ONLINE APPENDIX

"INVESTMENT CASH FLOW SENSITIVITY: FACT OR FICTION?"

Şenay Ağca

George Washington University

Abon Mozumdar

Virginia Tech

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APPENDIX A. Matching Cummins, Hasset, Oliner (2006) (CHO) (2006) Data and Compustat

We attempt to match CHO (2006) data with the Compustat data.[1] Since company identifiers are not available in the CHO (2006) data, we take the ratio of CF_t / K_t to I_t / K_t from CHO (2006) dataset and compare the resulting CF_t / I_t values with the CF_t / I_t and CF_{t+1} / I_t values obtained from the source dataset, Compustat. Each value from the CHO (2006) dataset is compared to all the values in the Compustat for that year. We consider a match if the ratio of the *CF*/*I* variables obtained from the CHO (2006) dataset to those obtained from the Compustat is within a tolerance band of 0.0001 or 0.00005. We allow multiple matches from Compustat. Since the 2000 version of Compustat is closer in date to that is used by CHO (2006), we also consider the 2000 version to match the CHO (2006) data in order to examine whether the results are sensitive to different versions of the Compustat. We present the results in Table A1. The results show that both versions of the Compustat produce comparable results, with a maximum of 45 percent matches between the CHO (2006) data and the Compustat.[2]

[1] We thank Stephen Oliner for suggesting this approach and for providing us the 2000 version of the Compustat obtained from CDs.

[2] We mainly concentrate on 1992 results since 1992 is used as base year to deflate the variables in CHO (2006) dataset, and price deflators are not available in the dataset. Hence, for years other than 1992, the variables are on real terms and therefore are expected to differ from the nominal values. For 1992, however, since the values are nominal and both *CF* and *I* variables are obtained from the Compustat in the CHO (2006) dataset, we expect to find a large percentage of matches between the two datasets for the correct series.

Table A1

Matching CHO (2006) Data and Compustat

Table A1 presents the results where the CHO (2006) data is matched with the Compustat using the ratio of cash flow to investment. Two cash flow series are considered: One that is contemporaneous to the analyzed year and one that is shifted one year ahead. The values in the CHO (2006) data are compared to all the values in the Compustat for a given year. Multiple matches from the Compustat are allowed. Two versions of the Compustat is considered: Compustat data obtained in 2000 and Compustat data obtained in 2011. A match is recognized when the variable obtained from the CHO (2006) data is within a narrow tolerance band of the one obtained from the Compustat. Tolerance bands are 0.005% and 0.01%.

		Compustat 2011				Compustat 2000			
		0.005% difference		0.01% difference		0.005% difference		0.01% difference	
Year	No. obs	CF_t/I_t	CF_{t+1}/I_t	CF_t/I_t	CF_{t+1}/I_t	CF_t/I_t	CF_{t+1}/I_t	CF_t/I_t	CF_{t+1}/I_t
1990	701	15%	14%	26%	25%	14%	13%	25%	23%
1991	750	13%	13%	26%	23%	13%	12%	25%	21%
1992	799	34%	14%	45%	26%	33%	13%	44%	24%
1993	840	14%	15%	28%	28%	13%	14%	26%	26%
1994	876	19%	18%	35%	29%	17%	17%	32%	28%
1995	908	18%	16%	34%	29%	17%	14%	32%	26%
1996	867	20%	15%	37%	29%	19%	14%	34%	27%
1997	799	19%	15%	33%	28%	17%	15%	30%	26%

APPENDIX B. Estimations with Matched Erickson and Whited (2000) (EW (2000)) Sample

We construct a sample by accessing Compustat data for the list of CUSIP numbers and all variables in Erickson and Whited (2000). For 590 firms, we obtain a match with EW (2000) except finished goods inventories (INVFG in Compustat and FGINV in EW (2000)) and income before extraordinary items (IB in Compustat and INC in EW (2000)).[3] Erickson and Whited (2010) corrected these errors based on the evidence of an earlier version.

We use original EW (2000) assumptions on this sample for the 1982-1995 period and omit observations with negative q values in the estimations. The results are given in Panel A of Table B1. Identification tests fail in 9 out of 14 years, and overidentifying restrictions hold in 4 years out of the remaining 5 years. These results show a large number of identification test failures and do not provide support for the insignificance of investment-cash flow sensitivity after addressing measurement error in q.

