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The expected investment growth premium

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Abstract

We propose a novel measure of investment plans, namely expected investment growth (EIG), and find stocks with high EIG outperform stocks with low EIG by 17% per annum. This premium can be generated in a neoclassical model with the investment plan friction, in which a firm's expected returns increases with its planned investment due to an embedded leverage effect. We provide empirical evidence on the interaction of the cash flow effect and discount rate effect in driving this EIG premium. Our findings highlight the investment plan friction as an important economic channel to understand the cross-sectional risk premium.

1 | INTRODUCTION

Investment plans, that is, investment lags between the investment decision and the actual capital expenditure, have been shown to be important in understanding economic fluctuations and the stock market. Cochrane (1991) and Lamont (2000) argue that the friction of investment plans can help to explain the weak empirical correlation between aggregate investment and future stock returns, a finding that is inconsistent with the q-theory of investment. In the presence of this friction, firms initiate larger investment plans following a negative shock to the discount rate, but the actual capital expenditure only materializes with a lag. Therefore, it should be the investment plan rather than the realized investment that negatively predicts market returns. While it is tempting to extend this discount rate argument to the cross section and predict a lower expected return for firms with larger investment plans, this prediction fails to take into account the important role of cash flow news at the firm level (e.g., Vuolteenaho, 2002). In a firm's optimization problem, stock returns, investment decisions, and risk premium are all endogenous in response to firm-specific cash flow news.

In this paper, we examine the relation between investment plans and stock returns in the cross section. Since firm-level investment plans are unobservable, we propose a novel measure, namely the expected investment growth (EIG), by projecting the firm-level investment growth onto prior stock returns, Tobin's q, and cash flows that have been shown to predict future investment (e.g., Barro, 1990; Morck et al., 1990; Fazzari et al., 1988)[1] and constructing EIG as the out-of-sample predicted investment growth. We compare EIG to the future realized investment growth to validate it as a measure for investment plans. In the EIG decile portfolios, the difference in the average realized investment growth between high and low EIG firms is quantitatively comparable to the spread of EIG itself, with EIG explaining more than 80% of the cross-sectional variation in the future investment growth. Beyond the EIG deciles, our investment plan measure also captures the investment behavior of a much broader set of portfolios, including portfolios sorted by size, book-to-market ratio, momentum, as well as industry classification.

Using this investment plan measure, we find that high EIG firms earn higher future returns than low EIG firms, in contrast to the negative relation between investment plans and stock returns at the aggregate level. In the U.S. sample between August 1972 and December 2016, a long–short portfolio based on EIG generates an annualized return of 17% that cannot be captured by leading asset pricing factor models, including the more recent Fama and French (2015) five-factor model. The EIG premium persists in Fama–MacBeth regressions and alternative sample selections. More importantly, the return predictive power of EIG is beyond that of the constituents of EIG. When we directly project the EIG premium on the premiums associated with momentum, q, and cash flow, the abnormal return remains highly significant. Further, when we construct the expected sales growth and expected gross profit growth following the same procedure as we construct EIG, the corresponding expected sales growth premium and expected gross profit growth premium are substantially weaker than the EIG premium. These results together highlight the distinct role of investment and suggest that the investment plan friction is an important economic channel for how variables such as momentum, q, and cash flow are associated with the cross-sectional risk premium.

To better understand the EIG premium, we develop a neoclassical model with the investment plan friction. In the model, firms are endowed with one asset-in-place and an option to expand its production capacity. A key assumption is that the asset expansion needs to be planned ahead and is costly to reverse, which is consistent with previous empirical findings that firms rarely cancel planned projects.[2] We show that the existence of this investment friction creates a leverage effect that makes the value of planned investment more sensitive to the economic condition than that of existing assets. In the cross section, firms with positive idiosyncratic productivity shocks initiate larger investment plans because of the positive cash flow effect. Meanwhile, the planned investment also raises the discount rate from the embedded leverage. The interaction of the endogenous cash flow effect and discount rate effect gives rise to a positive cross-sectional relation between investment plans and the risk premium.

We provide empirical evidence for the economic mechanism in the neoclassical model. First, compared to firms with low EIG, high EIG firms have higher future sales growth and gross profits growth several years into the future, indicating a strong incentive for these firms to expand their production capacity. Second, in addition to this cash flow effect, the planned investment also increases the risk premium, and we find that higher EIG is associated with higher cash flow sensitivity to the economic growth. Furthermore, investment is sizable compared with operating income, and the elasticity of cash flow (operating income minus investment) to operating income increases monotonically with EIG. These results suggest that the planned investment creates a leverage effect that makes high EIG firms riskier than low EIG firms. Third, the cross-sectional heterogeneity in risk exposures across EIG portfolios also appears in stock returns. A linear factor model with the market factor and economic growth (measured by industrial production growth, gross domestic product growth, or aggregate consumption growth) as the risk factors can well explain the average returns of EIG portfolios. Lastly, we find that the EIG premium is substantially larger in industries with greater investment irreversibility and longer project 255.3(lo5h18.9(atio,)n)-26856(c)-0.7(apsistent)-152.3(w)0h the

2 DATA AND THE INVESTMENT PLAN MEASURE

Our data come from several sources. Monthly stock data are from the Center for Research in Security Prices (CRSP) database. Accounting data are from the Compustat Annual and Quarterly databases. The Fama and French factors are from the Fama and French data library. Our sample includes all NYSE/AMEX/NASDAQ common stocks (excluding stocks in the financial and utility industries).

Since a firm's investment plan is empirically unobservable, we estimate it using the linear projection of the realized investment growth onto other publicly available information from the historical data. The literature on corporate investments offers useful guidance on the selection of investment predictors. For example, Barro (1990) and Morck et al. (1990) document that past stock returns are informative about future investment growth at both the aggregate level and the firm level. Fazzari et al. (1988) and Blanchard et al. (1993), among many others, show that Tobin's q strongly forecasts future investment, consistent with the q theory of investment. In order to balance the investment predictions of both in sample and out of sample performances, we construct our investment plan measure, the EIG, in two steps. In the first stage, we run a cross-sectional investment predictive regression at the end of June in each year $t+1$:

$$\mathrm{IG}_{it} = b_{0,t} + b_{\mathrm{MOM},t} \times \mathrm{MOM}_{it-1} + b_{\mathrm{q},t} \times \mathrm{q}_{it-1} + b_{\mathrm{CF},t} \times \mathrm{CF}_{it-1} + \epsilon_{it}, \tag{1}$$

where IG_{it} is investment growth at year t, MOM_{it-1} is momentum at year $t-1$, q_{it-1} and CF_{it-1} are Tobin's q and cash flow at year $t-1$.[6] To better estimate the relation between the subsequent investment growth and the three predictors, we utilize the long sample period in the Compustat Annual database for the accounting measures, IG, q, and CF. Our first-stage estimation starts from 1963 to avoid the backfilling bias of the Compustat data. In the second stage, we compute the monthly EIG as the out-of-sample predicted value of investment growth from Equation (1). To capture the timely information, we use the most recently available q and CF from Compustat Quarterly database, monthly updated momentum, along with the historical average of the cross-sectional regression coefficients ($\hat{b}_{0,t}$, $\hat{b}_{\mathrm{MOM},t}$, $\hat{b}_{\mathrm{q},t}$, and $\hat{b}_{\mathrm{CF},t}$) up to date.[7] Due to the data availability, the first month with a reasonable coverage of stocks with nonmissing EIG is July 1972,[8] and the monthly EIG portfolio returns in our benchmark analyses are from August 1972 to December 2016. Our procedure ensures that only publicly available information is used to construct EIG.[9]

Figure 1 provides two examples to illustrate to the EIG construction. Panel A shows the timing in the first-stage estimation. In the first example (Panel A.1), we consider a firm with a December fiscal year-end. To estimate Equation (1) at the end of June of year $t+1$, we use the firm's the investment growth from the fiscal year ending in December of year t (IG_{it}), q and cash flow from the fiscal year ending in December of year $t-1$ (q_{it-1} and CF_{it-1}), as well as the cumulative stock returns from December of year $t-2$ to November of year $t-1$ (MOM_{it-1}). In Panel A.2, we consider a different firm with April fiscal year-end. For this firm, since the financial statements for the fiscal year ending in year $t+1$ may not be released by the end of June of year $t+1$, we follow the Fama and French (1992) convention and use the firm's investment growth from the fiscal year ending in April of year t (IG_{it}), q and cash flow from the fiscal year

[6] Specifically, IG_{it} is defined as the growth rate of investment (Compustat item CAPX) in the fiscal year ending in calendar year t, that is, $\mathrm{IG}_{it} = \log(\mathrm{CAPX}_{it}/\mathrm{CAPX}_{it-1})$, MOM_{it-1} is the cumulative stock returns over the past 12 months skipping 1 month relative to the fiscal year ending in calendar year $t-1$, q_{it-1} is defined as the log of the market value of the firm, that is, the sum of market equity (ME), long-term debt (Compustat item DLTT), and short-term debt (Compustat item DLC), divided by total assets (Compustat item AT) in the fiscal year ending in calendar year $t-1$, and CF_{it-1} is measured as the sum of depreciation (Compustat item DP) and income before extraordinary items (Compustat item IB) in the fiscal year ending in calendar year $t-1$ divided by lag total assets.

