

Private Equity Barometer

Scoring the state of the PE return environment

PitchBook is a Morningstar company providing the most comprehensive, most accurate, and hard-to-find data for professionals doing business in the private markets.

Credits & contact

Research

ANDREW AKERS, CFA Senior Data Analyst
andrew.akers@pitchbook.com
pbinstitutionalresearch@pitchbook.com

Design

JULIA MIDKIFF

Contents

Key takeaways	1
Introduction	2
Factor selection	2-3
PE Barometer	3-7
Conclusion	7
Appendix	8-11

Key takeaways

- Most of the variation in historical quarterly PE returns can be explained by macro, credit, and equity factors that are common across risky assets, including public equity.
- LPs should consider these exposures in PE when constructing multi-asset portfolios and managing risk.
- On an ongoing basis, our PE Barometer provides insight into the state of the current return environment and which factors are driving aggregate returns.

Published on March 22, 2021

COPYRIGHT © 2021 by PitchBook Data, Inc. All rights reserved. No part of this publication may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, and information storage and retrieval systems—without the express written permission of PitchBook Data, Inc. Contents are based on information from sources believed to be reliable, but accuracy and completeness cannot be guaranteed. Nothing herein should be construed as investment advice, a past, current or future recommendation to buy or sell any security or an offer to sell, or a solicitation of an offer to buy any security. This material does not purport to contain all of the information that a prospective investor may wish to consider and is not to be relied upon as such or used in substitution for the exercise of independent judgment.

Introduction

Financial asset returns are a function of a complex and dynamic set of factors that can be easily overlooked when returns are presented as a single number. In this context, factors represent the underlying relationships between the behavior of economies and markets and how asset prices simultaneously change. Economic growth, interest rates, and inflation are examples of macroeconomic factors that affect all asset classes, but in different ways. Understanding the direction and magnitude of these relationships provides insight into the structural risks embedded in an asset and the drivers of current period returns. We applied a factor-based framework to PE¹ returns to create our Private Equity Barometer, which produces a single score that quantifies the state of the current return environment. In addition, the PE Barometer can be used to:

- Provide insight into the economic and market exposures in aggregate PE returns
- Track the latest values of key indicators and determine the drivers of current period returns
- Estimate PE returns on a monthly basis before quarterly fund returns become available

Factor selection

First, we narrow down the economic and market factors that are potentially important to explaining PE returns.² There are thousands of data points that could be included, so it is useful to start with a simple fundamental model of PE returns to narrow the list of potential factors. For time t , PE returns can be decomposed into the following:

$$R_t = \underbrace{\left(1 + \frac{\text{Revenue}_t \times \text{EBITDA Margin}_t}{\text{Revenue}_{t-1} \times \text{EBITDA Margin}_{t-1}} \right)}_{\% \text{ change in EBITDA}} \underbrace{\left(1 + \frac{\text{EV/EBITDA}_t}{\text{EV/EBITDA}_{t-1}} \right)}_{\% \text{ change in valuation}} \underbrace{\left(\frac{\text{Debt}_{t-1}}{\text{Equity}_{t-1}} \right)}_{\text{Leverage}} - 1$$

For this purpose, we will ignore the direct leverage component because it simply acts as a multiplier of the two other terms. The indirect impact of leverage, such as its effect on risk premiums used to discount future cash flows and expected growth rates, will primarily be captured in the valuation component. Thus, the return becomes the product of the percentage change in earnings and in the valuation multiple. The percentage change in earnings can be broken down into changes in revenue and the profit margin. We can then identify two terms that are closely tied to cyclical changes in the economy and market risk premiums: nominal revenue growth and valuation changes. At the aggregate level, revenue growth will be heavily

1: Private equity includes buyout, growth/expansion, mezzanine, and restructuring/turnaround strategies.

2: For this analysis, we adjusted the quarterly PE return series for artificial smoothing. Please see the Appendix for more detail.

influenced by economic growth, while changes in valuation multiples will be influenced by changes in economic growth expectations and in market risk premiums.

Using this framework as a guide, we selected an initial list of 14 indicators that fall into three broad categories: macro, credit, and equity. For each indicator, a separate time series was created for both level and trend, resulting in 28 initial indicators. The trend series for non-growth indicators (for example, credit spreads) was calculated as the quarter-over-quarter change, while the trend series for growth indicators (for example, real GDP growth) was calculated as the difference in the current level from its 12-month exponential moving average. Of the 28 indicators, 16 passed the screening to be included in the Barometer. Please see the Appendix for a dictionary of all the indicators considered and the statistical screening methodology and results.