To consider the effects of outliers in these results, we winsorize investment, cash flow and q at the top and bottom one percentile annually. The results are given in Panel B of Table B1. Identification tests fail in 6 out of 14 years. In the remaining 8 years, half of the years have positive and significant investment-cash flow sensitivities with at least one GMM estimation. Thus the positive investment-cash flow sensitivity and the failure of identification tests cannot be attributed to the outliers.

[3] All variables match except the following variables: There are some variations in capital expenditure numbers but generally the differences are not large. There are also deviations in price and common shares outstanding but market value is mostly comparable. We also observe some deviations in employees and staff expense and rarely in operating income. We omitted firms where the variations are large. As a result, we have a sample of 590 firms.

Next, we apply the variable definitions employed in the paper (described in Appendix 1) to the matched EW (2000) data. Investment, cash flow and q are winsorized at the top and bottom percentile. The results are presented in Panel C of Table B1, and are comparable to the sample run with original EW (2000) assumptions (Panel A and Panel B): Only 5 years out of 14 years pass the identification tests, and 4 out of those 5 years show positive and significant investment-cash flow sensitivities with at least one GMM estimation.

Overall, the results using both the original EW (2000) assumptions as well as more standard variable definitions with matched EW (2000) data show support for the main findings presented in the paper: The significance of cash flow cannot be attributed to measurement errors in q and that cash flow is a significant determinant of investment.

TABLE B1

Higher Order Moments Estimation using Matched EW (2000) Sample

Table B1 reports OLS and GMM results from estimating

$$\frac{I_t}{K_{t-1}} = a + \beta_1 q_t + \beta_2 \frac{CF_t}{K_{t-1}} + e_t$$

with Q_E used as a mismeasured proxy for q for the 590 firms that matches the Erickson and Whited (2000) sample with Compustat. The data discrepancy in the data concerning income and finished goods inventories are corrected in this sample. In Panel A and Panel B, original EW (2000) assumptions are used for variable definitions and observations with negative Q_E values are omitted. In Panel C, variable definitions used in the main text is employed. Results are reported for the 1982-1995 period. In Panel B and Panel C, investment, cash flow and Q_E are winsorized at the bottom and top percentile. GMM estimates are obtained using the measurement error-consistent higher-order moments estimators of Erickson and Whited (2000). The set of perfectly measured regressors includes a constant and normalized cash flow. Robust standard errors for OLS and Newey-McFadden (1994) influence function adjusted standard errors for GMM are reported in parentheses. [a], [b], and [c] denote significance at the 1%, 5%, and 10% levels, respectively. Also reported are test statistics for identification tests and *J*-tests of over-identifying restrictions along with their *p*-values.

