ISSN 0956-8549-728

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**FINANCIAL MARKETS GROUP**
**DISCUSSION PAPER No 728**

**February 2014**

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M. CECILIA BUSTAMANTE and ANDRÉS DONANGELO†

## ABSTRACT

This paper shows that product market competition has two opposing effects on asset returns. The first relates to the procyclical nature of the value destruction from expansion of competitors, which lowers exposure to systematic risk in more competitive industries. The second is related to the narrower profit margins due to competition, which increase exposure to systematic risk. We find that the first effect dominates the second, so that firms in more competitive industries generally earn lower asset returns. Our results are robust to using five alternative measures of competition and to controlling for the sample selection bias of publicly-listed firms.

*This version: January 2014.

†Cecilia is with the Department of Finance, London School of Economics, and Andrés is with the Finance Department, University of Texas at Austin. We thank Andres Almazan, Aydogan Alti, Andrea Buffa, Laurent Frésard, Lorenzo Garlappi, Thomas Gilbert, Gerald Hoberg, Christian Julliard, Xiaoji Lin, Richard Lowery, Daniel Paravisini, Veronica Rappoport, Sheridan Titman, and seminar participants at Boston University, Tilburg University, University of Cambridge, University of Maryland, University of Minnesota Asset Pricing Conference, University of Rochester, University of Texas at Austin, Vienna Graduate School of Finance, the 2013 Western Finance Association Meeting, and the 2013 European Finance Association Meeting. All errors are our own.

A stock price represents the present discounted value of the future stream of cash flows accrued to a firm's shareholders. Intuition dictates that the competitive environment in which a firm operates should significantly affect both the level and the riskiness of these cash flows. Despite the economic relevance of product market competition, there has been no conclusive empirical evidence on its effect on stock returns.[1] A likely reason for this gap in the literature is that product market competition is not directly observable and is difficult to measure. This paper addresses this challenge with a comprehensive approach that shows that firms in highly competitive industries generally have lower loadings on systematic risk and earn lower asset returns. Moreover, our methodology sheds light on the economic mechanisms through which competition affects a firm's exposure to systematic risk.

We hypothesize that product market competition affects a firm through two main channels: an investment channel and an operating leverage channel. The investment channel is related to the well-known theoretical prediction that competition erodes the value of growth options.[2] A direct implication of this channel is that a firm in a more competitive industry has higher earnings-to-price and book-to-market ratios since more of its value is generated by assets in place as opposed to growth options. The operating leverage channel is related to the fact that a firm in a more competitive industry has lower profit margins that buffer shocks to the firm. A direct implication of this channel is that a firm in a more competitive industry has operating profits that are more sensitive to shocks and therefore has higher levels of operating leverage.

The investment and operating leverage channels are consistent with the intuition that, unconditionally, product market competition reduces the value of a firm. Moreover, these channels imply that product market competition has two opposing effects on expected asset returns. Through the

[1]As we elaborate below, Hou and Robinson (2006) find that stock returns are negatively related to measures of industry concentration based on Compustat sales data. Ali, Klasa, and Yeung (2009) later shows that this result does not hold when measures of industry concentration that consider both public and private firms are used instead.

[2]See, for example, Leahy (1993) and Grenadier (2002) for discussions on this theoretical prediction.

investment channel, product market competition decreases expected asset returns by lowering the value of riskier growth options relative to safer assets in place. Through the operating leverage channel, product market competition increases expected asset returns by making profits more sensitive to systematic shocks. The net effect of product market competition on expected returns depends on the relative importance of the two channels and is thus an empirical question.

We find supporting empirical evidence for the existence of both channels, as well as for their implications for firm value and expected asset returns. Overall, we find that the investment channel dominates the operating leverage channel, so that product market competition is generally associated with lower average asset returns. This result is consistent with the idea that value destruction due to the threat of entry or expansion by competitors is procyclical, which effectively lowers a firm's expected returns in more competitive industries.

The challenge of our analysis is that an industry's competitive environment is not directly observable and that there is no consensus on the best way to measure it. To tackle this issue, we implement a broad empirical strategy and use five measures of imperfect product market competition (IPMC): (1) Herfindahl-Hirschman Index (HHI), (2) average industry markup, (3) characteristic-based concentration (CBC), (4) concentration and markup combined (CMC), and (5) text-based competition (TBC).

The widely-used HHI and the Markup measures capture the two traditional telltale signs of IPMC: concentration and market power. We construct the these two measures using U.S. Census data. A limitation of U.S. Census-based measures of IPMC is that they only cover manufacturing industries. Moreover, the HHI measure is only available for the period after 1982. The common workaround to these limitations is to construct concentration measures based on the subsample of publicly-listed firms. Ali et al. (2009) show that this solution is problematic since concentration measures based on Compustat data have low correlations with more representative concentration measures based on full samples of firms in each industry, such as those from the U.S. Census. We build upon this finding and present evidence that standard Compustat-based concentration measures are biased because the decision of firms to be publicly listed is affected by the industry's competitive environment. We construct the CBC measure using Compustat data adjusted for the likelihood of observing public firms in each industry. To the best of our knowledge, this is the first measure of industry competition based on publicly-listed firm data that incorporates the observation that the subsample of publicly-listed firms is nonrandom.

An additional concern is that industry concentration and average markup may not capture competition consistently in industries with nonclassical competitive environments, such as monopolistic competition or price wars. To address this issue, we construct the CMC measure which combines the CBC measure of industry concentration and the average industry markup. Finally, we consider the firm-specific text-based measure by Hoberg and Phillips (2010b) which we denote as "text-based competition" (TBC).[3] This measure is based on the product descriptions available in the 10-K filings of public firms to determine their closest competitors. The use of this fifth measure addresses the traditional concern in the industrial organization literature that market shares and markups are endogenous outcomes of competition.[4]

We further address the concern that even if product market competition was easily measurable, we only observe the market prices and stock returns of the publicly-listed firms. The use of a subsample of public firms would not be a problem if systematic differences between public and private firms within industries were unrelated to product market competition. Yet the empirical evidence suggests that a firm's public status is significantly influenced by the competitive environment in which it operates. For instance, Chemmanur, He, and Nandy (2010) document that the decision to go public is significantly affected by product markets. Similarly, in our working sample, we find

[3]We are grateful to Gerard Hoberg and Gordon Phillips for making the data available online.

[4]See, for instance, Baumol (1982) and Sutton (1998).

that the share of public firms in an industry is higher in less competitive industries. As a result, we test the relation between the asset returns of public firms and product market competition controlling for the sample selection bias of publicly-listed firms. The sample selection bias of public listing is potentially relevant for most empirical literature on the effects of industry characteristics on asset prices. To the best of our knowledge, this is the first work in asset pricing to raise this concern and address it empirically.

Our work relates to the growing empirical literature on the impact of competitive pressures on a firm's value and exposure to risk. Our findings contrast with those of Hou and Robinson (2006), who find that stock returns are negatively related to Compustat-based measures of industry concentration. Using portfolio sorts and Fama-MacBeth regressions that include our five IMPC measures, which are not subject to sample selection bias, we find that one-year-ahead returns and conditional market betas are higher in less competitive industries. These opposing results suggest the importance of considering both private and public firms when examining the link between product market competition and expected returns. Our findings relate to Hoberg and Phillips (2010a), who note that product market competition has a significant effect on asset prices. They document that average industry returns are more predictable in more competitive industries.

Our evidence on the investment channel relates to the empirical literature on the effects of competitive pressures on investment policies. The finding that firms in more competitive industries have higher earnings-to-price ratios is consistent with Bulan, Mayer, and Somerville (2009). They use real estate development data to show that competition erodes growth option values. Our paper also relates to Frésard and Valta (2013), who examine a sample of Compustat firms and suggest that competition has a significant effect on corporate investment.

Our evidence on the operating leverage channel relates to the finance literature on operating leverage. Novy-Marx (2011) documents that operating leverage increases firms' risk exposure.

We complement his work as we document that operating leverage is higher and contributes more significantly to the riskiness of firms in more competitive industries. Our results are also consistent with Ortiz-Molina and Phillips (2013). They report that firms with more illiquid assets have a higher cost of capital and that this effect is stronger in more competitive industries.

The investment and operating leverage channels are also consistent with existing models of oligopoly. For instance, Aguerrevere (2009), which builds upon Grenadier's (2002) model, predicts that stocks of firms in less competitive industries are expected to have higher returns when demand is high and lower returns otherwise.[5]

Lastly, we add to the empirical literature exploring differences in the risk-return profiles of public and private firms. In particular, our paper relates to the recent study by Cooper and Priestley (2013) on the riskiness of private firms. As a by-product of our approach, we find that private firms have lower earnings-to-price ratios, lower book-to-market ratios, lower operating leverage, and higher exposure to systematic risk than publicly-listed firms.

The rest of the paper proceeds as follows. In Section I, we elaborate on the main testable hypotheses. In Section II, we describe our empirical strategy. In Section III, we present and discuss the supporting empirical evidence. We conclude in Section IV.

# I. Hypothesis Development

In this section, we develop our hypotheses for the role of product market competition as it relates to a firm's value and exposure to systematic risk.[6] We start by considering a firm that operates

[5]Other related theoretical papers include Garlappi (2004), Bustamante (2013), and Carlson, Dockner, Fisher, and Giammarino (2013). While this literature focuses on the effect of intra-industry interactions on investment and expected returns, we focus instead the cross-section of average industry returns. The recent model by Loualiche (2013) also relates to our paper, insofar as it elaborates on the impact of entry by new firms on asset prices.

[6]Our hypotheses are consistent with models in the literature (e.g., those in Grenadier (2002) and Aguerrevere (2009)). For this reason, we briefly discuss our hypotheses using a decomposition of firm value and systematic risk loadings similar to that in Novy-Marx (2011). We present a model of an industry equilibrium consistent with our

in an industry, which represents the competitive environment. The price of the good produced by the firm is inversely related to total production in the industry. This feature is consistent with a downward-sloping demand curve, and implies that firms in the industry affect each other through production decisions.

The value $V$ of the firm can be expressed in terms of the present discounted value of cash flows generated when there are no changes in the capacity of the firm or the industry, $V^{A}$, and the present discounted value of future cash flows related to changes in the capacity of the firm or the industry, $V^{G}$, that is, $V = V^{A} + V^{G}$. We denote $V^{A}$ by "assets in place" and $V^{G}$ by "growth options," although the latter includes the value of standard growth options held by the firm, as well as the value destruction that arises from expected future capacity changes undertaken by the firm's competitors. To discuss the role of product market competition on operating leverage, we further decompose the value of assets in place into the present discounted value of revenues, $V^{R}$, and the present discounted value of operating costs, $V^{F}$. The value of the firm can thus be decomposed into three mutually exclusive components, $V = V^{R} - V^{F} + V^{G}$.

Based on the above decomposition of firm value, we also decompose the firm's exposure to systematic risk, $\beta$, in terms of the exposure to systematic risk of assets in place, $\beta^{A}$, and that of growth options, $\beta^{G}$, as follows:

$$\beta = \frac{V^{A}}{V}\beta^{A} + \left(1 - \frac{V^{A}}{V}\right)\beta^{G}. \tag{1}$$

We further decompose $\beta^{A}$ into the exposure to systematic risk of revenues, $\beta^{R}$, and of operating costs, $\beta^{F}$, and express $\beta$ as the weighted average of $\beta^{R}$, $\beta^{F}$, and $\beta^{G}$. After substituting for $\beta^{A}$ and

testable implications in the Appendix.

rearranging terms in equation (1), we obtain:

$$\beta = \beta^{\mathrm{G}} - \frac{V^{\mathrm{A}}}{V}\left(\beta^{\mathrm{G}} - \beta^{\mathrm{R}} - \frac{V^{\mathrm{F}}}{V^{\mathrm{A}}}\left(\beta^{\mathrm{R}} - \beta^{\mathrm{F}}\right)\right). \tag{2}$$

We hypothesize that product market competition affects a firm's value and expected returns through its effect on the ratio of the value of assets in place to total firm value, $\frac{V^{\mathrm{A}}}{V}$, and on operating leverage, that is, the ratio of the value of operating costs to total firm value, $\frac{V^{\mathrm{F}}}{V^{\mathrm{A}}}$. To show this, we first assume that revenues are riskier than operating costs and that growth options are riskier than assets in place, that is, $\beta^{\mathrm{R}} > \beta^{\mathrm{F}}$ and $\beta^{\mathrm{G}} > \beta^{\mathrm{A}} = \beta^{\mathrm{R}} + \frac{V^{\mathrm{F}}}{V^{\mathrm{A}}}\left(\beta^{\mathrm{R}} - \beta^{\mathrm{F}}\right)$. The first inequality is justified by the fact that a fraction of a firm's operating costs are fixed and thus unaffected by systematic risk, while variable costs should have exposures to systematic risk similar to those of revenues. The second inequality is supported by the findings in Bernardo, Chowdhry, and Goyal (2007), as well as our finding, which show that growth options have higher loadings on systematic risk than assets in place. Equation (2) shows that systematic risk loadings and therefore expected asset returns are increasing in operating leverage, $\frac{V^{\mathrm{F}}}{V^{\mathrm{A}}}$, and decreasing in the weight of assets in place, $\frac{V^{\mathrm{A}}}{V}$.[7]

In what follows, we use subscripts $M$ (i.e., "monopolistic") and $C$ (i.e., "competitive") to denote a firm in an industry with low levels of product market competition and a firm in an industry with high levels of product market competition, respectively. Hypothesis 1 is related to the effect of product market competition on the relative value of assets in place.

HYPOTHESIS 1 (Investment Channel): *All else equal, the ratio of assets in place to total firm value is lower in firms in less competitive industries than in otherwise identical firms in more*

[7] Conversely, expected asset returns are increasing in the relative weight of the value of growth options on total firm value, since $\frac{V^{\mathrm{A}}}{V} = 1 - \frac{V^{\mathrm{G}}}{V}$. We focus our discussion on the weight of assets in place, and not on that of growth options, to make it consistent with our empirical tests. In particular, $\frac{V^{\mathrm{A}}}{V}$ is conceptually related to observable financial variables, such as earnings-to-price and book-to-market ratios.

*competitive industries:*

$$\frac{V_{\mathrm{M}}^{\mathrm{A}}}{V_{\mathrm{M}}} < \frac{V_{\mathrm{C}}^{\mathrm{A}}}{V_{\mathrm{C}}}. \tag{3}$$

The intuition behind Hypothesis 1 is that product market competition erodes the growth option value of firms, which in turn makes assets in place relatively more valuable in more competitive industries. This hypothesis is consistent with the real options literature on competition.[8]

Hypothesis 2 is related to the effect of product market competition on operating leverage.

HYPOTHESIS 2 (Operating Leverage Channel): *All else equal, the degree of operating leverage of firms in less competitive industries is lower than that of firms in more competitive industries:*

$$\frac{V_{\mathrm{M}}^{\mathrm{F}}}{V_{\mathrm{M}}^{\mathrm{A}}} < \frac{V_{\mathrm{C}}^{\mathrm{F}}}{V_{\mathrm{C}}^{\mathrm{A}}}. \tag{4}$$

The intuition behind Hypothesis 2 is that product market competition reduces operating margins and thus the value of assets in place without greatly affecting the value of fixed operating costs. Fixed operating costs are unrelated to systematic risk and should thus be discounted at a rate close to the risk-free rate. This implies that, all else being the same, fixed operating costs carry greater weight on the value of assets in firms in more competitive industries.

Equation (2) shows that Hypotheses 1 and 2 imply opposing effects of product market competition on systematic risk loadings and thus on expected returns. The effect of product market competition on operating leverage (the operating leverage channel) increases expected returns, while the effect of product market competition on the relative value of growth options (the investment channel) decreases expected returns. Hypothesis 3 formalizes these two opposing effects of

[8] For instance, Grenadier (2002) shows that competition erodes the option value of waiting to invest, while Leahy (1993) shows that the value of future investment is effectively zero in the extreme case of perfect competition. In the Appendix, we show that the value of our broadly defined growth options becomes negative under perfect competition.

product market competition on expected returns.

HYPOTHESIS 3 (Opposing Effects of Product Market Competition on Expected Returns): *All else equal, the contribution of growth options to systematic risk loadings is decreasing, while that of operating leverage is increasing in the degree of product market competition in the industry.*

Hypothesis 3 highlights that the overall effect of product market competition on a firm's risk exposure is an empirical question. We investigate Hypothesis 1–3 in our empirical analyses.

# II. Empirical Strategy

Our broad strategy to test Hypotheses 1-3 is designed to address two main challenges. The first challenge is that the degree of IPMC in an industry is not directly observable and as such is difficult to measure. Moreover, there is no consensus in the industrial organization literature over a single best proxy for IPMC. Therefore, we consider five measures of IPMC, which we describe in greater detail later in this section.

The second challenge is that we only observe financial and accounting properties of publicly-listed firms. This would not pose a significant concern if the subsample of publicly-listed firms were random or unaffected by the variables of interest. However, the evidence shows that a firm's decision to be publicly listed is not random and is related to the level of IPMC in the industry (e.g., Chemmanur et al. (2010)). As a result, our analysis of the hypotheses based on the subsample of publicly-listed firms, for which we can observe financial and accounting data, is subject to a biased inference. We tackle this concern by correcting for the sample selection bias of public listing.

## *A. Data Sources and Definitions*

We define an industry as the universe of firms within the same four-digit Standard Industrial Classification (SIC) code. Our working sample combines data from different sources and covers the period from 1965 to 2011. We use data from the Bureau of Economic Analysis (BEA), the Comparative Effectiveness Research Program at the National Bureau of Economic Analysis (CER/NBER), and from the Census of Manufactures publications produced by the U.S. Census Bureau for variables related to industry-level characteristics.

We use financial and accounting data from both the Compustat and CRSP/Compustat Merged datasets (hereafter CCMD). Given that the Compustat dataset is more comprehensive, we compute the average industry characteristics of publicly-listed firms only using the annual Compustat files whenever possible. Annual stock returns are constructed as compounded monthly stock returns. Conditional market betas are estimated every year using monthly return data following the methodology in Lewellen and Nagel (2006). Market returns are from Kenneth French's website. We provide additional details on the database construction in the Appendix.