PE Barometer

At a high level, the PE Barometer is a simple linear regression that is a function of the indicators that passed the initial screening. The function takes the current value of the indicators as inputs and outputs an estimate of the standardized quarterly PE return. For this to be done properly, we first need to address the high degree of correlation among the indicators. A key assumption of a linear regression model is that the inputs are uncorrelated. When this assumption is violated, it becomes difficult to interpret which factors are driving the model output—an important component of this analysis. To mitigate this issue, we applied a technique called principal component analysis (PCA), which we cover in more detail in the Appendix.

The accompanying table shows the beta for each indicator in the PE Barometer regression model. We can assess the importance of each indicator by looking at the absolute value of its beta. Each indicator's contribution to the overall output is based on the product of its beta and its current standardized value. For example, if the value of Chicago National Activity Index was one standard deviation above its mean, the Barometer score (that is, the expected standardized PE return) for the period would increase by 0.13. The overall Barometer score can be calculated by summing up the individual contributions from each of the indicators.

PE Barometer coefficients

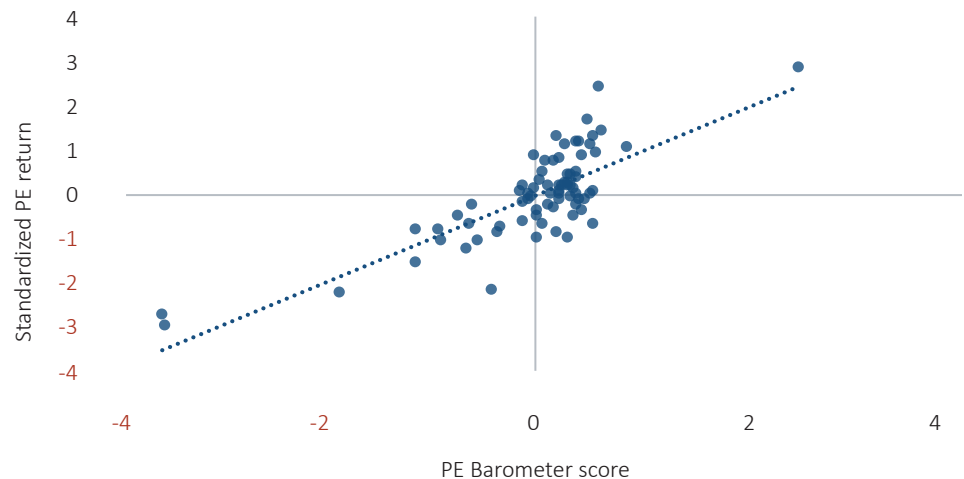
	Indicator	Signal	Beta	95% CI Lower*	95% CI Upper*
Macro	National Activity Index	Level	0.13	0.04	0.18
	National Activity Index	Trend	0.12	0.00	0.18
	Composite Leading Indicators	Level	0.01	-0.03	0.05
	Composite Leading Indicators	Trend	0.04	-0.04	0.10
	Consumer Confidence	Level	0.02	-0.02	0.04
	Consumer Confidence	Trend	0.01	-0.05	0.07
	Business Confidence	Level	0.05	0.01	0.07
	Business Confidence	Trend	0.06	0.00	0.09
Credit	High Yield Spreads	Level	-0.06	-0.09	-0.02
	High Yield Spreads	Trend	-0.09	-0.12	-0.05
	Lending Standards	Level	-0.03	-0.09	0.00
	Financial Stress Index	Level	-0.09	-0.12	-0.06
	Financial Stress Index	Trend	-0.12	-0.17	-0.06
Equity	Implied Equity Vol	Level	-0.08	-0.10	-0.05
	Implied Equity Vol	Trend	-0.12	-0.16	-0.07
	Small Cap Equity	Trend	0.10	0.08	0.13

Source: PitchBook | Geography: US

*Non-parametric confidence interval obtained via bootstrap resampling

The relationship between the PE Barometer score and the standardized quarterly PE return from Q4 2001 to Q3 2020 is shown in the two accompanying charts.

