Capital intensity and investment shocks: Implications for stock returns

Jiri Knesl

January 2, 2018

ABSTRACT

I show that firm's capital intensity determines the asset pricing implications of investment-specific technology shocks. Capital-intensive stocks sorted by the exposure to the IMC portfolio (Investment Minus Consumption producers) generate a highly significant annual abnormal return of up to 5%. This pattern is absent among labor-intensive stocks although the exposures are similar. I show that in contrast to the asset pricing implications of investment shock, value premium is independent of firm capital intensity. I extend prior models of the investment-specific technology shocks by a novel dimension, firm capital intensity. The model can rationalize many of the empirical findings.

I thank Lorenzo Garlappi, Adlai Fisher, Jan Bena, Murray Carlson, Jesse Perla and Zhongzhi Song for their support, comments and providing data and infrastructure. I thank Alexander Barinov (discussant at NFA) and participants in the PhD session at the NFA for helpful comments. The remaining errors are my own. Jiri Knesl is a PhD student at the University of British Columbia, Sauder School of Business.

I. Introduction

Technological innovations have been identified as the main driver of economic growth, Greenwood et al. (1997).[1] Large part of technological innovations is embodied in the formation of new capital and has been labeled as investment-specific technology shocks (IST), or more concisely, investment shocks. Recent finance literature, e.g. Papanikolaou (2011) has shown that investment shock is priced in stock returns. In this paper, I show that firm capital intensity has implications for stock returns and is an important dimension for understanding firm's responses to this type of shock. Intuitively, technological innovations embodied in new capital are expected to be relevant especially for capital-intensive firms as capital is the key production factor for these firms. In contrast, labor-intensive firms are expected not to be directly affected by such innovations.

Prior literature, e.g. Kogan and Papanikolaou (2014) has documented that the cross-section of stocks sorted by exposure to the investment shock has decreasing average and abnormal returns. I show that this pattern holds among capital-intensive firms, but it is almost absent among labor-intensive firms suggesting that the documented pattern is driven mainly by capital-intensive firms. Specifically, I divide the cross-section of firms into capital-intensive and labor-intensive firms. I use an empirical measure of investment shocks based on return spread between investment-goods and consumption-goods firms, the IMC portfolio, as proposed by Papanikolaou (2011). While sorting the firms by their exposure to IMC portfolio gives statistically significant abnormal return ranging from 5% to 7% among capital-intensive firms, the same sorting among labor-intensive firms leads to insignifficant abnormal return of low magnitude. This result gives support to the intuition that the investment shock is especially relevant for capital-intensive firms. Interestingly, the range of firms' estimated exposures to the IMC portfolio is similar for capital-intensive and labor-intensive firms. This result is puzzling since the same exposure to IMC portfolio seems to be priced differently among both types of firms.

[1] Greenwood et al. (2000); Fisher (2006); Justiniano et al. (2010) also identify the investment-specific technology shocks as a major source of business-cycle fluctuation.

I provide a unifying explanation for these observations. The IMC portfolio has a positive exposure to both market risk and size factor, both of which are priced positively. Labor-intensive firms, on average, tend to be more exposed to market risk and are smaller than capital-intensive firms. Since labor-intensive firms, in general, do not have much physical capital, the exposure to the IMC portfolio does not arise due to their exposure to investment shock but due mainly to their exposure to market and SMB factors. In contrast, capital-intensive firms possess enough capital but are exposed less to the market and SMB factors. Accordingly, their exposure to the IMC portfolio arises due mainly to their exposure to investment shock. Therefore, the IMC portfolio is a good proxy for measuring the exposure to investment shock among capital-intensive firms but fails to capture this exposure among labor-intensive firms with the same precision. Since the IMC portfolio is an easily available measure of investment shocks, (available also at high frequency), it is important to fully understand its capability.

Lastly, I show that value-premium is independent of firms' capital-intensity. Specifically, the return spread between value and growth firms has similar magnitude among capital-intensive and labor-intensive firms. This seems to be in contrast to the IST shock's asset pricing implication as they depend on firm's capital intensity. This empirical fact is interesting in light of previous literature on growth opportunities, investments and value premium. This stream of literature analyzes the differences in riskiness between assets in place and growth opportunities. A differential exposure of assets in place and growth opportunities to investment specific shock then naturally emerge as a possible explanation to value premium. In this paper I argue that the investment shock is able to justify the value premium only among capital-intensive firms but not among labor-intensive firms.

I extend the existing models of the investment-specific technology shock in a simple and tractable fashion to illustrate the economic mechanisms and analyze the quantitative aspects. I study the asset pricing implications of firm's capital intensity in a framework with both the total productivity (disembodied technology) shock and the investment-specific technology shock, building on Kogan and Papanikolaou (2014) two-sector model. This model consists of consumption-goods and investment-goods producers and differentiates between the factor neutral and the investment-specific shocks. The novel aspects of my model are firms with different capital (or labor) intensities and wage rigidity. I focus on two sub-samples of firms, one consisting of firms with high capital-labor ratio and one of firms with low capital-labor ratio. Wage rigidity generates operating leverage and makes a firm more exposed to market risk. Since labor-intensive firms tend to optimally choose higher use of labor, they also tend to be more levered and exposed to market risk than capital-intensive firms.

In the model, the measure of investment shocks, the IMC portfolio, is positively correlated with both the aggregate risk and investment risk as documented by empirical evidence. The model generates high abnormal return for capital-intensive stocks sorted on their exposure to the IMC portfolio. This pattern is considerably weaker for labor-intensive firms.

This paper contributes to several streams of literature. First, a large part macroeconomic literature studies the implications of investment shocks for growth and other macroeconomic variables. Representative papers in this area are Greenwood et al. (1997), Greenwood et al. (2000) and Fisher (2006). They show that investment shocks account for a large part of economic growth as well as for variations in output and other macroeconomic variables. Justiniano, Primaceri and Tambalotti (2010) show that investment shocks are the main driver for business cycle fluctuations. Greenwood et al. (1988) show that changes in capital utilizations are important for positive correlation between macroeconomic variables (investment, output, labor productivity). Second, investment shocks have become an active research area in financial economics. Papanikolaou (2011) is the first to study the implications of investment shocks for asset prices both on aggregate and in the cross-section. Garlappi and Song (2016b) study the implications of capital utilization and market power and show that flexibility in capital utilization affects mainly the price for IST shocks, while market power affects mainly the exposure of stock returns to IST shocks. Subsequent work by Kogan and Papanikolaou (2013) and Kogan and Papanikolaou (2014) studies the implications of investment shocks for growth options, investments and return anomalies. These papers show that sorting stocks by their exposure to a return-based measure of investment shock leads to decreasing abnormal returns. A long-short portfolio based on such sorting generates high and significant abnormal return, which is not priced by traditional pricing factors. They show that some prominent return anomalies generated from cross-sectional sorting by traditional variables such as valuation ratios, investment, profitability, market beta or idiosyncratic volatility, are driven by the same systematic factor, which is related to investment shock. Garlappi and Song (2016a) conduct a comprehensive empirical exercise using various measures of investment shocks to price a range of return anomalies.

I differ from this literature in that I introduce a novel dimension, capital intensity, into the analysis of the implications of investment shocks. Although firms' capital intensity has a very strong cross-sectional variation, existing literature has not analyzed the importance of firm's capital intensity for asset prices. I show that a model with the investment-specific shock is a logical framework to do so. In this framework capital intensity turns out to be important for understanding the implications of this type of shock for stock returns in the cross-section. I also add to the discussion on empirical measures of investment shocks. Measuring the investment shock is an important empirical challenge. The IMC portfolio has become a popular empirical measure of investment shocks with solid theoretical foundation. When constructed from the real data, the measure can significantly depart from its theoretical counterpart. I allow the model to be flexible enough to analyze the effects of these discrepancies and show that capital intensity affects the empirical success of this measure.

The paper proceeds as follows. In Section II, I describe the data, empirical methodology and establish the link between capital intensity and investment shocks. I analyze the cross-section of stocks returns and its relationship to firms' capital intensity in section III. In section IV, I show the independence of value premium on the capital-labor ratio. In section V, I develop a theoretical model and derive the empirical implications. I calibrate and simulate the model in section VI. Section VII concludes. Appendix contains details on data construction, model derivations and additional empirical results.

II. Methodology

A. Data

The data on stock prices are from CRSP. I use the universe of ordinary common stocks (shrcd=10, 11) of firms traded on NYSE, AMEX and NASDAQ (exchcd= 1, 2, 3) in the time period from 1950 to 2015. I exclude financial firms (SIC 6000-6799) and utilities (SIC 4900-4949). In order to categorize the firms into investment-goods producers and consumption-goods producers, I follow the approach in Garlappi and Song (2016a), Gomes et al. (2009) and Papanikolaou (2011). I use the NIPA Input-Output tables from 1987 and categorize the firms into invesment-goods and consumption-goods producers based on their contribution to each sector. Detailed procedure is described in appendix. Accounting data are from Compustat. I measure firm's capital intensity by the number of employees over property, plant and equipment ($\frac{emp_{f,t}}{ppegt_{f,t}}$). The detailed construction of the variables is described in appendix.

Table I shows the summary statistics of firms categorized into investment-goods and consumption-goods sector. The investment-goods sector is smaller than the consumption-goods sector.[2] The firms in the consumption-goods sector are similar to firms in the investment-goods sector in terms of book-to-market equity ratio, cashflow-to-assets ratio, book leverage and labor-capital ratio.

I construct the IMC portfolio following Kogan and Papanikolaou (2014) and Garlappi and Song (2016a). First, I calculate the value-weighted return for portfolios consisting of investment-goods firms (I-portfolio) and consumption-goods firms (C-portfolio), respectively. Then, I create the IMC (<u>I</u>nvestment <u>M</u>inus <u>C</u>onsumption), consisting of long position in the I-portfolio and short position in the C-portfolio. Since this measure of the IST shock is based on stock returns, it is available at relatively high frequency. I calculate weekly and monthly returns in order to estimate the exposure to the IST shocks. [3]

[2] Papanikolaou (2011) uses 1997-NIPA Input-Output tables based on NAICS code and identifies even higher number of firms in the consumption-goods sector.

[3] The correlation coefficient between my IMC portfolio and the IMC portfolio constructed by Garlappi

Table I: Summary (all firms)

	Consumption goods firms			Investment goods firms			Both sectors firms		
	median	10th	90th	median	10th	90th	median	10th	90th
Number of firms	1418.41			1080.98			2506.95		
market cap. (log)	4.16	1.97	6.89	4.14	1.95	6.78	4.14	1.96	6.83
market cap. (log, real)	4.94	2.75	7.67	4.92	2.73	7.56	4.93	2.74	7.62
Book-to-market ratio	0.65	0.21	1.63	0.68	0.24	1.57	0.66	0.22	1.6
Cash flows to assets	0.08	-0.15	0.17	0.08	-0.12	0.16	0.08	-0.14	0.17
Leverage	0.19	0.01	0.49	0.19	0.01	0.43	0.19	0.01	0.46
ppegt	51.41	3.41	1086.98	66.03	4.37	1433.6	55.9	3.66	1206.62
ppegt (real)	41.89	2.36	952.6	55.63	3.37	1270.92	46.4	2.65	1060.25
number of employees	2.06	0.25	20.2	1.68	0.21	16.96	1.87	0.22	19.03
labor-capital ratio (nom)	0.04	0.01	0.13	0.04	0.01	0.09	0.04	0.01	0.11
labor-capital ratio (real)	0.02	0.01	0.07	0.02	0	0.05	0.02	0	0.06

Note: The table shows the summary statistics of the consumption goods and investment goods companies.In order to base the estimates on the longest possible time period, number of firms and market capitalization are estimated from time period 1950-2015 CRSP data and the remaining ratios from 1959-2015 from Compustat data. I estimate the median and the 10-th and 90-th percentile in each year and average across the time. Market capitalization is logarithm of the product of the stock price and number of outstanding share from CRSP. Book-to-market is from Compustat items ceq/(prcc_c*cshpri). Cashflow to assets is from Compustat items (ib+dp)/at. Leverage is (dltt+dlc)/at. Labor-capital ratio is # of emp/ppegt. I deflate the nominal values of market capitalization and labor-capital ratio with the consumption deflator for nondurable consumption and nonresidential private investment, respectively.

I estimate the exposure of each consumption-goods firm to the IMC portfolio by estimating the $\beta_{f,t}^{IMC}$ from following regression equation at weekly and monthly requency.

$$r_{f,t} - r^{riskfree} = \alpha_{f,t} + \beta_{f,t}^{IMC} \times R_t^{IMC} + \epsilon_{f,t} \tag{1}$$

For estimating $\beta_{f,t}^{IMC}$ at weekly frequency, I use a rolling and non-overlapping one-year window of weekly returns. Accordingly, to estimate firm $f's$ exposure to the IMC portfolio at the end of year t, I use firm $f's$ and the IMC portfolio weekly returns only in year t. This approach is used in Papanikolaou (2011) and Kogan and Papanikolaou (2014) and highlights the advantage of the high frequency of the IMC portfolio. For estimating $\beta_{f,t}^{IMC}$ at monthly frequency, I use a rolling and overlapping window of monthly returns over the last 60 months. Accordingly, firm $f's$ $\beta_{f,t}^{IMC}$ at time t is estimated from monthly returns ranging from $t-60$ to $t-1$. The betas are updated annually. Since the results based on estimation from weekly and monthly returns are similar, I report the monthly returns-based results in the appendix.

I sort the stocks by their estimated $\beta_{f,t}^{IMC}$ into 5 or 10 portfolios at the end of each calendar year t. The return of each portfolio is the weighted average return of the stocks in that portfolio in the following year, $t+1$. I construct the time series of the portfolios from 1950 to 2015, but some parts of the analysis are restricted only to period from 1960 to 2012

and Song (2016) is 90% over the period from 1950 to 2012.

due to availability of data.[4]. Following the existing literature,e.g. Kogan and Papanikolaou (2013, 2014), I focus on the universe of consumption-goods stocks. I report the results for both consumption-goods and investment-goods stocks in appendix.

I show the pairwise correlation coefficients between the market excess return, SMB, HML, HML_cons and IMC portfolio in table II. IMC portfolio is negatively correlated with the value factor HML and especially the value factor constructed from consumption-goods firms HML_cons (-0.21 and -0.34, respectively). IMC portfolio, however, is also positively correlated with the two other factors, namely market and SMB with correlation coefficient of 0.45 in both cases. This suggests that sorting stocks by their $\beta_{f,t}^{IMC}$ is likely to capture exposure to these two factors as well. Stocks which have generally higher exposure to market and SMB will tend to have higher $\beta_{f,t}^{IMC}$.

Table II: Factors: correlation matrix

	Mkt-RF	SMB	HML	HML_cons	IMC
Mkt-RF	1.00	0.26	-0.24	-0.36	0.45
SMB	0.26	1.00	-0.20	-0.58	0.45
HML	-0.24	-0.20	1.00	0.74	-0.21
HML_cons	-0.36	-0.58	0.74	1.00	-0.34
IMC	0.45	0.45	-0.21	-0.34	1.00

Note: The table shows the pairwise correlation coefficients among the Fama-French factors, the IMC portfolio and HML_cons. The correlation coefficients are estimated from time series of monthly returns ranging from 1950 to 2015 except for HML_cons for which the coefficients are estimated from 1960 to 2015 due to data availability.

B. Capital intensity and investment shocks

In this section I provide some empirical foundation for the link between firm's capital intensity and its exposure to investment shocks. I create 10 capital-intensity portfolios by sorting stocks by their capital intensity in every year t and calculate the value weighted average return over the subsequent year $t+1$. I report the results in table III. The most capital-intensive firms are in portfolio p1 and the least capital intensive firms in portfolio p10. The average returns are slightly decreasing in capital intensity (Panel A).

[4]Kogan and Papanikolaou (2014) analyze the data from 1964 to 2008

The focus of this sorting is to study the exposure of these portfolios to the measure of investment shocks, the IMC portfolio. In panel B, I show the exposure, $IMC\,\beta$ estimated from a univariate regression of portfolio returns onto the returns of the IMC portfolio. These $IMC\,\beta$ has an increasing pattern. Surprisingly, labor-intensive firms (portfolios p9 and p10) have considerably higher $IMC\,beta$ than capital-intensive firms (p1 and p2). This pattern, however, changes when the $IMC\,\beta$ is estimated from multivariate regression inclusing Fama-French factors. These estimates are reported in panel B. The $IMC\,\beta$ FF is high for capital-intensive firms and low labor-intensive firms. The switch in this pattern comes from the fact that IMC portfolio correlates with the size factor SMB and market as mentioned above. The exposure to these two factors is increasing with labor-intensity. These results suggest that the IMC portfolio picks up some of the firm's exposure to the market and SMB. Since labor-intensive firms tend to have higher exposure to the market and SMB factors, their exposure to the IMC portfolio in a univariate regression is mainly driven by omitting these two factors.

In Panel D I report the median firm characteristics of each portfolio. Labor-intensive firms tend to have lower market capitalization and financial leverage. In contrast, capital expenditures are high for capital-intensive firms which follows from their nature. The portfolio p1 has considerably higher capital expenditures and lower R&D expenditures. Interestingly, book-to-market ratio is constant across all portfolios. This finding is important in light of the decreasing coefficients of the IMC portfolio. For instance, the lowest portfolio has IMC beta 0.2 and highest portfolio has IMC beta zero, but both have the same book-to-market ratio.

In this section I established the link between capital intensity and investment shocks. Portfolios sorted by firms' capital intensity exhibit decreasing pattern in their exposure to investment shocks when controlled for other factors. This pattern is not reflected in the book-to-market ratio. This suggests that capital intensity is an important cross-sectional dimension which drives exposure to investment shock independently of firms growth opportunities.

Table III: All firms, capital-intensity portfolios

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Panel A: CAPM										
Mean	5.39	5.54	7.35	6.99	7.47	5.94	7.37	6.06	6.32	7.39
Mean t-stat	2.79	2.87	3.53	3.09	3.59	2.72	3.15	2.63	2.5	2.83
Sigma	15.71	15.68	16.91	18.35	16.93	17.72	19.04	18.7	20.53	21.19
Alpha	0.23	-0.32	1.11	0.25	1.13	-0.67	0.48	-0.68	-0.97	-0.07
Alpha t-stat	0.17	-0.44	1.31	0.23	1.44	-0.79	0.43	-0.61	-0.77	-0.05
Market β	0.84	0.96	1.02	1.1	1.04	1.08	1.13	1.1	1.19	1.22
Market β t-stat	32.04	54.57	49.08	39.76	58.88	54.6	38.97	45.52	37.4	42.57
R-squared	68.13	88.06	85.69	85.05	88.3	87.71	82.49	81.82	79.34	78.16
Panel B: IMC portfolio										
IMC β	0.53	0.58	0.74	0.9	0.69	0.71	0.88	0.72	0.92	0.85
IMC β t-stat	6.89	7.32	9.25	11.64	10.32	8.65	12.02	8.59	11.57	9.85
Panel C:Fama-French 3-factor model + IMC										
Alpha FF	0.93	-0.79	2.73	1.78	1.37	-0.22	2.24	-0.14	-0.34	0.2
Alpha FF t-stat	0.77	-1.09	3.03	1.99	1.73	-0.25	2.36	-0.13	-0.31	0.15
Mkt-RF β FF	0.87	0.97	0.96	1	0.99	1.04	1.01	1.04	1.05	1.1
Mkt-RF β FF t-stat	29.34	57.03	45.05	48.46	51.06	45.99	46.32	34.71	40.91	44.41
HML β FF	0.14	0.09	-0.21	-0.19	-0.09	-0.11	-0.31	-0.16	-0.24	-0.24
HML β FF t-stat	2.5	2.97	-5.51	-4.64	-2.61	-3.23	-7.87	-3.51	-4.49	-4.36
SMB β FF	-0.28	-0.13	-0.09	0	0.12	0.13	0.2	0.25	0.49	0.54
SMB β FF t-stat	-6.66	-4.93	-2.59	0.07	4.3	3.6	4.69	3.88	11.8	12.19
IMC β FF	0.2	0.11	0.14	0.24	0.02	0	0.08	-0.06	0	-0.14
IMC β FF t-stat	4.15	2.81	3.97	4.63	0.77	0.07	1.86	-1.34	-0.02	-2.78
r-squared FF	72.49	88.96	88.01	88.55	89.28	88.69	87.55	84.25	87.07	85.62
Panel D: Median firm characteristics										
$\#Emp/Capital$	6.56	14.53	20.84	26.88	32.70	39.13	45.95	54.99	67.04	86.58
$Book/Market$	0.63	0.61	0.64	0.62	0.64	0.63	0.64	0.63	0.63	0.63
$Market\,Value$	713.61	407.19	250.59	255.28	288.18	239.30	187.70	172.34	157.70	119.80
$Financial\,leverage$	0.23	0.20	0.18	0.16	0.16	0.16	0.15	0.15	0.15	0.14
$CAPX/Sales$	11.33	7.96	5.93	4.92	4.27	3.96	3.57	3.47	3.31	3.00
$R\&D/Sales$	2.09	5.31	4.71	4.02	3.72	3.88	3.67	3.64	3.08	2.14
$\#Emp_{t+1}/\#Emp_t - 1$	0.17	1.65	1.41	2.32	3.19	4.12	3.81	4.95	6.28	7.58

Note: The stock return data is from CRSP and contains firms in both consumption-goods and investment-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1963 to 2015. Columns 'p1' - 'p10' are portfolios sorted by capital intensity. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM). Panel B shows coefficients from univariate regression. Panel C reports estimate from Fama-French 3-factor model augmented by the IMC portfolio. Panel D reports the median firm characteristics of each portfolio. Capital intensity, CAPX/Sales, R&D/Sales and $\left(\#Emp_{t+1}/\#Emp_t - 1\right)$ are multiplied by 100 for easier comparison.

III. Capital intensity and exposure to the IMC portfolio

A. β^{IMC} sorting

Now I focus on the return patterns of portfolios sorted by their exposure to the investment shock. Table IV presents the return characteristics of portfolios sorted by the exposure to the IMC portfolio based on β^{IMC} estimated from a univariate regression, which is the standard in previous literature. First, sorting stocks by $\beta_{f,t}^{IMC}$ gives decreasing average return. Since the β^{mkt} is increasing, $CAPM - \alpha$ exhibits even stronger decreasing pattern. Papanikolaou (2011) and Kogan and Papanikolaou (2014) first document this pattern and note that market portfolio does not price the long-short portfolio constructed by the portfolios with the highest and the lowest exposure (Hi-Lo) to the IMC portfolio. Moreover, they show that the decreasing returns coincide with descreasing exposure to HML portfolio evoking a possible relationship between value and IMC exposure. In Panel B, I regress the portfolio returns onto the Fama-French three factors, market, HML and SMB. Indeed, the loading on the HML factor is decreasing across the portfolios and the Hi-Lo portfolio has significant and negative exposure to HML factor. $Mkt - RF$ and SMB are also significant. Accordingly, R^2 increases to 43% compared to R^2 from the single-factor market model. However, the additional two factors in Fama-French 3-factor model do not price the $\alpha - return$ either. The $\alpha - return$ of the Hi-Lo portfolio has approximately the same magnitude when $CAPM$ or Fama-French 3-factor model is used suggesting that HML is not sufficient to price the Hi-Lo portfolio. In Panel C, I price the portfolios using Fama-French 3-factor model augmented by the IMC portfolio. $\alpha - return$ of the Hi-Lo portfolio decreases by approximately 3 percentage points and R^2 increases. Moreover, the loading on the HML portfolio remains almost unchanged.

In table V, I show exposure to various factors and the median firm characteristics of the β^{IMC}-sorted portfolios. Panel A presents the median sorting $\beta_{f,t}^{IMC}$ and exposures to the IMC portfolio, HML and HML_cons (HML portfolio consisting only of consumption-goods firms), each estimated from a univariate regression. I also report β^{IMC} FF estimated from regression controlling for the Fama-French three factors. The β^{IMC}-sorted portfolios have increasing exposure to the IMC portfolio (i.e. the sorting is persitent). This pattern holds also when controlled for additional factors, but the overall level decreases as β^{IMC} FF range from -0.46 to 0.39. The exposure to HML factor is also decreasing and suggests that high β^{IMC} firms have more growth opportunities.

Panel B shows the median firm characteristics. First the labor intensity is slightly increasing across the portfolios but the range is uncomparable to the range from table III (37-46 vs. 7-87). Second, the book-to-market ratio is almost constant across the portfolios. This is interesting since the loading on HML factor is decreasing. Third, both capital expenditures and employee growth increase almost monotonic across the portfolios but the increase is especially pronounced for employee growth. The results based on $\beta_{f,t}^{IMC}$ estimated from monthly returns are reported in appendix. They are quantitatively and qualitatively similar.

