The Value of Intangible Capital Around the World

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Abstract

We estimate the value of intangible capital across 77 countries through the valuation approach of a neoclassical model of investment with two heterogeneous types of capital inputs: physical capital (e.g. plants and machines) and intangible capital (e.g. brand name, stock of knowledge). We estimate the structural model using data on public listed firms across the world, and infer the contribution of intangible capital for the firm's market value in each country. We find that the neoclassical model with two types of capital fits the data well for most of the major economies. The good model fit is a consequence of the inclusion of intangible capital and country/region specific adjustment cost parameters, which suggests that frictions in the accumulation of intangible capital have a country/region specific component. Finally, we find that intangible capital accounts for the large share of the market value of firms in all countries. The growth of intangible capital value is faster in emerging economies such as China, but slower in developed economies such as the United States. Our estimation results explain the geography of intangible capital investment premium, by inferring the latent parameters for intangible capital valuation.

Key Words: Valuation, Neoclassical Investment, Structural Estimation, Intangible Capital
JEL Classification: D21, D22, E22, E24, G12, G32

1 Introduction

What determines the market value of firm's intangible capital? Do these values differ across countries? We answer these questions through the lens of a generalized neoclassical model of investment with two inputs: physical and intangible capital. Through structural estimation, and using data for a large cross section of publicly traded firms in 77 countries, we use the model to quantify the relative importance of intangible capital across the world.

In the model, changing the quantity of the capital inputs is costly, which we capture through standard adjustment cost functions. The firm's equilibrium market value depends on the shadow price and the quantity of each installed input, and the shadow prices can be inferred from investment data through the specification of an adjustment costs function. If the operating profit function and the adjustment costs function are both homogeneous of degree one, the market value of each input is the product of the input's shadow price and the corresponding stock variable. The total market value of the firm is then the sum of the market value of all the inputs, and this additive property allows us to compute the contribution of each input for firm value in a straightforward manner.

To take the model to the data, we need to measure the firm-level stocks of each capital input. For physical capital, the data is readily available from the firm's reports. For intangible capital, the capital stock data is not readily available given its nature. Following previous studies, see (Eisfeldt and Papanikolaou, 2013) and (Peters and Taylor, 2017), we construct firm-level measures of intangible stock from accounting data on Selling, General and Administrative (SG&A) expenses, a measure that is well populated in the data for our countries and includes many types of intangible capital.[1]As shown by (Lev and Radhakrishnan, 2005) SG&A is a broad measure of the multiple components of intangible capital, it captures the value of the skilled labor force (as it accounts for the costs of training workers), knowledge capital (as it often includes R&D expenditures), and brand capital (as it accounts for advertising expenses), and which also includes other operational expenses. We accumulate this expenditures using the perpetual inventory method to obtain the capital stocks for intangible capital.

Our estimation methodology follows (Belo et al., 2022b). We estimate the model by minimizing the distance between the observed and the model-implied valuation ratios (market value of equity plus net debt-to-book value of capital stocks). To reduce the impact of measurement error in firm-level data, we estimate the model using portfolio-level moments. We target the cross-sectional portfolio-level mean and match the realized time series of the portfolio-level valuation ratios.

Using data from Compustat (North America and Global), we estimate adjustment cost parameters for physical and intangible capital for individual countries and regions. For larger equity markets, where the data quality is superior, we estimate country specific adjustment cost parameters. We estimate this parameters for 18 countries, that include all major economies and account for 28% of world GDP and 9% of global value added. For the remaining countries, to overcome the data quality problem, we estimate the adjustment cost parameters by pooling these remaining countries into a region according to their location and following the region criteria of United Nation statistics. We estimate the region specific adjustment parameters for nine regions. In total, including the individual countries and the regions, our analysis includes 77 countries that represent 34% of world GDP and 11% of global value added. Using the estimated adjustment costs parameters, we use our model to decompose the value of the firms into physical and intangible capital for

[1]Other measures as expenditure of R&D or brand while well populated in the US and Canada (see Belo et al. (2022b)) is missing for the majority of the sample for other countries.

these countries. Next we describe our main empirical findings.

First, we show that the neoclassical model of investment with multiple inputs fits the data well for multiple economies. For the major markets, where we estimate country specific parameters, the model performs well in explaining both the time-series and the cross-sectional variation of the valuation ratios across portfolios, with a cross country average time-series R^2 of 33% and a cross-sectional R^2 of 69%. For the region estimation, the model also has good explanatory power, with an cross region average time-series R^2 of 44% and a cross-sectional R^2 of 68%. While the success of the multiple input for US and Canada is known (see (Belo et al., 2022b)), it is interesting (and surprising) that it also performs well for a wide range of countries.

Second, we find that the good model fit is a consequence of the inclusion of intangible capital and country/region specific adjustment cost parameters. For country-level analysis, the fit of the physical-capital-only model becomes negative for most of the countries, implying that the model fails to the dispersion of firm-valuation ratio. The results for regions is similar and together point towards the importance of the intangible capital in explaining firm value. To show the importance of the country specific adjustment cost parameters, we perform a counterfactual exercise. In this counter-factual estimation, we assume that all countries have the same adjustment cost parameter as that of US. With that assumption, the R^2, becomes negative again. This result is consistent with our finding that adjustment costs vary significantly across country and regions. For the larger equity markets, the physical capital parameter goes from 0.86 for Japan to 8.59 for USA, with a cross country average of 4.18 and standard deviation of 1.93. In Germany, UK and the India, estimated parameters are around that average, with estimated values of 6.21, 6.24 and 4.76 respectively. The intangible capital adjustment cost parameter is larger and more volatile than the physical capital one. The estimates range from 2.42 for Japan to 30.77 for China, with an cross country average of 10.82 and standard deviation of 6.36. The USA, UK and Canada are around that average, with estimated values of 15.69, 8.47 and 11.44. For regions, the figure is similar, with an average of 4.83 (11.43) and standard deviation of 2.37 (3.88) for physical (intangible).

Third, we find that intangible capital accounts for a large share of the market value of firms all countries. . We take the estimated parameters of geography-specific and capital-specific adjustment **cost to construct the market share of intangible capital for each firm and each time point. For the per country estimation, the value of intangible capital is on average 50.66% of the firm market value. There is a large heterogeneity in the market share of intangible capital, ranging from 63.56% in USA and 33.41% in South Korea. Besides the United States, top 5 intangible market share countries include China (61.73%) , UK (61.57%), France (59.42%) and Hong Kong (59.24%). For all countries, besides Germany and France, the cost of adjustment of intangible is higher than the cost of adjusting physical capital. On average, the adjustment cost of intangible is 2 times larger than the physical capital. The picture is similar for per region estimation, with market share of intangible capital being 15.81% higher than book. Together, these results imply that intangible capital is a key input of production and value for firms across the world.

Finally we use our estimated market share of intangible to study the risk premium of this input across different regions. Both the Fama-Macbeth cross-sectional regression, and the Panel OLS regression confirms that the market share of intangible capital brings empirically significant positive risk premium for financial market investors. For all firms in our sample, increasing 1% the market share of intangible capital, brings 0.070% additional return per year, while for firms locating in Asia, the slope of risk premium is 0.076% per year and higher than the value for North America and Europe (0.0054 and 0.053 respectively). . These results imply that high adjustment cost of intangible capital from the depth of capital markets, leads to the time-varying risk-exposure toward the aggregate shocks across firms in the globe. For practice of asset management and wealth management across the globe, quantifying the market environment for intangible capital helps identify the risk-exposure toward the aggregate economic shocks accurately and timely.

Our work is closely related to the large literature on valuation and production-based asset pricing, we focus our discussion on the part of intangible capital. (Belo et al., 2022b) decomposes of the value of the firms in North America across physical capital, labor and two intangibles (brand capital and knowledge capital). Taking the adjustment cost estimated in (Belo et al., 2022b) to decompose the long-run evolution of firm valuation, (Crouzet and Eberly, 2021) explains the quantitative tension between physical-capital investment rate and the firm valuation. (Peters and Taylor, 2017) incorporate organization capital into the measurement of a novel proxy for the Tobin's Q. This new proxy explains total firm investment better than standard proxies. (Eisfeldt and Papanikolaou, 2013) show that firms with more organization capital are riskier than firms with less organization capital. (Hansen et al., 2012) study the risk characteristics of intangible capital. In international macro-finance, research on the cross-section of equity valuation is scarce. To our knowledge, our paper is the first attempt for accounting value of intangible capital in global economy.

Our work directly talks to the cross-country study of equity market. (Fama and French, 2012) test the asset pricing models of local factors, the size, value, and momentum across 4 regions built from 23 countries. (Chaieb et al., 2021) estimate the asset pricing models and risk premium of factors, in the fashion of Fama-French factor models. (Asness et al., 2013) evaluate the value strategy and momentum strategy in US, UK, Japan and European region. They found the momentum strategy tends to yield positive investment return across markets, while it is difficult to establish the universal conclusion about the performance of value strategy. (Vincenz, 2023) constructed the ratio between the equity valuation and the intangible capital, build the cross-section investment strategy by longing the high-intangible firms and shorting the low-intangible firms. Across 4 regions, North America, Europe, Japan and Asia-Pacific, (Vincenz, 2023) found this intangible strategy generates positive investment return during 1983-2021. Compared to above research over reduced-form asset pricing models, our work carefully considered the Generalized-Q theory, which provides a simple and powerful framework to understand the firm valuation in the dynamic environment. Compared to (Vincenz, 2023), our work includes the physical capital, considers the time-varying contribution of intangible capital toward the firm valuation using the lens of a structural model. (Chui et al., 2010) investigate the cross-country heterogeneity of culture, and the corresponding outcome of stock market. Via a dataset of 41 countries, they claimed that in countries with high individualism, the stock market volatility tends to be higher, and the momentum strategy tends to yield higher investment return. (Hassan et al., 2021) extracts the firm-level exposure toward the country-specific risk, using the textual analysis. They found stock return is higher when the firm-level risk measure is higher, which is consistent with the risk-based asset pricing theories. Compared with above asset pricing research of cross-country study, our work quantifies the local capital market environment using the Q-theory, decomposes the value of intangible capital and the value of physical capital at firm-level. The decomposition of firm valuation provides a new measure of firm-level exposure, by considering the heterogeneity of intangible capital and physical capital within the firm.

Our work also talks to the recent literature of modern corporate sector in international finance. (Karabarbounis and Neiman, 2014) documente declining labor share of income in national accounting data, both in the United States and globally. (Chen et al., 2017) investigated the increasing corporate saving in the private corporate sector, globally. (De Loecker and Eeckhout, 2018) documente the increasing dispersion of markup globally. (Falato et al., 2022) provide an explanation for the simultaneous shift toward the intangible capital and the corporate saving. (Altomonte et al., 2021) claim that the frictions in intangible investments can lead to the dispersion of markup at firm-level. Our work quantifies the difficulty of intangible investments at the country/region level. The parameters of investment adjustment cost function, reflects the financial market friction in local market. Further, our work quantifies the stock of intangible capital and value of intangible capital at the country/region level. These statistics adds to above literature, in understanding the trend of intangible capital at the country/regional level, and the role of capital market environment in the financial valuation of intangible capital. From the asset pricing perspective, we documented the fact that firms with higher valuation share of intangible capital are charged with higher cost of equity.

Our work also talks to the recent literature of modern corporate sector with intangible capital. (Crouzet et al., 2022) demonstrate the spillover effect in the non-rivalry use of intangible capital in an extended Neoclassical investment model. Our work provides empirical investigation into the stationary distribution of intangible share across countries. We documented the fact that countries with higher dispersion of intangible share have lower level of intangible share, measured with median of distribution and mean of distribution. Further, our structural estimation of capital adjustment cost delineates the market environment of accumulating intangible capital and physical capital, such as the institution environment of intellectual property protection. In countries where the intangible capital is relatively less costly, the correlation between of dispersion and median is stronger, hence, the stronger predatory effect in using intangible capital.

The rest of the paper proceeds as follows. Section 2 presents the model. Section 3 introduces the functional forms, describes the estimation procedure. Section 4 describes the data and Section 5 presents the empirical results. In Section 6, we discuss risk premium of intangible capital . In Section 7, we compare the country-level stock market performance and stationary distribution of intangible share. Finally, Section 8 concludes. The Appendix has additional results and robustness checks.

2 The Model of the Firm

We consider a neoclassical model of the firm as in (Belo et al., 2022b)(we use the consistent notation with Belo et al. (2022b) whenever possible) with several quasi-fixed inputs. Time is discrete and the horizon is infinite. Firms choose costlessly adjustable inputs (e.g., materials, energy) each period, while taking their prices as given, to maximize operating profits (revenues minus the expenditures on these inputs). Because we treat intangible capital as quasi-fixed inputs, investments in intangible capital is excluded from our definition of operating profits. Then, taking these operating profits as given, firms optimally choose the physical and intangible capital investments, and debt to maximize their market value of equity.

To save on notation, we denote a firm's i set of capital as $\boldsymbol{K_{it}}$(variables in bold represent a vector). This set includes the physical capital stock (K^P_{it}) and the intangible capital stock (K^I_{it}). Similarly, we denote a firm's i set of investments in the inputs at time t, as $\boldsymbol{I_{it}}$. This set includes the investment in physical capital (I^P_{it}) and the investment in intangible capital (I^I_{it}).

The laws of motion of the firm's capital inputs are given by:

$$K^P_{it+1} = I^P_{it} + (1 - \delta^P_{it})K^P_{it} \quad (1)$$

$$K^I_{it+1} = I^I_{it} + (1 - \delta^I_{it})K^I_{it} \quad (2)$$

where δ_{it}^P and δ_{it}^I are the exogenous depreciation rates of physical and intangible capital, respectively.

2.1 Technology

The operating profit function for firm i at time t is $\Pi_{it} \equiv \Pi(\boldsymbol{K_{it}}, \boldsymbol{X_{it}})$, in which $\boldsymbol{X_{it}}$ denotes a vector of exogenous aggregate and firm-specific shocks. Firms incur adjustment costs when investing. The adjustment costs function is denoted $C_{it} \equiv C(\boldsymbol{I_{it}}, \boldsymbol{K_{it}})$. This function is increasing and convex in investment and hiring, and decreasing in the capital stocks. For physical and intangible capital inputs these costs include, for example, planning and installation costs, and costs related with production being temporarily interrupted. We assume that the firm's operating profit function and adjustment costs function are both homogeneous of degree one and we specify the functional forms in the empirical section below.

2.2 Taxable Profits and Firm's Payouts

Firms can issue debt to finance their operations.[2] At the beginning of time t, firm i issues an amount of debt, denoted B_{it+1}, which must be repaid at the beginning of time $t+1$. r_{it}^B denotes the gross corporate bond return on B_{it}.

We can write taxable corporate profits, denoted TCP, as operating profits minus intangible capital investments (which are expensed), physical capital depreciation, adjustment costs, and interest expense:

$$TCP_{it} = \Pi_{it} - I_{it}^I - \delta_{it}^P K_{it}^P - C_{it}.$$

Thus, adjustment costs are expensed, consistent with treating them as foregone operating profits.

Let τ_{it} be the corporate tax rate. The firm' payout, denoted D, is then given by:[3]

$$D_{it} \equiv (1-\tau_t)[\Pi_{it} - C_{it} - I_{it}^I] - I_{it}^P + B_{it+1} - r_{it}^B B_{it} + \tau_t \delta_{it}^P K_{it}^P + \tau_t (r_{it}^B - 1) B_{it}, \tag{3}$$

in which $\tau_t \delta_{it}^P K_{it}^P$ is the depreciation tax shield, and $\tau_t (r_{it}^B - 1) B_{it}$ is the interest tax shield.

2.3 Equity Value

Firm i takes the stochastic discount factor, denoted $M_{t+\triangle t}$, from period t to $\triangle t$ as given when maximizing its cum-dividend market value of equity:

$$V_{it} \equiv \max_{\{\mathbf{I}_{it+\triangle t}, \mathbf{K}_{it+\triangle t+1}, B_{it+\triangle t+1}\}_{\triangle t=0}^{\infty}} E_t \left[\sum_{\triangle t=0}^{\infty} M_{t+\triangle t} D_{it+\triangle t} \right], \tag{4}$$

subject to a transversality condition given by $\lim_{T\to\infty} E_t[M_{t+T} B_{it+T+1}] = 0$, and the laws of motion for the capital inputs given by equations (1).

Let $P_{it} \equiv V_{it} - D_{it}$ be the ex-dividend equity value. In theonline appendix we show that, given the homogeneity of degree one of the operating profit and adjustment costs functions, the firm's value

[2] We include debt in the model to better fit the data, but for parsimonious reasons we keep the financing side of the firm as simple as possible.

[3] Note that physical capital investment and intangible capital investments are treated differently given the different accounting rules. Investment in physical capital is spread out over time and expensed as depreciation, while the intangible capital costs are mostly treated as expenses at the time that they occur.

maximization implies that:

$$P_{it} + B_{it+1} = q^P_{it} K^P_{it+1} + q^I_{it} K^I_{it+1}, \tag{5}$$

in which

$$q^P_{it} \equiv 1 + (1-\tau_t)\partial C_{it}/\partial I^P_{it} \tag{6}$$
$$q^I_{it} \equiv (1-\tau_t)\left[1 + \partial C_{it}/\partial I^I_{it}\right] \tag{7}$$

and $\partial C_{it}/\partial x$ denotes the first derivative of the adjustment costs function with respect to variable x, q^P_{it}, and q^I_{it} measure the shadow prices of physical capital and intangible capital, respectively (the Lagrange multipliers of equations (1) to (2)). The valuation equation (5) is simply an extension of (Hayashi, 1982)'s result to a multi-factor inputs setting.