## *B. Measuring Product Market Competition*

The level of product market competition in an industry is determined by the dynamic interaction between firms inside and outside the industry, productive technologies, suppliers, workers, and customers, as well as aggregate economic conditions. The complexity of product market competition and its intrinsically unobservable nature represents a challenge for the study of its effect on firm risk. We partially address this problem by employing five alternative measures of IPMC.

*B.1. IPMC Measures Based on U.S. Census Data*

Two of our five measures of IPMC are constructed using U.S. Census data and are available for manufacturing industries only. The first measure of IPMC is the logarithm of the sales-based Herfindahl–Hirschman Index (HHI). HHI is the most commonly-used measure in the recent finance literature on competition and firm risk (Hoberg and Phillips (2010a)). The measure is defined as:

$$HHI_{it} \equiv \log \left[ \frac{1}{N_{it}} \sum_{j \in i} s_{jt}^2 \right], \tag{5}$$

where $s_j$ is the market share of sales of firm $j$ in industry $i$ and $N_i$ is the total number of firms in the industry.

We obtain HHI estimates from the Census of Manufactures publications of 1982, 1987, 1992, 1997, 2002, and 2007. Since the measure is only available every five years, we use the data from each year covered in the four subsequent years. We do not use data for a given year in previous years to avoid including forward-looking information (i.e., not available at the time to investors) in our empirical tests. We standardize the measure to four-digit SIC levels using the methodology in Ali et al. (2009).[9]

Our second measure of IPMC is the average operating markup of the industry based on annual data from the NBER–CES Manufacturing Industry Database files on aggregate industry characteristics. We follow Allayannis and Ihrig (2001) and construct the measure as:

$$Markup_{it} \equiv \frac{Value\ of\ Sales_{it} + \Delta Inventories_{it} - Payroll_{it} - Cost\ of\ Materials_{it}}{Value\ of\ Sales_{it} + \Delta Inventories_{it}}. \tag{6}$$

The measure is a noisy indicator of the Lerner index and proxies for the market power of firms

[9] The census makes available the measure at the four-digit SIC level in 1982, 1987, and 1992, and at the six-digit NAICS level in 1997, 2002, and 2007. Six-digit NAICS measures are aggregated into corresponding four-digit SIC measures by weighting them by their squared share of the broader industry classification.

in an industry. NBER–CES data are available up to year 2009. We extend the series to 2011 by repeating the data from 2009 for the years 2010 and 2011.

### *B.2. Characteristics-based Concentration Measure*

Given that a large fraction of firms in the CCMD dataset belong to non-manufacturing industries, the use of the measures of competition described in the previous section would lead to a significant sample restriction. To extend our sample, we construct an alternative sales concentration measure, characteristic-based concentration (CBC), for both manufacturing and non-manufacturing industries.

We construct the CBC measure based on two main economic arguments. The first argument is that the sales-based HHI is a function of the number of firms in the industry ($N_i$) and of the cross-sectional mean ($\mu_{\text{sales},i}$) and population variance ($\sigma^2_{\text{sales},i}$) of a firm's sales in the industry:[10]

$$HHI_{it} = \log\left[\frac{1}{N_{it}}\left(\frac{\sigma^2_{\text{sales},it}}{\mu^2_{\text{sales},it}}+1\right)\right]. \tag{7}$$

The second argument is that we can compute the industry means and variances of the sales of private and public firms in any industry by adjusting the corresponding industry means and variances of publicly-listed firms for the probability of observing a public firm in each industry. Using the sample selection correction methodology that we describe in subsection II.C, we obtain unbiased estimates that consider all firms, public and private, for the average industry sales ($\hat{\mu}_{\text{sales},i}$), the cross-sectional variance of sales ($\hat{\sigma}_{\text{sales},i}$), and the total number of firms ($\hat{N}_i$), for all industries available in the Compustat dataset.

We construct the CBC measure by replacing $\mu_{\text{sales},i}$, $\sigma_{\text{sales},i}$, and $N_i$ by their unbiased estimates.

[10]The equality follows from the definitions of the HHI, $\mu_{\text{sales},i} \equiv \frac{\Sigma_{j\in i}\text{sale}_t}{N_i}$, and $\sigma^2_{\text{sales},i} \equiv \frac{\Sigma_{j\in i}(\text{sale}_t-\mu_{\text{sales},i})^2}{N_i}$, where $\text{sale}_t$ is sales of firm $j$.

The CBC measure is then given by:

$$CBC_{it} = \log\left[\frac{1}{\hat{N}_{it}}\left(\frac{\hat{\sigma}^2_{\text{sales},it}}{\hat{\mu}^2_{\text{sales},it}} + 1\right)\right]. \tag{8}$$

We provide further details on the construction of our CBC measure in the Appendix.

We construct the CBC measure for all industries in the CCMD dataset since 1965.[11] Panel A of Table I reports the 15 top and bottom industries in our sample sorted by the CBC measure. The list shows that most highly-competitive industries are service-based, while most low competition ones are manufacturing-based.

*<< Table I here >>*

Figure 1 provides validating evidence for the CBC measure. The figure shows the estimates and associated confidence intervals of regressions of CBC on HHI. The figure shows that the HHI measure is systematically positively related to the CBC measure. The figure shows that the CBC measure is significantly positively related to the HHI measure based on Census data.

### *B.3. Combined Measure of Concentration and Markup*

For most industries, industry concentration and average profit margins are positively correlated. For instance, in a perfectly competitive industry with many firms competing away profits, both concentration and markup measures are expected to be low. The opposite holds in a monopolistic industry: both concentration and margins are expected to be high since the market power of the monopolist that concentrates market share is likely to also assure high profit margins. In these

[11] The start of the sample period is limited by the availability of observations for the variables used to construct inverse Mills ratios in the first stage of the sample correction model. See the Appendix.

cases, the concentration measures (i.e., HHI and CBC) should lead to the same ranking of industries as the markup measure.

Unfortunately, there are instances in which industry concentration and profit margins are likely to diverge. For instance, concentration measures may be low in an industry under monopolistic competition with many firms producing differentiated products, although firms are able to retain high profit margins. Another example in which industry concentration and markups are likely to diverge is the case of an industry facing a price war (e.g., Betrand competition), where a small number of firms fiercely compete away profit margins.

The discussion above suggests that industry concentration and profit margins possibly contain independent pieces of information about IPMC in some industries. To consider this possibility, we construct an additional IPMC measure, the CMC measure, which combines industry concentration and profit margins. To construct the measure, we first standardize the markup and CBC measures, so that they each have mean zero and a standard deviation of one in any given year. The CMC measure is constructed as the sum of these standardized measures:

$$CMC_{it} = CBC_{it}^{Z} + Markup_{it}^{Z}, \tag{9}$$

where $CBC_{it}^{Z}$ and $Markup_{it}^{Z}$ are the standardized CBC and Markup measures, respectively.

Panel B of Table I reports the bottom and top 15 manufacturing industries sorted by the CMC measure. Since the CMC measure only covers manufacturing industries, there is no overlap between the top 15 industries in Panels A and B since most competitive industries in Panel A are service-based. Nevertheless, there is a significant overlap between the panels among the least competitive industries. In particular, the least competitive industries in both panels are Pharmaceutical Preparations and Biological Products, Except Diagnostic Substances.

### *B.4. Text-based Competition Measure*

While the HHI and markup measures are pervasively used as proxies for product market competition, they are subject to the criticism of being endogenous industry equilibrium outcomes. For instance, market shares and profit margins are determined in equilibrium by firms' past investment decisions, macroeconomic conditions, and industry intrinsic contestability, as discussed by Baumol (1982).

To address this concern, we consider the competition measure (TBC) by Hoberg and Phillips (2010b). The TBC measure is based on a new industry classification method based on pairwise firm-similarity scores from product descriptions in firms' 10-K filings. Instead of using investment or market shares, the measure captures the level of similarity across firms' within each of the industries.[12]

As a caveat, the TBC measure is only available from year 1996 onwards. Furthermore, since the 10-K filings are only available for public firms, the TBC measure does not consider the existence of private firms that may compete with the public firms.

## *C. Sample Selection Correction*

We start by motivating the need to control for sample selection bias in our setting. Let the decision of a firm to be publicly listed be determined by an unobservable variable, $d_{ij}$. In particular, if $d_{ij} \geq \bar{d}$, then the firm chooses to be publicly listed and if $d_{ij} < \bar{d}$, the firm chooses to be private. Furthermore, assume that $d_{ij}$ is partially explained by some observable characteristics, as given by:

$$d_{ijt} = \gamma_t \mathbf{z}_{ij,t-1} + u_{ijt}, \tag{10}$$

[12] See Hoberg and Phillips (2010b) for details.

where $\mathbf{z}_{ij}$ is a vector of observable characteristics predetermined relative to $d_{ij}$ and $u_{ij}$ is the firm-specific deviation from the industry mean, such that $\mathrm{E}[u_{ij}] = 0$ and $\mathrm{Var}\left(u_{ij}\right) \equiv \sigma^2_{ui}$.[13] Let $h_{ij}$ denote a variable of interest (e.g., expected asset returns or sales) for firm $j$ in industry $i$. Without loss of generality, $h_{ijt}$ can be decomposed as:

$$h_{ijt} = \psi_t \mathbf{x}_{ij,t-1} + \varepsilon_{ijt}, \tag{11}$$

where $\mathbf{x}_{ij}$ is a vector of observable characteristics predetermined relative to $h_{ij}$ and $\varepsilon_{ij}$ is the firm-specific deviation from the industry mean, such that $\mathrm{E}[\varepsilon_{ij}] = 0$ and $\mathrm{Var}\left(\varepsilon_{ij}\right) \equiv \sigma^2_i$. The challenge is that one can only observe $h_{ij}$ for the subsample of firms that decide to be publicly listed (i.e., for those where $d_{ij} \geq \bar{d}$). The conditional mean of $h_{ij}$, given that we only observe publicly-listed firms, is given by:

$$\mathrm{E}_t[h_{ij}|h_{ij} \text{ is observable}] = \underbrace{\mathrm{E}_t[h_{ij}]}_{\text{population mean}} + \underbrace{\mathrm{E}_t[\varepsilon_{ij}|u_{ij} > \bar{d} - \gamma_t \mathbf{z}_{ij,t-1}]}_{\text{sample selection bias}}. \tag{12}$$

Equation (12) shows that the estimation is biased if $\varepsilon_{ij}$ is correlated with $u_{ij}$, that is, if $\varepsilon_{ij}$ is correlated with the underlying determinants of a firm's public status. In our setting, controlling for sample selection bias relies on the premise that product market competition affects both the decision to be public $d_{ij}$ in equation 10 and the variable of interest $h_{ij}$ in equation 11. For instance, the inference on the relation between stock returns and product market competition may be biased if the competitive environment in which firms operate affects both their exposure to risk and their public status.

We control for the sample selection bias of public listing in two different parts of our empirical analysis. First, we test Hypotheses 1-3 by controlling for the fact that we only observe the val-

[13] We consider lagged explanatory variables such that these are pre-determined relative to $d_{ijt}$.

uations and returns of publicly-listed firms. In this case, the pertinent observable characteristics, $h_{ij}$ from regression (11), are the earnings-to-price ratio, the book-to-market ratio, the operating leverage, and the returns of publicly-listed firms. Second, we adjust the sales of publicly-listed firms to construct the CBC measure. In this case, the pertinent observable characteristic, $h_{ij}$ from regression (11), is the sales of publicly-listed firms.

We employ a two-stage methodology adapted from that in Heckman (1979). In the first stage, we compute inverse Mills ratios by industry-year to control for the probability that a firm is publicly-listed. In the second stage, we use the inverse Mills ratios to either correct average industry characteristics for sample selection bias or as a regressor in our cross-sectional regressions. We provide the details about each of these two stages below.

### *C.1. First Stage: Selection Model*

In line with Heckman (1979), the standard first stage would involve the estimation of the selection model in equation (10) using a probit model in which the dependent variable equals one if the firm is publicly listed and zero otherwise. Given that we do not observe the characteristics of private firms at the firm level, we are unable to compute a probit model. We thus compute the average probability that a firm is public in a given industry-year using an alternative approach to test selection models using proportions data. The underlying assumption of our approach is that the likelihood of being public can be explained by average industry characteristics. We use the results of the first stage to compute an inverse Mills ratio.

We compute the inverse Mills ratios by industry and year using a methodology similar to that used in selection models of proportions data, which is discussed in Greene (1992). The methodology relies on the assumption that, conditional on observable information, all firms in the industry have the same probability of being in the sample in any given year. Let $p_{it} \equiv \frac{N_{it}^{\mathrm{PU}}}{N_{it}^{\mathrm{PU}}+N_{it}^{\mathrm{PR}}}$ be the proportion of public firms in industry $i$ in year $t$, where $N_{it}^{\mathrm{PU}}$ is the number of public firms and $N_{it}^{\mathrm{PR}}$ is the number of private firms in industry $i$. The selection model is given by:

$$p_{it} = \Phi\left(\gamma_t \mathbf{z}_{i,t-1}\right) + \zeta_{it}, \tag{13}$$

where $\mathbf{z}_i$ denotes the vector of industry-specific characteristics that determine the public status of firms in a given industry group, $\Phi$ denotes the normal cumulative density function, and $\zeta_i$ is the sampling error.[14] We treat the sampling of public firms within the same industry as a problem of sampling from a Bernoulli population. Hence $\zeta_i$ is such that $\mathrm{E}_t[\zeta_i] = 0$ and $\mathrm{Var}_t[\zeta_i] = \Phi\left(\gamma_t \mathbf{z}_{i,t-1}\right)\left(1 - \Phi\left(\gamma_t \mathbf{z}_{i,t-1}\right)\right)\left(N_{it}^{\mathrm{PU}}\right)^{-1}$.

The model in equation (13) can be estimated using non-linear least squares. However, as discussed in Greene (1992), there is a simpler approach using linear least squares. Given that the function $\Phi$ has an inverse, we use the alternative specification:

$$\Phi^{-1}\left(p_{it}\right) \approx \gamma_t \mathbf{z}_{i,t-1} + \frac{\zeta_{i,t}}{\phi\left(\gamma_t \mathbf{z}_{i,t-1}\right)}. \tag{14}$$

We estimate the selection model (14) in two steps. In the first step, we run an OLS regression for each yearly cross-section of industries in the U.S. Census Bureau data (i.e., where $p_i$ is observable). The vector $\mathbf{z}_i$ includes variables that explain the public status of firms. Since these variables should explain the *share* of public firms in the industry, we use both average industry characteristics of the whole sample of firms in the industry or the subsample of public firms in the industry. We specify the vector $\mathbf{z}_i$ differently depending on the variable $h_{ij}$ in the second stage.[15]

[14] We consider lagged explanatory variables such that these are pre-determined relative to $p_{it}$.

[15] To construct the CBC measure, the explanatory variables that we include in the vector $\mathbf{z}_i$ are consistent with the empirical study on the decision to go public by Chemmanur et al. (2010). We elaborate on the specification of vector $\mathbf{z}_i$ in the Appendix. To test Hypotheses 1-3, the set of variables in vector $\mathbf{z}_i$ equals a set of controls explaining cross-sectional variation in $h_{ij}$ in the second stage, plus two additional instruments that are not included in the second stage. We elaborate on such instruments in the Appendix. We describe the remaining explanatory variables in Section III.

The errors of the OLS regression of the first step are heteroskedastic. In the second step, we use the estimates of the coefficient $\gamma$ of the OLS regression (14), which we denote $\hat{\gamma}$, to generate the sample weights $w_i$, defined as:

$$w_{it} = \frac{N_{it}^{\mathrm{PU}} \Phi\left(\hat{\gamma}_t \mathbf{z}_{i,t-1}\right)^2}{\Phi\left(\hat{\gamma}_t \mathbf{z}_{i,t-1}\right)\left(1 - \Phi\left(\hat{\gamma}_t \mathbf{z}_{i,t-1}\right)\right)}. \tag{15}$$

We then repeat the same linear regression in equation (14) using the weights in (15) as p-weights, to obtain the unbiased estimates of the coefficient $\gamma$, which we denote $\hat{\hat{\gamma}}$, for all years in our sample of manufacturing industries. We use our estimates $\hat{\hat{\gamma}}$ to construct the inverse Mills ratio for all manufacturing industries, as given by:

$$\lambda_{it} \equiv \frac{\phi\left(\hat{\hat{\gamma}}_t \mathbf{z}_{i,t-1}\right)}{\Phi\left(\hat{\hat{\gamma}}_t \mathbf{z}_{i,t-1}\right)}. \tag{16}$$

The last step is to compute the inverse Mills ratio $\lambda_i$ for the non-manufacturing industries in our sample. Since we do not observe $p_i$ for these industries, we use the vector of instruments $\mathbf{z}_i$ and our estimates $\hat{\hat{\gamma}}$ to compute $\lambda_i$ for the non-manufacturing industries. The working assumption here is that the estimates $\hat{\hat{\gamma}}$ are the same for both manufacturing and non-manufacturing industries.

### *C.2. Second Stage: Cross-sectional Regressions*

In our second stage, we estimate the model in equation (11) including inverse Mills ratios to correct for the sample selection bias of public listing. Consistent with the literature on sample selection, we specify vector $\mathbf{x}_i$ to include the variables in vector $\mathbf{z}_i$. However, to account for the concern that the methodology may be misspecified when the normality assumptions on the error terms are violated, the vector $\mathbf{z}_i$ further includes two instruments that are not used in vector $\mathbf{x}_i$ during the second stage. The argument is that such instruments affect the going public decision but do not explain to the characteristic $h_{ij}$ in the second stage. We elaborate on these instruments in the Appendix.