Table IV: Consumption-goods sector, IMC-weekly

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: CAPM						
Mean	4.8	6.14	4.38	4.68	5.64	5	4.14	4.22	4.73	1.66	-3.14
Mean t-stat	2.45	3.28	2.38	2.42	2.92	2.28	1.78	1.71	1.63	0.47	-1
Sigma	15.92	15.21	14.92	15.7	15.69	17.76	18.89	20.06	23.63	28.7	25.48
Alpha	-0.78	0.28	-1.64	-1.83	-1.16	-2.43	-3.57	-4.07	-4.75	-9.43	-8.65
Alpha t-stat	-0.57	0.24	-1.6	-1.81	-1.34	-2.18	-2.83	-3.14	-2.89	-4.38	-3.03
Beta	0.78	0.82	0.84	0.91	0.95	1.04	1.08	1.16	1.32	1.55	0.77
Beta t-stat	29.51	37.1	42.62	46.74	56.85	48.39	44.27	46.36	41.82	37.33	13.98
R-squared	52.81	63.89	70.01	73.74	80.6	75.06	71.58	73.42	69.21	64.17	20.09
					Panel B: Fama-French 3-factor model						
FF alpha	-0.69	0.69	-1.59	-1.65	-1.34	-2.47	-3.33	-4.23	-3.58	-8.19	-7.5
FF alpha t-stat	-0.52	0.62	-1.56	-1.64	-1.53	-2.2	-2.65	-3.3	-2.31	-4.5	-3.07
FF mkt-beta	0.83	0.86	0.87	0.93	0.95	1.02	1.03	1.11	1.21	1.33	0.5
FF mkt-beta t-stat	30.86	38	42.25	45.85	53.58	45.12	40.76	43.14	38.72	36.33	10.16
FF HML-beta	0.02	-0.05	0.01	-0.02	0.03	0	-0.07	0	-0.29	-0.36	-0.39
FF HML-beta t-stat	0.52	-1.36	0.33	-0.5	1.2	-0.03	-1.77	0	-5.85	-6.32	-5
FF SMB-beta	-0.3	-0.26	-0.16	-0.15	0.03	0.07	0.17	0.24	0.39	0.87	1.17
FF SMB-beta t-stat	-7.42	-7.85	-5.13	-4.93	1.32	2.22	4.59	6.39	8.48	16.16	16.15
FF R-squared	56.08	66.54	71.04	74.54	80.67	75.23	72.54	74.78	73.44	75.07	43.26
					Panel C: Fama-French 3-factor model + IMC						
Alpha FF-IMC	-2.18	-0.93	-2.66	-2.56	-1.89	-2.55	-2.8	-3.7	-2.56	-6.91	-4.74
Alpha FF-IMC t-stat	-1.71	-0.92	-2.72	-2.62	-2.18	-2.25	-2.23	-2.89	-1.67	-3.85	-2.05
Mkt-RF beta FF-IMC	0.93	0.96	0.94	0.99	0.98	1.03	1	1.08	1.14	1.25	0.32
Mkt-RF beta FF-IMC t-stat	34.11	44.32	44.83	47.23	52.78	42.26	36.98	39.23	34.74	32.43	6.38
HML beta FF-IMC	0	-0.08	-0.01	-0.03	0.02	0	-0.06	0.01	-0.27	-0.34	-0.34
HML beta FF-IMC t-stat	-0.11	-2.42	-0.27	-1.04	0.86	-0.07	-1.54	0.23	-5.58	-6.05	-4.63
SMB beta FF-IMC	-0.14	-0.09	-0.05	-0.05	0.09	0.08	0.12	0.19	0.28	0.74	0.88
SMB beta FF-IMC t-stat	-3.52	-2.91	-1.48	-1.75	3.28	2.28	2.92	4.63	5.83	12.99	12.03
IMC beta FF-IMC	-0.46	-0.5	-0.33	-0.28	-0.17	-0.02	0.16	0.16	0.31	0.39	0.85
IMC beta FF-IMC t-stat	-9.92	-13.6	-9.26	-7.86	-5.39	-0.6	3.59	3.48	5.71	6.05	10.17
R-squared FF-IMC	61.03	72.99	73.92	76.42	81.37	75.24	72.99	75.17	74.51	76.19	49.95

Note: The stock return data is from CRSP and contains firms in consumption-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p10' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from weekly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio.

Table V: Consumption-goods sector: portfolio characteristics, IMC-weekly

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: Exposure to factors						
Beta-IMC-sort	-0.71	-0.11	0.21	0.46	0.69	0.93	1.19	1.5	1.93	2.81	NaN
β^{IMC}	0.13	0.15	0.31	0.4	0.56	0.74	0.93	1.01	1.31	1.7	1.57
β^{IMC} t-stat	2.19	2.64	5.66	6.91	10.02	11.9	14.74	15.05	17.16	18.84	19.94
HML beta	-0.25	-0.34	-0.31	-0.36	-0.36	-0.43	-0.53	-0.5	-0.86	-1.1	-0.85
HML beta t-stat	-4.14	-5.9	-5.45	-6.11	-6.07	-6.48	-7.51	-6.73	-10.09	-10.64	-9.09
HML_cons	-0.19	-0.29	-0.29	-0.37	-0.42	-0.49	-0.55	-0.63	-0.95	-1.32	-1.13
HML_cons t-stat	-3.58	-5.78	-6.06	-7.64	-8.69	-8.79	-9.64	-10.4	-13.39	-15.91	-14.95
β^{IMC} FF	-0.46	-0.5	-0.33	-0.28	-0.17	-0.02	0.16	0.16	0.31	0.39	0.85
β^{IMC} FF t-stat	-9.92	-13.6	-9.26	-7.86	-5.39	-0.6	3.59	3.48	5.71	6.05	10.17
					Panel B: Median firm characteristics						
$\#EMP/Capital$	37.20	36.18	36.91	38.34	37.73	39.03	39.69	42.54	42.22	45.67	NA
$Book/market$	0.68	0.67	0.67	0.66	0.67	0.67	0.66	0.67	0.66	0.65	NA
$Market\,size$	75.05	177.96	210.36	260.70	252.10	259.01	207.72	198.35	160.61	108.53	NA
$Financial\,leverage$	0.20	0.20	0.20	0.20	0.20	0.21	0.20	0.20	0.20	0.20	NA
$CAPX/Sales$	3.72	3.78	3.73	3.78	3.82	3.82	3.79	3.89	3.97	4.03	NA
$\#Emp_{t+1}/\#Emp_t - 1$	2.13	2.14	2.44	2.56	2.76	3.03	3.07	3.77	3.49	4.02	NA
$R\&D/Sales$	4.56	2.68	2.28	2.69	2.71	3.16	3.62	4.58	5.73	7.55	NA

Note: The stock return data is from CRSP and contains firms in consumption-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from weekly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly portfolio returns. Panel A reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel B reports the median firm characteristics. Labor intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in %.

B. Capital intensity and β^{IMC} sorting

Since the IST shock is defined as a shock to the price or quality of capital equipment, its effects are expected to be more pronounced among capital intensive firms. In order to analyze this intuition, I devide the universe of the consumption-goods firms into a sub-sample of capital intensive firms and a sub-sample of labor intensive firms. I measure the capital (labor intensity) of each firm f by $\frac{\# emp_{f,t}}{ppegt_{f,t}}$ in year t. I allocate the firm into low-labor (high labor) sub-sample if its capital intensity is below (above) the cross-sectional median in year t. Then, I sort the firms into quintile portfolios by their $\beta^{IMC}_{f,t}$ as in previous sections.[5]

I report the summary statistics of the capital-intensive (panel A) and labor-intensive (panel B) sub-samples in table VI. Both sub-samples consist of a comparable number of firms. Capital-intensive firms tend to be larger and more levered. On the other hand, firms in both sub-samples are similar in terms of book-to-market ratio and cashflow-to-assets ratio. This comparison holds for consumption-goods firms, as well as investment-goods firms.

Table VI: Low labor High labor Summary (consumption-goods sector)

	Consumption sectors firms			Investment goods firms			Both sectors firms		
	median	10th	90th	median	10th	90th	median	10th	90th
				Panel A: capital-intensive firms					
Number of firms	622.91	NA	NA	474.76	NA	NA	1101.17	NA	NA
market cap. (log)	4.87	2.3	7.92	4.84	2.26	7.58	4.85	2.27	7.77
market cap. (log, real)	5.46	2.88	8.51	5.43	2.84	8.17	5.44	2.85	8.35
Book-to-market ratio	0.63	0.21	1.6	0.7	0.24	1.65	0.66	0.22	1.62
Cashflow to assets	0.08	-0.15	0.17	0.09	-0.1	0.17	0.08	-0.13	0.17
Financial leverage	0.23	0.01	0.53	0.21	0.01	0.46	0.22	0.01	0.49
Property, plant and equipment	125.99	6.81	2377.98	185.89	10.61	2858.61	145.81	7.97	2580.09
Number of employees	2.15	0.22	24.24	2.01	0.2	20.45	2.03	0.19	22.63
# Emp/Capital	0.03	0.01	0.04	0.02	0	0.03	0.02	0	0.04
				Panel B: labor-intensive firms					
Number of firms	579.47	NA	NA	446.11	NA	NA	1028.39	NA	NA
Market cap. (log)	4.14	2.05	6.57	4.07	1.92	6.46	4.1	1.99	6.52
Market cap. (log, real)	4.73	2.64	7.16	4.66	2.51	7.04	4.69	2.58	7.11
Book-to-market ratio	0.68	0.21	1.65	0.65	0.23	1.48	0.66	0.21	1.58
Cashflow to assets	0.08	-0.15	0.16	0.08	-0.13	0.15	0.08	-0.15	0.16
Financial leverage	0.16	0.01	0.44	0.16	0.01	0.4	0.16	0.01	0.43
Property, plant and equipment	25.44	2.29	312.8	26.07	2.76	349.34	24.98	2.35	327.36
Number of employees	2.01	0.3	16.77	1.49	0.24	13.44	1.77	0.26	15.3
# Emp/Capital	0.07	0.05	0.19	0.06	0.04	0.12	0.07	0.05	0.16

Note: The table shows the summary statistics of the low and high labor-capital ratio firms in the consumption-goods sector. The estimates are based on the Compustat data over the time period 1960-2015. I estimate the median and the 10-th and 90-th percentile in each year and average across the time. Market capitalization is logarithm of the product of the stock price and number of outstanding share from CRSP at the end of each year. Book-to-market is from Compustat items ceq/(prcc_c*cshpri). Cashflow to assets is from Compustat items (ib+dp)/at. Financial leverage is (dltt+dlc)/at. Labor-capital ratio is # of emp/ppegt.

[5] Since each sub-sample consists of half of the stocks it is preferable to use quintiles instead of deciles. This helps lower the variance of the portfolio returns and increases statistical power.

Table VII reports the return characteristics of the portfolios sorted by β^{IMC} in each subsample. Panel A shows a clear pattern in the average returns and $CAPM - \alpha$ across the portfolios consisting of capital-intensive firms. Capital-intensive firms with high exposure to the IMC portfolios earn lower average and abnormal returns than capital-intensive firms with low exposure to investment shock. The Hi-Lo portfolio consisting of capital invensive firms has significantly negative $CAPM - \alpha$ of -5.29%. This pattern does not hold for labor-intensive firms and their Hi-Lo portfolio earns $CAPM - \alpha$ of much lower magnitude, -1.07%. Panel B shows similar result for Fama-French 3-factor model. When the Fama-French 3-factor model is augmented by IMC portfolio (panel C), the significant α return disappears and R^2 increases. This is especially noticable for the Hi-Lo portfolio, where augmenting Fama-French 3-factor model by the IMC portfolio increases R^2 from 35% (24%) to 47% (32%) for capital-(labor-) intensive firms.

Table VIII reports the exposures of the portfolios to different factors. In panel I, I estimate the exposure to IMC portfolio, HML portfolio and HML_{cons}, each from a univariate regression. I also report the exposure to the IMC portfolio estimated from regression controlling for the Fama-French three factors. Portfolios consisting of labor-intensive firms tend to have higher β^{IMC} but the range of β^{IMC} between the highest and lowest portfolio is lower. When I control for the Fama-French 3 factors, the estimated coefficients are lower among both capital and labor-intensive firms, but the decline is especially pronounced among labor intensive firms. For instance, for capital-intensive portfolio p1, the coefficient changes from 0.06 to -0.52, while for labor-intensive firms, the coefficient changes almost as twice as much, namely from 0.49 to -0.45. This shows that β^{IMC} captures exposure to different factors especially among labor-intensive firms. The exposure to value factor (both HML and HML_cons) decreases across the portfolios and is generally lower for labor-intensive firms. The results based on portfolio sorts from monthly $\beta^{IMC}_{f,t}$ are similar and reported in appendix. Panel B shows that labor-intensive firms tend to have slightly higher book-to-market ratio. Moreover, in line with results in table V, both capital- and labor-intensive firms increase capital expenditures and employee growth with growing exposure to the IMC portfolio.

These results show a potential problem of the IMC portfolio as a proxy for investment shock especially among labor-intensive firms. As mentioned above, labor-intensive companies are generally smaller than capital-intensive companies. Table VII (and table XX in appendix) also show that labor-intensive companies are more volatile and tend to have higher exposure to the market factor. Accrodingly, labor-intensive companies are expected to have higher exposure to the IMC portfolio, as shown in table VII.

The results in this section show that the mispricing from sorting stocks by their exposure to the IMC portfolio strongly depends on capital intensity of firms. The pattern in average returns and α is intuitive. Although the range of β^{IMC} is lower for labor-intensive firm, it does not seem to be low enough to justify the difference in the returns. This suggests that the pricing pattern identified in the previous section (single sorting on $\beta_{f,t}^{IMC}$) is driven by capital-intensive firms. In contrast sorting by $\beta_{f,t}^{IMC}$ among labor-intensive firms either does not seem to reflect the true exposure to the IST shock. Although the results so far are based on the firms in the consumption-goods sector, they hold similarly when the analysis is performed in the full sample including the firms in the investment-goods sector. I report these results in appendix, table XXI and XXII.

Table VII: Consumption-goods sector, IMC-weekly, labor pre-sort

	Capital-intensive firms						Labor-intensive firms					
	p1	p2	p3	p4	p5	Hi-Lo	p1	p2	p3	p4	p5	Hi-Lo
							Panel A: CAPM					
Mean	6.39	6.56	5.59	5.99	5.31	-1.08	2.47	5.57	7.23	4.66	5.39	2.92
Mean t-stat	3.59	3.5	2.79	2.53	1.81	-0.44	1.11	2.73	3.18	1.83	1.53	1.08
Sigma	14.46	15.24	16.25	19.23	23.81	19.96	18.13	16.61	18.45	20.72	28.67	22.03
Alpha	0.93	0.31	-1.36	-1.66	-4.36	-5.29	-4.46	-1.39	-0.46	-3.77	-5.53	-1.07
Alpha t-stat	0.87	0.32	-1.38	-1.25	-2.68	-2.4	-3.13	-1.33	-0.39	-2.58	-2.3	-0.38
Beta	0.76	0.87	0.97	1.07	1.35	0.59	0.97	0.97	1.07	1.18	1.52	0.56
Beta t-stat	25.68	38.53	43.95	34.02	27.09	8.41	25.18	36.62	34.01	30.68	24.16	6.84
R-squared	61.41	72.32	78.54	67.92	70.91	19.1	62.76	75.66	74.47	71.18	62.32	14.07
							Panel B: Fama-French 3-factor model					
FF alpha	1.36	0.64	-1.34	-1.31	-3.4	-4.77	-3.89	-1.28	-0.19	-3.44	-3.29	0.6
FF alpha t-stat	1.31	0.66	-1.33	-0.98	-2.26	-2.36	-2.89	-1.21	-0.17	-2.55	-1.53	0.22
FF mkt-beta	0.82	0.9	0.97	1.04	1.24	0.42	0.9	0.94	0.99	1.08	1.29	0.39
FF mkt-beta t-stat	30.06	40.24	44.79	30.06	25.69	6.28	26.43	34.37	38.14	32.41	26.39	5.53
FF HML-beta	-0.04	-0.04	0	-0.08	-0.25	-0.21	-0.15	-0.04	-0.1	-0.13	-0.56	-0.41
FF HML-beta t-stat	-0.66	-0.89	-0.01	-1.23	-3.18	-1.83	-2.17	-0.9	-1.53	-2.04	-4.61	-2.44
FF SMB-beta	-0.37	-0.22	-0.03	0.09	0.4	0.77	0.27	0.16	0.36	0.45	0.81	0.55
FF SMB-beta t-stat	-9.15	-7.66	-0.85	1.58	7.48	9.63	5.05	4.18	7.6	7.52	9.5	4.82
FF R-squared	67.37	74.19	78.57	68.34	74.85	34.84	65.63	76.66	78.48	76.21	74.35	23.83
							Panel C: Fama-French 3-factor model + IMC					
Alpha FF-IMC	-0.33	-0.34	-1.5	-0.69	-2.13	-1.81	-5.35	-2.02	-0.44	-3.21	-2.05	3.3
Alpha FF-IMC t-stat	-0.34	-0.37	-1.44	-0.53	-1.45	-0.97	-4.19	-1.94	-0.39	-2.27	-0.97	1.29
Mkt-RF beta FF-IMC	0.93	0.97	0.99	1	1.15	0.22	0.99	0.99	1.01	1.06	1.21	0.21
Mkt-RF beta FF-IMC t-stat	42.09	41.28	41.06	22.42	25.04	4.04	30.04	35.91	35.54	31.37	24.87	3.27
HML beta FF-IMC	-0.07	-0.06	0	-0.07	-0.22	-0.16	-0.18	-0.06	-0.11	-0.12	-0.54	-0.36
HML beta FF-IMC t-stat	-1.55	-1.48	-0.09	-1.15	-3.13	-1.7	-3	-1.24	-1.63	-2.04	-4.74	-2.47
SMB beta FF-IMC	-0.2	-0.12	-0.01	0.03	0.27	0.47	0.42	0.24	0.38	0.43	0.69	0.27
SMB beta FF-IMC t-stat	-5.43	-3.73	-0.4	0.46	4.3	5.79	8.44	5.7	7.94	7.43	7.97	2.54
IMC beta FF-IMC	-0.52	-0.3	-0.05	0.19	0.39	0.91	-0.45	-0.23	-0.08	0.07	0.38	0.83
IMC beta FF-IMC t-stat	-12.47	-6.42	-1.16	2.29	4.63	9.41	-7.5	-5.3	-1.49	0.94	3.92	6.9
R-squared FF-IMC	75.14	76.55	78.63	68.91	76.47	47.36	69.28	77.78	78.59	76.29	75.42	32.37

Note: The stock return data is from CRSP and contains firms in consumption-goods sector. Each year the firms are divided into capital-intensive and labor-intensive firms by their capital intensity. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p10' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from weekly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio.

Table VIII: Consumption-goods sector, exposure to factors, weekly

	Capital-intensive firms						Labor-intensive firms					
	p1	p2	p3	p4	p5	low Hi-Lo	p1	p2	p3	p4	p5	high Hi-Lo
						Panel A: Exposure to factors						
Beta-IMC-sort	-0.3	0.32	0.77	1.28	2.17	NaN	-0.31	0.38	0.85	1.37	2.3	NaN
IMC beta	0.06	0.33	0.63	0.92	1.38	1.32	0.49	0.59	0.84	1.05	1.67	1.19
IMC beta t-stat	0.85	4.57	7.93	9.01	12.91	15.84	6.2	7.36	10.2	9.63	14.15	10.27
HML beta	-0.29	-0.36	-0.39	-0.52	-0.84	-0.55	-0.57	-0.46	-0.58	-0.66	-1.26	-0.69
HML beta t-stat	-3.07	-3.95	-3.91	-4.23	-5.85	-3.8	-5.17	-5.29	-5.11	-5.14	-5.82	-3.46
HML_cons	-0.21	-0.29	-0.4	-0.51	-0.91	-0.7	-0.69	-0.54	-0.69	-0.78	-1.4	-0.71
HML_cons t-stat	-2.6	-4.09	-5.44	-6.21	-9.9	-8.07	-8.7	-7.44	-10.24	-9.24	-11.21	-4.81
IMC beta FF-IMC	-0.52	-0.3	-0.05	0.19	0.39	0.91	-0.45	-0.23	-0.08	0.07	0.38	0.83
IMC beta FF-IMC t-stat	-12.47	-6.42	-1.16	2.29	4.63	9.41	-7.5	-5.3	-1.49	0.94	3.92	6.9
						Panel B: Median firm characteristics						
$\#EMP/Capital$	20.33	22.11	23.24	23.70	21.97	NaN	69.28	68.13	67.47	68.71	72.28	NaN
$Book/Market$	0.62	0.61	0.63	0.63	0.62	NaN	0.72	0.69	0.68	0.66	0.62	NaN
$Market/,size$	238.89	443.98	368.03	278.00	160.39	NaN	73.57	147.30	199.03	168.13	101.16	NaN
$Financial/,leverage$	0.22	0.23	0.23	0.23	0.24	NaN	0.16	0.17	0.17	0.16	0.17	NaN
$CAPX/Sales$	5.76	5.62	5.60	6.08	7.16	NaN	2.58	2.68	2.72	2.80	3.01	NaN
$\#Emp_{t+1}/\#Emp_t - 1$	1.30	1.76	2.14	2.39	2.77	NaN	4.14	4.25	5.10	6.09	7.12	NaN
$R\&D/Sales$	4.20	2.76	3.31	4.29	8.26	NaN	4.29	2.64	3.06	4.08	6.64	NaN

The stock return data is from CRSP and contains firms in consumption-goods sector. Each year the firms are divided into capital-intensive and labor-intensive firms by their capital intensity. Factor returns are from Ken French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from weekly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel B reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

IV. Value premium and capital intensity

In this section, I show that value premium is independent of firm's capital intensity. For this purpose, I divide the universe of consumption-goods firms into capital and labor intensive firms in the same way as above. Then, I sort the stocks in decile portfolios by their book-to-market equity ratio. Tables IX, X and XI show the return characteristics of portfolios consisting of capital-intensive, labor-intensive and all consumption-goods firms, respectively. The average return of of Hi-Lo portfolio has the same magnitude for capital-intensive and labor-intensive firms suggesting that the value premium is independent of firm capital intensity. Moreover, this return is relatively low and not significant.[6] The comparison between capital-intensive and labor-intensive investment-goods firms is similar to the results reported in this section but the Hi-Lo portfolios generate higher return in those samples. This supports the hypothesis that value premium is independent of firm's.

Panels B of these three tables report the portfolios' exposures to the IMC and HML portfolio, each estimated from a univariate regression, and exposure the the IMC portfolio from regression controlling for the Fama-French three factors. The capital-intensive firms do have an increasing exposure to the IMC portfolio across the portfolios. This pattern also holds when I controll for the Fama-French factors. The exposure to the HML portfolio follows exactly the same patter, but with larger magnitudes. Among labor-intensive firms, the exposure to the HML portfolio increases, but the exposure to the IMC portfolio follows a U-pattern. The Hi-Lo portfolio consisting of the labor-intensive firms does not have any exposure to the investment shock. This is in line with the results in previous sections showing that the exposure to the IMC portfolio among labor-intensive firms is driven mainly by their exposure to market and SMB factors for which the IMC portfolio proxies to some extent.

The portfolio's median firm characteristics are reported in panel C. Firm's capital intensity is relatively constant across the portfolios. For capital-intensive firms it is around 20

[6]In appendix (tables XXVI, XXVII, XXVIII, XXIII, XXIV and XXV), I report the results for investment-goods firms and firms in both sectors together. The value premium identified among investment-goods firms is considerably higher compared to consumption-goods firms.

while for labor-intensive firms around 60. This fact supports the independence of value premium on capital or labor-intensity. The book-to-market ratio and R&D expenses over sales show the same behavior and are at the same levels in both sub-samples. The investment activity measured by capital expenditures relative to sales is decreasing across the portfolios for both capital- and labor-intensive firms. This ratio, however, is at very different level in these two sub-samples. For capital-intensive firms, CAPX/sales is between 7.8% and 6.2%, while for labor-intensive firms between 4.8% and 2.6%. In contrast, the portfolios exhibit decreasing pattern of growth in number of employees but with much higher numbers for labor-intensive firms. While capital-intensive growth firms increase the number of employees by 9.2%, labor-intensive firms by more than 16.0%. This result is very intuitive as I divide the sample by capital intensity. It supports the intuition of the irrelevance of capital-intensity for value premium.

The results in this section show that the value premium is independent of capital intensity. Both capital-intensive and labor-intensive growth firms exhibit very strong growth in the production factor which they use more while weaker growth in the production factor which they use less. The relationship between the exposure to the IMC portfolio and the HML portfolio is different in each sub-sample.