According to equation (5) the firm's market value is given by the sum of the value of the firm's installed capital inputs. This additive feature allows us to compute the fraction of firm value that is attributed to each input (henceforth referred simply as "input-shares") in a straightforward manner as follows:

$$\mu^P_{it} = \frac{q^P_{it} K^P_{it+1}}{q^P_{it} K^P_{it+1} + q^I_{it} K^I_{it+1}} \tag{8}$$
$$\mu^I_{it} = \frac{q^I_{it} K^I_{it+1}}{q^P_{it} K^P_{it+1} + q^I_{it} K^I_{it+1}} \tag{9}$$

The fundamental goal of the empirical analysis is to characterize these input-shares, including their variation across countries and over time.

3 Estimation Methodology

In this section we specify the functional forms and describe the estimation procedure.

3.1 Functional Forms

The valuation equation (5) only requires the specification of the adjustment costs function, not of the operating profit function. We consider the following quadratic adjustment costs function:

$$C_{it} = \frac{\theta_P}{2}\left(\frac{I^P_{it}}{K^P_{it}}\right)^2 K^P_{it} + \frac{\theta_I}{2}\left(\frac{I^I_{it}}{K^I_{it}}\right)^2 K^I_{it}, \tag{10}$$

in which $\theta_P, \theta_I > 0$ are the parameters that control the magnitude of the adjustment costs of each input.

This functional form implies that the shadow prices of the capital inputs can be inferred from firm-level data on investment, capital stocks, and taxes, and are given by:

$$q^P_{it} \equiv 1 + (1-\tau_t)\theta_P\left(\frac{I^P_{it}}{K^P_{it}}\right) \tag{11}$$
$$q^I_{it} \equiv (1-\tau_t)\left[1 + \theta_I\left(\frac{I^I_{it}}{K^I_{it}}\right)\right] \tag{12}$$

We adopt a simple quadratic adjustment cost specification for parsimonious reasons and to avoid parameter proliferation. There are several implicit assumptions in our simple specification, such as using gross flows, smooth, convex and symmetric adjustment costs. See (Belo et al., 2022b) for a discussion of these assumptions.

3.2 Estimation Procedure

The valuation equation (5) links firm value to the value of its capital inputs. Because the distribution of firm value is skewed, scaling variables avoid the attenuation bias from firm-year observations of large-size firms. We use the sum of the firm's capital inputs as the scalar variable, which we denote as A_{it+1}, the firm's total (effective) dollar amount of capital inputs (physical capital stock and intangible capital stock). Accordingly, we write a firm's valuation ratio ($VR_{it} \equiv (P_{it} + B_{it+1}) / A_{it+1}$) as:

$$VR_{it} = q_{it}^{P} \frac{K_{it+1}^{P}}{A_{it+1}} + q_{it}^{I} \frac{K_{it+1}^{I}}{A_{it+1}}. \tag{13}$$

The left-hand side (LHS) of equation (13) can be directly measured in the data from equity price and debt data (and measures of the capital stocks, which we discuss below). The right hand side (RHS) of equation (13) is the predicted valuation ratio from the model, which we will denote as $\widehat{VR}_{it}$, and depends on firm-level real variables and model parameters.

Equation (13) establishes an exact relationship between a firm's observed valuation ratio and its model-implied valuation ratio at each time-period. However, due to the noise in firm-level data and the sensitivity of their moments to entry and exit and missing observations, using equation (13) and firm-level data to directly estimate the model parameters is challenging. Therefore, we follow the same methodology as (Belo et al., 2022b) and estimate portfolio-level moments. The portfolio estimation methodology provide robust estimates when the data is noisy. Further, to avoid the attenuation bias from extreme years in the sample, we use rolling-window aggregation and estimate the accumulated moments during the window. This estimation methodology inherit the spirit of long-horizon Euler Equation estimation as (Parker and Julliard, 2005) and (Belo et al., 2022a).

We proceed as follows. In theory, at each point in time, any cross-sectional moment of the observed firm-level valuation ratios in the LHS of equation (13) should be equal to any corresponding cross-sectional moment of the model-implied firm-level valuation ratios in the RHS of equation (13). Accordingly, for each portfolio j and for each year t, we compute the cross-sectional mean observed and model-implied valuation ratios ($\overline{VR}_{jt}$ and $\widehat{\overline{VR}}_{jt}$, respectively) of the firms in the portfolio as follows:

$$\overline{VR}_{jt} = \sum_{h=0}^{H} \sum_{i} \frac{VR_{it+h}}{N_{jt+h}}$$

$$\widehat{\overline{VR}}_{jt}(\Theta) = \sum_{h=0}^{H} \sum_{i} \frac{\widehat{VR}_{it+h}}{N_{jt+h}}\ ,\ i \in \text{portfolio } j,$$

where Θ represents the vector of structural parameters, $\Theta = [\theta_P, \theta_I]$, and N_{jt} is the number of firms in portfolio j at time t. We target cross-sectional mean valuation ratios because these moments capture the economic behavior of a typical (average) firm in the economy, which is what the theoretical model is designed to study.

We then proceed under the standard assumption that the portfolio-level valuation ratio moments are observed with error by the econometrician:

$$\overline{VR}_{jt} = \widehat{\overline{VR}}_{jt}(\Theta) + \varepsilon_{jt}, \tag{14}$$

where ε captures measurement error in the portfolio-level moments.[4] Based on equation (14), we then estimate the model parameters by minimizing the squared distance between the portfolio-level observed and model-implied valuation ratio moments at each point in time:

$$\widehat{\Theta} = \arg\min_{\Theta} \frac{1}{TN} \sum_{t=1}^{T} \sum_{j=1}^{N} \left(\overline{VR}_{jt} - \widehat{\overline{VR}}_{jt}(\Theta) \right)^2, \tag{15}$$

where T is the number of years in the sample, and N is the number of portfolios. An attractive feature of our estimation approach is that it corresponds to a simple linear ordinary least squares (OLS) estimation of (modified) portfolio-level average valuation ratios on portfolio-level averages of firm-characteristics. This is due to the linear relationship between the model-implied valuation ratio and the parameters, combined with the use of portfolio-level cross-sectional means as target moments.[5]

3.3 Portfolio Sorts

As noted above, the estimation is performed at the portfolio-level. We form two sets of portfolios sorted on the following variables: $\left(\frac{I^P_{it}}{K^P_{it}}\right)\left(\frac{K^P_{it+1}}{A_{it+1}}\right)$, $\left(\frac{I^I_{it}}{K^I_{it}}\right)\left(\frac{K^I_{it+1}}{A_{it+1}}\right)$. These variables have the maximal correlation with the firm-valuation ratio. Sorting on these variables avoids the weak identification of model parameters. In the appendix, we show that the results are robust to different choices of sorting variables. We then follow Fama and French (1993) in constructing the portfolios. Specifically, we sort all firms in each year t into ten portfolios based on the deciles of the sorting variable of each firm for the fiscal year ending in $t-1$. The portfolios are re-balanced at the end of each year. This procedure gives a total of 20 portfolios.

4 Data

In this section we provide a general description of the data. Additional details about data sources and harmonization of measures are available in the Section D in appendix. Our goal is to compare the contribution of the different inputs across country, focusing on physical and intangible capital. We use place of headquarter for the country definition.[6]

[4]Mismeasured components of the valuation ratio such as the market value of debt and the capital inputs can be better observed by firms than by econometricians. Furthermore, the intrinsic value of equity can temporarily diverge from the market value of equity.

[5]To show this claim more formally, define the following variables: $\overline{VR}^M_{jt} = \frac{1}{N_{jt}} \sum_{i \in j} \frac{\left(P_{jt} + B_{jt+1} - K^P_{jt+1} - (1-\tau_t) K^I_{jt+1}\right)}{A_{jt+1}}$ (the modified valuation ratio), $\overline{IPA}_{jt} = \frac{1}{N_{jt}} \sum_{i \in j} (1-\tau_t) \frac{I^P_{it}}{K^P_{it}} \frac{K^P_{it+1}}{A_{it+1}}$, and $\overline{IKA}_{jt} = \frac{1}{N_{jt}} \sum_{i \in j} (1-\tau_t) \frac{I^I_{it}}{K^K_{it}} \frac{K^I_{it+1}}{A_{it+1}}$,. We can then write equation (14) as:

$$\overline{VR}^M_{jt} = \theta_P \overline{IPA}_{jt} + \theta_I \overline{IKA}_{jt} + \varepsilon_{jt} \tag{16}$$

which establishes a linear relation between the portfolio-level modified valuation ratio and portfolio-level characteristics. Thus, our objective function in (15) corresponds to a simple linear OLS regression of equation (16).

[6]For robustness check, we also consider defining the location of firm as its residing country. The result is similar.

We construct firm-level measures of market value, input investment and stock using the financial reports of publicly-traded firms in each country. For firms in United States and Canada, we collect the annual balance sheet information from Compustat North America Annual Fundamentals and stock price information provided by the Compustat-CRSP linked dataset. For firms located in other countries, we collect the annual information using the data from Compustat Global Annual Fundamentals and stock prices from Compustat Global Security Daily.

We set the currency as the U.S. dollar for all countries. For each country, we use the GDP and population provided by the database National Accounts Main Aggregates, from United Nations Statistics Division (UNSD). The frequency is annual and varies per country. For major economies the data is from 2000-2020 (see Table 1 for individual country sample). We deflate the variables using the country-specific consumer price index.[7]

We estimate the adjustment cost parameters by country for the economies with large equity market, which we define as the country having data for at least 200 firms in 2020. As described in Table 1, 18 countries satisfy this requirement: Australia, Canada, China, France, Germany, Hong Kong, India, Indonesia, Israel, Japan, Malaysia, Poland, Singapore, South Korea, Taiwan, Thailand, United Kingdom, United States of America. For the rest of the countries, to ensure the sample size, we estimate the adjustment cost parameters by pooling countries into a region according to their location and following the region criteria of United Nation statistics. We use the classification of sub-region, as the definition of region in our estimation. Under this criteria, there are 17 regions in total. For the 4 regions as Melanesia, Micronesia, Polynesia, Central Asia, we don't have valid observations of listed firms locating in these regions.

When estimating the parameters per region, we exclude the countries estimated individually. This procedure avoids the double-accounting of observations. In 3 regions as Northern America, Eastern Asia, Australia and New Zealand, we don't have valid observations of listed firms locating in these regions after the large economies are selected out (United States, Canada, China, Japan, India, Australia). In Africa, Egypt and Zimbabwe are excluded because the hyperinflation generates inconsistent meaure of firm-level capital. The two Sub-regions *Northern Africa* and *Sub-Saharan Africa*are are merged as *Africa* for sufficient observations inside this region. As such, the final sample is composted with 18 large countries and 9 regions. The regions are: *Southern Asia* (Bangladesh, Sri Lanka, Pakistan), *South-Eastern Asia* (Philippines, Viet Nam), *Western Asia* (United Arab Emirates, Bahrain, Cyprus, Jordan, Kuwait, Oman, Palestine, Qatar, Saudi Arabia, Turkey), *Southern Europe* (Spain, Greece, Croatia, Italy, Malta, Serbia, Slovenia), *Eastern Europe* (Bulgaria, Hungary, Romania, Russia, Ukraine), *Northern Europe* (Denmark, Estonia, Finland, Ireland, Iceland, Lithuania, Latvia, Norway,Sweden), *Western Europe* (Austria, Belgium, Switzerland, Luxembourg, Netherlands, Portugal), *Africa* (Cote D'ivoire, Gahana, Kenya, Mauritius, Morocco,, Nigeria,Tunisia, South Africa, Zambia, Zimbabwe), *Latin America and the Caribbean* (Argentina, Brazil, Chile, Colombia, Cayman Island, Jamaica, Mexico, Peru).

Overall, our analysis studies 77 countries across multiple regions. In the next subsection we describe the construction of specific variables, including the measurement of the intangible capital stocks, and report descriptive statistics of the key variables used in the analysis.

[7]Due to the hyper-inflation, we include firms locating in Zimbabwe after year 2010. For other countries with hyper-inflation, we restrict the ceiling of inflation rate as 25% per year, when computing the investment rate and capital stock.

4.1 Measure

4.1.1 Physical Capital

The initial physical capital stock, K_{it}^{P}, is given by net property, plant, and equipment (data item PPENT). The capital depreciation rate, δ_{it}^{P}, is the amount of depreciation (data item DP) divided by the beginning of the period capital stock.[8] We then construct a measure of the firm's capital stock at current prices. Specifically, we construct an investment-price adjusted capital stock that accounts for changes in the real cost of physical capital investment by repricing last period's capital stock using today's price of investment (P_t^P) as $K_{t+1}^P = K_t^P(1-\delta_t)\frac{P_{t+1}^P}{P_t^P} + I_{t+1}$. Following (Belo et al., 2022b) we infer physical capital investment from the law of motion of capital using the equation of law of motion (with adjustment of inflation). This procedure guarantees that the investment and capital stock are consistent with the law of motion for physical capital in the model.

4.1.2 Intangible Capital

Following (Eisfeldt and Papanikolaou, 2013) we construct a measure of intangible capital based on Selling, General and Administrative (SG&A) expense data (Compustat data item XSGA) and using the perpetual inventory method as follows:

$$K_{j,t+1}^{I} = \mathrm{I}_{j,t+1}^{I} + (1-\delta^{I}) \cdot K_{j,t}^{I} \cdot \frac{\mathrm{P}_{t+1}^{I}}{\mathrm{P}_{t}^{I}}. \tag{17}$$

where P_t^I is approximated as the CPI of home country in local currency. [9]

We set organization capital investment to be equal to 30% of SG&A expenditures following (Eisfeldt and Papanikolaou, 2013) and (Peters and Taylor, 2017). To implement the law of motion in equation (17) we must choose an initial stock and a depreciation rate. Using the perpetual inventory method, we set the initial stock to:

$$K_{j,0}^{I} = \frac{I_{j,0}^{I}}{g_{\mathrm{Ind}(j)}^{I} + \delta^{I} - \pi_{\mathrm{Ind}(j)}^{I} \cdot (1-\delta^{I})}. \tag{18}$$

in which $I_{J,0}^{I}$ is the firm's investment in organization capital in the first year in the sample, and $\pi_{\mathrm{Ind}(j)}^{K}$ is the average price growth rate, in the industry, in each country. We let $g_{\mathrm{Ind}(j)}^{K}$ be industry-specific and set it equal to the average growth rate of the SG&A investments in that industry. We consider the first 2-digits of NAICS industry code to classify the industry in each country. As for the intangible depreciation rate, δ^{I}, we use 20% following the (Eisfeldt and Papanikolaou, 2013). Once we have the initial capital stock, we iterate forward using the appropriate depreciation rate, SG&A expenses, and investment price index. The investment rate on intangible capital is then given by the ratio of the current period investment and the beginning of the period corresponding intangible capital stock I_t^I/K_t^I.

[8] Negative depreciation of capital is not well-defined. If the depreciation rate is greater than 1, we impute the rate as 1.

[9] Here, the depreciation rate of intangible capital is calibrated as the constant value. So the sub-script of depreciation rate is negliected in equation 17.

4.1.3 Additional Firm-level Variables and National Account Variables

We measure the debt value B_{it}, as book value of net total debt referring (Belo et al., 2022b). We calculate the net debt as long-term debt (Compustat data item DLTT) plus short-term debt (data item DLC), minus cash (data item CHE). We set the measure as zero when they are missing. The market value of equity, P_{it}, is the closing price per share (data item PRCCF) times the number of common shares outstanding (data item CSHO). The market value is calculated at the year-end price during the fiscal year of the firm. All nominal value in local currency are converted into the nominal USD dollar amount, using the annual-average exchange rate. We measure the tax rate, τ_t, as the corporate income tax rate from the Tax Foundation, available for each country. When we lack the information of corporate tax income rate, we use the corporate income tax rate from the Compustat Global-Economic Indicators. Stock variables with subscript t ($t+1$ for debt) are measured and recorded at the end of year t, while flow variables with subscript t are measured over the course of year t and recorded at the end of year $t+1$.

4.2 Summary Statistics

Table 1 and Table 2 present key statistics about the main countries and regions studied. These tables show that the sample of 77 countries is representative of the total production across the world. Our total sample (large individual countries and regions) includes 17,069 firms, and the sales represent 34.10% of the world GDP in 2020. For the main equity markets, the 18 countries include 13,698 firms, and the sales represent 28.23% of world GDP in 2020. For these countries, per capital GDP in 2020 ranges from $1,849 for India to $58,148 for US. In Table 2 we present the regional statistics by aggregating individual countries inside each region.[10]

We set the starting-year to the year when the country/region has sufficient firm-year observations.In Table 1 and Table 2, Column (1) reports the starting year for each country/region. The end-year is 2020 for all countries/regions.

4.3 Preview of the Firm Level Data

Table 3 and 4 report key summary statistics of the observed valuation ratios and their model-implied components according to equation (13), for the major equity markets and regions.

The median valuation ratio across all major markets is 1.44 with heterogeneity across countries. While China has the maximum valuation ratio of 2.94, Japan has the lowest valuation at 0.84. In terms of the average size of the scaled input as intangible capital, which amounts to 38% of total book capital on average across major economies. This is lowest for China, accounting for 20% and highest for France standing at 67%. For regions, the figure is similar, with average valuation ratio across all regions at 1.38 and average intangible capital share at 36%.

According to equations (11) to (12), the investment rates determine the shadow prices of the labor and capital inputs. Columns (2) and (3) shows that, in the pooled sample, investment in intangible capital is on average higher than investment in physical capital for the majority of countries, with the exception of France and Sweden. The average investment rate in intangible capital across countries is 25%, with a maximum of 32% in China and a minimum of 19% in India. The average physical capital investment rate is 16%,

[10]For each country in each region, these statistics are reported in Table 14 in the appendix.

with a minimum of 3% in India and maximum of 24% in USA. Across regions, the average physical capital investment is 8% and intangible is 20%.