To assess the link between industry valuations or industry returns and product market competition, we estimate the model using a Fama-MacBeth two-pass procedure. In the first pass, we run cross-sectional regressions of the dependent variable $h_{ij}$ in equation (11) on standardized IPMC measures, lagged average industry characteristics, and the inverse Mills ratio, namely:

$$h_{ijt} = \psi_{0,t} + \psi_{1,t}\text{IMPC}^{\text{Z}}_{i,t-1} + \psi_{2,t}\mathbf{x}_{ij,t-1} + \psi_{3,t}\lambda_{i,t-1} + \varepsilon_{ijt}, \tag{17}$$

where $\text{IMPC}^{\text{Z}}$ is the standardized IPMC measure, $\mathbf{x}_{ij}$ represents a vector of controls, and $\lambda$ is the inverse Mills ratio. We construct standardized IPMC measures by demeaning and scaling each IPMC measure so that each year they have mean zero and standard deviation of one. In the second pass, we estimate across-time averages for the coefficients of the first pass, as well as corresponding Newey-West standard errors. We run these tests both at the firm level and industry level.

To construct the CBC measure, the dependent variable $h_{ij}$ in equation (11) is the logarithm of a firm's sales. The details of the second stage used in the construction of the measure are given in the Appendix.

# III. Empirical Evidence

## A. Summary Statistics

Table II reports time series averages of median characteristics of five quintile portfolios of firms sorted on each of the five measures of IPMC. There are some trends in the statistics across the quintiles. Book-to-market and earnings-to-price ratios are consistently lower in less competitive industries. This finding is consistent with the hypothesis that a greater fraction of the value of firms in less competitive industries arises from growth options. Another common trait of firms in less competitive industries is their lower levels of financial leverage. One possible explanation for this finding is that capital owners respond to the greater exposure to risk in less competitive industries by setting lower levels of financial leverage. Another explanation is that the more prevalent growth options in less competitive industries cannot be used as effectively as productive assets as collateral. The table also shows that median market size is slightly higher in less competitive industries, although there is no clear trend in median total assets.

Table II shows the share of manufacturing industries in each of the five quintile portfolios. Consistent with the limitations of the data used for the construction of the HHI, Markup, and CMC measures, these only cover manufacturing industries as shown in Panels A, B, and D. Panel C shows that manufacturing industries are distributed across all CBC-sorted quintile portfolios, albeit generally concentrated among less competitive ones. Panel E shows that non-manufacturing industries are unevenly distributed across TBC-sorted quintile portfolios and concentrated among less competitive ones. The table also shows a negative relation between labor intensity and IPMC, although this is not consistent across the measures. In particular, Panel A shows no clear relation between labor intensity and HHI, possibly due to the fact that the HHI measure only covers manufacturing industries and spans a significantly shorter sample period.

Table II also shows the median Compustat-based HHI across IPMC quintiles. Consistent with the findings in Ali et al. (2009), the table shows that there is no clear relation between the Compustat-based concentration measure and our measures of IPMC. As we argue in this paper, a possible reason for this disconnection is related to the sample selection biases of firms that are publicly listed that distort industry concentration measures based on Compustat data.

*<< Table II here >>*

We find evidence that further supports the earlier observation in the empirical corporate finance literature that the public status of firms is not random, and that it is affected by product markets. Panel A in Figure 2 illustrates that relation between the public status of firms and the level of IPMC across industries. We observe that industries with higher shares of public firms tend to be relatively less competitive. This finding can be explained by the fact that firms in less competitive industries are larger, and that the likelihood of being public is also increasing in size. This finding suggests that a firm's decision to be publicly listed is significantly affected by the competitive environment in its industry. The remaining panels in Figure 2 illustrate the relation between the public status of firms by industry, book-to-market ratios, and firms' average exposure to risk. Panel B indicates that average book-to-market ratios are decreasing in the share of public firms in an industry (i.e., publicly-listed firms are more value-like firms relative to their private peers). Panels C and D show that industries with a higher share of public firms have higher returns, as well as higher betas on average. Taken together, these findings corroborate the need to correct for the sample selection bias of public listing in our tests.

### *B. Product Market Competition and Relative Valuations*

Hypothesis 1 states that the ratio of assets in place to total firm value is higher in more competitive industries. Since the market value of a firm's assets in place cannot be easily disentangled from other components of firm value, we use two different proxies for the ratio. The first proxy is the earnings-to-price ratio and is based on the idea that the value of assets in place should be proportional to the cash flows generated by them.

Table III reports results with earnings-to-price ratios as proxies for the ratio of assets in place to total firm value. For each measure of competition, we test the link between IPMC and earnings-to-price ratios using the two alternative specifications, with and without sample selection correction.

Given that our dependent variable uses market values, the controls do not include variables that contain market values, such as size or book-to-market ratio. Our controls include the labor intensity of the industry and the average firm size as measured by the logarithm of firm assets. Consistent with Hypothesis 1, the evidence in all specifications in Table III shows that earnings-to-price ratios are lower in less competitive industries. Panel A in Table III reports our results at the industry level, while Panel B shows results at the firm level.

The evidence in Table III indicates that, on average, there exists a difference between the earnings-to-price ratios of public and private firms. In all specifications in which we control for sample selection, the inverse Mills ratio has a positive coefficient when significant. This implies that, on average, private firms have lower earnings-to-price ratios than public firms. We observe this result at the industry level and at the firm level.

*<< Table III here >>*

Our second proxy for ratio of assets in place to total firm value is the book-to-market ratio. This proxy is based on Novy-Marx's (2011) assumption that the value of a firm's assets in place is approximately equal to the book value of its assets. Given this identifying assumption, the corresponding testable implication is that firms in more competitive industries should have higher book-to-market ratios. Table IV shows that the results with regressions using book-to-market as the dependent variable are similar to those using earnings-to-price ratios in Table III. In the two specifications used, we find that firms in less competitive industries have lower book-to-market ratios on average. This is consistent with the hypothesis that firms in less competitive industries better preserve the value of their growth options. Furthermore, the results from specification II in Table IV indicate that private firms have significantly lower unobservable book-to-market ratios than public firms. These findings hold qualitatively both at the industry and firm levels, as shown in Panels A and B.

*<< Table IV here >>*

## C. Product Market Competition and Operating Leverage

Hypothesis 2 states that, for the same level of fixed operating costs, the lower profit margins due to product market competition amplify the sensitivity of operating profits to shocks to a firm's productivity and are thus related to higher operating leverage. Yet a firm's fixed operating costs and associated operating leverage are not directly observable. In order to test Hypothesis 2, we use two alternative measures of operating leverage. We first construct an industry-level measure, $\text{OL}^{\text{TFP}}$, of operating leverage based on the sensitivity of operating profits to productivity shocks. We run time-series regressions at the industry level of value added growth on total factor productivity growth using NBER–CES data for manufacturing industries. We use the slope of this regression as an industry measure of operating leverage.

Due to the limited coverage of the NBER–CES dataset and the fact that $\text{OL}^{\text{TFP}}$ contains forward-looking information, we use an alternative measure, $\text{OL}^{\text{Comp}}$, of operating leverage that proxies for the ratio of the present value of fixed operating costs to total firm value.[16] We follow Novy-Marx (2011) and define operating leverage as the ratio of the sum of a firm's selling, general and administrative expenses and its costs of goods sold to total assets.

Table V shows that, consistent with Hypothesis 2, both measures of operating leverage are higher in more competitive industries.

[16] Here the superscript "Comp" refers to the fact that this measure of operating leverage is based on Compustat data.

*<< Table V here >>*

We also find supporting evidence for the negative relation between IPMC and operating leverage using Fama-MacBeth regressions. Due to its construction procedure, the measure $OL^{TFP}$ does not change over time. For this reason, we only employ the measure $OL^{Comp}$ in these regressions. The results of this analysis are shown in Table VI. We use the two specifications without and with adjustment for sample-selection biases. Consistent with Hypothesis 2, we find that firms in more competitive industries have higher levels of operating leverage under both specifications. Panels A and B show that these results hold both at the industry and firm levels, respectively.

Our results in Table VI further show that inverse Mills ratios are usually positively and significantly related to operating leverage. This suggests that private firms have lower operating leverage than public firms on average.

*<< Table VI here >>*

## *D. Product Market Competition and Exposure to Systematic Risk*

Hypothesis 3 relates to the impact of IPMC on a firm's exposure to systematic risk. A challenge for this analysis, and endemic to asset pricing in general, is that expected returns are intrinsically non-observable. To assess the overall effect of IPMC on a firm's exposure to systematic risk, we use proxies for expected returns based on different measures of realized asset returns and of loadings on systematic risk. We find strong evidence that firms in less competitive industries have higher exposure to systematic risk. This is consistent with the hypothesis that the investment channel has a stronger impact than the operating leverage channel in explaining the relation between IPMC and expected asset returns.

*D.1. Realized Asset Returns*

Table VII reports that realized asset returns are increasing in the lagged measures of IPMC. The table reports four different measures of asset returns. The first measure is the commonly-used excess stock return over the Treasury bill rate. To control for the systematic differences across IPMC quintiles reported in Table II, we also report results of portfolio sorts using additional specifications of adjusted returns. The second measure (DGTW) is based on stock returns adjusted for for size, book-to-market, and momentum, according to the methodology in Daniel, Grinblatt, Titman, and Wermers (1997). The third measure is stock returns adjusted for financial leverage. The use of unlevered returns is motivated by the fact that our proposed economic channels are related to expected asset returns, and not to expected equity returns, which are affected by endogenous capital structure decisions. There is no clear consensus in the literature of how to estimate unlevered returns. For this reason, we calculate unlevered returns in the simplest possible way: as excess returns times one minus the ratio of book value of debt to assets minus book value of equity plus market value of equity. The fourth measure is a variation of DGTW returns where we replace momentum for operating margins (EBITDA / Assets) as the third adjusted characteristic. This specification allow us to disentangle the effect of IPMC on returns from that of profitability, as in Novy-Marx (2013).

*<< Table VII here >>*

Table VIII presents results from our Fama-MacBeth regressions of realized stock returns of firms on the measures of IPMC and average firm controls. The table shows results from two specifications, without and with sample selection correction. The results confirm the findings from Table VII and shows a positive relation between realized stock returns and the measures of IPMC. Panels A and B show that this result generally holds both at the industry and firm levels. The effect of HHI on realized annual returns is not statistically significant; it is significant for CBC. A possible reason for this difference across the two concentration measures is the relatively smaller number of years and industries covered by the HHI measure.

In specification II, which controls for sample selection, our results in Table VIII show that inverse Mills ratios are usually negatively related to stock returns. This suggests that private firms have higher exposure to systematic risk than public firms on average. However, and in contrast with our results in previous tests, the inverse Mills ratios are only statistically significant for some specifications. The correction for sample selection bias appears to be more significant in the firm level regressions, in which the number of observations is much higher.

*<< Table VIII here >>*

### *D.2. Loadings on Market Risk*

Realized stock returns are notoriously noisy proxies for expected returns, which is particularly problematic given the relatively short sample period of the financial data commonly used in the literature. It is a well-known fact that estimates of betas, which are based on the second moments of return distributions, are more precise than those of average returns, which are based on the first moment. Hypotheses 1-3 are not contingent on the identity of the source of systematic risk in the economy. In order to use market betas, we make the additional assumption that the returns of our proxy for the market portfolio are related to the true source of systematic risk in the economy. This assumption implies that firms with higher loadings on the market portfolio (i.e., with high CAPM market betas) should earn higher returns in expectation.

We allow for the possibility that betas change over time. Conditional market betas (hereafter "betas") are constructed as in Lewellen and Nagel (2006) and defined as the slope of 12-month rolling univariate regressions of excess returns on the market portfolio one year ahead. We also construct unlevered betas calculated as market betas times one minus the lagged leverage ratio. Unlevered betas are used for the same reason that we also use unlevered returns in the previous section: to also consider the possibility that the effects of IPMC on systematic risk loadings are partially offset by the owners of capital in their capital structure decisions. Table IX reports that betas, and in particular unlevered betas, are increasing in the IPMC measures. Panel A reports the results of standard portfolio sorts, while Panel B reports the results of portfolio sorts within the size quintiles. Panel B shows that the results are more significant when we control for differences in firm size across industries.

*<< Table IX here >>*

### *D.3. Beta Decomposition and the Investment and Operating Leverage Channels*

Hypothesis 3 states that the investment and operating leverage channels have opposing effects on a firm's exposure to systematic risk. We investigate this hypothesis by analyzing the different components of betas from equation (2). Here we also assume that $\frac{V^{\mathrm{A}}}{V}$ is related to book-to-market ratios (BM) and $\frac{V^{\mathrm{F}}}{V^{\mathrm{A}}}$ is related to operating leverage (OL). We first decompose unlevered betas into the betas of assets in place and growth options as given in equation (1) to obtain:

$$\beta_t = \underbrace{\mathrm{BM}_t\,\beta_t^{\mathrm{A}}}_{\substack{\text{risk loading from}\\ \text{assets in place}}} + \underbrace{(1-\mathrm{BM}_t)\,\beta_t^{\mathrm{G}}}_{\substack{\text{risk loading from}\\ \text{growth options}}} . \tag{18}$$

We adapt Bernardo et al.'s (2007) to estimate $\beta^{\mathrm{A}}$ and $\beta^{\mathrm{G}}$ from equation (18). This methodology is based on the assumption that all firms within an industry have identical asset betas and growth betas. We decompose $\beta^{A}$ into components related to revenues and to operating leverage. Here we make the simplifying assumption that operating costs are unaffected by systematic shocks (i.e., $\beta^{F} = 0$), so that $\beta^{A} = \beta^{R} + \text{OL}\,\beta^{R}$. After substituting for $\beta^{A}$ and rearranging terms in equation (18), we obtain:

$$\beta_t = \underbrace{\text{BM}_t\,\beta_t^{R}}_{\substack{\text{risk loading}\\ \text{from revenues}}} + \underbrace{\text{BM}_t\,\text{OL}\,\beta_t^{R}}_{\substack{\text{risk loading from}\\ \text{operating leverage}}} + \underbrace{(1-\text{BM}_t)\,\beta_t^{G}}_{\substack{\text{risk loading from}\\ \text{growth options}}} . \tag{19}$$

For the second decomposition, we use the measure of operating leverage from Novy-Marx (2011): the sum of cost of good sales and sales (COGS) and general, and administrative expenses (XSGA), over revenues.[17]

Panel A of Table X reports the average estimated asset and growth beta, $\beta^{A}$ and $\beta^{G}$, across IPMC portfolios. The table shows that some of the extra riskiness of firms in less competitive industries is due to the extra riskiness of assets and growth options. Panel B of Table X reports the weights of the operating leverage and growth option components of equation (19) across IPMC portfolios. The table shows that, in general, the operating leverage component is larger for more competitive industries, while the growth option component is larger for less competitive industries.

*<< Table X here >>*

[17] The measures of BM and OL are used as linear approximations for the true ratios $\frac{V^{A}}{V}$ and $\frac{V^{F}}{V^{A}}$, respectively. In this sense, the estimation of the different components in equation (19) is affected by the scaling of these measures. We verified that multiplying (separately) the OL and BM measures by different constants (ranging from 1/2 to 2) does not significantly affect the results.

# IV. Conclusion

The findings in this paper are consistent with two opposing effects of product market competition on a firm's exposure to systematic risk. The first effect is that product market competition reduces the value of growth options, which in turns reduces the loadings on systematic risk. Consistent with this effect, we find that firms in competitive industries have higher earnings-to-price and book-to-market ratios. The second effect is that competition narrows operating profits, which increases operating leverage and a firm's exposure to systematic risk. Consistent with this finding, we find that firms in more competitive industries have operating profits that are more sensitive to shocks. We find that the first effect generally dominates the second, so firms in less competitive industries earn higher asset returns.

Our empirical analysis uses five alternative measures of imperfect product market competition. Two of these measures are based on U.S. Census data and are restricted to manufacturing industries. To expand our analysis to non-manufacturing industries, we construct an additional measure of industry concentration based on Compustat data and adjusted for the sample selection bias of public listing. We verify the robustness of our results by considering two additional measures of competition. As a by-product of our empirical approach, we also find that private firms are more exposed to systematic risk, and that they have lower earnings-to-price ratios, lower book-to-market ratios and lower operating leverage than publicly-listed firms.

Our evidence provides support for emphasizes the importance of the competitive environment in explaining a firm's loading on systematic risk. For instance, the common assumptions that a firm is a monopolist or operates under perfect competition need not be innocuous in theoretical asset pricing models. Our study also highlights the importance of correcting for the sample selection bias of the returns of publicly-listed firms. This correction may be significant for any empirical study that examines the link between asset returns and an industry characteristic that might affect a firm's decision to be publicly listed.

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# Appendix

## *A. A Parsimonious Real Options Model*

We first present a model of an industry equilibrium that allows us to formalize our predictions in hypotheses 1-3. We follow Berk, Green, and Naik (1999) and take the pricing kernel as exogenous. The dynamics of the pricing kernel $\Lambda$ are given by:

$$d\Lambda_t = -r\Lambda_t dt - \eta\Lambda_t dz_t, \tag{A1}$$

where $dz$ is a Wiener processes that represents the single source of systematic risk, $r > 0$ is the instantaneous risk-free rate, and $\eta > 0$ is the market price of risk in the economy.

We consider an industry composed of $N \geq 1$ firms indexed by $j$ with identical productive technologies. In what follows, we use lowercase letters for firm-level variables and uppercase letters for industry- or economy-level ones. To save on notation, we omit the firm subscript $j$ from lower case variables unless it is strictly necessary. Output at the firm level is given by:

$$y_t = A_t k_t^{\alpha} l_t^{1-\alpha}, \tag{A2}$$

where $l$ and $k$ are the number of labor hours and amount of capital employed in production, $0 < \alpha < 1$ is the capital intensity, and $A > 0$ is the industry's total factor productivity (TFP). TFP follows a diffusion process given by:

$$dA_t = \mu_A A_t dt + \sigma_A A_t dz_t. \tag{A3}$$

The industry produces and sells a single homogeneous good subject to a downward-sloping demand curve. The price of the good is given by:

$$P_t = Y_t^{-\frac{1}{\varepsilon}}, \tag{A4}$$

where $\varepsilon > 1$ is the elasticity of demand, and $Y \equiv \sum_{j \leq N} y_j$ is the total industry output.

We assume perfect competition in labor markets and full mobility of workers across industries such that, regardless of the level of competition, firms take wages $w$ as given.

To study the impact of operating leverage on firm risk, we assume that firms have fixed operating costs $fk_t$, which are unrelated to productivity but proportional to installed capital.

