.23	0.17	0.15	0.25
8 year time block	firm x 8 year time block, year	0.26	0.32	0.21	0.29	0.24	0.30	0.24	0.28	0.58
6 year time block	firm x 6 year time block, year	0.19	0.20	0.22	0.21	0.14	0.26	0.14	0.21	0.47
4 year time block	firm x 4 year time block, year	0.09	0.13	0.11	0.10	0.09	0.14	0.08	0.11	0.24
2 year time block	**firm x 2 year time block, year**	**0.02**	**0.06**	**0.03**	**0.04**	**0.03**	**0.04**	**0.02**	**0.04**	**0.06**
					B. Two-Way Clustering					
state, year	firm, year	0.12	0.25	0.09	0.14	0.08	0.14	0.24	0.09	0.27
one-digit SIC, year	firm, year	0.17	0.26	0.12	0.15	0.09	0.14	0.23	0.13	0.27
two-digit SIC, year	firm, year	0.13	0.22	0.09	0.12	0.09	0.14	0.23	0.10	0.25
state, year	firm, state x year	0.11	0.13	0.09	0.12	0.08	0.13	0.23	0.09	0.24
one-digit SIC, year	firm, one-digit SIC x year	0.17	0.24	0.12	0.14	0.08	0.14	0.23	0.13	0.28
two-digit SIC, year	firm, one-digit SIC x year	0.16	0.16	0.09	0.14	0.08	0.12	0.22	0.12	0.27
two-digit SIC, year	firm, two-digit SIC x year	0.12	0.13	0.07	0.11	0.08	0.13	0.20	0.09	0.21

Note: Size of 5% level tests obtained from simulation study. 1000 simulation replications were performed. The simulation standard error for a 5% level test is 0.0069. Panel A shows results based on one-way clustering, and Panel B shows results based on two-way clustering. The column "Clusters" gives the level at which clustering occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. The remaining columns give the names of the firm and time varying variables in the data whose effects we may be interested in inferring. Size is based on using standard normal critical values (i.e. 1.96) rather than the more appropriate t-critical values used in the results in the main text. Bold rows indicate that the largest size distortion in that row is .05 or less. Further details are provided in the main text, and details about the simulation design are provided in Section 2 of this supplement.

Table A3. p-value for Test of Design Homogeneity

Groups	Fixed Effects	RE_VALUE	STATE_INDEX	FRQ	FRQ x RE_VALUE	CASH FLOW	Q	LN_MVE	LEVERAGE	LN_AGE
state	firm, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
state	firm, state x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
state	firm, one-digit SIC x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
state	firm, size category x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
state	firm x 4 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
state	firm x 2 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000
one-digit SIC	firm, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
one-digit SIC	firm, state x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
one-digit SIC	firm, one-digit SIC x year	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005
one-digit SIC	firm, size category x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
one-digit SIC	firm x 4 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
one-digit SIC	firm x 2 year time block, year	0.0081	0.0000	0.0000	0.0000	0.0000	0.0000	0.0053	0.0000	0.0000
size category	firm, year	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
size category	firm, state x year	0.0000	0.0126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004
size category	firm, one-digit SIC x year	0.0000	0.0000	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
size category	firm, size category x year	0.0000	0.0000	0.0005	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
size category	firm x 4 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006
size category	firm x 2 year time block, year	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0003	0.0000	0.0018
year	firm, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
year	firm, state x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0022	0.0000
year	firm, one-digit SIC x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
year	firm, size category x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
year	firm x 4 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
year	firm x 2 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4 year time block	firm, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1736	0.0000
4 year time block	firm, state x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3569	0.0000
4 year time block	firm, one-digit SIC x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2493	0.0000
4 year time block	firm, size category x year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3773	0.0000
4 year time block	firm x 4 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4 year time block	firm x 2 year time block, year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: p-values for ad hoc across group variance homogeneity test. The column "Groups" gives the groups across which homogeneity is being tested; for example, we are testing for homogeneity of the squared covariates across states in rows labeled "state." level at which clustering occurs, and the column "Fixed Effects" gives the levels of fixed effects that are begin partialed out before trying to assess homogeneity; for example, we are testing for homogeneity after removing firm and time fixed effects in where the second column is "firm, year." The remaining columns give the names of the corresponding covariate from the data whose across group homogeneity is being assessed. Tests are based on assuming iid residuals from the regression of the squared x-variable onto the group membership dummies.

