Technical Document: Testing Portfolios

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Abstract

This Technical Document details the construction of the testing portfolios posted at `global-q.org` based on Hou, Xue, and Zhang (2020).

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1 Overview

We provide testing portfolios data for 187 anomalies, which are grouped into six categories, momentum (41), value-growth (32), investment (29), profitability (45), intangibles (30), and frictions (10). This section offers an overview of this Technical Document, Section 2 details variable definitions and portfolio constructions, and Section 3 describes our delisting adjustment for stock returns.

Stock Sample Our sample includes all NYSE, Amex, and Nasdaq common stocks with a CRSP share code of 10 or 11. We exclude financial firms (SIC between 6000 and 6999) and firms with negative book equity. Stock returns are adjusted for delisting. The sample period is from January 1967 to December 2020. Due to data limitations, some testing portfolios start later than January 1967.

Anomaly Selection Our anomalies are a subset of the 452 anomalies in Hou, Xue, and Zhang (2020). We first include the 158 anomalies that are significant ($|t| \geq 1.96$) in their original sample from January 1967 to December 2016. We then add anomalies that have become significant in three subsequent sample extensions, including 11 anomalies from the extension through December 2018 (Hou, Mo, Xue, and Zhang 2021), one through December 2019, and two through December 2020. For anomalies that have become insignificant over time since the first release of our data library, we continue their coverage to maintain backward compatibility with our prior releases. We also include Hou et al.'s expected growth with 1-, 6-, and 12-month holding periods. Finally, we add 12 anomalies that are prominent in empirical asset pricing, even though these anomalies are insignificant.[1]

Portfolio Construction For each anomaly variable, we provide value-weighted returns for one-way deciles and two-way (3 by 5) independently sorted portfolios by interacting the anomaly variable with market equity (size). We use NYSE breakpoints on a given anomaly variable. For size in the

[1]The 12 insignificant anomalies are standardized unexpected earnings (6-month holding period, Sue6), long-term reversal (1-month holding period, Rev1), dividend yield (Dp), payout yield (Op), total accruals (Ta), operating profits to equity (Ope), market equity (Me), idiosyncratic volatility per the Fama-French 3-factor model (1-month holding period, Ivff1), idiosyncratic volatility per the q-factor model (1-month holding period, Ivq1), total volatility (1-month holding period, Tv1), market beta (1-month holding period, β1), and short-term reversal (Srev).

two-way sorts, we split stocks into micro-, small-, and big-cap portfolios. Microcaps are below the NYSE 20th percentile of the market equity, small caps are between the 20th and 50th percentile, and big caps are above the 50th percentile. We provide portfolio returns in various frequencies, including daily, weekly (calendar, Friday close to Friday close), weekly (Wednesday-to-Wednesday, Wednesday close to Wednesday close), monthly, quarterly, and annual. We compute monthly portfolio returns using the end-of-prior-month market equity as weights, and we compute daily portfolio returns using the end-of-prior-day market equity as weights. We then compound monthly portfolio returns into quarterly and annual, and we compound daily portfolio returns into weekly.

Data Format The data files are in CSV format and the returns are in percent. We also provide the number of unique stocks for monthly and daily portfolios. We record missing portfolio-period observations as empty values and the corresponding number of stocks as zero.

Update Schedule The testing portfolios data will be updated annually in each April.

2 Variable Definitions and Portfolio Construction

2.1 Momentum

2.1.1 Sue1 and Sue6, Standardized Unexpected Earnings

Per Foster, Olsen, and Shevlin (1984), Sue denotes Standardized Unexpected Earnings, and is calculated as the change in split-adjusted quarterly earnings per share (Compustat quarterly item EPSPXQ divided by item AJEXQ) from its value four quarters ago divided by the standard deviation of this change in quarterly earnings over the prior eight quarters (six quarters minimum). At the beginning of each month t, we split all stocks into deciles based on their most recent past Sue. Before 1972, we use the most recent Sue computed with quarterly earnings from fiscal quarters ending at least four months prior to the portfolio formation. Starting from 1972, we use Sue computed with quarterly earnings from the most recent quarterly earnings announcement dates (Compustat quarterly item RDQ). For a firm to enter our portfolio formation, we require the end of the fiscal quarter

that corresponds to its most recent Sue to be within six months prior to the portfolio formation. We do so to exclude stale information on earnings. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (Sue1) and from month t to $t+5$ (Sue6). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Sue6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Sue6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Sue and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Sue1) and from month t to $t+5$ (Me-Sue6). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Sue6 mean that for a given Me-Sue6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Sue6 portfolio.

2.1.2 Abr1, Abr6, and Abr12, Cumulative Abnormal Returns Around Earnings Announcement Dates

We calculate cumulative abnormal stock return (Abr) around the latest quarterly earnings announcement date (Compustat quarterly item RDQ) (Chan, Jegadeesh, and Lakonishok 1996):

$$\text{Abr}_i = \sum_{d=-2}^{+1} r_{id} - r_{md}, \tag{1}$$

in which r_{id} is stock i's return on day d (with the earnings announced on day 0) and r_{md} is the value-weighted portfolio return of all NYSE, Amex, and Nasdaq common stocks with a CRSP share code of 10 or 11. We cumulate returns until one (trading) day after the announcement date to account for the 1-day-delayed reaction to earnings news.

At the beginning of each month t, we split all stocks into deciles based on their most recent past Abr. For a firm to enter our portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Abr to be within six months prior to the portfolio formation. We do so to exclude stale information on earnings. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (Abr1), from month t to $t+5$ (Abr6), and from month t to $t+11$ (Abr12). The deciles are rebalanced at the beginning of month $t+1$. The 6-month holding period for Abr6 means that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Abr6 decile. Because quarterly earnings announcement dates are largely unavailable before 1972, the Abr portfolios start in January 1972.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Abr and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Abr1), from month t to $t+5$ (Me-Abr6), and from month t to $t+11$ (Me-Abr12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Abr6 mean that for a given Me-Abr6 portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Abr6 portfolio.

2.1.3 Re1 and Re6, Revisions in Analyst Earnings Forecasts

Following Chan, Jegadeesh, and Lakonishok (1996), we measure earnings surprise as the revisions in analysts' forecasts of earnings obtained from the Institutional Brokers' Estimate System (IBES). Because analysts' forecasts are not necessarily revised each month, we construct a 6-month moving

average of past changes in analysts' forecasts:

$$\text{Re}_{it} = \frac{1}{6}\sum_{\tau=1}^{6} \frac{f_{it-\tau} - f_{it-\tau-1}}{p_{it-\tau-1}}, \tag{2}$$

in which $f_{it-\tau}$ is the consensus mean forecast (unadjusted IBES file, item MEANEST) issued in month $t-\tau$ for firm i's current fiscal year earnings (fiscal period indicator = 1), and $p_{it-\tau-1}$ is the prior month's share price (unadjusted file, item PRICE). We require both earnings forecasts and share prices to be denominated in U.S. dollars (currency code = USD). We also adjust for any stock splits and require a minimum of four monthly forecast changes when constructing Re. At the beginning of each month t, we split all stocks into deciles based on Re. Decile returns are calculated for the current month t (Re1) and from month t to $t+5$ (Re6). The deciles are rebalanced at the beginning of month $t+1$. The 6-month holding period for Re6 means that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Re6 decile. Because analyst forecast data start in January 1976, the Re portfolios start in July 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Re and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Re1) and from month t to $t+5$ (Me-Re6). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Re6 mean that for a given Me-Re6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Re6 portfolio.

2.1.4 $R^6$1, $R^6$6, and $R^6$12, Prior Six-month Returns

At the beginning of each month t, we split all stocks into deciles based on their prior 6-month returns, R^6, from month $t-7$ to $t-2$. Skipping month $t-1$, we calculate decile returns, separately,

for month t ($R^6 1$), from month t to $t+5$ ($R^6 6$), and from month t to $t+11$ ($R^6 12$). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $R^6 6$ mean that for a given $R^6 6$ decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdeciles returns as the return of the $R^6 6$ decile. We do not impose a price screen to exclude stocks with prices per share below \$5.

At the beginning of each month t, we also sort stocks into quintiles based on R^6 and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-$R^6 1$), from month t to $t+5$ (Me-$R^6 6$), and from month t to $t+11$ (Me-$R^6 12$). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-$R^6 6$ mean that for a given Me-$R^6 6$ portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$R^6 6$ portfolio.

2.1.5 $R^{11}1$, $R^{11}6$, and $R^{11}12$, Prior 11-month Returns

We split all stocks into deciles at the beginning of each month t based on their prior 11-month returns, R^{11}, from month $t-12$ to $t-2$. Skipping month $t-1$, we calculate decile returns for month t ($R^{11}1$), from month t to $t+5$ ($R^{11}6$), and from month t to $t+11$ ($R^{11}12$). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $R^{11}6$ mean that for a given $R^{11}6$ decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the $R^{11}6$ decile.

At the beginning of each month t, we also sort stocks into quintiles based on R^{11} and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-$R^{11}1$), from month t to $t+5$ (Me-$R^{11}6$), and from month t to $t+11$ (Me-$R^{11}12$). The portfolios are rebalanced at the beginning of

month $t+1$. Holding periods longer than one month like in Me-$R^{11}6$ mean that for a given Me-$R^{11}6$ portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$R^{11}6$ portfolio.

2.1.6 Im1, Im6, and Im12, Industry Momentum

We start with the Fama-French (1997) 49-industry classifications. Excluding financial firms from the sample leaves 45 industries. At the beginning of each month t, we sort industries based on their Im, which is the prior 6-month value-weighted returns from $t-6$ to $t-1$. Following Moskowitz and Grinblatt (1999), we do not skip month $t-1$. We form nine portfolios ($9\times5=45$), each of which contains five different industries. We define the return of a given portfolio as the simple average of the five industry returns within the portfolio. We calculate portfolio returns for the nine portfolios for the current month t (Im1), from month t to $t+5$ (Im6), and from month t to $t+11$ (Im12). The portfolios are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Im6 mean that for a given portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Im6 portfolio.

At the beginning of each month t, we also sort industries into quintiles ($5\times9=45$) based on their Im, each of which contains nine different industries. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. We define the return of a given Me-Im portfolio as the simple average of the nine industry returns within the portfolio. The industry returns are value-weighted and include only member stocks within a given Me-Im portfolio. Portfolio returns are calculated for the current month t (Me-Im1), from month t to $t+5$ (Me-Im6), and from month t to $t+11$ (Me-Im12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Im6 mean that for a given Me-Im6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Im6 portfolio.

2.1.7 Rs1, Revenue Surprises

Following Jegadeesh and Livnat (2006), we measure revenue surprises (Rs) as changes in revenue per share (Compustat quarterly item SALEQ/(item CSHPRQ times item AJEXQ)) from its value four quarters ago divided by the standard deviation of this change in quarterly revenue per share over the prior eight quarters (six quarters minimum). At the beginning of each month t, we split stocks into deciles based on their most recent past Rs. Before 1972, we use the most recent Rs computed with quarterly revenue from fiscal quarters ending at least four months prior to the portfolio formation. Starting from 1972, we use Rs computed with quarterly revenue from the most recent quarterly earnings announcement dates (Compustat quarterly item RDQ). Jegadeesh and Livnat report that quarterly revenue data are generally available when earnings are announced. For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Rs to be within six months prior to the portfolio formation. This restriction is imposed to exclude stale revenue information. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (Rs1) and the deciles are rebalanced at the beginning of month $t+1$.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Rs and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Rs1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.1.8 dEf1, dEf6, and dEf12, Changes in Analyst Earnings Forecasts

Following Hawkins, Chamberlin, and Daniel (1984), we define $\text{dEf} \equiv (f_{it-1} - f_{it-2})/(0.5\,|f_{it-1}| + 0.5\,|f_{it-2}|)$, in which f_{it-1} is the consensus mean forecast (unadjusted IBES file, item MEANEST) issued in month $t-1$ for firm i's current fiscal year earnings (fiscal period indicator = 1). We require earnings forecasts to be denominated in U.S. dollars (currency code = USD). We also adjust for

any stock splits between months $t-2$ and $t-1$ when constructing dEf. Firms with zero dEf are excluded to avoid stale forecasts. At the beginning of each month t, we sort stocks into deciles on their prior month dEf, and calculate decile returns for the current month t (dEf1), from month t to $t+5$ (dEf6), and from month t to $t+11$ (dEf12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in dEf6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the dEf6 decile. Because analyst forecast data start in January 1976, the dEf portfolios start in March 1976.

At the beginning of each month t, we also sort stocks into quintiles based on their prior month dEf and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-dEf1), from month t to $t+5$ (Me-dEf6), and from month t to $t+11$ (Me-dEf12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-dEf6 mean that for a given Me-dEf6 portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-dEf6 portfolio.

2.1.9 Nei1, The Number of Quarters with Consecutive Earnings Increase

We follow Barth, Elliott, and Finn (1999) and Green, Hand, and Zhang (2013) in measuring Nei as the number of consecutive quarters (up to eight quarters) with an increase in earnings (Compustat quarterly item IBQ) over the same quarter in the prior year. At the beginning of each month t, we sort stocks into nine portfolios (with Nei $= 0, 1, 2, \ldots, 7$, and 8, respectively) based on their most recent past Nei. Before 1972, we use Nei computed with quarterly earnings from fiscal quarters ending at least four months prior to the portfolio formation. Starting from 1972, we use Nei computed with earnings from the most recent quarterly earnings announcement dates (Compustat quarterly item RDQ). For a firm to enter the portfolio formation, we require the end of the fiscal quarter

that corresponds to its most recent Nei to be within six months prior to the portfolio formation. This restriction is imposed to exclude stale earnings information. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. We calculate decile returns for the current month t (Nei1) and rebalance the deciles at the beginning of month $t+1$. For sufficient data coverage, the Nei portfolios start in January 1969.

At the beginning of each month t, we sort stocks on their most recent past Nei into quintiles: low (Nei = 0), 1, (2, 3), (4, 5, 6), and high (Nei = 7, 8) and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Nei1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.1.10 52w6 and 52w12, 52-week High

At the beginning of each month t, we split stocks into deciles based on 52w, which is the ratio of its split-adjusted price per share at the end of month $t-1$ to its highest (daily) split-adjusted price per share during the 12-month period ending on the last day of month $t-1$. Decile returns are calculated from month t to $t+5$ (52w6) and from month t to $t+11$ (52w12), and the deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in 52w6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the 52w6 decile. Because a disproportionately large number of stocks can reach the 52-week high at the same time and have 52w equal to one, we use only 52w smaller than one to form the portfolio breakpoints. Doing so helps avoid missing portfolio observations.

At the beginning of each month t, we also sort stocks into quintiles based on 52w and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-52w6), and from month t to

$t+11$ (Me-52w12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-52w6 mean that for a given Me-52w6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-52w6 portfolio.

2.1.11 $\epsilon^6$6 and $\epsilon^6$12, Six-month Residual Momentum

We split all stocks into deciles at the beginning of each month t based on their $\epsilon^6$6, measured as the prior 6-month average residual returns from month $t-7$ to $t-2$ scaled by their standard deviation over the same period. Skipping month $t-1$, we calculate decile returns from month t to $t+5$ ($\epsilon^6$6) and from month t to $t+11$ ($\epsilon^6$12). Residual returns are estimated each month for all stocks over the prior 36 months from month $t-36$ to month $t-1$ from regressing stock excess returns on the Fama and French (1993) three factors. To reduce the noisiness of the estimation, we require returns to be available for all prior 36 months. The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\epsilon^6$6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\epsilon^6$6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on their ϵ^6 and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-$\epsilon^6$6) and from month t to $t+11$ (Me-$\epsilon^6$12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-$\epsilon^6$6 mean that for a given Me-$\epsilon^6$6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$\epsilon^6$6 portfolio.

2.1.12 $\epsilon^{11}1$, $\epsilon^{11}6$, and $\epsilon^{11}12$, 11-month Residual Momentum

We split all stocks into deciles at the beginning of each month t based on their ϵ^{11}, measured as the prior 11-month residual returns from month $t-12$ to $t-2$ scaled by their standard deviation over the same period. Skipping month $t-1$, we calculate decile returns for month t ($\epsilon^{11}1$), from month t to $t+5$ ($\epsilon^{11}6$), and from month t to $t+11$ ($\epsilon^{11}12$). Residual returns are estimated each month for all stocks over the prior 36 months from month $t-36$ to month $t-1$ from regressing stock excess returns on the Fama and French (1993) three factors. To reduce the noisiness of the estimation, we require returns to be available for all prior 36 months. The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\epsilon^{11}6$ mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\epsilon^{11}6$ decile.