Panel A: EW(2000) variable definitions

Year	ID Test	J Test		QE				CF			
(No. of obs.)		GMM4	GMM5	OLS	GMM3	GMM4	GMM5	OLS	GMM3	GMM4	GMM5
1982	2.727	0.632	6.825	-0.078[a]	-0.1	-0.103	-0.104	1.329[a]	1.332	1.333	1.333
(486)	(0.256)	(0.729)	(0.234)	(0.014)	(0.005)	(0.002)	(0.002)	(0.006)	(0.003)	(0.003)	(0.003)
1983	0.281	2.548	56.381	0.001	0.006	0.015	0	0.177[a]	0.142	0.068	0.187
(495)	(0.869)	(0.28)	(0)	(0.005)	(0.143)	(0.022)	(0.011)	(0.065)	(1.188)	(0.203)	(0.119)
1984	1.501	3.605	8.182	0.013	0.066	0.035	0.023	0.01	-0.594	-0.249	-0.112
(498)	(0.472)	(0.165)	(0.147)	(0.009)	(0.031)	(0.019)	(0.005)	(0.13)	(0.547)	(0.344)	(0.127)
1985	1.412	0.041	10.102	-0.004	-0.051	-0.058	-0.065	0.511[b]	0.779	0.818	0.862
(506)	(0.493)	(0.98)	(0.072)	(0.009)	(0.028)	(0.015)	(0.004)	(0.202)	(0.167)	(0.191)	(0.134)
1986	3.044	4.192	7.371	-0.009	-0.163	-0.058	-0.071	0.557[a]	0.648	0.586	0.594
(520)	(0.218)	(0.123)	(0.194)	(0.011)	(0.196)	(0.011)	(0.018)	(0.064)	(0.147)	(0.041)	(0.04)
1987	2.172	5.321	5.538	0.011[b]	0.033	0.029	0.268	0.36[a]	0.358	0.358	0.329
(541)	(0.338)	(0.07)	(0.354)	(0.005)	(0.009)	(0.005)	(0.142)	(0.005)	(0.007)	(0.006)	(0.033)
1988	4.561	59.172	12.973	-0.013[b]	-0.687	-3.746	-1.503	0.649[a]	1.564	5.718	2.672
(556)	(0.102)	(0)	(0.024)	(0.006)	(2.94)	(65.75)	(8.32)	(0.042)	(3.862)	(88.491)	(11.307)
1989	4.028	0.777	4.562	-0.043[a]	-0.317	-0.255	-0.08	0.804[a]	0.804	0.804	0.804
(565)	(0.133)	(0.678)	(0.472)	(0.014)	(0.143)	(0.144)	(0.022)	(0.001)	(0.001)	(0)	(0.001)
1990	6.786	3.351	7.334	0.002	0.095[b]	0.125[a]	0.065[a]	0.382[a]	0.121	0.039	0.205
(580)	(0.034)	(0.187)	(0.197)	(0.009)	(0.048)	(0.031)	(0.023)	(0.099)	(0.233)	(0.188)	(0.138)
1991	7.839	4.911	19.247	-0.008	0.07	0.255	0.031	0.468[a]	0.371	0.141	0.42[a]
(590)	(0.020)	(0.086)	(0.002)	(0.012)	(0.285)	(0.252)	(0.032)	(0.14)	(0.521)	(0.457)	(0.153)
1992	4.476[a]	2.065	3.731	0.006	0.051	0.043	0.024	0.236[a]	-0.067	-0.014	0.118
(590)	(0.107)	(0.356)	(0.589)	(0.004)	(0.041)	(0.024)	(0.01)	(0.054)	(0.293)	(0.19)	(0.09)
1993	10.928	1.389	5.775	0.01[a]	0.032[a]	0.026[a]	0.034[a]	0.121[a]	0.035	0.058[c]	0.029
(590)	(0.004)	(0.499)	(0.329)	(0.003)	(0.007)	(0.004)	(0.003)	(0.039)	(0.042)	(0.03)	(0.03)
1994	16.436	2.743	3.764	0.009[b]	0.093	0.025[a]	0.022[a]	0.137[a]	-0.233	0.065[b]	0.08[a]
(590)	0.000	(0.254)	(0.584)	(0.004)	(0.167)	(0.005)	(0.004)	(0.035)	(0.76)	(0.033)	(0.029)
1995	7.289	2.385	5.061	0.018[a]	0.032[a]	0.053[a]	0.051[a]	0.084[a]	0.043	-0.021	-0.014
(590)	(0.026)	(0.304)	(0.408)	(0.003)	(0.008)	(0.008)	(0.01)	(0.023)	(0.033)	(0.044)	(0.043)