Table A4. Size of 5% Level Tests Based on Clustered Standard Errors with Moving Block Bootstrap Critical Values from Simulation Experiment

Clusters	Fixed Effects	RE_VALUE	STATE_INDEX	FRQ	FRQ x RE_VALUE	CASH FLOW	Q	LN_MVE	LEVERAGE	LN_AGE
firm	firm, year	0.27	0.30	0.22	0.21	0.23	0.26	0.29	0.25	0.28
state	firm, year	0.25	0.30	0.21	0.20	0.22	0.24	0.27	0.24	0.27
one-digit SIC	firm, year	0.21	0.25	0.16	0.16	0.17	0.19	0.23	0.19	0.24
two-digit SIC	firm, year	0.23	0.28	0.20	0.20	0.20	0.23	0.27	0.23	0.26
size category	firm, year	0.20	0.22	0.16	0.18	0.18	0.20	0.21	0.19	0.22
8 year time block	**firm, year**	**0.07**	**0.08**	**0.04**	**0.06**	**0.07**	**0.06**	**0.06**	**0.05**	**0.09**
6 year time block	firm, year	0.07	0.09	0.06	0.07	0.06	0.06	0.06	0.07	0.14
4 year time block	firm, year	0.08	0.07	0.05	0.05	0.06	0.06	0.07	0.06	0.16
2 year time block	firm, year	0.08	0.09	0.04	0.05	0.07	0.06	0.08	0.07	0.14
state	firm, state x year	0.24	0.20	0.19	0.22	0.21	0.21	0.24	0.22	0.27
one-digit SIC	firm, one-digit SIC x year	0.21	0.24	0.16	0.16	0.15	0.19	0.23	0.19	0.22
two-digit SIC	firm, two-digit SIC x year	0.25	0.25	0.18	0.19	0.16	0.23	0.27	0.22	0.26
size category	firm, size category x year	0.19	0.23	0.17	0.18	0.17	0.20	0.17	0.17	0.20
8 year time block	**firm x 8 year time block, year**	**0.04**	**0.05**	**0.03**	**0.03**	**0.06**	**0.04**	**0.03**	**0.03**	**0.06**
6 year time block	**firm x 6 year time block, year**	**0.02**	**0.02**	**0.04**	**0.03**	**0.03**	**0.05**	**0.02**	**0.03**	**0.07**
4 year time block	**firm x 4 year time block, year**	**0.01**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.02**	**0.02**	**0.01**
2 year time block	**firm x 2 year time block, year**	**0.00**	**0.00**	**0.03**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**

Note: Size of 5% level tests obtained from simulation study. 1000 simulation replications were performed. The simulation standard error for a 5% level test is 0.0069. The column "Clusters" gives the level at which clustering occurs for computing standard errors, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. The remaining columns give the names of the firm and time varying variables in the data whose effects we may be interested in inferring. Critical values are obtained by applying the time series moving block bootstrap with a block size of two to simulate standard errors for t-statistics formed from models with fixed effects as in column "Fixed Effects" and standard errors clustered according to column "Clusters." Bold rows indicate that the largest size distortion in that row is .05 or less. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A5. Size of 5% Level Tests Based on Clustered Standard Errors and Balance Panel with Wild Bootstrap Critical Values from Simulation Experiment