[7] Specifically, CF is defined as the sum of cash flow (Compustat items IBQ + DPQ) over the previous four quarters divided by total assets (Compustat item ATQ) at the beginning of previous four quarters. q is defined as the sum of market cap, long-term liability (Compustat item DLTTQ), and short-term liability (Compustat item DLCQ), divided by the total asset value (Compustat item ATQ).

[8] Therefore, our first EIG is based on the regression coefficients from 10 years training data (1963–1972) in the first stage, which mitigates the impact of estimation errors.

[9] In the Appendix, we document that our main results are robust to alternative EIG definitions.

TABLE 1 Predictive regressions of EIG

Variables	(1)	(2)	(3)	(4)
Intercept	0.20	2.00	−2.71	−4.66
	(0.09)	(0.80)	(−1.40)	(−2.58)
MOM	35.17			29.68
	(21.36)			(22.48)
q		11.40		4.17
		(9.68)		(3.18)
CF			75.57	53.86
			(6.36)	(6.99)

This table reports the time series average of coefficients of the Fama–MacBeth investment growth predictive regressions on momentum (MOM, Column (1)), q (Column (2)), cash flow (CF, Column (3)), and all three variables together (Column (4)). Every year from 1964 to 2016, we run cross-sectional predictive regressions of firms' investment growth on its lagged MOM, q, and CF, among NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks). Investment growth is computed as the growth rate in capital expenditures (Compustat data item CAPX). MOM is the prior 2- to 12-month cumulative return relative to the fiscal year-end. q is computed as the log of the market value of the firm (sum of market equity, long-term debt, and short-term debt) divided by total assets (Compustat data item AT). CF is the sum of depreciation (Compustat data item DP) and income before extraordinary items (Compustat data item IB) divided by lag total assets. Variables are winsorized cross-sectionally at 1% and 99%. The *t*-statistics in parentheses are calculated based on the heteroskedasticity-consistent standard errors of Newey and West (1987).

ending in April of year $t-1$ (q_{it-1} and CF_{it-1}), as well as the cumulative stock returns from April of year $t-2$ to March of year $t-1$ (MOM_{it-1}) to run the first stage regressions at the end of June of year $t+1$. Panel B provides an example of the second-stage estimation for a firm with a December fiscal year-end and 45-day gap between fiscal quarter-end and the subsequent quarterly earnings 10-Q filings. Since the firm's reporting date for quarterly earnings (Compustat items RDQ) is May 15 for the first quarter (i.e., the fiscal quarter ending in March of year $t+1$) and August 15 for the second quarter (i.e., the fiscal quarter ending in June of year $t+1$), the EIG at the end of July of year $t+1$ (Panel B.1) is based on the q and CF from the most recently available quarterly financial statements from the first fiscal quarter ending in March, and MOM is defined as the cumulative returns from July, t to June, $t+1$. As time moves forward by 1 month (Panel B.2) and the financial statements for the second quarter become available, the EIG at the end of August of $t+1$ is based on q and CF from the financial statements for the fiscal quarter ending in June of year $t+1$ and the cumulative returns from August of year t to July of year $t+1$.

Table 1 confirms the roles of momentum, q, and CF in predicting investment growth by reporting the time series average coefficients from Equation (1) using the full sample. The first three columns are for the univariate regression of future investment growth on each predictive variable, and Column (4) includes all three variables. Consistent with findings in the literature, the estimated coefficients of CF, MOM, and q are all positive and statistically significant. Based on the estimation in Column (4) and the average cross-sectional dispersions in MOM, q, and CF (untabulated), a one-standard-deviation increase in MOM, q, and CF is associated with an increase in future investment growth by 16.0%, 2.8%, and 9.6%, respectively.

To validate that EIG indeed measures investment plans, Table 2 reports average future investment growth for decile portfolios sorted by EIG. The table presents the results from the EIG deciles in the first four quarters (Q1-Q4), as well as the first year (Y1), second year (Y2), third year (Y3), and fifth year (Y5) after the portfolio formation. Firms with high EIG have higher future investment growth than firms with low EIG in the first four quarters. For the bottom EIG decile, average investment growth is consistently negative and statistically significant from zero in all four quarters, which is in sharp contrast with consistently positive and significant investment growth for the top EIG decile. The difference in the investment growth rate between the high and low EIG deciles is 11.8% in the first quarter, 12.7% in the second

TABLE 2 EIG and future investment growth

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Q1	−5.33	−1.68	−0.52	0.63	1.32	1.51	2.06	2.64	3.61	6.44	11.78
Q2	−5.58	−1.72	−0.92	0.52	1.26	1.77	1.73	2.81	4.59	7.11	12.69
Q3	−4.49	−1.59	−0.55	0.50	0.89	1.24	1.82	2.32	3.96	5.80	10.29
Q4	−4.55	−1.64	−0.67	0.88	0.50	1.65	2.02	2.75	3.35	4.54	9.09
Y1	−19.42	−5.04	−0.12	3.23	5.55	8.80	10.56	12.37	17.95	26.10	45.52
Y2	−1.64	2.29	3.64	3.12	5.52	5.53	6.52	7.52	8.66	13.06	14.70
Y3	5.24	3.58	4.37	3.81	3.96	5.20	5.78	5.93	5.89	6.79	1.56
Y5	6.04	8.05	4.39	4.57	6.43	5.45	3.63	3.77	5.32	4.56	−1.48

This table reports the future investment growth of decile EIG portfolios formed based on NYSE breakpoints. We report the average (i.e., the time series mean of cross-sectional median) investment growth in the first four quarters (Q1–Q4), as well as in the first year (Y1), second year (Y2), third year (Y3), and fifth year (Y5) following EIG decile formations. Annual (quarterly) investment growth (in percentages) is computed as the percentage growth rate in capital expenditures from the previous year (quarter). We use the past four-quarter moving average of capital expenditure to smooth out seasonality. The sample includes all NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks) with a December fiscal year-end from 1984Q4 to 2016Q4 for quarterly growth due to the data availability of investment in Compustat Quarterly and from 1973 to 2016 for annual growth.

quarter, 10.3% in the third quarter, and 9.1% in the fourth quarter. However, this difference is relatively short-lived. Even though the investment growth spread between the high and low EIG deciles is 45.5% in the first year, the spread shrinks to only 14.7% and 1.6% in the second and third year, respectively. Therefore, if the investment plan friction is responsible for the difference in the investment dynamics among firms in different EIG portfolios, this friction should also be short-lived.

Figure 2 plots the time series of future 1-year investment growth of the EIG deciles 1, 3, 8, and 10 from 1973 to 2016. Portfolio investment growth tends to comove together, with sharp declines in the early 1980s, the burst of the dot-com bubble in early 2000s, and the 2008 financial crisis for almost all portfolios. More importantly, high EIG firms have higher future investment growth than low EIG firms most of the time, with the portfolio-level EIG explaining more than 80% of the portfolio-level realized investment growth from the cross-sectional regressions (untabulated). In addition to the EIG portfolios, Figure 3 plots the average realized investment growth against the average EIG for a much broader set of portfolios, including 10 size portfolios, 10 book-to-market portfolios, 10 momentum portfolios, and 17 industry portfolios based on the Fama and French 17-industry classification. Again, we find that EIG for these portfolios does capture a large cross-sectional variation in future realized investment growth. These findings therefore provide strong evidence for our EIG in measuring investment plans.

