

Internet Appendix to “Firm Characteristics and Stock Returns:  
The Role of Investment-Specific Shocks”

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# 1 Solution to the model

Here, we describe the solution of the model in more detail.

## 1.1 Valuation

Firms' investment decisions are based on a tradeoff between the market value of a new project and the cost of physical capital. Given (17), the time- $t$  market value of an existing project  $j$  is equal to the present value of its cashflows

$$p(u_{jt}, x_t, K_j) = \mathbb{E}_t \left[ \int_t^\infty e^{-\delta(s-t)} \frac{\pi_s}{\pi_t} \left( u_{js} x_s K_j^\alpha \right) ds \right] = A(u_{jt}) x_t K_j^\alpha, \\ A(u) = \frac{1}{r_f + \gamma_x \sigma_x + \delta - \mu_X} + \frac{1}{r_f + \gamma_x \sigma_x + \delta - \mu_X + \theta_u} (u - 1). \quad (\text{A.1})$$

The optimal investment decision follows the NPV rule: firm  $f$  chooses the amount of capital  $K_j$  to invest in project  $j$  to maximize it's net present value

$$NPV_{jt} = \max_{K_j} p(1, x_t, K_j) - p_t^I K_j. \quad (\text{A.2})$$

Because the marginal productivity of capital in (8) is infinite at the zero capital level, it is always optimal to invest a positive and finite amount. The optimal capital investment in the new project is given by

$$K^*(z_t) = \alpha^{\frac{1}{1-\alpha}} \left( \frac{p(1, x_t, K_j)}{p_t^I} \right)^{\frac{1}{1-\alpha}} = z_t^{\frac{1}{1-\alpha}} \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}}. \quad (\text{A.3})$$

Equation (A.3) illustrates the relation between the optimal level of investment  $K^*$  and the ratio of the market value of a new project  $p(1, x, K)$  to the cost of capital  $p^I$ . This ratio bears similarities to the marginal  $Q$  in the  $Q$ -theory of investment. However, in contrast to most  $Q$ -theory models, optimal investment depends on the market valuation of a new project, which in general is not directly linked to the market valuation of the entire firm. Furthermore, the relation in (A.3) holds conditional on the firm having the opportunity to invest. That is yet another reason why the firm's marginal (or average)  $Q$  is not a sufficient statistic for the optimal investment in our model, since investment depends on the firm's current investment opportunities  $\lambda_{ft}$ .

The market value of a firm is the sum of the value of its existing projects and the value of its

future growth opportunities:

$$VAP_{ft} = \sum_{j \in \mathcal{J}_{ft}} p(u_{jt}, x_t, K_j) = x_t \sum_{j \in \mathcal{J}_{ft}} A(u_{jt}) K_j^\alpha. \quad (\text{A.4})$$

The present value of growth opportunities equals the expected discounted NPV of future investments

$$PVGO_{ft} = \mathbb{E}_t \left[ \int_t^\infty \frac{\pi_s}{\pi_t} (\lambda_{fs} NPV_t) ds \right] = z_t^{\frac{\alpha}{1-\alpha}} x_t (G_L + p_{ft} (G_H - G_L)), \quad (\text{A.5})$$

where

$$NPV_t = x_t z_t^{\frac{\alpha}{1-\alpha}} (\alpha^{-1} - 1) \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}}, \quad (\text{A.6})$$

$$G_H = \lambda_f (\alpha^{-1} - 1) \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}} \left( \rho^{-1} + \frac{\mu_L}{\mu_L + \mu_H} (\lambda_H - \lambda_L) (\rho + \mu_H + \mu_L)^{-1} \right),$$

$$G_L = \lambda_f (\alpha^{-1} - 1) \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}} \left( \rho^{-1} - \frac{\mu_H}{\mu_L + \mu_H} (\lambda_H - \lambda_L) (\rho + \mu_H + \mu_L)^{-1} \right),$$

$$\rho = r - \mu_x - \frac{\alpha}{1-\alpha} \left( \mu_z + \frac{1}{2} \sigma_z^2 \right) - \frac{1}{2} \frac{\alpha^2}{(1-\alpha)^2} \sigma_z^2. \quad (\text{A.7})$$

Adding the two pieces, the total value of the firm is equal to

$$V_{ft} = x_t \sum_{j \in \mathcal{J}_{ft}} A(u_{jt}) K_j^\alpha + z_t^{\frac{\alpha}{1-\alpha}} x_t (G_L + p_{ft} (G_H - G_L)). \quad (\text{A.8})$$

Examining equation (A.8), we can see that the firm's stock return beta with the disembodied productivity shock  $x$  and the IST shock  $z$  is equal to

$$\beta_{ft}^x = 1, \quad (\text{A.9})$$

$$\beta_{ft}^z = \frac{\alpha}{1-\alpha} \frac{PVGO_{ft}}{V_{ft}}. \quad (\text{A.10})$$

The firm's asset mix between growth opportunities and assets in place determines its risk premium

$$\frac{1}{dt} \mathbb{E}_t [R_{ft}] - r_f = \gamma_x \sigma_x + \frac{\alpha}{1-\alpha} \gamma_z \sigma_z \frac{PVGO_{ft}}{V_{ft}}. \quad (\text{A.11})$$

Given (17), the price of the investment firm is given by

$$V_{I,t} = x_t z_t^{\frac{\alpha}{1-\alpha}} \frac{\phi}{\rho} \left( \int_{\mathcal{F}} \lambda_f df \right) \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}}. \quad (\text{A.12})$$

A positive IST shock  $z$  benefits the investment-good producers. Even though the price of their output declines, the elasticity of investment demand with respect to price is greater than one, so their profits increase.

## 1.2 Growth Opportunities and Firm Characteristics

### Tobin's Q

The firm's average Tobin's  $Q$ , defined as the market value of the firm  $V_f$  over the replacement cost of its capital stock

$$B_{ft} = p_t^I \sum_{j \in \mathcal{J}_{ft}} K_j, \quad (\text{A.13})$$

is positively related to the ratio of growth opportunities to firm value:

$$Q_{ft} = \frac{V_{ft}}{B_{ft}} = \left( 1 - \frac{PVGO_{ft}}{V_{ft}} \right)^{-1} \times \frac{VAP_{ft}}{B_{ft}}. \quad (\text{A.14})$$

### Investment rate

The firm's investment rate, measured as the ratio of capital expenditures to the lagged replacement cost of its capital stock,  $B_{ft}$ , is related to the ratio of growth opportunities to firm value. Specifically, a firm's investment over an interval  $[t, t + \Delta]$  is equal to the cumulative capital expenditures

$$INV_{f,t+\Delta} = \int_t^{t+\Delta} p_s^I K^*(z_s) dN_{fs}. \quad (\text{A.15})$$

### Earnings-to-Price

First, note that the value of assets in place increases in the output of current projects

$$VAP_{ft} = x_t \sum_{j \in \mathcal{J}_{ft}} a_0 K_j^\alpha + \frac{1}{r_f + \gamma_x \sigma_x + \delta - \mu_X} E_{ft} \approx \frac{1}{r_f + \gamma_x \sigma_x + \delta - \mu_X} E_{ft} \quad \text{if } \theta_u \ll 1, \quad (\text{A.16})$$

where  $E_{ft} = x_t \sum_{j \in \mathcal{J}_{ft}} u_{jt} K_j^\alpha$ , and  $a_0$  tends to zero as the persistence of the project-specific shocks increases.

## Market Beta

The market portfolio, defined as the value-weighted portfolio of all consumption and investment firms, is exposed to both the disembodied shock  $x$  and the IST shock  $z$

$$\beta_{Mt}^x = 1, \quad \beta_{Mt}^z = \frac{\alpha}{1-\alpha} \frac{PVGO_{Ct} + V_{It}}{V_{Ct} + V_{It}}, \quad (\text{A.17})$$

where  $PVGO_{Ct} = \int_{\mathcal{F}} PVGO_{ft} df$  and  $V_{Ct} = \int_{\mathcal{F}} V_{ft} df$  are the total present value of growth opportunities and the total firm value in the consumption sector respectively. A consumption-sector firm's market beta is therefore equal to

$$\begin{aligned} \beta_{ft}^M &= \frac{\sigma_x^2 + \left(\frac{\alpha}{1-\alpha}\right)^2 \frac{PVGO_{Ct} + V_{It}}{V_{Ct} + V_{It}} \times \frac{PVGO_{ft} \sigma_z^2}{V_{ft}}}{\sigma_x^2 + \left(\frac{\alpha}{1-\alpha}\right)^2 \left(\frac{PVGO_{Ct} + V_{It}}{V_{Ct} + V_{It}}\right)^2 \sigma_z^2} \\ &= B_{0t} + B_{1t} \frac{PVGO_{ft}}{V_{ft}}, \end{aligned} \quad (\text{A.18})$$

As a result, cross-sectional differences in market betas are positively related to cross-sectional differences in growth opportunities.

## Idiosyncratic volatility

In our model, the idiosyncratic variance of the firm return equals

$$\begin{aligned} IVOL_{ft}^2 &= \underbrace{\left[ \sigma_u^2 \sum_{j \in \mathcal{J}_{ft}} \frac{1}{u_{jt}} \left( \frac{x_t K_j^\alpha a_1 u_{jt}}{VAP_{ft}} \right)^2 + \delta \sum_{j \in \mathcal{J}_{ft}} \left( \frac{x_t K_j^\alpha A(u_{jt})}{VAP_{ft}} \right)^2 \right]}_{C(x_t, \{K_j, u_{jt}\}_{j \in \mathcal{J}_{ft}})} \left( \frac{VAP_{ft}}{V_{ft}} \right)^2 \\ &+ \underbrace{\left[ \bar{\lambda}_{ft} \left( A(p_{ft}) + B(p_{ft}) \right)^2 + h_e^2 B^2(p_{ft}) \right]}_{H(p_{ft})} \left( \frac{PVGO_{ft}}{V_{ft}} \right)^2, \end{aligned} \quad (\text{A.19})$$

where

$$A(p_{ft}) = \frac{(\alpha^{-1} - 1) \left( \frac{\alpha}{r_f + \gamma_x \sigma_x + \delta - \mu_X} \right)^{\frac{1}{1-\alpha}}}{G_L + p_{ft} (G_H - G_L)} \quad (\text{A.20})$$

$$B(p_{ft}) = \frac{(G_H - G_L) p_{ft} (\lambda_f \lambda_H - \bar{\lambda}_{ft})}{G_L + p_{ft} (G_H - G_L)}. \quad (\text{A.21})$$

## 2 Tables

### 2.1 Additional results

**Table A.1: Portfolio characteristics and leverage**

	Book leverage									
	Lo	2	3	4	5	6	7	8	9	Hi
Q	17.7	22.8	23.2	22.7	21.5	19.8	17.5	13.9	9.1	3.4
I/K	15.5	20.3	20.0	19.4	19.0	17.5	16.6	15.1	14.3	12.9
E/P	13.0	17.5	20.1	20.8	21.9	22.8	22.8	23.2	21.4	15.8
MBETA	15.5	18.8	19.3	18.9	18.4	17.9	17.7	17.2	16.7	15.0
IVOL	27.7	19.5	18.9	18.3	18.1	17.2	15.7	14.2	13.1	11.1

Table shows book leverage for decile portfolios of firms sorted on investment rate (I/K), Tobin's Q (Q), market beta (MBETA), idiosyncratic volatility (IVOL) and earnings to price (E/P).