Clusters	Fixed Effects	RE_VALUE	STATE_INDEX	FRQ	FRQ x RE_VALUE	CASH FLOW	Q	LN_MVE	LEVERAGE	LN_AGE
firm	firm, year	0.07	0.08	0.19	0.09	0.07	0.09	0.13	0.08	0.16
state	firm, year	0.10	0.14	0.20	0.12	0.10	0.13	0.15	0.10	0.18
one-digit SIC	firm, year	0.18	0.18	0.22	0.17	0.09	0.14	0.19	0.14	0.17
two-digit SIC	firm, year	0.10	0.11	0.18	0.11	0.08	0.12	0.15	0.11	0.16
size category	firm, year	0.11	0.13	0.20	0.15	0.11	0.12	0.13	0.11	0.14
8 year time block	firm, year	0.26	0.22	0.14	0.19	0.23	0.21	0.25	0.22	0.26
6 year time block	firm, year	0.20	0.22	0.17	0.19	0.17	0.17	0.20	0.20	0.37
4 year time block	firm, year	0.17	0.19	0.14	0.14	0.15	0.14	0.16	0.14	0.36
2 year time block	firm, year	0.16	0.17	0.11	0.11	0.13	0.13	0.16	0.13	0.26
state	firm, state x year	0.09	0.21	0.18	0.13	0.10	0.13	0.12	0.10	0.18
one-digit SIC	firm, one-digit SIC x year	0.18	0.18	0.22	0.17	0.11	0.14	0.18	0.14	0.18
two-digit SIC	firm, two-digit SIC x year	0.11	0.09	0.14	0.09	0.07	0.11	0.15	0.10	0.16
size category	firm, size category x year	0.09	0.15	0.20	0.17	0.12	0.13	0.09	0.09	0.11
8 year time block	firm x 8 year time block, year	0.12	0.15	0.08	0.10	0.09	0.10	0.05	0.08	0.25
6 year time block	firm x 6 year time block, year	0.13	0.15	0.14	0.12	0.11	0.15	0.09	0.10	0.40
4 year time block	firm x 4 year time block, year	0.11	0.19	0.12	0.12	0.12	0.11	0.09	0.10	0.29
2 year time block	firm x 2 year time block, year	0.10	0.24	0.09	0.11	0.08	0.09	0.08	0.10	0.24

Note: Size of 5% level tests obtained from simulation study. 1000 simulation replications were performed. The simulation standard error for a 5% level test is 0.0069. The column "Clusters" gives the level at which clustering occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. The remaining columns give the names of the firm and time varying variables in the data whose effects we may be interested in inferring. Critical values are obtained by applying the cluster wild bootstrap of Cameron et al. (2008) using the clusters defined in the column "Clusters." Note that in no row are size distortions uniformly .05 or smaller. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A6. Power for Coefficient on RE_VALUE from Simulation

Clusters	G-1	Fixed Effects	k = -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.21	0.15	0.10	0.05	0.04	0.06	0.09	0.14	0.20
2 year time block	7	firm x 2 year time block, year	0.25	0.13	0.06	0.01	0.01	0.02	0.05	0.12	0.24
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.22	0.17	0.12	0.08	0.07	0.09	0.12	0.16	0.23
8 year time block	-	firm x 8 year time block, year	0.10	0.08	0.07	0.04	0.04	0.04	0.05	0.07	0.10
6 year time block	-	firm x 6 year time block, year	0.11	0.07	0.04	0.02	0.02	0.03	0.04	0.06	0.10
4 year time block	-	firm x 4 year time block, year	0.09	0.05	0.03	0.01	0.01	0.01	0.03	0.06	0.09
2 year time block	-	firm x 2 year time block, year	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.02
C. Fama-MacBeth											
state	48	firm, state x year	0.22	0.15	0.09	0.04	0.04	0.05	0.10	0.18	0.27
one-digit SIC	8	firm, one-digit SIC x year	0.18	0.12	0.06	0.04	0.02	0.03	0.06	0.10	0.17
8 year time block	1	firm x 8 year time block, year	0.21	0.15	0.09	0.06	0.05	0.06	0.10	0.15	0.21
6 year time block	2	firm x 6 year time block, year	0.45	0.30	0.17	0.08	0.05	0.08	0.15	0.27	0.40
4 year time block	3	firm x 4 year time block, year	0.51	0.34	0.18	0.08	0.04	0.06	0.17	0.31	0.51
2 year time block	7	firm x 2 year time block, year	0.41	0.26	0.14	0.06	0.04	0.05	0.13	0.24	0.37
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.41	0.28	0.17	0.08	0.04	0.06	0.14	0.26	0.38
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.45	0.24	0.09	0.02	0.00	0.02	0.07	0.23	0.43
ad hoc Group Selection	-	-	0.46	0.31	0.17	0.08	0.05	0.07	0.16	0.29	0.46