At the beginning of each month t, we also sort stocks into quintiles based on their ϵ^{11} and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-$\epsilon^{11}1$), from month t to $t+5$ (Me-$\epsilon^{11}6$), and from month t to $t+11$ (Me-$\epsilon^{11}12$). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-$\epsilon^{11}6$ mean that for a given Me-$\epsilon^{11}6$ portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$\epsilon^{11}6$ portfolio.

2.1.13 Sm1 and Sm12, Segment Momentum

Following Cohen and Lou (2012), we extract firms' segment accounting and financial information from Compustat segment files. Industries are based on two-digit SIC codes. Stand-alone firms are those that operate in only one industry with segment sales, reported in Compustat segment files, accounting for more than 80% of total sales reported in Compustat annual files. Conglomerate firms are those that operating in more than one industry with aggregate sales from all reported segments

accounting for more than 80% of total sales. At the end of June of each year t, we form a pseudoconglomerate for each conglomerate firm. The pseudoconglomerate is a portfolio of the conglomerate's industry segments constructed with solely the stand-alone firms in each industry. The segment portfolios (value-weighted across stand-alone firms) are then weighted by the percentage of sales contributed by each industry segment within the conglomerate. The pseudoconglomerate portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June.

At the beginning of each month t (starting in July), we sort all conglomerate firms into deciles based on their Sm, which is the returns of their pseudo-conglomerate portfolios in month $t-1$. Decile returns are calculated for month t (Sm1) and from month t to $t+11$ (Sm12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Sm12 mean that for a given Sm12 decile in each month there exist 12 subdeciles, each initiated in a different month in the prior 12 months. We average the subdecile returns as the return of the Sm12 decile. Because the segment data start in 1976, the Sm portfolios start in July 1977.

At the beginning of each month t, we also sort stocks into quintiles based on their Sm and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for month t (Me-Sm1) and from month t to $t+11$ (Me-Sm12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Sm12 mean that for a given Me-Sm12 portfolio in each month there exist 12 subportfolios, each of which is initiated in a different month in the prior 12 months. We average the subportfolio returns as the return of the Me-Sm12 portfolio.

2.1.14 Ilr1, Ilr6, and Ilr12, Industry Lead-lag Effect in Prior Returns

We start with the Fama and French (1997) 49-industry classifications. Excluding financials leaves 45 industries. At the beginning of each month t, we sort industries based on their Ilr, measured as the month $t-1$ value-weighted return of the portfolio consisting of the 30% biggest (market equity) firms

within a given industry. We form nine portfolios ($9 \times 5 = 45$), each of which contains five different industries. We define the return of a given portfolio as the simple average of the five value-weighted industry returns within the portfolio. The nine portfolio returns are calculated for the current month t (Ilr1), from month t to $t+5$ (Ilr6), and from month t to $t+11$ (Ilr12), and the portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Ilr6 mean that for a given portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Ilr6 portfolio.

At the beginning of each month t, we also sort industries into quintiles ($5 \times 9 = 45$) based on their Ilr, each of which contains nine different industries. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. We define the return of a given Me-Ilr portfolio as the simple average of the nine industry returns within the portfolio. The industry returns are value-weighted and include only member stocks within a given Me-Ilr portfolio. Portfolio returns are calculated for the current month t (Me-Ilr1), from month t to $t+5$ (Me-Ilr6), and from month t to $t+11$ (Me-Ilr12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Ilr6 mean that for a given Me-Ilr6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Ilr6 portfolio.

2.1.15 Ile1, Industry Lead-lag Effect in Earnings Surprises

We start with the Fama-French (1997) 49-industry classifications. Excluding financials leaves 45 industries. We calculate standardized unexpected earnings, Sue, as the change in split-adjusted quarterly earnings per share (Compustat quarterly item EPSPXQ divided by item AJEXQ) from its value four quarters ago divided by the standard deviation of this change in quarterly earnings over the prior eight quarters (six quarters minimum). At the beginning of each month t, we sort industries based on their Ile, measured as the most recent past Sue averaged across the 30% biggest

firms within a given industry.[2] To mitigate the impact of outliers, we winsorize Sue at the 1st and 99th percentiles of its distribution each month. We form nine portfolios ($9 \times 5 = 45$), each of which contains five different industries. We define the return of a given portfolio as the simple average of the five value-weighted industry returns within the portfolio. The nine portfolio returns are calculated for the current month t (Ile1) and the portfolios are rebalanced at the beginning of month $t+1$.

At the beginning of each month t, we also sort industries into quintiles ($5 \times 9 = 45$) based on their Ile, each of which contains nine different industries. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. We define the return of a given Me-Ile portfolio as the simple average of the nine industry returns within the portfolio. The industry returns are value-weighted and include only member stocks within a given Me-Ile portfolio. Portfolio returns are calculated for the current month t (Me-Ile1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.1.16 Cm1 and Cm12, Customer Momentum

Following Cohen and Frazzini (2008), we extract firms' principal customers from Compustat segment files. For each firm we determine whether the customer is another company listed on the CRSP/Compustat tape, and we assign it the corresponding CRSP permno number. At the end of June of each year t, we form a customer portfolio for each firm with identifiable firm-customer relations for the fiscal year ending in calendar year $t-1$. For firms with multiple customer firms, we form equal-weighted customer portfolios. The customer portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June.

At the beginning of each month t, we sort stocks into quintiles on their customer momentum

[2]Before 1972, we use the most recent Sue with earnings from fiscal quarters ending at least four months prior to the portfolio month. Starting from 1972, we use Sue with earnings from the most recent quarterly earnings announcement dates (Compustat quarterly item RDQ). For a firm to enter our portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Sue to be within six months prior to the portfolio month. We also require the earnings announcement date to be after the corresponding fiscal quarter end.

(Cm), which is customer portfolio return in month $t-1$. We do not form deciles because a disproportionate number of firms can have the same Cm, which leads to fewer than ten portfolios in some months. Quintile returns are calculated for the current month t (Cm1) and from month t to $t+11$ (Cm12), and the quintiles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Cm12 mean that for a given quintile in each month there exist 12 subquintiles, each initiated in a different month in the prior 12 months. We average the subquintile returns as the return of the Cm12 quintile. Due to data coverage, we start the Cm portfolios in July 1979.

At the beginning of each month t, we also sort stocks into quintiles based on their Cm and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for month t (Me-Cm1) and from month t to $t+11$ (Me-Cm12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Cm12 mean that for a given Me-Cm12 portfolio in each month there exist 12 subportfolios, each of which is initiated in a different month in the prior 12 months. We average the subportfolio returns as the return of the Me-Cm12 portfolio.

2.1.17 Sim1, Sim12, Cim1, Cim6, and Cim12, Supplier (Customer) Industries Momentum

Following Menzly and Ozbas (2010), we use Benchmark Input-Output Accounts at the Bureau of Economic Analysis (BEA) to identify supplier and customer industries for a given industry. BEA Surveys are conducted roughly once every five years in 1958, 1963, 1967, 1972, 1977, 1982, 1987, 1992, 1997, 2002, 2007, and 2012. We delay the use of any data from a given survey until the end of the year in which the survey is publicly released during 1964, 1969, 1974, 1979, 1984, 1991, 1994, 1997, 2002, 2007, 2013, and 2018, respectively. The BEA industry classifications are based on SIC codes in the surveys from 1958 to 1992 and based on NAICS codes afterward. In the surveys from 1958 to 1992, we merge industry account pairs 1–2, 5–6, 9–10, 11–12, 20–21, and 33–34. We also merge industry account pairs 22–23 and 44–45 in the 1987 and 1992 surveys. In the surveys from

1997 to 2002, we merge three separate industry accounts, 2301, 2302, and 2303 into a single account. We also merge "Housing" (HS) and "Other Real Estate" (ORE) in the 2007 and 2012 surveys. We drop miscellaneous industry accounts related to government, import, and inventory adjustments.

At the end of June of each year t, we assign each stock to an BEA industry (at the summary level) based on its reported SIC or NAICS code in Compustat (fiscal year ending in $t-1$) or CRSP (June of t). Monthly value-weighted industry returns are calculated from July of year t to June of $t+1$, and the industry portfolios are rebalanced in June of $t+1$. For each industry, we further form two separate portfolios, the suppliers portfolio and the customers portfolios. The share of an industry's total purchases from other industries is used to calculate the supplier industries portfolio returns, and the share of the industry's total sales to other industries is used to calculate the customer industries portfolio returns. The cross-industry flows of goods and services are from the BEA Input-Output Accounts' Use Table (based on producers' prices).

At the beginning of each month t, we sort industries into deciles based on the supplier portfolio returns, Sim, and separately, on the customer portfolio returns, Cim, in month $t-1$. We then assign the decile rankings of each industry to its member stocks. Decile returns are calculated for month t (Sim1 and Cim1), from month t to $t+5$ (Cim6), and from month t to $t+11$ (Sim12 and Cim12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Cim6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Cim6 decile.

At the beginning of each month t, we also sort industries into quintiles based, separately, on Sim and Cim in month $t-1$. We then assign the quintile rankings of each industry to its member stocks. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections of the Me and Sim portfolios yields 15 Me-Sim portfolios. Similarly, taking intersections of the Me and Cim portfolios yields 15 Me-Cim portfolios. Portfolios returns are calculated

for month t (Me-Sim1 and Me-Cim1), from month t to $t+5$ (Me-Cim6), and from month t to $t+11$ (Me-Sim12 and Me-Cim12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Cim6 mean that for a given Me-Cim6 portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Cim6 portfolio.

2.2 Value-versus-growth

2.2.1 Bm, Book-to-market Equity

At the end of June of each year t, we split stocks into deciles on Bm, the book equity for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. For firms with more than one share class, we merge the market equity for all share classes before computing Bm. Firms with nonpositive book equity are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

At the end of June of each year t, we also sort stocks into quintiles based on Bm and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Bm portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.2 Bmj, Book-to-June-end Market Equity

Following Asness and Frazzini (2013), at the end of June of each year t, we sort stocks into deciles based on Bmj, which is book equity per share for the fiscal year ending in calendar year $t-1$ divided by share price (from CRSP) at the end of June of t. We adjust for any stock splits between the fiscal year end and the end of June. Book equity per share is book equity divided by the number of shares outstanding (Compustat annual item CSHO). Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock. Firms with nonpositive book equity are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Bmj and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Bmj portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.3 $\text{Bm}^{\text{q}}12$, Quarterly Book-to-market Equity

At the beginning of each month t, we split stocks into deciles based on Bm^{q}, which is the book equity for the latest fiscal quarter ending at least four months ago divided by the market equity (from CRSP) at the end of month $t-1$. For firms with more than one share class, we merge the market equity for all share classes before computing Bm^{q}. Firms with nonpositive book equity are excluded. We calculate decile returns from month t to $t+11$ ($\text{Bm}^{\text{q}}12$) and the deciles are rebalanced

at the beginning of month $t+1$. Holding periods longer than one month like in $\text{Bm}^{\text{q}}12$ mean that for a given $\text{Bm}^{\text{q}}12$ decile in each month there exist 12 subdeciles, each of which is initiated in a different month in the prior 12 months. We average the subdecile returns as the return of the $\text{Bm}^{\text{q}}12$ decile. Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (Compustat quarterly item TXDITCQ) if available, minus the book value of preferred stock (item PSTKQ). Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the book value of preferred stock, or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity.

Before 1972, the sample coverage is limited for quarterly book equity in Compustat quarterly files. We expand the coverage by using book equity from Compustat annual files as well as by imputing quarterly book equity with clean surplus accounting. Specifically, whenever available we first use quarterly book equity from Compustat quarterly files. We then supplement the coverage for fiscal quarter 4 with annual book equity from Compustat annual files. Following Davis, Fama, and French (2000), we measure annual book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if available. If not, stockholders' equity is the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

If both approaches are unavailable, we apply the clean surplus relation to impute the book equity. Specifically, we impute the book equity for quarter t forward based on book equity from prior quarters. Let BEQ_{t-j}, $1 \leq j \leq 4$ denote the latest available quarterly book equity as of quarter t, and $\text{IBQ}_{t-j+1,t}$ and $\text{DVQ}_{t-j+1,t}$ be the sum of quarterly earnings and quarterly dividends from quarter $t-j+1$ to t, respectively. BEQ_t can then be imputed as $\text{BEQ}_{t-j}+\text{IBQ}_{t-j+1,t}-\text{DVQ}_{t-j+1,t}$. We do not use prior book equity from more than 4 quarters ago (i.e., $1 \leq j \leq 4$) to reduce imputa-

tion errors. Quarterly earnings are income before extraordinary items (Compustat quarterly item IBQ). Quarterly dividends are zero if dividends per share (item DVPSXQ) are zero. Otherwise, total dividends are dividends per share times beginning-of-quarter shares outstanding adjusted for stock splits during the quarter. Shares outstanding are from Compustat (quarterly item CSHOQ supplemented with annual item CSHO for fiscal quarter 4) or CRSP (item SHROUT), and the share adjustment factor is from Compustat (quarterly item AJEXQ supplemented with annual item AJEX for fiscal quarter 4) or CRSP (item CFACSHR). Because we use quarterly book equity at least 4 months after the fiscal quarter end, all the Compustat data used in the imputation are at least 4-month lagged prior to the portfolio formation. In addition, we do not impute quarterly book equity backward using future earnings and book equity information to avoid look-ahead bias.

At the beginning of each month t, we also sort stocks into quintiles based on Bm^{q} and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+11$ (Me-Bm^{q}12) and the portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Bm^{q}12 mean that for a given Me-Bm^{q}12 portfolio in each month there exist 12 subportfolios, each initiated in a different month in the prior 12 months. We average the subportfolio returns as the return of the Me-Bm^{q}12 portfolio.

2.2.4 Rev1, Rev6, and Rev12, Reversal

To capture the De Bondt and Thaler (1985) long-term reversal (Rev) effect, at the beginning of each month t, we split stocks into deciles based on the prior returns from month $t-60$ to $t-13$. Decile returns are computed for the current month t (Rev1), from month t to $t+5$ (Rev6), and from month t to $t+11$ (Rev12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Rev6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdeciles

returns as the return of the Rev6 decile. To be included in a portfolio for month t, a stock must have a valid price at the end of $t-61$ and a valid return for $t-13$. In addition, any missing returns from month $t-60$ to $t-14$ must be -99.0, which is the CRSP code for a missing ending price.

At the beginning of each month t, we also sort stocks into quintiles based on Rev and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Rev1), from month t to $t+5$ (Me-Rev6), and from month t to $t+11$ (Me-Rev12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Rev6 mean that for a given Me-Rev6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Rev6 portfolio.

2.2.5 Ep, Earnings-to-price

At the end of June of each year t, we split stocks into deciles based on earnings-to-price, Ep, which is income before extraordinary items (Compustat annual item IB) for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. For firms with more than one share class, we merge the market equity for all share classes before computing Ep. Firms with nonpositive earnings are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Ep and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ep portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.6 Ep^{q}1, Ep^{q}6, and Ep^{q}12, Quarterly Earnings-to-price

At the beginning of each month t, we split stocks into deciles based on quarterly earnings-to-price, Ep^{q}, which is income before extraordinary items (Compustat quarterly item IBQ) divided by the

market equity (from CRSP) at the end of month $t-1$. Before 1972, we use quarterly earnings from fiscal quarters ending at least four months prior to the portfolio formation. Starting from 1972, we use quarterly earnings from the most recent quarterly earnings announcement dates (item RDQ). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent quarterly earnings to be within 6 months prior to the portfolio formation. This restriction is imposed to exclude stale earnings information. To avoid potentially err1ous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Firms with nonpositive earnings are excluded. For firms with more than one share class, we merge the market equity for all share classes before computing Ep^{q}. We calculate decile returns for the current month t ($\text{Ep}^{\text{q}}1$), from month t to t+5 ($\text{Ep}^{\text{q}}6$), and from month t to t+11 ($\text{Ep}^{\text{q}}12$), and the deciles are rebalanced at the beginning of month t+1. Holding periods longer than one month like in $\text{Ep}^{\text{q}}6$ mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\text{Ep}^{\text{q}}6$ decile.