Table IX: Capital-intensive Consumption-goods firms: value premium

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
						Panel A: CAPM					
Mean	7.98	5.96	8.4	8.45	8.02	7.94	8.33	12.1	11.04	10.29	2.31
Mean t-stat	3.65	2.94	4.36	4.27	4.29	3.81	3.81	5.15	4.08	3.12	0.75
Sigma	17.79	16.48	15.64	16.09	15.18	16.93	17.75	19.07	21.98	26.84	25.18
Alpha	1.79	0	2.83	2.96	2.76	2.18	2.44	5.65	3.96	2.78	0.98
Alpha t-stat	1.18	0	2.5	2.26	2.13	1.62	1.5	3.18	2.04	0.94	0.26
Beta	0.94	0.91	0.85	0.84	0.8	0.87	0.9	0.98	1.08	1.14	0.2
Beta t-stat	27.92	29.97	25.76	22.42	27.61	25.35	19.7	22.25	23.24	13.76	1.94
R-squared	69.75	75.46	73.06	67.18	69.35	66.52	63.43	65.84	59.87	45.23	1.61
						Panel B: Exposure to factors					
IMC beta	0.47	0.37	0.3	0.3	0.37	0.5	0.49	0.51	0.73	0.78	0.31
IMC beta t-stat	4.67	4.4	3.59	3.29	6.18	6.95	5.56	4.54	6.88	5.23	2.21
HML beta	-0.85	-0.59	-0.45	-0.19	-0.27	-0.28	-0.05	0.04	-0.1	0.31	1.16
HML beta t-stat	-6.63	-5.01	-4.28	-1.71	-2.93	-2.42	-0.48	0.34	-0.69	1.76	6.82
IMC beta FF-IMC	-0.22	-0.23	-0.27	-0.15	-0.05	0.06	0.08	0.08	0.18	0.21	0.43
IMC beta FF-IMC t-stat	-3.84	-5.34	-5.53	-2.54	-1.13	1.17	1.3	1.42	2.18	2.38	4.25
						Panel C: Median firm characteristics					
$\#EMP/Capital$	22.68	25.37	22.48	21.55	21.63	21.87	19.64	18.43	20.24	22.69	NA
$Book/Market$	0.12	0.23	0.32	0.40	0.49	0.58	0.68	0.80	0.96	1.23	NA
$Marketsize$	937.47	644.80	805.37	739.95	669.41	856.79	1535.10	1551.63	502.50	825.91	NA
$Financialleverage$	0.18	0.15	0.15	0.16	0.17	0.18	0.18	0.19	0.19	0.20	NA
$CAPX/Sales$	7.83	7.06	6.79	6.67	6.49	7.23	6.49	7.04	6.20	6.47	NA
$\#Emp_{t+1}/\#Emp_t - 1$	9.16	6.79	5.37	4.38	2.69	4.23	1.80	0.20	0.41	-1.23	NA
$R\&D/Sales$	13.51	10.70	6.86	5.70	4.28	3.20	3.14	2.43	2.22	2.28	NA

Note:The stock return data is from CRSP and contains capital-intensive firms in consumption-goods sector. Factor returns are from Ken French's website. The data covers the period from 1950 to 2015 for IMC and HML estimatesand 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panel B reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel C reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table X: Labor-intensive consumption-goods firms: value premium

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
						Panel A: CAPM					
mean	7.03	7.89	7.41	9.29	9.92	9.7	10.24	8.19	9.62	9.02	2
Mean t-stat	2.3	3.11	3	3.82	4.13	3.84	4.07	3.02	3.35	2.72	0.67
Sigma	24.78	20.62	20.05	19.73	19.5	20.53	20.47	22.04	23.29	26.96	24.14
Alpha	-1.3	0.56	0.13	2.07	2.98	2.41	3.36	0.96	2.01	1.25	2.55
Alpha t-stat	-0.54	0.34	0.08	1.43	1.88	1.31	1.81	0.46	0.91	0.42	0.63
Beta	1.27	1.12	1.11	1.1	1.06	1.11	1.05	1.1	1.16	1.18	-0.08
Beta t-stat	21.64	31.92	29.22	28.59	28.95	26.21	21.24	21.15	19.69	15.92	-0.81
R-squared	65.04	72.99	76.05	77.1	73.14	72.79	65.25	62.03	61.51	47.89	0.3
						Panel B: Exposure to factors					
IMC beta	1.06	0.78	0.69	0.74	0.62	0.64	0.7	0.82	0.86	0.97	-0.09
IMC beta t-stat	9.17	7.38	7.71	8.09	6.45	5.67	6.68	7.26	7.35	7.42	-0.6
HML beta	-1.37	-0.82	-0.63	-0.57	-0.39	-0.32	-0.34	-0.22	-0.24	-0.17	1.2
HML beta t-stat	-8.4	-5.45	-4.67	-4.65	-3.3	-2.49	-2.56	-1.47	-1.7	-0.84	7.72
IMC beta FF-IMC	0.08	-0.07	-0.18	-0.08	-0.21	-0.19	-0.12	0.02	0.04	0.07	0
IMC beta FF-IMC t-stat	1.16	-0.95	-3.21	-1.33	-3.93	-3	-1.66	0.29	0.64	0.64	-0.04
						Panel C: Median firm characteristics					
$\#EMP/Capital$	61.33	58.32	59.24	57.35	57.32	56.66	57.88	70.54	67.87	68.87	NA
$Book/Market$	0.12	0.22	0.32	0.41	0.51	0.61	0.72	0.87	1.04	1.31	NA
$Marketsize$	366.06	462.86	299.97	308.40	216.47	182.33	181.39	119.24	89.77	108.82	NA
$Financial\,leverage$	0.09	0.08	0.09	0.11	0.12	0.14	0.13	0.14	0.17	0.18	NA
$CAPX/Sales$	4.80	4.33	3.79	3.49	3.39	3.49	3.19	2.95	2.78	2.65	NA
$\#Emp_{t+1}/\#Emp_t - 1$	16.12	14.89	11.27	12.40	7.66	8.87	5.79	4.32	2.70	1.67	NA
$R\&D/Sales$	12.75	8.12	6.74	4.98	4.05	3.70	3.27	2.47	2.01	1.84	NA

Note:The stock return data is from CRSP and contains labor-intensive firms in consumption-goods sector. Factor returns are from Ken French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns except. Panel A reports the return characteristics from single-factor market model. Panel B reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel C reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XI: Consumption-goods firms: value premium

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
					Panel A: CAPM						
Mean	7.47	6.65	8.13	7.99	6.83	9.27	9.48	11.24	10.18	11.84	4.36
Mean t-stat	3.37	3.27	4.26	4.08	3.54	4.52	4.38	4.77	3.87	3.75	1.56
Sigma	18.04	16.54	15.53	15.89	15.65	16.66	17.59	19.14	21.38	25.62	22.79
Alpha	0.89	0.51	2.33	2.19	1.19	3.28	3.4	4.68	2.99	4.21	3.32
Alpha t-stat	0.64	0.46	2.37	2	0.99	2.67	2.32	2.71	1.61	1.52	0.93
Beta	1	0.93	0.88	0.88	0.86	0.91	0.92	1	1.09	1.16	0.16
Beta t-stat	32.28	34.18	30.03	27.2	29.7	34.16	21.47	22.74	25.64	15.31	1.59
R-squared	76.69	79.43	80.56	76.69	74.8	74.41	68.83	67.78	65.14	51.05	1.21
					Panel B: Exposure to factors						
IMC beta	0.58	0.4	0.35	0.37	0.44	0.48	0.55	0.59	0.74	0.82	0.24
IMC beta t-stat	5.78	5.59	4.33	4.23	6.34	5.55	6.19	5.36	7.02	5.74	1.51
HML beta	-0.93	-0.64	-0.47	-0.31	-0.36	-0.24	-0.09	-0.02	-0.1	0.18	1.11
HML beta t-stat	-7.48	-6.08	-4.64	-2.85	-3.77	-2	-0.85	-0.16	-0.69	1.01	6.58
IMC beta FF-IMC	-0.14	-0.26	-0.26	-0.16	-0.07	-0.02	0.09	0.09	0.14	0.16	0.3
IMC beta FF-IMC t-stat	-3.36	-6.33	-5.73	-3.13	-1.22	-0.44	1.49	1.62	1.74	2.09	3.51
					Panel C: Median firm characteristics						
$\#EMP/Capital$	40.16	38.93	36.07	36.14	34.02	33.31	37.07	35.04	40.79	37.80	NA
$Book/Market$	0.12	0.22	0.31	0.40	0.49	0.59	0.70	0.83	1.01	1.28	NA
$Marketsize$	522.11	462.75	383.28	339.85	341.21	339.98	511.58	590.95	502.43	148.45	NA
$Financial\,leverage$	0.13	0.10	0.11	0.14	0.15	0.16	0.16	0.17	0.17	0.18	NA
$CAPX/Sales$	6.09	5.65	5.08	4.85	4.64	4.95	4.28	4.31	4.51	4.36	NA
$\#Emp_{t+1}/\#Emp_t - 1$	10.59	10.19	8.78	7.06	5.29	4.45	2.73	1.86	1.17	-0.33	NA
$R\&D/Sales$	12.43	8.83	6.92	5.35	4.14	3.24	2.91	2.19	2.08	2.06	NA

Note:The stock return data is from CRSP and contains capital-intensive and labor-intensive firms in consumption-goods sector. Factor returns are from Ken French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panel B reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel C reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

V. Model

I build on Kogan and Papanikolaou (2014) and model the cross-section of consumption-goods firms. I introduce a new dimension, capital intensity, into this model and divide the sector of consumption-goods firms into capital and labor-intensive sectors. I define the wage exogenously and allow for wage rigidity. Rigid wages help to differentiate labor-intensive firms and generate firm and return characteristics similar to those observed in the data. The investment-goods firm is modeled in reduced form so that the model is able to generate the IMC portfolio as a potential measure of investment shocks. I describe the model with closed-form solutions in this sections and provide a detailed derivation in appendix.

A. Cash flow of consumption-goods firms

The universe of the consumption-goods firms consists of two sectors $s \in \{L, H\}$, where L and H denotes the low and high capital intensive firms, respectively. Each of these two sectors consists of set of firms F_s. Each firm consists of an individual number of projects enumerated by $j \in J_t^f$. Firms create projects by investment in productive capital and by hiring labor when a new project opportunity arrives. Project j owned by firm f in sector s generates output equal to:

$$y_{f,j,t} = \epsilon_{f,t} u_{j,t} x_t K_j^{\alpha_s} L_j^{1-\hat{\alpha}_s} \tag{2}$$

, where $\epsilon_{f,t}$ is a firm-specific shock affecting all project owned by firm f, $u_{j,t}$ is a project-specific shock affecting only project j, and x_t is an aggregate shock affecting all projects of all firms. The firm- and project-specific shocks are governed by mean-reverting processes, while the aggregate shock evolves as geometric Brownian motion to simulate aggregate growth:

$$
\begin{aligned}
d\epsilon_{f,t} &= -\theta_\epsilon \left(\epsilon_{f,t} - 1\right) dt + \sigma_\epsilon \sqrt{\epsilon_{f,t}} dB_{f,t} && (3) \\
du_{j,t} &= -\theta_u \left(u_{j,t} - 1\right) dt + \sigma_u \sqrt{u_{j,t}} dB_{j,t} && (4) \\
dx_t &= \mu_x x_t dt + \sigma_x x_t dB_{x,t} && (5)
\end{aligned}
$$

α_s and $\hat{\alpha}_s$ determine the capital and labor intensity of the firms in each sector s. Morever, $\alpha_s + (1 - \hat{\alpha}_s) < 1$ to suffice decreasing returns to scale. New capital $K_{j,t}$ can be acquired at price $x_t z_t^{-1}$, where z_t represents the investment shock and is governed by geometric Brownian motion:

$$
dz_t = \mu_z z_t dt + \sigma_z z_t dB_{z,t} \tag{6}
$$

The projects expire randomly according to Poisson process with a constant rate δ. When the project expires, the capital will be re-sold at the current price to other firms demanding capital.

The total cash flow of the project consists of three components, (i) cash inflow generated by production $CFI_{j,t}$, (ii) cash outflow due to labor cost $CFO_{j,t}$ and (iii) cash from capital re-sale $RS_{j,t}$ when the project expires. The value of each of this components is derived later in the text.

The stochastic discount factor is defined exogenously and is motivated by Papanikolaou (2011):

$$
\frac{d\pi_t}{\pi_t} = -r\, dt - \gamma_x\, dB_{x,t} - \gamma_z\, dB_{z,t} \tag{7}
$$

This specification means that two shocks are priced, the aggregate shock x with price γ_x and the investment shock z with price γ_z. Time t value of cash inflow generated by an existing project j is:

$$
\begin{aligned}
CFI_{j,t}\left(\epsilon_{f,t},u_{j,t},x_t,w,K_j,L_j\right) &= \mathbf{E}_t\left[\int_t^{\infty} e^{-\delta(s-t)}\frac{\pi_s}{\pi_t}\epsilon_{f,s}u_{j,s}x_sK_j^{\alpha_s}L_j^{1-\hat{\alpha}_s}ds\right] \\
&= A\left(\epsilon_{f,t},u_{j,t}\right)x_tK_j^{\alpha_s}L_j^{1-\hat{\alpha}_s} \qquad (8)
\end{aligned}
$$

, where

$$
\begin{aligned}
A &= \left[\frac{1}{r+\gamma_x\sigma_x+\delta-\mu_x}+\frac{\epsilon_{f,t}-1}{r+\gamma_x\sigma_x+\delta-\mu_x+\theta_\epsilon}\right. \\
&\quad \left.+\frac{u_{j,t}-1}{r+\gamma_x\sigma_x+\delta-\mu_x+\theta_u}+\frac{\left(u_{j,t}-1\right)\left(\epsilon-1\right)}{r+\gamma_x\sigma_x+\delta-\mu_x+\theta_u+\theta_\epsilon}\right]
\end{aligned} \qquad (9)
$$

I assume inelastic labor (i.e. infinite supply of labor for a given wage). The wage is given exogenously and has the same dynamics as the aggregate shock, so that the wage is $W_t = w * x_t$, where w is a positive constant. This assumption is reasonable for this type of partial-equilibrium model.[7] I assume that a fraction of the hired labor force, v, has flexible wage, i.e. their wage is stochastic over the project lifetime, while the remaining fraction $1-v$ has a rigid wage, i.e. the wage of this labor force is locked to the wage level the arrival of the project (T_j) and stays so for the project's lifetime. The parameter v allows to model a degree of wage rigidity in a tractable way without time dependence. In this model, the wage rigidity creates an operating leverage and helps to differentiate between the riskiness of firms in each sector s. In the data, capital-intensive and labor-intensive firms differ. Labor-intensive firms tend to be smaller, have higher volatility of returns, higher $market-\beta$ and higher exposure to the SMB factor. All this tends to increase the riskiness of firm and their exposure to positively priced factors. For the sake of simplicity of the model, I use only operating leverage as a source of higher riskiness of labor-intensive

[7] In general equilibrium, the wage would be determined by supply of labor from household and demand of labor from the firms.

firms. Then, the time t value of labor cost of an existing project j is:

$$\begin{aligned} CFO_{j,t} &= \mathbf{E}_t\left[\int_t^\infty ve^{-\delta(s-t)}\frac{\pi_s}{\pi_t}x_s wL_j + (1-v)e^{-\delta(s-t)}\frac{\pi_s}{\pi_t}x_{T_j}W_sL_jds\right] \\ &= \left[vx_t\left(B^{flex}\right)^{-1} + (1-v)\,x_{T_j}\left(B^{rig}\right)^{-1}\right]wL_j, \end{aligned} \tag{10}$$

where $\left(B^{flex}\right)^{-1} = \frac{1}{r+\gamma_x\sigma_x+\delta-\mu_x}$, $\left(B^{rig}\right)^{-1} = \frac{1}{r+\delta}$ and x_{T_j} is the level of aggregate productivity at the time of project $j's$ arrival, so that the wage for the project $j's$ $(1-v)$ fraction of labor force is constant at $x_{T_j}w$. The expected time t value of the cash flow from the capital re-sale is:

$$RS_{j,t} = \mathbf{E}_t\left[\int_t^\infty \delta e^{-\delta(s-t)}\frac{\pi_s}{\pi_t}x_s z_s^{-1}K_j\right] = x_t z_t^{-1}MK_j, \tag{11}$$

where $M = \frac{\delta}{r+\delta+-\mu_x+\mu_z-\sigma_z^2+\gamma_x\sigma_x-\gamma_z\sigma_z}$

The time t value of all cash flow (inflow, re-sale and outflow) generated by project j is:

$$\begin{aligned} p\left(\epsilon_{f,t}, u_{j,t}, x_t, z_t, w, K_j, L_j\right) &= CFI_{j,t} + RS_{j,t} - CFO_{j,t} \\ &= A\left(\epsilon_{f,t}, u_{j,t}\right)x_t K_j^{\alpha_s}L_j^{1-\hat{\alpha}_s} + x_t z_t^{-1}MK_j \\ &\quad -\left[vx_t\left(B^{flex}\right)^{-1} + (1-v)\,x_{T_j}\left(B^{rig}\right)^{-1}\right]wL_j. \end{aligned} \tag{12}$$

New projects arrive to each firm randomly according to a Poisson process with a firm-specific arrival rate $\lambda_{f,t}$. The firm-specific arrival rate itself is a random variable:

$$\lambda_{f,t} = \lambda_f \times \tilde{\lambda}_{f,t}, \tag{13}$$

where λ_f is a firm-specific constant and $\tilde{\lambda}_{f,t}$ underlies two-state Markov process with values $\tilde{\lambda}_{f,t} \in \{\lambda_H, \lambda_L\}$ and with transition probability matrix (between t and t+dt):

$$P = \begin{pmatrix} 1-\mu_L dt & \mu_L dt \\ \mu_H dt & 1-\mu_H dt \end{pmatrix} \tag{14}$$

B. Optimal labor and capital decision

Each project j arrives with project-specific productivity at the long-term mean $u_{j,t} = 1$. When a project j arrives, the firms f chooses labor L_j and capital K_j to maximize NPV:

$$\begin{aligned} NPV &= A\left(\epsilon_{f,t},1\right)x_t K_j^{\alpha_s} L_j^{1-\hat{\alpha}_s} + x_t z_t^{-1} M K_j - z_t^{-1} x_t K_j \\ &\quad - \left[v x_t \left(B^{flex}\right)^{-1} + (1-v)\, x_{T_j} \left(B^{rig}\right)^{-1} \right] w L_j \end{aligned} \tag{15}$$

The first order condition for L_j gives:

$$L_j^* = \left(v x_t \left(B^{flex}\right)^{-1} + (1-v)\, x_{T_j} \left(B^{rig}\right)^{-1} \right)^{\frac{1}{\hat{\alpha}_s}} A\left(\epsilon_{f,t},1\right)^{\frac{1}{\hat{\alpha}_s}} K_j^{\frac{\alpha_s}{\hat{\alpha}_s}} \left(\frac{1}{w}\right)^{\frac{1}{\hat{\alpha}_s}} \tag{16}$$

Using this expression in the NPV formula and taking the first order condition for K_j gives:

$$K_j^* = \left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}} \left(z_t^{-1}\left(1-M\right)\right)^{\frac{\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}} * A\left(\epsilon_{f,t},1\right)^{\frac{-1}{\alpha_s-\hat{\alpha}_s}} D\left(\hat{\alpha}_s, w\right)^{\frac{-\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}}, \tag{17}$$

where $D\left(\hat{\alpha}_s, w\right) = \left(v \left(B^{flex}\right)^{-1} + (1-v)\left(B^{rig}\right)^{-1} \right)^{\frac{\hat{\alpha}_s-1}{\hat{\alpha}_s}} \left(\left(\frac{1-\hat{\alpha}_s}{w}\right)^{\frac{1-\hat{\alpha}_s}{\hat{\alpha}_s}} - w\left(\frac{1-\hat{\alpha}_s}{w}\right)^{\frac{1}{\hat{\alpha}_s}} \right)$.

C. Value of consumption-goods firms

The time-t value of existing projects is:

$$\begin{aligned} VAP_{f,t} &= \sum_{j\in J_f}^{J_f} p\left(\epsilon_{f,t}, u_{j,t}, x_t, z_t, w, K_j, L_j\right) = \sum_{j\in J_f}^{J_f} CFI_{j,t} + RS_{j,t} - CFO_{j,t} \\ &= CFI_{f,t} + RS_{f,t} - CFO_{f,t} \end{aligned} \tag{18}$$

The present value of growth opportunities is the sum of all future projects' NPVs:

$$NPV = x_t A\left(\epsilon_{f,t},1\right)^{\frac{-1}{\alpha_s-\hat{\alpha}_s}} \left(z_t^{-1}\left(1-M\right)\right)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}} D\left(\hat{\alpha}_s, w\right)^{\frac{-\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}} \left[\left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}} - \left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}} \right] \tag{19}$$

$$PVGO_{f,t} \quad = \quad x_t z_t^{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}} G\left(\epsilon_{f,t}, \lambda_{f,t}, \alpha_s, \hat{\alpha}_s, w\right) \tag{20}$$

The firm $f's$ total value is:

$$V_{f,t} \quad = \quad \sum_{j \in J_f}^{J_f} p\left(\epsilon_{f,t}, u_{j,t}, x_t, w, K_j, L_j\right) + x_t z_t^{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}} G\left(\epsilon_{f,t}, \lambda_{f,t}, \alpha_s, \hat{\alpha}_s, w\right) \tag{21}$$

D. Returns of the consumption firms

The expected excess return on firm f in the consumption-goods sector is:

$$\frac{1}{dt}\mathbf{E}_t\left[R_{f,t}\right] - r_f = -cov\left(\frac{d\,V_{f,t}}{v_{f,t}}, \frac{d\,\pi_t}{\pi_t}\right). \tag{22}$$

Explicit closed-form expression for the expected excess return can be derived if the expected excess return is calculated as weighted average expected excess return of the particular components of the firm value $V_{f,t}$, namely $CFI_{f,t}$, $CFO_{f,t}$, $RS_{f,t}$ and $PVGO_{f,t}$. The expected return of the first three components are:

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^{CFI}\right] - r \quad = \quad -cov\left(\frac{dCFI_t}{CFI_t}, \frac{d\pi_t}{\pi_t}\right) = \sigma_x \gamma_x \tag{23}$$

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^{RS}\right] - r \quad = \quad -cov\left(\frac{dRS_t}{RS_t}, \frac{d\pi_t}{\pi_t}\right) = \sigma_x \gamma_x - \sigma_z \gamma_z \tag{24}$$

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^{CFO}\right] - r \quad = \quad -cov\left(\frac{dCFO_t}{CFO_t}, \frac{d\pi_t}{\pi_t}\right) = v \sigma_x \gamma_x. \tag{25}$$

Accordingly, the expected excess return on value at place $VAP_{f,t}$ is:

$$
\begin{aligned}
\frac{1}{dt}\mathbf{E}_t\left[R_t^{VAP}\right]-r &= \frac{1}{dt}\mathbf{E}_t\left[R_t^{CFI}\right]\frac{CFI_{f,t}}{CFI_{f,t}+RS_{f,t}-CFO_{f,t}} \\
&\quad +\frac{1}{dt}\mathbf{E}_t\left[R_t^{RS}\right]\frac{RS_{f,t}}{CFI_{f,t}+RS_{f,t}-CFO_{f,t}} \\
&\quad -\frac{1}{dt}\mathbf{E}_t\left[R_t^{CFO}\right]\frac{CFO_{f,t}}{CFI_{f,t}+RS_{f,t}-CFO_{f,t}} \\
&= \sigma_x\gamma_x\frac{CFI_{f,t}+RS_{f,t}-vCFO_{f,t}}{VAP_{f,t}}-\sigma_z\gamma_z\frac{RS_{f,t}}{VAP} \qquad (26)
\end{aligned}
$$

The expected return on the value at place depends on the exposure to the underlying risks x_t and z_t. The first term is a leveraged claim on the aggregate productivity shock x_t. The leverage arises from the rigidity of the wage. While the output fluctuates with the aggregate risk, the fraction $(1-v)$ of the labor force has a constant wage and hence results in constant labor cost, which is reflected in operating leverage. The operating leverage is determined by the parameter v. If $v=1$, the $CFI_{f,t}+RS_{f,t}-vCFO_{f,t}=VAP_{f,t}$ and the firm is unlevered. In contrast $v=0$ corresponds to the maximum possible leverage where $CFI_{f,t}+RS_{f,t}-vCFO_{f,t}=CFI_{f,t}+RS_{f,t}>VAP_{f,t}$. The second term in the VAP's expected return, exposure to IST shock, arises from the possibility of capital re-sale in case of project expiration.