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,RE\_VALUE} + ks_{RE\_VALUE}$ where k is given in the column labels, β_{0,RE_VALUE} denotes the true parameter value, and s_{RE_VALUE} is the standard error of the OLS estimator of β_{0,RE_VALUE} from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A7. Power for Coefficient on STATE_INDEX from Simulation

			k								
Clusters	G-1	Fixed Effects	-4	-3	-2	-1	0	1	2	3	4
			A. Clustered Standard Errors with t-Critical Value								
8 year time block	1	firm x 8 year time block, year	0.32	0.24	0.16	0.07	0.05	0.09	0.16	0.24	0.34
2 year time block	7	firm x 2 year time block, year	0.57	0.36	0.17	0.07	0.03	0.07	0.17	0.35	0.58
			B. Moving Blocks Boostrap								
8 year time block	-	firm, year	0.30	0.23	0.15	0.09	0.08	0.10	0.16	0.25	0.32
8 year time block	-	firm x 8 year time block, year	0.20	0.15	0.09	0.06	0.04	0.06	0.10	0.15	0.19
6 year time block	-	firm x 6 year time block, year	0.18	0.11	0.07	0.04	0.02	0.03	0.06	0.11	0.17
4 year time block	-	firm x 4 year time block, year	0.29	0.17	0.10	0.04	0.02	0.03	0.07	0.15	0.27
2 year time block	-	firm x 2 year time block, year	0.12	0.06	0.02	0.01	0.00	0.00	0.02	0.05	0.12
			C. Fama-MacBeth								
state	48	firm, state x year	0.06	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.06
one-digit SIC	8	firm, one-digit SIC x year	0.39	0.25	0.13	0.06	0.03	0.07	0.16	0.29	0.42
8 year time block	1	firm x 8 year time block, year	0.09	0.06	0.04	0.02	0.01	0.02	0.04	0.07	0.09
6 year time block	2	firm x 6 year time block, year	0.30	0.19	0.10	0.04	0.02	0.04	0.10	0.21	0.30
4 year time block	3	firm x 4 year time block, year	0.24	0.16	0.06	0.03	0.01	0.03	0.08	0.15	0.24
2 year time block	7	firm x 2 year time block, year	0.13	0.09	0.07	0.04	0.02	0.03	0.06	0.09	0.14
			D. Canay, Romano, and Shaikh								
2 year time block	-	firm x 2 year time block, year	0.18	0.14	0.10	0.07	0.05	0.06	0.10	0.14	0.21
			E. Sensitivity Analysis and ad hoc Group Selection								
Sensitivity Analysis	-	-	0.68	0.47	0.21	0.04	0.01	0.04	0.20	0.46	0.70
ad hoc Group Selection	-	-	0.29	0.18	0.09	0.04	0.02	0.04	0.09	0.18	0.26

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,STATE\_INDEX} + k s_{STATE\_INDEX}$ where k is given in the column labels, $\beta_{0,STATE\_INDEX}$ denotes the true parameter value, and s_{STATE_INDEX} is the standard error of the OLS estimator of $\beta_{0,STATE\_INDEX}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A8. Power for Coefficient on FRQ from Simulation