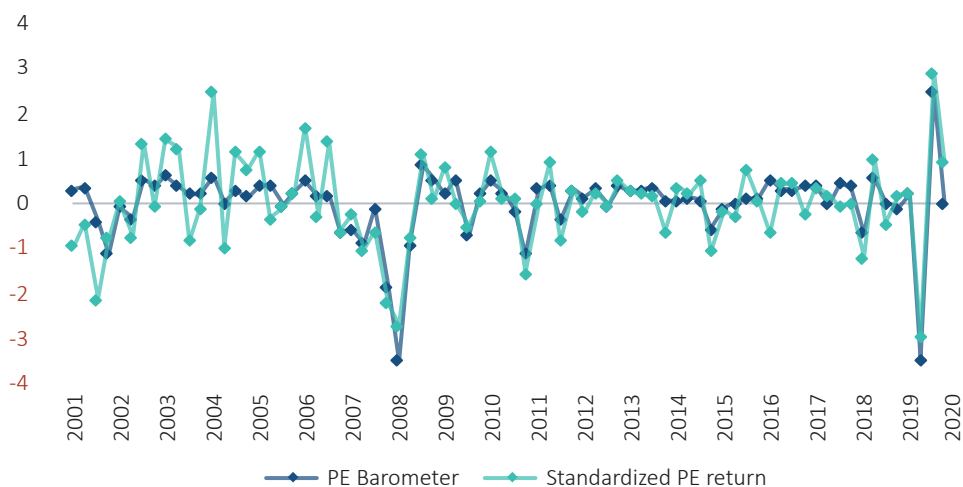
Relationship between the PE Barometer and PE returns



Source: PitchBook | Geography: US

*As of September 30, 2020

Time series of PE Barometer and PE returns



Source: PitchBook | Geography: US
*As of September 30, 2020

The PE Barometer has had a strong positive relationship with PE returns. The full period R^2 is 0.62, suggesting that economic and market factors explain most of the variation in aggregate PE returns. Further, there are two outlier quarters in the early 2000s that materially affected the results. These outliers may be the result of a thinner returns dataset in older periods that increases the sensitivity of aggregate returns to individual fund returns. If the outliers are removed, the full period R^2 increases to 0.67. It is also worth noting that the volatility of quarterly PE returns was significantly higher from 2001 to 2007, potentially caused by the same reasons as the aforementioned outliers. When only including the period from 2008 to present, the R^2 is 0.77.

This research has two primary takeaways for private market investors. First, from a strategic perspective, the PE Barometer shows that PE has significant exposure to the broader market, including macro, credit, and equity factors that are common across most asset classes. These relationships need to be considered when constructing a multi-asset portfolio that includes an allocation to PE. The accompanying chart illustrates the implied impact on quarterly expected PE returns from a one standard deviation move in each of the barometer indicators, considering the correlations among the indicators. Most of the economic indicators show an implied change of 1.5%-2.5%, while equity and credit market indicators show an implied change of 3.0%-4.5%.

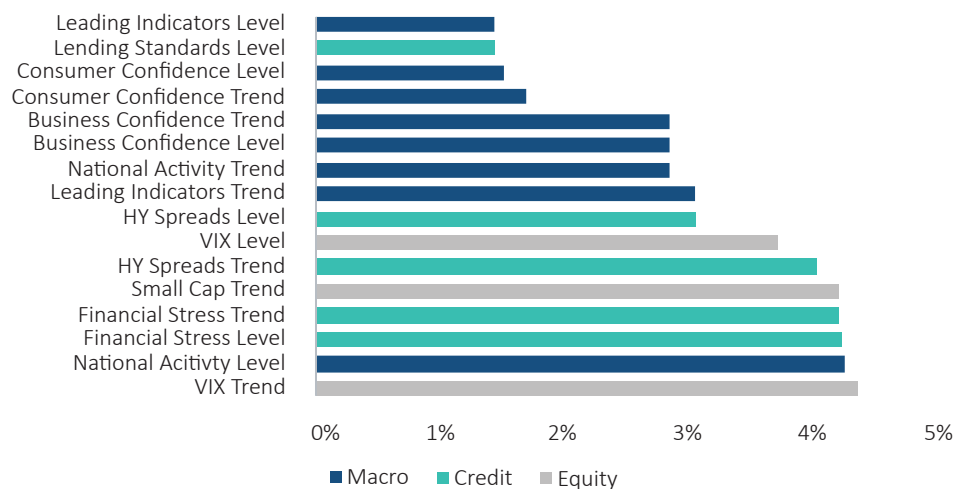
Another important strategic consideration is how these relationships change during periods of market stress. The distributions of risky financial assets are notoriously negatively skewed and fat-tailed, meaning that there are many more occurrences of large positive and negative returns than implied by a normal distribution, and these large returns tend to be negative more often than positive. Research has also shown that correlations between assets tend to increase significantly during periods of high volatility. We apply that logic here to test whether PE returns follow that same pattern with the PE Barometer by looking at 19 quarters in which the PE return had a standard deviation move larger than ± 1 . The R^2 jumps to 0.82 from 0.63 in the full period, suggesting that broader macro and market factors account for nearly all the variation in PE returns during periods of high volatility.