Firms' operating profits are defined as revenues net of labor costs. Firms optimize profits by determining the optimal amount of labor each period. Optimized operating profits, $\pi$, are given by:

$$\pi_t \equiv \max_{l_t} \left( P_t A_t k_t^{\alpha} (l_t)^{1-\alpha} - w l_t - f k_t \right). \tag{A5}$$

Firms can also incrementally and irreversibly adjust capital by increasing installed capacity by $dk_t \geq 0$ at a marginal cost $\kappa_{\mathrm{P}} > 0$. The owners of capital receive a dividend stream that equals operating profits net of investment costs, $\pi_t dt - dk_t \kappa_{\mathrm{P}}$.

### *A.1. General Solution*

Here we derive a general solution for the firm value and expected asset returns that is independent of the level of product market competition. In the next section, we derive the specific solutions for the monopolistic case, as well as the case with perfect competition. We follow the literature and assume that productivity shocks can be perfectly replicated with tradable securities.[18] The value of a firm, $V_t$, is defined as the maximized expected discounted stream of dividends that belong to the owners of capital:

$$V_t \equiv \max_{\{dk_s\}_{s \geq t}} \left( \mathrm{E}_t \left[ \int_t^{\infty} \frac{\Lambda_s}{\Lambda_t} (\pi_s ds - \kappa_{\mathrm{P}} dk_s) \right] \right). \tag{A6}$$

Using standard techniques, it is straightforward to show the solution to $V_t$ has the general form given by:

$$V_t = \frac{\Pi_t}{\delta} + G_+ X_t^{\upsilon_{\mathrm{G}}} - G_- X_t^{\upsilon_{\mathrm{G}}}, \tag{A7}$$

where the subscript "$+$" denotes expected changes in the value of the firm due to its own investment decisions, the subscript "$-$" denotes the expected changes in the value of the firm due to the investments of its competitors, $X_t \equiv A_t^{\varepsilon-1}$, $\upsilon_{\mathrm{G}} > 1$, $G_+$ and $G_-$ are positive constants, $\delta > 0$, is the risk-and-growth-adjusted discount rate given by:

$$\delta = r - \frac{(\gamma-1)^2 \sigma_{\mathrm{A}}^2}{2\alpha^2} + \frac{(\gamma-1)(2\mu_{\mathrm{A}} - \sigma_{\mathrm{A}}(2\eta + \sigma_{\mathrm{A}}))}{2\alpha}, \tag{A8}$$

[18]Examples of this literature are Berk et al. (1999), Goldstein, Ju, and Leland (2001), and Carlson, Fisher, and Giammarino (2004).

where $0 < \gamma \equiv (1-\alpha)(1-\frac{1}{\varepsilon}) < 1$ and ${}^{\Pi_t}\!/\delta$ is the net present value of the assets in place for the firm, namely:

$$\frac{\Pi_t}{\delta} \equiv \frac{\hat{\pi}_t}{\delta} - \frac{fk_t}{r}, \tag{A9}$$

where $\hat{\pi}_t \equiv \pi_t + fk_t$ is the optimized variable profits of the firm before fixed operating costs. The first component of the value of the firm in equation (A7) reflects the value of its assets in place. The second component, $G_+X_t^{\upsilon_G}$, is related to the present value of the discounted cash flows generated by future additions in the installed capacity of the firm. The last component, $-G_-X_t^{\upsilon_G}$, accounts for expected changes in the value of the firm caused by additions to industry capacity by competing firms. Equation (A7) shows that the value of a firm depends on all investment opportunities in the industry, both the ones held by the firm and those held by its competitors.

Expected asset returns are defined as the drift of the gains process that reinvests dividends into a tradable asset that perfectly replicates the value of the firm. From equation (A7), we have that:

$$\begin{aligned} \mathrm{E_t}[R_t] &\equiv \mathrm{E_t}\left[\frac{dV_t + \pi_t dt - \kappa_P dk}{V_t}\right] \\ &= r + \beta_t \eta, \end{aligned} \tag{A10}$$

where $\beta$ is the firm's loading on the single source of priced risk in the economy and is given by:[19]

$$\beta_t = \frac{{}^{\Pi_t}\!/\delta}{V_t}\sigma_X\gamma + \left(1 - \frac{{}^{\Pi_t}\!/\delta}{V_t}\right)\sigma_X\upsilon_G + \frac{{}^{fk_t}\!/r}{V_t}\sigma_X\gamma, \tag{A11}$$

where $\sigma_X$ is the volatility of the scaled TFP shock, $X_t$.

Equation (A11) characterizes the exposure to systematic risk of the firm as the weighted portfolio of the riskiness of its variable operating profits, the riskiness of the growth opportunities of the industry, and the riskiness due to its fixed operating costs. The first term of equation (A11) shows that the fundamental beta of a firm's variable operating profits is given by $\sigma_X\gamma$. The second term of (A11) shows that the beta of the portfolio of the future expected changes to the assets in place from the firm and its competitors equals $\sigma_X\upsilon_G$. The third term indicates that a firm's fixed operating costs amplify a firm's exposure to risk and are thus related to operating leverage.

An important insight of equation (A11) is that the positive root of the fundamental quadratic $\upsilon_G$ captures the riskiness of the growth opportunities of the industry. For any type of industry, the

[19] Note that, unlike traditional beta representations, $\beta$ is not scaled for aggregate risk.

riskiness of growth options is higher than that of assets in place since $\gamma < 1 < \upsilon_G$. In our model, a firm's future investment opportunities are levered positions in future assets that have the same riskiness as current assets in place.

### *A.2. Product Markets*

The degree of product market competition is determined by the significance of the interactions between firms in the industry. To capture this intuition, we focus on the two extreme cases to illustrate how competition affects a firm's value and exposure to systematic risk: no competition (monopoly) and perfect competition.[20]

In the monopolist case, $N = 1$, the single firm in the industry is insulated by high barriers to entry and is thus unaffected by other firms' decisions.[21] In the perfect competition case, $N \gg 1$, the industry has no barriers for new entrants. Any given firm in the industry is unable to directly affect other firms, current competitors or potential entrants, while it is greatly affected by their joint decisions.

We compare the two types of industries at a point in time where the aggregate amount of capital in each industry is the same and equal to $K$:

$$K_t^{\mathrm{M}} = K_t^{\mathrm{C}} \equiv \sum_{j=1}^{N} k_t = K_t, \tag{A12}$$

where the superscripts $M$ and $C$ denote the monopolist and competitive cases, respectively.

### *A.3. Model Solution for Monopoly*

The free cash flows of the firm are given by $\pi^{\mathrm{M}} - \kappa_{\mathrm{P}} dK$. Solving for the optimal labor decision of the firm, we get the expression for operating profits for the particular case without competition:

$$\pi_t^{\mathrm{M}} = \Gamma^{\mathrm{M}} X_t^{\gamma} K^{1-\gamma} - fK, \tag{A13}$$

[20] Although not explicitly modeled here, related literature suggests that the case with imperfect product market competition combines elements of the two extreme cases discussed here. Examples of this are the studies by Carlson et al. (2013) and Bustamante (2013), who consider asset pricing models of strategic investment in oligopolistic industries.

[21] Examples of barriers to entry include government regulation, intellectual property rights, high irreversible investment costs, and predatory pricing, among others.

where $\Gamma^{\mathrm{M}}$ is given by:

$$\Gamma^{\mathrm{M}} = \frac{(1+\alpha(\varepsilon-1))}{\varepsilon}\left(\frac{\gamma}{w}\right)^{\gamma(1-\alpha)(\varepsilon-1)}. \tag{A14}$$

$V^{\mathrm{M}}$ is a function of the capital stock $K$ and the stochastic variable $X$. Using the same argument as in Abel and Eberly (1996), we note that the functions $\pi^{\mathrm{M}}$ and $V^{\mathrm{M}}$ are homogeneous of degree one, such that:

$$V_t^{\mathrm{M}}(K,X) = K_t v^{\mathrm{M}}\left(\frac{X_t}{K_t}\right) \quad \text{and} \tag{A15}$$

$$\pi_t^{\mathrm{M}}(K,X) = K_t \pi^{\mathrm{M}}\left(\frac{X_t}{K_t}\right). \tag{A16}$$

We denote the ratio $\frac{X}{K}$ by $x$ and the optimal value of $x$ at which the monopolist invests by $x^{\mathrm{M}}$. The problem of the monopolist is to maximize the ODE of $v_t^{\mathrm{M}}$, namely:

$$rv = \pi^{\mathrm{M}} + x\mu_x v^{\mathrm{M}} + (\mu_x - \eta\sigma_x)xv^{\mathrm{M}\prime} + \frac{1}{2}\sigma_x^2 x^2 v^{\mathrm{M}\prime\prime}. \tag{A17}$$

We conjecture that $v_t^{\mathrm{M}}$ has the functional form given by:

$$v_t^{\mathrm{M}} = \frac{\Gamma^{\mathrm{M}}}{\delta}x_t^{\gamma} - \frac{f}{r} + G^{\mathrm{M}}x_t^{\upsilon_{\mathrm{M}}} + D^{\mathrm{M}}x_t^{\upsilon_{\mathrm{D}}}, \tag{A18}$$

where the constants $\upsilon_{\mathrm{G}} > 1$ and $\upsilon_{\mathrm{D}} < 0$ are the positive and negative roots of the fundamental quadratic and given by:

$$\upsilon_{\mathrm{G}} = \frac{1}{2} - \frac{(r-\delta)}{\sigma_x} + \left(\left(\frac{(r-\delta)}{\sigma_x}\right)^2 + 2\frac{\mu_x}{\sigma}\right)^{0.5} > 1 \quad \text{and} \tag{A19}$$

$$\upsilon_{\mathrm{D}} = \frac{1}{2} - \frac{(r-\delta)}{\sigma_x} - \left(\left(\frac{(r-\delta)}{\sigma_x}\right)^2 + 2\frac{\mu_x}{\sigma}\right)^{0.5} < 0, \tag{A20}$$

and $G^{\mathrm{M}}$ and $D^{\mathrm{M}}$ are constants to be determined.

The region of zero investment of the monopolist includes the limit as $x$ goes to zero. To keep $v^{\mathrm{M}}$ finite, we leave the negative power of $x$ out of the solution, and set $D^{\mathrm{M}} = 0$. The remaining constant $G^{\mathrm{M}}$ is determined by considering the optimal investment decision of the firm. We impose the optimality condition that the marginal product of capital equals the marginal cost $\kappa_{\mathrm{P}}$, namely:

$$v^{\mathrm{M}}(x) - xv^{\mathrm{M}\prime}(x) = \kappa_{\mathrm{P}}. \tag{A21}$$

The other requirement for the optimality of investment is that the derivative with respect to $x$ of the condition above equals zero, namely:

$$\frac{\partial(v^{\mathrm{M}}(x) - xv^{\mathrm{M}\prime}(x))}{\partial x_t} = 0. \tag{A22}$$

These equations provide a system with two unknowns: $G^{\mathrm{M}}$ and $x^{\mathrm{M}}$. The solution for $G^{\mathrm{M}}$:

$$G^{\mathrm{M}} = G^{\mathrm{M}}_{+} = \frac{\gamma\left(\kappa_{\mathrm{P}} + \frac{f}{r}\right)}{(\upsilon_{\mathrm{G}} - \gamma)(\upsilon_{\mathrm{G}} - 1)} \left[\frac{\Gamma^{\mathrm{M}}(1-\gamma)(\upsilon_{\mathrm{G}} - \gamma)}{\delta\left(\kappa_{\mathrm{P}} + \frac{f}{r}\right)\upsilon_{\mathrm{G}}}\right]^{\frac{\upsilon_{\mathrm{G}}}{\gamma}} > 0. \tag{A23}$$

The optimal investment threshold $x^{\mathrm{M}}$ that solves the equations above is:

$$x^{\mathrm{M}} = \left[\frac{\Gamma^{\mathrm{M}}}{\delta}\frac{(1-\gamma)(\upsilon_{\mathrm{G}} - \gamma)}{\left(\kappa_{\mathrm{P}} + \frac{f}{r}\right)\upsilon_{\mathrm{G}}}\right]^{-\frac{1}{\gamma}}. \tag{A24}$$

### *A.4. Model Solution for Perfect Competition*

Our derivation follows Leahy (1993). Solving for the optimal labor decision of the firm, we get the expression for operating profits for the particular case with perfect competition:

$$\pi^{\mathrm{C}}_t = \Gamma^{\mathrm{C}} X_t^{\gamma} K_t^{-\gamma} - fk, \tag{A25}$$

where $N$ is the total number of firms in the industry, each firm has $k$ units of capital, and $\Gamma^{\mathrm{C}}$ is given by:

$$\Gamma^{\mathrm{C}} = \left(\frac{1-\alpha}{w}\right)^{(1-\alpha)(\varepsilon-1)\gamma} k. \tag{A26}$$

We denote the ratio $\frac{X}{K}$ by $x$ and the optimal entry threshold by $x^{\mathrm{C}}$. The value and profits of the firm are homogeneous of degree zero in $X$ and $K$, so we solve for the value of the firm as a function of $x$. The ODE of the value of the incumbent firm $V_j^{\mathrm{C}}$ is given by:

$$rV_j^{\mathrm{C}} = \pi^{\mathrm{C}} + x\mu_x V_j^{\mathrm{C}} + (\mu_x - \eta\sigma_x)xV_j^{\mathrm{C}\prime} + \frac{1}{2}\sigma_x^2 x^2 V_j^{\mathrm{C}\prime\prime}. \tag{A27}$$

We conjecture that the value of the incumbent firm $V_j^{\mathrm{C}}$ has the functional form given by:

$$V_t^{\mathrm{C}} = \frac{\Gamma^{\mathrm{C}}}{\delta} x_t^{\gamma} - \frac{fk}{r} + G^{\mathrm{C}} x_t^{\upsilon_{\mathrm{G}}} + D^{\mathrm{C}} x_t^{\upsilon_{\mathrm{D}}}, \tag{A28}$$

where $\upsilon_{\mathrm{G}} > 1$ and $\upsilon_{\mathrm{D}} < 0$ are, respectively, the positive and negative roots of the fundamental quadratic, and $G^{\mathrm{C}}$ and $D^{\mathrm{C}}$ are constants to be determined.

To keep $V_j^{\mathrm{C}}$ finite, we leave the negative power of $x$ out of the solution, and set $D^{\mathrm{C}} = 0$. The remaining constant $G^{\mathrm{C}}$ is determined by considering the optimal investment decision of the new entrants. We define the value of any new entrant by $V_{-}^{\mathrm{C}}$ and conjecture that:

$$V_{-t}^{\mathrm{C}} = E^{\mathrm{C}}(x_t)^{\upsilon_{\mathrm{G}}}. \tag{A29}$$

The unknowns are therefore $G^{\mathrm{C}}$, $E^{\mathrm{C}}$, and the entry threshold $x^{\mathrm{C}}$. We first impose the optimality condition that the value of the new entrant net of the investment cost equals the value of the incumbent, namely:

$$V_t^{\mathrm{C}}(x) = V_{-jt}^{\mathrm{C}}(x) - \kappa_{\mathrm{P}} k. \tag{A30}$$

Another requirement is given by the smooth pasting condition:

$$\frac{\partial V_t^{\mathrm{C}}(x)}{\partial x_t} = \frac{\partial V_{-jt}^{\mathrm{C}}(x)}{\partial x_t}. \tag{A31}$$

Finally, we require that the derivative of $V_t^{\mathrm{C}}$ with respect to $X$ is zero, namely:

$$\frac{\partial V_t^{\mathrm{C}}(x)}{\partial x_t} = 0. \tag{A32}$$

The conditions above imply that $E^{\mathrm{C}}$ equals zero: the option value of an idle firm is zero under perfect competition. The solution for $G^{\mathrm{C}}$ is:

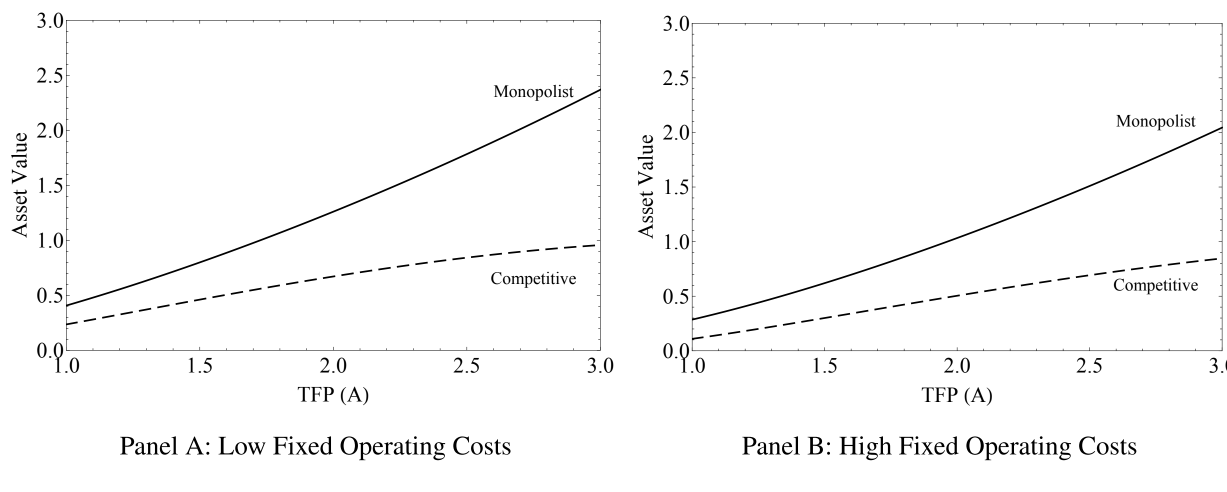
$$G^{\mathrm{C}} = -G_{-}^{\mathrm{C}} = -\frac{\gamma\Gamma^{\mathrm{C}}}{\upsilon_{\mathrm{G}}}\left[\frac{\Gamma^{\mathrm{C}}(\upsilon_{\mathrm{G}}-\gamma)}{\left(\kappa_{\mathrm{P}}+\frac{f}{r}\right)\upsilon_{\mathrm{G}}k}\right]^{\frac{\upsilon_{\mathrm{G}}}{\gamma}-1} < 0. \tag{A33}$$

For the sake of generality, the constant $G^{\mathrm{C}}$ in Section I uses a slightly different notation, such that it is equal to the product of the equation above times $K^{-\upsilon_G}$. Finally, the optimal investment threshold $x$ equals:

$$x^{\mathrm{C}} = \left[\frac{\Gamma^{\mathrm{C}}}{\delta}\frac{(\upsilon_{\mathrm{G}}-\gamma)}{\left(\kappa_{\mathrm{P}}+\frac{f}{r}\right)\upsilon_{\mathrm{G}}k}\right]^{-\frac{1}{\gamma}}. \tag{A34}$$

### *A.5. Hypothesis 1 (Investment Channel)*

Figure A1 shows the values of the firm for the cases of perfect competition and monopoly, for the cases with low (Panel A) and high (Panel B) fixed operating costs. The figure illustrates that product market competition unconditionally destroys firm value. Moreover, that the value destruction is procyclical (i.e., is larger when productivity is larger).