At the beginning of each month t, we also sort stocks into quintiles based on Ep^{q} and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-$\text{Ep}^{\text{q}}1$), from month t to t+5 (Me-$\text{Ep}^{\text{q}}6$), and from month t to $t+11$ (Me-$\text{Ep}^{\text{q}}12$). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-$\text{Ep}^{\text{q}}6$ mean that for a given Me-$\text{Ep}^{\text{q}}6$ portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$\text{Ep}^{\text{q}}6$ portfolio.

2.2.7 Cp, Cash Flow-to-price

At the end of June of each year t, we split stocks into deciles on cash flow-to-price, Cf, which is cash flows for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. Cash flows are income before extraordinary items (Compustat

annual item IB) plus depreciation (item DP)). For firms with more than one share class, we merge the market equity for all share classes before computing Cp. Firms with nonpositive cash flows are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Cp and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Cp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.8 Cp^q1, Cp^q6, and Cp^q12, Quarterly Cash Flow-to-price

At the beginning of each month t, we split stocks into deciles based on quarterly cash flow-to-price, Cp^q, which is cash flows for the latest fiscal quarter ending at least four months ago divided by the market equity (from CRSP) at the end of month $t-1$. Quarterly cash flows are income before extraordinary items (Compustat quarterly item IBQ) plus depreciation (item DPQ). For firms with more than one share class, we merge the market equity for all share classes before computing Cp^q. Firms with nonpositive cash flows are excluded. We calculate decile returns for the current month t (Cp^q1), from month t to $t+5$ (Cp^q6), and from month t to $t+11$ (Cp^q12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Cp^q6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Ep^q6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on Cp^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Cp^q1), from month t to $t+5$ (Me-Cp^q6), and from month t to $t+11$ (Me-Cp^q12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Cp^q6 mean that for a given Me-Cp^q6

portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Cp^{q}6 portfolio.

2.2.9 Dp, Dividend Yield

At the end of June of each year t, we sort stocks into deciles based on dividend yield, Dp, which is the total dividends paid out from July of year $t-1$ to June of t divided by the market equity (from CRSP) at the end of June of t. We calculate monthly dividends as the begin-of-month market equity times the difference between returns with and without dividends. Monthly dividends are then accumulated from July of $t-1$ to June of t. We exclude firms that do not pay dividends. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Dp and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Dp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.10 Op and Nop, (Net) Payout Yield

Per Boudoukh, Michaely, Richardson, and Roberts (2007), total payouts are dividends on common stock (Compustat annual item DVC) plus repurchases. Repurchases are the total expenditure on the purchase of common and preferred stocks (item PRSTKC) plus any reduction (negative change over the prior year) in the value of the net number of preferred stocks outstanding (item PSTKRV). Net payouts equal total payouts minus equity issuances, which are the sale of common and preferred stock (item SSTK) minus any increase (positive change over the prior year) in the value of the net number of preferred stocks outstanding (item PSTKRV). At the end of June of each year t, we sort stocks into deciles based on total payouts (net payouts) for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$ (Op and Nop, respectively). For firms with more than 1 share class, we merge the market equity for all share

classes before computing Op and Nop. Firms with nonpositive total payouts (zero net payouts) are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because the data on total expenditure and the sale of common and preferred stocks start in 1971, the Op and Nop portfolios start in July 1972.

At the end of June of each year t, we also sort stocks into quintiles based, separately, on Op and Nop. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections of the Me and Op portfolios yields 15 Me-Op portfolios. Similarly, taking intersections of the Me and Nop portfolios yields 15 Me-Nop portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.11 Em, Enterprise Multiple

Enterprise multiple, Em, is enterprise value divided by operating income before depreciation (Compustat annual item OIBDP). Enterprise value is the market equity plus the total debt (item DLC plus item DLTT) plus the book value of preferred stocks (item PSTKRV) minus cash and short-term investments (item CHE). At the end of June of each year t, we split stocks into deciles based on Em for the fiscal year ending in calendar year $t-1$. The Market equity (from CRSP) is measured at the end of December of $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Em. Firms with nonpositive enterprise value or operating income before depreciation are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Em and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Em portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.12 Em^q1, Em^q6, and Em^q12, Quarterly Enterprise Multiple

Em^q, is enterprise value scaled by operating income before depreciation (Compustat quarterly item OIBDPQ). Enterprise value is the market equity plus total debt (item DLCQ plus item DLTTQ) plus the book value of preferred stocks (item PSTKQ) minus cash and short-term investments (item CHEQ). At the beginning of each month t, we split stocks into deciles on Em^q for the latest fiscal quarter ending at least four months ago. The market equity (from CRSP) is measured at the end of month $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Em^q. Firms with nonpositive enterprise value or operating income before depreciation are excluded. Decile returns are calculated for the current month t (Em^q1), from month t to $t+5$ (Em^q6), and from month t to $t+11$ (Em^q12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Em^q6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Em^q6 decile. For sufficient data coverage, the EM^q portfolios start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Em^q for the latest fiscal quarter ending at least four months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Em^q1), from month t to $t+5$ (Me-Em^q6), and from month t to $t+11$ (Me-Em^q12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Em^q6 mean that for a given Me-Em^q6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Em^q6 portfolio.

2.2.13 Sp, Sales-to-price

At the end of June of each year t, we sort stocks into deciles based on sales-to-price, Sp, which is sales (Compustat annual item SALE) for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Sp. Firms with nonpositive sales are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Sp and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Sp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.14 Sp^q1, Sp^q6, and Sp^q12, Quarterly Sales-to-price

At the beginning of each month t, we sort stocks into deciles based on quarterly sales-to-price, Sp^q, which is sales (Compustat quarterly item SALEQ) divided by the market equity at the end of month $t-1$. Before 1972, we use quarterly sales from fiscal quarters ending at least 4 months prior to the portfolio formation. Starting from 1972, we use quarterly sales from the most recent quarterly earnings announcement dates (item RDQ). Sales are generally announced with earnings during quarterly earnings announcements (Jegadeesh and Livnat 2006). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent quarterly sales to be within 6 months prior to the portfolio formation. This restriction is imposed to exclude stale earnings information. To avoid potentially err1ous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Firms with nonpositive sales are excluded. For firms with more than one share class, we merge the market equity for all share classes before computing Sp^q. Decile returns are calculated for the current month t (Sp^q1), from month t to $t+5$ (Sp^q6), and from month t to $t+11$ (Sp^q12), and the deciles are

rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Sp^{q}6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Sp^{q}6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on Sp^{q} and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Sp^{q}1), from month t to $t+5$ (Me-Sp^{q}6), and from month t to $t+11$ (Me-Sp^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Sp^{q}6 mean that for a given Me-Sp^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Sp^{q}6 portfolio.

2.2.15 Ocp, Operating Cash Flow-to-price

At the end of June of each year t, we sort stocks into deciles based on operating cash flows-to-price, Ocp, which is operating cash flows for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. Operating cash flows are measured as funds from operation (Compustat annual item FOPT) minus change in working capital (item WCAP) prior to 1988, and then as net cash flows from operating activities (item OANCF) stating from 1988. For firms with more than one share class, we merge the market equity for all share classes before computing Ocp. Firms with nonpositive operating cash flows are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because the data on funds from operation start in 1971, the Ocp portfolios start in July 1972.

At the end of June of each year t, we also sort stocks into quintiles based on Ocp and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ocp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios

are rebalanced in June of $t+1$.

2.2.16 Ocp^{q}1, Quarterly Operating Cash Flow-to-price

At the beginning of each month t, we split stocks on quarterly operating cash flow-to-price, Ocp^q, which is operating cash flows for the latest fiscal quarter ending at least 4 months ago divided by the market equity at the end of month $t-1$. Operating cash flows are measured as the quarterly change in year-to-date funds from operation (Compustat quarterly item FOPTY) minus change in quarterly working capital (item WCAPQ) prior to 1988, and then as the quarterly change in year-to-date net cash flows from operating activities (item OANCFY) stating from 1988. For firms with more than one share class, we merge the market equity for all share classes before computing Ocp^q. Firms with nonpositive operating cash flows are excluded. Decile returns are calculated for the current month t (Ocp^{q}1) and the deciles are rebalanced at the beginning of $t+1$. Because the data on year-to-date funds from operation start in 1984, the Ocp^q portfolios start in January 1985.

At the beginning of each month t, we also sort stocks into quintiles based on Ocp^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ocp^{q}1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.2.17 Ir, Intangible Return

At the end of June of each year t, we perform the cross-sectional regression of each firm's past 5-year log stock return on its 5-year-lagged log book-to-market and 5-year log book return:

$$r(t-5,t) = \gamma_0 + \gamma_1 bm_{t-5} + \gamma_2 r^B(t-5,t) + u_t \tag{3}$$

in which $r(t-5,t)$ is the past 5-year log stock return from the end of year $t-6$ to the end of $t-1$, bm_{t-5} is the 5-year-lagged log book-to-market, and $r^B(t-5,t)$ is the 5-year log book return. The 5-year-lagged log book-to-market is computed as $bm_{t-5} = \log(B_{t-5}/M_{t-5})$, in which B_{t-5} is the

book equity for the fiscal year ending in calendar year $t-6$ and M_{t-5} is the market equity (from CRSP) at the end of December of $t-6$. For firms with more than 1 share class, we merge the market equity for all share classes before computing bm_{t-5}. The 5-year log book return is computed as $r^B(t-5,t) = \log(B_t/B_{t-5}) + \sum_{s=t-5}^{t-1}(r_s - \log(P_s/P_{s-1}))$, in which B_t is the book equity for the fiscal year ending in calendar year $t-1$, r_s is the stock return from the end of year $s-1$ to the end of year s, and P_s is the stock price per share at the end of year s. Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock. A firm's intangible return, Ir, is defined as its residual from the annual cross-sectional regression.

At the end of June of each year t, we sort stocks based on their Ir. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of year $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Ir and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ir portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.18 Vhp and Vfp, (Analyst-based) Intrinsic Value-to-market

Following Frankel and Lee (1998), at the end of June of each year t, we implement the residual income model to estimate the intrinsic value:

$$\mathrm{Vh}_t = \mathrm{B}_t + \frac{(E_t[\mathrm{Roe}_{t+1}] - r)}{(1+r)}\mathrm{B}_t + \frac{(E_t[\mathrm{Roe}_{t+2}] - r)}{(1+r)r}\mathrm{B}_{t+1} \quad (4)$$

$$\mathrm{Vf}_t = \mathrm{B}_t + \frac{(E_t[\mathrm{Roe}_{t+1}] - r)}{(1+r)}\mathrm{B}_t + \frac{(E_t[\mathrm{Roe}_{t+2}] - r)}{(1+r)^2}\mathrm{B}_{t+1} + \frac{(E_t[\mathrm{Roe}_{t+3}] - r)}{(1+r)^2 r}\mathrm{B}_{t+2} \quad (5)$$

in which Vh_t is the historical Roe-based intrinsic value and Vf_t is the analysts earnings forecast-based intrinsic value. B_t is the book equity (Compustat annual item CEQ) for the fiscal year ending in calendar year $t-1$. Future book equity is computed using the clean surplus accounting: $\mathrm{B}_{t+1} = (1 + (1-k)E_t[\mathrm{Roe}_{t+1}])\mathrm{B}_t$, and $\mathrm{B}_{t+2} = (1 + (1-k)E_t[\mathrm{Roe}_{t+2}])\mathrm{B}_{t+1}$. $E_t[\mathrm{Roe}_{t+1}]$ and $E_t[\mathrm{Roe}_{t+2}]$ are the return on equity expected for the current and next fiscal years. k is the dividend payout ratio, measured as common stock dividends (item DVC) divided by earnings (item IBCOM) for the fiscal year ending in calendar year $t-1$. For firms with negative earnings, we divide dividends by 6% of average total assets (item AT). r is a constant discount rate of 12%. When estimating Vh_t, we replace all Roe expectations with most recent Roe_t: $\mathrm{Roe}_t = \mathrm{Ni}_t/[(\mathrm{B}_t + \mathrm{B}_{t-1})/2]$, in which Ni_t is earnings for the fiscal year ending in $t-1$, and B_t and B_{t-1} are the book equity from the fiscal years ending in $t-1$ and $t-2$. The intrinsic value-to-market, Vhp, is Vh_t divided by the market equity (from CRSP) at the end of December of year $t-1$.

When estimating Vf_t, we use analyst earnings forecasts from IBES to construct Roe expectations. Let Fy1 and Fy2 be the 1-year-ahead and two-year-ahead consensus mean forecasts (unadjusted IBES file, item MEANEST; fiscal period indicator = 1 and 2) reported in June of year t. Let s be the number of shares outstanding from IBES (unadjusted file, item SHOUT). When IBES shares are not available, we use shares from CRSP (daily item SHROUT) on the IBES pricing date (item PRDAYS) that corresponds to the IBES report. Then $E_t[\mathrm{Roe}_{t+1}] = s\mathrm{Fy1}/[(\mathrm{B}_{t+1} + \mathrm{B}_t)/2]$, in which $\mathrm{B}_{t+1} = (1 + s(1-k)\mathrm{Fy1})\mathrm{B}_t$. Analogously, $E_t[\mathrm{Roe}_{t+2}] = s\mathrm{Fy2}/[(\mathrm{B}_{t+2} + \mathrm{B}_{t+1})/2]$, in which

$B_{t+2} = (1+s(1-k)Fy2)B_{t+1}$. Let Ltg denote the long-term earnings growth rate forecast from IBES (item MEANEST; fiscal period indicator = 0). Then $E_t[Roe_{t+3}] = s Fy2(1+Ltg)/[(B_{t+3}+B_{t+2})/2]$, in which $B_{t+3} = (1+s(1-k)Fy2(1+Ltg))B_{t+2}$. If Ltg is missing, we set $E_t[Roe_{t+3}]$ to be $E_t[Roe_{t+2}]$. Firms are excluded if their expected Roe or dividend payout ratio is higher than 100%. We also exclude firms with negative book equity. The analyst-based intrinsic value-to-market, Vfp, is Vf_t divided by the market equity at the end of June in year t.

At the end of June of each year t, we sort stocks into deciles based, separately on Vhp and Vfp. For firms with more than 1 share class, we merge the market equity for all share classes before computing intrinsic value-to-market. Firms with nonpositive intrinsic value are excluded. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because analyst forecast data start in 1976, the Vfp deciles start in July 1976.

At the end of June of each year t, we sort stocks into quintiles based, separately on Vhp and Vfp. Independently, we also sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections of the Me and Vhp portfolios yields 15 Me-Vhp portfolios. Similarly, taking intersections of the Me and Vfp portfolios yields 15 Me-Vfp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.19 Ebp, Enterprise Book-to-price

Following Penman, Richardson, and Tuna (2007), we measure enterprise book-to-price, Ebp, as the ratio of the book value of net operating assets (net debt plus book equity) to the market value of net operating assets (net debt plus market equity). Net debt is financial liabilities minus financial assets. We measure financial liabilities as the sum of long-term debt (Compustat annual item DLTT), debt in current liabilities (item DLC), carrying value of preferred stock (item PSTK), and preferred dividends in arrears (item DVPA, zero if missing), less preferred treasury stock (item TSTKP, zero if missing). We measure financial assets as cash and short-term investments (item

CHE). Book equity is common equity (item CEQ) plus any preferred treasury stock (item TSTKP, zero if missing) less any preferred dividends in arrears (item DVPA, zero if missing). Market equity is the number of common shares outstanding times share price (from CRSP).