The expected excess return on the growth option is:

$$
\frac{1}{dt}\mathbf{E}_t\left[R_{f,t}^{PVGO}\right]-r = -cov\left(\frac{dPVGO_{f,t}}{PVGO_{f,t}},\frac{d\pi_t}{\pi_t}\right)=\sigma_x\gamma_x+\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\sigma_z\gamma_z. \qquad (27)
$$

Accordingly, the expected excess return on the whole firm is a weighted average of the expected return on the firm $f's$ VAP and $PVGO$:

$$
\frac{1}{dt}\mathbf{E}_t\left[R_{f,t}\right]-r = \sigma_x\gamma_x\frac{V_{f,t}+(1-v)\,CFO_{f,t}}{V_{f,t}}+\sigma_z\gamma_z\left(\frac{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}PVGO_{f,t}-RS_{f,t}}{V_{f,t}}\right). \qquad (28)
$$

The realized return is:

$$
\begin{aligned}
R_{f,t} - r \quad = \quad & \sigma_x \gamma_x \frac{V_{f,t} + (1-v)\, CFO_{f,t}}{V_{f,t}} + \sigma_z \gamma_z \left(\frac{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s} PVGO_{f,t} - RS_{f,t}}{V_{f,t}} \right) \\
& + \frac{V_{f,t} + (1-v)\, CFO_{f,t}}{V_{f,t}} \sigma_x dB_{x_t} + \left(\frac{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s} PVGO_{f,t} - RS_{f,t}}{V_{f,t}} \right) \sigma_z dB_{z_t}.
\end{aligned}
\tag{29}
$$

It is also useful to derive firm f's exposure to shock the investment shock, z:

$$
\beta^z_{f,t} = \frac{\delta \ln V_{f,t}}{\delta \ln z_t} = \frac{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s} PVGO_{f,t} - RS_{f,t}}{V_{f,t}}. \tag{30}
$$

Firm's true exposure cannot be observed directly in the data. Below, I derive the a closed form formula for the empirical proxy of the IST shock, the IMC portfolio, and discuss how reliable are the estimates of firm's exposure to IST shocks for a firm with given capital- (or labor-) intensity. At this point, it is obvious that approximating firm's exposure to IST shock by firm's growth opportunities might be problematic for two reasons. First, $\beta^z_{f,t}$ depends not only on $PVGO_{f,t}$ but also on potential capital re-sale, $RS_{f,t}$. Second, $PVGO_{f,t}$ itself is multiplied by $\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}$, which captures capital intensity and varies strongly in the cross section.

E. Value of the investment-goods firm

Investment firm is modeled in a reduced form to get an appropriate counter-part for consumption-goods firms. I assume that the investment-goods firm produces exactly the capital demanded by the consumption-goods firms less the capital that is re-sold among the consumption-goods firms by themselves. This assumption corresponds to a market clearing condition for capital market in general equilibrium setting. The total expected demand for capital from sector s is $\bar{\lambda} \int_{F_s} K^*_{f,t} df$, where $K^*_{f,t}$ is the optimal capital for newly arrived projects of firm f as described above. The expected capital re-sold by the consumption-goods firms in sector s consists of two parts. First, the already existing capital is $\int_{f_s} K_{f,t} df = K_{s,t}$ and has a probability to be re-sold in future. Second, the capital which will be demanded in future for newly arrived project will be re-sold when these projects expire later. The profit of investment-goods firm is a fraction ϕ of the capital sold by the investment firm (i.e. total demanded capital less the capital re-sold among the consumption-goods firms). The total expected amount of demanded capital at each point in time is:

$$\bar{\lambda} \int_{F_s} K^*_{f,t} df = \bar{\lambda} \left(\frac{\hat{\alpha}_s}{\alpha_s} \right)^{\frac{\hat{\alpha}_s}{\alpha_s - \hat{\alpha}_s}} \left(z_t^{-1} (1-M) \right)^{\frac{\hat{\alpha}_s}{\alpha_s - \hat{\alpha}_s}} D (\hat{\alpha}_s, w)^{\frac{\hat{\alpha}_s}{\hat{\alpha}_s - \alpha_s}} \int_{F_s} A (\epsilon_{f,t}, 1)^{\frac{1}{\hat{\alpha}_s - \alpha_s}} df \tag{31}$$

The present value of the total capital demand of sector s is:

$$\begin{aligned} PDV_{s,t} &= \mathbf{E}_t \Bigg[\int_t^{\infty} x_s z_s^{-1} \frac{\pi_s}{\pi_t} \bar{\lambda}_s \left(\frac{\hat{\alpha}_s}{\alpha_s} \right)^{\frac{\hat{\alpha}_s}{\alpha_s - \hat{\alpha}_s}} \left(z_s^{-1} (1-M) \right)^{\frac{\hat{\alpha}_s}{\alpha_s - \hat{\alpha}_s}} D (\hat{\alpha}_s, w)^{\frac{\hat{\alpha}_s}{\hat{\alpha}_s - \alpha_s}} \\ &\quad \left(\int_{F_s} A (\epsilon f, t, 1)^{\frac{1}{\hat{\alpha}_s - \alpha_s}} df \right) ds \Bigg] \\ &= x_t z_t^{\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}} \Gamma_s \end{aligned} \tag{32}$$

The present value of the re-sale of the existing capital is:

$$NDVP_{s,t} = \mathbf{E}_t \left[\int_t^{\infty} \delta e^{-\delta(s-t)} \frac{\pi_s}{\pi_t} x_s z_s^{-1} \left(\int_{F_s} K_{f,t} df \right) ds \right] = x_t z_t^{-1} M K_{s,t} \tag{33}$$

The present value of the re-sale of the capital of projects that are expected to arrive in future is:

$$NDVF_{s,t} = \frac{1}{Q} \bar{\lambda} M x_t z_t^{-1} \left(\int_{F_s} K^*_{f,t} df \right) \tag{34}$$

, where $Q = r - \mu_x + \mu_z - \sigma_z^2 + \sigma_x \gamma_x - \sigma_z \gamma_z$.

The present value of the demand which will be supplied by the investment firm is:

$$\begin{aligned} ID_t &= \sum_{s \in \{L,H\}} PDV_{s,t} - NDVP_{s,t} - NDVF_{s,t} \\ &= x_t z_t^{\frac{\alpha_L}{\hat{\alpha}_L - \alpha_L}} \sum_{s \in \{L,H\}} \Gamma_s \left(1 - M\right)^{\frac{\hat{\alpha}_s}{\alpha_s - \hat{\alpha}_s}} - x_t z_t^{-1} \left(\frac{1}{Q} \bar{\lambda}_s M \left(\int_{F_s} K_{f,t}^* df \right) - M K_{s,t} \right) \end{aligned} \tag{35}$$

The value of the investment-goods firm is then:

$$V_t^I = \phi ID_t \tag{36}$$

F. Expected excess return on the investment-goods firm

The expected excess return on the investment-goods firm can be calculated as the weighted average expected excess return on the individual value components:

$$\begin{aligned} \frac{1}{dt} \mathbf{E}_t \left[R_t^I \right] - r &= \sum_{s \in \{L,H\}} \left(\frac{1}{dt} \mathbf{E}_t \left[R_t^{PDV_s} \right] - r \right) \frac{\phi PDV_{s,t}}{V_t^I} \\ &- \sum_{s \in \{L,H\}} \left(\frac{1}{dt} \mathbf{E}_t \left[R_t^{NDVP_s} \right] - r \right) \frac{\phi NDVP_{s,t}}{V_t^I} \\ &- \sum_{s \in \{L,H\}} \left(\frac{1}{dt} \mathbf{E}_t \left[R_t^{NDVF_s} \right] - r \right) \frac{\phi NDVF_{s,t}}{V_t^I} \end{aligned} \tag{37}$$

Expected excess return on the positive demand component ($PDV_{s,t}$):

$$\frac{1}{dt} \mathbf{E}_t \left[R_t^{PDV_s} \right] - r = \sigma_x \gamma_x + \frac{\alpha_s}{\hat{\alpha}_s - \alpha_s} \sigma_z \gamma_z \tag{38}$$

Expected excess return on the positive demand components ($NDVP_{s,t}$ and $NDVF_{s,t}$):

$$\frac{1}{dt} \mathbf{E}_t \left[R_t^{NDVP_s} \right] - r = \sigma_x \gamma_x - \sigma_z \gamma_z \tag{39}$$

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^{NDVF_s}\right]-r \quad = \quad \sigma_x\gamma_x+\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\sigma_z\gamma_z \tag{40}$$

The expected excess return on the investment-goods firm is:

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^I\right]-r \quad = \quad \sigma_x\gamma_x+\sigma_z\gamma_z\sum_{s\in\{L,H\}}\frac{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\left(PDV_{s,t}-NDVF_{s,t}\right)+NDVP_{s,t}}{V_t^I} \tag{41}$$

The second term comes from the exposure to the investment shock z_t and is determined by both, the firms' capital intensity parameters α_s and $\hat{\alpha}_s$ and the relative weights of $PDV_{s,t}$, $NDVF_{s,t}$ and $NDVP_{s,t}$ capturing the 'market clearing' condition for investment-goods market. The first term captures the investment-goods firm exposure to the aggregate productivity shock x_t. Since I do not explicitly model the capital or operating structure of the investment-goods firms, the first term is an unlevered claim on the underlying aggregate shock x_t. The exposure of the investment-goods firms to the aggregate shock x_t, however, affects the IMC portfolio's exposure this shock and I model this dimension when I construct the IMC portfolio in the following sub-section.

G. Expected excess return on the IMC portfolio

The expected excess return on each of the cross-section of consumption-goods firms is simply the value-weighted average of expected returns across the firms in both consumption-goods sectors:

$$\begin{aligned}\frac{1}{dt}\mathbf{E}_t\left[R_t^{s,C}\right]-r \quad &= \quad \int_{F_s}\left(\frac{1}{dt}\mathbf{E}_t\left[R_{f,t}\right]-r\right)\frac{V_{f,t}}{\int_{F_s}V_{v,t}dv}df \\ &= \quad \sigma_x\gamma_x\frac{\int_{F_s}1+(1-v)\,CFO_{f,t}df}{\int_{F_s}V_{f,t}df}+\sigma_z\gamma_z\frac{\int_{F_s}\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}PVGO_{f,t}-RS_{f,t}df}{\int_{F_s}V_{f,t}df}\end{aligned} \tag{42}$$

I denote the total value of all consumption-goods firms in both sectors as V_t^C. Then the expected excess return on cross-section of all consumption firms is:

$$\begin{aligned}\frac{1}{dt}\mathbf{E}_t\left[R_t^C\right]-r &= \sigma_x\gamma_x\sum_{s\in\{L,H\}}\frac{\int_{F_s}\left(1+(1-v)\,CFO_{f,t}\right)df}{V_t^C}\\ &\quad+\sigma_z\gamma_z\sum_{s\in\{L,H\}}\frac{\int_{F_s}\frac{\alpha_L}{\hat{\alpha}_L-\alpha_L}PVGO_{f,t}-RS_{f,t}df}{V_t^C}\end{aligned} \tag{43}$$

The realized excess return is similar, additionally with the corresponding stochastic part.

The expected excess return on the IMC portfolio can simply be calculated by subtracting the expected return on the consumption-goods sector from the expected return on the investment-goods sector. If both sectors have exactly the same exposure to the aggregate shock x_t, these exposures will cancel each other and the resulting IMC portfolio will span purely the dimension of the investment shock z_t. In reality both, the investment-goods and consumption-goods firms differ in their exposure to systematic risks. Accordingly, the IMC portfolio is exposed to the aggregate shock x to the extent of the differences in risk exposure between investment and consumption firms. Table II shows that the IMC portfolio is positively correlated with both market portfolio and SMB portfolio. In this model the differences in exposure to systematic risk(s) arise due only to difference in operating leverage. In order to capture this dimension between investment-goods and consumption-goods firms I include a parameter L_DIFF. Accordingly, the expected return on the IMC portfolio can be written as follows:

$$\begin{aligned}\frac{1}{dt}\mathbf{E}_t\left[R_t^I-R_t^C\right] &= -\sigma_x\gamma_x\sum_{s\in\{L,H\}}\frac{\int_{F_s}(1-v)\,CFO_{f,t}df}{V_t^C}\,L\_DIFF\\ &\quad+\sigma_z\gamma_z\sum_{s\in\{L,H\}}\frac{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\left(PDV_{s,t}-NDVF_{s,t}\right)+NDVP_{s,t}}{V_t^I}\\ &\quad-\sigma_z\gamma_z\sum_{s\in\{L,H\}}\frac{\int_{F_s}\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}PVGO_{f,t}-RS_{f,t}df}{V_t^C}\end{aligned} \tag{44}$$

, where L_DIFF is, in narrower sense, a parameter capturing the difference in the operating leverage between investment and consumption firms. In broader sense, L_DIFF captures differences between investment and consumption firms that lead to different exposure to the aggregate risk and result in a positive correlation between IMC and market portfolio. The realized return of the IMC portfolio is the expected return and the corresponding stochastic part. For the sake of simplicity, I define $CFO\_X_t = \sum_{s\in\{L,H\}} \frac{\int_{F_s}(1-v)CFO_{f,t}df}{V_t^C}$, $INV\_Z_t = \sum_{s\in\{L,H\}} \frac{\frac{\alpha_s}{\bar{\alpha}_s-\alpha_s}(PDV_{s,t}-NDVF_{s,t})+NDVP_{s,t}}{V_t^I}$ and $CONS\_Z_t = \sum_{s\in\{L,H\}} \frac{\int_{F_s}\frac{\alpha_s}{\bar{\alpha}_s-\alpha_s}PVGO_{f,t}-RS_{f,t}df}{V_t^C}$. The realized return is:

$$\begin{aligned} R_t^I - R_t^C &= -\sigma_x\gamma_x CFO\_X_t L\_DIFF - \sigma_x B_{x_t} CFO\_X_t L\_DIFF \\ &\quad +\sigma_z\gamma_z (INV\_Z_t - CONS\_Z_t) + \sigma_z B_{z_t}(INV\_Z_t - CONS\_Z_t) \end{aligned} \tag{45}$$

H. $\beta_{f,t}^{IMC}$ as a measure of firm's exposure to IST shock

In this section I analyze the IMC portfolio as an empirical proxy for investment shock. The purpose is to understand how well the IMC portfolio can capture firm's exposure to investment shock. In the ideal case when the IMC portfolio is exposed only to investment shock z_t, firm's exposure to the IMC portfolio will map one-to-one to firm's exposure to investment shock z_t. However, in reality the IMC portfolio correlates strongly with the aggregate shock x_t. Moreover, firm's exposure to investment shock differes in the cross-section dependend (among other factors) on firm's capital intensity. The closed-form expression of firm's exposure to the IMC portfolio, $\beta_{f,t}^{IMC}$, allows to analyze the pitfalls of estimating firm's exposure to IST shock from its exposure to the IMC portfolio and, at least partially, reconcile the empirical observations. The exposure of the IMC portfolio to each of the aggregate shocks x and IST shock z is:

$$\beta_t^{IMC,z} = \frac{cov\left(R_t^{IMC}, \frac{dz_t}{z_t}\right)}{var\left(\frac{dz_t}{z_t}\right)} = INV\_Z_t - CONS\_Z_t \tag{46}$$

$$\beta_t^{IMC,x} = \frac{cov\left(R_t^{IMC}, \frac{dx_t}{x_t}\right)}{var\left(\frac{dx_t}{x_t}\right)} = -CFO\_X_t L\_DIFF \tag{47}$$

The IMC's exposure to the aggregate shock x depends on the similarity of the investment and consumption firms. The exposure to the IST shocks z, depends on the relative value of growth opportunities to total firm value of the consumption firm as well as on how much of the demanded capital will be supplied by the investment firm vs. by re-sale. Firm $f's$ exposure to the IMC portfolio is:

$$\begin{aligned}\beta_{f,t}^{IMC} &= \frac{cov\left(R_{f,t}, R_t^{IMC}\right)}{var\left(R_t^{IMC}\right)} \\ &= -\frac{\sigma_x^2\left(\frac{CFI_{f,t}+RS_{f,t}+PVGO_{f,t}-vCFO_{f,t}}{V_{f,t}}\right)CFO\_X_t L\_DIFF}{\sigma_x^2\left(CFO\_X_t L\_DIFF\right)^2+\sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2} \\ &\quad + \frac{\sigma_z^2\beta_{f,t}^z\left(INV\_Z_t - CONS\_Z_t\right)}{\sigma_x^2\left(CFO\_X_t L\_DIFF\right)^2+\sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2}\end{aligned} \tag{48}$$

Firm $f's$ exposure to the IMC portfolio depends on the particular components of firm $f's$ total value as well as on the IMC's exposure to the shocks x and z. For this analysis, I assume $L\_DIFF < 0$. This results in positive correlation between IMC and market portfolio as observed from the data (see table II above). In reality, the positive correlation does not arise only due to the differences in operating leverage but most likely due to other reasons as well. Morever, I assume $INV\_Z_t - CONS\_Z_t > 0$ which means that investment-goods firms are more exposed to IST shock than consumption-goods firms. This assumption is well justified by data. Empirical evidence shows that investment firms have higher exposure to the quality-adjusted relative prices of equipment as an *exogenous* measure of IST shocks.[8] Accordingly, the IMC portfolio can to some degree serve as an empirical proxy for IST shocks.

Table XII summarizes how the particular value components affect firm's exposure to the shocks and the IMC portfolio. The value of firm's operating cash flow $CFI_{f,t}$ is positively correlated only with the aggregate shock x and hence it increases firm's $\beta_{f,t}^{IMC}$. Firm's oper-

[8]Investment firms' exposure to the IMC portfolio is on average higher as well. This argument, however, provides only limited support since IMC portfolio consists of investment firms.

Table XII: Value components and exposure to shocks and IMC

	x_t	z_t	IMC
$CFI_{f,t}$	+	none	+
$CFO_{f,t}$	+ (v)	none	+ (v)
$PVGO_{f,t}$	+	$+\left(\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\right)$	$+\left(\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\right)$
$RS_{f,t}$	+	-	+ if $\sigma_x^2 CFO\_X_t\, DIFF > \sigma_z^2 \frac{\alpha_s}{\hat{\alpha}_s-\alpha_S}\,(INV\_Z - CONS\_Z)$ - if $\sigma_x^2 CFO\_X_t\, DIFF < \sigma_z^2 \frac{\alpha_s}{\hat{\alpha}_s-\alpha_S}\,(INV\_Z - CONS\_Z)$

Note: The table shows how the firm's value components affect firm's exposure to the shocks x_t, z_t, and to the IMC portfolio. The value components are in rows and the shocks (the IMC portfolio) are in columns. The values in parentheses for CFO and PVGO components indicate the coefficients.

ating leverage arising from $vCFO_{f,t}$ increases firm's exposure to aggregate shock x_t so that also $\beta_{f,t}^{IMC}$ increases. Firm's growth opportunities $PVGO_{f,t}$ are positively exposed to both shocks and hence they increase the exposure to the IMC portfolio. The value of potential re-sale $RS_{f,t}$ is positively correlated with aggregate shocks x and negatively correlated with shocks z (a potential capital re-sale decreases firm's $\beta_{f,t}^{z}$). If IMC's covariance with shock x is stronger than with shock z, firm's potential re-sales increase $\beta_{f,t}^{IMC}$, while decrease in the opposite case. As a result, this analysis shows that firm's $\beta_{f,t}^{IMC}$ is not a precise measure of firm's exposure to the IST shocks and the quality of this measure depends both, on firm's components of firm's total value and IMC's exposure to the aggregate shock x relative to its exposure to the IST shock z.

For instance, a capital-intensive firm with large growth opportunities relative to existing assets will have high exposure to the IMC portfolio due to its exposure to IST shock, z_t. In contrast, highly levered labor-intensive firm will have high exposure to the IMC portfolio due to its exposure to aggregate shock x. Accordingly, similar level of $\beta_{f,t}^{IMC}$ has different meaning in terms of describing the exposure to the underlying shocks for capital-intensive and labor-intensive firms.

I. Empirical implications

The model is useful to show the asset pricing implications of firm's capital intensity as well as the discrepancies between true exposure to investment shocks and exposure to the IMC portfolio. In order to derive the asset pricing implication, I rewrite the formulas for firm's expected return and $\beta_{f,t}^{IMC}$ in the following way:

$$\frac{1}{dt}\mathbf{E}_t\left[R_{f,t}\right] - r \quad = \quad \sigma_x\gamma_x\beta_{f,t}^{x} + \sigma_z\gamma_z\beta_{f,t}^{z} \tag{49}$$

where $\beta_{f,t}^{z} = \frac{\frac{\alpha_s}{\bar{\alpha}_s-\alpha}PVGO_{f,t}-RS_{f,t}}{V_{f,t}}$ and $\beta_{f,t}^{x} = \frac{V_{f,t}+(1-v)CFO_{f,t}}{V_{f,t}}$.

$$\beta_{f,t}^{IMC} \quad = \quad \beta_{f,t}^{x} \times factor_1 + \beta_{f,t}^{z} \times factor_2 \tag{50}$$

,where $factor_1 > 0$ and $factor_2 > 0$ are defined in the appendix. We can observe that the asset pricing implication of $\beta_{f,t}^{z}$ in the firm's expected return formula is independent of the capital intensity. However, $\beta_{f,t}^{z}$ itself strongly depends on firm's capital intensity. Accordingly, the cross-sectional variation in expected returns of capital-intensive firms is driven strongly by their $\beta_{f,t}^{z}$ while this effect is much weaker for labor-intensive firms. Moreover, both firm's expected return and $\beta_{f,t}^{IMC}$ are determined by $\beta_{f,t}^{x}$ and $\beta_{f,t}^{z}$. Sorting the cross-section of firms by their $\beta_{f,t}^{IMC}$ will have two opposite effects. First, stocks with high $\beta_{f,t}^{IMC}$ tend to have lower expected return due to their high exposure to investment shock z_t, which is priced negatively. Second, stocks with high $\beta_{f,t}^{IMC}$ will have also higher exposure to the aggregate shock x_t, which is priced positively. This will increase their expected return again. The total effect on the stock returns depends on which effect turns out to be stronger. Capital intensity introduces an important dimension into the cross-sectional sorting by $\beta_{f,t}^{IMC}$ since it changes the relative strength of these two effects. Accordingly, sorting the capital-intensive firms by $\beta_{f,t}^{IMC}$ will be driven by firm's exposure to investment shock (i.e. $\beta_{f,t}^{z}$), while sorting the labor-intensive firms by $\beta_{f,t}^{IMC}$ will be driven mainly by $\beta_{f,t}^{x}$. As a result $\beta_{f,t}^{IMC}$ sorts of capital-intensive firms are expected to reveal strong and negative relation with abnormal returns, while the equivalent sort of labor-intensive firms are expected to have much weaker effect on abnormal returns.[9]. This empirical prediction is supported in the data and is the main asset pricing result of this paper. In table VII, the CAPM-α return generated by sorting on $\beta_{f,t}^{IMC}$ is significantly negative (-5.29%) for capital-

[9]Since $\beta_{f,t}^{z}$ is not observable, we cannot sort directly by this measure. However, theoretically this sorts do not have to have different results for capital- and labor-intensive firms as long as the range of the $\beta_{f,t}^{z}$ is comparable in both sub-samples

intensive firms but insignificant and of much lower magnitude (-1.07%) for labor-intensive firms.

The following implications of the model aim at measuring firm's exposure to IST shock. First, it can be shown that firms with the identical fraction of value accounted by growth opportunities can have different exposure to investment shock due to the differences in capital intensity. This follows straight from the formula for $\beta^{z}_{f,t}$ and the fact that $\alpha_L > \alpha_H$ and $\hat{\alpha}_L > \hat{\alpha}_H$. The flip side of this implication is that firms with the identical exposure to investment shocks do not need to have the same fractions of firm value coming from growth opportunities. Firm's exposure to investment shock measured by $\beta^{z}_{f,t}$ depends on firm's growth opportunities and the value of a potential capital re-sale. Accordingly, firms for which the value of potential re-sale does not play an important role are expected to have a stronger relationship between exposure to investment shock and growth opportunities. The evidence in the data supports this prediction. Portfolios of labor-intensive firms sorted $\beta^{IMC}_{f,t}$ tend to have higher dispersion of exposure to HML factor than capital-intensive firms. This can be seen from the coefficients on the HML factor in table VII. For instance, the HML coefficient of Hi-Lo portfolio is -0.21 for capital-intensive firms but -0.41 for capital-intensive firms.

Third, firm's exposure to the IMC portfolio does not map one to one to firm's exposure to investment shocks. Firm's exposure to investment shocks is strongly determined by capital intensity, while exposure to IMC portfolio also depends on firm's operating leverage. Contamination of the IMC portfolio by shocks different from investment shocks is an empirical fact but it makes the analysis blurred.[10] Firm's exposure to the IMC portfolio may arise for different reasons and hence following situations are possible.