Panel A: Low Fixed Operating Costs

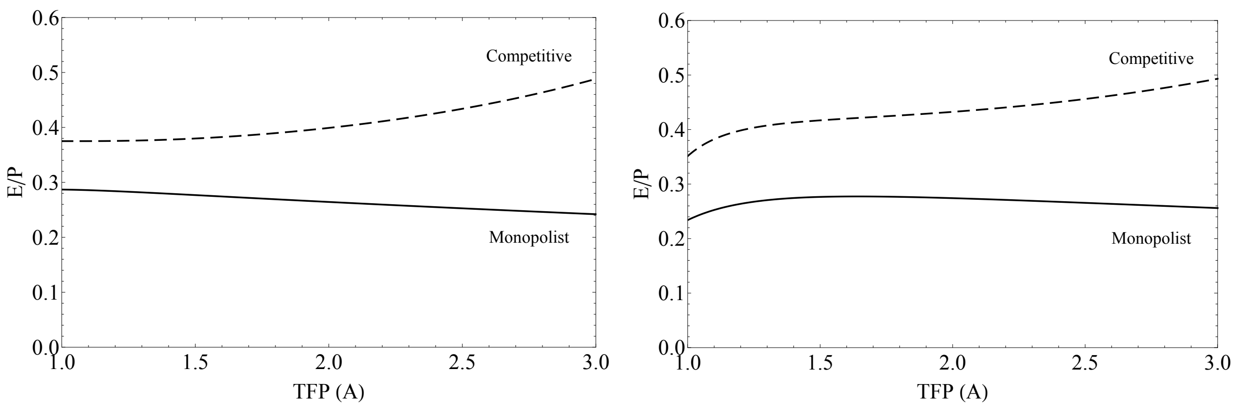
Panel B: High Fixed Operating Costs

**Figure A1. Model solution: Firm value for different levels of industry total factor productivity.** Parameters values used in plots: $\varepsilon = 3$, $\eta = 0.4$, $r = 5\%$, $w = 2$, $\alpha = 0.33$, $\mu_{\mathrm{A}} = 0\%$, $\sigma_{\mathrm{A}} = 50\%$, $K = 1$, $N = 1$, $\kappa_{\mathrm{P}} = 1$, $f = 0.05$ (Panel A), and $f = 0.10$ (Panel B).

The ratio of assets in place over total value is lower in firms in less competitive industries, than in otherwise identical firms in more competitive industries, such that:

$$\frac{\Pi_t^{\text{M}}/\delta}{V_t^{\text{M}}} < \frac{\Pi_t^{\text{C}}/\delta}{V_t^{\text{C}}}. \tag{A35}$$

The inequality relies on the fact that $G^{\text{M}} > 0$ while $G^{\text{C}} < 0$. From these inequalities, we get that $\frac{\hat{\pi}_t^{\text{M}}/\delta - fK_t/r}{V_t^{\text{M}}} < 1$ while $\frac{\hat{\pi}_t^{\text{C}}/\delta - fk_t/r}{V_t^{\text{C}}} > 1$. Hence $\frac{\hat{\pi}_t^{\text{M}}/\delta - fK_t/r}{V_t^{\text{M}}} < \frac{\hat{\pi}_t^{\text{C}}/\delta - fk_t/r}{V_t^{\text{C}}}$. This result is illustrated in Figure A2. The figure illustrates that, all else equal, firms in more competitive industries have higher earnings-to-price ratios.




Panel A: Low Fixed Operating Costs

Panel B: High Fixed Operating Costs

**Figure A2. Model solution: Earnings-to-price ratio for different levels of industry total factor productivity.** Parameters values used in plots: $\varepsilon = 3$, $\eta = 0.4$, $r = 5\%$, $w = 2$, $\alpha = 0.33$, $\mu_{\text{A}} = 0\%$, $\sigma_{\text{A}} = 50\%$, $K = 1$, $N = 1$, $\kappa_{\text{P}} = 1$, $f = 0.05$ (Panel A), and $f = 0.10$ (Panel B).

### *A.6. Hypothesis 2 (Operating Leverage Channel)*

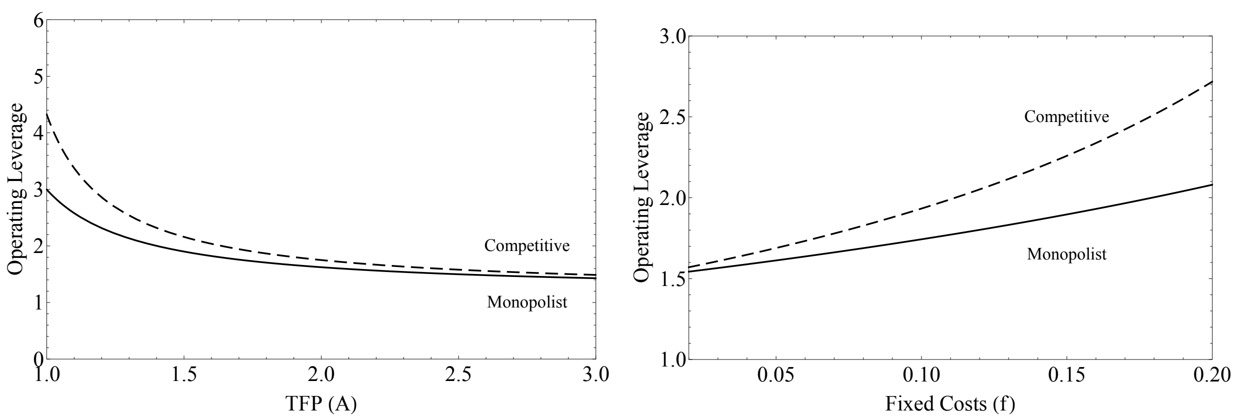
The model characterizes how a firm's fixed costs of production affects its operating leverage under different industry structures. We define operating leverage as the degree of sensitivity of operating profits to productivity shocks, such that:

$$\Theta \equiv \text{Cov}\left[\frac{d\pi}{\pi}, \frac{dA}{A}\right] \Big/ \text{Var}\left[\frac{dA}{A}\right] - 1, \tag{A1}$$

and we show in our simple model that the operating leverage of the firm is mechanically increasing in its fixed costs of production for any type of industry. The model shows that, for a given level of fixed costs per unit of capital $f$, a firm's operating leverage is higher in more competitive industries. All else being the same, the degree of operating leverage of a competitive firm is greater than that of a monopolistic one, such that:

$$\Theta_t^{\mathrm{M}} = \gamma(\varepsilon - 1)\left(\frac{fk_t}{\pi_t^{\mathrm{M}}} + 1\right) < \Theta^{\mathrm{C}} = \gamma(\varepsilon - 1)\left(\frac{fk_t}{\pi_t^{\mathrm{C}}} + 1\right). \tag{A2}$$

The inequality follows from the fact that, all else equal, $\frac{\pi^{\mathrm{C}}}{k} > \frac{\pi^{\mathrm{M}}}{K_t}$. In particular, total capital in both industries is equal to $K_t$. It follows that $\Gamma^{\mathrm{C}} < \Gamma^{\mathrm{M}}$. This result shows that a firm in a less competitive industry earns higher operating margins that partially buffer negative shocks. Figure A3 illustrates that operating leverage is unconditionally higher in more competitive industries.




Panel A: TFP

Panel B: Fixed Operating Costs

**Figure A3. Model solution: Operating leverage for different levels of TFP and fixed operating costs.** Parameters values used in plots: $\varepsilon = 3$, $\eta = 0.4$, $r = 5\%$, $w = 2$, $\mu_{\mathrm{A}} = 0\%$, $\sigma_{\mathrm{A}} = 50\%$, $K = 1$, $N = 1$, and $\kappa_{\mathrm{P}} = 1$. Additional parameter values used: $f = 0.1$ (Panel A) and $A = 4$ (Panel B).

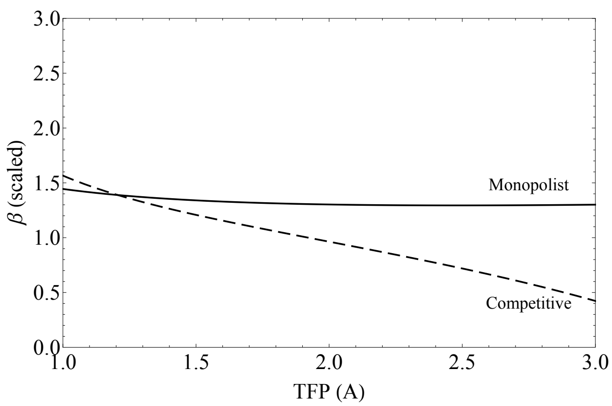
### *A.7. Hypothesis 3 (Opposing Effects of Product Market Competition on Expected Returns)*

All else being the same, the difference in betas between of a monopolistic firm and a competitive firm is such that:

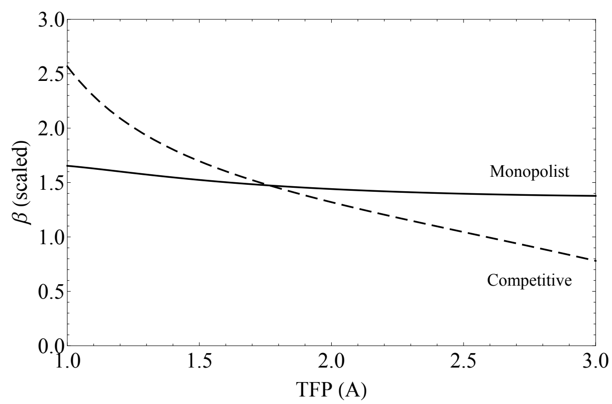
$$\beta_t^{\mathrm{M}} - \beta_t^{\mathrm{C}} \equiv (\sigma_{\mathrm{X}}\gamma - \sigma_{\mathrm{X}}\upsilon_{\mathrm{G}})\left(\frac{\Pi_t^{\mathrm{M}}/\delta}{V_t^{\mathrm{M}}} - \frac{\Pi_t^{\mathrm{C}}/\delta}{V_t^{\mathrm{C}}}\right) + \sigma_{\mathrm{X}}\gamma\left(\frac{fK_t/r}{V_t^{\mathrm{M}}} - \frac{fk_t/r}{V_t^{\mathrm{C}}}\right). \tag{A1}$$

The first term in the right side of equation (A1) is strictly positive. To see this, note that the first factor in the first term is strictly positive since $\gamma < 1$ and $\upsilon_{\mathrm{G}} > 1$. The second factor in the first term is strictly positive given our derivation of Hypothesis 1. The second term is strictly negative. To see this, note that the first factor is strictly positive. The second factor is strictly negative since $\frac{fK_t}{rV_t^{\mathrm{M}}} < \frac{fk_t}{rV_t^{\mathrm{C}}}$. This is illustrated by comparing Panels A and B in Figure A4. When fixed costs are relatively small (Panel A), the investment channel is stronger.

The result that product market competition may either reduce or increase risk exposure as shown in Figure A4 is consistent with the model proposed by Aguerrevere (2009). He considers a model of oligopoly in which firms are subject to fixed costs of production. He shows that product market competition affects expected returns differently depending on the level of market demand. For high levels of productivity, the relation between product market competition and risk exposure is positive (i.e. the investment channel prevails).




Panel A: Low Fixed Operating Costs




Panel B: High Fixed Operating Costs

**Figure A4. Model solution: Asset beta for different levels of industry total factor productivity.** Parameters values used in plots: $\varepsilon = 3$, $\eta = 0.4$, $r = 5\%$, $w = 2$, $\alpha = 0.33$, $\mu_{\mathrm{A}} = 0\%$, $\sigma_{\mathrm{A}} = 50\%$, $K = 1$, $N = 1$, $\kappa_{\mathrm{P}} = 1$, $f = 0.05$ (Panel A), and $f = 0.10$ (Panel B).

## *B. Database Construction*

Monthly common stock and accounting data are from firms covered in the CRSP/Compustat merged files that are listed on the NYSE, AMEX, and NASDAQ. We exclude industries with abnormal competitive environments, namely financial (SIC codes between 6000 and 6999) and regulated (SIC codes between 4900 and 4999). We exclude firm-year observations with at least one missing monthly return observation in the year or with a missing size, book-to-market, or leverage observation in the previous year. Firm-level accounting variables and size measures are Winsorized at the 0.5% level in each sample year to reduce the influence of possible outliers. For the same reason, we exclude from the sample the 5% smallest firms to avoid anomalies driven by micro-cap firms, as discussed by Fama and French (2008).

Size is defined as the market value of equity. Book value is defined as shareholders' equity divided by the market value of equity. We require the measures of book-to-market and size to be available at least seven months prior to the test year. Leverage ratios are calculated as the book value of debt adjusted for cash holdings, as reported in Compustat, divided by the sum of market value of equity and book value of debt (market-valued leverage ratio). Labor intensity is defined as the ratio of employment compensation divided by the industry value added net of taxes and subsidies, based on the U.S. Industry Account dataset published by BEA.

Annual stock returns are constructed as compounded monthly stock returns. Conditional market betas are estimated every year using monthly return data following the methodology in Lewellen and Nagel (2006). Conditional betas are robust for non-synchronous stock return data and are constructed, as in Dimson (1979), as the sum of the slope coefficients of regressions of excess returns on contemporaneous and lagged market excess returns. Market returns are from Kenneth French's website.

We also construct variables to use as controls in the first stage of the construction of the CBC measure as discussed below. The average industry annual growth in sales and the volatility in the industry growth are constructed using the item sale in Compustat. The volatility in industry growth is computed using a span of four years. The share of firms in the industry with positive expenses in R&D is constructed using the item *xrd* in Compustat. The average firm size by industry as measured by the logarithm of book assets (*at*). The average investment rate by industry is computed as the ratio of capital expenditures (*capex*) to total assets (*at*) as reported in Compustat. The average turnover of firms' shares by industry is constructed as the ratio of volume of stock traded divided by the number of shares outstanding for each firm; we then compute the average turnover by industry group. We also construct the share of public firms registered in NYSE by industry group; for this sake, we extract the main exchange for each firm as reported in CRSP.

## *C. Construction of the CBC Measure*

We construct the CBC measure in two stages. In the first stage, we estimate the inverse Mills ratios, as given by equation (16). In the second stage, we use these inverse Mills ratios to estimate adjusted means and variances of sales of public firms, as well as adjusted number of firms in the industry. This estimates are then used in our definition of the CBC measure, as given in equation (8).

To estimate the inverse Mills ratio, we first define the variables used in the vector $\mathbf{z}_i$ from equation (13). We purposely do not include any variables in $\mathbf{z}_i$ that contain market valuations. This is to avoid any mechanical relation between the CBC measure and a firm's earnings-to-price ratios, book-to-market ratios, or stock returns in our tests. We specify the vector $\mathbf{z}_i$ given the variables explaining the decision to go public discussed in Chemmanur et al. (2010). In particular, the vector $\mathbf{z}_i$ includes the average firm growth sales by industry, the standard deviation in the industry growth sales over the past four years, the share of firms in the industry with positive expenses in R&D, the average firm size by industry as measured by the logarithm of book assets, the average ratio of capital expenditures to total assets by industry. All variables are based on Compustat data. All these variables are also used in the vector $\mathbf{x}_i$ from equation (11) used in the second stage.

In addition to the variables above, the vector $\mathbf{z}_i$ also includes two instruments that are not included as explanatory variables in the second stage of the estimation. We consider these variables as instruments that are mechanically related to a firm's decision to be publicly listed, and yet they do not determine the level of sales and the variance of sales by industry. The first instrument is the average turnover of a firm's shares by industry. To construct this variable, we compute the ratio of volume of stock traded divided by the number of shares outstanding for each firm; we then compute the average turnover by industry group. This variable proxies for the amount of investor demand,as well as the amount of information produced for a given stock. Consistent with Chemmanur et al. (2010) and in untabulated results, we find that the share of public firms by industry is larger in industries with higher share turnover. The second instrument is the share of public firms in the industry quoting on NYSE. Given that each stock exchange has different listing requirements and different listing fees, this variable captures to what extent most public firms in a given industry prefer to quote on the NYSE exchange relative to other exchanges.

During the second stage, we consider $h_{ij}$ to be the logarithm of a firm's Compustat sales. We know that the conditional mean of $h_{ij}$ for a public firm is given by:

$$\begin{aligned} \mathrm{E}_t \left( h_{ij} | j \text{ is public} \right) &= \psi_t \mathbf{x}_{i,t-1} + \mathrm{E}_t \left( \varepsilon_{ij} | j \text{ is public} \right) \\ &= \psi_t \mathbf{x}_{i,t-1} + \rho_{it} \sigma_{it} \lambda_{it}, \end{aligned} \tag{C1}$$

where $\rho_i \sigma_i$ is the covariance of $\varepsilon_{ij}$ and $\zeta_i$ from equation (13). Similarly, the conditional variance of $h_{ijt}$ for a public firm is given by:

$$\begin{aligned}\text{Var}_t\left(h_{ij}|j \text{ is public}\right) &= \text{E}\left(\varepsilon_{ij}^2|j \text{ is public}\right) \\ &= \sigma_{it}^2\left[1-\rho_{it}^2\left(1-v_{it}\right)\right], \end{aligned} \tag{C2}$$

where $v_{it} \equiv 1-\lambda_{it}\left(\lambda_{it}+\hat{\hat{\gamma}}_t\mathbf{z}_{i,t-1}\right)$.