At the end of June of each year t, we sort stocks into deciles based on Ebp for the fiscal year ending in calendar year $t-1$. Market equity is measured at the end of December of $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Ebp and Ndp. We exclude firms with nonpositive book or market value of net operating assets. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Ebp for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ebp portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.2.20 Dur, Equity Duration

Following Dechow, Sloan, and Soliman (2004), we calculate firm-level equity duration, Dur, as

$$\text{Dur} = \frac{\sum_{t=1}^{T} t \times \text{CD}_t/(1+r)^t}{\text{Me}} + \left(T + \frac{1+r}{r}\right) \frac{\text{ME} - \sum_{t=1}^{T} \text{CD}_t/(1+r)^t}{\text{Me}}, \tag{6}$$

in which CD_t is the net cash distribution in year t, Me is market equity, T is the length of forecasting period, and r is the cost of equity. Market equity is price per share times shares outstanding (Compustat annual item PRCC_F times item CSHO). Net cash distribution, $\text{CD}_t = \text{B}_{t-1}(\text{Roe}_t - g_t)$, in which B_{t-1} is the book equity at the end of year $t-1$, Roe_t is return on equity in year t, and g_t is the book equity growth in t. We use autoregressive processes to forecast Roe and book equity growth in future years. We model Roe as a first-order autoregressive process with an autocorrelation coefficient of 0.57 and a long-run mean of 0.12, and the growth in book equity as a first-order autoregressive process with an autocorrelation coefficient of 0.24 and a long-run mean of 0.06. For

the starting year ($t = 0$), we measure Roe as income before extraordinary items (item IB) divided by 1-year-lagged book equity (item CEQ), and the book equity growth rate as the annual change in sales (item SALE). Nissim and Penman (2001) show that past sales growth is a better indicator of future book equity growth than past book equity growth. Finally, we use a forecasting period of $T = 10$ years and a cost of equity of $r = 0.12$. Firms are excluded if book equity ever becomes negative during the forecasting period. We also exclude firms with nonpositive Dur. At the end of June of each year t, we sort stocks into deciles based on Dur constructed with data from the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Dur constructed with data from the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Dur portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3 Investment

2.3.1 Aci, Abnormal Corporate Investment

At the end of June of year t, we measure abnormal corporate investment, Aci, as $\text{Ce}_{t-1}/[(\text{Ce}_{t-2} + \text{Ce}_{t-3} + \text{Ce}_{t-4})/3] - 1$, in which Ce_{t-j} is capital expenditure (Compustat annual item CAPX) scaled by sales (item SALE) for the fiscal year ending in calendar year $t-j$. The last 3-year average capital expenditure is designed to project the benchmark investment in the portfolio formation year. We exclude firms with sales less than ten million dollars.

At the end of June of each year t, we sort stocks into deciles based on Aci. Decile returns are computed from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles based on Aci and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from

CRSP) at the end of June of t. Taking intersections yields 15 Me-Aci portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.2 I/A, Investment-to-assets

At the end of June of each year t, we sort stocks into deciles based on investment-to-assets, I/A, which is measured as total assets (Compustat annual item AT) for the fiscal year ending in calendar year $t-1$ divided by total assets for the fiscal year ending in $t-2$ minus 1. Decile returns are computed from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles based on I/A and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-I/A portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.3 $\text{Ia}^{\text{q}}6$, and $\text{Ia}^{\text{q}}12$, Quarterly Investment-to-assets

Quarterly investment-to-assets, Ia^{q}, is defined as quarterly total assets (Compustat quarterly item ATQ) divided by 4-quarter-lagged total assets minus one. At the beginning of each month t, we sort stocks into deciles based on Ia^{q} for the latest fiscal quarter ending at least four months ago. Decile returns are calculated from month t to $t+5$ ($\text{Ia}^{\text{q}}6$) and from month t to $t+11$ ($\text{Ia}^{\text{q}}12$). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\text{Ia}^{\text{q}}6$ mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\text{Ia}^{\text{q}}6$ decile. For sufficient coverage of quarterly assets data, the Ia^{q} portfolios start in January 1973.

At the beginning of each month t, we also sort stocks into quintiles on Ia^{q} for the latest fiscal quarter ending at least four months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-$\text{Ia}^{\text{q}}6$) and from month t to $t+11$ (Me-$\text{Ia}^{\text{q}}12$). The portfolios are rebalanced at the be-

ginning of month $t+1$. Holding periods longer than one month like in Me-Ia^{q}6 mean that for a given Me-Ia^{q}6 portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Ia^{q}6 portfolio.

2.3.4 dPia, Changes in PPE and Inventory-to-assets

Changes in PPE and Inventory-to-assets, dPia, is defined as the annual change in gross property, plant, and equipment (Compustat annual item PPEGT) plus the annual change in inventory (item INVT) scaled by 1-year-lagged total assets (item AT). At the end of June of each year t, we sort stocks into deciles based on dPia for the fiscal year ending in calendar year $t-1$. Decile returns are computed from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on dPia for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-dPia portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.5 Noa and dNoa, (Changes in) Net Operating Assets

We measure net operating assets as operating assets minus operating liabilities. Operating assets are total assets (Compustat annual item AT) minus cash and short-term investment (item CHE). Operating liabilities are total assets minus debt included in current liabilities (item DLC, zero if missing), minus long-term debt (item DLTT, zero if missing), minus minority interests (item MIB, zero if missing), minus preferred stocks (item PSTK, zero if missing), and minus common equity (item CEQ). Noa is net operating assets scalded by 1-year-lagged total assets. Changes in net operating assets, dNoa, is the annual change in net operating assets scaled by 1-year-lagged total assets. At the end of June of each year t, we sort stocks into deciles based on Noa, and separately, on dNoa, for the fiscal year ending in calendar year $t-1$. Decile returns are computed from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year

t, we also sort stocks into quintiles on Noa, and separately, on dNoa, for the fiscal year ending in calendar year $t-1$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Noa portfolios and 15 Me-dNoa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.6 dLno, Changes in Long-term Net Operating Assets

We measure changes in long-term net operating assets as the annual change in net property, plant, and equipment (Compustat item PPENT) plus the change in intangibles (item INTAN) plus the change in other long-term assets (item AO) minus the change in other long-term liabilities (item LO) and plus depreciation and amortization expense (item DP). dLno is the change in long-term net operating assets scaled by the average of total assets (item AT) from the current and prior years. At the end of June of each year t, we sort stocks into deciles based on dLno for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on dLno for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-dLno portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.7 Ig, Investment Growth

At the end of June of each year t, we sort stocks into deciles based on investment growth, Ig, which is the growth rate in capital expenditure (Compustat annual item CAPX) from the fiscal year ending in calendar year $t-2$ to the fiscal year ending in $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Ig and, independently, into micro, small,

and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ig portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.8 2Ig, 2-year Investment Growth

At the end of June of each year t, we sort stocks into deciles based on 2-year investment growth, 2Ig, which is the growth rate in capital expenditure (Compustat annual item CAPX) from the fiscal year ending in calendar year $t-3$ to the fiscal year ending in $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on 2Ig and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-2Ig portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.9 Nsi, Net Stock Issues

At the end of June of year t, we measure net stock issues, Nsi, as the natural log of the ratio of the split-adjusted shares outstanding at the fiscal year ending in calendar year $t-1$ to the split-adjusted shares outstanding at the fiscal year ending in $t-2$. The split-adjusted shares outstanding is shares outstanding (Compustat annual item CSHO) times the adjustment factor (item AJEX).

At the end of June of each year t, we form deciles based on Nsi by assigning stocks with negative Nsi into two portfolios (1 and 2), stocks with zero Nsi into one portfolio (3), and stocks with positive Nsi into seven portfolios (4 to 10). Decile returns are from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the June-end of year t, we also form quintiles based on Nsi by assigning stocks with negative Nsi into one portfolio (1), stocks with zero Nsi into one portfolio (2), and stocks with positive Nsi into three portfolios (3 to 5). Independently, we sort stocks into micro, small, and big portfolios

based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Nsi portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.10 dIi, Percentage Change in Investment Relative to Industry

Following Abarbanell and Bushee (1998), we define the %d(·) operator as the percentage change in the variable in the parentheses from its average over the prior 2 years. For example, %d(Investment) = [Investment(t) − E[Investment(t)]]/E[Investment(t)], in which E[Investment(t)] = [Investment($t-1$) + Investment($t-2$)]/2. dIi is defined as %d(Investment) − %d(Industry investment), in which investment is capital expenditure in property, plant, and equipment (Compustat annual item CAPXV). Industry investment is the aggregate investment across all firms with the same 2-digit SIC code. Firms with nonpositive E[Investment(t)] are excluded and we require at least 2 firms in each industry. At the end of June of each year t, we sort stocks into deciles based on dIi for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on dIi for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-dIi portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.11 Cei, Composite Equity Issuance

At the end of June of each year t, we sort stocks into deciles based on composite equity issuance, Cei, which is the log growth rate in the market equity not attributable to stock return, $\log(\mathrm{Me_t}/\mathrm{Me_{t-5}}) - r(t-5,t)$. $r(t-5,t)$ is the cumulative log stock return from the last trading day of June in year $t-5$ to the last trading day of June in year t, and Me_t is the market equity (from CRSP) on the last trading day of June in year t. Decile returns are from July of year t to

June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Cei and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Cei portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.12 Ivg, Inventory Growth

At the end of June of each year t, we sort stocks into deciles based on inventory growth, Ivg, which is the annual growth rate in inventory (Compustat annual item INVT) from the fiscal year ending in calendar year $t-2$ to the fiscal year ending in $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Ivg and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ivg portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.13 Ivc, Inventory Changes

At the end of June of each year t, we sort stocks into deciles based on inventory changes, Ivc, which is the annual change in inventory (Compustat annual item INVT) scaled by the average of total assets (item AT) for the fiscal years ending in $t-2$ and $t-1$. We exclude firms that carry no inventory for the past 2 fiscal years. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Ivc and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ivc portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.14 Oa, Operating Accruals

Prior to 1988, we use Sloan's (1996) balance sheet approach to measure operating accruals, Oa, as changes in noncash working capital minus depreciation, in which the noncash working capital is changes in noncash current assets minus changes in current liabilities less short-term debt and taxes payable. $\text{Oa} = (\text{dCA} - \text{dCASH}) - (\text{dCL} - \text{dSTD} - \text{dTP}) - \text{DP}$, in which dCA is the change in current assets (Compustat annual item ACT), dCASH is the change in cash or cash equivalents (item CHE), dCL is the change in current liabilities (item LCT), dSTD is the change in debt included in current liabilities (item DLC), dTP is the change in income taxes payable (item TXP), and DP is depreciation and amortization (item DP). Missing changes in income taxes payable are set to zero.

Starting from 1988, we follow Hribar and Collins (2002) to measure Oa using the statement of cash flows as net income (item NI) minus net cash flow from operations (item OANCF). Doing so helps mitigate measurement errors that can arise from nonoperating activities such as acquisitions and divestitures. Data from the statement of cash flows are only available since 1988.

At the June-end of year t, we sort stocks into deciles on Oa for the fiscal year ending in year $t-1$ scaled by total assets (item AT) for the fiscal year ending in $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles based on Oa for the fiscal year ending in year $t-1$ scaled by total assets for the fiscal year ending in $t-2$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Oa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.15 Ta, Total Accruals

Prior to 1988, we use the balance sheet approach in Richardson, Sloan, Soliman, and Tuna (2005) to measure total accruals, $\text{Ta} = \text{dWc} + \text{dNco} + \text{dFin}$. dWc is the change in net noncash working capital. Net noncash working capital is current operating asset (Coa) minus current operating

liabilities (Col), with Coa = current assets (Compustat annual item ACT) − cash and short-term investments (item CHE) and Col = current liabilities (item LCT) − debt in current liabilities (item DLC). dNco is the change in net noncurrent operating assets. Net noncurrent operating assets are noncurrent operating assets (Nca) minus noncurrent operating liabilities (Ncl), with Nca = total assets (item AT) − current assets − long-term investments (item IVAO), and Ncl = total liabilities (item LT) − current liabilities − long-term debt (item DLTT). dFin is the change in net financial assets. Net financial assets are financial assets (Fna) minus financial liabilities (Fnl), with Fna = short-term investments (item IVST) + long-term investments, and Fnl = long-term debt + debt in current liabilities + preferred stocks (item PSTK). Missing changes in debt in current liabilities, long-term investments, long-term debt, short-term investments, and preferred stocks are set to zero.

Starting from 1988, we use the cash flow approach to measure Ta as net income (item NI) minus total operating, investing, and financing cash flows (items OANCF, IVNCF, and FINCF) plus sales of stocks (item SSTK, zero if missing) minus stock repurchases and dividends (items PRSTKC and DV, zero if missing). Data from the statement of cash flows are only available since 1988.

At the June-end of year t, we sort stocks into deciles on Ta for the fiscal year ending in year $t-1$ scaled by total assets for the fiscal year ending in $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles on Ta for the fiscal year ending in year $t-1$ scaled by total assets for the fiscal year ending in $t-2$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ta portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.16 dWc and dCoa, Changes in Net Non-cash Working Capital and in Current Operating Assets

dWc is the change in net noncash working capital. Net noncash working capital is current operating assets (Coa) minus current operating liabilities (Col), with Coa = current assets (Compustat annual item ACT) − cash and short term investments (item CHE) and Col = current liabilities (item LCT) − debt in current liabilities (item DLC). dCoa is the change in current operating assets. Missing changes in debt in current liabilities are set to zero. At the end of June of each year t, we sort stocks into deciles based, separately, on dWc and dCoa for the fiscal year ending in calendar year $t-1$, both scaled by total assets (item AT) for the fiscal year ending in calendar year $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based, separately, on dWc and dCoa for the fiscal year ending in calendar year $t-1$, both scaled by total assets for the fiscal year ending in calendar year $t-2$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections of the Me and dWc portfolios yields 15 Me-dWc portfolios. Similarly, taking intersections of the Me and dCoa portfolios yields 15 Me-dCoa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.17 dNco and dNca, Changes in Net Non-current Operating Assets and in Non-current Operating Assets

dNco is the change in net noncurrent operating assets. Net noncurrent operating assets are non-current operating assets (Nca) minus noncurrent operating liabilities (Ncl), with Nca = total assets (Compustat annual item AT) − current assets (item ACT) − long-term investments (item IVAO), and Ncl = total liabilities (item LT) − current liabilities (item LCT) − long-term debt (item DLTT). dNca is the change in noncurrent operating assets. Missing changes in long-term investments and long-term debt are set to zero. At the end of June of each year t, we sort stocks into deciles based, separately, on dNco and dNca for the fiscal year ending in calendar year $t-1$, both

scaled by total assets for the fiscal year ending in calendar year $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the June-end of year t, we also sort stocks into quintiles based, separately, on dNco and dNca for the fiscal year ending in calendar year $t-1$, both scaled by total assets for the fiscal year ending in year $t-2$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections of the Me and dNco portfolios yields 15 Me-dNco portfolios. Similarly, taking intersections of the Me and dNca portfolios yields 15 Me-dNca portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.18 dFin, dFnl, and dBe, Changes in Net Financial Assets, in Financial Liabilities, and in Book Equity

dFin is the change in net financial assets. Net financial assets are financial assets (Fna) minus financial liabilities (Fnl), with Fna = short-term investments (Compustat annual item IVST) + long-term investments (item IVAO), and Fnl = long-term debt (item DLTT) + debt in current liabilities (item DLC) + preferred stock (item PSTK). dFnl is the change in financial liabilities and dBe is the change in book equity (item CEQ). Missing changes in debt in current liabilities, long-term investments, long-term debt, short-term investments, and preferred stocks are set to zero (at least 1 change must be non-missing). At the end of June of each year t, we sort stocks into deciles based, separately, on dFin, dFnl, and dBe for the fiscal year ending in calendar year $t-1$, all scaled by total assets (item AT) for the fiscal year ending in calendar year $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based, separately, on dFin, dFnl, and dBe for the fiscal year ending in calendar year $t-1$, both scaled by total assets for the fiscal year ending in calendar year $t-2$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from

CRSP) at the end of June of t. Taking intersections of the Me and dFin portfolios yields 15 Me-dFin portfolios. Similarly, taking intersections of the Me and dFnl portfolios yields 15 Me-dFnl portfolios and taking intersections of the Me and dBe portfolios yields 15 Me-dBe portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.19 Dac, Discretionary Accruals

We measure discretionary accruals, Dac, per Dechow, Sloan, and Sweeney (1995):

$$\frac{\text{Oa}_{it}}{\text{A}_{it-1}} = \alpha_1 \frac{1}{\text{A}_{it-1}} + \alpha_2 \frac{\text{dSALE}_{it} - \text{dREC}_{it}}{\text{A}_{it-1}} + \alpha_3 \frac{\text{PPE}_{it}}{\text{A}_{it-1}} + e_{it}, \tag{7}$$

in which Oa_{it} is operating accruals for firm i (see Appendix 2.3.14), A_{it-1} is total assets (Compustat annual item AT) at the end of year $t-1$, dSALE_{it} is the annual change in sales (item SALE) from year $t-1$ to t, dREC_{it} is the annual change in net receivables (item RECT) from year $t-1$ to t, and PPE_{it} is gross property, plant, and equipment (item PPEGT) at the end of year t. We winsorize variables in equation (7) at the 1st and 99th percentiles of their distributions each year. We estimate the cross-sectional regression (7) for each 2-digit SIC industry and year combination, formed separately for NYSE/AMEX firms and for NASDAQ firms. We require at least 6 firms for each regression. The discretionary accrual for stock i is defined as the residual from the regression, e_{it}. At the end of June of each year t, we sort stocks into deciles based on Dac for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Dac for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Dac portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.20 Poa, Percent Operating Accruals