Two firms with the same capital intensity and same $\beta^{IMC}_{f,t}$ may have same or different $\beta^{z}_{f,t}$. If one firm is a trully growth firm with large growth opportunities and little assets in place its $\beta^{IMC}_{f,t}$ will be driven mostly by $\beta^{z}_{f,t}$. In contrast a firm that already has made significant investment will have lower $\beta^{z}_{f,t}$ since its value of potential re-sale has risen.

[10]In data the IMC portfolio is exposed to both market factor and SMB factor. I do not model SMB factor in my model, so the model generates only exposure to aggregate risk additionally to the investment shocks.

However, the investment will be accompanied by hiring which leads to higher operating leverage and increases $\beta_{f,t}^{IMC}$ again. How strong these forces are depends on volatilities of the shocks x and z, on the IMC's exposure to these shocks as well as well as on the capital-intensity of the particular firm. Since in this model the operating leverage arises from wage obligation, the effect coming from operating leverage will be stronger for labor-intensive firms. Accordingly, labor-intensive firms are expected to have higher $\beta_{f,t}^{IMC}$. This prediction is supported by data. The β^{IMC} of the quintile portfolios in table VIII ranges from 0.06 to 1.38 for capital-intensive firms while from 0.49 to 1.67 for labor-intensive firms.

In general, the range of firms' exposures to investment shocks should be much larger among capital-intensive firms than among labor-intensive firms. This implications is not easily testable in the data and portfolios sorted by $\beta_{f,t}^{IMC}$ do not provide a clear picture.

VI. Model calibration and simulation

I calibrate the model to match moments of aggregate dividend and investment growth, asset returns, accounting ratios, the IMC portfolio properties and capital intensity of firms. Moreover, I choose some of the parameters to be in close proximity to the parameters in the existing models, especially Kogan and Papanikolaou (2014) to allow comparison with a benchmark model. The goal of this exercise is to provide a quantitative result in support of the asset pricing implication of the model and show that capital-intensity matters for $\beta_{f,t}^{IMC}$ sorted stocks as found in the data. I simulate a cross-section of consumption-goods firms and the necessary counter-part of investment-good firm. The cross-section of consumption-goods firms consists of two sub-samples, namely capital-intensive and labor-intensive firms. Each sub-sample consists of 500 firms. I simulate the model for 100 years and use only second half (year 51-100) for estimating the moments. I run 100 simulations and report median moments across the simulations. The cross-sectional distribution of firm's project arrival rates $\lambda_f = \mathbf{E}\left[\lambda_{f,t}\right]$ is given as:

$$\lambda_f = \mu_\lambda \delta - \sigma_\lambda \delta log\left(X_f\right) \tag{51}$$

, where $X_f \sim N(0,1)$.

The parameters are provided in table XIII. The calibration is based on Kogan and Papanikolaou (2014) parameters. My extension of the model focuses on matching additional moments related to capital intensity. Accordingly, I choose α_s and $\hat{\alpha}_s$ to approximately match the size and capital intensity of capital-intensive firms relative to labor-intensive firms and the return moments in each cross-section of stocks.

Table XIII: Parameter values for model calibration

Parameter	Symbol	Value
Aggregate shocks		
Mean growth rate of agg. productivity shock	μ_x	0.01
Volatility of agg. productivity shock	σ_x	0.12
Mean growth rate of the IST shock	μ_z	0.001
Volatility of the IST shock	σ_z	0.033
Idiosyncratic shocks		
Persistence of the firm-specific shock	θ_ϵ	0.35
Volatility of the firm-specific shock	σ_ϵ	0.20
Persistence of the project-specific shock	θ_u	0.50
Volatility of the project-specific shock	σ_u	1.50
Project arrival and depreciation		
Project depreciation rate	δ	0.10
Arrival rate parameter 1	μ_λ	2.00
Arrival rate parameter 2	σ_λ	2.00
Transition probability into high-growth state	μ_H	0.075
Transition probability into low-growth state	μ_L	0.160
Project arrival rate in the high-growth state	λ_H	2.35
Stochastic discount factor		
Risk-free rate	r	0.03
Price of risk of the aggregate productivity shock	γ_x	0.59
Price of the IST shock	γ_z	-0.35
Capital and labor-intensity (production function)		
Capital intensity of H firms	α_L	0.82
Capital intensity of L firms	α_H	0.64
Labor intensity of H firms	$\hat{\alpha}_L$	0.03
Labor intensity of L firms	$\hat{\alpha}_H$	0.31
Other		
Profit margin of the investment sector	ϕ	0.07
Aggregate wage factor	w	0.005
Labor force with flexible wage	v	0.3
Leverage difference	L_DIFF	-70

Table XIV shows the moments from the simulated data from my model, from Kogan and Papanikolaou (2014) model (indicated by KP model) and the empirical counterparts. My model is close to the empirical moments and to the KP benchmark for the aggregate dividend growth, most of the asset pricing moments and several cross-sectional moments. The model generates lower investment growth and investment rate compared to both the empirical moments and KP benchmark. I keep the same values for the parameters of project arrival as the KP benchmark but in my model the project realization consists of both capital investment and labor hiring, which may be reflected in lower investment growth and investment rate. My model also generates a more volatile IMC portfolio. Among other

Table XIV: Moments

	data	KP model	capital intensity model
Aggregate moments			
Agg. dividend growth, mean	0.025	0.017	0.015
Agg. dividend growth, std.	0.118	0.15	0.183
Agg. investment growth, mean	0.047	0.041	0.013
Agg. investment growth, std.	0.157	0.171	0.168
Asset prices moments			
Mean excess return of market portfolio	0.059	0.056	0.044
Volatility of market portfolio return	0.161	0.164	0.143
Mean return of IMC portfolio	-0.014	-0.039	-0.028
Volatility of IMC portfolio return	0.113	0.115	0.39
IMC correlation with market	0.45	NA	0.89
IMC correlation with IST shocks	NA	1	0.39
Relative market capitalization of I and C sectors	0.149	0.140	0.11
Cross-sectional moments			
Firm investment rate, median	0.112	0.121	0.066
Firm investment rate, IQR	0.157	0.168	0.067
Cash flows-to-capital, median	0.16	0.249	0.124
Cash flows-to-capital, IQR	0.234	0.222	0.12
Tobin's Q, median	1.412	1.988	1.84
Tobin's Q, IQR	2.981	1.563	0.96
Relative firm size, median	0.2	0.701	0.80
Relative firm size, IQR	0.83	0.882	0.688
Correlation between Tobin's Q and relative firm size	0.16	-0.369	-0.328
Capital- vs. labor intensive firms			
Relative capital labor ratio, median	4.0	NA	8.63
Relative size of H vs. L firm, median	1.850	NA	0.98

Note: Most of the empirical moments are from Kogan and Papanikolaou (2014) who estimate them from 1963 to 2008. IQR indicates the interquintile range. Relative capital labor ratio is the capital-labor ratio of capital intensive firms divided by capital-labor ratio of labor-intensive firms. The moments generated from the current model are in the last column ('capital intensity model'). For comparison, I state the simulated moments from Kogan and Papanikolaou (2014) model in the 'KP-model' column.

things, the volatility of the IMC portfolio is affected by the leverage difference between consumption-goods and investment-goods sector, parameter L_DIFF. As mentioned above, the IMC portfolio correlates with both the market and SMB factors. Since my model does not include any pricing of firm size (i.e. stochastic discount factor does not include the SMB factor), the model has to compensate for this by a proportionally higher exposure of the IMC portfolio to the aggregate shock x_t, which necessarily results in higher volatility. Similarly, on the side of the individual firm's the absence of a priced exposure to SMB factor has to be compensated by proportionally higher labor-intensity (i.e., operating leverage) of labor-intensive firms, which results in higher relative capital-labor ratio. My model also generates a lower relative firm size of H vs. L firm. This is an artefact of the multiplicative production function with decreasing returns to scale. Departing from the selected parameter values is likely to provide a remedy. Since the firm size is not priced, this disrepancy is less relevant.

I report the cross-sectional properties of simulated stock returns sorted by the exposure to the IMC portfolio in table XV. Panel A contains the capital-intensive firms and panel B the labor-intensive firms. Similarly to the empirical results, the Hi-Lo portfolio consisting

Table XV: Simulated returns

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: capital-intensive firms						
return mean	5.90	5.00	4.60	4.30	3.90	3.60	3.30	2.90	2.70	2.60	-6.40
sorting β^{IMC}	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.35	NaN
σ	14.10	14.20	14.70	14.90	15.40	15.70	16.10	16.60	17.00	17.60	6.90
β^{mkt}	0.93	0.95	0.96	0.98	1.00	1.02	1.04	1.07	1.08	1.09	0.17
α	0.60	-0.40	-1.00	-1.40	-2.00	-2.50	-2.90	-3.50	-3.90	-4.10	-4.90
r-squared	0.99	1.00	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.36
α^{IMC}	9.40	8.60	8.30	7.90	7.60	7.30	7.00	6.70	6.40	6.30	-1.30
β^{IMC}	0.33	0.33	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.38	0.32
r-squared IMC	0.96	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.91	0.90	0.88
β^{z}	1.65	1.86	2.08	2.26	2.50	2.71	2.94	3.14	3.36	3.65	1.99
					Panel A: Labor-intensive firms						
return mean	9.90	9.20	8.70	8.30	8.00	7.80	7.50	7.30	7.10	7.30	-5.50
sorting β^{IMC}	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.32	NaN
σ	14.60	14.50	14.60	14.50	14.60	14.60	14.70	14.70	14.70	14.80	3.60
β^{mkt}	0.92	0.91	0.92	0.92	0.92	0.92	0.94	0.94	0.95	0.96	0.04
α	4.80	3.90	3.50	3.10	2.80	2.60	2.30	2.00	1.70	1.90	-2.80
r-squared	0.95	0.95	0.95	0.96	0.96	0.97	0.97	0.98	0.98	0.98	0.18
α^{IMC}	13.50	12.70	12.30	12.00	11.80	11.40	11.30	11.20	10.90	11.10	-1.70
β^{IMC}	0.32	0.32	0.33	0.32	0.33	0.33	0.33	0.34	0.33	0.34	0.11
r-squared IMC	0.94	0.94	0.94	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.62
β^{z}	0.74	0.74	0.82	0.87	0.94	1.01	1.09	1.20	1.31	1.45	0.72

of capital-intensive firms generates a strongly negative abnormal return, while the labor-intensive counterpart is much weaker.[11] When I include the IMC portfolio to the pricing regression (see row α^{IMC}) the abnormal return decreases to ca. 1.4-1.7%. The simulated data allows to analyze firm's true exposure to the investment shock, i.e. $\beta^{z}_{f,t}$. For capital-intensive firms, $\beta^{z}_{f,t}$ ranges from 1.65 to 3.65, while for labor-intensive firms only from 0.74 to 1.45. In my model, the wage and labor supply are exogenously given and hence the labor-intensive firms are relatively unaffected by the investment shock. .

VII. Conclusion

In this paper, I show that firm capital intensity is an important dimension for studying the asset pricing implications of the investment-specific technology shocks. Positive investment shocks, i.e. shocks to the formation of new capital are expected to benefit the capital-intensive firms. I extend the Kogan and Papanikolaou (2014) model by labor as a production factor and establish the link between capital intensity and the investment shock. This model allows to study the cross-section of capital- and labor-intensive firms. I show that most of the model predictions are supported by the data. Differences in firm's exposure

[11] The higher volatility of the IMC portfolio results in considerably lower levels of firms' $\beta^{IMC}_{f,t}$. As mentioned above, this could be fixed by including an additional pricing factor for small firms instead of modelling this effect through the more volatile IMC portfolio.

to the IMC portfolio are reflected in (abnormal) stock returns among capital-intensive firms. In contrast, this pattern is much weaker or absent among labor-intensive firms. Moreover, the model allows a transparent analysis of an imprecise measure of investment shocks.

I show that the value premium is independent on capital intensity, which imposes limits on investment shocks as a general explanation for this return anomaly. This result has general implications for other production or investment based explanations of various asset-pricing anomalies. Since the cross-sectional variation in the productions factors may strongly affect the cross-sectional variation in the models' asset pricing implications, the particular stock return anomalies are expected to exhibit similar variation in the cross-section as well.

REFERENCES

Fisher, J. D. (2006). The dynamic effects of neutral and investment-specific technology shocks. *Journal of political Economy 114*(3), 413–451.

Garlappi, L. and Z. Song (2016a). Can investment shocks explain the cross-section of equity returns? *Management Science, forthcoming*.

Garlappi, L. and Z. Song (2016b). Capital utilization, market power, and the pricing of investment shocks. *Journal of Financial Economics, forthcoming*.

Gomes, J. F., L. Kogan, and M. Yogo (2009). Durability of output and expected stock returns. *Journal of Political Economy 117*(5).

Greenwood, J., Z. Hercowitz, and G. W. Huffman (1988). Investment, capacity utilization, and the real business cycle. *The American Economic Review*, 402–417.

Greenwood, J., Z. Hercowitz, and P. Krusell (1997). Long-run implications of investment-specific technological change. *The American Economic Review*, 342–362.

Greenwood, J., Z. Hercowitz, and P. Krusell (2000). The role of investment-specific technological change in the business cycle. *European Economic Review 44*(1), 91–115.

Justiniano, A., G. E. Primiceri, and A. Tambalotti (2010). Investment shocks and business cycles. *Journal of Monetary Economics 57*(2), 132–145.

Kogan, L. and D. Papanikolaou (2013). Firm characteristics and stock returns: The role of investment-specific shocks. *Review of Financial Studies 26*(11), 2718–2759.

Kogan, L. and D. Papanikolaou (2014). Growth opportunities, technology shocks, and asset prices. *The Journal of Finance 69*(2), 675–718.

Papanikolaou, D. (2011). Investment shocks and asset prices. *Journal of Political Economy 119*(4), 639–685.

VIII. Appendix A - Link between capital intensity and investment shocks

Table XVI: All firms, capital-intensity correlation

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
p1	1.00	0.74	0.71	0.71	0.71	0.70	0.67	0.64	0.62	0.61
p2	0.74	1.00	0.87	0.86	0.88	0.87	0.83	0.84	0.79	0.80
p3	0.71	0.87	1.00	0.88	0.88	0.88	0.86	0.85	0.86	0.84
p4	0.71	0.86	0.88	1.00	0.89	0.89	0.89	0.87	0.88	0.85
p5	0.71	0.88	0.88	0.89	1.00	0.92	0.88	0.89	0.88	0.88
p6	0.70	0.87	0.88	0.89	0.92	1.00	0.89	0.89	0.89	0.89
p7	0.67	0.83	0.86	0.89	0.88	0.89	1.00	0.88	0.90	0.87
p8	0.64	0.84	0.85	0.87	0.89	0.89	0.88	1.00	0.89	0.89
p9	0.62	0.79	0.86	0.88	0.88	0.89	0.90	0.89	1.00	0.92
p10	0.61	0.80	0.84	0.85	0.88	0.89	0.87	0.89	0.92	1.00

Note: The table shows pairwise correlation coefficients of portfolios sorted by capital intensity. The underlying time series is monthly returns from 1965 to 2015. p1 consists of stocks with lowest $\#\, emp/ppegt$, while p10 consists of stocks with highest $\#\, emp/ppegt$.

Table XVII: Consumption-goods firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
Panel A: CAPM										
mean	6.2	7.08	8.45	6.5	6.72	6.76	6.88	6.66	6.67	5.74
mean t-stat	3.47	3.81	4.19	3.07	3.27	3	3.06	2.74	2.63	2.06
sigma	14.5	15.09	16.39	17.2	16.68	18.3	18.24	19.72	20.66	22.6
alpha	1.52	1.95	2.77	0.46	0.8	0.29	0.46	-0.06	-0.49	-1.83
alpha t-stat	1.28	1.73	2.68	0.4	0.72	0.24	0.38	-0.04	-0.35	-1.07
beta	0.76	0.84	0.93	0.99	0.97	1.06	1.05	1.1	1.17	1.24
beta t-stat	28.31	30.25	35.99	39.4	40.36	35.51	39.09	32.67	30.88	29.73
r-squared	65.56	72.75	75.73	77.93	79.29	78.78	78.14	73.08	75.72	70.64
Panel A: CAPM										
FF alpha	1.72	2.62	3.98	1.17	1.1	1.42	1.63	0.92	-0.03	-1.23
FF alpha t-stat	1.57	2.41	3.57	1.02	0.94	1.19	1.38	0.79	-0.03	-0.96
FF mkt-beta	0.84	0.87	0.93	0.97	0.93	0.97	0.99	0.94	1.02	1.03
FF mkt-beta t-stat	28.35	36.39	33.98	38.58	35.08	34.57	34.86	33.71	32.99	30.92
FF HML-beta	0.04	-0.06	-0.18	-0.12	-0.08	-0.26	-0.24	-0.31	-0.23	-0.3
FF HML-beta t-stat	0.82	-1.18	-3.37	-2.74	-1.75	-4.45	-4.99	-5.38	-4.33	-4.72
FF SMB-beta	-0.3	-0.22	-0.15	-0.04	0.09	0.17	0.06	0.48	0.52	0.71
FF SMB-beta t-stat	-5.99	-6.41	-2.71	-0.99	2.24	3.61	1.47	8.06	10.15	11.44
FF r-squared	70.44	74.97	77.43	78.4	79.86	81.81	79.85	82.47	84.33	83.6
Panel B: Fama-French 3-factor										
Alpha FF-IMC	1.78	2.51	3.82	0.49	0.87	1.64	1.59	1.23	-0.15	-1.42
Alpha FF-IMC t-stat	1.53	2.21	3.3	0.43	0.72	1.31	1.27	1	-0.13	-1.06
Mkt-RF beta FF-IMC	0.85	0.88	0.94	1.01	0.95	0.97	1.01	0.94	1.04	1.04
Mkt-RF beta FF-IMC t-stat	27.38	36.61	30.79	39.9	33.77	33.49	33.99	33.03	33.4	31.29
HML beta FF-IMC	0.01	-0.08	-0.22	-0.17	-0.11	-0.25	-0.26	-0.33	-0.27	-0.31
HML beta FF-IMC t-stat	0.25	-1.77	-3.71	-4.18	-2.45	-4.36	-5.04	-5.6	-4.65	-4.58
SMB beta FF-IMC	-0.27	-0.2	-0.1	0.05	0.13	0.17	0.08	0.49	0.59	0.74
SMB beta FF-IMC t-stat	-5.12	-5.46	-1.94	1.4	3.9	3.53	1.8	7.55	10.73	10.32
IMC beta FF-IMC	-0.1	-0.07	-0.11	-0.23	-0.13	0.01	-0.09	-0.03	-0.15	-0.06
IMC beta FF-IMC t-stat	-2.07	-1.36	-2.27	-5.01	-2.91	0.17	-2.24	-0.72	-3.22	-1.02
r-squared FF-IMC	70.35	74.73	77.48	79.92	80.23	82.11	79.82	82.32	85.02	83.71
Panel D: Exposure to factors										
IMC beta	0.27	0.38	0.47	0.45	0.53	0.75	0.63	0.86	0.83	1
IMC beta t-stat	4.01	4.31	5.11	6.89	6.37	9.9	8.62	10.29	10.44	10.86
HML beta	-0.27	-0.41	-0.57	-0.56	-0.53	-0.75	-0.71	-0.86	-0.82	-0.95
HML beta t-stat	-2.97	-3.92	-5.31	-5.47	-5.55	-6.24	-6.59	-6.42	-6.33	-6.06
Panel E: Median firm characteristics										
cap_lab	5.90	14.10	20.61	25.91	31.29	36.71	42.85	50.50	61.78	79.36
BM	0.61	0.55	0.61	0.57	0.58	0.60	0.61	0.59	0.62	0.62
MVEQ	1250.34	1003.25	293.45	263.50	291.52	247.74	241.15	219.91	179.69	140.41
fin_lev	0.21	0.20	0.17	0.15	0.16	0.16	0.14	0.13	0.13	0.12
capx_sale	10.82	8.72	6.08	5.02	4.57	4.14	3.91	3.60	3.45	2.96
xrd_sale	2.64	5.32	4.09	3.88	3.60	3.63	4.08	4.58	4.84	4.37
emp_gr	0.47	1.68	1.61	3.20	3.76	3.72	4.68	6.29	6.48	7.76

Note: The stock return data is from CRSP and contains firms in consumption-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1963 to 2015. Columns 'p1' - 'p10' are portfolios sorted by capital intensity. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM). Panel B reports parameter estimates for Fama-French 3-factor model. Panel C: reports estimate from Fama-French 3-factor model augmented by the IMC portfolio. Panel E reports the median firm characteristics of each portfolio. Capital intensity, CAPX/sales and R%D/sales are multiplied by 100 for easier comparison.

Table XVIII: Investment-goods firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10
				Panel A: CAPM						
mean	6.3	4.45	5.81	5.85	8.27	7.84	7.61	6.57	5.72	5.12
mean t-stat	2.31	1.68	2.22	2.19	2.85	3.26	2.76	2.51	1.87	1.56
sigma	22.15	21.47	21.29	21.75	23.62	19.52	22.45	21.3	24.79	26.69
alpha	0.46	-2.67	-1.5	-1.7	0.29	0.91	-0.05	-0.8	-2.46	-3.52
alpha t-stat	0.18	-1.57	-1	-1.1	0.15	0.74	-0.03	-0.52	-1.22	-1.65
beta	0.95	1.16	1.2	1.23	1.3	1.13	1.25	1.2	1.34	1.41
beta t-stat	18.14	31.08	31.47	35.75	28.76	44.16	35.76	42.04	25.11	29.02
r-squared	43.79	69.28	74.39	75.94	71.91	79.26	73.47	75.41	68.59	65.94
				Panel B: Fama-French 3-factor						
FF alpha	-2.02	-3.07	-1.18	-1.44	2.16	1.15	0.54	-0.75	-0.81	-2.7
FF alpha t-stat	-0.82	-1.87	-0.73	-1	1.29	0.95	0.35	-0.55	-0.46	-1.5
FF mkt-beta	1.03	1.16	1.13	1.14	1.18	1.07	1.11	1.07	1.14	1.21
FF mkt-beta t-stat	19.33	31.57	22.15	35.43	30.33	36.78	31.55	40.22	24.53	22.18
FF HML-beta	0.45	0.06	-0.12	-0.14	-0.41	-0.09	-0.23	-0.14	-0.46	-0.33
FF HML-beta t-stat	4.3	0.87	-1.39	-1.93	-4.91	-1.77	-3.68	-2.26	-5.05	-3.03
FF SMB-beta	0.05	0.06	0.21	0.33	0.22	0.18	0.46	0.49	0.55	0.65
FF SMB-beta t-stat	0.61	1.24	2	6.64	3.77	3.79	6.62	9.86	7.3	5.36
FF r-squared	47.35	69.42	75.81	78.93	75.88	80.52	79.47	81.82	77.79	74.42
				Panel C: Fama-French 3-factor + IMC						
Alpha FF-IMC	-0.33	-1.99	-0.89	-0.36	3.26	1.49	0.56	-0.06	-0.5	-2.11
Alpha FF-IMC t-stat	-0.14	-1.75	-0.69	-0.31	2.27	1.23	0.37	-0.05	-0.31	-1.15
Mkt-RF beta FF-IMC	0.96	1.01	1	1.03	1.07	1.02	1.05	1.01	1.04	1.13
Mkt-RF beta FF-IMC t-stat	16.73	41.34	22.46	45.54	32.1	35.9	28.27	37.49	26.99	19.38
HML beta FF-IMC	0.52	0.32	0.09	0.06	-0.21	0.01	-0.1	-0.05	-0.28	-0.17
HML beta FF-IMC t-stat	4.97	7.56	1.42	1.44	-3.61	0.16	-1.7	-0.89	-4.6	-1.71
SMB beta FF-IMC	-0.11	-0.23	-0.01	0.09	-0.01	0.06	0.32	0.37	0.35	0.47
SMB beta FF-IMC t-stat	-1.1	-5.88	-0.16	2.28	-0.22	1.11	5.53	7.19	5.32	3.55
IMC beta FF-IMC	0.42	0.94	0.74	0.72	0.72	0.37	0.45	0.38	0.61	0.57
IMC beta FF-IMC t-stat	3.7	16.36	13.79	14.54	10.66	7.6	7.13	7.57	8.1	7.07
r-squared FF-IMC	51.41	84.21	85.25	88.07	83.24	83.32	82.47	84.4	82.09	77.73
				Panel D: Exposure to factors						
IMC beta	0.74	1.3	1.28	1.34	1.42	0.99	1.25	1.16	1.49	1.51
IMC beta t-stat	4.96	13.03	18.16	16.26	14.93	11.26	15.51	14.23	15.07	13
HML beta	-0.04	-0.49	-0.69	-0.74	-1	-0.63	-0.86	-0.75	-1.11	-1.05
HML beta t-stat	-0.29	-3.61	-4.44	-4.96	-6.59	-5.75	-5.71	-5.46	-6.56	-5.61
				Panel E: Median firm characteristics						
cap_lab	7.40	13.55	20.58	26.53	32.94	39.24	46.35	55.67	65.47	81.89
BM	0.65	0.69	0.68	0.66	0.66	0.70	0.66	0.63	0.59	0.62
MVEQ	607.51	482.95	411.15	276.39	245.59	249.03	189.18	172.77	133.56	89.14
fin_lev	0.25	0.20	0.17	0.17	0.17	0.15	0.17	0.16	0.14	0.14
capx_sale	14.02	7.49	6.53	4.97	4.77	4.01	3.62	3.64	3.27	3.01
xrd_sale	1.90	5.66	5.96	5.49	4.86	4.76	4.61	4.75	5.32	5.48
emp_gr	-0.20	0.69	1.64	1.90	3.03	2.62	3.26	3.50	5.94	7.07

Note: The stock return data is from CRSP and contains firms in investment-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1963 to 2015. Columns 'p1' - 'p10' are portfolios sorted by capital intensity. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM). Panel B reports parameter estimates for Fama-French 3-factor model. Panel C: reports estimate from Fama-French 3-factor model augmented by the IMC portfolio. Panel E reports the median firm characteristics of each portfolio. Capital intensity, CAPX/sales and R%D/sales are multiplied by 100 for easier comparison.