Clusters	G-1	Fixed Effects	k: -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.23	0.17	0.12	0.06	0.02	0.05	0.11	0.17	0.23
2 year time block	7	firm x 2 year time block, year	0.76	0.53	0.26	0.06	0.01	0.05	0.24	0.52	0.75
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.21	0.15	0.11	0.07	0.04	0.06	0.10	0.15	0.20
8 year time block	-	firm x 8 year time block, year	0.15	0.13	0.08	0.05	0.04	0.04	0.08	0.11	0.16
6 year time block	-	firm x 6 year time block, year	0.40	0.29	0.16	0.07	0.04	0.08	0.17	0.28	0.41
4 year time block	-	firm x 4 year time block, year	0.54	0.35	0.19	0.08	0.04	0.09	0.20	0.36	0.52
2 year time block	-	firm x 2 year time block, year	0.49	0.31	0.16	0.05	0.02	0.04	0.14	0.32	0.49
C. Fama-MacBeth											
state	48	firm, state x year	0.74	0.56	0.33	0.16	0.07	0.14	0.32	0.53	0.69
one-digit SIC	8	firm, one-digit SIC x year	0.65	0.46	0.27	0.10	0.07	0.14	0.31	0.51	0.65
8 year time block	1	firm x 8 year time block, year	0.23	0.18	0.11	0.05	0.03	0.06	0.10	0.17	0.23
6 year time block	2	firm x 6 year time block, year	0.69	0.49	0.29	0.10	0.04	0.09	0.28	0.49	0.68
4 year time block	3	firm x 4 year time block, year	0.83	0.65	0.38	0.14	0.03	0.13	0.37	0.64	0.81
2 year time block	7	firm x 2 year time block, year	0.95	0.81	0.50	0.17	0.04	0.16	0.51	0.80	0.95
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.94	0.80	0.52	0.18	0.04	0.17	0.50	0.78	0.94
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.73	0.56	0.31	0.07	0.01	0.07	0.29	0.54	0.72
ad hoc Group Selection	-	-	0.74	0.57	0.32	0.11	0.03	0.11	0.33	0.56	0.73

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,FRQ} + k s_{FRQ}$ where k is given in the column labels, $\beta_{0,FRQ}$ denotes the true parameter value, and s_{FRQ} is the standard error of the OLS estimator of $\beta_{0,FRQ}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A9. Power for Coefficient on CASH FLOW from Simulation

			k								
Clusters	G-1	Fixed Effects	-4	-3	-2	-1	0	1	2	3	4
			A. Clustered Standard Errors with t-Critical Value								
8 year time block	1	firm x 8 year time block, year	0.21	0.15	0.10	0.06	0.04	0.05	0.10	0.15	0.20
2 year time block	7	firm x 2 year time block, year	0.53	0.32	0.13	0.04	0.01	0.03	0.13	0.30	0.57
			B. Moving Blocks Boostrap								
8 year time block	-	firm, year	0.14	0.12	0.10	0.07	0.07	0.07	0.08	0.10	0.14
8 year time block	-	firm x 8 year time block, year	0.10	0.08	0.06	0.06	0.05	0.05	0.06	0.07	0.09
6 year time block	-	firm x 6 year time block, year	0.11	0.07	0.05	0.04	0.04	0.04	0.05	0.07	0.11
4 year time block	-	firm x 4 year time block, year	0.13	0.08	0.04	0.03	0.03	0.04	0.07	0.10	0.14
2 year time block	-	firm x 2 year time block, year	0.09	0.06	0.03	0.02	0.01	0.01	0.03	0.05	0.08
			C. Fama-MacBeth								
state	48	firm, state x year	0.12	0.09	0.05	0.03	0.02	0.04	0.06	0.11	0.17
one-digit SIC	8	firm, one-digit SIC x year	0.11	0.07	0.04	0.01	0.01	0.01	0.04	0.07	0.13
8 year time block	1	firm x 8 year time block, year	0.23	0.17	0.12	0.06	0.04	0.05	0.11	0.17	0.23
6 year time block	2	firm x 6 year time block, year	0.53	0.37	0.19	0.07	0.05	0.09	0.21	0.38	0.56
4 year time block	3	firm x 4 year time block, year	0.62	0.42	0.23	0.08	0.03	0.08	0.23	0.45	0.65
2 year time block	7	firm x 2 year time block, year	0.72	0.50	0.28	0.11	0.05	0.10	0.27	0.53	0.73
			D. Canay, Romano, and Shaikh								
2 year time block	-	firm x 2 year time block, year	0.71	0.50	0.29	0.12	0.06	0.12	0.29	0.53	0.73
			E. Sensitivity Analysis and ad hoc Group Selection								
Sensitivity Analysis	-	-	0.52	0.26	0.09	0.02	0.00	0.02	0.12	0.31	0.55
ad hoc Group Selection	-	-	0.56	0.39	0.21	0.08	0.04	0.08	0.22	0.41	0.59