Accruals are traditionally scaled by total assets. Hafzalla, Lundholm, and Van Winkle (2011) show that scaling accruals by the absolute value of earnings (percent accruals) is more effective in selecting firms for which the differences between sophisticated and naive forecasts of earnings are the most extreme. At the end of June of each year t, we sort stocks into deciles based on percent operating accruals, Poa, calculated as operating accruals scaled by the absolute value of net income (Compustat annual item NI) for the fiscal year ending in calendar year $t-1$. See Appendix 2.3.14 for the measurement of operating accruals. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Poa for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Poa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.21 Pta, Percent Total Accruals

At the end of June of each year t, we sort stocks into deciles on percent total accruals, Pta, calculated as total accruals scaled by the absolute value of net income (Compustat annual item NI) for the fiscal year ending in calendar year $t-1$. See Appendix 2.3.15 for the measurement of total accruals. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of year $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Pta for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Pta portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.22 Pda, Percent Discretionary Accruals

At the end of June of each year t, we split stocks into deciles based on percent discretionary accruals, Pda, calculated as the discretionary accruals, Dac, for the fiscal year ending in calendar year $t-1$ multiplied with total assets (Compustat annual item AT) for the fiscal year ending in $t-2$ scaled by the absolute value of net income (item NI) for the fiscal year ending in $t-1$. See Appendix 2.3.19 for the measurement of discretionary accruals. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Pda for the fiscal year ending in calendar year $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Pda portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.3.23 Ndf, Net Debt Financing

Net debt financing, Ndf, is the cash proceeds from the issuance of long-term debt (item DLTIS) less cash payments for long-term debt reductions (item DLTR) plus the net changes in current debt (item DLCCH, zero if missing). At the end of June of each year t, we sort stocks into deciles based on Ndf for the fiscal year ending in calendar year $t-1$ scaled by the average of total assets for fiscal years ending in $t-2$ and $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because the data on financing activities start in 1971, the Ndf portfolios start in July 1972. At the June-end of year t, we also sort stocks into quintiles based on Ndf for the fiscal year ending in calendar year $t-1$ scaled by the average of total assets for fiscal years ending in $t-2$ and $t-1$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ndf portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4 Profitability

2.4.1 Roe1 and Roe6, Return on Equity

Return on equity, Roe, is income before extraordinary items (Compustat quarterly item IBQ) divided by 1-quarter-lagged book equity (Hou, Xue, and Zhang 2015). Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock (item PSTKQ). Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the book value of preferred stock, or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity.

Before 1972, the sample coverage is limited for quarterly book equity in Compustat quarterly files. We expand the coverage by using book equity from Compustat annual files as well as by imputing quarterly book equity with clean surplus accounting. Specifically, whenever available we first use quarterly book equity from Compustat quarterly files. We then supplement the coverage for fiscal quarter 4 with annual book equity from Compustat annual files. Following Davis, Fama, and French (2000), we measure annual book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if available. If not, stockholders' equity is the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

If both approaches are unavailable, we apply the clean surplus relation to impute the book equity. First, if available, we backward impute the beginning-of-quarter book equity as the end-of-quarter book equity minus quarterly earnings plus quarterly dividends. Quarterly earnings are income before extraordinary items (Compustat quarterly item IBQ). Quarterly dividends are zero if dividends per share (item DVPSXQ) are zero. Otherwise, total dividends are dividends per share

times beginning-of-quarter shares outstanding adjusted for stock splits during the quarter. Shares outstanding are from Compustat (quarterly item CSHOQ supplemented with annual item CSHO for fiscal quarter 4) or CRSP (item SHROUT), and the share adjustment factor is from Compustat (quarterly item AJEXQ supplemented with annual item AJEX for fiscal quarter 4) or CRSP (item CFACSHR). Because we impose a 4-month lag between earnings and the holding period month (and the book equity in the denominator of Roe is 1-quarter-lagged relative to earnings), all the Compustat data in the backward imputation are at least 4-month lagged prior to the portfolio formation. If data are unavailable for the backward imputation, we impute the book equity for quarter t forward based on book equity from prior quarters. Let BEQ_{t-j}, $1 \leq j \leq 4$ denote the latest available quarterly book equity as of quarter t, and $\text{IBQ}_{t-j+1,t}$ and $\text{DVQ}_{t-j+1,t}$ be the sum of quarterly earnings and quarterly dividends from quarter $t-j+1$ to t, respectively. BEQ_t can then be imputed as $\text{BEQ}_{t-j} + \text{IBQ}_{t-j+1,t} - \text{DVQ}_{t-j+1,t}$. We do not use prior book equity from more than 4 quarters ago (i.e., $1 \leq j \leq 4$) to reduce imputation errors.

At the beginning of each month t, we sort all stocks into deciles based on their most recent past Roe. Before 1972, we use the most recent Roe computed with quarterly earnings from fiscal quarters ending at least 4 months prior to the portfolio formation. Starting from 1972, we use Roe computed with quarterly earnings from the most recent quarterly earnings announcements (Compustat quarterly item RDQ). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Roe to be within 6 months prior to the portfolio formation. This restriction is imposed to exclude stale earnings information. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (Roe1) and from month t to $t+5$ (Roe6). The deciles are rebalanced monthly at the beginning of month $t+1$. Holding periods longer than one month like in Roe6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Roe6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Roe and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Roe1) and from month t to $t+5$ (Me-Roe6). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Roe6 mean that for a given Me-Roe6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Roe6 portfolio.

2.4.2 dRoe1, dRoe6, and dRoe12, 4-quarter Change in Return on Equity

Change in return on equity, dRoe, is return on equity minus its value from four quarters ago. At the beginning of each month t, we sort all stocks into deciles on their most recent past dRoe. Before 1972, we use the most recent dRoe with quarterly earnings from fiscal quarters ending at least four months ago. Starting from 1972, we use dRoe computed with quarterly earnings from the most recent quarterly earnings announcement dates (Compustat quarterly item RDQ). We require a firm's end of the fiscal quarter that corresponds to its most recent dRoe to be within six months prior to the portfolio formation. We also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (dRoe1), from month t to $t+5$ (dRoe6), and from month t to $t+11$ (dRoe12). The deciles are rebalanced monthly at the beginning of month $t+1$. Holding periods longer than one month like in dRoe6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the dRoe6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past dRoe and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-dRoe1),

from month t to $t+5$ (Me-dRoe6), and from month t to $t+11$ (Me-dRoe12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-dRoe6 mean that for a given Me-dRoe6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-dRoe6 portfolio.

2.4.3 Roa1, Return on Assets

Return on assets, Roa, is income before extraordinary items (Compustat quarterly item IBQ) divided by 1-quarter-lagged total assets (item ATQ). At the beginning of each month t, we sort all stocks into deciles based on Roa computed with quarterly earnings from the most recent earnings announcement dates (item RDQ). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Roa to be within 6 months prior to the portfolio formation. We also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (Roa1) and the deciles are rebalanced at the beginning of $t+1$. For sufficient data coverage, the Roa portfolios start in January 1972.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Roa and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Roa1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.4.4 dRoa1 and dRoa6, 4-quarter Change in Return on Assets

Change in return on assets, dRoa, is return on assets minus its value from four quarters ago. At the beginning of each month t, we sort all stocks into deciles based on dRoa computed with quarterly earnings from the most recent earnings announcement dates (Compustat quarterly item RDQ). We require a firm's end of the fiscal quarter that corresponds to its most recent dRoa to be within six months prior to the portfolio formation. We also require the earnings announcement date to be

after the corresponding fiscal quarter end. Decile returns are calculated for the current month t (dRoa1) and from month t to $t+5$ (dRoa6). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in dRoa6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the dRoa6 decile. For sufficient data coverage, the dRoa portfolios start in January 1973.

At the beginning of each month t, we also sort stocks into quintiles based on their most recent past dRoa and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-dRoa1) and from month t to $t+5$ (Me-dRoa6). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-dRoa6 mean that for a given Me-dRoa6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-dRoa6 portfolio.

2.4.5 Ato, Assets Turnover

At the end of June of each year t, we sort stocks into deciles based on asset turnover, Ato, measured as sales (Compustat annual item SALE) for the fiscal year ending in calendar year $t-1$ divided by net operating assets (Noa) for the fiscal year ending in $t-2$. Noa is operating assets minus operating liabilities. Operating assets are total assets (item AT) minus cash and short-term investment (item CHE), and minus other investment and advances (item IVAO, zero if missing). Operating liabilities are total assets minus debt in current liabilities (item DLC, zero if missing), minus long-term debt (item DLTT, zero if missing), minus minority interests (item MIB, zero if missing), minus preferred stocks (item PSTK, zero if missing), and minus common equity (item CEQ). We exclude firms with nonpositive Noa for the fiscal year ending in calendar year $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June

of each year t, we also sort stocks into quintiles based on Ato and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ato portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.6 Cto, Capital Turnover

At the end of June of each year t, we split stocks into deciles based on capital turnover, Cto, measured as sales (Compustat annual item SALE) for the fiscal year ending in calendar year $t-1$ divided by total assets (item AT) for the fiscal year ending in $t-2$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles based on Cto and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Cto portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.7 Rna^{q}1, Rna^{q}6, Ato^{q}1, Ato^{q}6, and Ato^{q}12, Quarterly Return on Net Operating Assets and Quarterly Assets Turnover

Quarterly return on net operating assets, Rna^{q}, is quarterly operating income after depreciation (Compustat quarterly item OIADPQ) divided by 1-quarter-lagged net operating assets (Noa). Noa is operating assets minus operating liabilities. Operating assets are total assets (item ATQ) minus cash and short-term investments (item CHEQ), and minus other investment and advances (item IVAOQ, zero if missing). Operating liabilities are total assets minus debt in current liabilities (item DLCQ, zero if missing), minus long-term debt (item DLTTQ, zero if missing), minus minority interests (item MIBQ, zero if missing), minus preferred stocks (item PSTKQ, zero if missing), and minus common equity (item CEQQ). Quarterly asset turnover, Ato^{q}, is quarterly sales (item SALEQ) divided by 1-quarter-lagged Noa.

At the beginning of each month t, we sort stocks into deciles based on Rna^{q} for the latest

fiscal quarter ending at least 4 months ago. Separately, we sort stocks into deciles based on Ato^{q} computed with quarterly sales from the most recent earnings announcement dates (item RDQ). Sales are generally announced with earnings during quarterly earnings announcements (Jegadeesh and Livnat 2006). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Ato^{q} to be within 6 months prior to the portfolio formation. We also require the earnings announcement date to be after the corresponding fiscal quarter end. We exclude firms with nonpositive 1-quarter lagged Noa when forming the Rna^{q} and the Ato^{q} portfolios. Decile returns are calculated for month t ($\text{Rna}^{\text{q}}1$ and $\text{Ato}^{\text{q}}1$), from month t to $t+5$ ($\text{Rna}^{\text{q}}6$ and $\text{Ato}^{\text{q}}6$), and from month t to $t+11$ ($\text{Ato}^{\text{q}}12$). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in $\text{Rna}^{\text{q}}6$ mean that for a given $\text{Rna}^{\text{q}}6$ decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\text{Rna}^{\text{q}}6$ decile. For sufficient data coverage, the Rna^{q} portfolios start in January 1976 and the Ato^{q} portfolios start in January 1972.

At the beginning of each month t, we also sort stocks into quintiles based on Rna^{q} for the latest fiscal quarter ending at least 4 months ago and separately, based on Ato^{q} computed with quarterly sales from the most recent earnings announcement dates. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections of the Me and Rna^{q} portfolios yields 15 Me-Rna^{q} portfolios. Similarly, taking intersections of the Me and Ato^{q} portfolios yields 15 Me-Ato^{q} portfolios. Portfolio returns are calculated for the current month t (Me-$\text{Rna}^{\text{q}}1$ and Me-$\text{Ato}^{\text{q}}1$), from month t to $t+5$ (Me-$\text{Rna}^{\text{q}}6$ and Me-$\text{Ato}^{\text{q}}6$), and from month t to $t+11$ (Me-$\text{Ato}^{\text{q}}12$). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-$\text{Rna}^{\text{q}}6$ mean that for a given Me-$\text{Rna}^{\text{q}}6$ portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-$\text{Rna}^{\text{q}}6$ portfolio.

2.4.8 Cto^{q}1, Cto^{q}6, and Cto^{q}12, Quarterly Capital Turnover

Quarterly capital turnover, Cto^{q}, is quarterly sales (Compustat quarterly item SALEQ) scaled by 1-quarter-lagged total assets (item ATQ). At the beginning of each month t, we sort stocks into deciles based on Cto^{q} computed with quarterly sales from the most recent earnings announcement dates (item RDQ). Sales are generally announced with earnings during quarterly earnings announcements (Jegadeesh and Livnat 2006). For a firm to enter the portfolio formation, we require the end of the fiscal quarter that corresponds to its most recent Ato^{q} to be within 6 months prior to the portfolio formation. We also require the earnings announcement date to be after the corresponding fiscal quarter end. Decile returns are calculated for month t (Cto^{q}1), from month t to $t+5$ (Cto^{q}6), and from month t to $t+11$ (Cto^{q}12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Cto^{q}6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Cto^{q}6 decile. For sufficient data coverage, the Cto^{q} portfolios start in January 1972. At the beginning of each month t, we also sort stocks into quintiles based on their most recent past Cto^{q} and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Cto^{q}1), from month t to $t+5$ (Me-Cto^{q}6), and from month t to $t+11$ (Me-Cto^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Cto^{q}6 mean that for a given Me-Cto^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Cto^{q}6 portfolio.

2.4.9 Gpa, Gross Profits-to-assets

We measure gross profits-to-assets, Gpa, as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS) divided by total assets (item AT, the denominator is current, not

lagged, total assets). At the end of June of each year t, we sort stocks into deciles based on Gpa for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Gpa for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Gpa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.10 Gla^{q}1, Gla^{q}6, and Gla^{q}12, Quarterly Gross Profits-to-lagged Assets

Gla^{q}, is quarterly total revenue (Compustat quarterly item REVTQ) minus cost of goods sold (item COGSQ) divided by 1-quarter-lagged total assets (item ATQ). At the beginning of each month t, we sort stocks into deciles based on Gla^{q} for the fiscal quarter ending at least 4 months ago. Decile returns are calculated for month t (Gla^{q}1), from month t to $t+5$ (Gla^{q}6), and from month t to $t+11$ (Gla^{q}12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Gla^{q}6 mean that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We average the subdecile returns as the return of the Gla^{q}6 decile. For sufficient data coverage, the Gla^{q} portfolios start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Gla^{q} for the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Gla^{q}1), from month t to $t+5$ (Me-Gla^{q}6), and from month t to $t+11$ (Me-Gla^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Gla^{q}6 mean that for a given Me-Gla^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We

average the subportfolio returns as the return of the Me-Gla^{q}6 portfolio.

2.4.11 Ope, Operating Profits to Equity

Following Fama and French (2015), we measure operating profitability to equity, Ope, as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS, zero if missing), minus selling, general, and administrative expenses (item XSGA, zero if missing), and minus interest expense (item XINT, zero if missing), scaled by book equity (the denominator is current, not lagged, book equity). We require at least 1 of the three expense items (COGS, XSGA, and XINT) to be nonmissing. Book equity is stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock. At the end of June of each year t, we sort stocks into deciles based on Ope for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Ope for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ope portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.12 Ole^{q}1 and Ole^{q}6, Quarterly Operating Profits-to-lagged Equity

Quarterly operating profits-to-lagged equity, Ole^q, is quarterly total revenue (Compustat quarterly item REVTQ) minus cost of goods sold (item COGSQ, zero if missing), minus selling, general, and administrative expenses (item XSGAQ, zero if missing), and minus interest expense (item XINTQ,

zero if missing), scaled by 1-quarter-lagged book equity. We require at least one of the three expense items (COGSQ, XSGAQ, and XINTQ) to be nonmissing. Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock (item PSTKQ). Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the book value of preferred stock, or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity.