3 | EIG AND FUTURE STOCK RETURNS

In this section, we examine the relation between investment plans and cross-sectional stock returns using EIG constructed from the previous section.

3.1 | Benchmark results

Table 3 reports the characteristics of monthly rebalanced decile portfolios sorted by EIG based on NYSE breakpoints. High EIG firms have better past stock performance (MOM) and accounting performance (CF) than low EIG firms. The

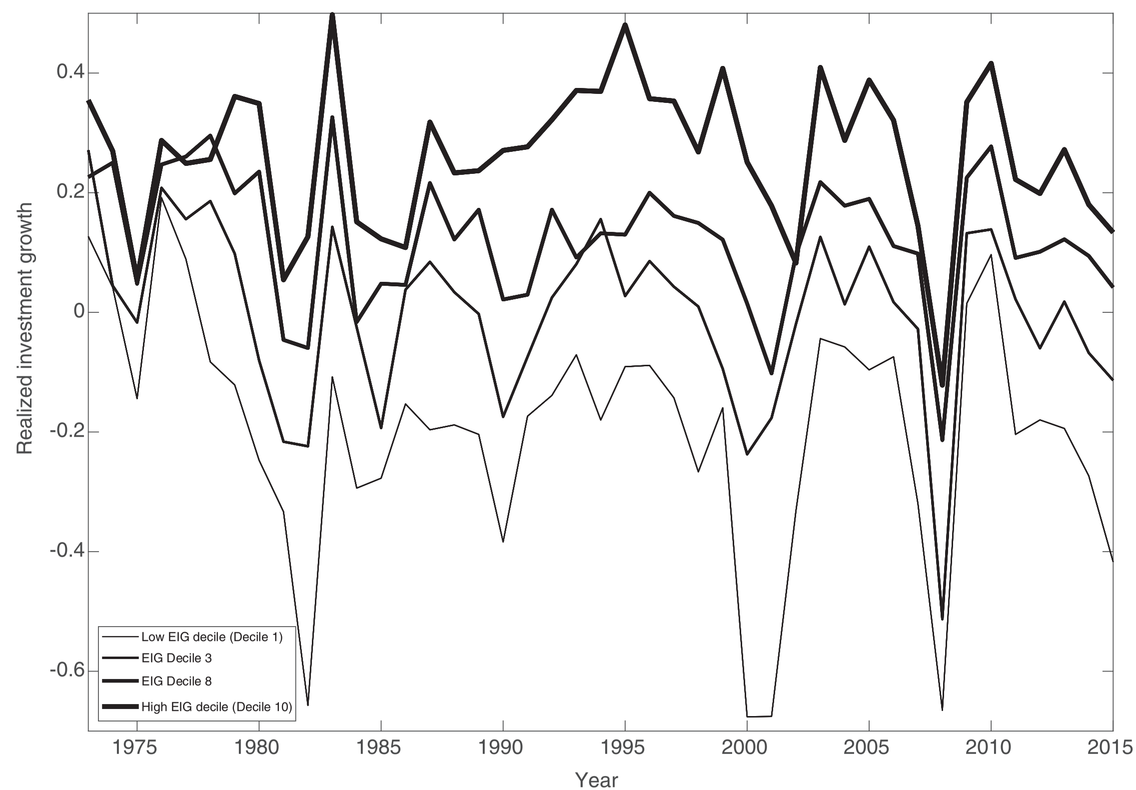

FIGURE 2 Times series of realized investment growth for EIG deciles
This figure plots the time series of the realized investment growth for the EIG deciles 1, 3, 8, and 10, formed based on NYSE breakpoints. The realized investment growth is computed as the growth rate of investment expenditure (Compustata data item CAPX) in the subsequent year. We use the median firm-level realized investment growth as the portfolio investment growth. The sample is annual from 1973 to 2016 and includes all NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks) with a December fiscal year-end.

TABLE 3 Characteristics of EIG portfolios

TABLE 5 Fama–MacBeth regressions

	Panel A: Full sample					Panel B: All-but-micro subsample				
Specification	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Intercept	0.66	1.54	1.57	1.51	1.56	0.43	0.83	0.87	0.82	0.83
	(2.52)	(4.16)	(4.30)	(3.88)	(4.09)	(1.72)	(1.91)	(2.03)	(1.86)	(1.88)
EIG	1.81	2.24	1.98	1.72	2.14	2.24	2.10	2.35	1.73	2.78
	(3.44)	(4.44)	(2.82)	(3.85)	(3.08)	(4.54)	(4.18)	(3.81)	(3.41)	(3.73)
LogBM		0.31	0.31	0.20	0.18		0.28	0.28	0.24	0.22
		(4.44)	(4.51)	(2.87)	(2.70)		(3.87)	(3.75)	(3.24)	(3.01)
LogME		−0.16	−0.16	−0.16	−0.16		−0.04	−0.05	−0.04	−0.04
		(−3.79)	(−3.89)	(−3.73)	(−4.01)		(−0.99)	(−1.14)	(−1.09)	(−1.10)
MOM			0.03		−0.20			−0.12		−0.40
			(0.12)		(−0.90)			(−0.56)		(−1.37)
GP				0.22	0.14				0.38	0.32
				(1.25)	(0.78)				(2.02)	(1.77)
AG				−0.68	−0.61				−0.77	−0.87
				(−1.72)	(−1.57)				(−4.33)	(−3.28)
IG					−0.08					−0.02
					(−2.83)					(−0.47)

This table reports the time-series average coefficients from the monthly Fama–MacBeth regressions of subsequent 1-month excess stock returns (in percentages) on EIG and other firm characteristics. Firm characteristics we consider include: expected investment growth (EIG), log of firm market value (LogME), log of book-to-equity ratio (LogBM), prior 2- to 12-month cumulative returns (MOM), gross profitability (GP), asset growth (AG), and investment growth (IG). Variable definitions are in Panel A of Table 3. The sample includes NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks) in Panel A and excludes microstocks (stocks smaller than 20% of the NYSE size cutoff in the previous month) in Panel B. The right-hand-side accounting variables are winsorized cross-sectionally at the 1st and 99th percentiles. The sample period is from August 1972 to December 2016. The *t*-statistics in parentheses are calculated based on White (1980).

portfolio (Hi-Lo) generates an average return of 17.03% per year with a Sharpe ratio of 0.70. Despite the large profitability, none of the leading factor models fully captures the EIG premium. The abnormal return ranges from 9.86% per year for the Carhart (1997) four-factor model to 22.49% per year for the Fama and French (1993) three-factor model.

To better control for firm characteristics that are not included in factor models, we run Fama–MacBeth cross-sectional regressions including book-to-market ratio (logBM), firm size (logME), momentum (MOM), gross profitability (GP), asset growth (AG), and past investment growth (IG). Table 5 reports the estimated coefficients for the full sample in Panel A and the all-but-micro subsample in Panel B. In the univariate regression of future stock returns on EIG (Specification (1) of Panel A), the EIG coefficient is 1.81, which is 3.44 standard errors greater than zero. Using the average cross-sectional dispersion in EIG (untabulated), a one-standard-deviation increase in EIG is associated with a 4.5% increase in the annual stock return. Controlling for firm size and book-to-market (Specification (2)) further increases the EIG coefficient to 2.24, whereas adding momentum to the regression (Specification (3)) weakens it to 1.98 because of the positive correlation between EIG and momentum. Interestingly, the coefficient of momentum is insignificant (0.03) in the presence of EIG, indicating that the return predictive power of momentum is in fact subsumed by EIG. Specifications (4) and (5) of Panel A add additional characteristics including gross profitability, asset growth, and past investment growth, and the return predictive power of EIG remains highly significant. Panel B of Table 5 repeats the same Fama–MacBeth regressions in all but microfirms. The EIG coefficients are quantitatively