A caveat to this analysis is that it only captures linear relationships that have been consistent through time, which means it does not explicitly account for some data likely to affect returns. To use central bank balance sheet expansion as an example, the consensus among market researchers and economists is that central bank asset purchases drive up equity prices. However, these asset purchases tend to occur as a response to market and economic stress, and the benefit to equity prices is realized with an unknown lag, making its impact in the current period hard to pinpoint. In addition, the Barometer does not factor in inflation, as we do not have reliable PE return data during a period of high inflation. Despite these omissions, the Barometer will indirectly pick up on variables that are not explicitly included because the information will be embedded in the indicators that are included. For example, the impact of central bank purchases on PE returns will likely be included in the Barometer from spread compression and higher public equity prices.

The second takeaway from this research is that it allows investors to track developments in the economy and markets, and objectively assess what is driving PE returns. Since the data that goes into the PE Barometer is available either daily or monthly, it also can estimate the quarterly PE return well in advance. As a case study, the table on the next page shows the PE Barometer for 2020 along with the standardized values for each indicator.

Nearly every indicator helped pull the PE Barometer down in Q1 2020 to -3.5, its lowest score since it posted a similar number in Q4 2008. The Barometer was highlighted by sharp drops in macro activity and sharp increases in financial stress and equity volatility. The bounce back in Q2 was not quite symmetrical, but still strong with credit stress and equity volatility easing. While Q3 was somewhat lackluster, Q4 saw strong public equity market gains and a continued recovery in economic data, such as business confidence. With a PE Barometer Score of 0.59, we expect another strong quarter of PE returns in Q4.

Implied impact on expected PE returns from a one standard deviation move*



Source: PitchBook | Geography: US

*Indicators are normalized such that a positive one standard deviation move shows an increase in expected PE returns.

PE Barometer in 2020

	Indicator	Signal	Beta	Q1	Q2	Q3	Q4
Macro	National Activity Index	Level	0.13	-4.26	5.88	0.49	0.47
	National Activity Index	Trend	0.12	-2.80	6.92	-3.70	-0.03
	Composite Leading Indicators	Level	0.01	-1.51	-2.61	-0.86	-0.30
	Composite Leading Indicators	Trend	0.04	-2.35	-2.17	3.37	1.07
	Consumer Confidence	Level	0.02	0.30	-0.93	-0.53	-0.41
	Consumer Confidence	Trend	0.01	-2.41	-2.76	0.92	0.28
	Business Confidence	Level	0.05	-1.30	-0.71	0.69	1.20
	Business Confidence	Trend	0.06	-0.59	0.90	2.20	0.77
Credit	High Yield Spreads	Level	-0.06	0.77	0.15	-0.13	-0.56
	High Yield Spreads	Trend	-0.09	2.26	-0.92	-0.40	-0.61
	Lending Standards	Level	-0.03	0.04	-0.19	1.54	2.78
	Financial Stress Index	Level	-0.09	3.28	-0.01	-0.21	-0.57
	Financial Stress Index	Trend	-0.12	4.54	-4.00	-0.22	-0.41
Equity	Implied Equity Vol	Level	-0.08	4.20	1.25	0.86	0.28
	Implied Equity Vol	Trend	-0.12	5.10	-3.06	-0.39	-0.60
	Small Cap Equity	Trend	0.10	-2.98	1.86	0.03	2.31
Private Equity Barometer Score				-3.47	2.45	-0.03	0.59
Private Equity Standardized Return				-2.94	2.90	0.89	N/A

Source: PitchBook | Geography: US

Conclusion

The research behind the PE Barometer provides evidence that the historical variation in aggregate PE returns can be explained by macro, credit, and equity factors that are common across risky assets, including public equity. This has important implications for multi-asset portfolio construction and risk management because overall risk tends to be concentrated in these factors in traditional allocations. Additionally, the relationship between PE returns and the Barometer increased during periods of elevated volatility. On an ongoing basis, private market investors can use the PE Barometer to track key economic and market indicators and objectively relate them to PE returns. This assessment can be done monthly rather than quarterly with a shorter lag time than traditional PE fund reporting cycles.