At the beginning of each month t, we sort stocks on Ole^q for the fiscal quarter ending at least 4 months ago. Decile returns are calculated for month t (Ole^{q}1) and from month t to $t+5$ (Ole^{q}6). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Ole^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Ole^{q}6 decile. For sufficient data coverage, the Ole^q portfolios start in January 1972.

At the beginning of each month t, we also sort stocks into quintiles based on Ole^q for the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ole^{q}1) and from month t to $t+5$ (Me-Ole^{q}6). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Ole^{q}6 mean that for a given Me-Ole^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Ole^{q}6 portfolio.

2.4.13 Opa, Operating Profits-to-assets

Following Ball, Gerakos, Linnainmaa, and Nikolaev (2015), we measure operating profits-to-assets, Opa, as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS), minus selling, general, and administrative expenses (item XSGA), and plus research and development expenditures (item XRD, zero if missing), scaled by book assets (item AT, the denominator

is current, not lagged, total assets). At the end of June of each year t, we sort stocks into deciles based on Opa for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Opa for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Opa portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.14 Ola^{q}1, Ola^{q}6, and Ola^{q}12, Quarterly Operating Profits-to-lagged Assets

Quarterly operating profits-to-lagged assets, Ola^q, is quarterly total revenue (Compustat quarterly item REVTQ) minus cost of goods sold (item COGSQ), minus selling, general, and administrative expenses (item XSGAQ), plus research and development expenditures (item XRDQ, zero if missing), scaled by 1-quarter-lagged book assets (item ATQ). At the beginning of each month t, we sort stocks into deciles based on Ola^q for the fiscal quarter ending at least 4 months ago. Decile returns are calculated for month t (Ola^{q}1), from month t to $t+5$ (Ola^{q}6), and from month t to $t+11$ (Ola^{q}12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Ola^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Ola^{q}6 decile. For sufficient data coverage, the Ola^q portfolios start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Ola^q for the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ola^{q}1), from month t to $t+5$ (Me-Ola^{q}6), and from month t to $t+11$ (Me-Ola^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer

than one month like in Me-Ola^{q}6 mean that for a given Me-Ola^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Ola^{q}6 portfolio.

2.4.15 Cop, Cash-based Operating Profitability

Following Ball, Gerakos, Linnainmaa, and Nikolaev (2016), we measure cash-based operating profitability, Cop, as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS), minus selling, general, and administrative expenses (item XSGA), plus research and development expenditures (item XRD, zero if missing), minus change in accounts receivable (item RECT), minus change in inventory (item INVT), minus change in prepaid expenses (item XPP), plus change in deferred revenue (item DRC plus item DRLT), plus change in trade accounts payable (item AP), and plus change in accrued expenses (item XACC), all scaled by book assets (item AT, the denominator is current, not lagged, total assets). All changes are annual changes in balance sheet items and we set missing changes to zero. At the end of June of each year t, we sort stocks into deciles based on Cop for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Cop for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Cop portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.16 Cla, Cash-based Operating Profits-to-lagged Assets

Cash-based operating profits-to-lagged assets, Cla, is total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS), minus selling, general, and administrative expenses (item XSGA), plus research and development expenditures (item XRD, zero if missing), minus change in accounts receivable (item RECT), minus change in inventory (item INVT), minus change in

prepaid expenses (item XPP), plus change in deferred revenue (item DRC plus item DRLT), plus change in trade accounts payable (item AP), and plus change in accrued expenses (item XACC), all scaled by 1-year-lagged book assets (item AT). All changes are annual changes in balance sheet items and we set missing changes to zero. At the end of June of each year t, we sort stocks into deciles based on Cla for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Cla for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Cla portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.4.17 Cla^{q}1, Cla^{q}6, and Cla^{q}12, Quarterly Cash-based Operating Profits-to-lagged Assets

Quarterly cash-based operating profits-to-lagged assets, Cla, is quarterly total revenue (Compustat quarterly item REVTQ) minus cost of goods sold (item COGSQ), minus selling, general, and administrative expenses (item XSGAQ), plus research and development expenditures (item XRDQ, zero if missing), minus change in accounts receivable (item RECTQ), minus change in inventory (item INVTQ), plus change in deferred revenue (item DRCQ plus item DRLTQ), and plus change in trade accounts payable (item APQ), all scaled by 1-quarter-lagged book assets (item ATQ). All changes are quarterly changes in balance sheet items and we set missing changes to zero. At the beginning of each month t, we split stocks on Cla^q for the fiscal quarter ending at least 4 months ago. Decile returns are calculated for month t (Cla^{q}1), from month t to $t+5$ (Cla^{q}6), and from month t to $t+11$ (Cla^{q}12). The deciles are rebalanced at the beginning of $t+1$. Holding periods longer than one month like in Cla^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Cla^{q}6 decile. For sufficient data coverage, the Cla^q portfolios start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Cla^{q} for the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Cla^{q}1), from month t to $t+5$ (Me-Cla^{q}6), and from month t to $t+11$ (Me-Cla^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Cla^{q}6 mean that for a given Me-Cla^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Cla^{q}6 portfolio.

2.4.18 F^{q}1, F^{q}6, and F^{q}12, Quarterly Fundamental Score

To construct quarterly F-score, F^{q}, we use quarterly accounting data and the same nine binary signals from Piotroski (2000). Among the four signals related to profitability, (1) Roa is quarterly income before extraordinary items (Compustat quarterly item IBQ) scaled by 1-quarter-lagged total assets (item ATQ). If the firm's Roa is positive, the indicator variable F_{Roa} equals one and zero otherwise. (2) Cf/A is quarterly cash flow from operation scaled by 1-quarter-lagged total assets. Cash flow from operation is the quarterly change in year-to-date net cash flow from operating activities (item OANCFY) if available, or the quarterly change in year-to-date funds from operation (item FOPTY) minus the quarterly change in working capital (item WCAPQ). If the firm's Cf/A is positive, the indicator variable $\text{F}_{\text{Cf/A}}$ equals one and zero otherwise. (3) dRoa is the current quarter's Roa less the Roa from 4 quarters ago. If dRoa is positive, the indicator variable F_{dROA} is one and zero otherwise. Finally, (iv) the indicator F_{Acc} equals one if Cf/A $>$ Roa and zero otherwise.

Among the three signals related changes in capital structure and a firm's ability to meet future debt obligations: (1) dLever is the change in the ratio of total long-term debt (Compustat quarterly item DLTTQ) to the average of current and 1-quarter-lagged total assets. F_{dLever} is one if the firm's leverage ratio falls, that is, dLever < 0, relative to its value 4 quarters ago, and zero otherwise. (2)

dLiquid measures the change in a firm's current ratio between the current quarter and four quarters ago, in which the current ratio is the ratio of current assets (item ACTQ) to current liabilities (item LCTQ). An improvement in liquidity (dLiquid > 0) is a good signal about the firm's ability to service current debt obligations. The indicator $\mathrm{F_{dLiquid}}$ equals one if the firm's liquidity improves and zero otherwise. (3) The indicator, Eq, equals one if the firm does not issue common equity during the past 4 quarters and zero otherwise. The issuance of common equity is sales of common and preferred stocks minus any increase in preferred stocks (item PSTKQ). To measure sales of common and preferred stocks, we first compute the quarterly change in year-to-date sales of common and preferred stocks (item SSTKY) and then take the total change for the past 4 quarters. Issuing equity is interpreted as a bad signal (inability to generate sufficient internal funds to service future obligations).

For the remaining two signals, (1) dMargin is the firm's current gross margin ratio, measured as gross margin (item SALEQ minus item COGSQ) scaled by sales (item SALEQ), less the gross margin ratio from four quarters ago. The indictor $\mathrm{F_{dMargin}}$ equals one if dMargin > 0 and zero otherwise. (2) dTurn is the firm's current asset turnover ratio, measured as (item SALEQ) scaled by 1-quarter-lagged total assets (item ATQ), minus the asset turnover ratio from four quarters ago. The indicator, $\mathrm{F_{dTurn}}$, equals one if dTurn > 0 and zero otherwise.

The composite score, $\mathrm{F^q}$, is the sum of the individual binary signals:

$$\mathrm{F^q} \equiv \mathrm{F_{Roa}} + \mathrm{F_{dRoa}} + \mathrm{F_{Cf/A}} + \mathrm{F_{Acc}} + \mathrm{F_{dMargin}} + \mathrm{F_{dTurn}} + \mathrm{F_{dLever}} + \mathrm{F_{dLiquid}} + \mathrm{Eq}. \tag{8}$$

At the beginning of each month t, we sort stocks on Fq for the fiscal quarter ending at least four months ago to form seven portfolios: low ($\mathrm{F^q} = 0,1,2$), 3, 4, 5, 6, 7, and high ($\mathrm{F^q} = 8, 9$). Portfolio returns are calculated for month t ($\mathrm{F^q}1$), from month t to $t+5$ ($\mathrm{F^q}6$), and from month t to $t+11$ ($\mathrm{F^q}12$), and the portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\mathrm{F^q}6$ mean that for a given portfolio in each month there exist six subportfolios, each initiated in a different month in prior six months. We average the subportfolio returns as the return of the $\mathrm{F^q}6$ portfolio. For sufficient data coverage, the $\mathrm{F^q}$ portfolios start in January 1985.

At the beginning of each month t, we also sort stocks into quintiles based on Fq for the fiscal quarter ending at least four months ago to form five portfolios: low (F^q = 0, 1, 2, 3), 4, 5, 6, and high (F^q = 7, 8, 9). Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-F^q1), from month t to $t+5$ (Me-F^q6), and from month t to $t+11$ (Me-F^q12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-F^q6 mean that for a given Me-F^q6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-F^q6 portfolio.

2.4.19 Fp^m6, Monthly Failure Probability

Failure probability (Fp) is from Campbell, Hilscher, and Szilagyi (2008, table IV, column 3):

$$\begin{aligned}\mathrm{Fp}_t \equiv\ & -9.164 - 20.264\mathrm{NIMTAAVG}_t + 1.416\mathrm{TLMTA}_t - 7.129\mathrm{EXRETAVG}_t \\ & + 1.411\mathrm{SIGMA}_t - 0.045\mathrm{RSIZE}_t - 2.132\mathrm{CASHMTA}_t + 0.075\mathrm{MB}_t - 0.058\mathrm{PRICE}_t \end{aligned} \tag{9}$$

in which

$$\mathrm{NIMTAAVG}_{t-1,t-12} \equiv \frac{1-\phi^3}{1-\phi^{12}}\left(\mathrm{NIMTA}_{t-1,t-3} + \cdots + \phi^9 \mathrm{NIMTA}_{t-10,t-12}\right) \tag{10}$$

$$\mathrm{EXRETAVG}_{t-1,t-12} \equiv \frac{1-\phi}{1-\phi^{12}}\left(\mathrm{EXRET}_{t-1} + \cdots + \phi^{11}\mathrm{EXRET}_{t-12}\right), \tag{11}$$

and $\phi = 2^{-1/3}$. NIMTA is net income (Compustat quarterly item NIQ) divided by the sum of market equity (share price times the number of shares outstanding from CRSP) and total liabilities (item LTQ). The moving average NIMTAAVG captures the idea that a long history of losses is a better predictor of bankruptcy than 1 large quarterly loss in a single month. EXRET $\equiv \log(1+R_{it}) - \log(1+R_{\mathrm{S\&P500},t})$ is the monthly log excess return on each firm's equity relative to the S&P 500 index. The moving average EXRETAVG captures the idea that a sustained decline in stock

market value is a better predictor of bankruptcy than a sudden stock price decline in a single month.

TLMTA is total liabilities divided by the sum of market equity and total liabilities. SIGMA is the annualized 3-month rolling sample standard deviation: $\sqrt{\frac{252}{N-1}\sum_{k\in\{t-1,t-2,t-3\}} r_k^2}$, in which k is the index of trading days in months $t-1, t-2$, and $t-3$, r_k is the firm-level daily return, and N is the total number of trading days in the 3-month period. SIGMA is treated as missing if there are less than 5 nonzero observations over the 3 months in the rolling window. RSIZE is the relative size of each firm measured as the log ratio of its market equity to that of the S&P 500 index. CASHMTA, aimed to capture the liquidity position of the firm, is cash and short-term investments (Compustat quarterly item CHEQ) divided by the sum of market equity and total liabilities (item LTQ). MB is the market-to-book equity, in which we add 10% of the difference between the market equity and the book equity to the book equity to alleviate measurement issues for extremely small book equity values (Campbell, Hilscher, and Szilagyi 2008). For firm-month observations that still have negative book equity after this adjustment, we replace these negative values with \$1 to ensure that the market-to-book ratios for these firms are in the right tail of the distribution. PRICE is each firm's log price per share, truncated above at \$15. We further eliminate stocks with prices less than \$1 at the portfolio formation date. We winsorize the variables on the right-hand side of equation (9) at the 1st and 99th percentiles of their distributions each month.

At the beginning of each month t, we sort stocks into deciles on Fp calculated with accounting data from the fiscal quarter ending at least 4 months ago. We calculate decile returns from month t to $t+5$ ($\text{Fp}^{\text{m}}6$) and the deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\text{Fp}^{\text{m}}6$ mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the $\text{Fp}^{\text{m}}6$ decile. For sufficient data coverage, the Fp^{m} deciles start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Fp calculated with accounting data from the fiscal quarter ending at least 4 months ago and, independently, into micro,

small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-Fp$^{\text{m}}$6) and the portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Fp$^{\text{m}}$6 mean that for a given Me-Fp$^{\text{m}}$6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Fp$^{\text{m}}$6 portfolio.

2.4.20 O$^{\text{q}}$1, Quarterly O-score

We use quarterly accounting data to construct the quarterly O-score as:

$$\begin{aligned} \text{O}^{\text{q}} \equiv\ & -1.32 - 0.407\log(\text{TA}^{\text{q}}) + 6.03\text{TLTA}^{\text{q}} - 1.43\text{WCTA}^{\text{q}} + 0.076\text{CLCA}^{\text{q}} \\ & - 1.72\text{OENEG}^{\text{q}} - 2.37\text{NITA}^{\text{q}} - 1.83\text{FUTL}^{\text{q}} + 0.285\text{IN2}^{\text{q}} - 0.521\text{CHIN}^{\text{q}}, \end{aligned} \tag{12}$$

in which TA$^{\text{q}}$ is total assets (Compustat quarterly item ATQ). TLTA$^{\text{q}}$ is the leverage ratio defined as total debt (item DLCQ plus item DLTTQ) divided by total assets. WCTA$^{\text{q}}$ is working capital (item ACTQ minus item LCTQ) divided by total assets. CLCA$^{\text{q}}$ is current liability (item LCTQ) divided by current assets (item ACTQ). OENEG$^{\text{q}}$ is 1 if total liabilities (item LTQ) exceeds total assets and zero otherwise. NITA$^{\text{q}}$ is the sum of net income (item NIQ) for the trailing 4 quarters divided by total assets at the end of the current quarter. FUTL$^{\text{q}}$ is the the sum of funds provided by operations (item PIQ plus item DPQ) for the trailing 4 quarters divided by total liabilities at the end of the current quarter. IN2$^{\text{q}}$ is equal to 1 if net income is negative for the current quarter and 4 quarters ago, and zero otherwise. CHIN$^{\text{q}}$ is $(\text{NIQ}_s - \text{NIQ}_{s-4})/(|\text{NIQ}_s| + |\text{NIQ}_{s-4}|)$, in which NIQ_s and NIQ_{s-4} are the net income for the current quarter and 4 quarters ago. We winsorize all nondummy variables on the right-hand side of equation (12) at the 1st and 99th percentiles of their distributions each month.

At the beginning of each month t, we sort stocks into deciles based on O$^{\text{q}}$ calculated with accounting data from the fiscal quarter ending at least 4 months ago. We calculate decile returns for the current month t (O$^{\text{q}}$1) and rebalance the deciles at the beginning of month $t+1$. For sufficient

data coverage, the O^q portfolios start in January 1976. At the beginning of each month t, we also sort stocks into quintiles based on O^q calculated with accounting data from the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-O^q1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.4.21 Tbi^{q}6 and Tbi^{q}12, Quarterly Taxable Income-to-book Income

Quarterly taxable income-to-book income, Tbi^q, is quarterly pretax income (Compustat quarterly item PIQ) divided by net income (NIQ). At the beginning of each month t, we split stocks into deciles based on Tbi^q calculated with accounting data from the fiscal quarter ending at least 4 months ago. We exclude firms with nonpositive pretax income or net income. Decile returns are calculated from month t to $t+5$ (Tbi^{q}6) and from month t to $t+11$ (Tbi^{q}12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Tbi^{q}6 mean that for a given Tbi^{q}6 decile in each month there exist 6 subdeciles, each initiated in a different month in the prior 6 months. We average the subdecile returns as the return of the Tbi^{q}6 decile.