IX. Appendix B - Formulas and proofs

Present value of growth opportunities:

$$
\begin{aligned}
PVGO_{f,t} &= \mathbf{E}_t\Bigg[\int_t^\infty \frac{\pi_s}{\pi_t} x_s \left(z_s^{-1}(1-M)\right)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}} A\left(\epsilon_{f,t},1\right)^{\frac{-1}{\alpha_s-\hat{\alpha}_s}} \\
&\quad \times D\left(\hat{\alpha}_s, w\right)^{\frac{-\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}} \left[\left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}} - \left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}}\right] \lambda_{f,s} ds\Bigg] \\
&= x_t z_t^{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}} C\left(\alpha_s,\hat{\alpha}_s,w\right) \mathbf{E}_t\left[\int_t^\infty e^{-\rho_s(s-t)} \lambda_{f,s} A\left(\epsilon_{f,s},1\right)^{\frac{1}{\hat{\alpha}_s-\alpha_s}} ds\right] \\
&= x_t z_t^{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}} G\left(\epsilon_{f,t},\lambda_{f,t},\alpha_s,\hat{\alpha}_s,w\right)
\end{aligned} \tag{52}
$$

, where $\rho_s = r + \gamma_x\sigma_x - \mu_x - \frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\left(\mu_z - \gamma_z\sigma_z - \frac{1}{2}\sigma_z^2\right) - \frac{1}{2}\left(\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\right)^2\sigma_z^2$
and $C\left(\alpha_s,\hat{\alpha}_s,w\right) = D\left(\hat{\alpha}_s,w\right)^{\frac{\hat{\alpha}_s}{\hat{\alpha}_s-\alpha_s}}(1-M)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}}\left[\left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\alpha_s}{\alpha_s-\hat{\alpha}_s}} - \left(\frac{\hat{\alpha}_s}{\alpha_s}\right)^{\frac{\hat{\alpha}_s}{\alpha_s-\hat{\alpha}_s}}\right]$.

$$
\begin{aligned}
G\left(\epsilon_{f,t},\lambda_{f,t},\alpha_s,\hat{\alpha}_s,w\right) &= C\,\mathbf{E}_t\left[\int_t^\infty e^{\rho(s-t)}\lambda_{f,s} A\left(\epsilon_{f,t}\right)^{\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}} ds\right] \\
&= \begin{cases} \lambda_f\left(G_1\left(\epsilon_{f,t}\right) + \frac{\mu_L}{\mu_L+\mu_H}\left(\lambda_H-\lambda_L\right)G_2\left(\epsilon_{f,t}\right)\right) & ,\tilde{\lambda}_{f,t} = \lambda_H \\ \lambda_f\left(G_1\left(\epsilon_{f,t}\right) - \frac{\mu_H}{\mu_L+\mu_H}\left(\lambda_H-\lambda_L\right)G_2\left(\epsilon_{f,t}\right)\right) & ,\tilde{\lambda}_{f,t} = \lambda_L \end{cases}
\end{aligned} \tag{53}
$$

, where G_1 and G_2 are solutions to ordinary differential equations.

The present value of the re-sale of the capital of projects that are expected to arrive in future is:

$$
\begin{aligned}
NDVF_{s,t} &= \mathbf{E}_t\left[\int_t^\infty \frac{\pi_\tau}{\pi_t}\left(\int_\tau^\infty \delta e^{-\delta(u-\tau)}\frac{\pi_u}{\pi_\tau} x_\tau z_\tau^{-1}\bar{\lambda}\left(\int_{F_s} K_{f,t}^* df\right) du\right) d\tau\right] \\
&= \mathbf{E}_t\left[\int_t^\infty \frac{\pi_\tau}{\pi_t}\frac{\delta\bar{\lambda}}{\delta + r - \mu_x + \mu_z - \sigma_z^2 + \sigma_x\gamma_x - \sigma_z\gamma_z} x_\tau z_\tau^{-1}\left(\int_{F_s} K_{f,t}^* df\right) d\tau\right] \\
&= \int_t^\infty e^{-Q(\tau-t)}\bar{\lambda} M x_\tau z_\tau^{-1}\left(\int_{F_s} K_{f,t}^* df\right) d\tau \\
&= \frac{1}{Q}\bar{\lambda} M x_t z_t^{-1}\left(\int_{F_s} K_{f,t}^* df\right)
\end{aligned} \tag{54}
$$

Expected excess return on the positive demand component ($PDV_{s,t}$):

$$\begin{aligned}
\frac{1}{dt}\mathbf{E}_t\left[R_t^{PDV_s}\right]-r &= -cov\left(\frac{dPDV_{s,t}}{PDV_{s,t}},\frac{d\pi_t}{\pi_t}\right)=-cov\left(\frac{dx_t}{x_t}+\frac{\alpha}{\hat{\alpha}_s-\alpha}\frac{dz_t}{z_t},-\gamma_x dB_{x_t}-\gamma_z dB_{z_t}\right)\\
&= -cov\left(\sigma_x dB_{x_t}+\frac{\alpha}{\hat{\alpha}_s-\alpha}\sigma_z dB_{z_t},-\gamma_x dB_{x_t}-\gamma_z dB_{z_t}\right)\\
&= \sigma_x\gamma_x+\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\sigma_z\gamma_z
\end{aligned} \tag{55}$$

Expected excess return on the positive demand components ($NDVP_{s,t}$ and $NDVF_{s,t}$):

$$\frac{1}{dt}\mathbf{E}_t\left[R_t^{NDVP_s}\right]-r=-cov\left(\frac{dNDVP_{s,t}}{NDVP_{s,t}},\frac{d\pi_t}{\pi_t}\right)=\sigma_x\gamma_x-\sigma_z\gamma_z \tag{56}$$

$$\begin{aligned}
\frac{1}{dt}\mathbf{E}_t\left[R_t^{NDVF_s}\right]-r &= -cov\left(\frac{dNDVF_{s,t}}{NDVF_{s,t}},\frac{d\pi_t}{\pi_t}\right)=-cov\left(\frac{dx_t}{x_t}+\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\frac{dz_t}{z_t},-\gamma_x dB_{x_t}-\gamma_z dB_{z_t}\right)\\
&= -cov\left(\sigma_x dB_{x_t}+\sigma_z\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}dB_{z_t},-\gamma_x dB_{x_t}-\gamma_z dB_{z_t}\right)\\
&= \sigma_x\gamma_x+\frac{\alpha_s}{\hat{\alpha}_s-\alpha_s}\sigma_z\gamma_z
\end{aligned} \tag{57}$$

The expected excess return on the investment-goods firm is:

$$\begin{aligned}
\frac{1}{dt}\mathbf{E}_t\left[R_t^{I}\right]-r &= \sigma_x\gamma_x\left(\frac{PDV_{L,t}+PDV_{H,t}-NDV_{L,t}-NDV_{H,t}}{V_t^I}\right)\\
&\quad+\sigma_z\gamma_z\left(\frac{\alpha_L}{\hat{\alpha}_L-\alpha_L}\frac{PDV_{L,t}-NDVF_{L,t}}{V_t^I}+\frac{\alpha_H}{\hat{\alpha}_H-\alpha_H}\frac{PDV_{H,t}-NDVF_{H,f}}{V_t^I}\right.\\
&\quad\left.-\frac{NDVP_{L,t}+NDVP_{H,t}}{V_t^I}\right)\\
&= \sigma_x\gamma_x+\\
&\quad\sigma_z\gamma_z\frac{\frac{\alpha_L}{\hat{\alpha}_L-\alpha_L}\left(PDV_{L,t}-NDVF_{L,t}\right)+\frac{\alpha_H}{\hat{\alpha}_H-\alpha_H}\left(PDV_{H,t}-NDVF_{H,t}\right)}{V_t^I}+\\
&\quad\sigma_z\gamma_z\frac{NDVP_{L,t}+NDVP_{H,t}}{V_t^I}
\end{aligned} \tag{58}$$

, where I define $NPV_{s,t}=NDVP_{s,t}+NDVF_{s,t}$ for sake of simplicity.

The exposure of the IMC portfolio to each of the aggregate shocks x and IST shock z is:

$$\begin{aligned}\beta_t^{IMC,z} &= \frac{cov\left(R_t^{IMC}, \frac{dz_t}{z_t}\right)}{var\left(\frac{dz_t}{z_t}\right)} = \frac{cov\left(\sigma_z dB_{z_t}\left(INV\_Z_t - CONS\_Z_t\right), \sigma_z dB_{z_t}\right)}{var\left(\sigma_z dB_{z_t}\right)} \\ &= INV\_Z_t - CONS\_Z_t \end{aligned} \tag{59}$$

$$\begin{aligned}\beta_t^{IMC,x} &= \frac{cov\left(R_t^{IMC}, \frac{dx_t}{x_t}\right)}{var\left(\frac{dx_t}{x_t}\right)} = \frac{cov\left(-\sigma_x dB_{x_t} CFO\_X_t L\_DIFF, \sigma_x dB_{x_t}\right)}{var\left(\sigma_x dB_{x_t}\right)} \\ &= -CFO\_X_t L\_DIFF \end{aligned} \tag{60}$$

Firm $f's$ exposure to the IMC portfolio is:

$$\begin{aligned}\beta_{f,t}^{IMC} &= \frac{cov\left(R_{f,t}, R_t^{IMC}\right)}{var\left(R_t^{IMC}\right)} \\ &= \frac{cov\left(\sigma_x dB_{x_t} \frac{CFI_{f,t}+RS_{f,t}+PVGO_{f,t}}{V_{f,t}}, -\sigma_x dB_{x_t} CFO\_X_t L\_DIFF\right)}{var\left(R_t^{IMC}\right)} \\ &+ \frac{cov\left(\sigma_z dB_{x_t}\left(\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}\frac{PVGO_{f,t}}{V_{f,t}} - \frac{RS_{f,t}}{V_{f,t}}\right), \sigma_z dB_{z,t}\left(INV\_Z_t - CONS\_Z_t\right)\right)}{var\left(R_t^{IMC}\right)} \\ &= -\frac{\sigma_x^2\left(\frac{CFI_{f,t}+RS_{f,t}+PVGO_{f,t}}{V_{f,t}}\right) CFO\_X_t L\_DIFF}{\sigma_x^2\left(CFO\_X_t L\_DIFF\right)^2 + \sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2} \\ &+ \frac{\sigma_z^2\left(\frac{\alpha_s}{\hat{\alpha}_s - \alpha_s}\frac{PVGO_{f,t}}{V_{f,t}} - \frac{RS_{f,t}}{V_{f,t}}\right)\left(INV\_Z_t - CONS\_Z_t\right)}{\sigma_x^2\left(CFO\_X_t L\_DIFF\right)^2 + \sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2}\end{aligned} \tag{61}$$

$$factor_1 = -\sigma_x^2 \frac{CFO\_X_t\, L\_DIFF_t}{\sigma_x^2\left(CFO\_X_t\, L\_DIFF\right)^2 + \sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2} > 0 \tag{62}$$

$$factor_2 = \sigma_z^2 \frac{\left(INV\_Z_t - CONS\_Z_t\right)}{\sigma_x^2\left(CFO\_X_t\, L\_DIFF\right)^2 + \sigma_z^2\left(INV\_Z_t - CONS\_Z_t\right)^2} > 0 \tag{63}$$

X. Appendix C - Data

The CRSP monthly file has 2,528,862 entries after dropping financials and utilities by the Compustat sic code. Compustat 4-digit matching selects 570,598 entries for investment firms, 568,408 entries for consumption firms and 1,413,060 entries remain in the file. CRSP 4-digit matching selects 179,373 entries for investment firms, 317,607 entries for consumption firms and 916,080 entries remain in the file. CRSP 3-digit matching selects 164,392 entries for investment firms, 284,136 entries for consumption firms and 467,552 entries remain in the file. Compustat 3-digit matching selects 17,604 entries for investment firms and 65,570 entries for consumption firms. In total out of 2,528,862 entries 2,167,688 are selected, which means that ca 86% of the data were allocated in either of the two sectors.

The CRSP daily file has 51,432,868 entries after dropping financials and utilities by the Compustat sic code. Compustat 4-digit matching selects 11,964,790 entries for investment firms, 11,911,086 entries for consumption firms and 28,474,990 entries remain in the file. CRSP 4-digit matching selects 3,806,841 entries for investment firms, 6,729,157 entries for consumption firms and 17,938,992 entries remain in the file. CRSP 3-digit matching selects 3,455,239 entries for investment firms, 5,966,773 entries for consumption firms and 8,516,980 entries remain in the file. Compustat 3-digit matching selects 252,399 entries for investment firms and 1,158,323 entries for consumption firms. In total out of 51,432,868 entries 45,244,608 are selected, which means that ca 88% of the data were allocated in either of the two sectors. In terms of market capitalization, on average the consumption-goods sector and nvestment-goods sector are 61% and 29% of the aggregate market capitalization (excluding financials and utilities), respectively. On average, the aggregate market capitalization of the investment-goods sector amounts to 49% of the aggregate market capitalization of the consumption-goods sector.

For deflating the Property, Plant, Equipment, I use the consumption deflator from NIPA Table 1.1.9. row 9 (Gross private domestic investment - Nonresidential). This price series consists of price series for structures, equipment and intellectual property. The correlation coefficient between these three series is between 57% and 80%. The increase between 1950 and 2015 is for structures, equipment and intelectual property 1,453%, 172% and 341%, respectively.

XI. Internet Appendix A - $\beta_{f,t}^{IMC}$ sorting

Table XIX: Consumption-goods sector, IMC-monthly

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
Panel A: CAPM											
mean	5.95	4.08	5.23	4.63	5.58	4.46	2	3.33	4	2.68	-3.27
mean t-stat	3.54	2.26	2.78	2.27	2.54	1.85	0.78	1.22	1.27	0.72	-1.02
sigma	13.67	14.67	15.28	16.58	17.82	19.56	20.88	22.15	25.52	30.37	26.15
alpha	1.13	-1.51	-0.55	-1.9	-1.28	-3.14	-6.02	-5.19	-5.41	-8.1	-9.23
alpha t-stat	1.11	-1.69	-0.57	-2.18	-1.24	-2.87	-4.91	-4.02	-3.16	-3.64	-3.22
beta	0.74	0.86	0.89	1.01	1.06	1.17	1.24	1.31	1.45	1.66	0.92
beta t-stat	38.41	50.77	49.28	60.7	53.55	56.23	52.93	53.3	44.43	39.15	16.81
r-squared	66.9	77.93	76.89	83.46	79.71	81.24	79.33	79.56	73	67.74	27.91
Panel B: Fama-French 3-factor model											
FF alpha	1.17	-1.73	-0.93	-2.55	-1.74	-2.73	-5.72	-4.83	-4.42	-7.15	-8.32
FF alpha t-stat	1.29	-2.03	-0.99	-2.92	-1.67	-2.51	-4.79	-4.15	-2.77	-3.68	-3.46
FF mkt-beta	0.83	0.91	0.94	1.03	1.05	1.13	1.17	1.2	1.32	1.45	0.62
FF mkt-beta t-stat	44.95	52.92	49.49	58.39	49.82	51.36	48.57	51.16	40.85	36.9	12.78
FF HML-beta	0.07	0.08	0.1	0.12	0.06	-0.11	-0.11	-0.16	-0.28	-0.35	-0.41
FF HML-beta t-stat	2.29	3.14	3.46	4.54	1.95	-3.16	-2.88	-4.3	-5.57	-5.67	-5.44
FF SMB-beta	-0.36	-0.2	-0.14	0.01	0.12	0.13	0.24	0.43	0.44	0.8	1.16
FF SMB-beta t-stat	-13.76	-8	-4.97	0.39	4.1	4.18	6.9	12.61	9.36	14.11	16.58
FF r-squared	74.26	80.19	78.17	83.92	80.21	82.03	80.98	83.92	77.28	76.24	50.78
Panel C: Fama-French 3-factor model + IMC											
Alpha FF-IMC	-0.37	-2.5	-1.15	-2.23	-1.11	-2.05	-3.66	-2.76	-1.27	-3.22	-2.85
Alpha FF-IMC t-stat	-0.47	-3.02	-1.22	-2.55	-1.07	-1.91	-3.59	-2.81	-1	-2.11	-1.65
Mkt-RF beta FF-IMC	0.92	0.96	0.95	1.01	1.01	1.08	1.04	1.07	1.12	1.2	0.27
Mkt-RF beta FF-IMC t-stat	55.08	54.26	47.1	53.88	45.62	47.08	47.66	50.98	40.9	36.61	7.42
HML beta FF-IMC	0.04	0.07	0.1	0.13	0.07	-0.1	-0.07	-0.12	-0.23	-0.28	-0.32
HML beta FF-IMC t-stat	1.64	2.77	3.34	4.75	2.3	-2.88	-2.34	-4.02	-5.72	-5.9	-5.95
SMB beta FF-IMC	-0.21	-0.12	-0.11	-0.02	0.06	0.06	0.03	0.22	0.11	0.4	0.6
SMB beta FF-IMC t-stat	-8.44	-4.64	-3.82	-0.83	1.85	1.87	0.93	7.01	2.81	8.25	11.11
IMC beta FF-IMC	-0.46	-0.23	-0.07	0.1	0.19	0.2	0.61	0.62	0.94	1.17	1.63
IMC beta FF-IMC t-stat	-16.48	-7.79	-1.98	3.07	5.13	5.28	16.91	17.66	20.76	21.61	26.55
r-squared FF-IMC	81.26	81.72	78.28	84.12	80.9	82.7	86.35	88.75	85.74	85.53	75.01
Panel D: Exposure to factors											
beta-IMC-sort	-0.06	0.4	0.69	0.92	1.13	1.36	1.61	1.92	2.35	3.18	NaN
IMC beta	0.08	0.37	0.52	0.76	0.91	1.01	1.37	1.5	1.83	2.27	2.2
IMC beta t-stat	1.44	6.75	9.4	13.33	15.18	15.61	22.18	23.38	25.85	28.15	37.29
HML beta	-0.23	-0.29	-0.29	-0.35	-0.44	-0.65	-0.7	-0.81	-0.98	-1.19	-0.97
HML beta t-stat	-4.27	-5.07	-4.98	-5.45	-6.52	-9	-9.01	-9.91	-10.56	-10.81	-10.09
HML_cons	-0.15	-0.28	-0.27	-0.35	-0.47	-0.61	-0.69	-0.83	-0.94	-1.24	-1.08
HML_cons t-stat	-3.48	-6.16	-5.56	-6.81	-8.49	-10.09	-10.8	-12.71	-12.3	-13.86	-14.03
Panel E: Median firm characteristics											
cap_lab	28.68	33.13	35.74	36.02	37.83	39.26	38.80	40.45	42.13	44.14	
BM	0.56	0.61	0.66	0.69	0.69	0.71	0.73	0.72	0.75	0.70	
MVEQ	582.24	320.43	297.49	273.04	261.01	241.44	208.87	177.65	149.73	105.69	
fin_lev	0.21	0.20	0.21	0.21	0.20	0.21	0.21	0.20	0.21	0.22	
capx_sale	4.14	3.86	3.69	3.71	3.70	3.55	3.56	3.59	3.55	3.73	
emp_gr	2.23	1.90	1.94	1.53	2.09	2.05	2.28	2.28	2.76	2.95	
xrd_sale	1.94	1.94	1.93	2.02	2.46	2.69	2.94	4.39	5.42	8.55	

Note: The stock return data is from CRSP and contains firms in consumption-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p10' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from monthly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio. Panel D reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. The statistics are estimated from monthly returns. Panel E reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XX: Consumption-goods sector, IMC-monthly, labor pre-sort

	Capital-intensive firms						Labor-intensive firms					
	p1	p2	p3	p4	p5	low Hi-Lo	p1	p2	p3	p4	p5	high Hi-Lo
Panel A: CAPM												
mean	5.55	5.85	6.66	4.51	2.68	-2.87	5.23	2.29	5.41	6.01	4.85	-0.38
mean t-stat	3.31	3.13	2.96	1.78	0.86	-1.09	2.75	1.07	2.37	2.19	1.41	-0.13
sigma	13.63	15.17	18.3	20.61	25.22	21.31	15.45	17.41	18.54	22.32	27.97	23.29
alpha	0.8	0.22	-0.17	-3.22	-6.3	-7.11	-0.12	-4.08	-1.44	-2.04	-4.54	-4.42
alpha t-stat	0.81	0.24	-0.14	-2.44	-3.45	-2.93	-0.09	-3.19	-1.15	-1.23	-1.97	-1.54
beta	0.73	0.87	1.05	1.19	1.39	0.65	0.82	0.98	1.06	1.24	1.45	0.62
beta t-stat	27.32	40	34.38	38.42	30.04	10.3	24.02	29.84	31.12	32.09	23.62	7.55
r-squared	65.09	74.11	74.72	75.5	68.21	21.3	64.38	72.04	73.28	69.85	60.57	16.19
Panel B: Fama-French 3-factor model												
FF alpha	0.86	0.27	0.35	-3.11	-5.76	-6.61	-0.27	-4.9	-2.19	-2.02	-3.33	-3.06
FF alpha t-stat	0.98	0.3	0.27	-2.24	-3.49	-3.24	-0.23	-4.03	-1.77	-1.37	-1.52	-1.14
FF mkt-beta	0.82	0.92	1.05	1.14	1.22	0.4	0.86	0.97	1	1.12	1.26	0.4
FF mkt-beta t-stat	34.67	44.82	31.32	29.11	27.12	7.37	25.27	28.69	30.47	30.32	24.25	5.66
FF HML-beta	0.07	0.04	-0.09	-0.06	-0.23	-0.31	0.05	0.13	0.08	-0.11	-0.37	-0.42
FF HML-beta t-stat	1.62	0.79	-1.62	-0.81	-3.01	-3.15	0.78	1.74	1.24	-1.34	-3.15	-2.7
FF SMB-beta	-0.41	-0.23	-0.05	0.2	0.63	1.04	-0.12	0.17	0.35	0.52	0.65	0.77
FF SMB-beta t-stat	-16.88	-6.39	-1.18	2.3	7.96	12.51	-1.98	2.2	4.71	6.4	6.67	5.93
FF r-squared	74.55	76.4	74.97	76.55	75.52	47.84	65.09	73.17	76.56	75.54	68.05	30.95
Panel C: Fama-French 3-factor model + IMC												
Alpha FF-IMC	-0.77	-0.42	0.49	-2.94	-4.94	-4.16	-1.65	-5.57	-2.66	-1.86	-2.41	-0.76
Alpha FF-IMC t-stat	-0.96	-0.47	0.38	-2.01	-2.95	-2.07	-1.44	-4.66	-2.12	-1.25	-1.08	-0.29
Mkt-RF beta FF-IMC	0.93	0.96	1.04	1.13	1.17	0.24	0.94	1.02	1.03	1.11	1.2	0.25
Mkt-RF beta FF-IMC t-stat	49.25	46.12	29.86	24.76	26.24	5.13	30.93	30.5	28.44	27.34	21.1	3.47
HML beta FF-IMC	0.05	0.02	-0.09	-0.06	-0.22	-0.27	0.03	0.12	0.07	-0.11	-0.35	-0.38
HML beta FF-IMC t-stat	1.5	0.59	-1.58	-0.78	-2.83	-3.01	0.53	1.68	1.15	-1.32	-3.16	-2.77
SMB beta FF-IMC	-0.25	-0.16	-0.07	0.18	0.55	0.79	0.02	0.23	0.39	0.5	0.56	0.53
SMB beta FF-IMC t-stat	-9.48	-4.24	-1.39	2.29	6.41	8.58	0.39	3.02	6.22	6.43	5.85	4.59
IMC beta FF-IMC	-0.49	-0.2	0.04	0.05	0.24	0.73	-0.41	-0.2	-0.14	0.05	0.28	0.69
IMC beta FF-IMC t-stat	-11.42	-5.17	0.79	0.8	3.72	9.01	-6.94	-3.29	-2.11	0.81	2.76	5.96
r-squared FF-IMC	82.49	77.53	75	76.59	76.1	55.16	69.46	73.99	76.93	75.57	68.65	36.34
Panel D: Exposure to factors												
beta-IMC-sort	0.04	0.57	0.97	1.44	2.27	NaN	0.17	0.7	1.11	1.58	2.43	NaN
IMC beta	0.03	0.39	0.75	0.95	1.38	1.35	0.26	0.6	0.76	1.1	1.47	1.21
IMC beta t-stat	0.44	4.53	8.9	8.15	15.17	18.19	3.03	5.81	6.71	10.6	12.52	9.57
IMC beta FF-IMC	-0.49	-0.2	0.04	0.05	0.24	0.73	-0.41	-0.2	-0.14	0.05	0.28	0.69
IMC beta FF-IMC t-stat	-11.42	-5.17	0.79	0.8	3.72	9.01	-6.94	-3.29	-2.11	0.81	2.76	5.96
HML beta	-0.21	-0.33	-0.56	-0.63	-0.94	-0.73	-0.31	-0.36	-0.46	-0.74	-1.09	-0.78
HML beta t-stat	-2.21	-3.22	-5.38	-4.5	-6.02	-4.23	-2.88	-3.22	-4.44	-5.03	-5.97	-3.82
HML_cons	-0.12	-0.26	-0.45	-0.6	-1.05	-0.93	-0.32	-0.42	-0.53	-0.84	-1.19	-0.88
HML_cons t-stat	-1.59	-3.06	-6.02	-5.36	-12.49	-9.35	-3.18	-4.13	-5.36	-8.31	-12.42	-6.81
Panel E: Median firm characteristics												
cap_lab	16.92	21.15	22.22	23.00	22.28	NaN	59.69	60.94	63.88	65.63	65.77	NaN
BM	0.52	0.63	0.68	0.68	0.69	NaN	0.67	0.73	0.74	0.76	0.73	NaN
MVEQ	970.98	509.43	360.47	256.08	170.36	NaN	150.11	193.92	199.80	148.87	97.75	NaN
fin_lev	0.23	0.22	0.23	0.23	0.25	NaN	0.17	0.18	0.18	0.17	0.19	NaN
capx_sale	5.92	5.40	5.47	5.46	6.10	NaN	2.48	2.56	2.62	2.61	2.63	NaN
emp_gr	1.41	1.03	1.29	1.68	1.57	NaN	3.34	3.02	3.06	3.57	3.84	NaN
xrd_sale	2.56	2.30	2.87	3.72	9.58	NaN	1.65	1.71	2.15	3.60	5.76	NaN