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,\text{CASH FLOW}} + k s_{\text{CASH FLOW}}$ where k is given in the column labels, $\beta_{0,\text{CASH FLOW}}$ denotes the true parameter value, and $s_{\text{CASH FLOW}}$ is the standard error of the OLS estimator of $\beta_{0,\text{CASH FLOW}}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A10. Power for Coefficient on Q from Simulation

Clusters	G-1	Fixed Effects	k: -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.27	0.21	0.14	0.07	0.04	0.08	0.14	0.20	0.28
2 year time block	7	firm x 2 year time block, year	0.61	0.37	0.15	0.04	0.02	0.07	0.17	0.37	0.60
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.16	0.12	0.10	0.07	0.06	0.07	0.09	0.14	0.18
8 year time block	-	firm x 8 year time block, year	0.11	0.09	0.06	0.04	0.04	0.05	0.07	0.09	0.12
6 year time block	-	firm x 6 year time block, year	0.23	0.15	0.10	0.06	0.04	0.05	0.09	0.16	0.23
4 year time block	-	firm x 4 year time block, year	0.23	0.15	0.07	0.04	0.03	0.04	0.08	0.15	0.23
2 year time block	-	firm x 2 year time block, year	0.18	0.10	0.05	0.03	0.01	0.02	0.05	0.10	0.17
C. Fama-MacBeth											
state	48	firm, state x year	0.23	0.15	0.09	0.06	0.03	0.04	0.08	0.14	0.22
one-digit SIC	8	firm, one-digit SIC x year	0.32	0.22	0.11	0.05	0.02	0.05	0.12	0.23	0.35
8 year time block	1	firm x 8 year time block, year	0.27	0.21	0.14	0.07	0.04	0.07	0.14	0.21	0.28
6 year time block	2	firm x 6 year time block, year	0.68	0.48	0.26	0.10	0.06	0.13	0.29	0.48	0.69
4 year time block	3	firm x 4 year time block, year	0.82	0.60	0.35	0.14	0.06	0.15	0.38	0.64	0.84
2 year time block	7	firm x 2 year time block, year	0.87	0.66	0.33	0.10	0.05	0.13	0.39	0.66	0.86
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.85	0.64	0.33	0.10	0.05	0.13	0.38	0.65	0.85
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.69	0.46	0.19	0.05	0.01	0.05	0.19	0.44	0.70
ad hoc Group Selection	-	-	0.73	0.51	0.29	0.12	0.06	0.13	0.32	0.54	0.76

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,Q} + ks_Q$ where k is given in the column labels, $\beta_{0,Q}$ denotes the true parameter value, and s_Q is the standard error of the OLS estimator of $\beta_{0,Q}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A11. Power for Coefficient on LN MVE from Simulation