**Table A.2: IMC-beta and characteristics: Model**

BIMC( $t$ )	a. Market Beta	b. Investment	c. Price/Earnings	d. Idiosyncratic Volatility	e. Tobin's $Q$	f. All
$BIMC_{t-1}$	0.610 (104.47)	0.149 (28.33)	0.505 (54.60)	0.565 (98.17)	0.506 (82.35)	0.179 (24.91)
$MBETA_{t-1}$	0.757 (98.14)	0.151 (16.15)				0.071 (14.10)
$(I/K)_{t-1}$		0.061 (4.02)	-0.181 (-17.15)			-0.392 (-33.22)
$E/P_{t-1}$			-5.817 (-249.20)	-4.934 (-145.62)		-5.061 (-139.69)
$IVOL_{t-1}$				4.552 (38.81)	1.569 (27.57)	0.457 (8.56)
$\ln Q(t-1)$					0.128 (51.03)	0.035 (32.39)

Table reports the relation between firm's IMC-beta (BIMC) and firm characteristics in simulated data.

**Table A.3: Fama-MacBeth regressions: Model**

	a. Market Beta	b. Investment	c. Earnings/Price	d. Idiosyncratic Volatility	e. Tobin's $Q$
$E_{t-1}[BIMC_t]$	-0.046 (-3.67)	-0.077 (-4.03)	-0.084 (-3.18)	-0.075 (-3.98)	-0.074 (-3.93)
$MBETA_{t-1}$	-0.06 (-4.24)	-0.06 (-4.08)	-0.007 (-2.39)	-0.053 (-4.00)	-0.046 (-3.90)
$(I/K)_{t-1}$		-0.078 (-4.95)	-0.052 (-2.44)	-0.009 (-1.04)	
$E/P_{t-1}$			0.501 (4.32)	0.419 (4.38)	0.011 (0.90)
$IVOL_{t-1}$				-0.209 (-4.41)	-0.183 (-5.16)
$\ln Q_{t-1}$					-0.031 (-1.35)
					-0.011 (-4.52)
					-0.008 (-5.41)
					-0.002 (-2.22)

Table reports results of running Fama-McBeth regressions in simulated data. See main text and notes to Table 7 for more details.



**Table A.4: Correlation between characteristic decile assignments**

Sort	Data				Model			
	Q	I/K	P/E	MBETA	Q	I/K	P/E	MBETA
Q								
I/K	38.1				19.3			
P/E	63.6	20.6			47.4	27.5		
MBETA	20.5	-19.3	-14.3		40.4	25.6	73.2	
IVOL	12.3	-11.3	-11.5	21.3	12.7	44.3	49.2	39.1

Table reports correlations between portfolio decile assignments across the characteristics Q, I/K, E/P, MBETA, and IVOL. See main text and notes to Tables 1 for more details.

**Table A.5: market beta and characteristics**

$MBETA_t$	a. Investment	b. Earnings/Price	c. Idiosyncratic Volatility	d. Tobin's $Q$	e. All
$MBETA_{t-1}$	0.335 (11.67)	0.345 (11.92)	0.340 (12.20)	0.325 (11.25)	0.318 (11.38)
$(I/K)_{t-1}$	0.411 (10.36)				0.235 (6.67)
$E/P_{t-1}$		-0.061 (-1.38)			(4.53)
$IVOL_{t-1}$		-0.029 (-0.76)	1.969 (2.95)	0.998 (1.68)	0.037 (1.31)
$\ln Q_{t-1}$				0.100 (7.94)	1.378 (2.20)
$R^2$	0.092	0.080	0.086	0.105	0.084 (6.88)
		0.181	0.182	0.192	0.112 (4.85)

Table reports results of regressing a firm's market beta (MBETA) on lagged estimates of MBETA and firm characteristics – equation (4) in main text. All specifications include year-fixed effects. We report  $t$ -statistics in parenthesis computed using clustered errors by firm and year. See main text and notes to Tables 1 for more details.

**Table A.6: PC1-beta and characteristics**

	a. Market Beta	b. Investment	c. Earnings/Price	d. Idiosyncratic Volatility	e. Tobin's $Q$	f. All
$BPC1_t$						
$BPC1_{t-1}$	0.198 (10.21)	0.152 (8.32)	0.200 (9.57)	0.198 (9.51)	0.195 (9.79)	0.146 (8.46)
$MBETA_{t-1}$	0.161 (2.89)	0.132 (2.80)				0.088 (1.82)
$(I/K)_{t-1}$		0.506 (8.07)	0.406 (7.97)			0.177 (4.00)
$E/P_{t-1}$			-0.383 (-2.72)			0.022 (0.33)
$IVOL_{t-1}$				9.775 (14.72)	8.038 (12.69)	7.457 (11.19)
$\ln Q_{t-1}$					0.107 (5.21)	0.052 (3.33)
$R^2$	0.238	0.268	0.235	0.266	0.240	0.270
		0.274	0.291	0.236	0.268	0.280

This table reports results of regressing a firm's PC1-beta (BPC1) on lagged estimates of PC1-beta and firm characteristics – following equation (4) in main text. All specifications include year-fixed effects. We report  $t$ -statistics in parenthesis computed using clustered errors by firm and year. Estimation sample is 1964-2008. See main text and notes to Tables 1 for more details.

Table A.7: HML-beta and characteristics

	a. Market Beta	b. Investment	c. Earnings/Price	d. Idiosyncratic Volatility	e. Tobin's $Q$	f. All
$BHML_t$						
$BHML_{t-1}$	0.151 (8.45)	0.182 (8.65)	0.184 (9.20)	0.175 (9.06)	0.157 (8.54)	0.124 (6.99)
$MBETA_{t-1}$	-0.256 (-5.51)	-0.169 (-4.37)				-0.212 (-4.95)
$(I/K)_{t-1}$		-0.562 (-9.81)	-0.448 (-9.23)			-0.194 (-5.58)
$E/P_{t-1}$			-0.007 (-0.08)			-0.025 (-0.54)
$IVOL_{t-1}$				1.719 (1.21)	1.405 (1.09)	3.545 (2.80)
$\ln Q_{t-1}$					-0.182 (-9.60)	-0.156 (-8.83)
$R^2$	0.311	0.296	0.319	0.301	0.336	0.334

This table reports results of regressing a firm's HML-beta (BHML) on lagged estimates of HML-beta and firm characteristics – equation (4) in main text. All specifications include year-fixed effects. We report  $t$ -statistics in parenthesis computed using clustered errors by firm and year. Estimation sample is 1964-2008. See main text and notes to Tables 1 for more details.

**Table A.8: Fama-MacBeth regressions – split sample, predicted market beta**

	a. Market Beta	b. Investment	c. Price/Earnings	d. Idiosyncratic Volatility	e. Tobin's $Q$
$E_{t-1}[BIMC_t]$	-0.346 (-5.31)	-0.327 (-4.95)	-0.276 (-5.00)	-0.151 (-1.61)	-0.345 (-5.43)
$E_{t-1}[MBETA_t]$	-0.089 (-3.09)	-0.063 (-2.20)	-0.083 (-3.17)	0.208 (3.64)	0.319 (4.74)
$(I/K)_{t-1}$	-0.151 (-6.01)	-0.118 (-5.84)	-0.075 (-3.57)		
$E/P_{t-1}$			0.255 (4.60)	0.236 (4.72)	0.152 (3.86)
$IVOL_{t-1}$				-1.831 (-6.63)	-1.112 (-3.11)
$\ln Q_{t-1}$					-0.031 (-4.15)
					-0.025 (-3.94)

Table reports results of Fama and MacBeth (1973) regressions using lagged firm characteristics, contemporaneous fitted values of IMC beta ( $\widehat{BIMC}$ ) and MBETA using the regression model in the last column of Table A.5 estimated during the 1965-1986 subsample. Estimation is done at annual frequencies, with the stock return on fiscal year  $t$  defined as the stock return from June of calendar year  $t$  to May of calendar year  $t + 1$ . The sample period used in the Fama-Macbeth regression is 1987-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.9: Fama-MacBeth regressions – split sample, PC1 beta**

	a. Market Beta	b. Investment	c. Price/Earnings	d. Idiosyncratic Volatility	e. Tobin's $Q$
$\widehat{BPC1}_t$	-0.143 (-6.18)	-0.133 (-5.73)	-0.121 (-6.00)	-0.067 (-1.75)	-0.132 (-6.04)
$MBETA_{t-1}$	-0.013 (-1.10)	-0.006 (-0.57)	-0.013 (-1.24)	-0.008 (-0.78)	-0.003 (-0.31)
$(I/K)_{t-1}$		-0.144 (-6.01)	-0.094 (-4.23)		
$E/P_{t-1}$			0.255 (4.60)	0.247 (4.61)	
$IVOL_{t-1}$				-1.831 (-6.63)	-1.054 (-2.49)
$\ln Q_{t-1}$					-0.031 (-4.15)
					-0.030 (-3.69)

Table reports results of Fama and MacBeth (1973) regressions using lagged firm characteristics, contemporaneous fitted values of PC1 beta ( $\widehat{BIMC}$ ) using the regression model in the last column of Table A.6 estimated during the 1965-1986 subsample. Estimation is done at annual frequencies, with the stock return on fiscal year  $t$  defined as the stock return from June of calendar year  $t$  to May of calendar year  $t + 1$ . The sample period used in the Fama-Macbeth regression is 1987-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.10: Fama-MacBeth regressions – split sample, HML beta**

	a. Market Beta	b. Investment	c. Price/Earnings	d. Idiosyncratic Volatility	e. Tobin's $Q$
$\widehat{BHM}L_t$	-0.017 (-0.82)	-0.052 (-2.40)	0.015 (0.69)	0.120 (3.80)	-0.147 (-4.94)
$MBETA_{t-1}$	-0.013 (-1.10)	-0.006 (-0.57)	-0.013 (-1.24)	-0.008 (-0.77)	-0.003 (-0.31)
$(I/K)_{t-1}$		-0.144 (-6.01)	-0.179 (-9.08)		-0.055 (-3.90)
$E/P_{t-1}$			0.255 (4.60)	0.248 (4.61)	
$IVOL_{t-1}$				-1.832 (-6.63)	-2.411 (-6.14)
$\ln Q_{t-1}$					-0.031 (-4.15)
					-0.030 (-4.27)
					-0.055 (-5.61)

Table reports results of Fama and MacBeth (1973) regressions using lagged firm characteristics, contemporaneous fitted values of HML beta ( $\widehat{BHM}L$ ) using the regression model in the last column of Table A.7 estimated during the 1965-1986 subsample. Estimation is done at annual frequencies, with the stock return on fiscal year  $t$  defined as the stock return from June of calendar year  $t$  to May of calendar year  $t + 1$ . The sample period used in the Fama-Macbeth regression is 1987-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

Table A.11: Fama-MacBeth regressions – full sample

	a. Market Beta	b. Investment	c. Price/Earnings	d. Idiosyncratic Volatility	e. Tobin's $Q$
$E_{t-1}[BIMC_t]$	-0.263 (-5.35)	-0.247 (-5.01)	-0.217 (-4.60)	-0.167 (-3.86)	-0.228 (-3.84)
$MBETA_{t-1}$	0.061 (4.15)	-0.019 (-1.92)	-0.024 (-2.47)	-0.019 (-2.00)	0.053 (2.86)
$(I/K)_{t-1}$		-0.138 (-5.26)	-0.123 (-2.31)		
$E/P_{t-1}$			0.269 (5.96)		
$IVOL_{t-1}$				-1.625 (-4.10)	-0.721 (-1.84)
$\ln Q_{t-1}$					-0.029 (-5.61)
					-0.026 (-1.66)

Table reports results of Fama and MacBeth (1973) regressions using lagged firm characteristics, lagged point estimates of IMC beta (BIMC) estimated using equation (32) and contemporaneous fitted values of IMC beta (BIMC) using the regression model in the last column of Table 6. Estimation is done at annual frequencies, with the stock return on fiscal year  $t$  defined as the stock return from June of calendar year  $t$  to May of calendar year  $t + 1$ . The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).