TABLE 6 The role of investment

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Panel A: Alternative decile portfolios											
Panel A.1: Momentum portfolios											
Ret^e	−2.03	4.23	5.04	6.52	6.45	5.53	7.02	8.04	8.63	13.43	15.46
	(−0.44)	(1.25)	(1.70)	(2.44)	(2.56)	(2.22)	(2.91)	(3.25)	(3.22)	(4.00)	(3.78)
SR	−0.07	0.19	0.25	0.37	0.38	0.33	0.44	0.49	0.48	0.60	0.57
Panel A.2: q portfolios											
Ret^e	11.51	9.15	8.38	7.42	7.13	8.22	7.27	7.04	4.94	5.79	−5.72
	(3.53)	(3.06)	(2.68)	(2.78)	(2.70)	(3.26)	(2.85)	(2.82)	(2.03)	(2.11)	(−2.34)
SR	0.53	0.46	0.40	0.42	0.41	0.49	0.43	0.42	0.30	0.32	−0.35
Panel A.3: Cash flow portfolios											
Ret^e	2.14	6.21	7.97	6.96	7.03	7.33	8.58	5.65	6.41	7.26	5.12
	(0.56)	(2.12)	(2.83)	(2.64)	(2.70)	(3.06)	(3.72)	(2.30)	(2.58)	(2.62)	(1.98)
SR	0.08	0.32	0.42	0.40	0.40	0.46	0.56	0.35	0.39	0.39	0.30
Panel A.4: Expected sales growth portfolios											
Ret^e	1.73	4.42	5.94	7.18	6.53	6.32	6.98	6.29	6.71	8.20	6.47
	(0.41)	(1.30)	(1.97)	(2.49)	(2.50)	(2.47)	(2.88)	(2.55)	(2.66)	(2.75)	(1.79)
SR	0.06	0.20	0.29	0.37	0.37	0.37	0.43	0.38	0.40	0.41	0.27
Panel A.5: Expected gross profit growth portfolios											
Ret^e	0.95	6.40	7.19	5.11	6.30	5.62	6.73	6.23	6.66	9.01	8.06
	(0.23)	(1.84)	(2.37)	(1.79)	(2.41)	(2.20)	(2.67)	(2.51)	(2.61)	(2.96)	(2.16)
SR	0.03	0.28	0.36	0.27	0.36	0.33	0.40	0.38	0.39	0.44	0.32

Panel B: Projection of EIG premium on momentum, q, and cash flow premia

	α	β_{MOM}	β	β_{CF}
Estimate	4.46	0.67	0.02	0.46
	(2.96)	(17.11)	(0.60)	(15.56)

This table examines the role of investment. Panel A reports average returns (Ret^e) and Sharpe ratios (SR) of various decile portfolios. Panels A.1–A.3 report the result for decile portfolios sorted on momentum (Panel A.1), q (Panel A.2), and cash flow (Panel A.3). Panels A.4 to A.5 report the result for decile portfolios sorted on expected sales growth (Panel A.4) and expected gross profit growth (Panel A.5). Panel B reports the estimated coefficients from the time series regression of the EIG premium onto the momentum, q, and cash flow premia. Each of the premium is constructed as the corresponding long-short decile portfolio return spread. The returns and abnormal returns are annualized and reported in percentages. The sample period is from August 1972 to December 2016. The t-statistics in parentheses are calculated based on the heteroskedasticity-consistent standard errors of White (1980).

series regression. Although the EIG premium has positive exposures to all three premia, the abnormal return remains 4.46% per year and is about three standard deviations from zero.

In Table 7, we consider three alternative specifications of EIG estimation and report the results of the corresponding investment return predictive regressions in Panel A and the portfolio returns in Panel B. In Specification (1), we further include the stock returns in the prior 2–5 years. In contrast to the strong and positive return predictive power of momentum, Panel A shows the coefficients on the prior 3–5 year returns are significantly negative, and Panel B.1 shows that the EIG premium remains high at 11.4% per year with the inclusion of the longer stock returns. In Specification (2), we remove momentum from Specification (1) to alleviate the concern is that the EIG premium is completely

TABLE 7 EIG based on alternative investment growth predictors

Panel A: Predictive regressions of expected investment growth

Specification	Intercept	MOM	$RET_{-24,-13}$	$RET_{-36,-25}$	$RET_{-48,-37}$	$RET_{-60,-49}$	q	CF	CF_{-1}	CF_{-2}	CF_{-3}	CF_{-4}
(1)	−4.41	28.35	1.74	−2.51	−3.09	−2.00	3.81	57.66				
	(−2.81)	(19.21)	(1.76)	(−2.51)	(−2.78)	(−3.24)	(3.36)	(5.36)				
(2)	−3.30		−1.94	−5.72	−5.30	−3.81	10.16	84.20				
	(−1.69)		(−1.83)	(−4.94)	(−4.70)	(−5.15)	(5.57)	(5.82)				
(3)	−1.01	25.86	2.32	−0.42	−1.15	−1.39	4.77	112.29	−73.53	−20.56	−13.89	19.10
	(−0.49)	(15.55)	(2.23)	(−0.52)	(−1.12)	(−1.85)	(5.74)	(4.77)	(−3.32)	(−2.08)	(−1.27)	(1.57)

Panel B: Portfolio returns sorted on various EIGs in Panel A

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Panel B.1: EIG based on Specification (1)											
Ret^e	−1.10	3.25	6.13	5.30	6.62	5.67	7.40	7.65	7.74	10.34	11.44
	(−0.27)	(0.95)	(2.03)	(1.95)	(2.68)	(2.32)	(3.09)	(3.24)	(3.05)	(3.40)	(3.46)
SR	−0.04	0.14	0.30	0.29	0.40	0.35	0.46	0.49	0.46	0.51	0.52
Panel B.2: EIG based on Specification (2)											
Ret^e	3.37	6.80	6.79	7.90	7.82	8.56	7.78	5.91	6.19	7.50	4.14
	(0.89)	(2.16)	(2.39)	(2.90)	(2.95)	(3.48)	(3.24)	(2.45)	(2.53)	(2.94)	(1.65)
SR	0.13	0.32	0.36	0.43	0.44	0.52	0.49	0.37	0.38	0.44	0.25
Panel B.3: EIG based on Specification (3)											
Ret^e	3.79	5.88	7.70	6.62	6.05	8.63	8.72	8.36	9.20	11.18	7.40
	(1.02)	(1.89)	(2.63)	(2.46)	(2.42)	(3.52)	(3.65)	(3.36)	(3.50)	(3.43)	(2.44)
SR	0.16	0.30	0.41	0.39	0.38	0.55	0.57	0.53	0.55	0.54	0.38

driven by the momentum profits. Panel B.2 shows that without momentum the EIG premium indeed reduces to 4.14% per year (t-statistic = 1.65). However, in untabulated analyses, we find the weaker premium is partly due to the exposure to standard factors. In particular, the abnormal return of this alternative EIG premium is 6.82% (t-statistic = 2.99) from the CAPM test, 9.38% (t-statistic = 4.78) from the Fama and French three-factor model test, 6.08% (t-statistic = 3.28) from the Cahart model test, and 5.61% (t-statistic = 3.07) from the Fama and French five-factor model test. Therefore, even without momentum, the information about future investment growth still positively predicts stock returns. In Specification (3), we also include cash flows from prior 2–5 years. Unlike the strong positive coefficient on the cash flows from the prior year, the further lagged cash flows have negative predictions for subsequent investment growth, and the EIG premium is smaller albeit both statistically and economically significant at 7.4% per year.

Taken together, the results highlight the distinct role of investment. While the goal of these analyses is not to claim the EIG premium as another cross-sectional anomaly, the fact that the EIG premium is stronger than the premiums of momentum, q, and cash flow, and beyond the factors in the leading asset pricing models suggest that the investment plan friction provides an important *economic* channel through which variables such as past stock returns, valuation ratios, and cash flows affect firms' risk premium in the cross section. In the next section, we develop a neoclassical model to understand this premium.

4 | A NEOCLASSICAL MODEL

There are two periods in the model. In the first period ($t = 0$), firms are endowed with an existing project of the scale K_0, which is normalized to one without loss of generality. Firms' production is exposed to both firm-level productivity A and aggregate productivity X. The production function of a project with scale K takes the form $Y = AXK^{\alpha}$, where Y is the project's output and $0 < \alpha < 1$ captures the decreasing returns to scale of production. At $t = 0$, each firm is also endowed with an investment opportunity. Depending on the realized productivity A_0 and X_0 at $t = 0$, firms need to make an investment plan for $t = 1$ on how much capital to install (K_1). Once the plan is made, the firm commits to invest and uses the new project to produce additional outputs along with the existing project. For simplicity, we assume zero capital depreciation and abstract from convex capital adjustment costs.