Appendix

Return unsmoothing

Applying a factor-based analysis to PE is a unique challenge because of the lack of market-based pricing in private markets. Unlike public market assets, where prices are set daily in a transparent manner, private market prices are updated infrequently and are typically an unaudited, educated guess of what an asset could have sold for. There is an extensive amount of research on the implications of the pricing practices for private assets. This research has shown that private asset returns are biased estimators of true market returns,³ where the true market return represents the change in the value of an asset had it sold. Instead of reflecting the true market return in the current period, private asset returns are a weighted average of current and prior true market returns. Evidence also indicates that, because PE fund managers mark their portfolio to market well after the quarter-end, developments in the following quarter affect current quarter returns with a positive bias.⁴ All of this results in the time series of private asset returns, such as PE, being artificially smoothed. This smoothing causes volatility and correlations with other time series (for example, public market return, economic data, and so on) to be understated.

Since the goal of the PE Barometer is to analyze linear relationships between PE returns and economic and market factors, we first need to account for this smoothing. To do so, we use the Geltner unsmoothing method,⁵ which adjusts the quarterly PE return series based on the first-order autocorrelation coefficient. While this adjustment is an improvement, it is still an estimate, which adds some degree of error that will impact the results of the analysis. The adjusted quarterly return was calculated as:

$$R_{adj,t} = \frac{R_t - (R_{t-1} \times ACF_{R,t-1})}{1 - ACF_{R,t-1}}, \text{ where } ACF_{R,t-1} \text{ is the one-quarter autocorrelation coefficient}$$

Indicators

The factors selected for consideration were based on a fundamental view of return drivers in PE, which fall into three broad risk categories: macro, credit, and equity. For all factors, we used both level and change. The following factors were considered:

Macro

- Real GDP Growth (YoY%)
 - The year-over-year percentage change in real economic output
- [Chicago Fed National Activity Index](#)
 - The CFNAI is a weighted average of 85 monthly indicators of national economic activity

3: "Smoothing in Appraisal-Based Returns," *Journal of Real Estate Finance and Economics*, David Geltner, Kluwer Academic Publishers, 1991.

4: "MIT Study: Private Equity Managers Exaggerate Performance," *Institutional Investor*, Amy Whyte, October 6, 2017.

5: "Estimating Market Values from Appraised Values without Assuming an Efficient Market," *The Journal of Real Estate Research*, Vol. 8, No. 3, David Geltner, 1993.

- A positive index reading corresponds to growth above trend and a negative index reading corresponds to growth below trend
- The 85 economic indicators that are included in the CFNAI are drawn from four broad categories of data: production and income, employment, personal consumption, and sales/orders/inventories.
- **OECD Composite Leading Indicators**
 - The OECD CLI is designed to provide early signals of turning points in business cycles showing fluctuation around its long-term potential level
 - The CLI contains the following series: housing starts, durable new goods orders, equity prices, consumer confidence, manufacturing weekly hours worked, and yield curve shape
- **Corporate Profits (YoY%)**
 - The year-over-year percentage change in non-financial corporate profits for all US businesses
- **Core PCE Inflation (YoY%)**
 - The year-over-year percentage change in consumer prices, excluding food and energy
- **OECD Consumer Confidence**
 - Consumer confidence provides an indication of future developments of households' consumption and saving, based upon answers regarding their expected financial situation, their sentiment about the general economic situation, unemployment, and capability of savings
- **OECD Business Confidence**
 - Business confidence provides information on future developments, based upon opinion surveys on developments in production, orders, and stocks of finished goods in the industry sector

Credit

- **Corporate High Yield Spreads**
 - The option-adjusted spread of high yield corporate debt
- **Yield Curve**
 - The difference between the 10-year and three-month Treasury yields
- **Corporate Lending Standards**
 - The net difference in the percentage of banks tightening lending standards versus easing lending standards for middle- to large-size corporates