Column (7) of the tables reports the investment rate cross-correlations.The table shows that, as expected, the investment/hiring rates are all positively correlated among each other. The correlations range between 17% and 42% for major equity markets and 17% to 31% for regions. These correlations are significantly smaller than one, thus suggesting that there is at least some independent variation in the shadow prices, and hence the market values, of the different capital inputs in the data.

5 Estimation Results

This section reports the main empirical findings. Subsection 5.1 reports the parameter estimates and model fit. In subsection 5.2 we display the estimates and model fit of the model assuming the firm uses only the physical capital. Subsection 5.3 discusses the model-implied composition of firm value

5.1 Parameter Estimates and Model Fit

In Table 5, columns (1) and (2) report the adjustment cost parameter estimates of the model. The estimates are all positive, and are statistically significant, which implies that we cannot reject the hypothesis that these inputs are subject to zero adjustment costs. Furthermore, while there is a large heterogeneity across countries, overall the adjustment cost parameters of intangible capital are higher than the physical one. The cross country average adjustment cost coefficient of physical capital is $\theta_P = 4.18$, while the average adjustment cost coefficient of intangible capital is $\theta_I = 10.82$.

The dispersion in the estimated adjustment cost coefficient of intangible capital θ_I is larger than that of the physical capital. For physical capital, the standard deviation of the estimates across countries is 1.93, with estimates ranging from 0.86 for Japan to 8.59 for USA. For the intangible capital, the cross-countries standard deviation of the estimates is 6.36. The estimate of θ_I is relatively low in the European countries – like France (7.06), Germany (8.41) and the U.K. (8.47) – but high in North American countries like the United States (15.69) and Canada (11.44). The picture is less clear for Asia, with the estimates being low in Japan (2.42), South Korea (3.73) , Hong Kong (7.24) and Singapore (6.76), and high in China, India and Taiwan. We observe similar dispersion in the estimates across regions in Table 6.

Our structural estimation of adjustment cost reflects economic factors such as the intellectual property protection. We show that the estimated adjustment cost parameters convey information about the market environment of intellectual property protection. We collect the sufficient statistic of intellectual property protection from the the World Intellectual Property Organization (WIPO)[11] during 2016-2020 and compute the time-series average for available years in each country. . We also do robustness with Center for Prospective Studies and International Information (CEPII) using the similar approach.[12] Table 30 demonstrates the negative correlation between the ratio of adjustment cost, and the strength of intellectual property protection. Specifically, we find that one standard deviation of IP-protection leads to the decrease of relative cost as 0.31. [13]

[11] The url of WIPO is: https://www.internationalpropertyrightsindex.org/#world-map

[12] We use the statistics reported by CEPII in the year 2016.

[13] If using the strength measure of IP-protection provided by (CEPII), one standard deviation of IP-protection leads to the decrease of relative cost as 0.28.

The model including both the physical capital and intangible capital fit the data well, when we evaluate the model-fitness using the cross-sectional fitness measure and the time-series fitness measure. Table 5 shows that the cross-sectional R^2 is high, with an average of 69% across countries, even though the model estimation does not explicitly targets this moment. The average time-series R^2 is 33%. In terms of average valuation ratio errors, the model scaled mean absolute error (m.a.e./$\overline{\text{VR}}$) is 18% on average .

The good model-fit implies that the generalized Q-theory model with intangible and physical capital describes the valuation of firms well across a wide variety of countries. As demonstrated by the dispersed estimates of adjustment cost coefficient in each country/region, the market environment for accumultating physical capital and intangible capital differs across countries/regions. As the other side of the coin, the model explains the data better when it includes the country/region specific adjustment cost parameter in the estimation. In Table 5, Columns (6) to (8) displays the fitness of model assuming that the adjustment cost coefficients for all countries equal to the estimated cost coefficients for the US ($\theta_P = 8.59$ and $\theta_I = 15.69$). The estimated R^2 is negative for a wide range of countries, implying mispecification of common market environment for accumulating physical capital and intangible capital.

Turning to the analysis of the per region estimation of the model, Table 4, columns (1) and (2) show that all the adjustment cost parameters are positive The patterns are similar to the ones in the main equity markets. Investment in intangible capital is consistently more costly than the investment of physical capital. For physical capital, the cross-region average adjustment cost coefficient is 4.83, while this statistic is 11.43 for the intangible capital. Similar with Table 5, the dispersion of estimated parameter θ_I is larger than the parameter for physical capital θ_P . For the adjustment cost coefficient of intangible, the standard deviation equal to 3.88. For physical capital, the standard deviation is 2.37. The model fitness is high across regions. Table 6 shows that the cross sectional R^2 is high, with an average of 68% across regions and 44% for the time-series R^2. In terms of average valuation ratio errors, the model scaled mean absolute error (m.a.e./$\overline{\text{VR}}$) is 18% on average across regions. Northern Europe and Latin American & Caribbean have particular high model-fitness. In Northern Europe, cross-sectional R^2 is 82% and time-series R^2 as 49%. In Latin American & Caribbean, correponding statistics are 86% and 62%. Again, columns (6) to (8) display the poor model-fitness when we assume US parameters.

Overall, the estimation results show that adjustment costs of the inputs vary across countries and regions, especially for intangible capital. The estimation results of Table 5 and Table 6 illustrate the importance of quantifying the heterogeneous market environment using country/region specific adjustment cost parameters.

5.2 Physical Capital Only Model

To help understand the role of various capital inputs in firm valuation, Tables 7 and 8 report the parameter estimates and model fitness for the counter-factural model where the firm uses only physical capital for the capital inputs in production. To provide a meaningful comparison of the model fit in terms of R^2, we use the same set of firms in the estimation (the sample used for the estimation of the baseline model).

The model with only the physical-capital input, allows for the comparison for the Generalized Q-theory model and the standard-Q theory model. Comparing the adjustment cost coefficient of physical-capital, estimated in in Table 5, we observe that the estimated adjustment cost coefficient of physical capital is significantly larger in this single-capital model, with an across country average of 12.38 and dispersion of 4.78. These results imply that under the mis-specified single-capital model, the point estimates of physical capital adjustment cost coefficient is biased due to the latent correlation between the physical capital investment rate and the intangible capital investment rate. The model-fitness statistics displayed in columns (3) to (5) show that neglecting intangible capital significantly hinders the explanation for the firm-valuation.

The per region estimation of the single-capital model presented in Table 8 tells a similar story, with higher physical capital adjustment cost parameters and lower model-fitness. Overall, these results suggests the importance of intangible capital input in modern corporations with heavy utilization of high-skill labor force and new technology. We describe the accurate quantitative evaluation for the contribution of intangible capital in subsection 5.3.

5.3 The Value of Intangible and Physical Capital

The parameter estimate allows us to compute the model-implied shadow prices of each input, and hence evaluate the contribution of each input for firm value (input-shares) based on each input's market value. Specifically, using the estimates reported in Table 5 and 6 , we compute the model-implied scaled value of each capital input, the values of $q_{it}^P \frac{K_{it+1}^P}{A_{it+1}}$ and $q_{it}^I \frac{K_{it+1}^I}{A_{it+1}}$, for each firm and in each year. We then substitute these values in equations (8) to (9) to compute the shares of each capital inputs.[14]To characterize the data in a comprehensive yet parsimonious manner, we summarize the properties of the firm-level input-shares in the economy. We compute the median of intangible share in each year and each country, then calculate the mean across years for each country/region.

In Table 9, column (1) shows that intangible capital is an important determinant of firms' market values across all countries. The cross-country average share of intangible capital is 50.66% . There is significant heterogeneity across countries on this statistic, with the cross country dispersion of 9.33%. While USA sits on top of the intangible market share, with about 63.56% of the market valuation coming from it, South Korea is on the bottom with 33.41%. Large economies, like UK and China have above average intangible capital market shares, with respectively 61.57% and 61.73%. Figure 1 visualizes the share of intangible capital for each countries in our sample. Across countries, the darkness of color illustrates the share of intangible capital. As shown in Figure 1, the Northern European area and Western European area have particular high intangible market share, while the East Asian area has relatively lower share. Inside the Asia-Pacific area, the cross-firm median intangible market share of China is 63.05%, higher than the that statistic of Japan 48.15%, as shown in the Figure 1.

Turning to the analysis across regions, Column (1) in Table 10 shows that the importance of the intangible capital for each regions. The cross region average is 50.26% . Overall, this analysis shows that the intangible capital inputs are important determinants of firms' market values across the world. Next we discuss the magnitude of adjustment costs with respect to the firm output, compare the share of intangible capital in the total capital inputs and the share of intangible capital in the market valuation.[15]

5.3.1 Implied Adjustment Costs

Next we evaluate the economic magnitude of the adjustment costs of the two inputs across the major economies and regions.This allows us to assess whether the model fits the data with economically reasonable

[14]Note that, with this procedure, the input-shares add up to 100% by construction. For succinct description of estimation results, we report the share of intangible capital in firm valuation.

[15]In some situations, we use *book share of intangible* for the share of intangible capital in the total capital inputs. This statistic is directly calculated without the knowledge of model parameters. We use *market share of intangible* for the share of intangible capital in the market valuation. Calculating this statistic requires estimating the model and the point-estimate of parameters.

parameter values, and also to better understand the relatively high importance intangible capital inputs for firm value.

Specifically, using the functional form specification in equation (10) and the parameter estimates, the realized adjustment costs of each input (denoted as CP and CI) can be computed as a fraction of firm's total annual sales as follows:

$$\frac{CP_{it}}{Y_{it}} = \frac{\frac{\theta_P}{2}\left(\frac{I^P_{it}}{K^P_{it}}\right)^2 K^P_{it}}{Y_{it}} \tag{19}$$

$$\frac{CI_{it}}{Y_{it}} = \frac{\frac{\theta_I}{2}\left(\frac{I^I_{it}}{U^I_{it}}\right)^2 K^I_{it}}{Y_{it}}. \tag{20}$$

Table 9, columns (2) and (3), reports the average realized adjustment costs of each input, computed as the time-series average of cross-sectional medians of the ratios in equations (19) – (20). The across countries average adjustment cost of intangible capital is around 5.82% of annual sales. This cost is, for most major equity markets, higher than the adjustment costs for physical capital, which average about 2.73% of sales. China stands out as having the highest adjustment cost of intangible capital, followed by US. For physical capital, US and European countries top the list.

Table 10 shows the numbers for regions, with cross region average intangible capital adjustment cost at 4.74% of sales. Northern Europe sits at the top, with costs aggregate above this average. The physical adjustment cost is on average lower, with aggregate measure of 2.23% of sales.

Overall the adjustment costs calculated point towards a costly adjustment of intangible capital, both across major equity markets and regions. In the next subsection, we discuss how this adjustment costs explains the high market value of intangible capital.

5.3.2 Book versus Market

In this subsection we compare the book share of the inputs to its market share. When an input is costly to adjust, naturally the installed values of the inputs are valuable to the firm, because the accumulated capital inputs avoid adjustment costs in the future. If adjustment costs are zero, the shadow prices of the inputs in equations (11) and (12) are simply one (physical capital) and $(1 - \tau_t)$ (intangible capital)). As a result, the value of each capital input is given by its book-value (adjusting for the tax rate), and the fraction of firm value attributed to each capital input (input-shares) can be directly computed from equations (8) and (9).

As Table 9 illustrates, the market share departs from the book share, due to different adjustment costs of intangible and physical capital. Column (4) lists the book share of intangible capital. Compared to the 50.66% average cross country market share, the cross-country average book share is 34.85%, for the major equity markets. China stands out with a 21.02% book share of intangible capital versus a 61.73% market share. For the US and UK, while the book share is lower than market, the difference is less stark (in the US it goes from 51.81% to 63.56% and in the UK 56.16% to 61.57%).

From the quantity channel, if the book share is high, we shall find a high market share. This is true for United Kingdom and developed European countries. From the valuation channel, if the intangible capital investment is costly, we also observe the high market share. This is true for East Asia. The intangible investment cost θ_I is highest in China, in our whole sample. On the other hand, the adjustment cost parameter of intangible capital is very low in Japan. As the result, we observe that the large difference between book and market value of intangible capital in China, but relatively small difference in Japan (book at 38.52% and market at 46.20%). We also observe this fact in South Korea where the adjustment cost parameter of intangible capital is close with that of physical capital.

5.4 Drivers of the Intangible Share

Next we investigate drivers of the cross-country heterogeneity in intangible share. We document a relationship between the median and dispersion of the firm's intangible intensity.[16] For each year, for each country, these statistics are calculated using the firm-level distribution within the country. Specifically, we find that for countries with higher dispersion of intangible share, the median of intangible share tends to be lower. We document this relationship by running the following regression

$$\mu_{50\%,c,t} = \beta \times \frac{\mu_{75\%}}{\mu_{25\%}}_{c,t} + e_{c,t} \tag{21}$$

.

In equation , the $\mu_{50\%,c,t}$is the the median of intangible share for each country in each available year, $\frac{\mu_{75\%}}{\mu_{25\%}}_{c,t}$ is the the dispersion of intangible share for each country in each available year. Table 11 shows that an increase of dispersion ratio to 1.25 of previous ratio, is accompanied with 2.38% decrease of median intangible share . [17] This lower level of intangible share is particularly severe across countries with lower relative adjustment cost of intangible capital: an increase of dispersion ratio to 1.25 of previous ratio, is accompanied with 3.91% decrease of median intangible share . The lower level of intangible share accompanied with high dispersion within country is quantitatively important, compared to the standard devision of median intangible share in Table 9 and Table 10 (9.33% and 8.13% respectively).

This empirical fact about the distribution of intangible share is consistent with a predatory production effect of intangible capital across firms in each country. The intangible capital owned by a firm has positive spillover effect toward other firms. Firms with intensive use of intangible capital have higher production from the positive spillover of cohort firms. As the result of higher productivity in the whole market, the profit of firms with low intangible share becomes lower. This asymmetric gain of intangible capital spillover renders lower valuation of firms with low intangible capital. Therefore, firms with intensive use of intangible capital deter the entry of new firms with low initial intangible capital.

Columns (2) and (3) of Table 11 show that this negative correlation between the dispersion and median is larger in countries where the adjustment cost of intangible capital is low relative to the magnitude of the adjustment cost of physical capital. Columns (4) and (5) shows similar patterns when we use the World Intellectual Property Organization (WIPO) to classify countries as the High/Low-protection group. This comes as no surprise as Table 30 documents a negative relation between adjustment cost ratios and the level of IP protection. In Figure 2, we demonstrate the difference of intangible distribution in countries with relatively low adjustment cost of intangible capital, and countries with relatively high cost. For straightforward illustration, we calculate the time-series average statistics for cross-firm distribution in each country. In panel (a) of Figure 2, we can see that the correlation line of median and dispersion is steeper for countries with relatively low adjustment cost of intangible capital. If we gauge the mean statistic in panel (a) , we

[16] Here, the intangible intensity refers to μ, the share of intangible capital in the total firm valuation, or the *market share of intangible* when we mention this statistic in a shorter name. This statistic is calculated using the parameters from Table 5 and Table 6. Results described below are similar if we use the mean of intangible share to gauge the level of intangible intenisty in a country. Here we use the median statistic because it is less affected by the skewness of firm-level distribution.

[17] Note that here the dispersion is a statistic of ratio, while the market share of intangible capital is in the unit of percentage.

observe the similar relationship between the two group of countries. High adjustment cost in intangible capital accumulation weakens this predatory effect of intangible capital in production. If the intangible capital accumulation is less costly, the benefit from this predatory effect is stronger. As such, we observe the stronger negative correlation between the median of intangible share and the dispersion of intangible share. We interpret these results as further support to our hypothesis of predatory effect of intangible capital in firm production. This summarizes the distribution of intangible share, in different countries.

6 Risk-Premium of Intangible Capital

When investment rate of capital inputs are imperfectly correlated, the firm revenue contributed by physical and intangible capital have different exposure to productivity shock. Aside from the asynchronized investment rates, the duration of physical capital is different from the intangible capital, so the two capital inputs have different exposure to the fluctuation of discount rate in financial market. Combing the cashflow channel and the discount-rate channel, physical capital and intangible capital charge different amounts of risk premium. In this section, we study the risk premium of firm's intangible capital.

The estimation in Table 5 and Table 6 allows us to trace the time-varying risk-premium across firms using the market-share of intangible capital. Table 12 tests whether the intangible capital generates different amount of risk-premium, compared with the physical capital. Formally, we use Fama-Macbeth (2nd step) regression, and the Pooled OLS regression to estimate the equity risk premium from the intangible capital.

$$r^e_{i,t} = a + \lambda \times \mu_{I,t-1} + \gamma \times \vec{Z}_{i,t-1} + e_{i,t}. \tag{22}$$

As illustrated in Table 12, the estimate of coefficients λ is statistically positive with an average 0.070 in the annual cross-sectional regressions. Quantitatively, as the market share of intangible capital μ_I increases by 1%, the annual expected return increases by 0.070%. The estimated risk-premium of intangible capital λ is particularly high for the firms locating in Asia, as illustrated in Column (5) and Column (8) of Table 12. Next we investigate if this pattern holds for stock market indices.

6.1 Cross-Country Comparison

In Table 13, we investigate whether the share of intangible capital in a country predicts the excess return of stock market indices. We create a measure of intangibility intensity of each index using public-traded firms with available information for intangible capital in our sample. We construct the mimicking indices of stock market for each country, using these listed firms with available balance-sheet information. We run the same cross-sectional and pooled regressions as specified in equation 22 , using the holding-return of market indices. Across these stock market indices, 1% of share intangible capital adds 0.217% excess return annually, after controlling the firm fundamental information and country-year characteristics[18].