We use the results of the OLS cross-sectional regressions of the log sales in Compustat on $\mathbf{x}_i$ and $\lambda_i$ to compute the adjusted mean and variance in sales of public and private firms for all industry years. Given that the empirical methodology to correct for selection bias relies on the normality assumption, we use log sales in the OLS regressions since sales are highly skewed and the goodness-of-fit is higher when we use the variable in logs.

We use the results of the OLS regressions to construct the adjusted average sales for public and private firms by industry-year, $\hat{\mu}_{lnsales}$, and the adjusted industry variance in sales of public and private firms by industry-year, $\hat{\sigma}_{lnsales}$. Using the definition of the mean and variance of the log normal distribution function, we then apply these estimates to compute $\hat{\mu}_{sales}$ and $\hat{\sigma}_{sales}$.

We construct the CBC measure using the estimates $\hat{\mu}_{sales}$ and $\hat{\sigma}_{sales}$ in equation (8). For those industries in which we do not observe the total number of firms (i.e., non-manufacturing industries), we use the adjusted number of firms in the industry $\hat{N}_{it}$ given by:

$$\hat{N}_{it} \equiv \frac{N_{it}^{\text{PU}}}{\Phi(\hat{\hat{\gamma}}_t\mathbf{z}_{it})}. \tag{C3}$$

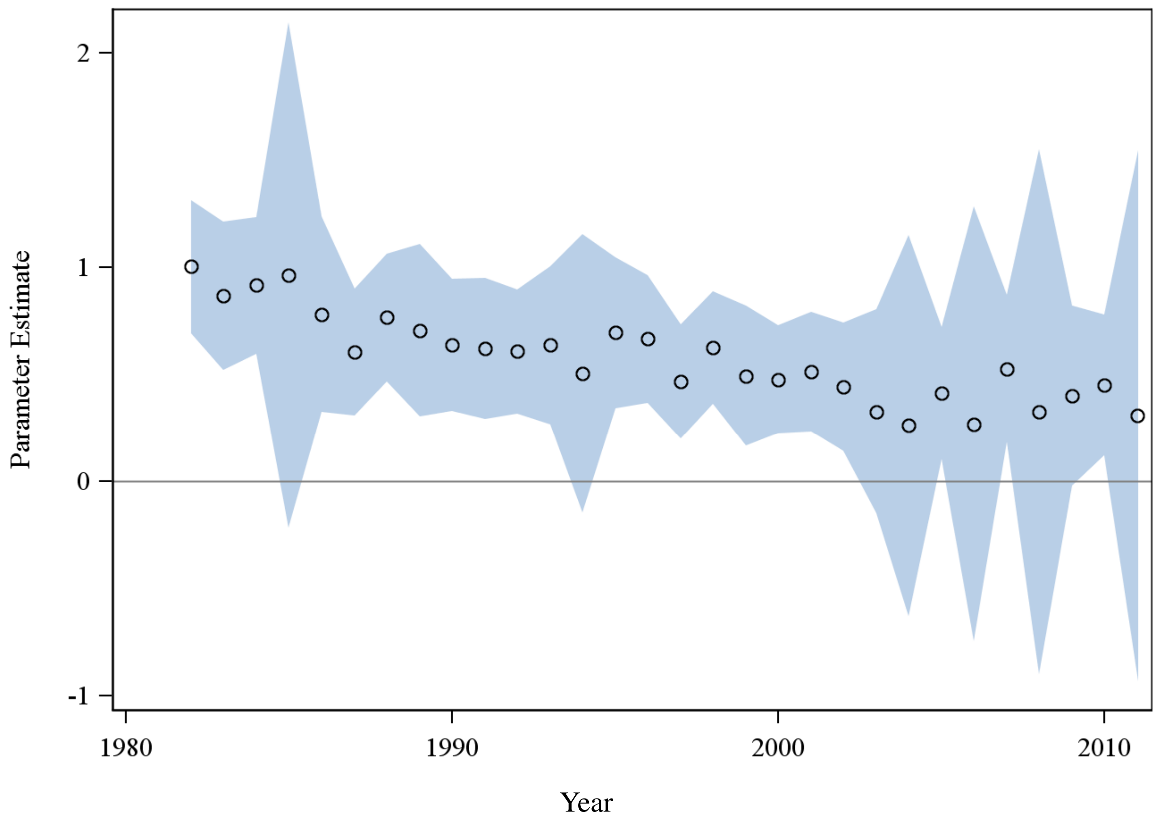
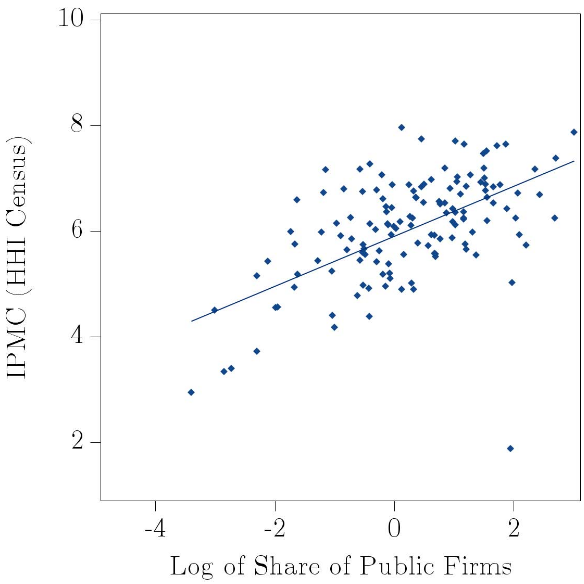
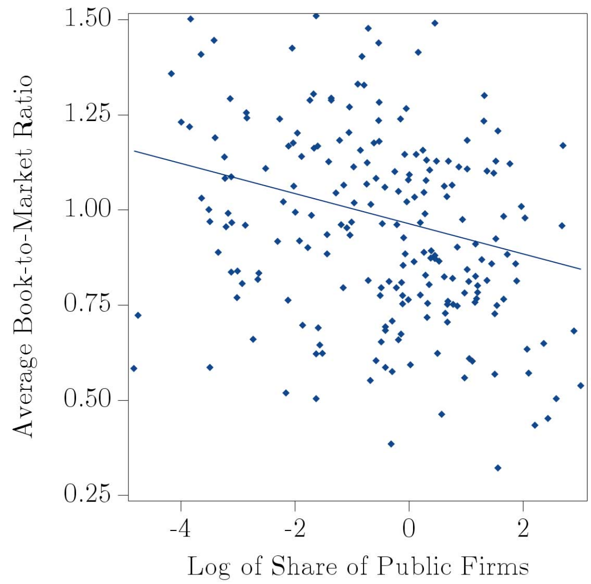


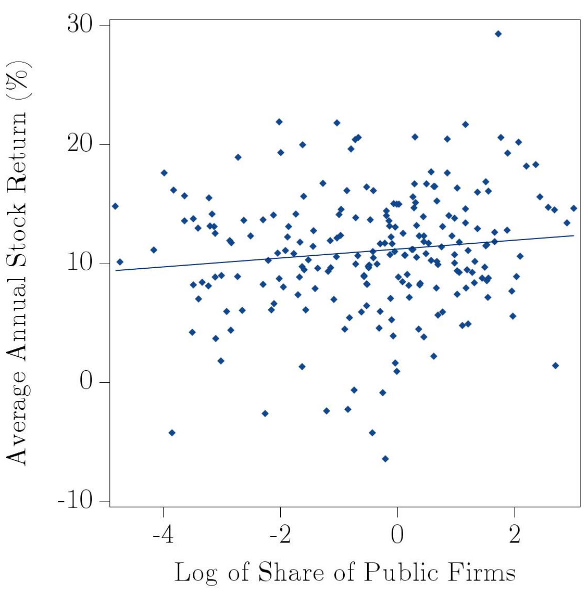

**Figure 1. Validation of CBC Measure:** This plot shows the estimates (circles) of the coefficients and associated confidence intervals (shaded area) of cross-sectional regressions of the characteristic-based concentration (CBC) measure on the U.S. Census-based sales HHI measure. The sample period is 1982 to 2011.



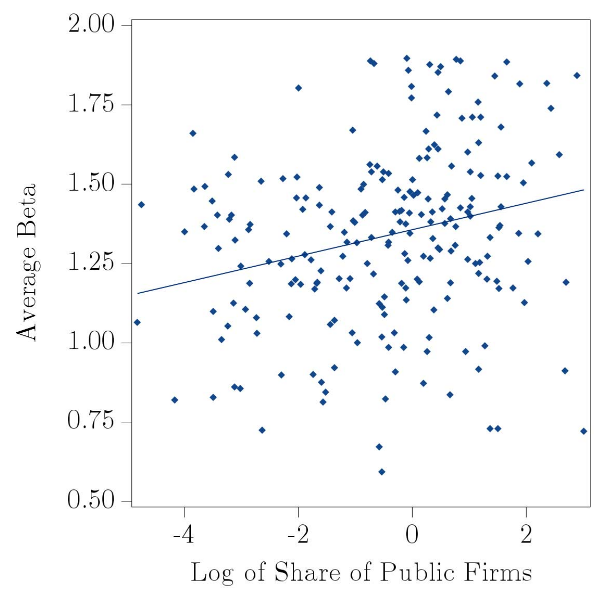

Panel A: Average Measure of IPMC (HHI)




Panel B: Average Book-to-Market Ratios




Panel C: Average Stock Returns




Panel D: Average CAPM Betas

**Figure 2. Evidence For Non-randomness in the Compustat Sample:** Panels A-D show the relation between the share of public firms to total firms in the industry to average betas, stock returns, book-to-market ratios, and the HHI measure of imperfect product market competition. The sample covers all industries in Compustat over the 1965 to 2011 period, except for Panel A, which only covers manufacturing industries over the 1982 to 2011 period.

**Table I**
**Most Competitive and Least Competitive Industries**

The table presents the bottom and top 15 four-digit SIC industries sorted on measures of imperfect product market competition (IPMC) in 2009.

| Panel A: Sorts by Characteristic-based Concentration (CBC) | | |
|---|---|---|
| SIC | Industry Title | CBC |
| | Most Competitive Industries | |
| 8721 | Accounting, Auditing, and Bookkeeping Services | -1.1 |
| 7371 | Computer Programming Services | -0.9 |
| 8741 | Management Services | -0.5 |
| 8011 | Offices and Clinics of Doctors of Medicine | -0.4 |
| 8734 | Testing Laboratories | 0.0 |
| 5712 | Furniture Stores | 0.1 |
| 5013 | Motor Vehicle Supplies and New Parts | 0.1 |
| 1731 | Electrical Work | 0.2 |
| 5531 | Auto and Home Supply Stores | 0.5 |
| 7812 | Motion Picture and Video Tape Production | 0.5 |
| 7311 | Advertising Agencies | 0.8 |
| 7381 | Detective, Guard, and Armored Car Services | 0.8 |
| 2741 | Miscellaneous Publishing | 0.9 |
| 5084 | Industrial Machinery and Equipment | 1.0 |
| 5063 | Electrical Apparatus and Equipment Wiring Supplies | 1.1 |
| | Least Competitive Industries | |
| 2834 | Pharmaceutical Preparations | 12.8 |
| 2836 | Biological Products, Except Diagnostic Substances | 12.7 |
| 1311 | Crude Petroleum and Natural Gas | 9.8 |
| 3663 | Radio and Television Broadcasting and Com. Equipment | 9.6 |
| 3674 | Semiconductors and Related Devices | 9.2 |
| 3845 | Electromedical and Electrotherapeutic Apparatus | 8.9 |
| 3572 | Computer Storage Devices | 8.0 |
| 3841 | Surgical and Medical Instruments and Apparatus | 8.0 |
| 2835 | In Vitro and In Vivo Diagnostic Substances | 7.7 |
| 2631 | Paperboard Mills | 7.6 |
| 7372 | Prepackaged Software | 7.6 |
| 2911 | Petroleum Refining | 7.5 |
| 3826 | Laboratory Analytical Instruments | 7.4 |
| 2111 | Cigarettes | 7.2 |
| 3825 | Instruments for Measuring and Testing of Electricity | 7.2 |

**Table I**
**Most Competitive and Least Competitive Industries (Cont.)**

| | Panel B: Sorts by Concentration Markup Combined (CMC) | |
|---|---|---|
| SIC | Industry Title | CMC |
| | Most Competitive Industries | |
| 2421 | Sawmills and Planing Mills, General | -2.9 |
| 2511 | Wood Household Furniture, Except Upholstered | -2.6 |
| 2011 | Meat Packing Plants | -2.5 |
| 3713 | Truck and Bus Bodies | -2.4 |
| 3341 | Secondary Smelting and Refining of Nonferrous Metals | -2.3 |
| 3312 | Steel Works, Blast Furnaces, and Rolling Mill | -2.2 |
| 2451 | Mobile Homes | -2.1 |
| 3443 | Fabricated Plate Work (Boiler Shops) | -2.1 |
| 3531 | Construction Machinery and Equipment | -2.0 |
| 3317 | Steel Pipe and Tubes | -2.0 |
| 3677 | Electronic Coils, Transformers, and Other Inductors | -2.0 |
| 3711 | MotorVehicles and Passenger Car Bodies | -1.8 |
| 3357 | Drawing and Insulating of Nonferrous Wire | -1.8 |
| 3442 | Metal Doors, Sash, Frames, Molding, and Trim Manuf. | -1.8 |
| 3081 | Unsupported Plastics Film and Sheet | -1.8 |
| | Least Competitive Industries | |
| 2834 | Pharmaceutical Preparations | 3.5 |
| 2836 | Biological Products, Except Diagnostic Substances | 3.0 |
| 2111 | Cigarettes | 2.8 |
| 3674 | Semiconductors and Related Devices | 1.7 |
| 3841 | Surgical and Medical Instruments and Apparatus | 1.1 |
| 2835 | In Vitro and In Vivo Diagnostic Substances | 1.0 |
| 3845 | Electromedical and Electrotherapeutic Apparatus | 1.0 |
| 3663 | Radio and Television Broadcasting and Com. Equipment | 0.8 |
| 3842 | Orthopedic, Prosthetic, and Surgical Appliances and Supplies | 0.8 |
| 2085 | Distilled and Blended Liquors | 0.5 |
| 2621 | Paper Mills | 0.3 |
| 2631 | Paperboard Mills | 0.3 |
| 3572 | Computer Storage Devices | 0.2 |
| 2082 | Malt Beverages | 0.2 |
| 3826 | Laboratory Analytical Instruments | 0.2 |

## Table II
## Summary Statistics of Firms Sorted on Industry Measures of Imperfect Competition

The table reports time series averages of median characteristics of portfolios of firms sorted on industry measures of imperfect competition. HHI is the logarithm of the Herfindahl-Hirschman Index of sales of firms in the industry, Markup is the average industry markup, CBC is the characteristic-based concentration measure, and CMC is the combined measure of CBC and *Markup*. CMC is constructed as the sum of the standardized *Markup* and CBC measures each year. TBC is the logarithm of the text-based measure of competition from Hoberg and Phillips (2010b). *HHI Comp.* is the logarithm of the Herfindahl-Hirschman Index of sales of firms in the industry using Compustat data, constructed as in Hou and Robinson (2006). *Lab. Int.* is the ratio of employee compensation to industry GDP from data from BEA. *Log Asset* is the logarithm of book value of assets. *Log Size* is the logarithm of market value of equity plus book value of total debt. *B/M* is shareholders equity divided by market value of equity. *E/P* is earnings divided by market value of equity. *Lev.* is the ratio of book value of debt adjusted for cash holdings, as reported in Compustat, divided by the assets. *Share Man.* is the share of manufacturing firms (SIC codes between 2000 and 3999). The sample period is 1965–2011, except for HHI, which covers 1982–2011, and TBC, which covers 1996–2011. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial (SIC codes between 6000 and 6999) and regulated (SIC codes between 4900 and 4999).

| Portfolio | Measure | HHI Comp. | Lab. Int. | Log. Asset | Log Size | B/M | E/P | Lev. | Share Man. |
|---|---|---|---|---|---|---|---|---|---|
| Panel A: Sorts by HHI measure | | | | | | | | | |
| L | 5.02 | 7.23 | 0.70 | 4.73 | 4.55 | 0.61 | 0.13 | 0.32 | 1.00 |
| 2 | 5.85 | 6.66 | 0.60 | 4.66 | 4.84 | 0.48 | 0.09 | 0.24 | 1.00 |
| 3 | 6.12 | 7.13 | 0.55 | 4.71 | 4.83 | 0.53 | 0.11 | 0.29 | 1.00 |
| 4 | 6.51 | 7.01 | 0.64 | 4.66 | 4.83 | 0.53 | 0.08 | 0.25 | 1.00 |
| H | 7.16 | 7.22 | 0.73 | 5.08 | 5.17 | 0.57 | 0.11 | 0.27 | 1.00 |
| Panel B: Sorts by Markup measure | | | | | | | | | |
| L | 0.21 | 7.49 | 0.73 | 5.05 | 4.54 | 0.83 | 0.22 | 0.44 | 1.00 |
| 2 | 0.28 | 7.42 | 0.72 | 4.77 | 4.42 | 0.75 | 0.20 | 0.38 | 1.00 |
| 3 | 0.34 | 7.43 | 0.72 | 4.49 | 4.32 | 0.68 | 0.17 | 0.33 | 1.00 |
| 4 | 0.42 | 7.02 | 0.67 | 4.11 | 4.28 | 0.55 | 0.12 | 0.25 | 1.00 |
| H | 0.54 | 6.97 | 0.53 | 4.39 | 4.70 | 0.44 | 0.09 | 0.22 | 1.00 |
| Panel C: Sorts by CBC measure | | | | | | | | | |
| L | 3.33 | 7.54 | 0.71 | 4.75 | 4.28 | 0.74 | 0.20 | 0.42 | 0.44 |
| 2 | 5.07 | 7.45 | 0.72 | 4.88 | 4.50 | 0.72 | 0.19 | 0.40 | 0.50 |
| 3 | 6.41 | 7.40 | 0.73 | 4.77 | 4.49 | 0.68 | 0.18 | 0.36 | 0.83 |
| 4 | 8.27 | 7.27 | 0.70 | 4.80 | 4.67 | 0.66 | 0.16 | 0.33 | 0.96 |
| H | 11.32 | 7.02 | 0.49 | 4.61 | 4.74 | 0.51 | 0.12 | 0.28 | 0.81 |
| Panel D: Sorts by CMC measure | | | | | | | | | |
| L | -1.60 | 7.58 | 0.72 | 4.75 | 4.25 | 0.81 | 0.21 | 0.42 | 1.00 |
| 2 | -0.80 | 7.53 | 0.72 | 4.82 | 4.47 | 0.75 | 0.20 | 0.38 | 1.00 |
| 3 | -0.14 | 7.35 | 0.74 | 4.77 | 4.59 | 0.69 | 0.17 | 0.34 | 1.00 |
| 4 | 0.85 | 6.96 | 0.70 | 4.57 | 4.64 | 0.61 | 0.14 | 0.28 | 1.00 |
| H | 2.69 | 6.88 | 0.51 | 4.35 | 4.72 | 0.45 | 0.08 | 0.21 | 1.00 |
| Panel E: Sorts by TBC measure | | | | | | | | | |
| L | 4.67 | 7.67 | 0.67 | 5.29 | 5.09 | 0.58 | 0.13 | 0.34 | 1.00 |
| 2 | 4.88 | 7.60 | 0.68 | 5.89 | 5.65 | 0.58 | 0.13 | 0.34 | 1.00 |
| 3 | 5.22 | 7.37 | 0.68 | 6.02 | 5.88 | 0.57 | 0.12 | 0.32 | 0.44 |
| 4 | 5.78 | 7.19 | 0.68 | 5.92 | 5.94 | 0.52 | 0.10 | 0.28 | 0.00 |
| H | 6.77 | 6.85 | 0.56 | 5.22 | 5.70 | 0.38 | 0.03 | 0.16 | 0.69 |