**Table A.12: Fama-MacBeth regressions, raw IMC beta**

$BIMC_t$	-0.022 (-2.31)	-0.022 (-2.56)	-0.019 (-2.11)	-0.024 (-2.69)	-0.017 (-2.06)	-0.016 (-2.10)	-0.010 (-1.32)	-0.020 (-2.49)	-0.018 (-2.03)
$MBETA_{t-1}$	-0.010 (-1.09)		-0.005 (-0.61)		-0.013 (-1.49)		-0.014 (-1.82)		-0.004 (-0.48)
$(I/K)_{t-1}$		-0.123 (-5.36)	-0.119 (-5.34)						
$E/P_{t-1}$				0.245 (6.18)	0.239 (6.18)				
$IVOL_{t-1}$						-1.435 (-3.64)	-1.386 (-3.55)		
$\ln Q_{t-1}$								-0.026 (-5.55)	-0.025 (-5.62)

Table A.12 reports results of Fama and MacBeth (1973) regressions using lagged firm characteristics, lagged point estimates of IMC beta ( $BIMC$ ) estimated using equation (32) and contemporaneous fitted values of IMC beta ( $\widehat{BIMC}$ ) using the regression model in the last column of Table 6. Estimation is done at annual frequencies, with the stock return on fiscal year  $t$  defined as the stock return from June of calendar year  $t$  to May of calendar year  $t + 1$ . The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.13: Investment response to IST shock: response to PC1**

$(I/K)_{ft}$	Q	I/K	E/P	MBETA	IVOL
$\Delta z_{t-1}$	-0.23 (-0.84)	0.17 (0.77)	1.14 (2.00)	-0.10 (-0.29)	0.04 (0.13)
$D(G_f)_2 \times \Delta z_{t-1}$	0.24 (2.03)	-0.08 (-0.65)	-1.03 (-1.89)	-0.07 (-0.44)	0.05 (0.36)
$D(G_f)_3 \times \Delta z_{t-1}$	0.40 (2.92)	0.13 (0.93)	-1.18 (-2.20)	0.03 (0.18)	0.38 (0.19)
$D(G_f)_4 \times \Delta z_{t-1}$	0.54 (2.28)	0.13 (1.24)	-1.22 (-2.35)	0.20 (0.71)	0.50 (1.68)
$D(G_f)_H \times \Delta z_{t-1}$	0.77 (2.34)	0.84 (1.92)	-1.47 (-2.92)	1.13 (3.07)	0.82 (2.53)

Table shows the differential response of investment of firms with different characteristics  $G_f \in \{Q, I/K, E/P, MBETA, IVOL\}$  on the empirical risk factor PC1.

**Table A.14: Investment response to IST shock: model**

$(I/K)_{ft}$	Q	I/K	E/P	MBETA	IVOL
$\Delta z_{t-1}$	2.48 (4.64)	1.92 (4.45)	4.16 (5.27)	2.48 (4.84)	1.94 (4.43)
$D(G_f)_2 \times \Delta z_{t-1}$	0.13 (1.25)	0.64 (3.32)	-0.59 (-2.66)	0.15 (1.21)	0.59 (3.72)
$D(G_f)_3 \times \Delta z_{t-1}$	0.39 (2.00)	1.17 (4.54)	-1.05 (-4.03)	0.47 (2.69)	0.98 (4.85)
$D(G_f)_4 \times \Delta z_{t-1}$	0.72 (3.60)	1.52 (5.40)	-1.61 (-4.89)	0.79 (3.94)	1.46 (5.34)
$D(G_f)_H \times \Delta z_{t-1}$	1.50 (4.78)	2.30 (6.60)	-2.39 (-5.27)	1.37 (4.81)	2.44 (5.97)

Table shows the differential response of investment of firms with different characteristics  $G_f \in \{Q, I/K, E/P, MBETA, IVOL\}$  on the IST shock in simulated data.

Table A.15: Return predictability: Model vs Data

Horizon (k) (years)	a. Price/Dividend		b. Price/Earnings		c. Tobin's Q		d. Investment rate		e. Market volatility						
	Slope	$t$	$R^2$	Slope	$t$	$R^2$	Slope	$t$	$R^2$	Slope	$t$	$R^2$			
A. Model															
1	-0.10	-2.04	0.07	-0.14	-2.02	0.07	-0.11	-1.81	0.06	-0.06	-1.93	0.06	-0.13	-1.52	0.04
2	-0.19	-2.47	0.13	-0.27	-2.42	0.13	-0.22	-2.29	0.12	-0.12	-2.32	0.12	-0.25	-1.90	0.07
3	-0.26	-2.76	0.19	-0.38	-2.70	0.19	-0.32	-2.65	0.17	-0.18	-2.56	0.16	-0.36	-2.11	0.10
4	-0.33	-2.97	0.24	-0.47	-2.94	0.24	-0.39	-2.82	0.21	-0.22	-2.70	0.20	-0.46	-2.25	0.12
5	-0.40	-3.18	0.28	-0.57	-3.15	0.28	-0.47	-3.02	0.25	-0.27	-2.84	0.23	-0.55	-2.51	0.15
B. Data															
1	-0.12	-2.14	0.07	-0.09	-1.64	0.05	-0.11	-1.97	0.06	-0.40	-1.79	0.05	-0.01	-0.16	0.00
2	-0.14	-2.04	0.08	-0.11	-1.51	0.04	-0.13	-1.86	0.06	-0.68	-2.82	0.11	-0.07	-0.91	0.01
3	-0.16	-1.60	0.06	-0.13	-1.25	0.04	-0.15	-1.55	0.06	-1.00	-3.20	0.16	-0.13	-1.27	0.03
4	-0.21	-1.59	0.08	-0.18	-1.37	0.06	-0.21	-1.71	0.09	-1.22	-3.22	0.19	-0.05	-0.40	0.00
5	-0.27	-1.62	0.12	-0.22	-1.38	0.09	-0.27	-1.84	0.15	-1.37	-3.08	0.23	-0.02	-0.15	0.00

Table reports results of return predictability regressions in simulated data. In particular, we report coefficients  $b(k)$  from

$$\sum_{h=1}^k r_{M,t+h} = a(k) + b(k) x_t + u_{t+h}$$

$r_M$  is log gross return on the market portfolio;  $x$  is the log aggregate price dividend ratio (panel a), log aggregate price-earnings ratio (panel b), log aggregate Tobin's  $Q$  (panel c), and log aggregate investment rate (panel d). Standard errors are computed using the Newey-West procedure with the number of lags equal to 1.5 times the return horizon. Point estimates,  $t$ -statistics, and the  $R^2$  are median values across 1,000 independent simulations of the model. For each simulated sample we start with 100 years of simulate data and omit the first 50 years to eliminate the effect of initial conditions.

**Table A.16: Estimates of the stochastic discount factor, by cross-section**

Factor price	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	10 portfolios sorted on Market beta					10 portfolios sorted on Idiosyncratic volatility				
$\Delta x$	1.32	-0.88				0.38	-0.74			
	[0.54, 2.09]	[-1.62, -0.13]				[-0.42, 1.19]	[-1.76, 0.28]			
$R_{MKT}$			0.29	0.45	0.38			0.16	0.50	0.46
			[0.08, 0.49]	[0.22, 0.67]	[0.18, 0.59]			[-0.06, 0.37]	[0.22, 0.79]	[0.19, 0.72]
$\Delta z^I$		-1.32					-1.33			
		[-2.01, -0.63]					[-2.12, -0.54]			
$R_{IMC}$				-0.47					-0.65	
				[-0.87, -0.07]					[-1.21, -0.09]	
$-R_{HML}$					-0.45					-1.22
					[-0.85, -0.05]					[-2.33, -0.11]
SSQE	0.47	0.08	0.49	0.07	0.09	1.86	0.42	1.09	0.35	0.82
	10 portfolios sorted on Investment					10 portfolios sorted on Tobin's Q				
$\Delta x$	1.33	-0.62				1.54	0.35			
	[0.49, 2.18]	[-1.64, 0.40]				[0.79, 2.30]	[-0.21, 0.91]			
$R_{MKT}$			0.29	0.53	0.44			0.34	0.62	0.43
			[0.10, 0.48]	[0.30, 0.75]	[0.24, 0.63]			[0.15, 0.53]	[0.39, 0.85]	[0.23, 0.63]
$\Delta z^I$		-1.28					-0.78			
		[-2.00, -0.56]					[-1.41, -0.15]			
$R_{IMC}$				-0.71					-1.21	
				[-1.08, -0.33]					[-1.67, -0.75]	
$-R_{HML}$					-0.65					-0.57
					[-0.98, -0.33]					[-0.88, -0.27]
SSQE	1.00	0.31	0.82	0.10	0.10	0.61	0.31	0.84	0.12	0.20
	10 portfolios sorted on Price/Earnings					10 portfolios sorted on profitability				
$\Delta x$	1.62	0.93				1.64	0.91			
	[0.89, 2.35]	[0.15, 1.70]				[0.59, 2.68]	[-0.35, 2.18]			
$R_{MKT}$			0.37	0.54	0.47			0.32	0.49	0.27
			[0.17, 0.57]	[0.32, 0.75]	[0.26, 0.67]			[0.12, 0.52]	[0.22, 0.75]	[0.06, 0.47]
$\Delta z^I$		-0.47					-0.38			
		[-1.21, 0.28]					[-0.93, 0.18]			
$R_{IMC}$				-0.84					-0.62	
				[-1.20, -0.48]					[-1.08, -0.17]	
$-R_{HML}$					-0.85					0.35
					[-1.23, -0.47]					[-0.06, 0.77]
SSQE	0.38	0.30	1.07	0.35	0.21	0.39	0.36	0.30	0.11	0.23

Table reports empirical estimates of  $\gamma_x$  and  $\gamma_z$  from the model SDF:  $m = a - \gamma_x \Delta x - \gamma_z \Delta z$ . We sort firms on Q, I/K, E/P, MBETA, IVOL and GP/A (see main text for variable definitions). We use annual data in the 1964-2008 period and report first-stage estimates; 90%-confidence intervals around the point estimates computed using the Newey-West procedure with 3 lags; the sum of squared errors (SSQE); and mean absolute pricing errors (MAPE).