Table B1 - *continued*

Panel B: EW(2000) variable definitions – winsorized sample

Year (No.of obs.)	ID Test	J Test		QE				CF			
		GMM4	GMM5	OLS	GMM3	GMM4	GMM5	OLS	GMM3	GMM4	GMM5
1982	4.306	1.619	4.963	0.013	0.067	0.077	0.085	0.192^{b}	-0.155	-0.215	-0.27
(486)	(0.116)	(0.445)	(0.42)	(0.008)	(0.019)	(0.019)	(0.028)	(0.08)	(0.186)	(0.183)	(0.204)
1983	3.473	0.228	5.699	0.015^{a}	0.06	0.072	0.079	0.208^{a}	-0.058	-0.13	-0.17
(4950	(0.176)	(0.892)	(0.337)	(0.005)	(0.028)	(0.018)	(0.012)	(0.055)	(0.153)	(0.134)	(0.102)
1984	3.91	1.995	6.652	0.018^{a}	0.055	0.054	0.044	0.173^{b}	-0.17	-0.163	-0.067
(498)	(0.142)	(0.369)	(0.248)	(0.006)	(0.01)	(0.009)	(0.009)	(0.082)	(0.12)	(0.114)	(0.093)
1985	5.768	1.425	3.831	0.023^{a}	0.049^{a}	0.051^{a}	0.065^{a}	0.117^{b}	-0.03	-0.039	-0.116
(506)	(0.056)	(0.491)	(0.574)	(0.006)	(0.008)	(0.01)	(0.005)	(0.049)	(0.062)	(0.074)	(0.072)
1986	10.418	1.39	12.219	0.002	0.019	0.034^{a}	0.019	0.434^{a}	0.35^{a}	0.27^{b}	0.347^{a}
(520)	(0.005)	(0.499)	(0.032)	(0.005)	(0.016)	(0.01)	(0.004)	(0.068)	(0.127)	(0.106)	(0.071)
1987	5.805	1.747	5.219	0.014^{a}	0.041^{a}	0.05^{a}	0.05^{a}	0.218^{a}	0.06	0.01	0.009
(541)	(0.055)	(0.418)	(0.39)	(0.005)	(0.009)	(0.004)	(0.003)	(0.056)	(0.062)	(0.057)	(0.058)
1988	5.575	2.934	6.682	0.006^{b}	0.032^{c}	0.066^{b}	0.04^{a}	0.202^{a}	0.041	-0.169	-0.005
(556)	(0.062)	(0.231)	(0.245)	(0.003)	(0.017)	(0.032)	(0.009)	(0.028)	(0.108)	(0.198)	(0.063)
1989	11.445	1.819	13.082	0.008^{b}	0.019	0.039^{a}	0.013	0.266^{a}	0.211^{b}	0.113	0.243^{a}
(565)	(0.003)	(0.403)	(0.023)	(0.004)	(0.016)	(0.01)	(0.009)	(0.05)	(0.092)	(0.072)	(0.077)
1990	6.395	2.768	15.092	-0.005	-0.006	-0.085^{a}	0	0.464^{a}	0.469^{a}	0.879^{a}	0.438
(580)	(0.041)	(0.251)	(0.01)	(0.005)	(0.031)	(0.026)	(0)	(0.067)	(0.177)	(0.161)	(12.00)
1991	3.886	1.183	6.89	0.009^{b}	0.049	0.053	0.053	0.175^{a}	-0.013	-0.033	-0.033
(590)	(0.143)	(0.554)	(0.229)	(0.004)	(0.025)	(0.027)	(0.024)	(0.042)	(0.115)	(0.125)	(0.121)
1992	4.67	0.924	4.634	0.006^{a}	0.028^{a}	0.026^{a}	0.018^{a}	0.197^{a}	0.043	0.061	0.117^{b}
(590)	(0.097)	(0.63)	(0.462)	(0.002)	(0.01)	(0.007)	(0.005)	(0.03)	(0.082)	(0.061)	(0.048)
1993	3.831	1.702	3.966	0.008^{a}	0.031	0.029	0.038	0.169^{a}	0.028	0.038	-0.016
(590)	(0.147)	(0.427)	(0.554)	(0.002)	(0.012)	(0.008)	(0.007)	(0.024)	(0.076)	(0.054)	(0.048)
1994	4.418	0.614	5.466	0.006^{a}	0.022	0.024	0.022	0.206^{a}	0.09	0.076	0.091
(590)	(0.110)	(0.736)	(0.362)	(0.002)	(0.013)	(0.012)	(0.006)	(0.023)	(0.099)	(0.085)	(0.046)
1995	7.404	3.603	4.451	0.017^{a}	0.037^{a}	0.031^{a}	0.04^{a}	0.105^{a}	0.019	0.045	0.007
(590)	(0.025)	(0.165)	(0.487)	(0.003)	(0.007)	(0.008)	(0.011)	(0.025)	(0.038)	(0.039)	(0.048)