Note: The stock return data is from CRSP and contains firms in consumption-goods sector divided into capital and labor-intensive sub-sample. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p5' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from monthly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio. Panel D reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. The statistics are estimated from monthly returns. Panel E reports the median firm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXI: Both sectors, IMC-weekly, labor pre-sort

	Capital-intensive firms						Labor-intensive firms					
	p1	p2	p3	p4	p5	low Hi-Lo	p1	p2	p3	p4	p5	high Hi-Lo
Panel A: CAPM												
mean	6.38	6.12	5.73	5.09	4.27	-2.11	3.56	6.02	4.65	5.02	7.05	3.48
mean t-stat	3.63	3.43	2.71	2.14	1.37	-0.82	1.66	2.98	2.05	1.87	2.08	1.41
sigma	14.29	14.5	17.19	19.29	25.32	21.01	17.4	16.42	18.45	21.8	27.55	20.12
alpha	0.69	-0.32	-1.91	-3.32	-5.96	-6.65	-3.41	-1.11	-3.41	-4.29	-4.13	-0.72
alpha t-stat	0.69	-0.44	-2.29	-3.2	-3.44	-2.83	-2.81	-1.24	-3.46	-3.39	-2.22	-0.32
beta	0.79	0.9	1.07	1.17	1.43	0.63	0.97	0.99	1.12	1.3	1.56	0.59
beta t-stat	40.9	65.44	66.44	58.69	42.84	13.98	41.66	57.71	59.23	53.28	43.45	13.41
r-squared	68.25	84.63	85.02	81.58	70.23	20.07	69.04	81.06	81.85	78.49	70.82	18.79
Panel B: Fama-French 3-factor model												
FF alpha	0.89	-0.46	-1.92	-2.96	-4.97	-5.86	-3.26	-1.17	-3.1	-3.33	-2.03	1.23
FF alpha t-stat	0.95	-0.65	-2.28	-2.86	-2.98	-2.67	-2.75	-1.33	-3.59	-2.89	-1.34	0.57
FF mkt-beta	0.86	0.93	1.05	1.14	1.33	0.47	0.92	0.96	1.04	1.19	1.35	0.43
FF mkt-beta t-stat	45.75	65.42	62.08	54.48	39.43	10.61	38.42	54.15	59.65	51.54	44.21	9.98
FF HML-beta	0.01	0.04	-0.01	-0.09	-0.24	-0.25	-0.07	-0.01	-0.11	-0.25	-0.52	-0.45
FF HML-beta t-stat	0.24	2.02	-0.3	-2.6	-4.64	-3.63	-1.74	-0.46	-4.11	-6.74	-10.85	-6.67
FF SMB-beta	-0.35	-0.12	0.07	0.11	0.35	0.7	0.26	0.18	0.38	0.38	0.72	0.46
FF SMB-beta t-stat	-12.64	-5.97	2.88	3.52	7.08	10.74	7.43	6.99	14.97	11.09	15.99	7.16
FF r-squared	73.8	85.46	85.19	82.09	73.11	32.54	71.38	82.23	86.47	82.81	81.3	29.06
Panel C: Fama-French 3-factor model + IMC												
Alpha FF-IMC	-0.51	-0.89	-0.9	-1.13	-1.06	-0.55	-4.5	-1.75	-2.99	-2.26	0.43	4.93
Alpha FF-IMC t-stat	-0.6	-1.28	-1.14	-1.28	-0.9	-0.37	-3.98	-2.02	-3.44	-2.03	0.32	2.66
Mkt-RF beta FF-IMC	0.95	0.96	0.98	1.02	1.07	0.12	1	1	1.03	1.12	1.19	0.19
Mkt-RF beta FF-IMC t-stat	52.94	63.92	58.19	53.71	42.04	3.65	41.11	53.59	55.21	47.07	41.59	4.74
HML beta FF-IMC	-0.02	0.04	0.01	-0.05	-0.18	-0.16	-0.09	-0.02	-0.11	-0.23	-0.48	-0.39
HML beta FF-IMC t-stat	-0.67	1.7	0.41	-1.89	-4.71	-3.33	-2.45	-0.85	-4.02	-6.46	-11.37	-6.65
SMB beta FF-IMC	-0.21	-0.08	-0.03	-0.08	-0.05	0.15	0.39	0.24	0.37	0.27	0.47	0.08
SMB beta FF-IMC t-stat	-7.73	-3.62	-1.31	-2.87	-1.39	3.2	10.78	8.78	13.43	7.58	11.01	1.31
IMC beta FF-IMC	-0.43	-0.13	0.31	0.56	1.2	1.63	-0.38	-0.18	0.03	0.33	0.75	1.13
IMC beta FF-IMC t-stat	-14.17	-5.28	11.01	17.69	28.18	30.03	-9.32	-5.75	1.1	8.19	15.71	16.94
r-squared FF-IMC	79.19	85.96	87.19	87.24	86.72	68.82	74.27	82.96	86.49	84.18	85.82	48.23
Panel D: Exposure to factors												
beta-IMC-sort	-0.18	0.49	0.98	1.53	2.5	NaN	-0.24	0.48	0.97	1.54	2.5	NaN
IMC beta	0.14	0.49	0.99	1.25	1.96	1.82	0.53	0.64	0.96	1.29	1.91	1.39
IMC beta t-stat	2.69	9.45	18.04	21.66	30.1	39.75	8.32	11.12	15.76	18.91	24.28	23.96
HML beta	-0.26	-0.3	-0.45	-0.57	-0.86	-0.6	-0.49	-0.44	-0.62	-0.81	-1.22	-0.73
HML beta t-stat	-4.86	-5.53	-7.02	-8	-9.31	-7.66	-7.65	-7.23	-9.15	-10.33	-12.71	-10.04
HML_cons	-0.21	-0.32	-0.49	-0.59	-0.86	-0.65	-0.63	-0.55	-0.73	-0.86	-1.28	-0.66
HML_cons t-stat	-4.55	-7.14	-9.17	-9.83	-10.91	-9.63	-12.26	-11.23	-13.44	-13.38	-16.12	-10.32

Note: The stock return data is from CRSP and contains firms in investment-goods sector divided into capital and labor-intensive sub-sample. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p5' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from weekly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio. Panel D reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates.

Table XXII: Both sectors, IMC-monthly, labor pre-sort

	Capital-intensive firms						Labor-intensive firms					
	p1	p2	p3	p4	p5	low Hi-Lo	p1	p2	p3	p4	p5	high Hi-Lo
Panel A: CAPM												
mean	5.75	5.73	6.31	3.41	3.31	-2.44	5.12	4.57	6.16	3.19	6.2	1.08
mean t-stat	3.49	2.98	2.76	1.3	1.02	-0.91	2.75	2.15	2.59	1.15	1.81	0.4
sigma	13.38	15.63	18.56	21.23	26.29	21.7	15.13	17.3	19.3	22.51	27.8	21.65
alpha	0.8	-0.4	-0.92	-4.73	-6.1	-6.9	-0.38	-2.06	-1.21	-5.34	-3.94	-3.55
alpha t-stat	0.9	-0.47	-0.9	-3.77	-3.22	-2.8	-0.36	-2	-1.05	-3.84	-2.05	-1.46
beta	0.76	0.94	1.12	1.26	1.45	0.69	0.85	1.02	1.14	1.31	1.56	0.71
beta t-stat	45.03	58.61	57.11	52.5	40.16	14.64	42.38	52.15	51.46	49.71	42.75	15.44
r-squared	73.53	82.47	81.71	79.06	68.84	22.69	71.1	78.84	78.39	77.19	71.46	24.61
Panel B: Fama-French 3-factor model												
FF alpha	0.74	-0.59	-0.71	-4.36	-5.32	-6.06	-0.71	-2.69	-0.91	-5.28	-2.08	-1.37
FF alpha t-stat	0.98	-0.71	-0.68	-3.54	-2.98	-2.76	-0.67	-2.66	-0.82	-4.23	-1.26	-0.63
FF mkt-beta	0.85	0.98	1.11	1.19	1.31	0.47	0.87	1	1.07	1.2	1.36	0.49
FF mkt-beta t-stat	55.77	58.31	52.78	48	36.44	10.51	40.64	48.92	47.38	47.72	40.7	11.08
FF HML-beta	0.09	0.07	-0.04	-0.12	-0.25	-0.34	0.07	0.09	-0.11	-0.11	-0.49	-0.56
FF HML-beta t-stat	3.63	2.48	-1.28	-3.01	-4.42	-4.85	2.18	2.7	-3.17	-2.76	-9.29	-8.08
FF SMB-beta	-0.37	-0.14	0	0.22	0.47	0.84	-0.05	0.19	0.26	0.49	0.6	0.64
FF SMB-beta t-stat	-16.67	-5.61	0.06	6.07	9.1	13.15	-1.48	6.43	7.98	13.36	12.4	10.09
FF r-squared	81.54	83.44	81.76	80.47	73.14	40.62	71.41	80.06	80.6	82.13	79.38	40.55
Panel C: Fama-French 3-factor model + IMC												
Alpha FF-IMC	-0.59	-0.4	0.24	-1.86	-1.35	-0.76	-1.86	-2.93	-0.56	-3.99	0.28	2.15
Alpha FF-IMC t-stat	-0.92	-0.47	0.24	-1.92	-1.03	-0.52	-1.85	-2.87	-0.5	-3.35	0.19	1.12
Mkt-RF beta FF-IMC	0.93	0.97	1.05	1.03	1.06	0.13	0.94	1.02	1.04	1.12	1.21	0.27
Mkt-RF beta FF-IMC t-stat	68.18	54	48.66	49.99	37.86	4.13	43.74	46.55	43.59	43.89	37.73	6.51
HML beta FF-IMC	0.06	0.07	-0.03	-0.08	-0.18	-0.25	0.05	0.08	-0.11	-0.09	-0.45	-0.5
HML beta FF-IMC t-stat	3.22	2.6	-0.83	-2.5	-4.47	-5.37	1.71	2.58	-3.01	-2.33	-9.49	-8.32
SMB beta FF-IMC	-0.23	-0.16	-0.1	-0.04	0.07	0.3	0.07	0.21	0.22	0.35	0.36	0.28
SMB beta FF-IMC t-stat	-11.51	-5.92	-3.04	-1.26	1.65	6.45	2.29	6.69	6.35	9.45	7.58	4.72
IMC beta FF-IMC	-0.4	0.06	0.28	0.75	1.18	1.58	-0.34	-0.07	0.11	0.38	0.7	1.05
IMC beta FF-IMC t-stat	-17.38	1.9	7.96	21.73	25.38	30.09	-9.62	-1.94	2.65	9.08	13.21	15.39
r-squared FF-IMC	86.96	83.53	83.22	88.16	85.76	73.56	74.64	80.16	80.78	83.95	83.37	55.16
Panel D: Exposure to factors												
beta-IMC-sort	0.2	0.79	1.22	1.72	2.59	NaN	0.25	0.84	1.28	1.79	2.67	NaN
IMC beta	0.13	0.64	0.98	1.47	2	1.87	0.34	0.73	0.97	1.36	1.83	1.49
IMC beta t-stat	2.52	11.68	15.9	24.19	29.27	40.67	6	12.01	14.99	19.47	22.18	23.94
HML beta	-0.22	-0.35	-0.55	-0.71	-0.96	-0.74	-0.31	-0.41	-0.66	-0.77	-1.25	-0.93
HML beta t-stat	-4.16	-5.87	-7.85	-9.03	-9.93	-9.25	-5.4	-6.28	-9.21	-9.24	-12.63	-12.03
HML_cons	-0.15	-0.29	-0.47	-0.68	-0.92	-0.77	-0.33	-0.46	-0.65	-0.81	-1.2	-0.87
HML_cons t-stat	-3.55	-6	-8.1	-10.44	-11.52	-11.56	-7.06	-8.64	-11.13	-12.09	-15.14	-13.69

Note: The stock return data is from CRSP and contains firms in investment-goods sector divided into capital and labor-intensive sub-sample. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015. Columns 'p1' - 'p5' are portfolios sorted by $\beta_{f,t}^{IMC}$, which were estimated from monthly returns. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Average returns and sigmas are annualized. Panel A contains parameter estimates from single (market) factor asset pricing model (CAPM), Panel B: reports estimate from Fama-French 3-factor model. Panel C reports estimates from Fama-French 3-factor model augmented by the IMC portfolio. Panel D reports firms' median sorting-$\beta_{f,t}^{IMC}$ and exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates.

XII. Internet Appendix B - Value premium and capital intensity: investment firms and both sectors

Table XXIII: Full sample, low cap-lab ratio firms, all firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: CAPM						
mean	5.63	5.34	6.66	7.15	8.03	8.29	8.28	12.12	10.08	11.21	5.58
mean t-stat	2.45	2.48	3.36	3.51	4.07	3.88	3.73	5.11	3.86	3.71	2.1
sigma	18.64	17.48	16.12	16.52	16.02	17.35	18.05	19.26	21.23	24.55	21.62
alpha	-1.17	-1.39	0.39	0.91	2	1.9	1.74	5.14	2.85	3.69	4.86
alpha t-stat	-0.77	-1.27	0.45	0.88	1.85	1.55	1.23	3.17	1.5	1.41	1.4
beta	1.03	1.02	0.95	0.95	0.92	0.97	0.99	1.06	1.1	1.14	0.11
beta t-stat	31.46	38.57	44.64	37.1	35.11	34.07	24.93	29.14	28	16.99	1.23
r-squared	76.57	85.48	87.36	82	81.6	78.34	75.65	75.6	66.98	54.15	0.65
					Panel B: Fama-French 3-factor						
FF alpha	1.92	0.11	0.88	0.02	1.31	0.55	-0.62	2.21	-0.73	-2.16	-4.08
FF alpha t-stat	1.64	0.12	1	0.02	1.32	0.49	-0.52	1.73	-0.46	-1.13	-1.88
FF mkt-beta	0.97	1	0.95	0.97	0.95	1.03	1.05	1.12	1.15	1.18	0.21
FF mkt-beta t-stat	38.1	45.55	45	38.61	37.11	40.23	35.01	39.61	29.14	30.32	4.78
FF HML-beta	-0.57	-0.27	-0.09	0.17	0.15	0.28	0.45	0.54	0.61	0.95	1.52
FF HML-beta t-stat	-11.6	-6.9	-2.5	3.54	3.39	6.04	8.43	11.67	10.06	15.59	20.94
FF SMB-beta	-0.22	-0.12	-0.04	0.04	-0.01	0.01	0.13	0.21	0.36	0.7	0.92
FF SMB-beta t-stat	-5.16	-3.98	-1.16	0.8	-0.29	0.16	2.64	5.91	5.03	12.1	12.07
FF r-squared	85.46	87.87	87.65	83.01	82.46	80.76	81.3	83.11	76.22	73.41	56.43
					Panel C: Fama-French 3-factor + IMC						
Alpha FF-IMC	1.82	0.11	0.72	0.32	1.81	1.08	-0.14	3.15	0.5	-0.41	-2.22
Alpha FF-IMC t-stat	1.47	0.12	0.77	0.31	1.8	0.94	-0.12	2.53	0.33	-0.24	-1.07
Mkt-RF beta FF-IMC	0.96	0.98	0.94	0.95	0.91	0.98	1.01	1.07	1.07	1.09	0.13
Mkt-RF beta FF-IMC t-stat	37.38	45.03	40.23	35.58	34.38	37.07	35.81	38.37	28.71	29.01	2.87
HML beta FF-IMC	-0.56	-0.24	-0.07	0.22	0.2	0.35	0.53	0.62	0.71	1.06	1.61
HML beta FF-IMC t-stat	-10.86	-5.58	-1.68	4.22	4.27	7.6	10	12.15	12.9	17.38	22.72
SMB beta FF-IMC	-0.23	-0.15	-0.05	0	-0.07	-0.05	0.05	0.11	0.24	0.55	0.78
SMB beta FF-IMC t-stat	-5.08	-3.88	-1.18	0	-1.77	-1.03	1.15	2.82	3.82	10.37	10.96
IMC beta FF-IMC	0.03	0.08	0.05	0.13	0.19	0.22	0.26	0.3	0.38	0.46	0.42
IMC beta FF-IMC t-stat	0.73	2.09	1.26	2.72	4.31	5.16	4.43	5.91	5.1	6.57	5.81
r-squared FF-IMC	85.44	88.12	87.79	83.27	83.33	82.03	83.13	85.19	79.59	77.19	59.9
					Panel D: Exposure to factors						
IMC beta	0.72	0.7	0.61	0.61	0.62	0.65	0.68	0.75	0.86	0.95	0.23
IMC beta t-stat	7.47	8.56	8.56	7.87	7.79	7.87	6.9	6.87	7.96	6.93	1.64
HML beta	-0.97	-0.71	-0.52	-0.29	-0.29	-0.2	-0.08	-0.05	-0.02	0.21	1.18
HML beta t-stat	-7.48	-6.26	-5.28	-2.79	-2.85	-1.72	-0.74	-0.39	-0.15	1.25	7.98
					Panel E: Median firm characteristics						
cap_lab	22.18	24.05	23.07	22.65	21.29	21.20	22.76	20.12	21.14	23.07	
BM	0.13	0.26	0.35	0.44	0.53	0.63	0.73	0.86	1.03	1.28	
MVEQ	837.18	804.52	794.79	670.99	781.75	483.42	751.58	275.01	259.59	132.13	
fin_lev	0.16	0.16	0.17	0.19	0.18	0.20	0.19	0.20	0.19	0.19	
capx_sale	8.70	7.69	7.05	6.59	6.57	6.44	5.97	5.74	5.75	5.11	
emp_gr	7.08	6.72	5.28	3.91	3.12	2.44	0.69	0.29	-0.61	-1.53	
xrd_sale	10.81	6.77	5.82	4.22	3.62	3.31	3.01	2.70	3.08	2.84	

Note: The stock return data is from CRSP and contains capital-intensive firms in both consumption-goods and investment-goods sectors. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXIV: Full sample, high cap-lab ratio firms, all firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: CAPM						
mean	7.07	6.69	5.73	8.26	9.85	7.48	10.32	7.64	11.31	12.82	5.75
mean t-stat	2.42	2.86	2.31	3.35	4.15	2.87	4.07	2.89	4.01	4.08	2.23
sigma	23.7	19.02	20.14	19.99	19.31	21.17	20.6	21.49	22.9	25.54	20.98
alpha	-1.31	-0.45	-1.76	0.87	2.61	-0.25	2.96	0.21	3.63	4.93	6.24
alpha t-stat	-0.67	-0.36	-1.19	0.64	1.98	-0.15	1.64	0.11	1.83	1.86	1.74
beta	1.27	1.09	1.14	1.12	1.1	1.18	1.12	1.13	1.17	1.2	-0.07
beta t-stat	27.6	43.76	31.76	28.39	33.5	29.68	25.39	23.48	21.87	17.42	-0.8
r-squared	72.08	81.38	79.66	78.71	81.05	76.8	73.51	68.97	64.9	55.04	0.31
					Panel B: Fama-French 3-factor						
FF alpha	1.87	0.42	-2.4	0.1	1.46	-1.95	0.31	-3.3	0.02	-0.49	-2.35
FF alpha t-stat	1.21	0.36	-1.85	0.07	1.35	-1.28	0.23	-2.23	0.01	-0.29	-1.14
FF mkt-beta	1.1	1.03	1.07	1.08	1.03	1.1	1.04	1.08	1.06	1.1	0.01
FF mkt-beta t-stat	34.32	33.39	29.44	23.94	32.27	32.99	30.34	32.68	28.11	25.74	0.18
FF HML-beta	-0.74	-0.21	0	0.05	0.08	0.15	0.29	0.46	0.39	0.69	1.44
FF HML-beta t-stat	-9.94	-3.45	-0.03	0.59	1.22	1.57	4.68	7.7	6.74	10.04	16.55
FF SMB-beta	0.17	0.07	0.34	0.28	0.41	0.51	0.67	0.7	0.91	1.12	0.95
FF SMB-beta t-stat	3.15	0.86	4.85	3.2	6.08	6.22	16.83	13.88	16.13	15.31	12.77
FF r-squared	82.52	82.81	82.83	80.79	85.88	83.08	85.33	82.42	82.87	78.96	55.88
					Panel C: Fama-French 3-factor + IMC						
Alpha FF-IMC	2.46	0.49	-2.53	0.41	1.35	-1.9	-0.22	-3.61	0.44	-0.54	-3
Alpha FF-IMC t-stat	1.5	0.41	-1.85	0.28	1.23	-1.17	-0.16	-2.31	0.29	-0.3	-1.37
Mkt-RF beta FF-IMC	1.09	1.06	1.09	1.08	1.04	1.08	1.05	1.08	1.04	1.1	0.01
Mkt-RF beta FF-IMC t-stat	34.62	32.33	28.26	24.48	30.65	30.01	30.02	29.29	28.03	24.91	0.15
HML beta FF-IMC	-0.74	-0.26	-0.03	0.05	0.08	0.2	0.27	0.45	0.42	0.71	1.45
HML beta FF-IMC t-stat	-9.68	-4.35	-0.4	0.57	1.32	2.25	4.33	7.18	6.46	10.21	17.31
SMB beta FF-IMC	0.15	0.11	0.38	0.28	0.43	0.47	0.7	0.71	0.89	1.11	0.97
SMB beta FF-IMC t-stat	2.48	1.5	5.12	2.93	6.02	5.38	15.72	13.78	15.96	14.51	12.78
IMC beta FF-IMC	0.05	-0.15	-0.1	0.01	-0.03	0.13	-0.07	-0.03	0.1	0.05	0
IMC beta FF-IMC t-stat	0.88	-2.63	-1.89	0.26	-0.64	1.87	-1.52	-0.57	1.73	0.65	-0.05
r-squared FF-IMC	82.59	83.36	82.84	80.81	86.59	83.37	85.54	82.38	83.07	79.24	56.42
					Panel D: Exposure to factors						
IMC beta	1.06	0.64	0.73	0.76	0.76	0.92	0.77	0.76	0.96	0.94	-0.13
IMC beta t-stat	9.51	5.9	7.42	7.75	8.1	8.13	9.09	7.47	9.32	7.4	-0.76
HML beta	-1.31	-0.72	-0.59	-0.53	-0.52	-0.5	-0.37	-0.23	-0.34	-0.12	1.19
HML beta t-stat	-8.27	-5.35	-4.74	-3.9	-4.38	-3.17	-2.93	-1.64	-2.01	-0.65	10.74
					Panel E: Median firm characteristics						
cap_lab	67.10	61.53	62.78	67.85	65.73	67.44	66.01	67.38	71.07	64.29	
BM	0.13	0.24	0.33	0.42	0.52	0.62	0.74	0.88	1.06	1.33	
MVEQ	302.28	388.22	269.87	277.58	233.32	194.30	145.97	108.38	75.74	62.76	
fin_lev	0.11	0.09	0.11	0.13	0.15	0.16	0.16	0.16	0.17	0.18	
capx_sale	4.71	4.35	3.73	3.42	3.52	3.22	3.09	2.97	2.66	2.68	
emp_gr	15.88	14.69	12.84	9.96	7.94	6.39	4.42	3.82	3.09	0.85	
xrd_sale	9.47	6.31	4.63	3.78	3.05	2.64	2.10	2.27	1.94	1.48	