**Table III**
**Earnings-to-Price Ratio and Measures of Imperfect Industry Competition**

The table shows estimates and standard errors of Fama-MacBeth regressions of the average logarithm of earnings-to-price ratios on standardized measures of imperfect competition and average financial leverage. Averages are estimated by SIC 4-digit industry and year. *E/P* is the industry average of the logarithm of earnings divided by market value of equity in a given year. $\lambda$ is the inverse Mills ratio that controls for the sample-selection bias of public firms. Remaining variables are industry averages of described in Table II. Remaining variables are described in Table II. Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level), and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

Panel A: Industry Level Regressions

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-1}$ | -0.49$^{***}$ | -0.24$^{***}$ | -1.10$^{***}$ | -1.03$^{***}$ | -0.69$^{***}$ | -0.44$^{***}$ | -1.46$^{***}$ | -1.11$^{***}$ | -1.48$^{***}$ | -1.23$^{**}$ |
| | (0.08) | (0.08) | (0.12) | (0.13) | (0.17) | (0.12) | (0.14) | (0.12) | (0.42) | (0.42) |
| $\text{Log Asset}_{t-1}$ | 1.24$^{***}$ | 1.42$^{***}$ | 0.98$^{***}$ | 1.17$^{***}$ | 0.98$^{***}$ | 1.04$^{***}$ | 1.02$^{***}$ | 1.16$^{***}$ | 0.94$^{***}$ | 1.29$^{***}$ |
| | (0.12) | (0.14) | (0.10) | (0.13) | (0.09) | (0.10) | (0.11) | (0.12) | (0.17) | (0.16) |
| $\text{Leverage}_{t-1}$ | 15.05$^{***}$ | 14.38$^{***}$ | 11.95$^{***}$ | 10.62$^{***}$ | 13.82$^{***}$ | 13.62$^{***}$ | 11.20$^{***}$ | 11.22$^{***}$ | 16.78$^{***}$ | 13.81$^{***}$ |
| | (1.56) | (1.30) | (1.64) | (1.60) | (1.09) | (1.11) | (1.51) | (1.50) | (1.66) | (1.60) |
| $\text{Lab Int}_{t-1}$ | -0.10 | -0.12 | 0.01 | -0.12 | -0.13 | -0.15 | -0.28 | -0.28 | -0.40$^{***}$ | -0.54$^{***}$ |
| | (0.25) | (0.20) | (0.24) | (0.17) | (0.17) | (0.17) | (0.20) | (0.19) | (0.12) | (0.13) |
| $\lambda_{t-1}$ | | 2.30$^{***}$ | | 2.03$^{***}$ | | 0.69$^{*}$ | | 1.42$^{***}$ | | 1.55$^{***}$ |
| | | (0.31) | | (0.43) | | (0.37) | | (0.41) | | (0.31) |
| R-sq. (%) | 5.05 | 4.70 | 4.81 | 4.28 | 4.61 | 4.58 | 4.29 | 4.22 | 5.62 | 5.31 |
| Obs. | 3,177 | 2,909 | 5,487 | 4,454 | 6,791 | 6,791 | 4,240 | 4,240 | 3,019 | 2,806 |

**Table III**
**Earnings-to-Price Ratio and Measures of Imperfect Industry Competition (Cont.)**

| Panel B: Firm Level Regressions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HHI | | Markup | | CBC | | CMC | | TBC | |
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-1}$ | -0.36*** | 0.00 | -1.66*** | -1.39*** | -1.21*** | -0.94*** | -1.89*** | -1.68*** | -2.33*** | -1.52*** |
| | (0.11) | (0.09) | (0.12) | (0.11) | (0.22) | (0.12) | (0.18) | (0.14) | (0.32) | (0.37) |
| $\text{Log Asset}_{t-1}$ | 0.59*** | 0.63*** | 0.54*** | 0.51*** | 0.50*** | 0.48*** | 0.53*** | 0.48*** | 0.41** | 0.45*** |
| | (0.07) | (0.07) | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) | (0.15) | (0.14) |
| $\text{Leverage}_{t-1}$ | 17.26*** | 16.22*** | 13.54*** | 13.33*** | 14.44*** | 14.30*** | 13.41*** | 13.42*** | 16.88*** | 15.33*** |
| | (0.92) | (0.91) | (1.03) | (0.96) | (0.84) | (0.83) | (0.93) | (0.92) | (1.27) | (1.16) |
| $\text{Lab Int}_{t-1}$ | 0.00 | -0.25** | -0.08 | -0.15* | -0.33** | -0.31** | -0.34*** | -0.31*** | -0.76*** | -0.92*** |
| | (0.12) | (0.12) | (0.09) | (0.09) | (0.15) | (0.13) | (0.08) | (0.08) | (0.08) | (0.07) |
| $\lambda_{t-1}$ | | 3.51*** | | 1.51*** | | -0.06 | | -0.03 | | 3.25*** |
| | | (0.36) | | (0.47) | | (0.51) | | (0.54) | | (0.34) |
| R-sq. (%) | 8.42 | 8.23 | 7.48 | 7.28 | 7.65 | 7.61 | 7.33 | 7.29 | 8.91 | 8.64 |
| Obs. | 21,910 | 20,785 | 35,714 | 31,299 | 56,080 | 56,080 | 31,085 | 31,085 | 22,277 | 21,673 |

**Table IV**
**Book-to-Market Ratio and Measures of Imperfect Industry Competition**

The table shows estimates and standard errors of Fama-MacBeth regressions of the average logarithm of book-to-market ratios on standardized measures of imperfect competition and the average of the logarithm of annual revenues. Averages are estimated by SIC 4-digit industry and year. *B/M* is the industry average logarithm of shareholders equity divided by market value of equity in a given year. $\lambda$ is the inverse Mills ratio that controls for the sample-selection bias of public firms. Remaining variables are described in Table II. Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level), and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

Panel A: Industry Level Regressions

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-1}$ | -0.60*** | -0.28*** | -1.86*** | -1.75*** | -0.91*** | -0.45*** | -2.16*** | -1.77*** | -1.93*** | -1.66*** |
| | (0.07) | (0.07) | (0.09) | (0.08) | (0.15) | (0.12) | (0.17) | (0.10) | (0.27) | (0.32) |
| $\text{Log Asset}_{t-1}$ | 0.76*** | 1.03*** | 0.54*** | 0.64*** | 0.66*** | 0.77*** | 0.62*** | 0.72*** | 0.46*** | 0.72*** |
| | (0.14) | (0.16) | (0.09) | (0.13) | (0.11) | (0.12) | (0.11) | (0.13) | (0.09) | (0.11) |
| $\text{Leverage}_{t-1}$ | 0.79 | -0.88 | -1.66 | -1.67 | 1.70 | 1.23 | -1.52 | -1.36 | -1.28 | -3.39* |
| | (2.10) | (1.91) | (1.40) | (1.29) | (1.29) | (1.33) | (1.58) | (1.57) | (2.03) | (1.74) |
| $\text{Lab Int}_{t-1}$ | 0.00 | -0.20 | -0.18 | -0.43** | -0.29* | -0.34** | -0.52*** | -0.50*** | -0.37*** | -0.56*** |
| | (0.19) | (0.20) | (0.17) | (0.16) | (0.16) | (0.15) | (0.17) | (0.17) | (0.10) | (0.10) |
| $\lambda_{t-1}$ | | 3.24*** | | 2.34*** | | 1.59*** | | 1.37** | | 2.16*** |
| | | (0.30) | | (0.60) | | (0.55) | | (0.61) | | (0.20) |
| R-sq. (%) | 4.80 | 4.59 | 4.66 | 4.24 | 4.54 | 4.46 | 4.31 | 4.21 | 5.18 | 4.91 |
| Obs. | 3,219 | 2,942 | 5,545 | 4,493 | 6,841 | 6,841 | 4,268 | 4,268 | 3,072 | 2,850 |

**Table IV**
**Book-to-Market Ratio and Measures of Imperfect Industry Competition (Cont.)**

| Panel B: Firm Level Regressions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HHI | | Markup | | CBC | | CMC | | TBC | |
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-1}$ | -0.43*** | 0.17 | -2.25*** | -1.89*** | -1.29*** | -0.99*** | -2.39*** | -2.14*** | -3.04*** | -2.25*** |
| | (0.11) | (0.10) | (0.11) | (0.07) | (0.21) | (0.12) | (0.17) | (0.10) | (0.23) | (0.22) |
| $\text{Log Asset}_{t-1}$ | 0.69*** | 0.60*** | 0.50*** | 0.41*** | 0.38*** | 0.36*** | 0.45*** | 0.38*** | 0.28** | 0.22* |
| | (0.08) | (0.07) | (0.10) | (0.11) | (0.09) | (0.10) | (0.10) | (0.10) | (0.11) | (0.11) |
| $\text{Leverage}_{t-1}$ | -0.40 | -1.53 | -2.04** | -1.91** | -0.36 | -0.52 | -1.84** | -1.80** | -2.88** | -3.73*** |
| | (1.03) | (0.92) | (0.81) | (0.82) | (0.82) | (0.83) | (0.88) | (0.86) | (1.24) | (1.12) |
| $\text{Lab Int}_{t-1}$ | 0.39*** | 0.00 | 0.13 | 0.01 | -0.18 | -0.18 | -0.15 | -0.14 | -0.43*** | -0.53*** |
| | (0.13) | (0.12) | (0.12) | (0.11) | (0.14) | (0.12) | (0.12) | (0.10) | (0.07) | (0.06) |
| $\lambda_{t-1}$ | | 5.09*** | | 2.08*** | | 0.44 | | 0.14 | | 2.38*** |
| | | (0.29) | | (0.56) | | (0.54) | | (0.64) | | (0.34) |
| R-sq. (%) | 8.23 | 7.95 | 7.43 | 7.25 | 7.65 | 7.61 | 7.33 | 7.27 | 8.27 | 8.12 |
| Obs. | 27,609 | 26,245 | 42,379 | 37,312 | 65,270 | 65,270 | 37,087 | 37,087 | 27,718 | 27,003 |

**Table V**

**Operating Leverage of Firms Sorted on Measures of Imperfect Industry Competition**

The table reports average measures of operating leverage of firms sorted on lagged measures of imperfect competition. $OL^{\text{Comp}}$ is the measure of operating leverage from Novy-Marx (2011), defined as costs of goods sold plus sales, general, and administrative expenses over total assets. $OL^{\text{TFP}}$ is a measure of operating leverage based on the NBER/CES data defined as the slope of rolling time-series regressions of changes in value added on changes in TFP. H-L is the difference between the average statistic of firms with high imperfect competition (H) and of firms with low imperfect competition (L). Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level) and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Portfolio | $OL^{\text{Comp}}$ | $OL^{\text{TFP}}$ | $OL^{\text{Comp}}$ | $OL^{\text{TFP}}$ | $OL^{\text{Comp}}$ | $OL^{\text{TFP}}$ | $OL^{\text{Comp}}$ | $OL^{\text{TFP}}$ | $OL^{\text{Comp}}$ | $OL^{\text{TFP}}$ |
| L | 1.12 | 1.73 | 1.47 | 1.93 | 1.56 | 1.54 | 1.48 | 1.94 | 1.15 | 1.76 |
| 2 | 1.04 | 1.47 | 1.16 | 1.91 | 1.57 | 1.85 | 1.17 | 2.06 | 1.15 | 1.77 |
| 3 | 1.05 | 1.43 | 1.09 | 1.70 | 1.22 | 1.97 | 1.09 | 1.72 | 1.11 | 1.90 |
| 4 | 1.04 | 1.71 | 1.00 | 1.46 | 1.06 | 1.58 | 0.97 | 1.25 | 1.05 | 1.63 |
| H | 1.02 | 1.70 | 0.93 | 1.09 | 0.84 | 1.04 | 0.92 | 1.06 | 0.83 | 1.23 |
| H-L | -0.10*** | -0.03 | -0.53*** | -0.84*** | -0.72*** | -0.50*** | -0.56*** | -0.88*** | -0.32*** | -0.54*** |
| | (0.02) | (0.12) | (0.02) | (0.14) | (0.04) | (0.13) | (0.02) | (0.08) | (0.03) | (0.03) |

**Table VI**

**Operating Leverage and Measures of Imperfect Industry Competition**

The table shows estimates and standard errors of Fama-MacBeth regressions of operating leverage on standardized measures of imperfect competition and the average logarithm of firm market value. Averages are estimated by SIC 4-digit industry and year. The measure of operating leverage is the yearly industry average of the measure of operating leverage from Novy-Marx (2011), defined as costs of goods sold plus sales, general, and administrative expenses over total assets. $\lambda$ is the inverse Mills ratio that controls for the sample-selection bias of public firms. Remaining variables are described in Table II. Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level), and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

Panel A: Industry Level Regressions

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification | I | II | I | II | I | II | I | II | I | II |
| Measure$_{t-1}$ | -0.18*** | -0.05 | -1.74*** | -1.59*** | -0.82*** | -0.44*** | -1.90*** | -1.73*** | -0.98*** | -0.78*** |
| | (0.05) | (0.08) | (0.08) | (0.07) | (0.12) | (0.13) | (0.14) | (0.10) | (0.12) | (0.11) |
| Log Asset$_{t-1}$ | -0.12* | 0.05 | -0.18*** | 0.08* | 0.50*** | 0.63*** | -0.07 | 0.04 | 0.10 | 0.28** |
| | (0.07) | (0.07) | (0.06) | (0.04) | (0.06) | (0.06) | (0.04) | (0.05) | (0.09) | (0.11) |
| Leverage$_{t-1}$ | 7.59*** | 7.28*** | 3.35*** | 2.54*** | 3.85*** | 3.48*** | 3.31*** | 3.18*** | 7.20*** | 5.26*** |
| | (0.63) | (0.83) | (0.83) | (0.71) | (0.86) | (0.80) | (0.71) | (0.72) | (1.10) | (0.89) |
| Lab Int$_{t-1}$ | 1.82*** | 1.75*** | 1.81*** | 1.75*** | 3.42*** | 3.41*** | 1.53*** | 1.55*** | 3.31*** | 3.09*** |
| | (0.15) | (0.15) | (0.11) | (0.11) | (0.10) | (0.09) | (0.11) | (0.11) | (0.11) | (0.09) |
| $\lambda_{t-1}$ | | 1.70*** | | 1.63*** | | 1.26*** | | 0.63*** | | 1.74*** |
| | | (0.17) | | (0.17) | | (0.22) | | (0.21) | | (0.08) |
| R-sq. (%) | 3.30 | 3.13 | 2.86 | 2.70 | 4.17 | 4.14 | 2.75 | 2.73 | 4.88 | 4.69 |
| Obs. | 3,217 | 2,942 | 5,531 | 4,491 | 6,808 | 6,808 | 4,266 | 4,266 | 3,058 | 2,836 |

**Table VI**
**Operating Leverage and Measures of Imperfect Industry Competition (Cont.)**

| Panel B: Firm Level Regressions | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HHI | | Markup | | CBC | | CMC | | TBC | |
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-1}$ | -0.14*** | 0.07 | -1.44*** | -1.28*** | -1.13*** | -0.95*** | -1.42*** | -1.36*** | -1.71*** | -1.08*** |
| | (0.04) | (0.04) | (0.08) | (0.07) | (0.10) | (0.13) | (0.09) | (0.08) | (0.14) | (0.18) |
| $\text{Log Asset}_{t-1}$ | -0.36*** | -0.37*** | -0.29*** | -0.27*** | 0.22*** | 0.20** | -0.27*** | -0.27*** | -0.25*** | -0.23*** |
| | (0.09) | (0.09) | (0.07) | (0.07) | (0.08) | (0.07) | (0.07) | (0.07) | (0.05) | (0.04) |
| $\text{Leverage}_{t-1}$ | 8.24*** | 7.69*** | 4.74*** | 4.76*** | 4.71*** | 4.63*** | 4.89*** | 4.90*** | 6.73*** | 5.83*** |
| | (0.54) | (0.49) | (0.62) | (0.57) | (0.32) | (0.30) | (0.56) | (0.55) | (0.46) | (0.41) |
| $\text{Lab Int}_{t-1}$ | 1.63*** | 1.44*** | 1.79*** | 1.69*** | 3.41*** | 3.39*** | 1.58*** | 1.58*** | 2.89*** | 2.80*** |
| | (0.16) | (0.15) | (0.13) | (0.12) | (0.11) | (0.11) | (0.11) | (0.11) | (0.12) | (0.11) |
| $\lambda_{t-1}$ | | 2.15*** | | 1.18*** | | 0.11 | | 0.13 | | 2.06*** |
| | | (0.15) | | (0.17) | | (0.40) | | (0.19) | | (0.14) |
| R-sq. (%) | 4.73 | 4.64 | 4.19 | 4.20 | 5.65 | 5.62 | 4.23 | 4.23 | 6.00 | 5.88 |
| Obs. | 25,496 | 24,188 | 39,971 | 35,072 | 59,624 | 59,624 | 34,847 | 34,847 | 25,024 | 24,342 |