Table B1 - *continued*

Panel C: Variable definitions in Main Appendix- Winsorized Sample

Year (No. of obs.)	ID Test	J Test		QE				CF			
		GMM4	GMM5	OLS	GMM3	GMM4	GMM5	OLS	GMM3	GMM4	GMM5
1982	4.159	5.137	6.581	0.094[b]	0.489	0.641	0.477	0.216[a]	0.034	-0.035	0.04
(486)	(0.125)	(0.077)	(0.254)	(0.042)	(0.165)	(0.096)	(0.129)	(0.066	(0.092)	(0.096)	(0.086)
1983	5.442	5.602	12.664	0.031	-0.284	-2.334	-0.003	0.253[a]	0.376[b]	1.177	0.266
(495)	(0.066)	(0.061)	(0.027)	(0.027)	(0.473)	(2.125)	(0.256)	(0.063	(0.188)	(0.898)	(0.117)
1984	3.629	0.717	2.518	0.085[a]	0.269	0.293	0.28	0.16[a]	0.04	0.024	0.032
(498)	(0.163)	(0.699)	(0.774)	(0.025)	(0.044)	(0.024)	(0.033)	(0.049	(0.05)	(0.053)	(0.06)
1985	5.89	3.495	8.495	0.1[a]	0.275[a]	0.247[a]	0.612[a]	0.103[a]	0.041	0.051[b]	-0.078
(506)	(0.053)	(0.174)	(0.131)	(0.021)	(0.052)	(0.034)	(0.184)	(0.03)	(0.029)	(0.026)	(0.099)
1986	2.166	0.226	11.217	0.026	0.153	0.199	0.116	0.247[a]	0.184	0.162	0.203
(520)	(0.339)	(0.893)	(0.047)	(0.017)	(0.128)	(0.086)	(0.033)	(0.039	(0.077)	(0.062)	(0.044)
1987	2.042	0.799	2.809	0.035[b]	0.18	0.262	0.23	0.127[a]	0.035	-0.017	0.003
(541)	(0.360)	(0.67)	(0.729)	(0.015)	(0.146)	(0.106)	(0.047)	(0.036	(0.094)	(0.063)	(0.039)
1988	0.058	1.031	9.5	0.029[a]	0.002	0.004	0.003	0.137[a]	0.151	0.15	0.151
(556)	(0.971)	(0.597)	(0.091)	(0.011)	(1.065)	(0.352)	(0.177)	(0.024	(0.568)	(0.192)	(0.102)
1989	0.112	1.72	2.961	0.032[a]	0.59	0.013	0.382	0.141[a]	-0.195	0.152	-0.07
(565)	(0.945)	(0.423)	(0.706)	(0.012)	(5.807)	(1.027)	(0.129)	(0.024	(3.501)	(0.62)	(0.096)
1990	5.935	0.939	9.712	0.002	0.086	0.016	0.376	0.186[a]	0.115	0.174[a]	-0.131
(580)	(0.051)	(0.625)	(0.084)	(0.009)	(0.093)	(0.039)	(0.156)	(0.028	(0.084)	(0.037)	(0.145)
1991	5.442	2.13	7.354	0.052[a]	0.174[a]	0.077	0.06[b]	0.075[a]	0.015	0.062[b]	0.071[a]
(590)	(0.066)	(0.345)	(0.196)	(0.013)	(0.048)	(0.047)	(0.027)	(0.022	(0.03)	(0.027)	(0.022)
1992	2.158	4.183	8.685	0.019[b]	0.062	0.001	0.032	0.141[a]	0.111	0.155	0.132
(590)	(0.340)	(0.124)	(0.122)	(0.008)	(0.046)	(0.07)	(0.029)	(0.021	(0.04)	(0.057)	(0.027)
1993	7.394	1.98	14.442	0.015[b]	-0.25	-1.091	-0.002	0.114[a]	0.255	0.702	0.123
(590)	(0.025)	(0.371)	(0.013)	(0.006)	(0.38)	(1.582)	(0.041)	(0.017	(0.198)	(0.843)	(0.027)
1994	1.468	5.195	6.67	0.024[a]	-0.092	-0.002	-0.075	0.105[a]	0.155	0.117	0.148
(590)	(0.480)	(0.074)	(0.246)	(0.007)	(0.217)	(0.11)	(0.096)	(0.014	(0.092)	(0.048)	(0.042)
1995	2.468	1.308	9.721	0.042[a]	0.132	0.158	0.099	0.088[a]	0.067	0.061	0.075
(590)	(0.291)	(0.52)	(0.084)	(0.013)	(0.123)	(0.08)	(0.055)	(0.023	(0.034)	(0.029)	(0.027)

APPENDIX C. Estimations with Alternative Variable Definitions

Estimations with CHO (2006) Definitions

In the paper, we calculate q based on more standard definitions in the literature. Here, we calculate q using the same assumptions as in CHO (2006). In this regard, we look at 1982-1999 period as in CHO (2006) and define q as follows:

(C1)
$$Q_{it} = \frac{1}{(1-\tau_t)}\left[\left(\frac{L_{it}V_{it}+B_{it}-A_{it}-C_{it}}{p_t^k(1-\delta)K_{it-1}}\right)-\frac{p_t^k(1-\Gamma_{it})}{p_t}\right]$$