In Figure 4, we illustrate the positive correlation between the market share of intangible capital and

[18]Table 22 in appendix shows that the sub-sample with estimated share of intangible capital accounts for 67.98% of the sample with available balance-sheet information (47.95% of sample with balance-sheet information, if the equity security of primary issuance is not rigorously matched with each firm). The number 67.98% (47.95%) takes the average of coverage ratio, across the available stock indices in the Compustat-Global dataset. Here, the sub-sample with estimated share of intangible capital, differs from the sample with available balance-sheet information, because the information of sale and capital investment is incomplete for certain firms.

the expected excess return of equity.[19] In the country-level analysis, a country has multiple observations in different years. We calculate the average share of intangible capital and average excess return for each country. Panel (a) of Figure 4 shows that countries with higher share of intangible capital, have high expected excess return during the sample-period. Furthermore, given the same share of intangible capital, Asian countries tend to have higher expected excess equity return.

In Table 12, we observe the facts that share of intangible capital positively predicts the equity return at firm-level estimation in major regions such as Asia, Europe and North America. To visualize the quantitative magnitude, we sort firms into deciles based on the market share of intangible capital within each region in each year, then calculate the realized equity return in next year for each portfolio. Panel (b) of Figure 4 demonstrates this positive correlation between the market share of intangible capital and the expected excess return, across portfolios in each major region.

7 Conclusion

We incorporate intangible capital into the neoclassical model of investment and estimate its contribution of each input for explaining firm market values across 77 countries between 2006 and 2020. For the major markets, where we estimate country specific parameters, the model performs well in explaining both the time-series and the cross-sectional variation of the valuation ratios across portfolios, with an cross country average time-series R^2 of 33% and a cross-sectional R^2 of 69%. For the region estimation, the model also has good explanatory power, with an cross-region average time-series R^2 of 44% and a cross-sectional R^2 of 68%.

We find that the importance of the intangible capital for firm value varies across countries and regions and is substantial, ranging from 33.41% to 63.56% . We show that financial markets assign large and positive values to the installed stocks of the capital inputs because they are costly to adjust, thus firm valuation contains the compensation for the cost of adjusting the inputs. The adjustment cost of intangible capital is higher and more volatile than that of physical capital. When quantifying the market environment for accumulating intangible capital for each country/region, we observe dispersed point estimates of adjustment cost parameters. In countries with better protection in intellectual property, the adjustment cost parameter of intangible capital is relatively lower. International finance and economics call for quantitative researches with explicit models featuring financial friction, high-skill labor market, and patent protection. Estimating the adjustment cost function of each capital inputs for different countries and regions, provides a preliminary support for future researches in this direction.

[19] Here we want to re-emphasize the definition of realized excess return of equity, and the definition of expected excess return of equity. Given the $\mu_{I,t-1}$, the market share of intangible capital in the year $t-1$, the realized excess return of equity is $r_{I,t-1}$, while the expected excess return of equity is $E_t[r_{I,t-1}]$. Whent taking these definitions into the empirical inference, we use $r_{I,t}$ as the proxy of $E_t[r_{I,t-1}]$.

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A Tables

Table 1: Descriptive Statistics for Countries

The table below reports the snapshot of selected statistics of listed corporations and selected national statistics in the economy, in the year 2020. **Sample** is the start year where the analysis is performed for each country, the end year is 2020 for all countries. **Firms** counts the average number of listed firms with qualified financial reports. $\frac{Y}{GDP}$ reports the ratio of total output produced by firms, over the GDP of home-country, in the unit of percentage. $\frac{VA}{GDP}$ reports the ratio of total value-added (COGS-SALES) by firms, over the GDP of home-country, in the unit of percentage. **Per capita** reports the GDP per capita of firms' home-country, in the unit of dollars in constant price of year 2015. All national statistics comes from the UN-stat. All statistics of listed corporations are calculated by authors. **Total** summarizes the statistics for listed corporations locating in countries listed as a share of all 200 countries in the UN-Stat.

	Start (1)	Firms (2)	$\frac{Y}{GDP}$ (%) (3)	$\frac{VA}{GDP}$ (%) (4)	Per Capita (USD) (5)
Australia	2004	354	17.49	6.73	53244
Canada	2000	342	27.79	8.35	42391
China	2001	1371	20.06	4.60	10166
France	2007	285	48.22	18.98	35700
Germany	2006	283	38.50	13.13	40992
Hong Kong	2002	517	145.36	43.37	41715
India	2001	1055	19.83	7.74	1849
Indonesia	2000	220	13.96	4.07	3757
Israel	2008	158	25.12	8.82	39912
Japan	2000	1556	92.14	27.15	34637
Malaysia	2002	483	36.76	10.12	10617
Poland	2007	224	11.74	2.94	14681
Singapore	2002	284	51.14	10.58	56423
South Korea	2000	419	63.75	17.76	31674
Taiwan	2001	976	-	-	-
Thailand	2000	310	40.39	10.08	6199
UK	2000	523	32.10	11.18	42455
USA	2000	2002	40.66	14.68	58148
Total		13698	28.23	9.02	

Table 2: Descriptive Statistics for Regions

The table below reports the snapshot of selected statistics of listed corporations and selected national statistics in each region, in the year 2020. **Sample** is the start year

where the analysis is performed for each country, the end year is 2020 for all countries. **Firms** counts the average number of listed firms with qualified financial reports, we aggregate across countries. $\frac{Y}{GDP}$ reports the ratio of total output produced by firms, over the GDP of home-country, in the unit of percentage. $\frac{VA}{GDP}$ reports the ratio of total value-added (SALES- COGS) by firms, over the GDP of home-country, in the unit of percentage. **Per capita** reports the GDP per capita of firms' home-country, in the unit of dollars in constant price of year 2015. For those macro variables, we calculate each country individually and average across countries. All national statistics comes from the UN-stat. All statistics of listed corporations are calculated by authors. **Total** summarizes the statistics for listed corporations locating in countries listed, including the ones from Table 1.

	Start (1)	Firms (2)	$\frac{Y}{GDP}$ (%) (3)	$\frac{VA}{GDP}$ (%) (4)	Per Capita (USD) (5)	Countries (6)
Southern Asia	2006	321	8.71	2.32	2420	Bangladesh, Sri Lanka, Pakistan
South-eastern Asia	2000	163	13.62	4.03	2963	Philippines, Viet Nam
Western Asia	2004	439	14.28	4.56	21548	United Arab Emirates, Bahrain, Cyprus, Jordan Kuwait, Oman, Palestine, Qatar, Saudi Arabia, Turkey
Eastern Europe	2009	167	13.38	5.05	9041	Bulgaria, Hungary, Romania, Russia, Ukraine
Northern Europe	2000	370	28.52	10.63	46491	Denmark, Estonia, Finland, Ireland, Iceland, Lithuania, Latvia, Norway, Sweden
Southern Europe	2004	362	15.35	4.88	20506	Spain, Greece, Croatia, Italy, Malta, Serbia, Slovenia
Western Europe	2002	251	73.39	24.00	64281	Austria, Belgium, Switzerland, Luxembourg Netherlands, Portugal
Africa	2006	260	13.24	4.30	3374	Cote Divoire, Ghana, Kenya, Mauritius, Morocco, Nigeria,
L.America and the Carib.	2000	355	47.07	11.79	18182	Argentina, Brazil, Chile, Colombia, Cayman Islands, Jamaica, Mexico, Peru
Total		17024	34.10	11.19		All countries

Table 3: Descriptive Firm Statistics for Countries

This table reports the median and standard-deviation of firm-level selected characteristics across all firms in the each country. Data is winsorized with [2%,98%]. Firm valuation is Q. Installed physical capital is K^P with investment flow equal to I^P. Installed intangible capital is K^I with investment flow equal to I^I.

		$\frac{Q}{K^I+K^P}$ (1)	$\frac{I^P}{K^P}$ (2)	$\frac{I^I}{K^I}$ (3)	$\frac{K^I}{K^I+K^P}$ (4)	$\rho(\frac{I^P}{K^P}, \frac{I^I}{K^I})$ (5)
Australia	Median	1.58	0.22	0.31	0.37	0.30
	Std.	3.19	0.94	0.28	0.30	
Canada	Median	1.56	0.19	0.28	0.20	0.38
	Std.	2.05	0.45	0.18	0.29	
China	Median	2.94	0.16	0.32	0.20	0.35
	Std.	3.85	0.32	0.15	0.19	
France	Median	1.35	0.23	0.24	0.67	0.25
	Std.	2.12	0.39	0.11	0.24	
Germany	Median	1.43	0.21	0.24	0.58	0.26
	Std.	2.42	0.36	0.14	0.23	
Hong Kong	Median	1.38	0.17	0.28	0.41	0.18
	Std.	3.25	0.74	0.15	0.27	
India	Median	1.46	0.03	0.19	0.33	0.36
	Std.	2.67	0.32	0.16	0.21	
Indonesia	Median	1.32	0.08	0.21	0.26	0.28
	Std.	2.46	0.33	0.12	0.23	
Israel	Median	1.55	0.21	0.25	0.53	0.17
	Std.	2.33	0.61	0.09	0.25	
Japan	Median	0.84	0.13	0.22	0.46	0.42
	Std.	0.77	0.16	0.05	0.21	
Malaysia	Median	1.24	0.08	0.24	0.26	0.20
	Std.	1.88	0.30	0.12	0.19	
Poland	Median	1.15	0.11	0.25	0.38	0.37
	Std.	1.44	0.23	0.13	0.22	
Singapore	Median	1.21	0.16	0.28	0.38	0.23
	Std.	2.07	0.57	0.15	0.25	
South Korea	Median	1.02	0.11	0.25	0.26	0.31
	Std.	1.03	0.20	0.09	0.20	
Taiwan	Median	1.70	0.13	0.24	0.28	0.28
	Std.	2.16	0.29	0.09	0.20	
Thailand	Median	1.54	0.14	0.24	0.28	0.21
	Std.	1.75	0.33	0.09	0.21	
UK	Median	1.50	0.21	0.25	0.60	0.28
	Std.	2.66	0.43	0.15	0.28	
USA	Median	2.05	0.24	0.26	0.62	0.34
	Std.	2.90	0.40	0.12	0.28	
Summary of Median and Correlation						
	Median	1.44	0.16	0.25	0.38	0.28
	Average	1.49	0.16	0.25	0.39	0.29
	S.E.	0.44	0.06	0.03	0.15	0.07

Table 4: Descriptive Firm Statistics for Regions

This table reports the median and standard-deviation of firm-level selected characteristics across all firms in the each regions. Data is winsorized with [2%,98%]. Firm valuation is Q. Installed physical capital is $K^P$with investment flow equal to I^P. Installed intangible capital is $K^I$with investment flow equal to I^I.

		$\frac{Q}{K^I+K^P}$ (1)	$\frac{I^P}{K^P}$ (2)	$\frac{I^I}{K^I}$ (3)	$\frac{K^I}{K^I+K^P}$ (4)	$\rho(\frac{I^P}{K^P},\frac{I^I}{K^I})$ (5)
Southern Asia	Median	1.22	0.03	0.20	0.19	0.17
	Std.	1.73	0.28	0.09	0.18	
South-eastern Asia	Median	1.66	0.11	0.24	0.30	0.19
	Std.	2.70	0.51	0.13	0.22	
Western Asia	Median	1.66	0.06	0.20	0.26	0.23
	Std.	2.86	0.43	0.12	0.22	
Eastern Europe	Median	0.93	0.04	0.18	0.31	0.24
	Std.	1.37	0.22	0.11	0.21	
Northern Europe	Median	1.68	0.22	0.25	0.56	0.27
	Std.	3.24	0.47	0.16	0.27	
Southern Europe	Median	1.24	0.11	0.22	0.38	0.23
	Std.	2.32	0.34	0.14	0.24	
Western Europe	Median	1.55	0.21	0.25	0.53	0.23
	Std.	3.10	0.33	0.13	0.24	
Africa	Median	1.45	0.08	0.20	0.41	0.27
	Std.	2.02	0.23	0.13	0.24	
L.Amer. & Carib.	Median	1.07	0.08	0.20	0.33	0.31
	Std.	1.58	0.46	0.11	0.24	
Summary of Median and Correlation						
	Median	1.45	0.08	0.20	0.33	0.23
	Average	1.38	0.10	0.22	0.36	0.24
	S.E.	0.26	0.06	0.02	0.11	0.04

Table 5: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification. The estimation uses 20 portfolios sorted based on proxies of the lagged values of the inputs (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. Column (3) reports the sample that the model fit is calculated for. We calculate model fit for both the entire sample used for estimation and to allow for cross country comparison the 2006-2020 sample for which most of the countries have data. In columns (6) to (8) we calculate the implied model fit using, for all countries, the parameters estimated for the USA.

		Point Estimate		Model Fit			Using US Parameters		
		θ_P	θ_K	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Australia		2.87	11.06	0.63	0.37	0.21	-4.49	-3.05	0.50
	s.e.	(0.46)	(0.87)						
Canada		3.76	11.44	0.88	0.51	0.18	-3.13	-2.23	0.50
	s.e.	(0.27)	(0.77)						
China		4.72	30.77	0.20	-0.03	0.23	-0.50	-0.50	0.29
	s.e.	(0.92)	(3.31)						
France		6.56	7.06	0.74	0.20	0.20	-5.53	-3.50	0.52
	s.e.	(0.87)	(0.72)						
Germany		6.21	8.41	0.77	0.26	0.23	-1.81	-1.27	0.46
	s.e.	(1.26)	(1.30)						
Hong Kong		2.43	7.24	0.73	0.33	0.21	-13.87	-7.75	0.84
	s.e.	(0.39)	(0.72)						
India		4.76	19.16	0.78	0.14	0.25	0.85	-0.04	0.27
	s.e.	(0.52)	(1.26)						
Indonesia		5.74	12.99	0.85	0.51	0.18	0.68	0.34	0.20
	s.e.	(0.72)	(1.58)						
Israel		3.20	9.11	0.48	0.18	0.21	-9.73	-4.87	0.58
	s.e.	(0.41)	(0.71)						
Japan		0.86	2.42	0.20	0.11	0.16	-132.64	-46.73	1.36
	s.e.	(0.49)	(0.41)						
Malaysia		2.85	11.72	0.73	0.25	0.16	-3.76	-2.90	0.39
	s.e.	(0.65)	(1.21)						
Poland		3.37	4.42	0.79	0.48	0.15	-38.14	-12.37	0.93
	s.e.	(0.47)	(0.37)						
Singapore		2.00	6.76	0.74	0.38	0.17	-43.75	-14.90	1.01
	s.e.	(0.35)	(0.53)						
South Korea		1.76	3.73	0.57	0.41	0.10	-61.29	-30.99	0.88
	s.e.	(0.34)	(0.55)						
Taiwan		4.87	13.98	0.85	0.34	0.13	-1.66	-1.35	0.25
	s.e.	(0.38)	(0.80)						
Thailand		4.49	10.28	0.78	0.33	0.20	-3.34	-0.86	0.34
	s.e.	(0.67)	(1.38)						
UK		6.24	8.47	0.84	0.56	0.17	-1.46	-0.75	0.36
	s.e.	(0.62)	(0.75)						
USA		8.59	15.69	0.89	0.69	0.15	0.89	0.69	0.15
	s.e.	(0.77)	(0.81)						
Summary of Point Estimation, Model Fitness									
	Average	4.18	10.82	0.69	0.33	0.18	-17.93	-7.39	0.55
	S.E.	1.93	6.36	0.20	0.17	0.04	32.76	12.16	0.32

Table 6: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification. The estimation uses 20 portfolios sorted based on proxies of the lagged values of the inputs (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS - R^2$ is the cross-sectional R^2, $TS - R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. The results are reported for the sample of all firms. Column (3) reports the sample that the model fit is calculated for. We calculate model fit for both the entire sample used for estimation and to allow for cross country comparison the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit			Using US Parameters		
		θ_P	θ_I	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Southern Asia		4.31	18.22	0.94	0.75	0.12	0.80	0.60	0.15
	s.e.	(0.54)	(1.10)						
South-eastern Asia		4.20	12.03	0.67	0.32	0.18	-0.88	-0.62	0.29
	s.e.	(1.00)	(1.70)						
Western Asia		7.39	16.68	0.20	0.21	0.18	0.07	0.15	0.19
	s.e.	(1.07)	(2.17)						
Eastern Europe		1.00	4.52	0.51	0.18	0.17	-27.92	-9.87	0.75
	s.e.	(0.31)	(0.44)						
Northern Europe		4.45	11.21	0.82	0.49	0.21	-0.81	-0.52	0.36
	s.e.	(0.63)	(0.72)						
Southern Europe		3.77	10.74	0.76	0.56	0.20	-0.55	-0.34	0.37
	s.e.	(0.69)	(1.00)						
Western Europe		6.13	10.24	0.66	0.29	0.23	-1.23	-0.68	0.35
	s.e.	(0.95)	(1.26)						
Africa		9.47	11.23	0.72	0.50	0.16	-0.57	0.25	0.20
	s.e.	(1.12)	(0.98)						
L.Amer. & Carib.		2.76	7.96	0.86	0.62	0.13	-5.34	-4.32	0.56
	s.e.	(0.43)	(1.01)						
Summary of Point Estimation, Model Fitness									
	Average	4.83	11.43	0.68	0.44	0.18	-4.05	-1.71	0.36
	S.E.	2.37	3.88	0.21	0.18	0.03	8.59	3.19	0.18

Table 7: Counter-Factual Accounting: Single Capital

Table 7 compares the baseline estimation outcome and the counter-factual outcome where we assume the intangible capital plays no role in the production function nor the adjustment cost function. The point estimate of adjustment cost coefficient in the physical capital, and the statistics of model fit are reported.