Clusters	G-1	Fixed Effects	k: -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.27	0.21	0.13	0.07	0.03	0.07	0.12	0.19	0.27
2 year time block	7	firm x 2 year time block, year	0.66	0.40	0.17	0.04	0.01	0.02	0.13	0.36	0.64
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.18	0.14	0.10	0.07	0.06	0.07	0.11	0.16	0.19
8 year time block	-	firm x 8 year time block, year	0.09	0.07	0.06	0.04	0.03	0.03	0.06	0.09	0.11
6 year time block	-	firm x 6 year time block, year	0.13	0.09	0.06	0.04	0.03	0.03	0.05	0.08	0.12
4 year time block	-	firm x 4 year time block, year	0.17	0.10	0.05	0.02	0.02	0.03	0.05	0.09	0.14
2 year time block	-	firm x 2 year time block, year	0.14	0.07	0.03	0.01	0.00	0.01	0.02	0.05	0.13
C. Fama-MacBeth											
state	48	firm, state x year	0.51	0.32	0.18	0.08	0.06	0.09	0.19	0.33	0.47
one-digit SIC	8	firm, one-digit SIC x year	0.40	0.27	0.14	0.06	0.02	0.05	0.14	0.26	0.38
8 year time block	1	firm x 8 year time block, year	0.30	0.23	0.15	0.08	0.04	0.06	0.13	0.22	0.29
6 year time block	2	firm x 6 year time block, year	0.62	0.43	0.24	0.09	0.03	0.09	0.21	0.41	0.59
4 year time block	3	firm x 4 year time block, year	0.75	0.59	0.33	0.11	0.03	0.10	0.28	0.52	0.72
2 year time block	7	firm x 2 year time block, year	0.80	0.58	0.34	0.11	0.03	0.09	0.30	0.56	0.78
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.80	0.58	0.35	0.13	0.05	0.11	0.32	0.55	0.77
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.69	0.46	0.17	0.02	0.00	0.02	0.12	0.41	0.65
ad hoc Group Selection	-	-	0.69	0.51	0.30	0.10	0.03	0.10	0.26	0.46	0.66

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,LN\ MVE} + k s_{LN\ MVE}$ where k is given in the column labels, $\beta_{0,LN\ MVE}$ denotes the true parameter value, and $s_{LN\ MVE}$ is the standard error of the OLS estimator of $\beta_{0,LN\ MVE}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A12. Power for Coefficient on LEVERAGE from Simulation

Clusters	G-1	Fixed Effects	k: -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.21	0.16	0.11	0.07	0.05	0.07	0.10	0.16	0.20
2 year time block	7	firm x 2 year time block, year	0.36	0.21	0.10	0.04	0.02	0.03	0.08	0.19	0.33
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.14	0.11	0.08	0.07	0.05	0.06	0.08	0.11	0.14
8 year time block	-	firm x 8 year time block, year	0.09	0.07	0.05	0.04	0.04	0.04	0.06	0.07	0.09
6 year time block	-	firm x 6 year time block, year	0.10	0.07	0.05	0.04	0.03	0.04	0.04	0.06	0.08
4 year time block	-	firm x 4 year time block, year	0.11	0.07	0.04	0.03	0.02	0.02	0.04	0.07	0.10
2 year time block	-	firm x 2 year time block, year	0.07	0.04	0.02	0.01	0.01	0.01	0.02	0.03	0.07
C. Fama-MacBeth											
state	48	firm, state x year	0.50	0.35	0.22	0.12	0.05	0.05	0.08	0.17	0.29
one-digit SIC	8	firm, one-digit SIC x year	0.18	0.12	0.06	0.03	0.02	0.02	0.05	0.12	0.18
8 year time block	1	firm x 8 year time block, year	0.23	0.18	0.11	0.07	0.05	0.07	0.12	0.16	0.22
6 year time block	2	firm x 6 year time block, year	0.52	0.35	0.20	0.10	0.06	0.09	0.20	0.37	0.51
4 year time block	3	firm x 4 year time block, year	0.61	0.41	0.19	0.09	0.05	0.09	0.21	0.41	0.60
2 year time block	7	firm x 2 year time block, year	0.58	0.38	0.21	0.09	0.06	0.09	0.19	0.36	0.55
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.58	0.39	0.22	0.10	0.06	0.09	0.20	0.37	0.54
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.48	0.24	0.08	0.02	0.00	0.01	0.08	0.23	0.46
ad hoc Group Selection	-	-	0.57	0.39	0.20	0.10	0.06	0.09	0.20	0.39	0.56

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,LEVERAGE} + ks_{LEVERAGE}$ where k is given in the column labels, $\beta_{0,LEVERAGE}$ denotes the true parameter value, and $s_{LEVERAGE}$ is the standard error of the OLS estimator of $\beta_{0,LEVERAGE}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.