At the beginning of each month t, we sort stocks into quintiles on Tbi^q calculated with accounting data from the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-Tbi^{q}6) and from month t to $t+11$ (Me-Tbi^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Tbi^{q}6 mean that for a given Me-Tbi^{q}6 portfolio in each month there exist 6 subportfolios, each initiated in a different month in the prior 6 months. We average the subportfolio returns as the return of the Me-Tbi^{q}6 portfolio.

2.4.22 Sg^q1, Quarterly Sales Growth

Quarterly sales growth, Sg^q, is quarterly sales (Compustat quarterly item SALEQ) divided by its value four quarters ago. At the beginning of each month t, we sort stocks into deciles based on the latest Sg^q. Before 1972, we use the most recent Sg^q from fiscal quarters ending at least four months ago. Starting from 1972, we use Sg^q from the most recent quarterly earnings announcement dates (item RDQ). Sales are generally announced with earnings during quarterly earnings announcements (Jegadeesh and Livnat 2006). We require a firm's fiscal quarter end that corresponds to its most recent Sg^q to be within six months prior to the portfolio formation. We also require the earnings announcement date to be after the corresponding fiscal quarter end. We calculate decile returns for the current month t (Sg^q1) and rebalance the deciles at the beginning of month $t+1$.

At the beginning of each month t, we also sort stocks into quintiles based on the latest Sg^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Sg^q1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.4.23 Eg1, Eg6, and Eg12, Expected Growth

Following Hou et al. (2021), we estimate monthly cross-sectional forecasting regressions of one-year-ahead investment-to-assets change, d^1I/A, on the natural log of Tobin'q, $\ln(q)$, operating cash flows, Cop, and the change in return on equity, dRoe. At the beginning of each month t, we measure current investment-to-assets as total assets (Compustat annual item AT) from the most recent fiscal year ending at least four months ago minus the total assets from one year prior, scaled by the 1-year-prior total assets. The one-year ahead investment-to-assets change, d^1I/A, is the investment-to-assets from the first year after the most recent fiscal year end minus the current investment-to-assets.

At the beginning of each month t, Tobin's q is the market equity (from CRSP) plus long-term debt (Compustat annual item DLTT) and short-term debt (item DLC) scaled by book assets (item

AT), all from the most recent fiscal year ending at least four months ago. For firms with multiple share classes, we merge the market equity for all classes. Following Ball, Gerakos, Linnainmaa, and Nikolaev (2016), we measure operating cash flows, Cop, as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS), minus selling, general, and administrative expenses (item XSGA), plus research and development expenditures (item XRD, zero if missing), minus change in accounts receivable (item RECT), minus change in inventory (item INVT), minus change in prepaid expenses (item XPP), plus change in deferred revenue (item DRC plus item DRLT), plus change in trade accounts payable (item AP), and plus change in accrued expenses (item XACC), scaled by book assets, all from the fiscal year ending at least four months ago. Missing annual changes are set to zero. The change in return on equity, dRoe, is Roe minus the 4-quarter-lagged Roe. Roe is income before extraordinary items (Compustat quarterly item IBQ) scaled by the 1-quarter-lagged book equity. See Appendix 2.4.1 for the measurement of quarterly book equity. We compute dRoe with earnings from the most recent announcement dates (item RDQ), and if not available, from the fiscal quarter ending at least four months ago. We winsorize all variables at the 1st and 99th percentiles of their distributions each month. Finally, missing dRoe values are set to zero in the cross-sectional forecasting regressions.

At the beginning of each month t, we construct expected one-year-ahead investment-to-assets changes, denoted $E_t[\mathrm{d}^1\mathrm{I/A}]$, by combining most recent winsorized predictors with the average slopes estimated from the prior 120-month rolling window (30 months minimum). The most recent predictors, $\ln(q)$ and Cop, are from the most recent fiscal year ending at least four months ago as of month t. dRoe is computed using the latest announced quarterly earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago. To avoid look-ahead bias, the average slopes in calculating $E_t[\mathrm{d}^1\mathrm{I/A}]$ are estimated from the prior rolling window regressions, in which $\mathrm{d}^1\mathrm{I/A}$ is from the most recent fiscal year ending at least four months ago as of month t, and the regressors are further lagged by 12 months.

At the beginning of each month t, we sort all stocks into expected growth (Eg) deciles based on

$E_t[\text{d}^1\text{I/A}]$. Decile returns are calculated for the current month t (Eg1), from month t to $t+5$ (Eg6), and from month t to $t+11$ (Eg12). The deciles are rebalanced at the beginning of month $t+1$. The holding period that is longer than one month as in, for instance, Eg6, means that for a given decile in each month there exist six subdeciles, each of which is initiated in a different month in the prior six months. We take the simple average of the subdeciles returns as the return of the Eg6 decile.

At the beginning of each month t, we also sort stocks into quintiles based on $E_t[\text{d}^1\text{I/A}]$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Eg1), from month t to $t+5$ (Me-Eg6), and from month t to $t+11$ (Me-Eg12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-dRoe6 mean that for a given Me-Eg6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Eg6 portfolio.

2.5 Intangibles

2.5.1 Oca and Ioca, (Industry-adjusted) Organizational Capital-to-assets

Following Eisfeldt and Papanikolaou (2013), we construct the stock of organization capital, Oc, using the perpetual inventory method:

$$\text{Oc}_{it} = (1-\delta)\text{Oc}_{it-1} + \text{SG\&A}_{it}/\text{CPI}_t, \tag{13}$$

in which Oc_{it} is the organization capital of firm i at the end of year t, $\text{SG\&A}_{it}$ is selling, general, and administrative (SG&A) expenses (Compustat annual item XSGA) in t, CPI_t is the average consumer price index during year t, and δ is the annual depreciation rate of Oc. The initial stock of Oc is $\text{Oc}_{i0} = \text{SG\&A}_{i0}/(g+\delta)$, in which $\text{SG\&A}_{i0}$ is the first valid SG&A observation (zero or positive) for firm i and g is the long-term growth rate of SG&A. We assume a depreciation rate of 15% for Oc and a long-term growth rate of 10% for SG&A. Missing SG&A values after the starting

date are treated as zero. For portfolio formation at the end of June of year t, we require SG&A to be nonmissing for the fiscal year ending in calendar year $t-1$ because this SG&A value receives the highest weight in Oc. In addition, we exclude firms with zero Oc. Organizational Capital-to-assets, Oca, is Oc scaled by inflation-adjusted total assets (item AT). We industry-standardize Oca with the Fama and French (1997) 17-industry classification. To calculate the industry-adjusted Oca, Ioca, we demean a firm's Oca by its industry mean and then divide the demeaned Oca by the standard deviation of Oca within its industry. To alleviate the impact of outliers, we winsorize Oca at the 1st and 99th percentiles of all firms each year before the industry standardization.

At the end of June of each year t, we sort stocks into deciles based on Oca, and separately, on Ioca, for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Oca, and separately, on Ioca, for the fiscal year ending in calendar year $t-1$. Independently, we sort stocks into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections of the Me and Oca portfolios yields 15 Me-Oca portfolios. Similarly, taking intersections of the Me and Ioca portfolios yields 15 Me-Ioca portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.2 Adm, Advertising Expense-to-market

At the end of June of each year t, we sort stocks into deciles based on advertising expenses-to-market, Adm, which is advertising expenses (Compustat annual item XAD) for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Adm. We keep only firms with positive advertising expenses. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because sufficient XAD data start in 1972, the Adm portfolios start in July 1973. At the end of June of

each year t, we also sort stocks into quintiles based on Adm and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Adm portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.3 Rdm, R&D Expense-to-market

At the end of June of each year t, we sort stocks into deciles based on R&D-to-market, Rdm, which is R&D expenses (Compustat annual item XRD) for the fiscal year ending in calendar year $t-1$ divided by the market equity (from CRSP) at the end of December of $t-1$. For firms with more than one share class, we merge the market equity for all share classes before computing Rdm. We keep only firms with positive R&D expenses. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because the accounting treatment of R&D expenses was standardized in 1975, the Rdm portfolios start in July 1976. At the June-end of year t, we also sort stocks into quintiles based on Rdm and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Rdm portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.4 $\text{Rdm}^{\text{q}}1$, $\text{Rdm}^{\text{q}}6$, and $\text{Rdm}^{\text{q}}12$, Quarterly R&D Expense-to-market

At the beginning of each month t, we split stocks into deciles based on quarterly R&D-to-market, Rdm^{q}, which is quarterly R&D expense (Compustat quarterly item XRDQ) for the fiscal quarter ending at least 4 months ago scaled by the market equity (from CRSP) at the end of $t-1$. For firms with more than 1 share class, we merge the market equity for all share classes before computing Rdm^{q}. We keep only firms with positive R&D expenses. We calculate decile returns for the current month t ($\text{Rdm}^{\text{q}}1$), from month t to $t+5$ ($\text{Rdm}^{\text{q}}6$), and from month t to $t+11$ ($\text{Rdm}^{\text{q}}12$), and the deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in $\text{Rdm}^{\text{q}}6$ mean that for a given decile in each month there exist six subdeciles, each initiated in a dif-

ferent month in the prior six months. We average the subdecile returns as the return of the Rdm^{q}6 decile. Because the quarterly R&D data start in late 1989, the Rdm^q portfolios start in January 1990. At the beginning of each month t, we also sort stocks into quintiles based on Rdm^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Rdm^{q}1), from month t to $t+5$ (Me-Rdm^{q}6), and from month t to $t+11$ (Me-Rdm^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Rdm^{q}6 mean that for a given Me-Rdm^{q}6 portfolio in each month there exist six subportfolios, each initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Rdm^{q}6 portfolio.

2.5.5 Rds^{q}6 and Rds^{q}12, Quarterly R&D Expense-to-sales

At the beginning of each month t, we split stocks into deciles based on quarterly R&D-to-sales, Rds^q, which is quarterly R&D expense (Compustat quarterly item XRDQ) scaled by sales (item SALEQ) for the fiscal quarter ending at least 4 months ago. We keep only firms with positive R&D expenses. We calculate decile returns from month t to $t+5$ (Rds^{q}6) and from month t to $t+11$ (Rds^{q}12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Rds^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Rds^{q}6 decile. Because the quarterly R&D data start in late 1989, the Rds^q portfolios start in January 1990.

At the beginning of each month t, we also sort stocks into quintiles based on Rds^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+5$ (Me-Rds^{q}6) and from month t to $t+11$ (Me-Rds^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Rds^{q}6 mean that for a given Me-Rds^{q}6 portfolio in each

month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Rds^{q}6 portfolio.

2.5.6 Ol, Operating Leverage

Operating leverage, Ol, is operating costs scaled by total assets (Compustat annual item AT, the denominator is current, not lagged, total assets). Operating costs are cost of goods sold (item COGS) plus selling, general, and administrative expenses (item XSGA). At the end of June of year t, we sort stocks into deciles based on Ol for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Ol for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Ol portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.7 Ol^{q}1, Ol^{q}6, and Ol^{q}12, Quarterly Operating Leverage

At the beginning of each month t, we split stocks into deciles based on quarterly operating leverage, Ol^q, which is quarterly operating costs divided by assets (Compustat quarterly item ATQ) for the fiscal quarter ending at least 4 months ago. Operating costs are the cost of goods sold (item COGSQ) plus selling, general, and administrative expenses (item XSGAQ). We calculate decile returns for the current month t (Ol^{q}1), from month t to $t+5$ (Ol^{q}6), and from month t to $t+11$ (Ol^{q}12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Ol^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Ol^{q}6 decile. For sufficient data coverage, the Ol^q portfolios start in January 1973.

At the beginning of each month t, we also sort stocks into quintiles based on Ol^q and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles

of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ol^{q}1), from month t to $t+5$ (Me-Ol^{q}6), and from month t to $t+11$ (Me-Ol^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Ol^{q}6 mean that for a given Me-Ol^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Ol^{q}6 portfolio.

2.5.8 Rca, R&D Capital-to-assets

Following Li (2011), we measure R&D capital, Rc, by accumulating annual R&D expenses over the past 5 years with a linear depreciation rate of 20%:

$$\text{Rc}_{it} = \text{XRD}_{it} + 0.8\,\text{XRD}_{it-1} + 0.6\,\text{XRD}_{it-2} + 0.4\,\text{XRD}_{it-3} + 0.2\,\text{XRD}_{it-4}, \tag{14}$$

in which XRD_{it-j} is firm i's R&D expenses (Compustat annual item XRD) in year $t-j$. R&D capital-to-assets, Rca, is Rc scaled by total assets (item AT). At the end of June of each year t, we sort stocks into deciles based on Rca for the fiscal year ending in calendar year $t-1$. We keep only firms with positive Rc. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. For the portfolio formation at the end of June of year t, we require R&D expenses to be nonmissing for the fiscal year ending in calendar year $t-1$, because this value of R&D expenses receives the highest weight in Rc. Because Rc requires past 5 years of R&D expenses data and the accounting treatment of R&D expenses was standardized in 1975, the Rca portfolios start in July 1980. At the end of June of each year t, we also sort stocks into quintiles based on Rca for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Rca portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.9 Hs, Industry Concentration in Sales

Following Hou and Robinson (2006), we measure a firm's industry concentration with the Herfindahl index, $\sum_{i=1}^{N_j} s_{ij}^2$, in which s_{ij} is the market share of firm i in industry j, and N_j is the total number of firms in the industry. We calculate the market share of a firm using sales (Compustat annual item SALE). Industries are defined by 3-digit SIC codes. We exclude financial firms (SIC between 6000 and 6999) and firms in regulated industries. Following Barclay and Smith (1995), the regulated industries include: railroads (SIC=4011) through 1980, trucking (4210 and 4213) through 1980, airlines (4512) through 1978, telecommunication (4812 and 4813) through 1982, and gas and electric utilities (4900 to 4939). To improve the accuracy of the concentration measure, we exclude an industry if the market share data are available for fewer than 5 firms or 80% of all firms in the industry. We measure industry concentration as the average Herfindahl index during the past 3 years. At the end of June of each year t, we sort stocks into deciles based on industry concentration in sales, Hs, for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Hs for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Hs portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.10 Etr, Effective Tax Rate

Following Abarbanell and Bushee (1998), we measure effective tax rate, Etr, as

$$\text{Etr}(t) = \left[\frac{\text{TaxExpense}(t)}{\text{EBT}(t)} - \frac{1}{3}\sum_{\tau=1}^{3}\frac{\text{TaxExpense}(t-\tau)}{\text{EBT}(t-\tau)}\right] \times \text{dEPS}(t), \tag{15}$$

in which TaxExpense(t) is total income taxes (Compustat annual item TXT) paid in year t, EBT(t) is pretax income (item PI), and dEPS is the change in split-adjusted earnings per share (item EP-

SPX divided by item AJEX) between years $t-1$ and t, deflated by the split-adjusted stock price (item PRCC_F divided by item AJEX) at the end of $t-1$. At the end of June of each year t, we sort stocks into deciles based on Etr for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

At the end of June of each year t, we also sort stocks into quintiles based on Etr for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Etr portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.11 Rer, Industry-adjusted Real Estate Ratio

Following Tuzel (2010), we measure the real estate ratio as the sum of buildings (Compustat annual item PPENB) and capital leases (item PPENLS) divided by net property, plant, and equipment (item PPENT) prior to 1983. From 1984 onward, the real estate ratio is the sum of buildings at cost (item FATB) and leases at cost (item FATL) divided by gross property, plant, and equipment (item PPEGT). Industry-adjusted real estate ratio, Rer, is the real estate ratio minus its industry average. Industries are defined by 2-digit SIC codes. To alleviate the impact of outliers, we winsorize the real estate ratio at the 1st and 99th percentiles of its distribution each year before computing Rer. Following Tuzel (2010), we exclude industries with fewer than five firms. At the end of June of each year t, we sort stocks into deciles based on Rer for the fiscal year ending in calendar year $t-1$. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. Because the real estate data start in 1969, the Rer portfolios start in July 1970.