Figure A.1: Investment shock and firm output comovement: Model

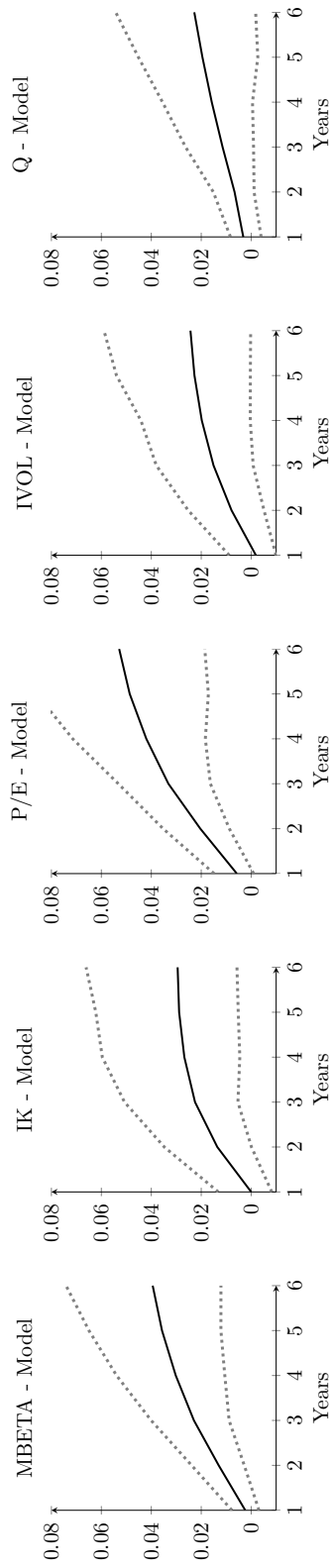


Figure plots the differential response of sales growth on the IST shock between firms with high and low  $I/K$ ,  $E/P$ ,  $Q$ ,  $IVOL$  or  $MBETA$  using equation (7) in the text.

**Table A.17: Portfolios sorted on Tobin's  $Q$**

Data											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.26 (4.43)	9.48 (5.01)	7.43 (3.91)	5.74 (2.82)	4.19 (1.80)	4.27 (2.10)	5.76 (2.21)	5.13 (1.91)	4.94 (1.93)	1.47 (0.58)	-8.79 (-3.26)
$\sigma(\%)$	19.06	19.74	16.87	16.62	18.13	17.29	17.35	20.85	20.31	24.94	20.75
$\beta^{mkt}$	0.86 (7.25)	0.92 (7.27)	0.82 (8.82)	0.82 (10.24)	0.90 (16.87)	0.89 (20.49)	0.87 (15.79)	1.06 (13.78)	0.99 (15.13)	1.15 (9.61)	0.29 (1.66)
$\alpha(\%)$	5.98 (3.25)	4.90 (3.68)	3.35 (3.22)	1.66 (1.61)	-0.32 (-0.35)	-0.20 (-0.26)	1.43 (1.16)	-0.17 (-0.14)	-0.00 (-0.00)	-4.29 (-2.25)	-10.27 (-3.64)
$R^2(\%)$	65.33	69.79	75.77	78.14	79.96	86.69	81.02	83.85	76.71	69.02	6.55
$\beta^{imc}$	0.07	0.17	0.12	0.22	0.21	0.31	0.15	0.41	0.31	0.68	0.61
$I/K$	0.08	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.21	0.28	
$Q$	0.29	0.53	0.72	0.95	1.27	1.77	2.56	4.07	7.57	23.83	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.12 (6.44)	8.31 (4.87)	7.36 (4.05)	6.71 (3.50)	6.16 (3.05)	5.70 (2.69)	5.32 (2.43)	5.03 (2.25)	4.81 (2.16)	4.85 (2.35)	-5.27 (-5.71)
$\sigma(\%)$	11.23	12.30	13.16	13.98	14.78	15.53	16.14	16.47	16.51	15.82	6.89
$\beta^{mkt}$	0.72 (21.96)	0.80 (33.01)	0.86 (46.04)	0.92 (60.03)	0.97 (66.17)	1.02 (63.02)	1.06 (56.91)	1.08 (54.01)	1.08 (51.91)	1.03 (46.87)	0.31 (7.71)
$\alpha(\%)$	5.61 (11.73)	3.30 (8.95)	1.98 (6.49)	0.99 (3.89)	0.12 (0.39)	-0.63 (-2.50)	-1.24 (-4.29)	-1.66 (-5.30)	-1.88 (-5.89)	-1.51 (-4.94)	-7.13 (-10.83)
$R^2(\%)$	89.60	94.29	96.07	96.94	97.27	97.25	97.11	96.92	96.80	96.08	53.34
$\beta^{imc}$	0.50	0.57	0.64	0.70	0.78	0.84	0.90	0.93	0.93	0.86	0.36
$I/K$	0.08	0.08	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.15	
$Q$	1.81	2.21	2.56	2.92	3.31	3.71	4.10	4.51	5.01	5.89	

Table shows characteristics for the 10 portfolios of firms sorted on Tobin's  $Q$ . The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.18: Portfolios sorted on the earnings-to-price ratio (E/P)**

Data											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	2.28 (0.72)	1.65 (0.84)	2.23 (1.13)	5.35 (2.56)	7.34 (3.67)	6.65 (3.47)	7.89 (3.51)	8.23 (3.33)	8.95 (3.98)	11.19 (4.25)	8.91 (3.00)
$\sigma(\%)$	25.72	16.90	16.24	16.99	18.25	17.27	17.86	19.05	19.76	20.96	19.72
$\beta^{mkt}$	1.21 (10.72)	0.86 (12.44)	0.85 (15.67)	0.85 (12.41)	0.90 (10.86)	0.88 (13.09)	0.91 (10.10)	0.92 (10.37)	0.81 (4.85)	0.97 (9.59)	-0.25 (-1.62)
$\alpha(\%)$	-3.80 (-2.24)	-2.63 (-2.67)	-2.00 (-3.02)	1.11 (1.72)	2.85 (2.40)	2.26 (3.10)	3.36 (2.95)	3.64 (2.88)	4.88 (2.50)	6.35 (3.15)	10.15 (3.51)
$R^2(\%)$	72.25	83.28	88.35	81.05	78.41	83.92	83.54	75.21	55.15	68.98	5.11
$\beta^{imc}$	0.87	0.31	0.30	0.08	0.17	0.24	0.17	0.18	-0.04	0.18	-0.69
$I/K$	0.13	0.12	0.11	0.11	0.11	0.11	0.10	0.11	0.12	0.13	
$Q$	2.20	2.11	1.99	1.80	1.62	1.41	1.34	1.22	1.00	0.44	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	2.97 (0.99)	3.75 (1.41)	4.32 (1.75)	4.91 (2.15)	5.49 (2.57)	6.11 (3.06)	6.82 (3.66)	7.62 (4.43)	8.60 (5.48)	10.18 (7.47)	7.21 (3.93)
$\sigma(\%)$	20.48	18.69	17.55	16.53	15.59	14.65	13.66	12.63	11.48	9.85	13.33
$\beta^{mkt}$	1.36 (26.04)	1.25 (32.56)	1.18 (40.53)	1.11 (51.63)	1.05 (66.04)	0.99 (78.22)	0.92 (63.71)	0.84 (44.29)	0.76 (30.22)	0.62 (17.48)	-0.74 (-9.53)
$\alpha(\%)$	-5.76 (-7.65)	-4.28 (-7.86)	-3.27 (-7.81)	-2.24 (-7.09)	-1.27 (-5.28)	-0.24 (-1.42)	0.90 (3.66)	2.18 (7.25)	3.71 (9.67)	6.18 (11.69)	11.94 (10.47)
$R^2(\%)$	92.30	94.52	95.84	96.59	97.12	97.25	96.88	95.69	92.83	83.49	64.23
$\beta^{imc}$	1.22	1.09	0.99	0.91	0.83	0.75	0.66	0.58	0.49	0.35	-0.90
$I/K$	0.13	0.12	0.12	0.11	0.11	0.10	0.09	0.08	0.07	0.07	
$Q$	4.27	4.26	4.11	3.86	3.61	3.27	2.97	2.69	2.47	2.26	

Table shows characteristics for the 10 portfolios of firms sorted on the earnings-to-price ratios. The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).



**Table A.19: Portfolios sorted on the investment rate (I/K)**

Data											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.46 (3.00)	6.98 (3.42)	7.25 (4.40)	7.08 (3.73)	6.98 (3.29)	6.00 (2.64)	5.74 (2.45)	4.07 (1.67)	3.28 (1.30)	2.51 (0.65)	-4.94 (-1.42)
$\sigma(\%)$	20.60	17.04	15.15	16.47	16.33	17.81	18.72	19.50	23.00	33.30	24.86
$\beta^{mkt}$	0.94 (7.79)	0.82 (10.05)	0.73 (10.61)	0.83 (12.24)	0.85 (15.75)	0.91 (12.85)	0.93 (15.96)	0.99 (14.18)	1.16 (14.69)	1.56 (9.52)	0.62 (2.91)
$\alpha(\%)$	2.77 (1.40)	2.87 (2.16)	3.61 (4.13)	2.92 (4.38)	2.70 (2.87)	1.43 (1.70)	1.09 (0.88)	-0.89 (-0.89)	-2.52 (-2.02)	-5.27 (-1.85)	-8.04 (-2.41)
$R^2(\%)$	67.02	75.49	75.24	82.93	88.70	85.42	80.01	83.89	82.52	70.80	20.13
$\beta^{imc}$	0.13	0.14	0.07	0.13	0.24	0.30	0.23	0.35	0.67	1.16	1.03
I/K	0.03	0.05	0.07	0.09	0.11	0.13	0.16	0.21	0.30	0.64	
$Q$	0.96	0.78	0.91	1.03	1.19	1.45	1.73	2.08	2.83	4.54	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	9.41 (5.95)	8.13 (4.57)	7.24 (3.77)	6.53 (3.20)	5.97 (2.78)	5.54 (2.48)	5.52 (2.48)	6.10 (2.99)	6.34 (3.45)	4.61 (2.30)	-4.81 (-7.85)
$\sigma(\%)$	11.51	13.03	14.09	14.95	15.67	16.18	15.97	14.64	13.39	14.45	4.41
$\beta^{mkt}$	0.75 (27.22)	0.87 (44.25)	0.94 (61.23)	1.00 (70.66)	1.05 (63.66)	1.09 (56.21)	1.07 (45.82)	0.99 (52.66)	0.90 (56.02)	0.98 (53.67)	0.22 (7.10)
$\alpha(\%)$	4.52 (11.11)	2.49 (8.34)	1.12 (4.41)	0.04 (-0.02)	-0.85 (-3.34)	-1.49 (-5.05)	-1.44 (-4.42)	-0.30 (-1.00)	0.50 (1.90)	-1.71 (-6.81)	-6.23 (-13.88)
$R^2(\%)$	91.98	95.73	96.81	97.13	97.11	96.87	96.60	96.84	96.81	97.11	53.01
$\beta^{imc}$	0.48	0.62	0.72	0.80	0.87	0.92	0.92	0.79	0.67	0.78	0.29
I/K	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.14	0.25	
$Q$	2.36	2.81	3.21	3.60	3.96	4.22	4.36	4.31	2.90	2.97	