**Table VII**

**Cross-Section of Returns of Stocks Sorted on Measures of Imperfect Industry Competition**

The table reports two years ahead post-ranking mean annual excess stock returns over annualized one-month Treasury bill rates, and adjusted annual stock returns of portfolios of stocks sorted on lagged measures of imperfect competition. *ER* is portfolio returns minus the one-month Treasury bill, *DGTW* is returns adjusted for size, book-to-market, and momentum, according to the methodology in Daniel et al. (1997), *Unlev.* is unlevered returns calculated as excess returns times one minus book value of debt divided by assets minus book value of equity plus market value of equity. *Adj.* is returns adjusted for size, book-to-market, and operating margins (EBITDA / Assets). H-L is the zero investment portfolio long the portfolio of firms with high imperfect competition (H) and short the portfolio of firms with low imperfect competition (L). Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level) and (*** = 1% level). The sample period is 1967–2012, except for HHI, which covers 1984–2012, and TBC, which covers 1998–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

| Portfolio | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ER | DGTW | ER | DGTW | ER | DGTW | ER | DGTW | ER | DGTW |
| L | 10.56 | -1.45 | 11.50 | 0.06 | 10.96 | -0.63 | 11.10 | -0.85 | 13.01 | -0.63 |
| 2 | 12.40 | 2.42 | 9.77 | -1.25 | 11.79 | -0.27 | 9.36 | -1.78 | 11.76 | -0.78 |
| 3 | 11.30 | 1.44 | 12.15 | 0.48 | 10.98 | -0.07 | 11.48 | 0.99 | 13.01 | -0.25 |
| 4 | 12.56 | 2.07 | 11.32 | 1.76 | 11.00 | 0.83 | 11.61 | 1.95 | 14.81 | 2.30 |
| H | 14.80 | 3.87 | 13.81 | 4.57 | 12.26 | 3.26 | 14.34 | 5.05 | 19.02 | 5.95 |
| H-L | 4.24 | 5.32 | 2.30 | 4.51* | 1.30 | 3.89 | 3.24 | 5.89* | 6.01 | 6.57 |
| | (3.88) | (3.49) | (3.41) | (2.59) | (3.54) | (2.47) | (4.04) | (3.04) | (6.58) | (4.96) |
| | Unlev. | Adj. | Unlev. | Adj. | Unlev. | Adj. | Unlev. | Adj. | Unlev. | Adj. |
| L | 4.99 | -2.30 | 4.30 | -0.77 | 4.19 | -1.35 | 4.25 | -1.85 | 4.87 | -1.20 |
| 2 | 7.67 | 1.79 | 4.23 | -1.88 | 5.22 | -0.86 | 3.91 | -2.46 | 4.88 | -2.20 |
| 3 | 5.84 | 1.44 | 5.82 | -0.04 | 4.32 | -0.64 | 5.37 | -0.06 | 5.32 | -0.63 |
| 4 | 6.85 | 2.15 | 6.49 | 1.85 | 5.44 | 0.31 | 6.61 | 1.94 | 6.65 | 0.92 |
| H | 8.00 | 4.15 | 8.27 | 4.92 | 7.00 | 3.43 | 8.84 | 5.74 | 10.63 | 6.95 |
| H-L | 3.01 | 6.45* | 3.96* | 5.69** | 2.81 | 4.78* | 4.59* | 7.58** | 5.76 | 8.15* |
| | (2.50) | (3.69) | (2.11) | (2.58) | (2.34) | (2.48) | (2.68) | (3.04) | (4.82) | (4.57) |

**Table VIII**
**Annual Stock Returns and Measures of Imperfect Industry Competition**

The table shows estimates and standard errors of Fama-MacBeth regressions of stock returns of equally-weighted industry portfolios on standardized measures of imperfect competition and average firm characteristics. Averages are estimated by SIC 4-digit industry and year. λ is the inverse Mills ratio that controls for the sample-selection bias of public firms. Remaining variables are described in Table II. Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level), and (*** = 1% level). The sample period is 1967–2012, except for HHI, which covers 1984–2012, and TBC, which covers 1998–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

Panel A: Industry Level Regressions

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification | I | II | I | II | I | II | I | II | I | II |
| $Measure_{t-2}$ | 0.75 | 0.65 | 1.25* | 1.61*** | 1.74** | 1.57* | 2.43*** | 2.22*** | 8.46*** | 8.24** |
| | (0.71) | (0.68) | (0.65) | (0.57) | (0.76) | (0.81) | (0.75) | (0.70) | (2.77) | (3.02) |
| Log $Size_{t-2}$ | -5.64 | -4.91 | -10.03* | -12.48* | -16.84*** | -17.32*** | -8.99 | -8.54 | -7.82 | -15.68* |
| | (8.09) | (7.19) | (5.74) | (6.36) | (5.52) | (5.40) | (7.11) | (6.59) | (7.87) | (7.70) |
| Log $B/M_{t-2}$ | -3.82 | -2.09 | -6.82 | -8.60 | -11.52** | -11.54** | -4.99 | -3.58 | -4.30 | -8.40 |
| | (7.79) | (6.84) | (5.70) | (5.73) | (4.47) | (4.45) | (6.29) | (5.77) | (7.28) | (6.54) |
| Log $E/P_{t-2}$ | 0.57 | 0.90 | 2.02 | 1.60 | 2.08 | 1.94 | 1.21 | 1.00 | 5.10 | 4.41 |
| | (2.10) | (2.34) | (1.99) | (1.89) | (2.08) | (2.08) | (1.93) | (1.94) | (3.52) | (3.04) |
| Log $Asset_{t-2}$ | 4.86 | 3.76 | 8.77 | 11.53* | 16.10*** | 16.73*** | 8.14 | 7.66 | 7.18 | 14.71* |
| | (7.85) | (6.85) | (5.76) | (6.29) | (5.28) | (5.13) | (6.81) | (6.43) | (7.69) | (7.30) |
| $Leverage_{t-2}$ | -6.70 | -5.77 | -17.93 | -21.53 | -35.83*** | -37.05*** | -13.86 | -13.97 | -29.24 | -46.08* |
| | (21.10) | (18.86) | (15.44) | (14.29) | (12.96) | (12.56) | (15.48) | (14.76) | (22.99) | (23.25) |
| Lab $Int_{t-2}$ | -1.28 | -0.86 | -0.64 | 0.54 | 1.06 | 1.26 | 0.69 | 0.79 | -0.57 | 0.13 |
| | (0.83) | (0.87) | (0.69) | (0.96) | (1.11) | (1.03) | (1.09) | (1.07) | (1.63) | (1.60) |
| $\lambda_{t-2}$ | | -1.55 | | -2.36 | | -0.18 | | -1.69 | | -3.15* |
| | | (1.66) | | (2.53) | | (2.47) | | (2.90) | | (1.60) |
| R-sq. (%) | 30.76 | 30.47 | 29.64 | 27.41 | 29.35 | 29.20 | 26.86 | 26.66 | 38.84 | 37.53 |
| Obs. | 3,266 | 2,980 | 5,607 | 4,540 | 6,908 | 6,908 | 4,304 | 4,304 | 3,149 | 2,916 |

**Table VIII**
**Annual Stock Returns and Measures of Imperfect Industry Competition (Cont.)**

Panel B: Firm Level Regressions

| | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| Specification | I | II | I | II | I | II | I | II | I | II |
| $\text{Measure}_{t-2}$ | 1.19 | 0.76 | 2.21$^{**}$ | 1.98$^{**}$ | 1.74$^{***}$ | 1.24$^{**}$ | 2.92$^{***}$ | 2.36$^{***}$ | 4.49$^{**}$ | 3.67$^{**}$ |
| | (0.84) | (0.80) | (0.86) | (0.82) | (0.59) | (0.51) | (0.83) | (0.85) | (1.63) | (1.65) |
| Log $\text{Size}_{t-2}$ | -3.09 | -2.36 | -2.13 | -1.65 | -4.14$^{*}$ | -4.08$^{*}$ | -1.37 | -1.47 | -4.07 | -3.95 |
| | (3.84) | (3.68) | (2.19) | (2.40) | (2.16) | (2.19) | (2.35) | (2.40) | (3.34) | (3.32) |
| Log $\text{B/M}_{t-2}$ | 1.38 | 2.61 | 2.70 | 3.01 | -0.45 | -0.38 | 3.30 | 3.26 | 1.44 | 1.92 |
| | (2.89) | (2.72) | (1.99) | (2.08) | (1.63) | (1.67) | (2.01) | (2.04) | (2.10) | (2.05) |
| Log $\text{E/P}_{t-2}$ | -0.42 | -0.42 | 0.90 | 0.80 | 1.15 | 1.19 | 0.90 | 0.87 | -1.66 | -1.21 |
| | (1.86) | (1.91) | (1.34) | (1.36) | (1.07) | (1.04) | (1.35) | (1.35) | (1.70) | (1.62) |
| Log $\text{Asset}_{t-2}$ | 1.65 | 0.82 | 0.02 | -0.40 | 2.55 | 2.48 | -0.61 | -0.57 | 2.50 | 2.30 |
| | (3.67) | (3.49) | (2.08) | (2.20) | (1.86) | (1.88) | (2.15) | (2.19) | (3.33) | (3.32) |
| $\text{Leverage}_{t-2}$ | -0.53 | 1.87 | 4.77 | 5.73 | -2.74 | -2.69 | 6.34 | 6.00 | 2.75 | 4.17 |
| | (8.18) | (7.63) | (5.53) | (4.89) | (3.75) | (3.74) | (4.97) | (4.91) | (7.84) | (7.19) |
| Lab $\text{Int}_{t-2}$ | -1.26$^{*}$ | -0.87 | -0.96$^{*}$ | -0.74 | 0.20 | 0.17 | -0.65 | -0.58 | -0.37 | -0.10 |
| | (0.71) | (0.76) | (0.57) | (0.57) | (0.89) | (0.86) | (0.63) | (0.59) | (1.05) | (0.99) |
| $\lambda_{t-2}$ | | -5.34$^{***}$ | | -3.94$^{**}$ | | -1.00 | | -2.23 | | -4.05$^{**}$ |
| | | (1.31) | | (1.74) | | (1.86) | | (1.84) | | (1.63) |
| R-sq. (%) | 59.75 | 59.73 | 53.20 | 52.18 | 52.60 | 52.53 | 52.32 | 52.27 | 63.96 | 63.82 |
| Obs. | 23,628 | 22,439 | 37,987 | 33,366 | 60,385 | 60,385 | 33,130 | 33,130 | 24,732 | 24,037 |

**Table IX**

**Average Conditional Betas of Stocks Sorted on Measures of Imperfect Industry Competition**

The table reports average conditional betas of portfolios stocks sorted on lagged measures of imperfect competition. *Beta* is the betas with respect to the market risk factor from Kenneth French's website. *Unlev.* is unlevered betas, calculated as beta times one minus book value of debt divided by assets minus book value of equity plus market value of equity. H-L is the zero investment portfolio long the portfolio of firms with high imperfect competition (H) and short the portfolio of firms with low imperfect competition (L). Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level) and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

| Portfolio | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Beta | Unlev. | Beta | Unlev. | Beta | Unlev. | Beta | Unlev. | Beta | Unlev. |
| Panel A: Sorts Across All Firms | | | | | | | | | | |
| L | 1.54 | 1.01 | 1.54 | 0.88 | 1.49 | 0.85 | 1.52 | 0.87 | 1.38 | 0.89 |
| 2 | 1.56 | 1.16 | 1.56 | 0.95 | 1.54 | 0.92 | 1.53 | 0.94 | 1.42 | 0.92 |
| 3 | 1.51 | 1.05 | 1.60 | 1.05 | 1.63 | 1.03 | 1.57 | 1.03 | 1.49 | 0.99 |
| 4 | 1.83 | 1.32 | 1.72 | 1.26 | 1.62 | 1.08 | 1.65 | 1.16 | 1.61 | 1.13 |
| H | 1.75 | 1.26 | 1.65 | 1.26 | 1.57 | 1.13 | 1.67 | 1.30 | 1.85 | 1.50 |
| H-L | 0.21*** | 0.25*** | 0.12 | 0.38*** | 0.08 | 0.28*** | 0.14 | 0.42*** | 0.47*** | 0.61*** |
| | (0.07) | (0.07) | (0.08) | (0.07) | (0.09) | (0.09) | (0.12) | (0.11) | (0.12) | (0.12) |
| Panel B: Sorts Within 5 Groups of Firms Sorted on Size | | | | | | | | | | |
| L | 1.51 | 1.00 | 1.53 | 0.87 | 1.47 | 0.85 | 1.48 | 0.85 | 1.36 | 0.88 |
| 2 | 1.53 | 1.13 | 1.56 | 0.96 | 1.51 | 0.91 | 1.53 | 0.95 | 1.45 | 0.94 |
| 3 | 1.58 | 1.13 | 1.60 | 1.06 | 1.63 | 1.04 | 1.57 | 1.03 | 1.51 | 1.00 |
| 4 | 1.78 | 1.27 | 1.69 | 1.23 | 1.63 | 1.07 | 1.66 | 1.16 | 1.60 | 1.12 |
| H | 1.78 | 1.27 | 1.69 | 1.28 | 1.60 | 1.15 | 1.69 | 1.30 | 1.84 | 1.48 |
| H-L | 0.27*** | 0.27*** | 0.16* | 0.41*** | 0.13* | 0.29*** | 0.21* | 0.45*** | 0.48*** | 0.60*** |
| | (0.07) | (0.06) | (0.09) | (0.08) | (0.08) | (0.08) | (0.11) | (0.11) | (0.12) | (0.12) |

**Table X**

**Beta Decomposition of Firms Sorted on Measures of Imperfect Industry Competition**

The table shows results from the decomposition of unlevered conditional betas of portfolios of stocks sorted on lagged measures of imperfect competition. The decomposition follows the methodology in Bernardo et al. (2007). Panel A reports average betas of assets in place ($\beta^A$) and betas of growth options ($\beta^G$), as given in equation (18). Panel B reports weights of the components of unlevered betas related to operating leverage and growth options, as given in equation (19). H-L is the difference between the average statistic of firms with high imperfect competition (H) and of firms with low imperfect competition (L). Newey-West standard errors estimated with one lag are shown in parentheses. Significance levels are denoted by (* = 10% level), (** = 5% level) and (*** = 1% level). The sample period is 1966–2012, except for HHI, which covers 1983–2012, and TBC, which covers 1997–2012. The sample covers manufacturing-only industries, except for CBC and TBC, which cover all industries in Compustat except for financial and regulated.

| Portfolio | HHI | | Markup | | CBC | | CMC | | TBC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Panel A: Betas** | | | | | | | | | |
| | Assets in Place | Growth Options | Assets in Place | Growth Options | Assets in Place | Growth Options | Assets in Place | Growth Options | Assets in Place | Growth Options |
| L | 0.54 | 1.42 | 0.47 | 1.36 | 0.45 | 1.41 | 0.47 | 1.39 | 0.54 | 1.32 |
| 2 | 0.53 | 1.45 | 0.54 | 1.53 | 0.47 | 1.47 | 0.52 | 1.46 | 0.53 | 1.31 |
| 3 | 0.53 | 1.38 | 0.57 | 1.51 | 0.54 | 1.54 | 0.57 | 1.51 | 0.55 | 1.37 |
| 4 | 0.57 | 1.53 | 0.58 | 1.55 | 0.59 | 1.56 | 0.59 | 1.52 | 0.60 | 1.44 |
| H | 0.63 | 1.60 | 0.59 | 1.51 | 0.52 | 1.49 | 0.56 | 1.51 | 0.66 | 1.53 |
| H-L | 0.09*** | 0.18*** | 0.12*** | 0.15*** | 0.07*** | 0.08 | 0.09** | 0.12* | 0.12*** | 0.20*** |
| | (0.03) | (0.04) | (0.04) | (0.05) | (0.02) | (0.06) | (0.03) | (0.07) | (0.04) | (0.05) |
| | **Panel B: Weights (%)** | | | | | | | | | |
| | Op. Lev. | Growth Options | Op. Lev. | Growth Options | Op. Lev. | Growth Options | Op. Lev. | Growth Options | Op. Lev. | Growth Options |
| L | 33.5 | 33.9 | 48.3 | 12.0 | 44.2 | 21.3 | 46.9 | 15.6 | 31.3 | 36.8 |
| 2 | 26.4 | 45.6 | 41.1 | 21.0 | 42.4 | 23.5 | 42.3 | 19.3 | 31.5 | 35.6 |
| 3 | 29.7 | 38.4 | 37.1 | 26.8 | 38.0 | 26.5 | 37.5 | 25.7 | 31.1 | 35.3 |
| 4 | 31.5 | 36.0 | 29.4 | 39.3 | 36.0 | 28.5 | 31.9 | 33.2 | 27.5 | 40.9 |
| H | 31.4 | 35.4 | 24.6 | 47.2 | 29.1 | 39.3 | 23.8 | 48.7 | 19.6 | 54.7 |
| H-L | -2.0** | 1.4 | -23.7*** | 35.1*** | -15.1*** | 18.0*** | -23.2*** | 33.2*** | -11.7*** | 17.9*** |
| | (0.8) | (1.3) | (1.6) | (2.8) | (2.0) | (3.9) | (1.8) | (3.6) | (1.3) | (3.1) |