	Point Estimate		Model Fit			Cost
	θ_P	[std]	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$	c_P (% sales)
	(1)	(2)	(3)	(4)	(5)	(6)
Australia	7.96	0.75	-1.81	-1.32	0.41	12.97
Canada	8.08	0.56	-1.28	-1.11	0.38	8.52
China	16.80	0.89	-1.90	-1.63	0.39	6.95
France	17.43	1.12	-1.03	-1.61	0.38	14.12
Germany	16.55	0.99	-0.14	-0.57	0.33	12.54
Hong Kong	8.03	0.46	-0.23	-0.72	0.33	4.59
India	13.46	1.06	-2.24	-1.76	0.50	2.61
Indonesia	13.93	0.82	-0.33	-0.38	0.29	3.32
Israel	10.05	0.70	-2.11	-2.22	0.43	13.71
Japan	7.28	0.50	-3.08	-2.25	0.30	2.93
Malaysia	11.98	0.53	0.18	-1.07	0.28	3.89
Poland	10.29	0.57	-1.55	-0.92	0.30	2.92
Singapore	7.41	0.35	-0.15	-0.61	0.29	3.87
South Korea	6.56	0.40	-3.29	-1.94	0.21	1.69
Taiwan	13.37	0.54	-1.61	-1.94	0.28	5.57
Thailand	11.39	0.56	-1.02	-0.45	0.28	5.55
UK	16.66	0.91	-1.09	-0.82	0.36	12.83
USA	25.53	1.38	-1.18	-0.73	0.36	23.12
Summary of Point Estimation, Model Fitness, Adjustment Cost						
Average	12.38		-1.33	-1.23	0.34	7.87
S.E.	4.78		0.96	0.60	0.07	5.62

Table 8: Counter-Factual Accounting: Single Capital

Table 7 compares the baseline estimation outcome and the counter-factual outcome where we assume the intangible capital plays no role in the production function nor the adjustment cost function.

	Point Estimate		Model Fit			Cost
	θ_P	[std]	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$	c_P (% sales)
	(1)	(2)	(3)	(4)	(5)	(6)
Southern Asia	15.07	1.04	-0.01	-0.33	0.27	3.98
South-eastern Asia	9.54	0.99	-0.72	-0.71	0.32	3.08
Western Asia	17.10	0.83	-1.38	-0.83	0.30	7.88
Eastern Europe	5.37	0.79	-6.08	-2.32	0.36	1.69
Northern Europe	15.60	1.12	-0.97	-0.92	0.40	14.17
Southern Europe	11.32	0.76	-0.48	-0.34	0.34	5.96
Western Europe	16.95	1.00	-0.65	-0.62	0.33	11.17
Africa	25.81	1.58	-4.11	-1.05	0.35	7.92
L.Amer. & Carib.	8.39	0.47	-0.19	-0.73	0.29	2.79
Summary of Point Estimation, Model Fitness, Adjustment Cost						
Average	13.91		-1.62	-0.87	0.33	6.52
S.E.	5.72		1.95	0.56	0.04	3.94

Table 9: Capital Accounting: Share of Intangible

This table reports the contribution of intangible capital in the firm valuation. The intangible share reports the share computed as the median of share across firm-portfolios. Both the statistics of share are calculated as the time-series average during the year 2016-2020 for which the sample is available for all countries.

	Market Share	Adjustment Cost		Book Share
	μ_I	c_I (% sales)	c_P (% sales)	$\overline{\mu}_I$
	(1)	(2)	(3)	(4)
Australia	54.30	9.05	4.67	33.47
Canada	34.45	5.00	3.96	16.99
China	61.73	17.03	1.95	21.02
France	59.42	7.01	5.32	57.01
Germany	55.48	6.16	4.71	48.70
Hong Kong	59.24	4.51	1.39	44.34
India	53.96	3.72	0.92	27.12
Indonesia	38.49	4.51	1.37	18.95
Israel	58.57	5.04	4.36	44.60
Japan	46.20	1.38	0.35	38.52
Malaysia	46.07	4.60	0.92	24.02
Poland	45.73	2.43	0.96	34.78
Singapore	51.66	3.31	1.05	36.63
South Korea	33.41	1.70	0.45	22.78
Taiwan	48.13	5.40	2.03	26.88
Thailand	39.84	5.38	2.18	23.56
UK	61.57	6.38	4.80	56.16
USA	63.56	12.13	7.78	51.81
Summary of Market Share, Adjustment Cost, Book Share				
Average	50.66	5.82	2.73	34.85
S.E.	9.33	3.68	2.07	12.70

Table 10: Capital Accounting: Share of Intangible per Region

This table reports the contribution of intangible capital in the firm valuation. The intangible share reports the share computed as the median of share across firm-portfolios. Both the statistics of share are calculated as the time-series average during the year 2016-2020 for which the sample is available for all countries.

	Market Share	Adjustment Cost		Book Share
	μ_I	c_I (% sales)	c_P (% sales)	$\overline{\mu}_I$
	(1)	(2)	(3)	(4)
Southern Asia	38.80	4.31	1.14	13.27
South-eastern Asia	43.71	4.18	1.36	23.47
Western Asia	47.78	4.64	3.41	24.86
Eastern Europe	42.20	1.61	0.32	30.32
Northern Europe	66.12	7.74	4.04	54.79
Southern Europe	52.80	6.07	1.98	34.64
Western Europe	56.23	7.30	4.04	45.05
Africa	57.21	3.89	2.90	36.06
L.Amer. & Carib.	47.53	2.95	0.92	30.33
Summary of Market Share, Adjustment Cost, Book Share				
Average	50.26	4.74	2.23	32.53
S.E.	8.13	1.87	1.32	11.50

Table 11: Country-level Distribution Characteristic

The table below reports the estimation results from regressions of the form: $\mu_{50\%,c,t} = \beta \times \frac{\mu_{75\%}}{\mu_{25\%}}_{c,t} + e_{c,t}$, in which the Median $\mu_{50\%,c,t}$is the the median share of intangible capital for each country in each available year, Dispersion$\frac{\mu_{75\%}}{\mu_{25\%}}_{c,t}$ is the the dispersion of intangible share for each country in each available year. The share of intangible capital μ is calculated using the parameters from Table 5 and Table 6. The sample is the same with Table 12. In Columns (2)-(3), countries are classified into the group of **Low Relative Cost** $\frac{\theta_U}{\theta_K}$, and the group of **High Relative Cost** $\frac{\theta_U}{\theta_K}$. In Columns (4)-(5), countries are classified into the group of **High Intellectual Property Protection Score**, and the group of **Low Intellectual Property Protection Score.**

	Pooled Sample	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	High-IP Score	Low-IP Score
	(1)	(2)	(3)	(4)	(5)
Dispersion	-9.532***	-15.657***	-5.380**	-18.882***	-4.832**
	(0.766)	(3.574)	(2.167)	(4.048)	(1.885)
Observations	818	412	406	387	431
R^2	0.162	0.256	0.087	0.342	0.068
Adjusted R^2	0.146	0.228	0.052	0.316	0.034

Table 12: Firm-level stock return predictability regressions

The table below reports the estimation results from stock return predicatability regressions of the form:$r^e_{i,t+1} = a + \lambda \times \mu_{I,t} + e_{i,t+1}$,in which the $r^e_{i,t+1}$is the firm-level firms's compounded annual excess stock return in the next fiscal year, $\mu_{I,t}$ is the available market share of intangible capital calculated using the parameters from Table 5 and Table 6. The sample is from Jan 2006 to Dec 2020, firms locating in Western Asia and Sub-african are excluded. All the stock returns are harmonized into the USD dollar amount. Calculation of excess return use the 3-month treasury rate of United States as the risk-free rate, in the unit of percentage (%). All predicting variables are winsorized with [2%,98%], by year and country (region) in Table 5 and Table 6. Columns (1) reports the time-series average risk premium using the previous equation for each year **controlling the indicator variable of Covid period {2019,2020}**, using the firm-year observation in the sample . The dummy of industry (first 2 digits of SIC code), and the dummy of home-country are included when estimating the risk-premium of market share contributed by intangible capital. In Columns(1)-(2), Newey-West 3 lagged standard error are reported. Time-series average of sample size are reported in the row of **Obs.**. Time-series average of cross-firm R^2 (after adjustment of period-sample size and the dimension of explanatory variables) are reported in the row of **Adj-R^2**. Column (2) includes the set of firm-level variables related with cross-section anomalies**.** Columns (3) to (4) report the estimated slope coefficientes in the previous equation obtained by pooled OLS regressions, using the subsample from Jan 2006 to Dec 2018. Column (3) includes the industry, the country, and year fixed effects. Column (4) includes the set of variables related with cross-section anomalies. In Columns (3)-(4), the standard error of pooled OLS regression is clustered at the firm-level and year-level. Columns (5)-(7) reports the estimation reasults per major region using the identical specification and methods with Column (1). Columns (8)-(10) reports the estimation reasults per major region using the identical specification and methods with Column (3). Columns (5) and (8) **Asia** uses the subsample of firms located in China, India, Malaysia, Thailand, Taiwan, Japan, South Korea, Singapore, Hong Kong, Vietnam, Israel, Turkey and countries in Southern Asia, South-eastern Asia; Column (6) and (8) **North America** uses the subsample of firms located in North America, with homecountry as Canada or U.S.; Columnd (7) and (10) **Europe** uses the subsample of firms located in France, Germany, UK, Poland and countries of Southern Europe, Eastern Europe, Northern Europe, Western Europe. Industry is defined as the first 2 digits of SIC code. The set of variables related with cross-section anomalies are Size, Value, Reversal, Momentum, Idiosyncratic Volatility, Market Beta.The **Size** is the log of equity valuation, after conversion into the USD dollar amount. The **BMratio(log)** is the log of book equity over the market valuation. The **Ret(-1,0)** is the recent monthly return in the month of financial report disclosure. The **Ret(-12,-2)** is the recent 11month accumulated return in the lagged month of financial report disclosure. The **IVoL(log)** is the recent 24-month log idiosyncratic volatility of monthly stock return, using the U.S. CAPM model, updated at the end of fiscal year. The **betaM(-24,0)** is the recent-24-month risk-loading toward the U.S. Equity Market Index , using the United States CAPM model. P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	All Countries				Major Regions					
	Cross-sectional		Pooled		Cross-sectional			Pooled		
	(1)	(2)	(3)	(4)	(5) Asia	(6) N.Amer.	(7) Europe	(8) Asia	(9) N.Amer.	(10) Europe
MarketShare	0.070***	0.065***	0.0793**	0.0465	0.076***	0.054***	0.053***	0.0803*	0.0940**	0.134***
-Intangible	(0.016)	(0.014)	(0.0284)	(0.0309)	(0.025)	(0.020)	(0.012)	(0.0398)	(0.0310)	(0.0414)
Anomaly	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	-	-	Yes	Yes	-	-	-	Yes	Yes	Yes
Obs.	11753	11753	146095	146095	7358	1609	2047	90146	20736	26004
Adj-R^2	0.109	0.119	0.053	0.059	0.151	0.089	0.175	0.077	0.075	0.089

Table 13: Country-level stock return predictability regressions

The table below reports the estimation results from stock return predicatability regressions of the form:$r^e_{c,t+1} = a + \lambda \times \mu_{I,t} + e_{c,t+1}$, in which the $r^e_{c,t+1}$is the country-level market-valuation weighted excess stock return in the next fiscal year, $\mu_{I,t}$ is the market-valuation weighted share of intangible capital across firm-level variable. The firm-level share of intangible capital is calculated using the parameters from Table 5 and Table 6. The sample is from Jan 2006 to Dec 2020, countries in Western Asia and Sub-african are excluded. All the stock returns are harmonized into the USD dollar amount. Calculation of excess return use the 3-month treasury rate of United States as the risk-free rate, in the unit of percentage (%). At firm-level, all variables are winsorized with [2%,98%], by year and country (region) in Table 5 and Table 6. Columns (1) to(6) reports the time-series average risk premium using the previous equation for each year, using the country-year observation in the sample. The time-series average risk premium is estimated within the subsample of non-Covid Period. Newey-West 3 lagged standard error are reported. Time-series average of sample size are reported in the row of **Obs.**. Time-series average of cross-firm R^2 (after adjustment of period-sample size and the dimension of explanatory variables) are reported in the row of **Adj-**R^2. Column (2) excludes the industry fixed effect from the excess stock return at firm-level, then uses the market-valuation weighted return after excluding industry fixed effect. Column (3-4) includes the set of variables related with the country-year economic indicators. Column (5-6) includes the set of variables related with cross-section anomalies, and the country-year economic indicators. Columns (7) to (12) report the estimated slope coefficientes in the previous equation obtained by pooled OLS regressions.**The indicator variable of Covid period {2019,2020}** is used to separate the non-Covid period and Covid period. Column (7) includes the year fixed effects. Column (8) excludes the industry fixed effect from the excess stock return. In Columns (3)-(4), the standard error of pooled OLS regression is clustered at the country-level. Column (9-10) includes the set of variables related with the country-year economic indicators. Column (11-12) includes the set of variables related with cross-section anomalies, and the country-year economic indicators. Industry is defined as the first 2 digits of SIC code. The set of variables related with cross-section anomalies are Size, Value, Reversal, Momentum, Idiosyncratic Volatility, Market Beta.The **Size** is the log of equity valuation, after conversion into the USD dollar amount. The **BMratio(log)** is the log of book equity over the market valuation. The **Ret(-1,0)** is the recent monthly return in the month of financial report disclosure. The **Ret(-12,-2)** is the recent 11month accumulated return in the lagged month of financial report disclosure. The **IVoL(log)** is the recent 24-month log idiosyncratic volatility of monthly stock return, using the U.S. CAPM model, updated at the end of fiscal year. The **betaM(-24,0)** is the recent-24-month risk-loading toward the U.S. Equity Market Index , using the United States CAPM model. In each year, the set of country-level variables are market-valuation weighted firm-level variables. Economic indicators include the growth of GDP per capita in the previous year, the currency return in the previous year. Industry fixed effect is estimated at the firm-level using the full-sample. Estimation of industry fixed effect includes country fixed effect. P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	Countries with Economic Indicators											
	Cross-sectional						Pooled OLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
IntangibleShare	0.178*	0.171*	0.187**	0.198***	0.217***	0.186***	0.196***	0.177***	0.200***	0.181***	0.216***	0.172***
	(0.104)	(0.087)	(0.080)	(0.061)	(0.050)	(0.044)	(0.063)	(0.062)	(0.055)	(0.057)	(0.062)	(0.058)
Anomaly	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Economic	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
SIC-2 FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	57	57	57	57	57	57	802	802	802	802	802	802
Adj-R^2	0.030	0.027	0.081	0.069	0.276	0.256	-0.007	-0.010	0.038	0.037	0.058	0.078

B Figures

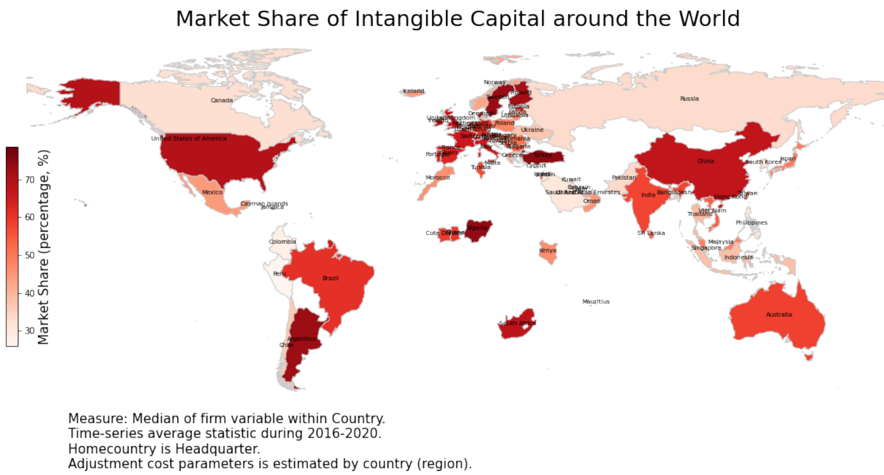

Figure 1: Contribution of Intangible Capital in Firm Value across Globe

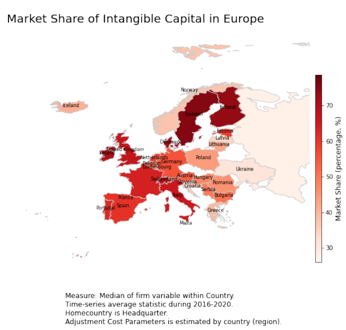

Figure 1: (a) Europe

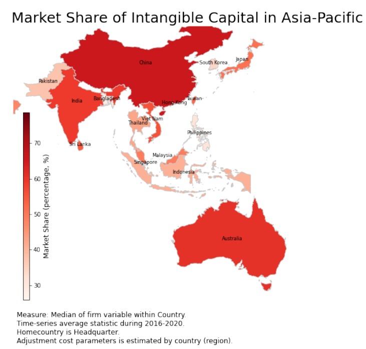

Figure 1: (b) Asia-Pacific

This figure plots the contribution of intangible capital in the firm valuation in individual countries, using the heatmap. The statistics are plotted for countries in Table 9 and Appendix Table 16. The statistic for the the contribution of intangible capital in the firm valuation are graphed. The statistic is the time-series average of median market share μ_I from the year 2016 to the year 2020, using the availabe firm-year observations inside the country. The market share μ_I is estimated using the Benchmark model and Benchmark estimation specification in Table 5 and Table 6. For countries with insufficient observations of public listed firms, they are omitted in the heatmap. The sub-figure 1 (a) plots the statistics for countries in Europe. The sub-figure 1 (b) plots the statistics for Australia and countries in Asia.