For marginal tax rate τ, we use effective marginal tax rates based on 2 digit SIC codes, obtained from the Report to the Congress on Depreciation Recovery Periods and Methods (2000). L is an indicator variable that equals to 1 if a firm is not paying dividends and $(1-m_i)/(1-z_i)$ if the firm is paying dividends, where m_i is the personal tax rate on dividends, and z_i is the accrual equivalent capital gains tax rate. These tax rates are obtained from Kemsley, Nissim and Williams (2004). V is either analyst forecast based stock value or market based stock value. Market based firm value is stock price (prcc_f) multiplied by the number of shares outstanding (csho). Analyst forecast based stock value is analyst forecast based equity value as in equation (10) multiplied by the number of shares outstanding. B is the book value of outstanding debt (the sum of short term debt (dlc) and long term debt (dltt)). Marginal effective tax rates used in the calculation includes depreciation allowance. Hence we do not include A (present value of depreciation allowances) additionally. C is net current assets (total current assets (act) - total current liabilities excluding debt in current liabilities (lct-dlc)). p^k is the price of capital goods and p is the price of output, both of which are obtained from the NBER-CES Manufacturing Industry Database. δ is the depreciation allowance determined at the industry level using Hulten and Wykoff (1981). As we use effective corporate tax rates, present value of tax benefits i.e. Γ are not included in addition.

K_{t-1} is calculated using the standard perpetual inventory model with the first firm observation set to the first net plant property and equipment (ppent) of the firm. Investment, q and cash flow are winsorized at the top and bottom one percentile.

The results are reported in Panel A of Table C1. We carry out OLS, static GMM (as in Table 2) and dynamic GMM (as in Table 3) estimations for the same sample period as in CHO (2006), which is 1982-1999. The number of observations reported in the table is lower than those found by using *q* values that are more standard in the literature as reported in Table 3, since the calculated *q* measure using the formula in equation (C1) provides a large number of negative values and outliers, which are eliminated.

Estimations using EW (2000) variable definitions

We use variable definitions of Erickson and Whited (2000) are used for the sample period 1982-1995 (the same sample period as in Erickson and Whited, 2000) and GMM estimates are obtained using the measurement error-consistent higher-order moments estimators of Erickson and Whited (2000). Results are reported in In Panel B of Table C1. Although estimations pass identification tests, overidentifying restrictions are satisfied in half of the years out of 14 years with GMM4 estimations and only in 3 years with GMM5 estimations. For the panel estimations, over-identifying restrictions do not hold for both GMM4 and GMM5 estimations. When we look at yearly estimates, cash flow is a positive and significant determinant of investment in 11 out of 14 years (only the period 1982-1984 show insiginificant cash flow coefficients). Panel estimations also show positive and significant cash flow coefficients with GMM3 estimations. Thus, employing the same variable definitions as in EW (2000) do still show that cash flow cannot be disregarded as an artifact of measurement error.

Table C1

Alternative Variable Definitions

Table C1 reports OLS, static GMM, dynamic GMM and higher order moments GMM estimations using alternative variable definitions. In Panel A, variable definitions of Cummins, Hasset and Oliner (2006) are used for the sample period of 1984-1999. In Panel A, static model corresponds to the model presented in Table 2, and the dynamic model corresponds to the one given in Table 3. For both the static and dynamic model estimations given in Panel A, the first set of results include 3rd and 4th lags of normalized investment and cash flow as instruments. In the second set of results, 3rd and 4th lags are used as instruments when both lags are available, and only 3rd lags are used when 4th lags are not available. In the third set of results, all available lags of length greater than 2 of normalized investment and cash flow are included as instruments. In Panel B, variable definitions of Erickson and Whited (2000) are used for the sample period 1982-1995 and GMM estimates are obtained using the measurement error-consistent higher-order moments estimators of Erickson and Whited (2000). In Panel B, results are reported for yearly estimations as well as for panel data (given at the bottom of Panel B). In the panel data estimations, the variables are demeaned to include fixed effects. Robust standard errors are reported in parentheses. [a], [b], and [c] denote significance at the 1%, 5%, and 10% levels, respectively. Panel A reports *p*-values for *J*-tests for over-identifying conditions and m_2 tests for second order serial correlation as in Arellano and Bond (1991). In Panel B, robust standard errors for OLS and Newey-McFadden (1994) influence function adjusted standard errors for GMM are reported in parentheses. Also reported in Panel B are statistics for identification tests and *J*-tests of over-identifying restrictions along with their *p*-values.