At the end of June of each year t, we also sort stocks into quintiles based on Rer for the fiscal year ending in calendar year $t-1$ and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Rer portfolios. Portfolio returns are calculated from July

of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.12 Eprd, Earnings Predictability

Following Francis, LaFond, Olsson, and Schipper (2004), we estimate earnings predictability, Eprd, from a first-order autoregressive model for annual split-adjusted earnings per share (Compustat annual item EPSPX divided by item AJEX). At the end of June of each year t, we estimate the autoregressive model in the 10-year rolling window up to the fiscal year ending in calendar year $t-1$. Only firms with a complete 10-year history are included. Eprd is measured as the residual volatility. We sort stocks into deciles based on Eprd. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the end of June of each year t, we also sort stocks into quintiles based on Eprd and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Eprd portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.13 Etl, Earnings Timeliness

Following Francis, LaFond, Olsson, and Schipper (2004), we measure earnings timeliness, Etl, from the following rolling-window regression:

$$\text{EARN}_{it} = \alpha_{i0} + \alpha_{i1}\,\text{NEG}_{it} + \beta_{i1}R_{it} + \beta_{i2}\text{NEG}_{it}R_{it} + e_{it}, \tag{16}$$

in which EARN_{it} is earnings (Compustat annual item IB) for the fiscal year ending in calendar year t, scaled by the fiscal year-end market equity. R_{it} is firm i's 15-month stock return ending 3 months after the end of fiscal year ending in calendar year t. NEG_{it} equals 1 if $R_{it} < 0$, and zero otherwise. For firms with more than 1 share class, we merge the market equity for all share classes. We measure Etl as the R^2 from the regression in (16). At the end of June of each year t, we sort stocks into deciles based on Etl, which is calculated over the 10-year rolling window up to the fiscal year ending in calendar year $t-1$. Only firms with a complete 10-year history are included. Decile returns are

calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$. At the June-end of year t, we also sort stocks into quintiles on Etl and independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of June of t. Taking intersections yields 15 Me-Etl portfolios. Portfolio returns are calculated from July of year t to June of $t+1$, and the portfolios are rebalanced in June of $t+1$.

2.5.14 Alm^{q}1, Alm^{q}6, and Alm^{q}12, Quarterly Asset Liquidity

We measure quarterly asset liquidity as cash + 0.75 × noncash current assets + 0.50 × tangible fixed assets. Cash is cash and short-term investments (Compustat quarterly item CHEQ). Noncash current assets are current assets (item ACTQ) minus cash. Tangible fixed assets are total assets (item ATQ) minus current assets (item ACTQ), and minus intangibles (item INTANQ, zero if missing). Alm^q is quarterly asset liquidity scaled by 1-quarter-lagged market value of assets. The market value of assets is total assets plus market equity (item PRCCQ times item CSHOQ) minus book equity (item CEQQ). At the beginning of each month t, we sort stocks into deciles based on Alm^q for the fiscal quarter ending at least 4 months ago. Decile returns are calculated for the current month t (Alm^{q}1), from month t to $t+5$ (Alm^{q}6), and from month t to $t+11$ (Alm^{q}12). The deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Alm^{q}6 mean that for a given decile in each month there exist six subdeciles, each initiated in a different month in the prior six months. We average the subdecile returns as the return of the Alm^{q}6 decile. For sufficient data coverage, the quarterly asset liquidity portfolios start in January 1976.

At the beginning of each month t, we also sort stocks into quintiles based on Alm^q for the fiscal quarter ending at least 4 months ago and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Alm^{q}1), from month t to $t+5$ (Me-Alm^{q}6), and from month t to $t+11$ (Me-Alm^{q}12). The portfolios are rebalanced at the beginning of month $t+1$. Holding periods

longer than one month like in Me-Alm^{q}6 mean that for a given Me-Alm^{q}6 portfolio in each month there exist six subportfolios, each of which is initiated in a different month in the prior six months. We average the subportfolio returns as the return of the Me-Alm^{q}6 portfolio.

2.5.15 R_{a}^{1}, R_{n}^{1}, $R_{a}^{[2,5]}$, $R_{n}^{[2,5]}$, $R_{a}^{[6,10]}$, $R_{n}^{[6,10]}$, $R_{a}^{[11,15]}$, and $R_{a}^{[16,20]}$, Seasonality

Following Heston and Sadka (2008), at the beginning of each month t, we sort stocks into deciles based on various measures of past performance, including returns in month $t-12$ (R_{a}^{1}), average returns from month $t-11$ to $t-1$ (R_{n}^{1}), average returns across months $t-24, t-36, t-48$, and $t-60$ ($R_{a}^{[2,5]}$), average returns from month $t-60$ to $t-13$ except for lags 24, 36, 48, and 60 ($R_{n}^{[2,5]}$), average returns across months $t-72, t-84, t-96, t-108$, and $t-120$ ($R_{a}^{[6,10]}$), average returns from month $t-120$ to $t-61$ except for lags 72, 84, 96, 108, and 120 ($R_{n}^{[6,10]}$), average returns across months $t-132, t-144, t-156, t-168$, and $t-180$ ($R_{a}^{[11,15]}$), and average returns across months $t-192, t-204, t-216, t-228$, and $t-240$ ($R_{a}^{[16,20]}$). Decile returns are calculated for the current month t, and the deciles are rebalanced at the beginning of month $t+1$. At the beginning of each month t, we also sort stocks into quintiles based on various measures of past performance and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-R_{a}^{1}, Me-R_{n}^{1}, Me-$R_{a}^{[2,5]}$, Me-$R_{n}^{[2,5]}$, Me-$R_{a}^{[6,10]}$, Me-$R_{n}^{[6,10]}$, Me-$R_{a}^{[11,15]}$, Me-$R_{a}^{[16,20]}$) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6 Trading frictions

2.6.1 Me, Market Equity

Market equity, Me, is price times shares outstanding from CRSP. At the end of June of each year t, we sort stocks into deciles based on the June-end Me. Decile returns are calculated from July of year t to June of $t+1$, and the deciles are rebalanced in June of $t+1$.

2.6.2 Ivff1, Idiosyncratic Volatility per the Fama-French 3-factor Model

Following Ang, Hodrick, Xing, and Zhang (2006), we calculate idiosyncratic volatility relative to the Fama-French 3-factor model, Ivff, as the residual volatility from regressing a stock's excess returns on the Fama-French 3 factors. At the beginning of each month t, we sort stocks into deciles based on the Ivff estimated with daily returns from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Ivff1) and the deciles are rebalanced at the beginning of month $t+1$. At the beginning of each month t, we also sort stocks into quintiles based on their Ivff in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ivff1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.3 Ivq1, Idiosyncratic Volatility per the q-factor Model

We calculate idiosyncratic volatility per the Hou, Xue, and Zhang (2015) q-factor model, Ivq, as the residual volatility from regressing a stock's excess returns on the q-factors. At the beginning of each month t, we sort stocks into deciles based on the Ivq estimated with daily returns from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Ivq1) and the deciles are rebalanced at the beginning of month $t+1$. Because the q-factors start in January 1967, the Ivq portfolios start in February 1967.

At the beginning of each month t, we also sort stocks into quintiles based on their Ivq in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Ivq1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.4 Tv1, Total Volatility

At the beginning of each month t, we sort stocks into deciles based on total volatility, Tv, estimated as the volatility of a stock's daily returns from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Tv1) and the deciles are rebalanced at the beginning of month $t+1$. At the beginning of each month t, we also sort stocks into quintiles based on their Tv in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Tv1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.5 Sv1, Systematic Volatility Risk

We measure systematic volatility risk, Sv, as β^i_{dVXO} from the bivariate regression:

$$r^i_d = \beta^i_0 + \beta^i_{\text{MKT}}\text{MKT}_d + \beta^i_{\text{dVXO}}\text{dVXO}_d + \epsilon^i_d, \tag{17}$$

in which r^i_d is stock i's excess return on day d, MKT_d is the market factor return, and dVXO_d is the aggregate volatility shock measured as the daily change in the Chicago Board Options Exchange S&P 100 volatility index (VXO). At the beginning of each month t, we sort stocks into deciles based on β^i_{dVXO} estimated with the daily returns from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Sv1) and the deciles are rebalanced at the beginning of month $t+1$. Because the VXO data start in January 1986, the Sv portfolios start in February 1986. At the beginning of each month t, we also sort stocks into quintiles based on their Sv in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Sv1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.6 β1, Market Beta

At the beginning of each month t, we sort stocks into deciles on their market beta, β, which is estimated with monthly returns from month $t-60$ to $t-1$. We require a minimum of 24 monthly returns. Decile returns are calculated for the current month t (β1) and the deciles are rebalanced at the beginning of month $t+1$. At the beginning of each month t, we also sort stocks into quintiles based on β and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-β1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.7 Dtv12, Dollar Trading Volume

At the beginning of each month t, we sort stocks into deciles based on their average daily dollar trading volume, Dtv, over the prior six months from $t-6$ to $t-1$. We require a minimum of 50 daily observations. Dollar trading volume is share price times the number of shares traded. We adjust the trading volume of NASDAQ stocks per Gao and Ritter (2010).[3] Decile returns are calculated from month t to $t+11$ (Dtv12) and the deciles are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Dtv12 mean that for a given decile in each month there exist 12 subdeciles, each initiated in a different month in the prior 12 months. We average the subdeciles returns as the return of the Dtv12 decile.

At the beginning of each month t, we also sort stocks into quintiles based on Dtv over the prior six months from $t-6$ to $t-1$ and, independently, into micro, small, and big portfolios based on

[3] We adjust the NASDAQ trading volume to account for the institutional differences between NASDAQ and NYSE-Amex volumes (Gao and Ritter 2010). Prior to February 1, 2001, we divide NASDAQ volume by 2. This procedure adjusts for the practice of counting as trades both trades with market makers and trades among market makers. On February 1, 2001, according to the director of research of NASDAQ and Frank Hathaway (the chief economist of NASDAQ), a "riskless principal" rule goes into effect and results in a reduction of approximately 10% in reported volume. From February 1, 2001 to December 31, 2001, we thus divide NASDAQ volume by 1.8. During 2002, securities firms began to charge institutional investors commissions on NASDAQ trades, rather than the prior practice of marking up or down the net price. This practice results in a further reduction in reported volume of approximately 10%. For 2002 and 2003, we divide NASDAQ volume by 1.6. For 2004 and later years, in which the volume of NASDAQ (and NYSE) stocks has mostly been occurring on crossing ne2rks and other venues, we use a divisor of 1.0.

the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated from month t to $t+11$ (Me-Dtv12) and the portfolios are rebalanced at the beginning of month $t+1$. Holding periods longer than one month like in Me-Dtv12 mean that for a given Me-Dtv12 portfolio in each month there exist 12 subportfolios, each of which is initiated in a different month in the prior 12 months. We average the subportfolio returns as the return of the Me-Dtv12 portfolio.

2.6.8 Isff1, Idiosyncratic Skewness per the Fama-French 3-factor Model

At the beginning of each month t, we sort stocks into deciles based on idiosyncratic skewness, Isff, calculated as the skewness of the residuals from regressing a stock's excess return on the Fama and French (1993) three factors using daily observations from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Isff1) and the deciles are rebalanced at the beginning of month $t+1$. At the beginning of each month t, we also sort stocks into quintiles based on Isff in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Isff1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.9 Isq1, Idiosyncratic Skewness per the q-factor Model

At the beginning of each month t, we sort stocks into deciles based on idiosyncratic skewness, Isq, calculated as the skewness of the residuals from regressing a stock's excess return on the Hou, Xue, and Zhang (2015) q-factors using daily observations from month $t-1$. We require a minimum of 15 daily returns. Decile returns are calculated for the current month t (Isq1) and the deciles are rebalanced at the beginning of month $t+1$. Because the q-factors start in January 1967, the Ivq portfolios start in February 1967. At the beginning of each month t, we also sort stocks into quintiles based on Isq in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end

of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Isq1) and the portfolios are rebalanced at the beginning of month $t+1$.

2.6.10 Srev, Short-term Reversal

At the beginning of each month t, we sort stocks into short-term reversal (Srev) deciles based on the return in month $t-1$. To be included in a decile in month t, a stock must have a valid price at the end of month $t-2$ and a valid return for month $t-1$. Decile returns are calculated for the current month t, and the deciles are rebalanced at the beginning of month $t+1$.

At the beginning of each month t, we also sort stocks into quintiles based on the return in month $t-1$ and, independently, into micro, small, and big portfolios based on the NYSE 20th and 50th percentiles of their market equity (Me, from CRSP) at the end of month $t-1$. Taking intersections yields 15 portfolios. Portfolio returns are calculated for the current month t (Me-Srev) and the portfolios are rebalanced at the beginning of month $t+1$.

3 Delisting Adjustment

Following Beaver, McNichols, and Price (2007), we adjust monthly stock returns for delisting returns by compounding returns in the month before delisting with delisting returns from CRSP.

As discussed in Beaver, McNichols, and Price (2007), the monthly CRSP delisting returns (file `msedelist`) might not adjust for delisting properly. We follow their procedure to directly construct the delisting-adjusted monthly stock returns. For delisting that occurs before the last trading day in month t, we calculate the delisting-adjusted monthly return, DR_t, as

$$\text{DR}_t = (1 + \text{pmr}_{dt})(1 + \text{der}_{dt}) - 1, \tag{1}$$

in which pmr_{dt} is the partial month return from the beginning of the month to the delisting day d, and der_{dt} is the delisting event return from the daily CRSP delisting file (`dsedelist`).

We calculate the partial month return, pmr_{dt}, as follows:

- When the delisting date (item DLSTDT) is the same as the delisting payment date (item DLPDT), the monthly CRSP delisting return, mdr_t, includes only the partial month return:

$$\text{pmr}_{dt} = \text{mdr}_t. \tag{2}$$

- When the delisting date precedes the delisting payment date, pmr_{dt} can be computed from the monthly CRSP delisting return and the delisting event return:

$$\text{pmr}_{dt} = \frac{1 + \text{mdr}_t}{1 + \text{der}_{dt}} - 1. \tag{3}$$

- If pmr_{dt} cannot be computed via the above methods, we construct it by accumulating daily returns from the beginning of month t to the delisting day d:

$$\text{pmr}_{dt} = \prod_{i=1}^{d} (1 + \text{ret}_{it}) - 1, \tag{4}$$

in which ret_{it} is the regular stock return on day i.

For delisting that occurs on the last trading day of month t, we include only the regular monthly return for month t, and account for the delisting return at the beginning of the following month: $\text{DR}_t = \text{ret}_t$ and $\text{DR}_{t+1} = \text{der}_{dt}$, in which ret_t is the regular full month return. Differing from Beaver, McNichols, and Price (2007), we do not account for these last-day delistings in the same month, because delisting generally occurs after the market closes. Also, delisting events are often surprises, and their payoffs cannot be determined immediately (Shumway 1997). As such, it might be problematic to incorporate delisting returns immediately on the last trading date in month t.

When delisting event returns are missing, the delisting-adjusted monthly returns cannot be computed. Among nonfinancial firms traded on NYSE, Amex, and NASDAQ, there are 17,442 delistings from 1925 to 2020, with 86% of the delisting event returns available. One option is to exclude missing delisting returns. However, previous studies show that omitting these stocks can introduce significant biases in asset pricing tests (Shumway 1997; Shumway and Warther 1999). As such, we

replace missing delisting event returns using the average available delisting returns with the same stock exchange and delisting type (1-digit delisting code) during the past 60 months. We condition on stock exchange and delisting type because average delisting returns vary significantly across exchanges and delisting types. We also allow replacement values to vary over time because average delisting returns can vary greatly over time. Our procedure is inspired by prior studies. Shumway (1997) proposes a constant replacement value of -30% for all performance-related delistings on NYSE and Amex. Beaver, McNichols, and Price (2007) construct replacement values conditional on stock exchange and delisting type, but do not allow the replacement values to vary over time. We also adjust daily returns for delisting. For delisting occurring on day t, we include only the regular daily return for day t and account for the delisting return on the first *trading* day within ten days after delisting. We replace missing delisting returns using the average available delisting returns with the same stock exchange and delisting type (1-digit delisting code) during the past 60 months.

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