Note: The stock return data is from CRSP and contains labor-intensive firms in both consumption-goods and investment-goods sectors. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returnsy. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXV: Full sample, low and high cap-lab ratio firms, all firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-Lo
					Panel A: CAPM						
mean	5.97	5.79	6.7	7.26	7.47	8.16	8.8	11.52	10.75	12.27	6.3
mean t-stat	2.56	2.66	3.3	3.59	3.77	3.81	3.96	4.99	4.17	4.25	2.65
sigma	18.94	17.68	16.48	16.45	16.08	17.38	18.05	18.73	20.95	23.47	19.31
alpha	-1.15	-1.15	0.13	0.85	1.27	1.5	2.02	4.68	3.26	4.64	5.8
alpha t-stat	-0.87	-1.14	0.18	1.01	1.28	1.42	1.58	3.06	1.92	1.99	1.83
beta	1.08	1.06	1	0.98	0.94	1.01	1.03	1.04	1.14	1.16	0.08
beta t-stat	35.88	45.23	52.91	47.58	36.21	42.29	28.57	27.18	30.05	18.94	0.91
r-squared	81.46	88.84	91.58	87.72	85.57	84.51	81.27	76.66	73.66	60.78	0.39
					Panel B: Fama-French 3-factor						
FF alpha	1.81	0.55	0.48	0.22	0.56	-0.03	-0.26	1.53	-0.25	-0.81	-2.62
FF alpha t-stat	1.86	0.74	0.66	0.27	0.6	-0.03	-0.27	1.32	-0.19	-0.53	-1.49
FF mkt-beta	1	1.01	0.97	0.97	0.96	1.04	1.06	1.08	1.15	1.16	0.16
FF mkt-beta t-stat	44.75	56.8	56.56	51.41	40.23	52.78	38.82	38.85	38.63	36.8	4.25
FF HML-beta	-0.57	-0.33	-0.09	0.09	0.14	0.27	0.39	0.54	0.56	0.84	1.41
FF HML-beta t-stat	-13.49	-9.15	-2.67	2.31	3.03	5.32	8.23	13.28	10.82	15.68	22.67
FF SMB-beta	-0.14	-0.07	0.04	0.1	0.03	0.14	0.23	0.32	0.47	0.78	0.92
FF SMB-beta t-stat	-3.39	-2.41	1.56	2.75	0.75	3.53	5.58	9.1	8.14	15.62	13.87
FF r-squared	89.72	92.01	91.95	88.29	86.27	87.01	86.48	85.89	83.63	80.83	63.17
					Panel C: Fama-French 3-factor + IMC						
Alpha FF-IMC	1.98	0.5	0.23	0.55	0.83	0.35	0.01	2.31	0.7	0.23	-1.74
Alpha FF-IMC t-stat	1.92	0.65	0.3	0.64	0.86	0.35	0.01	2.05	0.55	0.16	-0.99
Mkt-RF beta FF-IMC	1	1.01	0.97	0.96	0.94	1	1.02	1.03	1.1	1.1	0.09
Mkt-RF beta FF-IMC t-stat	42.88	56.84	51.79	48.61	37.01	48.95	40.54	38.76	36.34	36.06	2.53
HML beta FF-IMC	-0.57	-0.33	-0.08	0.12	0.18	0.33	0.46	0.61	0.62	0.93	1.5
HML beta FF-IMC t-stat	-12.43	-8.12	-2.52	2.8	3.61	7.86	9.86	13.93	13.82	17.98	24.07
SMB beta FF-IMC	-0.15	-0.07	0.05	0.07	-0.01	0.08	0.16	0.24	0.39	0.67	0.82
SMB beta FF-IMC t-stat	-3.43	-1.87	1.63	1.71	-0.23	2.18	4.19	6.24	8.38	13.26	11.93
IMC beta FF-IMC	0.01	-0.01	0	0.1	0.12	0.2	0.23	0.25	0.27	0.35	0.34
IMC beta FF-IMC t-stat	0.15	-0.24	-0.08	2.39	2.64	5.22	4.54	5.72	3.96	5.66	4.98
r-squared FF-IMC	89.69	92.11	91.99	88.46	86.4	87.97	87.83	87.26	85.52	83.01	66.1
					Panel D: Exposure to factors						
IMC beta	0.76	0.69	0.63	0.66	0.6	0.7	0.73	0.74	0.86	0.94	0.18
IMC beta t-stat	7.88	9.12	8.67	8.11	7.04	8.21	7.77	7.14	8.05	7.38	1.34
HML beta	-1.01	-0.79	-0.56	-0.39	-0.32	-0.26	-0.17	-0.05	-0.11	0.09	1.1
HML beta t-stat	-7.79	-6.9	-5.56	-3.65	-3.03	-2.01	-1.48	-0.43	-0.75	0.54	7.78
					Panel E: Median firm characteristics						
cap_lab	41.76	42.38	41.72	38.82	40.52	38.41	34.30	39.63	39.20	38.77	
BM	0.13	0.24	0.34	0.43	0.52	0.63	0.74	0.87	1.04	1.31	
MVEQ	446.55	420.64	439.72	401.06	365.19	295.61	257.84	154.75	114.76	92.26	
fin_lev	0.13	0.12	0.14	0.16	0.17	0.18	0.18	0.18	0.18	0.18	
capx_sale	6.07	5.34	4.85	4.83	4.67	4.62	4.55	3.92	3.75	3.67	
emp_gr	11.23	10.63	8.19	5.95	5.17	4.11	2.14	1.13	0.67	-0.77	
xrd_sale	9.99	6.67	5.02	4.02	3.15	2.80	2.55	2.55	2.36	2.07	

Note: The stock return data is from CRSP and contains capital and labor-intensive firms in both consumption-goods and investment-goods sectors. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXVI: Full sample, low cap-lab ratio firms, investment-goods firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
Panel A: CAPM											
mean	2.1	4.63	4.14	5.78	8.45	7.75	8.65	8.86	12.5	12.02	9.92
mean t-stat	0.66	1.64	1.49	2.27	3.37	2.94	3.2	3.11	4.16	3.42	3.13
sigma	25.94	22.9	22.51	20.67	20.38	21.42	21.97	23.17	24.4	28.58	25.74
alpha	-6.46	-3.33	-3.73	-1.68	1.28	0.34	1.05	1.08	5.11	4.04	10.5
alpha t-stat	-2.46	-1.65	-1.84	-1.04	0.7	0.17	0.55	0.51	1.95	1.18	2.44
beta	1.3	1.21	1.2	1.13	1.09	1.13	1.16	1.18	1.12	1.21	-0.09
beta t-stat	21.36	26.54	30.13	31.13	24.95	23.38	26.9	22.86	21.22	18.49	-0.95
r-squared	62.66	69.51	70.45	74.98	71.38	68.94	68.96	65.15	52.95	44.95	0.28
Panel B: Fama-French 3-factor											
FF alpha	-3.21	-2.06	-3.42	-2.79	-0.31	-2.24	-1.61	-2.51	1.39	-1.45	1.75
FF alpha t-stat	-1.47	-1.05	-1.72	-1.79	-0.18	-1.32	-0.93	-1.34	0.59	-0.48	0.55
FF mkt-beta	1.14	1.12	1.14	1.15	1.13	1.16	1.16	1.22	1.1	1.23	0.09
FF mkt-beta t-stat	21.12	25.29	31.89	32.7	26.59	26.99	31.56	27.13	23.33	20.31	1.25
FF HML-beta	-0.73	-0.32	-0.13	0.19	0.3	0.44	0.41	0.6	0.54	0.86	1.59
FF HML-beta t-stat	-8.14	-5	-1.19	3.48	4.88	7.11	4.94	8.72	6.11	7.78	11.62
FF SMB-beta	0.1	0.14	0.15	0.11	0.1	0.27	0.37	0.4	0.62	0.75	0.65
FF SMB-beta t-stat	1.45	2.02	2.02	2.51	1.96	4.41	4.77	7.24	7.01	8.1	6.88
FF r-squared	70.53	72.01	71.39	75.93	73.35	73.66	74.34	73.1	62.64	58.25	37.43
Panel C: Fama-French 3-factor + IMC											
Alpha FF-IMC	-0.55	-0.96	-2.52	-1.51	0.56	-0.75	-0.05	-0.31	3.21	2.89	3.43
Alpha FF-IMC t-stat	-0.32	-0.61	-1.33	-1.12	0.37	-0.54	-0.04	-0.2	1.68	1.13	1.08
Mkt-RF beta FF-IMC	0.98	0.98	1.05	1.06	1.03	1.06	1.06	1.09	0.96	1.07	0.09
Mkt-RF beta FF-IMC t-stat	26.39	28.59	33.78	31.31	28.34	27.47	30.38	27.68	23.34	18.11	1.2
HML beta FF-IMC	-0.43	-0.07	0.02	0.35	0.46	0.61	0.57	0.81	0.73	1.08	1.51
HML beta FF-IMC t-stat	-7.24	-1.19	0.19	5.83	6.97	9.64	7.32	11.73	8.12	10.84	11.86
SMB beta FF-IMC	-0.23	-0.12	-0.02	-0.05	-0.06	0.07	0.18	0.16	0.4	0.45	0.67
SMB beta FF-IMC t-stat	-3.61	-2.31	-0.22	-1.11	-1.03	1.4	3	2.83	5.56	5.65	6.25
IMC beta FF-IMC	1.01	0.84	0.53	0.52	0.55	0.61	0.58	0.73	0.75	0.86	-0.14
IMC beta FF-IMC t-stat	13.87	12.81	5.69	8.48	7.13	9.2	6.12	10.13	7.44	7.69	-1.05
r-squared FF-IMC	82.56	82.63	75.75	81.28	79.14	80.65	80.76	81.96	72.58	67.93	38.41
Panel D: Exposure to factors											
IMC beta	1.66	1.39	1.14	1	0.96	1.03	1.07	1.14	1.22	1.28	-0.38
IMC beta t-stat	15.39	15.92	9.61	8.58	7.59	8.53	8.41	8.04	8.79	8.82	-2.28
HML beta	-1.3	-0.89	-0.71	-0.38	-0.26	-0.18	-0.23	-0.08	-0.14	0.09	1.38
HML beta t-stat	-7.61	-6.19	-4.46	-2.72	-2.18	-1.24	-1.53	-0.57	-0.89	0.49	8.85
Panel E: Median firm characteristics											
cap_lab	21.42	24.64	22.78	23.48	21.09	22.04	22.30	20.98	22.01	22.18	
BM	0.15	0.29	0.39	0.48	0.57	0.66	0.77	0.89	1.06	1.32	
MVEQ	1140.69	1207.74	833.98	713.62	549.07	472.58	342.50	271.89	240.83	141.41	
fin_lev	0.17	0.18	0.19	0.19	0.21	0.19	0.20	0.19	0.18	0.19	
capx_sale	11.16	8.84	7.93	6.99	7.36	6.50	6.12	5.56	5.52	5.22	
emp_gr	9.93	7.28	5.65	4.95	4.65	1.45	0.79	-0.33	-0.80	-2.38	
xrd_sale	8.78	6.33	5.50	5.04	4.02	3.88	4.01	3.96	4.16	4.06	

Note: The stock return data is from CRSP and contains capital-intensive firms in investment-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXVII: Full sample, high cap-lab ratio firms, investment-goods firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
Panel A: CAPM											
mean	4.02	4.85	3.78	7.63	10.71	5.33	13.26	11.55	11.43	17.09	13.07
mean t-stat	1.14	1.55	1.32	2.75	3.74	1.73	4.48	3.73	3.65	4.92	4.39
sigma	28.59	25.39	23.28	22.57	23.23	24.99	24.07	25.13	25.44	28.21	24.18
alpha	-5.23	-3.95	-4.38	-0.53	2.61	-3.06	5.27	3.42	3.7	8.45	13.68
alpha t-stat	-1.9	-1.79	-2.25	-0.32	1.36	-1.25	2.28	1.41	1.47	2.97	3.51
beta	1.41	1.34	1.24	1.24	1.23	1.28	1.21	1.24	1.18	1.31	-0.09
beta t-stat	25.75	25.02	33.99	33.13	28.26	19.53	23.65	22.8	20.64	19.13	-1.15
r-squared	60.41	69.3	70.87	75.44	69.96	64.95	63.47	60.38	53.2	54.05	0.37
Panel B: Fama-French 3-factor											
FF alpha	-2.78	-2.71	-4.45	-0.97	1.17	-3.63	3.66	0.33	0.57	4.37	7.15
FF alpha t-stat	-1.08	-1.44	-2.49	-0.63	0.72	-1.56	1.76	0.15	0.28	2.13	2.13
FF mkt-beta	1.2	1.19	1.13	1.15	1.16	1.18	1.1	1.18	0.98	1.15	-0.05
FF mkt-beta t-stat	20.39	21.7	29.92	31.62	24.49	23.54	23.53	23.66	20.47	21.11	-0.7
FF HML-beta	-0.68	-0.4	-0.15	-0.07	0.12	-0.05	0.08	0.39	0.2	0.39	1.07
FF HML-beta t-stat	-6.55	-3.68	-2.18	-1.01	1.25	-0.28	0.92	4.39	2.12	3.86	8.26
FF SMB-beta	0.38	0.34	0.41	0.39	0.46	0.41	0.65	0.66	1.13	1.16	0.78
FF SMB-beta t-stat	3.25	2.76	6.05	5.86	4.23	4.51	9.78	6.45	10.55	13.69	5.12
FF r-squared	68.58	74.27	75.04	78.87	74.15	68.05	71.24	68.83	74.37	72.44	25.11
Panel C: Fama-French 3-factor + IMC											
Alpha FF-IMC	-1.93	-1.86	-3.65	-0.24	2.02	-2.7	4.18	1.4	1.45	5	6.93
Alpha FF-IMC t-stat	-0.73	-0.94	-1.95	-0.16	1.21	-1.13	2.08	0.65	0.69	2.47	1.94
Mkt-RF beta FF-IMC	1.12	1.12	1.07	1.08	1.12	1.09	1.03	1.13	0.93	1.1	-0.03
Mkt-RF beta FF-IMC t-stat	18.38	20.4	26.83	30.38	22.54	22.36	21.84	23.22	18.95	22.2	-0.37
HML beta FF-IMC	-0.51	-0.27	-0.04	0.06	0.23	0.14	0.18	0.41	0.3	0.52	1.03
HML beta FF-IMC t-stat	-5.03	-2.67	-0.58	0.86	2.11	1.03	2.25	4.21	3.12	5.22	7.87
SMB beta FF-IMC	0.19	0.18	0.28	0.25	0.36	0.22	0.52	0.61	1.03	1.05	0.86
SMB beta FF-IMC t-stat	1.53	1.35	3.63	3.75	2.81	2.32	7.37	5.18	9.61	13.02	5.64
IMC beta FF-IMC	0.55	0.45	0.37	0.42	0.32	0.59	0.36	0.19	0.32	0.38	-0.16
IMC beta FF-IMC t-stat	5.92	5.1	5.36	6.23	3.86	5.03	3.35	1.76	3.82	4.53	-1.26
r-squared FF-IMC	71.39	76.51	76.87	81.44	75.76	72.35	73.12	69.66	75.78	74.54	26.09
Panel D: Exposure to factors											
IMC beta	1.51	1.31	1.16	1.16	1.06	1.29	1.15	0.98	1.24	1.32	-0.19
IMC beta t-stat	12.03	9.59	12.71	12.36	8.95	7.93	8.99	6.74	8.97	10.67	-1.13
HML beta	-1.34	-1.05	-0.79	-0.71	-0.55	-0.71	-0.61	-0.34	-0.56	-0.45	0.89
HML beta t-stat	-7.18	-5.76	-5.41	-5.24	-3.59	-3.11	-4.18	-2.05	-2.48	-1.94	4.35
Panel E: Median firm characteristics											
cap_lab	74.00	71.18	67.02	69.79	59.42	69.28	62.76	60.71	62.78	64.33	
BM	0.15	0.26	0.35	0.44	0.52	0.61	0.73	0.84	1.00	1.23	
MVEQ	240.63	312.41	310.20	302.38	282.64	182.47	132.44	94.03	71.16	43.31	
fin_lev	0.13	0.13	0.13	0.15	0.16	0.15	0.16	0.15	0.15	0.16	
capx_sale	4.79	3.96	3.61	3.49	3.88	3.24	3.28	2.96	2.91	2.67	
emp_gr	16.01	15.26	9.97	7.70	7.69	6.52	5.82	2.75	3.44	0.82	
xrd_sale	10.06	6.87	5.43	5.22	4.71	4.68	4.47	4.35	4.35	4.32	

Note: The stock return data is from CRSP and contains labor-intensive firms in investment-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returnsy. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.

Table XXVIII: Full sample, low and high cap-lab ratio firms, investment-goods firms

	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	Hi-lo
					Panel A: CAPM						
mean	2.62	4.89	3.33	5.51	9.12	7.18	8.86	10.8	11.49	12.38	9.76
mean t-stat	0.83	1.73	1.22	2.27	3.65	2.72	3.36	4.11	4.09	3.9	3.53
sigma	25.58	22.92	22.1	19.76	20.32	21.42	21.42	21.34	22.82	25.76	22.48
alpha	-6.01	-3.51	-4.85	-1.82	1.69	-0.66	1.2	3.29	4.02	4.47	10.48
alpha t-stat	-2.37	-2.07	-3.11	-1.31	1.08	-0.39	0.67	1.81	1.8	1.58	2.68
beta	1.31	1.28	1.24	1.11	1.13	1.19	1.17	1.14	1.14	1.2	-0.11
beta t-stat	23.47	32.37	40.07	37.7	30.06	27.23	29.6	28.59	24.66	20.09	-1.28
r-squared	65.62	77.51	79.06	79.31	77.2	77.12	73.71	71.25	61.79	54.38	0.59
					Panel B: Fama-French 3-factor						
FF alpha	-2.77	-2.03	-4.7	-2.51	0.22	-2.05	-1.39	0.1	0.56	-0.42	2.35
FF alpha t-stat	-1.34	-1.34	-3.1	-1.85	0.15	-1.3	-0.89	0.06	0.29	-0.17	0.83
FF mkt-beta	1.12	1.16	1.17	1.09	1.14	1.17	1.16	1.15	1.08	1.19	0.07
FF mkt-beta t-stat	21.42	32.22	37.31	37.31	31.38	31.13	35.26	36.21	26.45	26.1	1.28
FF HML-beta	-0.78	-0.39	-0.13	0.07	0.24	0.18	0.39	0.5	0.45	0.73	1.51
FF HML-beta t-stat	-9.05	-6.76	-1.67	1.22	3.78	2.06	5.97	9.14	6.12	9.53	13.8
FF SMB-beta	0.22	0.19	0.24	0.19	0.19	0.28	0.4	0.43	0.69	0.75	0.53
FF SMB-beta t-stat	2.81	3.68	4.21	4.26	3.27	4.84	6.62	10.51	8.32	12.77	6.46
FF r-squared	75.73	81.4	80.95	80.29	79.01	79.25	79.41	79.24	73.54	68.36	43.06
					Panel C: Fama-French 3-factor + IMC						
Alpha FF-IMC	-0.8	-0.92	-3.6	-1.48	1.34	-0.99	0	1.9	1.96	2.89	3.69
Alpha FF-IMC t-stat	-0.46	-0.75	-2.63	-1.28	1.02	-0.77	0	1.5	1.27	1.54	1.33
Mkt-RF beta FF-IMC	0.99	1.04	1.09	1.01	1.05	1.06	1.06	1.06	0.95	1.06	0.06
Mkt-RF beta FF-IMC t-stat	25.09	38.3	38.29	37.86	29.35	35.14	37.1	34.7	26.81	27.07	1.19
HML beta FF-IMC	-0.52	-0.17	0.01	0.21	0.39	0.38	0.53	0.64	0.63	0.91	1.43
HML beta FF-IMC t-stat	-7.41	-3.38	0.17	3.46	5.89	6.54	8.83	12.07	10.51	13.19	13.5
SMB beta FF-IMC	-0.06	-0.04	0.08	0.03	0.03	0.07	0.22	0.26	0.49	0.5	0.56
SMB beta FF-IMC t-stat	-0.74	-0.8	1.47	0.59	0.51	1.5	4.59	5.95	8.25	9.4	6
IMC beta FF-IMC	0.84	0.72	0.51	0.5	0.52	0.65	0.54	0.52	0.67	0.72	-0.12
IMC beta FF-IMC t-stat	12.85	13.9	7.21	7.67	7.28	11.79	6.51	6.83	8.57	9.45	-1.16
r-squared FF-IMC	84.3	89.42	85.05	85.48	84.04	86.66	85.16	85.25	81.98	77.56	44.69
					Panel D: Exposure to factors						
IMC beta	1.61	1.4	1.19	1.03	1	1.17	1.07	1.02	1.22	1.22	-0.38
IMC beta t-stat	15.57	15.32	12.47	9.46	7.73	11	9.14	7.95	10.64	9.43	-2.84
HML beta	-1.36	-0.99	-0.75	-0.49	-0.35	-0.44	-0.26	-0.15	-0.24	-0.02	1.34
HML beta t-stat	-8.03	-6.81	-4.79	-4.22	-2.72	-2.56	-1.86	-1.17	-1.45	-0.14	9.99
					Panel E: Median firm characteristics						
cap_lab	42.31	47.45	46.12	41.87	46.95	42.29	37.32	34.75	39.67	35.53	
BM	0.14	0.27	0.36	0.45	0.54	0.64	0.75	0.87	1.03	1.28	
MVEQ	531.65	542.61	498.06	467.92	331.82	290.34	234.34	163.06	113.17	83.32	
fin_lev	0.14	0.15	0.15	0.17	0.17	0.18	0.18	0.17	0.17	0.17	
capx_sale	6.48	5.64	4.72	5.13	4.82	4.70	4.39	4.24	4.13	3.71	
emp_gr	11.53	10.21	7.63	6.96	5.41	3.01	2.12	0.61	0.65	-1.26	
xrd_sale	9.13	6.58	5.45	4.76	4.49	3.93	4.00	4.21	4.08	4.05	

Note: The stock return data is from CRSP and contains capital and labor-intensive firms in investment-goods sector. Factor returns are from Kenneth French's website. The data covers the period from 1950 to 2015 for IMC and HML estimates and 1965-2015 for HML_cons estimates. Columns 'p1' - 'p10' are portfolios sorted by book-to-market ratio. Column 'Hi-Lo' is a long-short portfolio consisting of p10-p1. The statistics are estimated from monthly returns. Panel A reports the return characteristics from single-factor market model. Panels B and C show parameter estimates for Fama-French 3-factor model and Fama-French 3-factor model augmented by the IMC portfolio, respectively. Panel C reports exposure to various factors. Coefficients without FF are from univariate regressions and coefficients with FF are from multivariate regression controlling for Fama-French 3 factors. Panel D reports the median
rm characteristics. Capital intensity is multiplied by 1000 factor. CAPX/sales, employee growth and R&D/sales are multiplied by 100 and hence in % of sales.