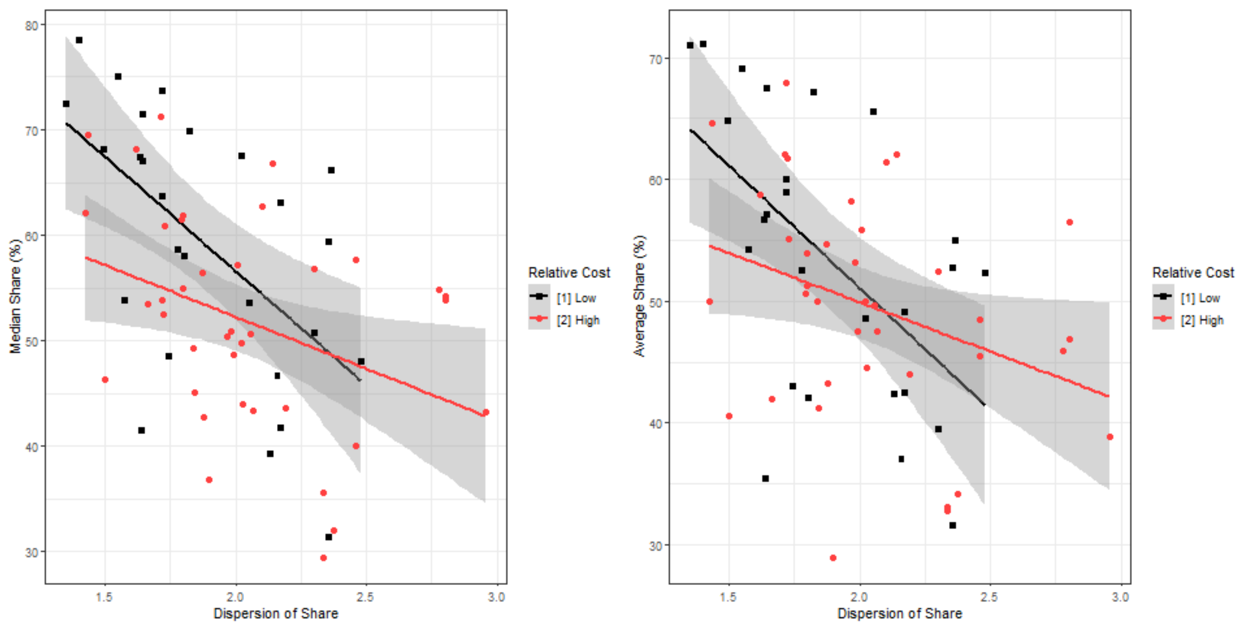

Figure 2: (a) Median-Share

Figure 2: (b) Average-Share

The subfigure 2 figure plots the time-series average dispersion of intangible share $\frac{\mu_{75\%}}{\mu_{25\%}}$, and the time-series average median of intangible capital $\mu_{50\%}$, for each country in Table 11. Country-level observations are classified into the group of **Low Relative Cost** $\frac{\theta_U}{\theta_K}$, and the group of **High Relative Cost** $\frac{\theta_U}{\theta_K}$. The black(red) dots plots the countries in the group of **Low(High) Relative Cost** $\frac{\theta_U}{\theta_K}$. The black(red) line is the best linear line fits the cross-country data points in the group of **Low(High) Relative Cost** $\frac{\theta_U}{\theta_K}$. The subfigure 2 figure plots the time-series average dispersion of intangible share, and the time-series average mean of intangible capital, for each country in Table 11.

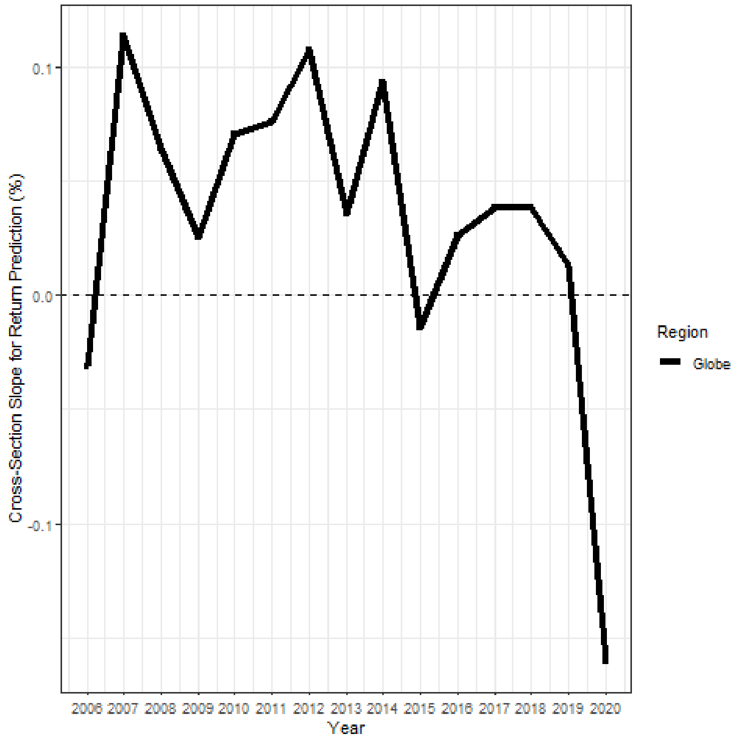

Figure 3: Fama-Macbeth Regression Slope

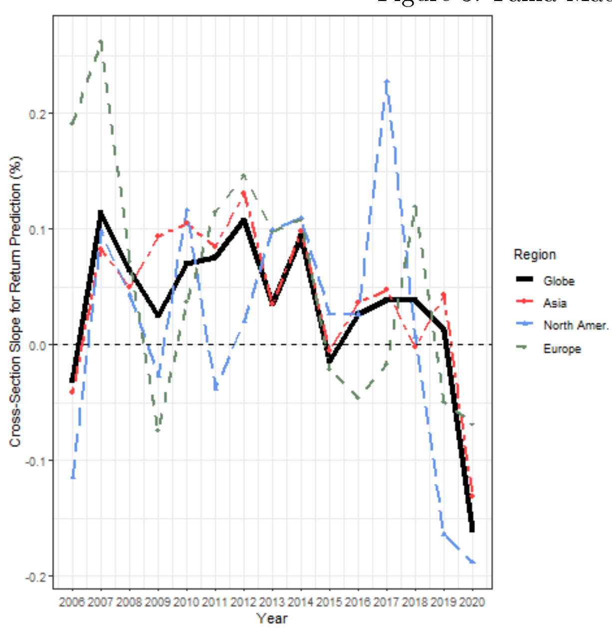

Figure 3: (a) Major Regions

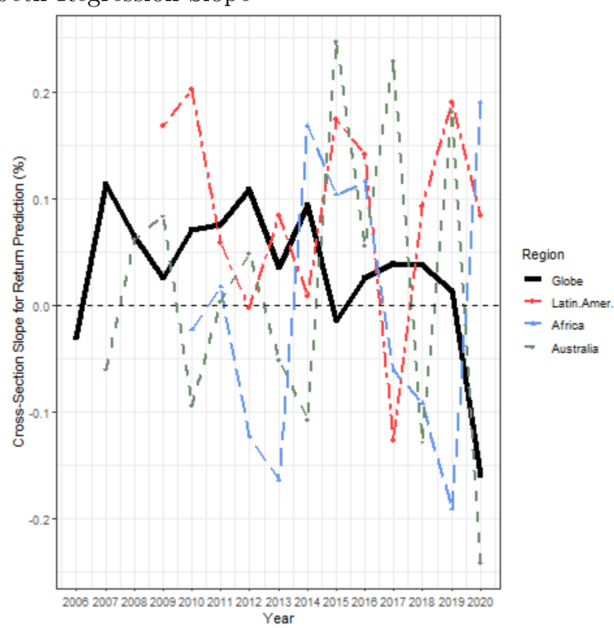

Figure 3: (b) Rest of the World

This figure plots the slope of annual cross-section regression in Column (1) of Table 12. The black line **marketshare** plots the cross-section slope of **MarketShare-Intangible**. The subfigure 3plots the slope of cross-section slope for Columns (5)-(7) in Table 12, using the benchmark sample during 2006-2020: the red line **Asia** uses the subsample of firms located in located in China, India, Malaysia, Thailand, Taiwan, Japan, South Korea, Singapore, Hong Kong, Vietnam, Israel, Turkey and countries in Southern Asia, South-eastern Asia, Western Asia; the blue line **North America** uses the subsample of firms located in Canada and U.S.; the green line **Europe** uses the subsample of firms located in France,Germany, Italy, UK, Poland, Sweden and countries of Southern Europe,Eastern Europe,Northern Europe,Western Europe. The subfigure 3plots the cross-section slope, after including the anomaly control.

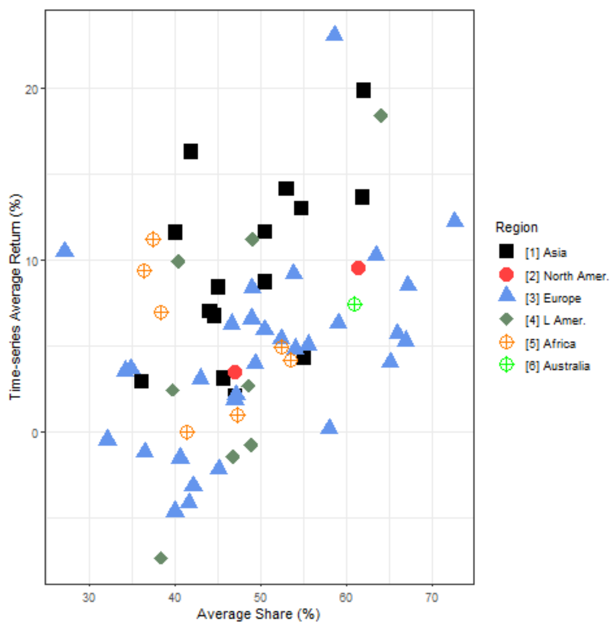

Figure 4: (a) Country-level

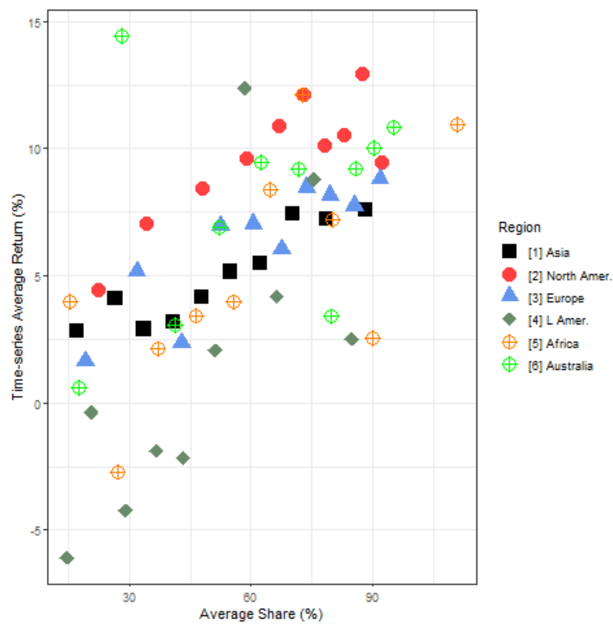

Figure 4: (b) Portfolio-level

This figure plots the time-series average equity excess return, and the time-series average share of intangible capital, for each country in Table 13. In the subfigure 4, the black dots plots country-level average variables in **Asia**, the blue dots for **Europe**, the red dots for **North America**. The subfigure 4 time-series average equity excess return and the time-series average share of intangible capital, for each within-region sorted 10-portfolios, in the similar approach of subfigure 4. In each year, each major region, the firms are sorted into 10 tercile-portfolios based on the share of intangible capital estimated in Table 5 and Table 6. Firm-year observations and country-year observations are excluded for firms locating in Western Asia and Sub-african, to avoid the noise from model of low fitness.

C Additional Tables

Table 14: Descriptive Statistics

	Region (1)	Start (2)	Firms (3)	$\frac{Y}{GDP}$ (%) (4)	$\frac{VA}{GDP}$ (%) (5)	Per Capita (USD) (6)
Cote Divoire	Africa	2010	12	4.36	1.08	2313
Ghana		2013	11	4.88	1.43	2044
Kenya		2007	18	7.22	3.14	1560
Morocco		2006	32	8.91	3.52	3061
Mauritius		2014	10	14.59	3.81	9015
Nigeria		2006	49	2.38	0.81	2434
Tunisia		2007	26	6.84	1.88	3574
South Africa		2006	113	57.39	19.40	5116
Zambia		2014	8	12.39	3.57	1343
Argentina	L.America and the Carib.	2000	29	3.56	1.11	12348
Brazil		2000	119	21.05	6.97	8229
Cayman Islands		2008	21	238.48	45.49	86788
Chile		2000	70	39.78	13.26	12954
Colombia		2001	17	21.13	7.27	5889
Jamaica		2007	15	12.92	4.37	4532
Mexico		2000	58	22.07	8.73	8921
Peru		2000	42	17.57	7.15	5792
Bangladesh	Southern Asia	2008	60	2.37	0.88	1666
Sri Lanka		2006	101	11.06	3.10	4148
Pakistan		2006	168	12.71	2.97	1447
Philippines	South-Eastern Asia	2000	55	14.37	5.18	3270
Viet Nam		2007	162	12.88	2.89	2656
U.A.E.	Western Asia	2006	32	8.99	3.41	37498
Bahrain		2008	12	14.05	4.35	19343
Cyprus		2004	31	29.14	8.20	26942
Jordan		2004	45	16.70	3.67	4029
Kuwait		2005	42	19.49	7.17	24433
Oman		2004	33	11.61	2.38	13737
Palestine		2013	12	7.39	3.70	2747
Qatar		2009	15	11.52	4.84	56019
Saudi Arabia		2004	72	12.20	4.74	18691
Turkey		2004	165	11.76	3.19	12039

Table 14: Descriptive Statistics

	Region (1)	Start (2)	Firms (3)	$\frac{Y}{GDP}$ (%) (4)	$\frac{VA}{GDP}$ (%) (5)	Per Capita (USD) (6)
Spain	Southern Europe	2007	70	16.49	6.65	25254
Greece		2004	130	18.60	4.00	17778
Croatia		2006	37	16.59	5.92	12803
Italy		2007	123	7.46	2.82	28857
Malta		2015	10	7.91	4.66	29764
Portugal		2007	25	28.58	8.81	19958
Serbia		2013	14	8.18	2.79	6486
Slovenia		2007	10	18.95	3.35	23149
Bulgaria	Eastern Europe	2009	24	4.55	1.02	7904
Hungary		2009	8	12.81	3.87	14502
Romania		2009	41	4.67	1.86	10856
Russia		2009	83	40.26	17.36	9704
Ukraine		2011	12	4.62	1.17	2238
Denmark	Northern Europe	2000	55	30.01	16.13	56583
Estonia		2006	11	10.95	2.58	19803
Finland		2000	50	46.38	15.29	44692
Ireland		2000	38	64.95	25.91	79464
Iceland		2013	10	24.11	8.74	57119
Lithuania		2004	19	5.67	1.33	17666
Latvia		2006	12	2.26	1.03	15695
Norway		2005	69	18.50	6.78	74481
Sweden		2000	138	53.90	17.83	52920
Austria	Western Europe	2002	32	20.62	7.29	42898
Belgium		2002	45	22.15	8.01	40264
Switzerland		2002	102	67.21	32.60	85506
Luxembourg		2002	18	206.86	57.58	105581
Netherlands		2002	54	50.12	14.51	47156

Table 15: Descriptive Firm Statistics for Regions

	Median				Std				
	$\frac{Q}{TK}$	$\frac{I^P}{K^P}$	$\frac{I^I}{K^I}$	$\frac{K^I}{TK}$	$\frac{Q}{TK}$	$\frac{I^P}{K^P}$	$\frac{I^I}{K^I}$	$\frac{K^I}{TK}$	$\rho(\frac{I^P}{K^P}, \frac{I^I}{K^I})$
Cote Divoire	1.53	0.19	0.23	0.51	1.74	0.20	0.09	0.14	0.08
Ghana	0.86	-0.03	0.10	0.53	1.32	0.22	0.05	0.22	0.43
Kenya	0.99	0.06	0.20	0.33	1.92	0.20	0.08	0.22	0.23
Morocco	2.55	0.10	0.26	0.37	2.51	0.21	0.10	0.20	0.25
Mauritius	1.08	0.11	0.23	0.26	5.23	0.20	0.13	0.21	0.10
Nigeria	0.92	-0.01	0.15	0.42	1.69	0.22	0.10	0.22	0.32
Tunisia	2.13	0.07	0.20	0.35	1.98	0.19	0.10	0.14	0.23
South Africa	1.34	0.11	0.21	0.50	1.67	0.24	0.15	0.28	0.23
Zambia	0.74	-0.07	0.14	0.42	0.70	0.27	0.34	0.26	0.13
Argentina	0.76	-0.05	0.09	0.55	1.77	0.34	0.06	0.25	0.07
Brazil	1.09	0.09	0.19	0.42	1.69	0.47	0.12	0.24	0.37
Cayman Islands	1.34	0.18	0.31	0.26	2.44	1.27	0.19	0.25	0.16
Chile	1.33	0.09	0.22	0.25	1.27	0.22	0.08	0.19	0.32
Colombia	0.89	0.05	0.21	0.19	1.40	0.66	0.14	0.16	0.45
Jamaica	1.39	0.08	0.17	0.63	2.33	0.73	0.10	0.23	0.12
Mexico	1.10	0.08	0.21	0.35	1.38	0.27	0.08	0.21	0.20
Peru	0.65	0.10	0.23	0.20	1.13	0.33	0.10	0.15	0.32
Bangladesh	2.19	0.05	0.23	0.14	2.10	0.35	0.09	0.20	0.10
Sri Lanka	0.94	0.04	0.21	0.25	1.10	0.25	0.08	0.16	0.19
Pakistan	1.22	0.01	0.18	0.16	1.78	0.27	0.09	0.19	0.17
Philippines	1.54	0.14	0.25	0.23	3.60	0.60	0.17	0.20	0.17
Viet Nam	1.71	0.09	0.24	0.34	2.09	0.45	0.10	0.22	0.19
United Arab Emirates	1.59	0.14	0.26	0.19	2.55	0.34	0.13	0.21	0.29
Bahrain	1.57	0.14	0.24	0.24	1.84	0.55	0.09	0.23	-0.01
Cyprus	0.66	0.06	0.22	0.22	0.67	0.40	0.11	0.22	0.17
Jordan	1.65	0.04	0.22	0.19	1.83	0.20	0.09	0.16	0.15
Kuwait	2.12	0.16	0.25	0.23	5.18	0.85	0.16	0.21	0.22
Oman	1.70	0.12	0.26	0.18	1.45	0.51	0.12	0.17	0.17
Palestine	1.55	0.08	0.23	0.30	4.76	0.33	0.09	0.18	-0.01
Qatar	2.25	0.18	0.30	0.09	4.20	0.78	0.16	0.18	0.11
Saudi Arabia	2.58	0.08	0.26	0.14	3.32	0.25	0.11	0.16	0.10
Turkey	1.46	-0.02	0.14	0.41	2.05	0.32	0.07	0.22	0.20