- M1 Money Stock
 - The year-over-year change in the total amount of M1 money stock in circulation
- St. Louis Fed Financial Stress Index
 - The St. Louis Fed FSI is the first principal component of 18 distinct measures of financial stress, consisting primarily of interest rates and credit spreads
 - A measure of 0 indicates normal financial conditions

Equity

- Quarterly return of US public small cap equities
- Implied volatility (VIX, monthly average)
 - The VIX is a measure of implied 30-day equity volatility based on S&P 500 option pricing

Factor screening

Each indicator and level/trend pair was screened based on a single factor linear regression model where the factor is the independent variable, and the quarterly PE return is the dependent variable. The statistical significance of each factor was determined based on the regression coefficient t-statistic. Factors where the p-value related to the t-statistic was less than 0.1 were included in the Barometer. The table below shows the regression results with included factors in bold.

The results indicate that out of the 28 indicator and level/trend pairs tested, 16 passed the screening. The indicators with the strongest relationship to PE returns include public market equity returns, public market equity volatility (VIX), corporate high yield credit spreads, and the Chicago Fed National Activity Index, which is a composite series of a variety of economic measures and a proxy for growth. Somewhat surprisingly, real GDP growth did not end up being included, which highlights the importance of the timing of indicators in this type of analysis. While in the long run GDP should be an important indicator for returns, asset prices often move ahead of short-term changes in GDP.

PE Barometer in 2020

Indicator	Signal	Beta	Std. error	t statistic	P-value
Real GDP	Level	-0.01	0.12	-0.08	0.94
Real GDP	Trend	-0.03	0.12	-0.28	0.78
National Activity Index	Level	0.63	0.09	7.00	0.00
National Activity Index	Trend	0.41	0.11	3.88	0.00
Composite Leading Indicators	Level	0.20	0.11	1.77	0.08
Composite Leading Indicators	Trend	0.47	0.10	4.53	0.00
Corporate Profits*	Level	0.31	0.11	2.79	0.01
Corporate Profits	Trend	0.08	0.12	0.67	0.51
Core PCE Inflation	Level	-0.12	0.12	-1.01	0.32
Core PCE Inflation	Trend	-0.06	0.12	-0.54	0.59
HY Corporate Spreads	Level	-0.45	0.10	-4.30	0.00
HY Corporate Spreads	Trend	-0.56	0.10	-5.76	0.00
Treasury Curve	Level	-0.15	0.11	-1.34	0.18
Treasury Curve	Trend	-0.07	0.12	-0.56	0.58
Lending Standards	Level	-0.30	0.11	-2.71	0.01
Lending Standards	Trend	-0.05	0.12	-0.42	0.68
M1 Money Stock**	Level	0.28	0.11	2.49	0.02
M1 Money Stock**	Trend	0.29	0.11	2.57	0.01
Financial Stress Index	Level	-0.58	0.09	-6.11	0.00
Financial Stress Index	Trend	-0.58	0.09	-6.08	0.00
VIX	Level	-0.52	0.10	-5.23	0.00
VIX	Trend	-0.63	0.09	-6.90	0.00
Small Cap Equity	Trend	0.69	0.08	8.24	0.00
Consumer Confidence	Level	0.20	0.11	1.77	0.08
Consumer Confidence	Trend	0.28	0.11	2.47	0.02
Business Confidence	Level	0.36	0.11	3.37	0.00
Business Confidence	Trend	0.42	0.11	3.93	0.00

Source: PitchBook | Geography: US

*Not included due to significant lag in data availability

**Not included despite a p-value of less than 0.1 due to outlier observations causing instability in the estimates

Principal component analysis

Principal component analysis (PCA) is a commonly used feature extraction technique to deal with multicollinearity in multiple linear regression. PCA transforms a correlated set of factors by determining the directions within those factors that contain the most information. The transformed factors, called principal components, are made up of a linear combination of the original factors. As an added benefit, the principal components are designed to be completely uncorrelated. After applying PCA, we supply the transformed factors as inputs to a linear regression model, keeping only the principal components that are statistically significant at the 5% level. Finally, because the PCA transformed inputs are linear combinations of the original inputs, we can reverse the transformation to interpret the model in terms of the original inputs.