Two assumptions require further discussion. First, we can think of one period in the model as 1 year, so our 2-year investment plan structure is consistent with the existing empirical findings. For example, Koeva (2000) documents that the average time for project completion is approximately 2 years in most industries, and Mayer (1960) finds that the average project takes 22 months to complete with the first 7 months are the preconstruction planning phase. Second, we have implicitly assumed that the planned investment needs to be completed, no matter what the subsequent business conditions are. This is also consistent with the empirical evidence for the irreversibility of planned investment. For example, out of 106 projects in the sample of Koeva (2000), only one was canceled because of a change in demand and nine projects were delayed because of technical issues.

Given the stochastic discount factor (SDF) M_1 for $t = 1$, which we specify below, the firm's problem is to choose the investment plans I_1 and K_1 to maximize the firm's value:

$$\begin{aligned} V_0 &= \max_{I_1, K_1} \left\{ A_0 X_0 + E_0[M_1(A_1 X_1 K_1^{\alpha} - I_1 + A_1 X_1)] \right\} \\ &\text{s.t. } K_1 = \kappa I_1, \end{aligned} \tag{2}$$

where $\kappa < 1$ captures the adjustment cost associated with installing the new capital. Firms have two sources of income from production at $t = 1$: one from the existing project endowed at $t = 0 (A_1 X_1)$ and the second one from the newly invested project ($A_1 X_1 K_1^{\alpha}$), which costs I_1 to establish at $t = 1$.

We assume both X and A follow geometric Brownian motion, that is,

$$x_1 = x_0 + \sigma_x \epsilon_x - \frac{1}{2}\sigma_x^2, \tag{3}$$

$$a_1 = a_0 + \sigma_a \epsilon_a - \frac{1}{2}\sigma_a^2, \tag{4}$$

where we have denoted the lowercase x and a to be the natural logarithm of X and A, respectively, and σ_x and σ_a measure the volatility of these two shocks. Finally, the SDF is assumed to take the form:

$$M_1 = \exp\left(-r_f - \gamma\sigma_x\epsilon_x - \frac{1}{2}\gamma^2\sigma_x^2\right), \tag{5}$$

where γ captures the price of risk for X shocks and r_f is the risk-free rate.

The first-order condition of Equation (1) gives the following proposition.

Proposition 1. *The firm's optimal investment plans I_1 and K_1 are given by:*

$$I_1^* = K_1^*/\kappa = \kappa^{\frac{\alpha}{1-\alpha}}\left[\alpha \exp\left(a_0 + x_0 - \gamma\sigma_x^2\right)\right]^{\frac{1}{1-\alpha}}. \tag{6}$$

Since $0 < \alpha < 1$, this equation predicts that all else being equal, firms with high productivity a_0 will initiate larger investment plans. Furthermore, because firms' realized stock returns, q, and cash flow are also increasing functions of a_0, they contain useful information about investment plans when the latter is unobservable. Indeed, as shown in the top left, top right, and bottom left panels in Figure 4, our model implies that firms with higher realized stock returns, higher q, and higher cash flows initiate larger investment plans than firms with lower stock returns, lower q, and lower cash flows. These relations are consistent with the selection of investment predictors in Section 2.

Using the expression for I^* and K^* from Proposition 1, the ex-dividend firm value (P_0) at the ex-dividend f4.2(39hc 0

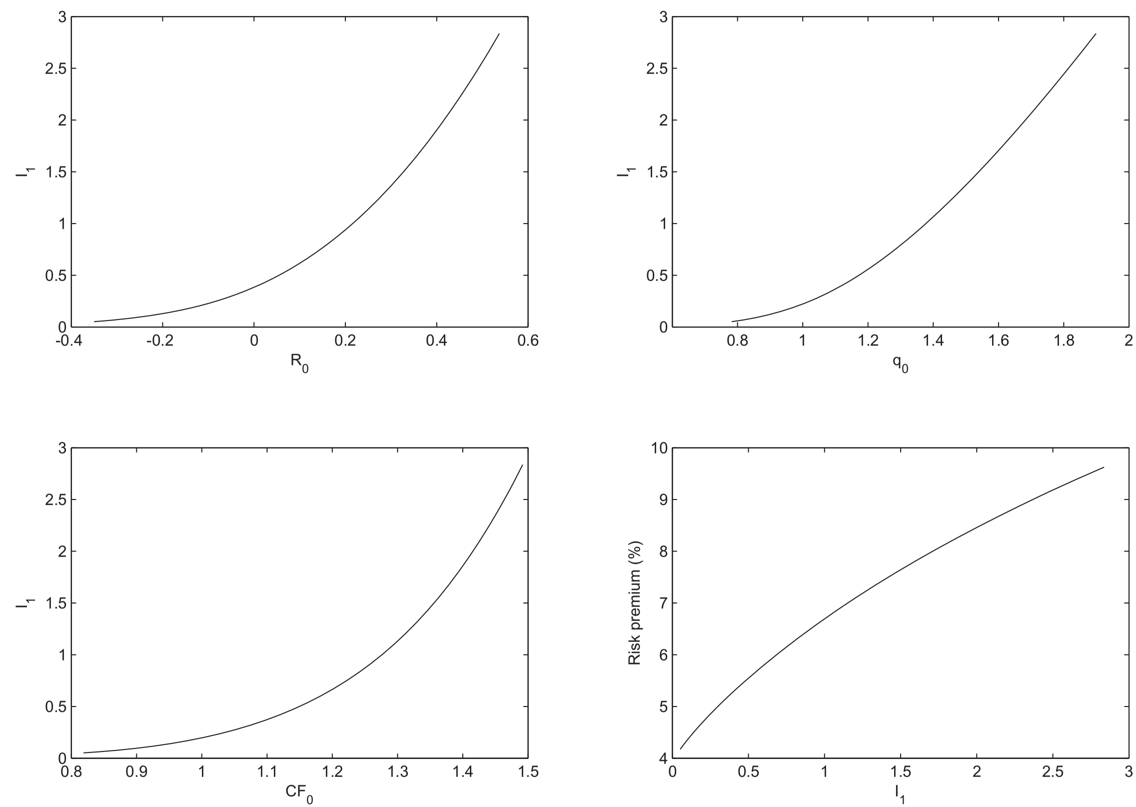

FIGURE 4 Model-implied relation between realized return, q, cash flow, expected investment, and risk premium

This figure plots the relation between realized stock return (R_0), q_0, cash flow (CF_0), expected investment (I_1), and risk premium implied from the two-period model. The parameter values we choose to generate these plots are $\alpha = 0.85$, $X_0 = 1$, $\gamma = 15$, $\sigma_x = 0.05$, $r_f = 0.02$, and $\varkappa = 0.95$.

Proposition 2 predicts a positive expected investment premium, and the intuition is as follows. The expected return of a stock can be considered as the weighted average of the expected return of the existing project and the expected return of the planned project. The expected return of the existing project is $\exp(r_f + \gamma\sigma_x^2)$. The expected return of the investment plan is $\exp(r_f)\frac{\alpha^{\frac{\alpha}{1-\alpha}}\exp(\gamma\sigma_x^2)-\alpha^{\frac{1}{1-\alpha}}}{\alpha^{\frac{\alpha}{1-\alpha}}-\alpha^{\frac{1}{1-\alpha}}}$, which is higher than $\exp(r_f + \gamma\sigma_x^2)$ because the planned investment creates a leverage effect that increases the cash flow risk to the economic condition. In the cross section, when a firm experiences a positive productivity shock a_0, a greater portion of firm value derives from the planned project than from the existing project. This asset composition effect gives rise to a positive expected investment premium, which is confirmed in the bottom right panel of Figure 4. More precisely, a positive idiosyncratic productivity shock creates two competing effects on firms' investment decisions in the presence of investment lags. On the one hand, higher productivity generates a positive cash flow effect, inducing firms to initiate larger investment plans. On the other hand, larger investment plans increase the discount rate, which lowers firm values. The cash flow effect dominates the discount rate effect so that firms with positive productivity shocks optimally choose larger investment plans, despite the higher risk premiums.