Table 15: Descriptive Firm Statistics for Regions

	Median				Std				
	$\frac{Q}{TK}$	$\frac{I^P}{K^P}$	$\frac{I^I}{K^I}$	$\frac{K^I}{TK}$	$\frac{Q}{TK}$	$\frac{I^P}{K^P}$	$\frac{I^I}{K^I}$	$\frac{K^I}{TK}$	$\rho(\frac{I^P}{K^P}, \frac{I^I}{K^I})$
Spain	1.78	0.16	0.23	0.45	3.14	0.36	0.11	0.24	0.20
Greece	1.03	0.06	0.22	0.30	1.11	0.29	0.11	0.21	0.35
Croatia	0.93	0.08	0.20	0.28	1.10	0.20	0.12	0.17	0.35
Italy	1.60	0.19	0.24	0.52	2.85	0.40	0.16	0.25	0.15
Malta	2.65	0.12	0.29	0.24	5.75	0.45	0.10	0.31	0.21
Portugal	1.28	0.13	0.21	0.47	1.50	0.30	0.24	0.24	0.18
Serbia	0.79	0.07	0.18	0.34	0.92	0.20	0.23	0.18	0.05
Slovenia	0.99	0.10	0.20	0.34	0.78	0.15	0.11	0.20	0.31
Bulgaria	1.10	0.07	0.21	0.35	2.40	0.19	0.13	0.19	0.16
Hungary	1.05	0.09	0.17	0.42	0.90	0.17	0.13	0.23	0.24
Romania	0.62	0.03	0.19	0.32	0.56	0.15	0.10	0.18	0.21
Russia	1.03	0.03	0.16	0.28	1.24	0.24	0.11	0.22	0.22
Ukraine	0.83	-0.05	0.13	0.26	1.23	0.32	0.11	0.20	0.47
Denmark	1.17	0.17	0.23	0.57	3.71	0.34	0.13	0.24	0.22
Estonia	1.61	0.14	0.22	0.48	2.39	0.36	0.17	0.22	0.28
Finland	1.60	0.20	0.22	0.61	2.27	0.36	0.15	0.25	0.14
Ireland	2.32	0.22	0.26	0.53	2.68	0.45	0.15	0.24	0.19
Iceland	2.23	0.27	0.21	0.45	1.61	0.48	0.05	0.26	0.12
Lithuania	1.00	0.13	0.23	0.34	1.19	0.51	0.21	0.21	0.42
Latvia	0.79	0.11	0.19	0.24	1.28	0.40	0.13	0.21	0.27
Norway	1.39	0.19	0.27	0.29	3.05	0.62	0.25	0.30	0.36
Sweden	2.08	0.27	0.26	0.64	3.70	0.48	0.13	0.24	0.22
Austria	1.25	0.17	0.23	0.46	2.14	0.29	0.12	0.22	0.41
Belgium	1.52	0.19	0.24	0.49	3.09	0.29	0.11	0.24	0.28
Switzerland	1.69	0.21	0.26	0.58	2.77	0.31	0.11	0.24	0.18
Luxembourg	1.24	0.16	0.25	0.27	3.84	0.46	0.22	0.23	0.26
Netherlands	1.67	0.24	0.24	0.58	3.76	0.34	0.14	0.24	0.17

Table 16: Capital Accounting: Share of Intangible

	Market Share	Adjustment Cost		Book Share
	Market μ_I	c_I (% sales)	c_P (% sales)	Book $\overline{\mu}_I$
Cote Divoire	54.72	6.77	5.13	43.19
Ghana	55.02	1.70	3.10	40.27
Kenya	45.65	5.15	1.91	25.20
Morocco	44.88	5.93	3.04	29.62
Mauritius	35.91	5.53	4.58	25.47
Nigeria	75.71	3.16	7.28	40.11
Tunisia	52.55	3.63	1.55	31.02
South Africa	61.90	3.87	2.59	47.04
Zambia	94.61	4.08	10.92	31.23
Argentina	70.83	0.64	3.01	64.68
Brazil	57.61	2.66	1.13	41.34
Cayman Islands	46.50	4.32	2.10	30.52
Chile	36.28	3.52	0.79	21.32
Colombia	28.61	2.07	0.57	15.15
Jamaica	69.79	4.95	1.02	55.42
Mexico	44.57	3.81	0.93	27.94
Peru	25.91	2.77	0.63	14.45
Bangladesh	31.43	5.28	1.01	9.56
Sri Lanka	49.57	8.86	1.02	20.25
Pakistan	35.85	2.47	1.45	12.15
Philippines	32.44	5.99	3.50	16.50
Viet Nam	50.39	3.66	0.96	28.46
United Arab Emirates	43.33	9.01	5.41	19.40
Bahrain	31.22	7.26	10.89	21.19
Cyprus	36.15	7.46	4.16	23.23
Jordan	34.05	5.97	1.22	16.78
Kuwait	41.29	7.06	7.10	22.25
Oman	44.74	10.15	5.86	20.78
Palestine	44.85	8.63	3.43	26.53
Qatar	26.53	8.26	19.13	9.14
Saudi Arabia	32.60	7.12	2.18	12.99
Turkey	78.71	2.22	3.55	38.00

Table 16: Capital Accounting: Share of Intangible

	Market Share	Adjustment Cost		Book Share
	Market μ_I	c_I (% sales)	c_P (% sales)	Book $\overline{\mu}_I$
Spain	58.28	7.10	2.59	39.87
Greece	44.47	5.17	1.04	26.11
Croatia	43.15	4.12	1.19	28.00
Italy	60.65	7.57	3.02	44.80
Malta	28.66	10.81	5.06	16.69
Portugal	59.10	5.71	2.68	42.43
Serbia	49.52	4.38	0.82	30.91
Slovenia	38.19	1.41	1.75	25.72
Bulgaria	50.95	2.73	0.21	36.98
Hungary	48.17	1.98	0.65	35.50
Romania	47.40	3.83	0.24	32.59
Russia	35.76	1.07	0.43	26.88
Ukraine	38.06	0.88	0.84	28.19
Denmark	68.52	9.67	3.35	53.97
Estonia	58.13	4.19	1.27	45.20
Finland	70.19	6.11	2.91	58.55
Ireland	65.63	8.83	4.55	55.09
Iceland	44.52	7.07	10.91	34.93
Lithuania	45.71	3.84	1.94	34.99
Latvia	41.24	6.46	2.73	28.25
Norway	43.72	6.04	6.76	26.56
Sweden	71.59	9.69	5.32	62.06
Austria	51.96	6.58	3.87	39.17
Belgium	51.15	5.80	4.00	37.96
Switzerland	62.40	8.87	3.91	52.81
Luxembourg	36.07	4.34	4.30	26.53
Netherlands	57.86	7.07	5.10	49.98

Table 17: Firm-level stock return predictability regressions - Major Regions

The table below reports the estimation reasults for each major regions using the identical specification in Column (2) and Column (4) in Table 12. Estimation excludes the set of variables related with cross-section anomalies. Definitions of major regions are identical with Table 12. The table below reports the estimation reasults by each major regions using the Method of pooled OLS regressions and the identical specification in Column (3) and Column (4) in Table 12. Columns (1)-(3) reports the time-series average slope from the Cross-sectional regressions. Newey-West 3 lagged standard errors are reported. Columns (4) -(6) reports the slope from the Pooled OLS regressions. The standard error of OLS regression is clustered at the firm-level and year-level. Definitions of major regions are identical with Table 12. P-value of t-stat are indicated using * for $p<0.10$, ** for $p<0.05$, *** for $p<0.010$.

	Cross-sectional			Pooled OLS		
	(1) Asia	(2) North Amer.	(3) Europe	(4) Asia	(5) North Amer.	(6) Europe
MarketShare	0.080***	0.056**	0.077**	0.0809*	0.0832**	0.118***
-intangible	(0.025)	(0.028)	(0.034)	(0.0406)	(0.0350)	(0.0373)
Anomaly Controlled	No	No	No	No	No	No
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	-	-	-	Yes	Yes	Yes
Obs.	7358	1609	2047	90146	20736	26004
Adj-R^2	0.137	0.051	0.118	0.063	0.065	0.065

Table 18: Firm-level stock return predictability regressions - Rest of World

The table below reports the estimation reasults for the Rest of World using the Fama-Macbeth cross-sectional regressions and the identical specification in Column (1) and Column (2) in Table 12. Columns (1)-(3) have identical specification with the Columns (5)-(7) in in Table 12. Columns (4)-(6) exclude the set of variables related with cross-section anomalies. Column (1) and (4) **Latin America** uses the subsample of firms located in countries of Latin America and the Caribbean; Column (2) and (5) **Africa** uses the subsample of firms located in countries of Sub-Saharan Africa and Northern Africa. Column (3) and (6) **Australia** uses the subsample of firms located in Australia. P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	(1) L. Amer.	(2) Africa	(3) Aus.	(4) L. Amer.	(5) Africa	(6) Aus.
MarketShare	0.076***	0.047*	−0.058	0.081***	0.029	0.032
-intangible	(0.019)	(0.028)	(0.054)	(0.017)	(0.030)	(0.047)
Anomaly	Yes	Yes	Yes	No	No	No
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	282	213	288	282	213	288
Adj-R^2	0.206	0.164	0.028	0.150	0.124	-0.012

Table 19: Firm-level stock return predictability regressions - Rest of World

The table below reports the estimation reasults for the Rest of World using the Method of pooled OLS regressions and the identical specification in Column (3) and Column (4) in Table 12. Columns (1)-(3) has identical specification with the Columns (8)-(10) in in Table 12. Columns (4)-(6) exclude the set of variables related with cross-section anomalies. Definition of regions is identical with Table 18 P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	(1) L. Amer.	(2) Africa	(3) Aus.	(4) L. Amer.	(5) Africa	(6) Aus.
MarketShare	0.0758	0.0611	0.0638	0.0892	0.0531	0.106
-intangible	(0.0457)	(0.0453)	(0.0760)	(0.0594)	(0.0437)	(0.0756)
Anomaly	Yes	Yes	Yes	No	No	No
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3145	2598	3464	3145	2598	3464
Adj-R^2	0.267	0.106	0.064	0.213	0.101	0.045

Table 20: Firm-level stock return predictability regressions

The table below reports the estimation results using the Method of pooled OLS regressions and the identical specification in Column (3) and Column (4) in Table 12. The sample is from Jan 2006 to Dec 2020. Estimation uses the equation: $r^e_{c,t+1} = a + \lambda \times \mu_{I,t} + \gamma_1 \times \mu_{I,t} \times Covid_t + e_{c,t+1}$. P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	All Countries		Major Regions					
	Pooled		Pooled			Pooled		
	(3)	(4)	(5) Asia	(6) N.Amer.	(7) Europe	(8) Asia	(9) N.Amer.	(10) Europe
MarketShare	0.0600*	0.0214	0.0690	0.0475	0.109***	0.0926**	0.0433	0.114**
-Intangible	(0.0338)	(0.0396)	(0.0498)	(0.0419)	(0.0349)	(0.0427)	(0.0448)	(0.0401)
Anomaly	No	Yes	No	No	No	Yes	Yes	Yes
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	173567	173567	109197	23549	30053	109197	23549	30053
Adj-R^2	0.022	0.025	0.020	0.062	0.055	0.027	0.074	0.075

Table 21: Firm-level stock return predictability regressions - Rest of World

The table below reports the estimation reasults for the Rest of World using the Method of pooled OLS regressions and the identical specification in Column (3) and Column (4) in Table 12. The sample is from Jan 2006 to Dec 2020. Estimation uses the equation: $r^e_{c,t+1} = a + \lambda \times \mu_{I,t} + \gamma_1 \times \mu_{I,t} \times Covid_t + e_{c,t+1}$. P-value of t-stat are indicated using * for p<0.10, ** for p<0.05, *** for p<0.010.

	(1) L. Amer.	(2) Africa	(3) Aus.	(4) L. Amer.	(5) Africa	(6) Aus.
MarketShare	0.0823	0.0509	0.0628	0.0946	0.0514	0.107
-intangible	(0.0470)	(0.0413)	(0.0763)	(0.0570)	(0.0408)	(0.0734)
Anomaly	Yes	Yes	Yes	No	No	No
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3763	3014	3990	3763	3014	3990
Adj-R^2	0.235	0.123	0.074	0.194	0.111	0.056

Table 22: Descriptive Statistics for Equity Index

The table below reports the descriptive statistics for sample used in the Table 12. **Index Abbrev.** is the identifier of equity index reported in Compustat-Index dataset. **Decription of Index** is the description of index reported in Compustat-Index dataset. **Firm Number** is the time-series average number of firms included in the index constitute. **1st stage-Coverage (%)** is the time-series average coverage of market valuation, between the firms with balance sheet information reported in Compustat-Global and the firms reported in the index constitute. **2nd stage-Coverage (%)** is the time-series average coverage of market valuation, between the firms with estimated share of intangible capital and the firms reported in the index constitute. **Relative Coverage (%)** is the time-series average coverage of market valuation, between the firms with estimated share of intangible capital and the firms reported in Compustat-Global.

Index Abbrev.	Description of Index	Firm Number	All-Issuance (%)	All-Industry (%)	1st stage (%)	2nd stage(%)	Relative (%)
AEX	Amsterdam Stock Exchange	10.91	56.98	39.63	30.18	16.20	50.77
ATHENS	Athens Stock Exchange	36.68	63.07	55.57	48.00	31.47	67.32
ASX	Australian Stock Exchange	212.96	42.06	37.59	30.26	16.66	55.41
BOMBAY	Bombay Stock Exchange	50.22	72.34	73.85	63.26	39.23	60.85
BOVESPA	Brazilian Stock Exchange	16.00	80.14	47.70	48.30	22.96	48.64
DNK	Copenhagen Stock Exchange	11.86	77.87	64.50	60.92	29.66	50.43
TECDAX	Deutschier Aktien TECDAX (Perf)	20.53	88.74	79.30	75.06	38.70	52.36
STOXX	Dow Jones STOXX Indices	247.52	61.40	46.45	38.73	24.70	63.00
BEL	Euronext Brussels Stock Exchange	39.52	72.21	54.45	44.41	28.02	62.92
DAX	Germany Major Exchange Indices	260.57	69.12	54.14	49.83	40.02	78.59
HANGSENG	Hong Kong Stock Exchange	18.78	45.45	38.02	30.18	16.49	61.59
TUR	Istanbul Stock Exchange	11.19	56.80	54.02	37.27	36.06	96.85
JASDAQ	Japanese Over the Counter Exchange	346.87	42.15	44.23	44.06	16.19	37.17
KOR	Korea Stock Exchange	143.73	85.00	81.74	75.53	67.05	88.81
KLSE	Kuala Lumpur Stock Exchange	20.83	40.67	42.33	35.64	26.88	73.32
MEX	Mexican Stock Exchange	18.77	84.48	71.19	66.86	51.41	76.69
OMX	Nordic Baltic Marketplace Indices	84.86	86.24	71.72	62.74	44.95	71.61
OSE	Oslo Stock Exchange	14.18	83.57	61.24	47.01	29.91	57.41
CAC	Paris Bourse Exchange	20.41	79.63	58.35	48.74	29.43	60.02
PRT	Portugal Stock Exchange	13.05	88.39	75.30	52.81	46.79	87.06
SBF	SBF France Indices	165.74	76.71	60.45	51.38	31.47	60.99
SGP	Singapore Index	12.61	36.78	36.24	25.71	21.15	82.06
ESP	Spanish Stock Exchanges	64.57	58.51	50.01	35.47	20.22	58.49
SPI	Swiss Market Index - Performance	104.65	71.23	49.79	48.99	36.82	75.19
TWN	Taiwan Index	629.09	84.91	77.31	73.44	62.28	84.96
TSE	Tokyo Stock Exchange	1059.57	66.31	62.53	56.77	43.94	77.42
AUT	Vienna Stock Exchange	18.30	48.79	48.00	39.31	32.41	82.23
WIG	Warsaw Stock Exchange	168.96	47.59	51.15	33.59	24.47	81.14
Summary of Relative Coverage							
Average							67.98
S.E.							14.21

Table 23: Country-level stock return predictability regressions

The table below reports the estimation results from stock return predicatability regressions as in Table 13 This table reports the estimation reasults using the sub-sample, where information of long-term interest rate and short-term interest rate is available for the country. Economic indicators include the growth of GDP per capita in the previous year, the currency return in the previous year, short-term interest rate and long-term interest rate in the previous year .