Table shows characteristics for the 10 portfolios of firms sorted on investment rate. The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.20: Portfolios sorted on the market beta (MBETA)**

Data											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.81 (2.51)	6.40 (3.04)	5.42 (2.72)	6.73 (3.77)	5.92 (3.13)	5.08 (2.65)	6.02 (2.43)	5.04 (1.95)	3.98 (1.19)	3.84 (0.98)	-1.97 (-0.52)
$\sigma(\%)$	18.20	16.21	17.50	15.60	16.86	16.62	20.16	21.02	25.47	30.98	26.47
$\beta^{mkt}$	0.71 (5.19)	0.64 (5.42)	0.78 (5.33)	0.76 (13.67)	0.80 (10.39)	0.83 (10.02)	1.06 (18.41)	1.10 (24.42)	1.27 (14.65)	1.46 (11.75)	0.75 (4.26)
$\alpha(\%)$	2.24 (1.11)	3.21 (2.09)	1.53 (1.32)	2.93 (2.72)	1.90 (1.59)	0.95 (0.87)	0.74 (0.76)	-0.44 (-0.43)	-2.39 (-1.64)	-3.47 (-1.48)	-5.71 (-1.87)
$R^2(\%)$	49.70	50.28	64.13	76.94	73.46	80.12	88.95	88.09	81.13	72.10	25.93
$\beta^{imc}$	0.10	-0.13	-0.00	0.12	0.05	0.11	0.44	0.57	0.78	1.14	1.05
$I/K$	0.09	0.09	0.09	0.09	0.10	0.11	0.12	0.13	0.15	0.17	
$Q$	1.04	1.02	1.07	1.13	1.23	1.32	1.48	1.62	1.98	2.61	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	9.59 (6.50)	8.63 (5.38)	7.81 (4.54)	7.14 (3.92)	6.53 (3.37)	6.01 (2.93)	5.50 (2.54)	5.07 (2.21)	4.63 (1.90)	4.04 (1.56)	-5.55 (-4.06)
$\sigma(\%)$	10.66	11.66	12.53	13.32	14.13	14.88	15.65	16.49	17.33	18.33	9.84
$\beta^{mkt}$	0.68 (21.22)	0.76 (29.69)	0.83 (39.88)	0.88 (53.09)	0.94 (67.40)	0.99 (71.61)	1.05 (63.28)	1.10 (52.33)	1.15 (41.13)	1.22 (31.87)	0.54 (9.21)
$\alpha(\%)$	5.21 (10.71)	3.74 (9.56)	2.49 (7.63)	1.46 (5.34)	0.48 (1.91)	-0.38 (-1.78)	-1.21 (-4.77)	-2.00 (-6.26)	-2.78 (-6.73)	-3.77 (-6.95)	-8.98 (-10.14)
$R^2(\%)$	87.92	92.50	94.89	96.17	96.78	97.12	97.05	96.72	96.01	94.66	63.49
$\beta^{imc}$	0.40	0.47	0.54	0.60	0.67	0.73	0.80	0.86	0.93	1.02	0.65
$I/K$	0.05	0.07	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.12	
$Q$	2.40	2.55	2.73	2.96	3.16	3.41	3.63	3.80	3.91	3.96	

Table shows characteristics for the 10 portfolios of firms sorted on market beta. The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.21: Portfolios sorted on idiosyncratic return volatility (IVOL)**

Data											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.02 (2.45)	5.96 (2.60)	6.40 (3.23)	7.28 (2.89)	5.84 (1.99)	5.60 (1.72)	3.59 (0.97)	3.42 (0.87)	1.01 (0.20)	-0.84 (-0.14)	-5.86 (-0.95)
$\sigma(\%)$	15.35	17.38	17.82	20.69	25.59	26.55	30.27	32.75	39.33	42.44	37.05
$\beta^{mkt}$	0.77 (12.71)	0.92 (44.95)	0.93 (18.91)	1.07 (19.60)	1.29 (15.81)	1.26 (10.53)	1.45 (10.81)	1.53 (9.59)	1.67 (9.23)	1.76 (8.20)	0.98 (3.97)
$\alpha(\%)$	1.14 (1.12)	1.34 (1.65)	1.73 (2.10)	1.92 (2.69)	-0.63 (-0.42)	-0.68 (-0.30)	-3.67 (-1.41)	-4.24 (-1.43)	-7.34 (-1.71)	-9.64 (-1.90)	-10.78 (-1.83)
$R^2(\%)$	82.67	91.64	89.14	86.86	82.69	72.53	74.67	70.99	58.41	55.65	22.85
$\beta^{imc}$	0.07	0.27	0.32	0.41	0.77	0.81	0.98	1.04	1.55	1.45	1.37
$I/K$	0.10	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.15	0.12	
$Q$	0.93	1.19	1.23	1.28	1.38	1.43	1.65	1.88	1.95	2.25	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	9.61 (6.45)	8.27 (4.86)	7.56 (4.15)	7.02 (3.68)	6.57 (3.31)	6.15 (2.99)	5.76 (2.71)	5.39 (2.47)	4.99 (2.25)	4.37 (1.95)	-5.24 (-5.38)
$\sigma(\%)$	10.90	12.51	13.36	13.99	14.49	14.92	15.33	15.65	15.88	15.85	7.03
$\beta^{mkt}$	0.70 (21.74)	0.83 (35.65)	0.89 (49.38)	0.94 (65.35)	0.98 (76.75)	1.01 (70.48)	1.03 (60.14)	1.05 (49.43)	1.07 (42.20)	1.07 (35.09)	0.36 (6.99)
$\alpha(\%)$	5.06 (10.78)	2.92 (8.65)	1.79 (6.44)	0.97 (3.96)	0.29 (1.06)	-0.32 (-1.65)	-0.89 (-3.48)	-1.40 (-4.63)	-1.89 (-5.33)	-2.50 (-6.01)	-7.56 (-10.68)
$R^2(\%)$	89.17	94.78	96.29	96.90	97.13	97.09	96.93	96.65	96.15	95.53	54.79
$\beta^{imc}$	0.41	0.56	0.63	0.69	0.74	0.79	0.82	0.85	0.87	0.89	0.48
$I/K$	0.04	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.13	0.15	
$Q$	2.63	3.09	3.33	3.50	3.63	3.74	3.83	3.84	3.74	3.12	

Table shows characteristics for the 10 portfolios of firms sorted on idiosyncratic volatility. The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

**Table A.22: Portfolios sorted on profitability to book**

Data											
Gross Profit.	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	3.75 (1.03)	4.54 (1.52)	3.02 (1.41)	5.81 (2.83)	5.93 (2.76)	3.92 (1.95)	6.90 (2.88)	4.81 (2.00)	7.85 (3.10)	7.92 (2.80)	4.17 (1.28)
$\sigma(\%)$	36.24	22.48	18.07	18.91	19.79	17.82	20.13	17.18	19.71	19.31	32.86
$\beta_{MKT}$	1.44 (6.00)	1.12 (9.41)	0.92 (12.84)	0.98 (14.25)	1.04 (18.27)	0.92 (11.80)	1.02 (12.48)	0.83 (11.68)	0.86 (8.14)	0.89 (10.36)	-0.55 (-1.85)
$\alpha(\%)$	-3.45 (-1.26)	-1.07 (-0.58)	-1.58 (-1.46)	0.94 (1.08)	0.74 (0.68)	-0.69 (-0.59)	1.77 (1.60)	0.67 (0.57)	3.57 (2.30)	3.50 (2.14)	6.95 (1.96)
$R^2(\%)$	51.21	80.86	83.91	86.29	89.16	86.55	84.07	75.41	61.11	68.15	9.25
$\beta^{imc}$	1.36	0.60	0.33	0.41	0.40	0.29	0.41	0.18	0.21	0.10	-1.26
$I/K$	0.09	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.11	
$Q$	6.53	1.10	0.90	1.06	1.23	1.45	1.73	2.01	2.47	2.48	
Model											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	3.79 (1.80)	5.12 (2.73)	6.69 (3.27)	6.98 (3.58)	7.09 (3.74)	7.13 (3.83)	7.07 (3.84)	7.03 (3.83)	6.97 (3.86)	7.11 (4.19)	3.32 (2.13)
$\sigma(\%)$	18.79	16.00	14.66	14.01	13.65	13.46	13.37	13.40	13.31	12.72	7.70
$\beta^{mkt}$	1.25 (31.44)	1.07 (47.93)	0.98 (56.28)	0.94 (59.10)	0.91 (56.51)	0.90 (54.62)	0.89 (51.39)	0.89 (47.16)	0.88 (44.00)	0.83 (34.89)	-0.42 (-7.90)
$\alpha(\%)$	-4.21 (-5.79)	-1.77 (-2.26)	0.37 (1.47)	0.94 (3.75)	1.22 (4.74)	1.34 (5.06)	1.34 (4.92)	1.30 (4.48)	1.32 (4.17)	1.81 (4.65)	6.02 (6.80)
$R^2(\%)$	94.40	96.46	96.86	96.78	96.64	96.53	96.37	96.17	95.80	93.71	60.24
$\beta^{imc}$	1.05	0.83	0.73	0.68	0.64	0.63	0.62	0.61	0.60	0.55	-0.49
$I/K$	0.11	0.11	0.10	0.09	0.08	0.08	0.07	0.08	0.08	0.09	
$Q$	3.48	3.06	2.86	2.88	2.99	3.16	3.39	3.69	4.11	5.12	

Table shows characteristics for the 10 portfolios of firms sorted on gross profitability (Compustat gp over at). The top panel shows results from actual data, the bottom panel shows results from data simulated by the model. We report average returns in excess of the risk-free rate, as well CAPM alphas and univariate post-formation betas with respect to the market portfolio,  $\beta_t^{mkt}$ , and the investment minus consumption portfolio (defined in Appendix A),  $\beta_t^{imc}$ . Estimation is done at annual frequencies in both the model and the data. The sample period is 1965-2008 and excludes firms producing investment goods, financial firms (SIC6000-6799) and utilities (SIC4900-4949).