It should be noted that investment lags are crucial for the cross-sectional risk premium in this model. In the absence of this friction (i.e., if I_1 is incurred in $t = 0$), the leverage effect does not exist, and the existing project and the newly initiated project have the same exposures to X. In this case, firms' expected returns are independent of a_0 and equal to $\exp(r_f + \gamma\sigma_x^2)$. The friction of investment plans also differs from the convex adjustment cost in the standard q-theory of investment. When the capital adjustment cost is convex, investment spikes immediately in response to a positive productivity shock and gradually decays afterwards. Therefore, the q theory predicts a negative, rather than positive, relation between stock returns and subsequent investment growth, inconsistent with the previous empirical findings in the literature.

We consider this simple model to be illustrative and by no means to be comprehensive enough to capture other cross-sectional phenomena such as the value premium. There can be other forces that affect the relation between firms' valuation ratios and risk premiums. For instance, firms differ in their investment opportunities (e.g., Ai et al., 2013; Kogan Papanikolaou, 2012), with growth firms having more growth options than value firms. When growth options are less risky than assets in place, growth firms have lower risk premiums than value firms. Another interpretation for the value premium is that value firms may have higher operating leverage and financial leverage (e.g., Carlson et al., 2004; Choi, 2013), making them riskier than growth firms. Importantly, these channels may work at different horizons from the investment plan channel. While the investment plan friction tends to be relatively short-lived, the asset composition and operating/financial leverage channels work at much lower frequencies. It is beyond the scope of this paper, but extending the model to multiple periods such as infinite horizons can potentially reconcile these premiums.

5 | ADDITIONAL TESTS OF ECONOMIC MECHANISM

In this section, we provide additional empirical evidence for the economic mechanism in our neoclassical model. As discussed in the previous section, the model suggests two opposing effects of firm-specific productivity shocks. On the one hand, a positive productivity shock increases future cash flows, providing an incentive to initiate larger investment (i.e., the cash flow effect). On the other hand, the existence of the investment plan friction increases firm's risk premium because of the embedded leverage effect (i.e., the discount rate effect). The cash flow effect dominates, so firms with larger investment plans have higher risk premiums than firms with smaller investment plans. In Sections 5.1 and 5.2, we examine the cash flow effect and show that the cash flow of high EIG firms is more sensitive to economic conditions than low EIG firms. In Section 5.3, we provide direct evidence for the leverage effect induced by investment plans. We test the exposure of EIG portfolio returns to the economic growth in a two-factor model asset pricing

TABLE 8 EIG and future profitability

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Panel A: Sales growth											
Y1	2.13	4.80	5.66	6.45	7.46	8.05	9.29	10.27	12.83	17.23	15.10
	(2.17)	(2.70)	(3.57)	(3.98)	(4.77)	(4.75)	(6.30)	(5.51)	(8.24)	(9.55)	(11.27)
Y2	3.37	5.25	5.57	5.89	6.61	7.05	8.59	8.56	9.52	11.88	8.51
	(3.43)	(4.14)	(4.39)	(4.28)	(4.98)	(5.36)	(5.99)	(5.49)	(6.90)	(8.91)	(9.94)
Y3	3.84	5.24	5.55	5.41	6.02	6.46	6.86	7.63	8.16	9.92	6.08
	(3.79)	(4.17)	(5.26)	(4.41)	(5.05)	(5.33)	(6.20)	(6.29)	(8.16)	(10.63)	(14.37)
Panel B: Gross profit growth											
Y1	1.17	1.34	1.61	1.99	2.24	2.62	3.02	3.39	4.64	6.74	5.57
	(4.67)	(3.07)	(3.95)	(4.41)	(6.19)	(6.52)	(8.77)	(8.23)	(15.01)	(15.66)	(16.80)
Y2	1.72	1.83	1.89	1.97	2.12	2.27	2.89	2.97	3.33	4.38	2.66
	(7.98)	(5.06)	(6.38)	(5.89)	(6.68)	(7.91)	(7.42)	(9.45)	(11.91)	(17.57)	(11.76)
Y3	1.69	1.99	2.08	1.92	2.06	2.24	2.27	2.74	3.06	3.75	2.06
	(6.71)	(5.38)	(5.05)	(4.95)	(6.73)	(8.08)	(9.17)	(9.28)	(17.55)	(16.73)	(7.02)

This table reports the average (i.e., the time series mean of cross-sectional median) profitability, measured by the growth rates in sales (Panel A) and in gross profits (Panel B), both in percentages, in the first year (Y1), second year (Y2), and third year (Y3) following EIG decile formations. Sales growth is defined as the change in sales divided by lagged total assets, and gross profit growth is defined as change in gross profit (i.e., revenue minus costs of goods sold) scaled by lagged total assets. The *t*-statistics in parentheses are calculated based on the heteroskedasticity-consistent standard errors of Newey and West (1987). The sample includes NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks) with a December fiscal year-end from 1973 to 2016.

test in Section 5.4. In Section 5.5, we examine the relation between EIG premium and two measures of the strength of investment plan friction—investment inflexibility and project duration.

5.1 | EIG and future profitability

To test the difference in the investment incentive for firms across EIG deciles, we examine the relation between EIG and future profitability. We consider two firm-level profitability measures: sales growth and gross profit growth. Table 8 reports the average growth rate of sales and gross profits in the first, second, and third year of the EIG deciles following portfolio formation. In Panel A, the average sales growth (defined as the change in sales scaled by lagged total assets) increases monotonically from the low to high EIG portfolios in the first year following portfolio formation. Sales growth is 2.13% for the low EIG stocks as compared with 17.23% for the high EIG stocks. The difference of 15.10% is statistically significant. The difference in sales growth gradually decreases to about 8.51% in the second year and 6.08% in the third year.

Results are similar for the growth rate of gross profits (defined as the change in gross profits scaled by lagged total assets) in Panel B. The gross profit growth increases from 1.17% for the low EIG portfolio to 6.74% for the high EIG

5.2 | EIG and cash flow risks

In the two-period model in Section 2, firms with larger investment plans have higher expected returns because they have greater risk exposures to the economic conditions. Because of the embedded leverage from the investment plan friction, a positive shock to economic growth induces greater responses of future cash flows for firms with larger investment plans. Therefore, the cash flow of high EIG firms should be more procyclical with respect to X shocks than that of low EIG firms. In this section, we test this prediction using the following panel regressions:

$$\Delta \mathrm{CF}_{i,t+h} = a + b \times \mathrm{EIG}_{i,t-1} + c \times \Delta X_t + d \times \mathrm{EIG}_{i,t-1} \times \Delta X_t, \tag{9}$$

where subscript i is the firm label, t is the year label, and $h = 0, 1, 2$, or 3. ΔCF is the change in cash flows, measured as revenue minus the sum of cost of goods sold, selling, general and administrative expense, and capital expenditure, all scaled by lagged total assets. ΔX is measured as industrial production growth (ΔIP), GDP growth (ΔGDP), or personal consumption expenditure growth (ΔC). ΔX and EIG are normalized to have zero mean and unit standard deviation, so the coefficient c can be interpreted as the cumulative impulse response of cash flows to a positive one-standard-deviation X shock for an average firm. $h = 0$ represents the contemporaneous response, and $h = 1, 2$, and 3 represent the cumulative responses in year 1, 2, and 3, respectively. The variable of interest d captures how these cash flow responses differ with EIG.

Table 9 reports the results from the panel regressions. For all three measures of ΔX, the coefficient on ΔX is significantly positive when $h = 0$, so a positive shock to the economic growth persistently increases the level of current and future cash flows of an average firm. For instance, a one-standard-deviation increase in industrial production raises the contemporaneous cash flow growth by 0.55 on average (Specification (1)). More importantly, there is a large cross-sectional heterogeneity in the cash flow responses across firms with different EIG. The estimated coefficients on the interaction terms are strongly positive, suggesting that firms with high EIG respond more to positive economic growth than firms with low EIG. When ΔIP is used as the proxy for ΔX (Specification (1)), a one-standard-deviation increase in EIG raises the cash flow response by 1.40 from 0.55 for the average firm when $h = 0$, by 1.88 from 0.22 for the average firm when $h = 1$, by 1.69 from −0.01 for the average firm when $h = 2$, and by 1.21 from 0.01 for the average firm when $h = 3$. The results are similar when we use GDP growth (Specification (2)) or aggregate consumption growth (Specification (3)) as the proxy for ΔX. Therefore, firms with larger investment plans are more procyclical with respect to economic conditions.[11]

5.3 | EIG and embedded leverage

In our neoclassical model, the higher cash flow risk of planned investment is due to the embedded leverage effect because the planned investment (K_1) is predetermined and not exposed to the business condition at $t = 1$. In this subsection, we provide more direct empirical evidence for the novel leverage channel.