Panel A: CHO (2006) Variable Definitions

Sample and Instruments	Q_E	$\hat{Q}$	CF/K	I/K	J	m_2
Ordinary Least Squares Estimation						
	0.059[a]		0.146[a]			
Sample period: 1984-1999	(0.008)		(0.023)			
Number of firms: 536		0.042[a]	0.158[a]			
Number of observations: 3808		(0.011)	(0.023)			
	0.053[a]	0.015	0.146[a]			
	(0.009)	(0.011)	(0.023)			
Static Model GMM						
	0.102[b]		0.178[a]		0.582	0.019
Sample period: 1986-1999	(0.045)		(0.067)			
Number of firms: 536		0.100[c]	0.182[a]		0.674	0.016
Number of observations: 2200		(0.052)	(0.063)			
Instruments used:	0.084[a]	0.023	0.176[a]		0.641	0.023
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$, $i = 3,4$	(0.078)	(0.083)	(0.065)			
	0.084[c]		0.179[b]		0.593	0.005
Sample period: 1984-1999	(0.049)		(0.071)			
Number of firms: 536		0.085	0.183[a]		0.494	0.005
Number of observations: 3272		(0.057)	(0.067)			
Instruments used:	0.060	0.041	0.174[b]		0.554	0.005
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$,	(0.062)	(0.067)	(0.069)			
i =3, min(t-1,4)						

Table C1 – *continued*

Sample and Instruments	Q_E	$\hat{Q}$	CF/K	I/K	J	m_2
	0.100[a]		0.122[b]		0.495	0.003
Sample period: 1984-2013	(0.028)		(0.056)			
Number of firms: 536		0.100[a]	0.128[b]		0.253	0.003
Number of observations: 3272		(0.038)	(0.053)			
Instruments used:	0.084[b]	0.034	0.113[b]		0.453	0.003
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$,	(0.035)	(0.045)	(0.055)			
i =3,4,….,t-1						
Dynamic Model GMM						
Sample period: 1986-1999	0.096[b]		0.141[b]	-0.177[b]	0.593	0.008
Number of firms: 536	(0.050)		(0.069)	(0.076)		
Number of observations: 2200		0.085[c]	0.177[a]	-0.118	0.439	0.017
Instruments used:		(0.054)	(0.062)	(0.055)		
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$, i = 3,4	0.121	-0.048	0.136[b]	-0.160[b]	0.567	0.016
	(0.085)	(0.082)	(0.071)	(0.079)		
Sample period: 1984-2013	0.106[b]		0.114[c]	-0.242[a]	0.664	0.001
Number of firms: 2654	(0.058)		(0.070)	(0.089)		
Number of observations: 25921		0.087	0.146[b]	0.187[a]	0.509	0.001
Instruments used:		(0.065)	(0.069)	(0.094)		
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$,	0.113[c]	-0.004	0.110	-0.258[a]	0.665	0.001
i =3, min(t-1,4)	(0.068)	(0.070)	(0.072)	(0.094)		
Sample period: 1984-2013	0.098[a]		0.089[c]	-0.122[c]	0.503	0.001
Number of firms: 2654	(0.032)		(0.054)	(0.070)		
Number of observations: 25921		0.090[b]	0.109[b]	-0.069	0.270	0.001
Instruments used:		(0.037)	(0.053)	(0.070)		
$(I/K)_{t-i}$ and $(CF/K)_{t-i}$,	0.092[a]	0.013	0.088[c]	-0.120[c]	0.438	0.001
i =3,4,….,t-1	(0.036)	(0.042)	(0.052)	(0.045)		