## 2.2 Comparative statics

**Table A.23: Characteristics and average returns: calibration without learning**

10 MBETA portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.46 (7.85)	8.99 (5.99)	7.97 (4.87)	7.11 (4.01)	6.37 (3.35)	5.67 (2.78)	5.03 (2.30)	4.40 (1.87)	3.74 (1.47)	2.83 (1.02)	-7.63 (-4.42)
10 I/K portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.76 (6.50)	6.71 (4.99)	5.96 (4.09)	5.36 (3.45)	4.84 (2.95)	4.43 (2.59)	4.42 (2.59)	5.01 (3.23)	5.26 (3.75)	3.78 (2.45)	-3.98 (-7.80)
10 P/E portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.66 (8.11)	9.17 (6.15)	8.09 (4.95)	7.18 (4.06)	6.34 (3.33)	5.61 (2.75)	4.90 (2.23)	4.19 (1.77)	3.45 (1.34)	2.41 (0.82)	-8.25 (-4.50)
10 IVOL portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.13 (2.43)	6.02 (3.04)	6.49 (3.39)	6.86 (3.69)	7.21 (3.98)	7.51 (4.24)	7.78 (4.49)	8.01 (4.70)	8.10 (4.75)	5.99 (3.11)	0.86 (1.79)
10 Q portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.37 (6.94)	8.62 (5.32)	7.67 (4.46)	6.97 (3.84)	6.36 (3.32)	5.83 (2.89)	5.36 (2.56)	5.05 (2.35)	4.90 (2.28)	5.16 (2.56)	-5.20 (-5.59)
10 Profitability (ROA) portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	3.99 (1.52)	5.51 (2.53)	6.41 (3.23)	6.91 (3.68)	7.18 (3.94)	7.31 (4.07)	7.37 (4.14)	7.32 (4.15)	7.23 (4.14)	7.26 (4.36)	3.27 (3.07)

Table shows moments of decile portfolios in a calibration of the model without the learning channel.

**Table A.24: Characteristics and average returns: Kogan and Papanikolaou (2011) model**

10 MBETA portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.58 (3.79)	7.48 (3.61)	7.30 (3.45)	7.05 (3.27)	6.84 (3.10)	6.59 (2.91)	6.29 (2.70)	5.89 (2.43)	5.41 (2.12)	4.91 (1.65)	-2.67 (-2.11)
10 I/K portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	6.77 (3.14)	6.66 (3.05)	6.63 (3.02)	6.65 (3.01)	6.58 (2.96)	6.52 (2.92)	6.57 (2.93)	6.50 (2.86)	6.40 (2.77)	6.17 (2.57)	-0.61 (-1.04)
10 P/E portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.11 (3.51)	7.08 (3.39)	6.91 (3.24)	6.86 (3.13)	6.64 (2.97)	6.46 (2.82)	6.23 (2.65)	5.95 (2.45)	5.67 (2.22)	4.94 (1.79)	-2.17 (-1.81)
10 IVOL portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	6.62 (2.98)	6.58 (2.96)	6.55 (2.95)	6.54 (2.93)	6.51 (2.93)	6.50 (2.93)	6.51 (2.94)	6.50 (2.95)	6.53 (2.98)	6.53 (3.05)	-0.09 (-0.13)
10 Q portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	8.11 (3.85)	7.42 (3.60)	7.05 (3.42)	6.71 (3.26)	6.58 (3.09)	6.41 (2.90)	6.07 (2.67)	5.57 (2.42)	4.92 (2.07)	3.96 (1.52)	-4.15 (-2.90)
10 Profitability (ROA) portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	6.29 (2.54)	6.45 (2.73)	6.53 (2.84)	6.61 (2.92)	6.68 (2.98)	6.66 (3.01)	6.71 (3.07)	6.69 (3.08)	6.56 (3.04)	6.35 (2.97)	0.06 (0.20)

Table shows characteristics for decile portfolios sorted on the corresponding characteristics using the model in Kogan and Papanikolaou (2011).

**Table A.25: Parameters**

Parameter	Symbol	Value
<i>Technology</i>		
Growth rate of X-shock	$\mu_x$	0.50%
Volatility of $x$ -shock	$\sigma_x$	7.00%
Growth rate of IST shock	$\mu_Z$	0.30%
Volatility of IST shock	$\sigma_Z$	4.20%
Mean-reversion parameter of project-specific shock	$\theta_u$	0.03
Volatility of project-specific shock	$\sigma_u$	1.25
<i>Production</i>		
Project DRS parameter	$\alpha$	0.85
Profit margin of investment firms	$\phi$	7.5%
Depreciation rate of capital	$\delta$	10%
<i>Learning</i>		
Noise in public signal	$\sigma_e$	15%
<i>Investment</i>		
Maximum long-run project arrival rate	$\bar{\lambda}$	25
Minimum long-run project arrival rate	$\underline{\lambda}$	5
Project arrival rate in high-growth state	$\lambda_H$	5.100
Transition probability into high-growth state	$\mu_H$	0.050
Transition probability into low-growth state	$\mu_L$	0.250
<i>Stochastic discount factor</i>		
Risk-free rate	$r$	3%
Price of risk of $x$ -shock	$b_x$	1.77
Price of risk of IST shock	$b_z$	-0.57

Table shows the parameters in model calibration. See main text for more details.

## 2.3 Robustness tests

Table A.26: Portfolio characteristics: decile portfolios, sorted by industry

10 MBETA portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	6.64 (2.41)	5.06 (3.17)	5.85 (3.03)	5.81 (2.85)	4.99 (2.67)	6.62 (3.01)	5.25 (2.09)	4.90 (2.04)	5.24 (1.86)	3.56 (1.13)	-3.09 (-1.08)
$\sigma(\%)$	20.29	16.85	16.62	17.31	15.98	18.17	18.07	18.65	21.87	24.59	17.82
$\beta_{MKT}$	0.83 (6.64)	0.76 (7.73)	0.85 (13.20)	0.89 (15.77)	0.77 (9.89)	0.92 (10.67)	0.95 (29.60)	0.98 (28.23)	1.13 (18.27)	1.25 (16.62)	0.42 (3.06)
$\alpha(\%)$	2.50 (1.13)	1.28 (0.97)	1.61 (1.94)	1.33 (1.44)	1.12 (0.93)	2.02 (1.52)	0.48 (0.51)	-0.01 (-0.01)	-0.41 (-0.34)	-2.68 (-1.54)	-5.19 (-2.06)
$R^2(\%)$	53.99	65.41	84.12	86.75	76.04	83.22	90.30	89.76	86.68	83.53	18.02
$\beta_{IMC}$	0.21 (0.86)	0.07 (0.50)	0.19 (1.83)	0.19 (1.81)	0.02 (0.17)	0.29 (2.96)	0.38 (3.11)	0.34 (2.40)	0.64 (5.74)	0.71 (5.30)	0.51 (2.66)
10 E/P portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	4.11 (1.65)	3.70 (1.55)	2.96 (1.32)	5.43 (2.42)	5.38 (2.74)	6.67 (2.82)	7.16 (3.28)	7.69 (4.33)	8.43 (3.52)	9.04 (3.92)	4.92 (2.65)
$\sigma(\%)$	22.19	18.43	16.52	18.07	15.26	17.56	16.28	16.06	20.38	20.34	15.73
$\beta_{MKT}$	1.17 (29.18)	0.96 (20.88)	0.83 (10.54)	0.95 (18.34)	0.75 (9.90)	0.88 (12.86)	0.82 (14.18)	0.79 (9.26)	0.93 (7.66)	0.93 (7.97)	-0.24 (-1.95)
$\alpha(\%)$	-1.73 (-1.60)	-1.09 (-1.34)	-1.20 (-1.10)	0.67 (1.11)	1.61 (1.65)	2.26 (2.28)	3.06 (3.61)	3.73 (4.35)	3.77 (2.21)	4.39 (2.57)	6.12 (3.01)
$R^2(\%)$	89.77	87.40	82.09	90.07	78.77	81.75	81.96	78.63	67.80	67.70	7.44
$\beta_{IMC}$	0.55 (4.25)	0.37 (3.15)	0.14 (1.41)	0.19 (1.60)	0.06 (0.73)	0.09 (0.74)	0.07 (0.64)	0.10 (0.79)	0.03 (0.15)	0.14 (0.78)	-0.41 (-3.03)
10 Q portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.21 (5.03)	6.94 (3.36)	7.23 (3.59)	4.88 (2.49)	6.27 (2.60)	5.27 (2.11)	4.55 (2.09)	3.74 (1.84)	4.93 (2.25)	2.78 (1.00)	-7.43 (-3.23)
$\sigma(\%)$	20.41	17.39	18.12	15.87	16.67	17.59	17.93	18.09	18.57	24.49	17.87
$\beta_{MKT}$	0.99 (10.80)	0.85 (9.90)	0.93 (15.48)	0.80 (17.35)	0.82 (15.79)	0.90 (15.59)	0.90 (15.03)	0.93 (13.75)	0.89 (11.17)	1.21 (12.55)	0.22 (1.54)
$\alpha(\%)$	5.27 (4.48)	2.68 (2.46)	2.58 (2.75)	0.87 (1.00)	2.15 (1.77)	0.74 (0.68)	0.06 (0.07)	-0.94 (-1.33)	0.50 (0.34)	-3.26 (-2.18)	-8.53 (-3.91)
$R^2(\%)$	75.75	77.94	85.33	82.91	79.20	85.74	81.37	86.68	73.99	78.76	4.94
$\beta_{IMC}$	0.27 (1.72)	0.24 (1.91)	0.23 (2.15)	0.24 (2.05)	0.25 (2.04)	0.23 (2.18)	0.12 (0.95)	0.37 (3.22)	0.19 (1.65)	0.67 (5.61)	0.40 (3.14)

Table shows characteristics for decile portfolios using industry breakpoints. We use the 17 industry classification of Fama and French (1997).



**Table A.27: Portfolio characteristics: decile portfolios, sorted by industry, continued**

10 I/K portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.67 (2.85)	8.25 (3.49)	7.48 (2.91)	6.66 (2.74)	5.11 (2.01)	5.99 (2.26)	5.05 (1.85)	3.63 (1.30)	3.04 (1.18)	2.81 (0.74)	-4.86 (-1.95)
$\sigma(\%)$	19.76	16.78	18.48	17.38	16.68	17.45	18.70	20.03	17.68	26.40	17.49
$\beta_{MKT}$	0.92 (8.65)	0.81 (11.59)	0.92 (11.24)	0.86 (10.57)	0.82 (10.57)	0.90 (17.02)	0.96 (16.14)	0.97 (12.30)	0.90 (11.93)	1.30 (11.65)	0.39 (2.52)
$\alpha(\%)$	3.09 (2.00)	4.20 (3.30)	2.88 (2.54)	2.34 (2.57)	1.01 (0.99)	1.47 (1.60)	0.24 (0.20)	-1.22 (-1.02)	-1.44 (-1.26)	-3.70 (-1.78)	-6.79 (-2.72)
$R^2(\%)$	69.60	75.54	80.33	79.82	78.13	86.62	85.48	75.98	83.26	78.80	15.76
$\beta_{IMC}$	0.26 (1.39)	0.25 (1.43)	0.35 (1.81)	0.19 (1.20)	0.13 (0.85)	0.48 (4.35)	0.37 (2.76)	0.21 (1.03)	0.45 (3.02)	0.91 (4.35)	0.66 (4.09)
10 IVOL portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	4.93 (2.31)	5.12 (2.10)	6.62 (2.76)	5.63 (2.47)	6.12 (2.58)	4.57 (1.69)	5.99 (1.98)	7.27 (2.42)	0.88 (0.30)	2.74 (0.76)	-2.19 (-0.93)
$\sigma(\%)$	16.18	18.19	17.83	18.95	20.14	20.30	25.07	23.37	24.73	29.18	21.15
$\beta_{MKT}$	0.86 (18.98)	0.94 (12.54)	0.94 (19.69)	0.99 (14.00)	1.06 (20.49)	1.03 (16.02)	1.25 (13.15)	1.19 (19.61)	1.17 (10.23)	1.35 (11.35)	0.50 (3.33)
$\alpha(\%)$	0.64 (0.77)	0.42 (0.38)	1.91 (2.91)	0.67 (0.78)	0.82 (1.03)	-0.60 (-0.38)	-0.24 (-0.16)	1.32 (0.64)	-4.98 (-2.57)	-4.03 (-1.46)	-4.67 (-1.47)
$R^2(\%)$	91.05	86.51	90.44	88.90	90.00	84.14	80.20	83.88	72.62	69.85	17.90
$\beta_{IMC}$	0.21 (2.05)	0.11 (0.88)	0.24 (2.40)	0.22 (1.72)	0.37 (2.85)	0.33 (2.24)	0.42 (3.25)	0.61 (5.10)	0.57 (4.36)	0.68 (3.41)	0.47 (3.16)

Table shows characteristics for decile portfolios using industry breakpoints. We use the 17 industry classification of Fama and French (1997).