In Panel A of Table 10, we report the cross-sectional distribution of the investment-to-operating-income ratio (INV/OI). For a typical firm, its investment represents about 28% of its operating income, so capital expenditure is an economically sizable and important determinant of a firm's cash flow. More importantly, INV/OI varies substantially

[11] Although the coefficients of the interaction terms in this table are positive and statistically significant at all subsequent years, the biggest response in cash flows happens at $h = 0$, and this is consistent with the story that after a firm's investment, its capital stock, and hence outputs and cash flows increase permanently. While the result in this table shows that the firm value (i.e., the present value of future cash flows) responds differently to a shock to economic growth for firms with different EIG, it does not imply that their risk exposures last for 3 years.

TABLE 9 EIG and cash flow risks

	ΔCF, (=0)	ΔCF, +1 (=1)	ΔCF, +2 (=2)	ΔCF, +3 (=3)

TABLE 10 EIG and the leverage effect induced by investment plans

Panel A: Distribution of INV/OI					
	P10	Q1	Median	Q3	P90
	0.12	0.20	0.33	0.54	0.89
Panel B: Cash flow elasticities across EIG quintiles					
EIG Portfolio	Lo	2	3	4	Hi
Elasticity	0.81	0.91	1.02	1.03	1.09
	(33.75)	(25.21)	(26.12)	(21.54)	(31.72)

This table tests the relation between EIG and the leverage effect induced by investment plans. Panel A reports the cross-sectional distribution of the investment-to-operating-income ratio (INV/OI). Investment is defined as the Compustat item CAPX, and operating income (OI) is defined as revenue (REVT) minus cost of goods sold (COGS) and selling, general, and administrative expenses (XSGA). Panel B reports the cash flow elasticity with respect to operating income across EIG quintiles, where cash flow is defined as operating income minus capital expenditure. Within each EIG quintile portfolio, we run

TABLE 11 Factor loadings of EIG premium and GMM estimation

Panel A: Factor loadings of EIG long-short portfolio			
Δ =	ΔIP	ΔGDP	ΔC
MKT	−0.50	−0.53	−0.57
	(−2.48)	(−2.70)	(−3.06)
ΔX	1.84	3.47	4.70
	(2.15)	(1.79)	(2.12)

Panel B: GMM-SDF tests						
Δ =	ΔIP		ΔGDP		ΔC	
Stage	First	Second	First	Second	First	Second
b(MKT)	3.96	3.13	3.56	3.22	2.53	2.84
	(1.99)	(3.03)	(1.54)	(2.68)	(1.02)	(2.38)
$b(\Delta X)$	41.55	25.53	101.59	56.13	113.08	73.60
	(1.38)	(3.48)	(1.53)	(3.84)	(1.69)	(3.46)
MAE(%)	1.56	1.90	1.77	2.16	1.44	2.28
R^2(%)	64.28	44.51	63.07	12.79	72.88	20.28
χ^2	3.85	4.70	3.47	3.91	4.13	4.01
p-value	0.87	0.79	0.90	0.86	0.84	0.86

Panel A reports the factor loadings of the EIG long-short portfolio (Decile 10 minus Decile 1) from two-factor time series regressions with the market excess return (MKT) and economic growth ΔX as the risk factors. We use three proxies for ΔX: industrial production growth (ΔIP), GDP growth (ΔGDP), and personal consumption expenditures growth (ΔC). The t-statistics in parentheses are calculated based on the heteroskedasticity-consistent standard errors of White (1980). Panel B reports the results from stochastic discount factor (SDF) GMM estimations on the EIG decile portfolios using the same two factors in the linear SDF specification. We report the estimated price of risk b, the mean absolute pricing errors (MAE), the OLS-R^2, the overidentification test statistic χ^2, and the associated p-value from both the first and second stages of the GMM estimation. EIG deciles are value-weighted EIG portfolios formed based on NYSE breakpoints. The sample is annual from 1973 to 2016 and includes all NYSE/AMEX/NASDAQ common stocks (excluding stocks in financial and utility industries).

and we estimate this model using the general method of moments (GMM) estimation with the 10 EIG decile portfolios as the testing assets.[14] Panel B of Table 11 reports the GMM estimation results from both the first and second stages. Besides the prices of risk b_{MKT} and $b_{\Delta X}$, we also report the mean absolute pricing errors (MAE), the OLS-R^2, the overidentification test statistic χ^2, and the associated p-value.

The results in Panel B of Table 11 show that both factors have positive estimated prices of risk. For the market factor, the estimated price of risk is around 3.96 when we use industrial production growth as the measure for ΔX, and around 3.56 when we use GDP growth. The estimated price of risk for ΔX is around 42 when we use ΔIP and more than 100 when we use ΔGDP or ΔC.[15] The two-factor model in general captures the EIG premium reasonably well. The OLS-R^2s are above 60% in the first-stage estimations, and the overidentification test fails to reject the model in all specifications. Figure 5 provides a visual illustration of this comparison between the model-predicted returns and the actual average returns across the EIG decile portfolios. For the three measures of ΔX, the EIG deciles align well

[14] Cochrane (2005a) provides an excellent textbook exposition on this topic. Since the testing assets are excess returns, a and b cannot be separately identified. Without loss of generality, we normalize the SDF by demeaning the factors. The results are similar when we normalize $a = 1$ and are available upon request.

[15] The large price of risk for aggregate consumption growth is in line with the large literature on the equity premium puzzle; see, for example, Mehra and Prescott (1985), Campbell (2003), and Cochrane (2005b).

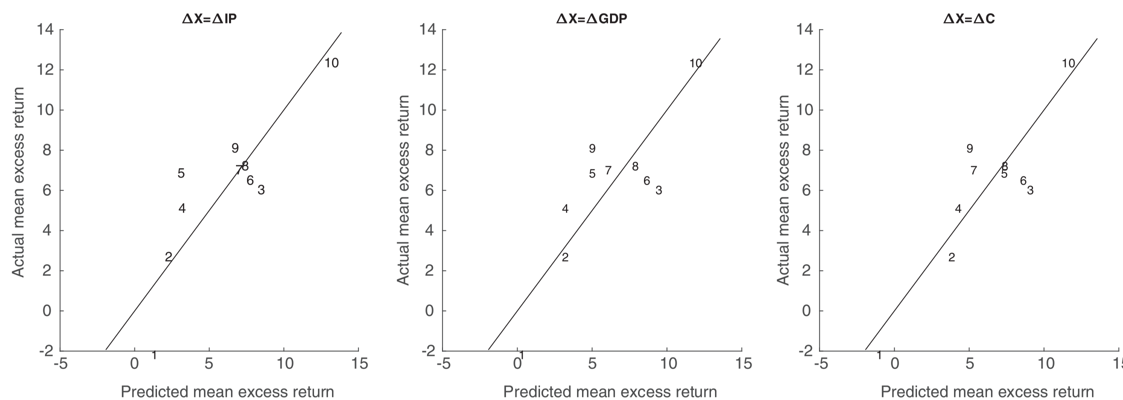

FIGURE 5 GMM estimation of a two-factor model

This figure plots the actual mean excess returns against the predicted excess returns of EIG decile portfolios from a two-factor SDF GMM estimation. The first factor in the SDF is the market excess return, and the second factor is a measure of economic growth ΔX. We use three proxies for ΔX: industrial production growth (ΔIP), GDP growth (ΔGDP), and personal consumption expenditures growth (ΔC). The sample is annual from 1973 to 2016 and includes all NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks). The excess returns are reported in percentages.