Table C1 - *continued*

Panel B: EW (2000) Variable Definitions

Year (No. of obs.)	ID Test	J-Test		QE				CF			
		GMM4	GMM5	OLS	GMM3	GMM4	GMM5	OLS	GMM3	GMM4	GMM5
1982	8.79	1.793	6.539	0.021^{a}	0.066^{a}	0.07^{a}	0.077^{a}	0.259^{a}	0.055	0.04	0.009
(1,449)	(0.01)	(0.408)	(0.257)	(0.004)	(0.008)	(0.006)	(0.002)	(0.039)	(0.048)	(0.049)	(0.047)
1983	15.87	0.528	12.983	0.012^{a}	0.04^{a}	0.041^{a}	0.06^{a}	0.21^{a}	0.071	0.067	-0.03
(1,511)	0.00	(0.768)	(0.024)	(0.002)	(0.006)	(0.006)	(0.005)	(0.035)	(0.047)	(0.049)	(0.063)
1984	11.17	7.372	9.748	0.011^{a}	0.035^{a}	0.029	0.033	0.157^{a}	0.067	0.086	0.073
(1,504)	(0.00)	(0.025)	(0.083)	(0.002)	(0.005)	(0.003)	(0.001)	(0.031)	(0.042)	(0.035)	(0.041)
1985	15.05	4.189	11.103	0.015^{a}	0.038^{a}	0.035^{a}	0.037	0.158^{a}	0.106^{a}	0.115^{a}	0.108
(1,544)	(0.00)	(0.123)	(0.049)	(0.003)	(0.004)	(0.003)	(0.002)	(0.03)	(0.039)	(0.036)	(0.038)
1986	10.38	5.145	11.92	0.012^{b}	0.07^{a}	0.072	0.044	0.352^{a}	0.197^{c}	0.193	0.267
(1,546)	(0.01)	(0.076)	(0.036)	(0.005)	(0.012)	(0.009)	(0.007)	(0.056)	(0.104)	(0.087)	(0.067)
1987	18.61	2.148	6.163	0.013^{a}	0.043^{a}	0.04^{a}	0.03^{a}	0.219^{a}	0.167^{a}	0.172^{a}	0.19^{a}
(1,585)	0.00	(0.342)	(0.291)	(0.003)	(0.006)	(0.006)	(0.003)	(0.042)	(0.053)	(0.053)	(0.043)
1988	23.87	2.161	12.621	0.011^{a}	0.033^{a}	0.031^{a}	0.024	0.195^{a}	0.169^{a}	0.171^{a}	0.179
(1,567)	0.00	(0.339)	(0.027)	(0.002)	(0.007)	(0.007)	(0.003)	(0.029)	(0.036)	(0.034)	(0.031)
1989	14.83	0.554	15.583	0.011^{a}	0.032^{a}	0.031^{a}	0.026	0.151^{a}	0.11^{a}	0.111^{a}	0.122
(1,546)	(0.00)	(0.758)	(0.008)	(0.002)	(0.004)	(0.004)	(0.003)	(0.021)	(0.028)	(0.029)	(0.023)
1990	11.99	6.439	11.651	0.009^{a}	0.048^{a}	0.038	0.038	0.231^{a}	0.207^{a}	0.213	0.213
(1,600)	(0.00)	(0.04)	(0.04)	(0.002)	(0.007)	(0.005)	(0.005)	(0.037)	(0.051)	(0.045)	(0.044)
1991	19.53	1.468	12.477	0.013^{a}	0.037^{a}	0.037^{a}	0.031	0.144^{a}	0.111^{a}	0.111^{a}	0.12
(1,682)	0.00	(0.48)	(0.029)	(0.002)	(0.004)	(0.004)	(0.003)	(0.026)	(0.033)	(0.034)	(0.028)
1992	35.47	13.898	31.839	0.008^{a}	0.014^{a}	0.021	0.031	0.027^{b}	0.035^{b}	0.044	0.056
(1,641)	0.00	(0.001)	(0)	(0.001)	(0.001)	(0.002)	(0.003)	(0.013)	(0.016)	(0.024)	(0.034)
1993	29.73	8.372	24.95	0.008^{a}	0.014^{a}	0.018	0.016	0.049^{a}	0.069^{a}	0.082	0.077
(1,573)	0.00	(0.015)	(0)	(0.001)	(0.001)	(0.001)	(0.001)	(0.011)	(0.013)	(0.018)	(0.015)
1994	31.83	16.507	30.024	0.008^{a}	0.013^{a}	0.021	0.025	0.054^{a}	0.068^{a}	0.092	0.102
(1,524)	0.00	(0)	(0)	(0.001)	(0.001)	(0.002)	(0.002)	(0.011)	(0.013)	(0.022)	(0.028)
1995	17.31	10.004	16.981	0.012^{a}	0.024^{a}	0.023	0.044	0.074^{a}	0.051^{a}	0.052	0.014
(1,470)	0.00	(0.007)	(0.005)	(0.001)	(0.002)	(0.002)	(0.006)	(0.013)	(0.015)	(0.015)	(0.033)

	17.41	18.634	38.735	0.012^{a}	0.066^{a}	0.032^{a}	0.035^{a}	0.159^{a}	0.095^{a}	0.136^{a}	0.132^{a}
1982-1995	0.00	(0.000)	(0.000)	(0.001)	(0.023)	(0.003)	(0.003)	(0.010)	(0.033)	(0.012)	(0.011)
(21,742)											