**Table A.28: Excess return comovement, within industry sort**

	Cross-sections						Eigenvalues
	I/K	P/E	IVOL	MBETA	Q	ALL	$\lambda_1 / \sum \lambda_i$
I/K							31.3
(p-value)							(0.00)
P/E	79.1						41.1
(p-value)							(0.00)
IVOL	4.3	4.7					40.5
(p-value)							(0.00)
MBETA	68.0	74.6	3.7				30.5
(p-value)							(0.00)
Q	84.1	79.9	18.3	66.3			30.8
(p-value)							(0.00)
ALL (I/K, PE, IVOL, MBETA, Q)	89.8	67.4	31.6	63.7	76.5		32.3
(p-value)	(0.00)	(0.00)	(0.14)	(0.00)	(0.00)		(0.00)
IMC	57.5	75.2	4.8	63.8	69.6	43.8	
-HML	-63.5	-68.3	-27.4	-63.0	-73.9	-63.7	
$\Delta z^I$	11.4	9.3	6.3	35.1	17.7	4.5	

Table shows return comovement across the 5 decile portfolio sorts (I/K, PE, MBETA and IVOL), constructed using industry breakpoints. We extract the first principal component from standardized return residuals from a market model regression. We normalize the sign of the first principal component so that it loads positively on portfolio 10 with the exception of the  $E/P$  sort, where it loads negatively on portfolio 10. In addition, we extract the first principal component from a pooled cross-section of 20 portfolios that includes portfolios 1,2, 9 and 10 from each sort. We show the correlation matrix of these principal components, along with their correlations with IMC, HML and the real proxy for the IST shock  $\Delta z^I$ . We compute  $p$ -values based on 10,000 bootstraps, where we randomly permute the order of each cross-section separately.

**Table A.29: Portfolio characteristics: decile portfolios, exclude small firms**

10 MBETA portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	4.44 (2.19)	5.98 (2.91)	6.41 (3.39)	6.60 (3.79)	5.05 (2.56)	6.23 (3.07)	5.43 (2.21)	4.88 (1.83)	4.52 (1.35)	2.97 (0.75)	-1.47 (-0.38)
$\sigma(\%)$	16.27	16.39	16.46	15.08	17.17	18.72	19.54	21.00	25.66	31.04	26.99
$\beta_{MKT}$	0.68 (6.51)	0.71 (6.45)	0.82 (8.31)	0.73 (11.13)	0.86 (12.46)	0.92 (9.54)	1.01 (21.74)	1.08 (17.23)	1.28 (15.54)	1.47 (11.68)	0.80 (4.21)
$\alpha(\%)$	1.05 (0.71)	2.44 (1.76)	2.32 (2.38)	2.95 (2.66)	0.75 (0.75)	1.61 (1.32)	0.37 (0.35)	-0.51 (-0.50)	-1.90 (-1.23)	-4.41 (-1.88)	-5.46 (-1.73)
$R^2(\%)$	56.26	60.53	80.13	75.62	81.18	78.92	87.04	85.70	81.25	73.18	28.27
$\beta_{IMC}$	0.03 (0.18)	-0.08 (-0.76)	0.12 (1.20)	0.05 (0.49)	0.12 (0.91)	0.16 (1.13)	0.48 (4.13)	0.51 (3.53)	0.80 (5.28)	1.16 (8.23)	1.13 (7.44)
10 E/P portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	2.31 (0.89)	3.49 (1.49)	4.06 (1.95)	5.29 (2.46)	4.92 (2.64)	6.69 (3.14)	8.08 (3.83)	9.28 (3.88)	7.92 (3.28)	10.55 (5.08)	8.24 (3.63)
$\sigma(\%)$	23.50	19.93	15.55	17.33	16.92	17.16	17.49	19.06	19.50	18.87	19.05
$\beta_{MKT}$	1.16 (12.63)	0.97 (12.71)	0.76 (16.86)	0.89 (16.56)	0.83 (8.40)	0.85 (9.70)	0.87 (11.02)	0.88 (7.14)	0.96 (12.10)	0.83 (7.33)	-0.33 (-1.84)
$\alpha(\%)$	-3.48 (-2.80)	-1.38 (-1.10)	0.25 (0.32)	0.83 (0.93)	0.74 (0.78)	2.44 (2.19)	3.70 (4.29)	4.89 (3.47)	3.12 (2.25)	6.38 (3.77)	9.86 (4.46)
$R^2(\%)$	78.67	77.14	77.75	85.87	78.99	79.72	81.03	68.70	78.81	63.14	9.45
$\beta_{IMC}$	0.79 (5.28)	0.32 (2.54)	0.11 (1.04)	0.24 (2.65)	0.13 (1.20)	0.21 (1.79)	0.15 (1.04)	0.02 (0.11)	0.23 (1.40)	0.08 (0.51)	-0.71 (-8.37)
10 Q portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	9.99 (4.87)	8.76 (4.81)	6.54 (3.40)	5.57 (2.67)	4.26 (1.76)	4.32 (2.14)	5.95 (2.19)	5.01 (1.87)	4.61 (1.78)	1.02 (0.39)	-8.97 (-3.30)
$\sigma(\%)$	18.84	18.43	16.37	17.10	18.80	16.98	18.41	20.87	20.08	25.39	21.30
$\beta_{MKT}$	0.88 (7.49)	0.87 (8.13)	0.77 (8.73)	0.83 (10.30)	0.94 (16.76)	0.87 (21.04)	0.94 (22.46)	1.05 (12.84)	0.98 (16.58)	1.16 (8.67)	0.28 (1.36)
$\alpha(\%)$	5.57 (3.67)	4.38 (3.42)	2.68 (2.82)	1.40 (1.33)	-0.42 (-0.46)	-0.03 (-0.03)	1.22 (1.02)	-0.24 (-0.19)	-0.31 (-0.24)	-4.79 (-2.25)	-10.37 (-3.56)
$R^2(\%)$	71.24	73.04	72.26	77.04	80.55	85.04	85.27	82.03	77.90	67.93	5.56
$\beta_{IMC}$	0.11 (0.75)	0.16 (1.04)	0.09 (0.79)	0.21 (1.61)	0.28 (2.35)	0.21 (1.73)	0.28 (2.85)	0.41 (3.44)	0.31 (2.20)	0.71 (5.32)	0.60 (4.41)

Table shows characteristics for decile portfolios of firms sorted on market beta (Panel A) profitability (Panel B) or Q (Panel C), excluding the bottom 20% of firms in terms of market capitalization.

**Table A.30: Portfolio characteristics: decile portfolios, exclude small firms, continued**

10 I/K portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.94 (2.82)	7.74 (3.99)	6.68 (3.90)	7.56 (3.76)	6.84 (3.22)	5.47 (2.33)	4.98 (2.06)	4.40 (1.86)	2.88 (1.07)	3.08 (0.82)	-2.86 (-1.00)
$\sigma(\%)$	18.70	15.95	15.30	17.08	16.22	18.75	18.63	20.32	23.91	33.23	23.96
$\beta_{MKT}$	0.89 (9.73)	0.75 (11.40)	0.76 (11.53)	0.88 (14.25)	0.83 (14.28)	0.96 (13.30)	0.96 (27.17)	1.03 (14.92)	1.20 (13.13)	1.56 (9.50)	0.66 (3.25)
$\alpha(\%)$	1.47 (1.02)	3.97 (3.30)	2.89 (4.33)	3.14 (4.28)	2.67 (2.53)	0.67 (0.70)	0.16 (0.17)	-0.76 (-0.75)	-3.14 (-2.41)	-4.71 (-1.76)	-6.18 (-2.25)
$R^2(\%)$	74.00	72.35	79.28	86.78	85.88	84.67	86.88	83.46	82.38	71.15	24.82
$\beta_{IMC}$	0.13 (0.86)	0.05 (0.50)	0.15 (1.05)	0.17 (1.67)	0.19 (2.02)	0.33 (2.84)	0.34 (3.16)	0.37 (3.29)	0.71 (4.85)	1.13 (6.95)	1.00 (8.60)
$\beta_{IMC}$	0.62 (3.43)	0.39 (1.84)	0.34 (1.97)	0.22 (1.20)	0.46 (3.35)	0.31 (2.16)	0.33 (2.08)	0.17 (1.18)	0.06 (0.37)	0.37 (2.32)	-0.25 (-1.47)
10 IVOL portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.34 (2.58)	5.36 (2.31)	5.34 (2.86)	7.93 (3.19)	5.49 (2.15)	7.07 (2.34)	4.22 (1.31)	3.08 (0.84)	3.32 (0.80)	-2.03 (-0.40)	-7.38 (-1.39)
$\sigma(\%)$	15.32	17.23	16.93	20.33	22.03	27.70	25.88	29.87	36.23	37.00	31.43
$\beta_{MKT}$	0.76 (11.97)	0.91 (31.95)	0.88 (18.70)	1.05 (20.49)	1.12 (15.58)	1.38 (13.25)	1.23 (12.37)	1.44 (11.20)	1.63 (9.11)	1.63 (10.30)	0.87 (4.36)
$\alpha(\%)$	1.52 (1.37)	0.80 (1.01)	0.92 (1.23)	2.66 (3.92)	-0.14 (-0.13)	0.16 (0.09)	-1.96 (-0.87)	-4.11 (-1.62)	-4.83 (-1.44)	-10.19 (-2.38)	-11.71 (-2.26)
$R^2(\%)$	80.63	90.59	88.31	87.02	84.51	80.72	73.88	75.07	65.57	62.97	24.66
$\beta_{IMC}$	0.08 (0.89)	0.22 (1.87)	0.24 (2.45)	0.51 (4.08)	0.44 (2.60)	0.84 (5.94)	0.83 (6.12)	0.96 (5.65)	1.35 (9.03)	1.32 (8.50)	1.24 (7.89)

Table shows characteristics for decile portfolios, excluding the bottom 20% of firms in terms of market capitalization every year.