TABLE 12 Investment friction and EIG premium

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Panel A: EIG premiums and investment irreversibility											
Less	−0.25	5.55	6.13	9.35	6.72	7.62	8.89	8.38	8.36	11.65	11.90
inflexible	(−0.05)	(1.44)	(1.91)	(3.01)	(2.46)	(2.78)	(3.40)	(3.28)	(3.04)	(3.43)	(3.15)
More	−4.00	5.28	8.39	7.74	9.76	9.77	8.80	9.17	8.60	14.11	18.11
inflexible	(−0.80)	(1.32)	(2.44)	(2.45)	(3.22)	(3.45)	(3.03)	(3.32)	(2.99)	(3.73)	(4.53)
Panel B: EIG premiums and project durations											
Shorter	2.14	3.83	5.83	8.83	6.79	6.37	8.29	6.86	9.71	10.32	8.18
durations	(0.50)	(1.16)	(1.87)	(2.92)	(2.52)	(2.35)	(3.20)	(2.68)	(3.63)	(3.21)	(2.21)
Longer	−3.56	4.44	5.47	4.74	8.44	5.81	5.12	7.94	9.14	10.27	13.83
durations	(−0.76)	(1.19)	(1.61)	(1.55)	(2.90)	(2.13)	(1.95)	(3.08)	(3.31)	(2.97)	(3.52)

This table reports the average value-weighted excess returns of EIG portfolios for industries with low and high investment irreversibility (Panel A) and for industries with shorter and longer project durations (Panel B). We use the inflexibility in Gu et al. (2017) to measure investment irreversibility. At the beginning of every month, we divide industries into two groups based on or its irreversibility (Panel A) or average project duration (Panel B). Within each group, we further sort stocks into EIG deciles based on NYSE breakpoints. Industries are defined by SIC 2-digit codes. Panel B only includes stocks in the 22 industries studied in Koeva (2000). The returns are annualized and reported in percentages. The sample period is from July 1980 to December 2016 in Panel A and from August 1972 to December 2016 in Panel B. The *t*-statistics in parentheses are calculated based on White (1980).

along the 45-degree line, indicating that the two factors, especially the economic growth ΔX, are important for the EIG premium that we document in Section 3.

5.5 | Investment plan friction and EIG premium

Our economic channel suggests that the EIG premium should be closely related to the strength of investment plan friction. One aspect of such friction is the investment irreversibility. If investment is fully reversible, firms can undo its previously planned investment so the investment plan friction no long induces leverage and affects its cash flow risks. Our first test is to examine if the EIG premium is stronger among firms with higher investment irreversibility. We proxy investment irreversibility using the inflexibility from Gu et al. (2017). Gu et al. (2017) use a real option model to motivate their inflexibility measure and define it as the range of the ratio of operating cost to sales, normalized by the standard deviation of the growth rate of asset turnover (sales divided by total asset). Intuitively, when firms are inflexible in adjusting capital stock (i.e., when nonconvex adjustment cost is high), the inaction region is wide and the observed range of cost-to-sales ratio is large.

Panel A of Table 12 confirms our prediction. We split firms into two groups based on the inflexibility of their affiliated industries, and within each group we sort firms into 10 EIG deciles. We follow Gu et al. (2017) and start our portfolio sample from July 1980 to ensure there are enough observations to construct their inflexibility measure. Panel A shows that although the EIG premium is positive and economically large for both groups, it is more than 50% larger among firms in more inflexible industries (18.11% vs. 11.90% annualized). Therefore, the result in this panel suggests that the EIG premium indeed larger among industries with greater investment irreversibility.

Another aspect of investment friction is the duration of project completion. All else being equal, a longer project duration is associated with a stronger embedded leverage effect and hence higher risk premium. We use the average project duration (or time-to-build) estimates from Koeva (2000) and compare the EIG premium between the industries with high and low project durations. Based on a representative sample of 106 Compustat firms, Koeva (2000) documents a large cross-industry difference in the project duration: while “Rubber” and “Fabricated metals” have an average project duration of slightly longer than 1 year, industries such as “Primary metals” and “Nondurable goods, wholesale,” an average project takes more than 3 years to complete. We categorize the 22 industries in her study into those with shorter and longer project durations, with each group including 11 industries.

In Panel B of Table 12

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APPENDIX A: ADDITIONAL ROBUSTNESS CHECKS

TABLE A1 EIG based on predictors in Hou et al. (2020)

Panel A: Investment growth predictive regressions

	Intercept	ΔROE	q	OCF	^{2}
Estimate	−0.02	0.52	0.11	0.35	2.71%
	(−0.69)	(2.51)	(7.07)	(7.92)	

Panel B: EIG portfolio returns

Portfolio	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
Ret^e	3.77	4.74	6.36	5.85	4.64	5.90	5.84	6.91	8.27	8.77	5.00
	(1.15)	(1.54)	(2.18)	(2.13)	(1.76)	(2.28)	(2.42)	(2.88)	(3.45)	(3.31)	(2.57)
α^{CAPM}	−4.49	−2.96	−1.03	−1.18	−2.15	−0.72	−0.42	0.70	2.08	2.07	6.56
	(−3.41)	(−2.27)	(−0.89)	(−1.11)	(−2.21)	(−0.72)	(−0.49)	(0.82)	(2.40)	(1.92)	(3.60)
α^{FF3}	−5.48	−4.20	−2.77	−2.26	−2.71	−1.00	−0.25	1.56	3.13	4.59	10.07
	(−4.40)	(−3.21)	(−2.47)	(−2.12)	(−2.74)	(−0.98)	(−0.29)	(1.83)	(3.81)	(5.03)	(6.16)
α^{CARH}	−2.93	−1.36	−1.09	−0.97	−1.54	0.00	0.27	1.63	2.44	3.48	6.41
	(−2.34)	(−1.03)	(−0.96)	(−0.94)	(−1.59)	(0.00)	(0.31)	(1.85)	(2.86)	(3.82)	(4.14)
α^{FF5}	−4.02	−3.85	−3.27	−3.33	−3.44	−1.73	−1.46	0.75	2.23	4.87	8.89
	(−2.93)	(−2.61)	(−2.75)	(−3.07)	(−3.52)	(−1.65)	(−1.64)	(0.86)	(2.74)	(5.24)	(4.94)

This table constructs EIG based on the explanatory variables used in Hou et al. (2020). Panel A reports the coefficients of the Fama–MacBeth investment growth predictive regressions on change in ROE (ΔROE), q, and operating cash flow (OCF) as used in Hou et al. (2020). Each year from 1964 to 2016, we run cross-sectional predictive regressions of firms' investment growth on its lagged ΔROE, q, and OCF, among NYSE/AMEX/NASDAQ common stocks (excluding stocks in the regulatory industries, i.e., financial and utility stocks). Investment growth is computed as the growth rate in capital expenditures (Compustat data item CAPX). ΔROE is the change in ROE from four quarters ago. q is computed as the log of the market value of the firm (sum of market equity, long-term debt, and short-term debt) divided by total assets (Compustat data item AT). OCF is revenue (Compustat data item REVT) minus cost of goods sold (Compustat data item COGS), minus selling, general, and administrative expenses (Compustat data item XSGA), plus research and development expenditures (Compustat data item XRD), minus change in accounts receivable (Compustat data item RECT), minus change in inventory (Compustat data item INVT), minus change in prepaid expenses (Compustat data item XPP), plus change in deferred revenue (Compustat data item DRC plus Compustat data item DRLT), plus change in trade accounts payable (Compustat data item AP), and plus change in accrued

(Continues)

TABLE A1 (Continued)

expenses (Compustat data item XACC), divided by book assets. Missing change of accounting variables are set to 0. Variables are winsorized cross-sectionally at 1% and 99%. Panel B reports the value-weighted average excess returns (Ret^e), abnormal returns (α), and Sharpe ratio (SR) of the EIG deciles, and the asset pricing test results from CAPM, Fama–French three-factor model, Carhart four-factor model , and Fama–French five-factor model. At the beginning of every month, we sort stocks into EIG deciles based on NYSE breakpoints. The excess returns and abnormal returns are annualized and reported in percentages. The t-statistics in parentheses are calculated based on the heteroskedasticity-consistent standard errors of White (1980). The sample period is from August 1972 to December 2016.