Table A13. Power for Coefficient on LN AGE from Simulation

Clusters	G-1	Fixed Effects	k: -4	-3	-2	-1	0	1	2	3	4
A. Clustered Standard Errors with t-Critical Value											
8 year time block	1	firm x 8 year time block, year	0.43	0.33	0.22	0.12	0.10	0.14	0.21	0.33	0.42
2 year time block	7	firm x 2 year time block, year	0.16	0.11	0.07	0.04	0.04	0.04	0.06	0.10	0.14
B. Moving Blocks Boostrap											
8 year time block	-	firm, year	0.26	0.20	0.16	0.10	0.08	0.10	0.14	0.18	0.24
8 year time block	-	firm x 8 year time block, year	0.16	0.11	0.08	0.07	0.05	0.06	0.08	0.11	0.15
6 year time block	-	firm x 6 year time block, year	0.23	0.17	0.11	0.08	0.07	0.07	0.10	0.16	0.21
4 year time block	-	firm x 4 year time block, year	0.09	0.06	0.04	0.02	0.01	0.01	0.03	0.05	0.08
2 year time block	-	firm x 2 year time block, year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Fama-MacBeth											
state	48	firm, state x year	0.52	0.38	0.24	0.13	0.07	0.10	0.20	0.34	0.51
one-digit SIC	8	firm, one-digit SIC x year	0.44	0.30	0.17	0.06	0.03	0.06	0.15	0.28	0.42
8 year time block	1	firm x 8 year time block, year	0.14	0.11	0.07	0.04	0.02	0.04	0.07	0.10	0.14
6 year time block	2	firm x 6 year time block, year	0.21	0.14	0.08	0.04	0.02	0.04	0.07	0.12	0.19
4 year time block	3	firm x 4 year time block, year	0.26	0.16	0.09	0.04	0.02	0.03	0.07	0.14	0.25
2 year time block	7	firm x 2 year time block, year	0.16	0.10	0.06	0.03	0.03	0.04	0.06	0.11	0.15
D. Canay, Romano, and Shaikh											
2 year time block	-	firm x 2 year time block, year	0.16	0.11	0.06	0.04	0.03	0.03	0.06	0.10	0.15
E. Sensitivity Analysis and ad hoc Group Selection											
Sensitivity Analysis	-	-	0.48	0.33	0.20	0.06	0.02	0.05	0.17	0.31	0.44
ad hoc Group Selection	-	-	0.23	0.15	0.08	0.04	0.02	0.04	0.07	0.13	0.22

Note: Power of 5% level tests obtained from simulation study. Power is against the alternative that the parameter value is equal to $\beta_{0,LN\ AGE} + k s_{LN\ AGE}$ where k is given in the column labels, $\beta_{0,LN\ AGE}$ denotes the true parameter value, and $s_{LN\ AGE}$ is the standard error of the OLS estimator of $\beta_{0,LN\ AGE}$ from a model using only firm and time fixed effects obtained from the simulation. 1000 simulation replications were performed. Panel A shows results based on one-way clustering with critical values from a t-distribution with G-1 degrees of freedom where G is the number of clusters used in forming the one-way clustered standard errors. Panel B shows results based on using critical values from the moving blocks bootstrap. Panel C presents results based on Fama-MacBeth with critical values from a t-distribution with G-1 degrees of freedom where G is the number of groups. The G-1 used to obtain critical values for clustering or Fama-MacBeth is provided in the column "G-1" for reference. Panel D shows results based on the randomization inference procedure of Canay, Romano, and Shaikh (2014). Panel E presents results from the sensitivity analysis procedure and the *ad hoc* procedure for selecting groups. The column "Clusters" gives the level at which clustering or sample-splitting occurs, and the column "Fixed Effects" gives the levels of fixed effects that are included in the estimated model. Further details are provided in the main text, and details about the simulation design are given in a supplementary appendix.