**Table A.31: Excess return comovement, excluding small firms**

	Cross-sections						Eigenvalues
	I/K	P/E	IVOL	MBETA	Q	ALL	$\lambda_1 / \sum \lambda_i$
I/K							35.5
(p-value)							(0.00)
P/E	85.4						41.7
(p-value)							(0.00)
IVOL	48.6	30.5					48.9
(p-value)							(0.00)
MBETA	80.3	74.5	57.4				43.8
(p-value)							(0.00)
Q	76.2	77.8	40.0	65.8			30.8
(p-value)							(0.00)
ALL (I/K, E/P, IVOL, MBETA, Q)	92.1	84.6	53.6	88.1	76.9		39.0
(p-value)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)		(0.00)
IMC	61.5	59.5	55.8	68.3	-69.6	64.8	
-HML	-74.4	-70.7	-30.5	-71.1	-73.9	-83.2	
$\Delta z^I$	27.2	28.0	15.0	42.3	-17.7	29.6	

Table shows return comovement across the 5 decile portfolio sorts (I/K, E/P, MBETA and IVOL), excluding the bottom 20% of firms in terms of market capitalization. We extract the first principal component from standardized return residuals from a market model regression. We normalize the sign of the first principal component so that it loads positively on portfolio 10 with the exception of the *E/P* sort, where it loads negatively on portfolio 10. In addition, we extract the first principal component from a pooled cross-section of 20 portfolios that includes portfolios 1,2, 9 and 10 from each sort. We show the correlation matrix of these principal components, along with their correlations with IMC, HML and the real proxy for the IST shock  $\Delta z^I$ . We compute *p*-values based on 10,000 bootstraps, where we randomly permute the order of each cross-section separately.

**Table A.32: Portfolio characteristics: decile portfolios, exclude services firms**

10 MBETA portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	6.53 (2.35)	7.47 (3.58)	5.82 (2.50)	5.84 (3.23)	4.94 (2.36)	6.39 (3.12)	5.42 (2.20)	4.38 (1.57)	3.79 (1.14)	3.47 (0.81)	-3.06 (-0.65)
$\sigma(\%)$	20.37	16.10	17.97	16.02	17.75	17.32	19.68	21.41	25.57	32.61	26.81
$\beta_{MKT}$	0.81 (4.89)	0.67 (6.49)	0.84 (7.69)	0.80 (15.47)	0.88 (12.38)	0.84 (9.67)	1.00 (16.80)	1.11 (17.97)	1.24 (12.14)	1.50 (11.25)	0.69 (3.49)
$\alpha(\%)$	2.47 (0.92)	4.13 (2.93)	1.63 (1.05)	1.83 (1.62)	0.52 (0.56)	2.20 (2.01)	0.41 (0.39)	-1.16 (-1.00)	-2.42 (-1.51)	-4.02 (-1.50)	-6.49 (-1.76)
$R^2(\%)$	51.47	55.55	70.49	81.27	80.25	75.77	84.32	86.85	76.61	68.49	21.31
$\beta_{IMC}$	0.26 (1.25)	0.01 (0.11)	0.14 (1.35)	0.21 (2.17)	0.15 (0.95)	0.19 (1.52)	0.41 (2.70)	0.63 (5.17)	0.88 (5.61)	1.26 (8.22)	1.00 (4.80)
10 E/P portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	3.41 (1.03)	2.26 (0.85)	3.18 (1.89)	5.16 (2.26)	5.78 (2.91)	6.35 (2.75)	8.11 (3.98)	6.71 (2.95)	8.93 (3.42)	10.46 (4.39)	7.05 (2.16)
$\sigma(\%)$	27.18	21.26	16.56	18.22	16.83	17.88	17.95	18.23	19.23	19.68	24.16
$\beta_{MKT}$	1.24 (8.83)	1.06 (12.01)	0.82 (11.89)	0.92 (9.99)	0.84 (12.08)	0.90 (13.27)	0.90 (10.83)	0.91 (9.91)	0.90 (9.64)	0.78 (5.20)	-0.46 (-2.09)
$\alpha(\%)$	-2.77 (-1.33)	-3.03 (-2.80)	-0.91 (-1.03)	0.54 (0.49)	1.58 (1.68)	1.87 (1.48)	3.61 (3.89)	2.15 (1.88)	4.40 (3.14)	6.58 (3.06)	9.35 (3.07)
$R^2(\%)$	67.05	80.51	79.01	83.23	80.75	81.31	81.18	81.07	71.76	50.39	11.76
$\beta_{IMC}$	0.96 (3.88)	0.62 (4.23)	0.32 (2.52)	0.22 (1.69)	0.17 (1.38)	0.25 (2.17)	0.28 (2.18)	0.18 (1.67)	0.20 (1.22)	0.00 (0.03)	-0.96 (-6.62)
10 Q portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	10.49 (4.55)	9.59 (4.71)	7.22 (3.98)	6.47 (2.89)	4.11 (1.89)	6.28 (2.48)	5.25 (2.13)	4.83 (1.75)	4.68 (1.76)	0.66 (0.25)	-9.83 (-4.01)
$\sigma(\%)$	19.57	20.85	16.22	18.65	17.69	19.76	17.09	21.36	20.22	24.98	19.17
$\beta_{MKT}$	0.90 (8.57)	1.03 (10.19)	0.76 (8.73)	0.90 (11.01)	0.90 (17.18)	1.01 (15.60)	0.86 (19.65)	1.07 (15.02)	0.96 (14.22)	1.15 (8.95)	0.24 (1.44)
$\alpha(\%)$	5.96 (3.59)	4.44 (3.12)	3.42 (3.34)	1.95 (1.62)	-0.41 (-0.51)	1.23 (0.94)	0.95 (0.93)	-0.50 (-0.42)	-0.13 (-0.09)	-5.09 (-2.38)	-11.05 (-4.19)
$R^2(\%)$	69.23	79.19	71.06	76.06	84.48	84.70	81.82	80.76	73.44	68.58	5.29
$\beta_{IMC}$	0.29 (2.01)	0.35 (2.60)	0.20 (1.52)	0.38 (2.24)	0.33 (3.13)	0.26 (1.81)	0.25 (2.35)	0.46 (3.63)	0.32 (1.99)	0.75 (5.66)	0.47 (4.22)

Table shows characteristics for decile portfolios, excluding investment firms and services (Fama and French (1997) classifications 14-17).

**Table A.33: Portfolio characteristics: decile portfolios, exclude services firms, continued**

10 I/K portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	7.26 (3.09)	7.10 (3.15)	7.68 (4.31)	7.71 (3.97)	6.15 (2.97)	4.78 (2.11)	6.25 (2.28)	4.48 (1.99)	2.66 (1.05)	2.46 (0.61)	-4.80 (-1.59)
$\sigma(\%)$	21.35	18.00	15.94	16.98	16.75	16.88	20.44	20.36	22.74	34.34	21.74
$\beta_{MKT}$	1.01 (12.24)	0.87 (10.19)	0.79 (11.69)	0.85 (11.66)	0.86 (13.52)	0.87 (16.12)	0.98 (12.61)	1.04 (14.11)	1.11 (15.03)	1.61 (8.69)	0.60 (3.70)
$\alpha(\%)$	2.20 (1.31)	2.75 (1.94)	3.75 (4.79)	3.47 (4.88)	1.83 (2.29)	0.43 (0.56)	1.33 (0.82)	-0.72 (-0.69)	-2.90 (-3.10)	-5.60 (-1.92)	-7.79 (-2.58)
$R^2(\%)$	72.80	76.03	78.83	80.56	86.32	86.06	75.04	84.68	77.35	71.29	24.60
$\beta_{IMC}$	0.52 (4.88)	0.28 (1.87)	0.20 (1.52)	0.14 (0.95)	0.22 (2.03)	0.32 (2.81)	0.25 (1.67)	0.48 (4.41)	0.74 (6.06)	1.31 (8.50)	0.79 (6.64)
10 IVOL portfolios											
	Lo	2	3	4	5	6	7	8	9	Hi	Hi-Lo
$E(R) - r_f(\%)$	5.64 (2.71)	5.38 (2.57)	8.10 (3.46)	6.07 (2.14)	5.67 (1.80)	5.81 (1.76)	1.87 (0.48)	3.01 (0.67)	0.69 (0.13)	-0.78 (-0.13)	-6.42 (-1.03)
$\sigma(\%)$	15.67	17.15	19.22	22.52	27.84	27.06	30.82	37.09	40.98	44.23	38.92
$\beta_{MKT}$	0.81 (16.94)	0.91 (32.51)	0.98 (21.45)	1.16 (17.08)	1.34 (11.89)	1.30 (10.19)	1.43 (10.46)	1.70 (8.65)	1.68 (9.02)	1.76 (7.37)	0.94 (3.47)
$\alpha(\%)$	1.57 (1.84)	0.83 (1.04)	3.18 (3.89)	0.27 (0.21)	-1.01 (-0.50)	-0.70 (-0.32)	-5.29 (-1.76)	-5.48 (-1.59)	-7.72 (-1.71)	-9.57 (-1.80)	-11.14 (-1.84)
$R^2(\%)$	87.46	91.43	84.89	86.00	74.63	74.90	70.02	67.81	54.64	51.21	19.06
$\beta_{IMC}$	0.14 (1.42)	0.31 (3.40)	0.51 (3.99)	0.53 (3.02)	0.95 (6.84)	0.94 (6.59)	1.12 (6.29)	1.33 (8.18)	1.65 (7.93)	1.64 (8.48)	1.50 (7.46)

Table shows characteristics for decile portfolios, excluding investment firms and services (Fama and French (1997) classifications 14-17).

**Table A.34: Excess return comovement, excluding services**

	Cross-sections					Eigenvalues	
	I/K	E/P	IVOL	MBETA	Q	ALL	$\lambda_1/\sum \lambda_i$
I/K							33.7
(p-value)							(0.00)
-E/P	65.0						31.3
(p-value)							(0.00)
IVOL	52.8	46.9					54.2
(p-value)							(0.00)
MBETA	61.1	59.9	57.3				36.4
(p-value)							(0.00)
Q	77.2	56.7	46.3	56.1			30.8
(p-value)							(0.00)
ALL (I/K, E/P, IVOL, MBETA, Q)	76.0	72.9	80.7	81.8	71.3		29.0
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)
IMC	52.9	59.3	61.2	59.8	69.6	71.9	
-HML	60.3	55.1	33.3	66.7	73.9	69.9	
$\Delta z^I$	17.9	31.8	20.6	41.2	17.7	29.4	

Table shows return comovement across the 5 decile portfolio sorts (Q, I/K, E/P, MBETA and IVOL), excluding investment firms and services (Fama and French (1997) classifications 14-17).. We extract the first principal component from standardized return residuals from a market model regression. We normalize the sign of the first principal component so that it loads positively on portfolio 10 with the exception of the  $E/P$  sort, where it loads negatively on portfolio 10. In addition, we extract the first principal component from a pooled cross-section of 20 portfolios that includes portfolios 1, 2, 9 and 10 from each sort. We show the correlation matrix of these principal components, along with their correlations with IMC, HML and the real proxy for the IST shock  $\Delta z^I$ . We compute  $p$ -values based on 10,000 random permutations, where we randomly permute the order of each cross-section separately.



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