	Countries with Records of Interest Rate											
	Cross-sectional						Pooled OLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
IntangibleShare	0.166**	0.220***	0.155***	0.206***	0.310***	0.304***	0.188***	0.232***	0.187***	0.214***	0.196**	0.193***
	(0.069)	(0.069)	(0.054)	(0.055)	(0.117)	(0.105)	(0.056)	(0.058)	(0.056)	(0.051)	(0.080)	(0.062)
Anomaly	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Economic	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
SIC-2 FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	33	33	33	33	33	33	466	466	466	466	466	466
Adj-R^2	0.079	0.060	0.186	0.150	0.363	0.401	-0.015	-0.008	0.004	0.004	0.026	0.096

Table 24: Country-level stock return predictability regressions

The table below reports the estimation results from stock return predicatability regressions as in Table 13 This table reports the estimation reasults using the full sample, including countries without information of economic indicators or the information of intellectual property protection.

	All Countries							
	Cross-sectional				Pooled OLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IntangibleShare	0.182**	0.176**	0.185***	0.158***	0.196***	0.180***	0.209***	0.163***
	(0.090)	(0.075)	(0.062)	(0.043)	(0.061)	(0.061)	(0.063)	(0.058)
Anomaly	No	No	Yes	Yes	No	No	Yes	Yes
SIC-2 FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	-	-	-	-	Yes	Yes	Yes	Yes
Obs.	59	59	59	59	892	892	892	892
Adj-R^2	0.026	0.023	0.206	0.183	-0.008	-0.009	0.012	0.025

Table 25: Firm-level Cash-holding Correlation regressions - Major Regions

The table below reports the estimation results in each major region, for the same estimation in Table **??**. Columns (1)-(3) reports the estimation reasults per major region using the identical specification and methods with Column (1) in Table **??**. Columns (6)-(8) reports the estimation reasults per major region using the identical specification and methods with Column (3) in Table **??**. Columns (4)-(5) reports the estimation reasults per major region using the identical specification and methods with Column (2) in Table **??**. Columns (9)-(10) reports the estimation reasults per major region using the identical specification and methods with Column (4) in Table **??**. For sufficent dispersion of parameter$\theta_{I,m}$, Columns (5) and Column (10) **North America and Europe** uses the subsample of firms located in Canada or U.S., France,Germany, UK, Poland and countries of Southern Europe,Eastern Europe,Northern Europe,Western Europe.

	Major Regions									
	Cross-sectional					Pooled				
	(1) Asia	(2) N.Am.	(3) Europe	(4) Asia	(5) NA & Eu	(6) Asia	(7) N.Am.	(8) Europe	(9) Asia	(10) NA & Eu
$\hat{\mu}_{I,i,t}$	0.506***	0.298***	0.039**			0.469***	0.289***	0.0854***		
	(0.048)	(0.018)	(0.015)			(0.0176)	(0.0302)	(0.0185)		
$\theta_{I,m} * \hat{\mu}_{I,i,t}$				0.029***	0.046***				0.0133***	0.0223***
				(0.002)	(0.001)				(0.00177)	(0.00344)
$\hat{\mu}_{I,i,t}$	-	-	-	Yes	Yes	-	-	-	Yes	Yes
Anomaly	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC-2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes
Obs.	7520	1684	2065	7520	3749	96549	20786	26194	96549	46980
Adj-R^2	0.345	0.373	0.277	0.363	0.334	0.312	0.240	0.184	0.315	0.211

Table 26: Country-level Distribution: Industry Fixed Effect

The table below reports the estimation results of Table 11 using the share of intangible after excluding the fixed effect of Fama-French 10 industry. Industry fixed effect is estimated at the firm-level using the full-sample. Estimation of industry fixed effect includes country fixed effect.

	Median	Median		Mean		Median	
	Pooled Sample	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	High-IP Score	Low-IP Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dispersion	-11.761***	-16.426**	-6.904**	-13.987*	-8.081***	-25.484***	-3.672
	(1.555)	(7.608)	(3.290)	(7.563)	(2.592)	(7.834)	(3.734)
Observations	818	412	406	412	406	387	431
R^2	0.067	0.102	0.033	0.105	0.065	0.200	0.010
Adjusted R^2	0.049	0.068	-0.004	0.071	0.029	0.168	-0.026

Table 27: Country-level Distribution of Book-share

The table below reports the estimation results from regressions of the form: $\hat{\mu}_{50\%,c,t} = \beta \times \frac{\hat{\mu}_{75\%}}{\hat{\mu}_{25\%}}_{c,t} + e_{c,t}$, in which the $\hat{\mu}_{50\%,c,t}$is the the median book share of intangible capital for each country in each available year, Dispersion$\frac{\hat{\mu}_{75\%}}{\hat{\mu}_{25\%}}_{c,t}$ is the the dispersion of book share for each country in each available year. The book share of intangible capital μ is calculated in Table 11. The sample is the same with Table 12. In Columns (2)-(5), countries are classified into the group of **Low Relative Cost** $\frac{\theta_U}{\theta_K}$, and the group of **High Relative Cost** $\frac{\theta_U}{\theta_K}$. In Columns (4)-(5), the regression use the average book share of intangible capital, instead of the median. In Columns (6)-(7), countries are classified into the group of **High Intellectual Property Protection Score**, and the group of **Low Intellectual Property Protection Score**.

	Median	Median		Mean		Median	
	Pooled Sample	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	High-IP Score	Low-IP Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dispersion	-6.308***	-9.087***	-1.455	-7.001***	-0.347	-8.874***	-2.552
	(0.610)	(2.570)	(1.635)	(1.929)	(1.428)	(2.248)	(1.729)
Observations	818	412	406	412	406	387	431
R^2	0.117	0.182	0.011	0.176	0.001	0.212	0.032
Adjusted R^2	0.101	0.151	-0.027	0.145	-0.038	0.180	-0.003

Table 28: Country-level Distribution: Weighted Quantile (A)

The table below reports the estimation results of Table 11 using the distribution statistics weighted by Equity Valuation. To avoid the superstar firm inside each country, this estimation uses the subsample excluding the African countries and country-year observation with less than 20 firms.

	Median	Median		Mean		Median	
	Pooled Sample	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	High-IP Score	Low-IP Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dispersion	-8.656***	-10.172***	-6.280***	-8.296***	-5.007***	-13.354***	-5.460**
	(0.762)	(2.919)	(2.139)	(2.472)	(1.444)	(2.581)	(2.363)
Observations	588	279	309	279	309	309	279
R^2	0.184	0.271	0.101	0.310	0.121	0.325	0.103
Adjusted R^2	0.163	0.229	0.055	0.271	0.076	0.290	0.052

Table 29: Country-level Distribution: Weighted Quantile (B)

The table below reports the estimation results of Table 11 using the distribution statistics weighted by accumulated intangible capital owned by each firm. To avoid the superstar firm inside each country, this estimation uses the subsample excluding the African countries and country-year observation with less than 20 firms.

	Median	Median		Mean		Median	
	Pooled Sample	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	Low-$\frac{\theta_U}{\theta_K}$	High-$\frac{\theta_U}{\theta_K}$	High-IP Score	Low-IP Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dispersion	-9.091***	-13.598***	-5.518***	-11.168***	-5.113***	-9.397***	-7.897***
	(0.760)	(3.321)	(1.619)	(2.408)	(1.358)	(2.420)	(2.297)
Observations	588	279	309	279	309	309	279
R^2	0.200	0.340	0.094	0.398	0.141	0.195	0.178
Adjusted R^2	0.179	0.302	0.048	0.364	0.097	0.154	0.131

Table 30: Country-level Distribution Characteristic

The table below reports the correlation of **Relative Cost** ${\frac{\theta_U}{\theta_K}}_c$ and the **Intellectual Property Protection Score** $IPScore_c$ .Parameters of investment adjustment cost $\theta_{U\,c}$ and $\theta_{K\,c}$are from Table 5 and Table 6. In Columns (1), the IP-score is the statistic provided by World Intellectual Property Organization (WIPO) , slope of IP-score is reported for regression: ${\frac{\theta_U}{\theta_K}}_c = \alpha + \beta \times IPScore_c + e_c$. In Columns (2), the IP-score is the statistic in "Institutional Profiles Database" (IPD) provided by the Centre for Prospective Studies and International Information (CEPII), slope of IP-score is reported for regression: $IPScore_c = \alpha + \beta \times {\frac{\theta_U}{\theta_K}}_c + e_c$. Columns (3)-(4) report the same estimation for the subsample excluding the African countries and country-year observations with less than 20 firm-year observations.

	All Countries		Subsample	
	Relative Cost $\frac{\theta_U}{\theta_K}$		Relative Cost $\frac{\theta_U}{\theta_K}$	
	(1)	(2)	(3)	(4)
WIPO-Score	-0.215**		-0.344***	
	(0.097)		(0.099)	
CEPII-Score		-0.290*		-0.552***
		(0.145)		(0.150)
Intercept	4.065***	3.527***	3.527***	4.514***
	(0.628)	(0.434)	(0.434)	(0.464)
Observations	62	62	44	44
R^2	0.076	0.062	0.223	0.244
Adjusted R^2	0.061	0.047	0.204	0.226

Statistic	N	Mean	St. Dev.	Min	Max
WIPO-Score	62	6.320	1.426	3.173	8.612
CEPII-Score	62	2.833	0.960	1.000	4.000
Relative Cost	62	2.705	1.114	1.076	6.513
Share-Median	62	54.999	11.745	29.472	78.415
Share-Dispersion	62	1.977	0.373	1.350	2.957

Table 31: Model Fit in Full Sample

This table reports the measures of fit for the base line model specification in Table (5). We calculate model fit for the entire sample used for estimation in columns (4) to (6). The beginning year for each country is reported in Column (3).

		Point Estimate		Start	Model Fit		
		θ_P	θ_K		XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)	(6)
Australia		2.87	11.06	2004	0.61	0.31	0.20
	s.e.	(0.46)	(0.87)				
Canada		3.76	11.44	2000	0.90	0.54	0.16
	s.e.	(0.27)	(0.77)				
China		4.72	30.77	2001	0.25	0.16	0.26
	s.e.	(0.92)	(3.31)				
France		6.56	7.06	2007	0.74	0.20	0.20
	s.e.	(0.87)	(0.72)				
Germany		6.21	8.41	2006	0.77	0.26	0.23
	s.e.	(1.26)	(1.30)				
Hong Kong		2.43	7.24	2002	0.82	0.30	0.21
	s.e.	(0.39)	(0.72)				
India		4.76	19.16	2001	0.90	0.35	0.25
	s.e.	(0.52)	(1.26)				
Indonesia		5.74	12.99	2000	0.94	0.58	0.21
	s.e.	(0.72)	(1.58)				
Israel		3.20	9.11	2008	0.48	0.18	0.21
	s.e.	(0.41)	(0.71)				
Japan		0.86	2.42	2000	0.36	0.11	0.16
	s.e.	(0.49)	(0.41)				
Malaysia		2.85	11.72	2002	0.78	0.25	0.15
	s.e.	(0.65)	(1.21)				
Poland		3.37	4.42	2007	0.79	0.48	0.15
	s.e.	(0.47)	(0.37)				
Singapore		2.00	6.76	2002	0.81	0.39	0.16
	s.e.	(0.35)	(0.53)				
South Korea		1.76	3.73	2000	0.66	0.42	0.15
	s.e.	(0.34)	(0.55)				
Taiwan		4.87	13.98	2001	0.90	0.42	0.13
	s.e.	(0.38)	(0.80)				
Thailand		4.49	10.28	2000	0.90	0.42	0.21
	s.e.	(0.67)	(1.38)				
UK		6.24	8.47	2000	0.89	0.53	0.18
	s.e.	(0.62)	(0.75)				
USA		8.59	15.69	2000	0.90	0.66	0.15
	s.e.	(0.77)	(0.81)				

Table 32: Parameter Estimates and Model Fit

This table reports the measures of fit for the base line model specification in Table (5). We calculate model fit for the entire sample used for estimation in columns (4) to (6). The beginning year for each region is reported in Column (3).

		Point Estimate		Start	Model Fit		
		θ_P	θ_I		XS-R^2	TS-R^2	$m.a.e./VR$
		(1)	(2)	(3)	(4)	(5)	(6)
Southern Asia		4.31	18.22	2006	0.94	0.75	0.12
	s.e.	(0.54)	(1.10)				
South-eastern Asia		4.20	12.03	2000	0.67	0.32	0.18
	s.e.	(1.00)	(1.70)				
Western Asia		7.39	16.68	2004	-0.50	0.01	0.22
	s.e.	(1.07)	(2.17)				
Eastern Europe		1.00	4.52	2009	0.51	0.18	0.17
	s.e.	(0.31)	(0.44)				
Northern Europe		4.45	11.21	2000	0.86	0.48	0.22
	s.e.	(0.63)	(0.72)				
Southern Europe		3.77	10.74	2004	0.76	0.52	0.20
	s.e.	(0.69)	(1.00)				
Western Europe		6.13	10.24	2002	0.69	0.31	0.25
	s.e.	(0.95)	(1.26)				
Africa		9.47	11.23	2006	0.72	0.50	0.16
	s.e.	(1.12)	(0.98)				
L.Amer. & Carib.		2.76	7.96	2000	0.88	0.61	0.16
	s.e.	(0.43)	(1.01)				

Table 33: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification as in Table 5. The estimation uses 40 portfolios sorted based on proxies of the lagged values of the inputs (20 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P	θ_K	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)
Australia		2.60	11.35	0.51	0.30	0.23
	s.e.	(0.33)	(0.66)			
Canada		3.66	11.61	0.86	0.48	0.19
	s.e.	(0.21)	(0.60)			
China		5.02	29.81	0.14	-0.06	0.24
	s.e.	(0.78)	(2.80)			
France		6.20	7.27	0.67	0.16	0.23
	s.e.	(0.72)	(0.56)			
Germany		5.94	8.64	0.73	0.24	0.25
	s.e.	(0.91)	(0.93)			
Hong Kong		2.12	7.68	0.70	0.31	0.23
	s.e.	(0.27)	(0.50)			
India		4.77	19.11	0.77	0.14	0.25
	s.e.	(0.39)	(0.94)			
Indonesia		4.83	14.19	0.79	0.41	0.21
	s.e.	(0.50)	(1.10)			
Israel		2.63	9.79	0.42	0.15	0.25
	s.e.	(0.39)	(0.62)			
Japan		0.88	2.42	0.21	0.11	0.16
	s.e.	(0.36)	(0.32)			
Malaysia		2.66	11.93	0.69	0.22	0.18
	s.e.	(0.44)	(0.88)			
Poland		3.37	4.43	0.75	0.43	0.18
	s.e.	(0.43)	(0.31)			
Singapore		1.78	7.05	0.65	0.32	0.20
	s.e.	(0.27)	(0.43)			
South Korea		1.65	3.83	0.51	0.32	0.12
	s.e.	(0.25)	(0.39)			
Taiwan		4.78	14.07	0.82	0.32	0.14
	s.e.	(0.31)	(0.65)			
Thailand		4.04	10.94	0.72	0.30	0.21
	s.e.	(0.45)	(0.92)			
UK		6.08	8.56	0.81	0.50	0.18
	s.e.	(0.46)	(0.58)			
USA		8.53	15.72	0.88	0.68	0.15
	s.e.	(0.59)	(0.59)			
Summary of Point Estimation, Model Fitness						
	Average	3.97	11.02	0.65	0.30	0.20
	S.E.	1.92	6.17	0.21	0.17	0.04

Table 33: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification, as in Table 6. The estimation uses 40 portfolios sorted based on proxies of the lagged values of the inputs (20 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS - R^2$ is the cross-sectional R^2, $TS - R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. The results are reported for the sample of all firms. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P (1)	θ_I (2)	XS-R^2 (3)	TS-R^2 (4)	$m.a.e./\overline{VR}$ (5)
Southern Asia		3.75	18.91	0.89	0.64	0.15
	s.e.	(0.49)	(0.88)			
South-eastern Asia		3.27	15.06	0.69	0.35	0.18
	s.e.	(0.85)	(1.48)			
Western Asia		5.78	19.04	0.23	0.15	0.20
	s.e.	(0.62)	(1.49)			
Eastern Europe		1.21	4.29	0.40	0.10	0.21
	s.e.	(0.32)	(0.38)			
Northern Europe		4.05	11.55	0.79	0.44	0.22
	s.e.	(0.45)	(0.52)			
Southern Europe		3.56	11.01	0.74	0.51	0.22
	s.e.	(0.54)	(0.80)			
Western Europe		5.41	10.86	0.56	0.22	0.26
	s.e.	(0.77)	(0.91)			
Africa		8.87	11.50	0.61	0.40	0.19
	s.e.	(0.91)	(0.82)			
L.Amer. & Carib.		2.39	8.49	0.83	0.56	0.16
	s.e.	(0.30)	(0.71)			
Summary of Point Estimation, Model Fitness						
	Average	4.25	12.30	0.64	0.37	0.20
	S.E.	2.09	4.48	0.20	0.18	0.03

Table 34: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification as in Table 5. The estimation uses 60 portfolios sorted based on proxies of the lagged firm-level variables, {valuation ratio, book-share of intangible capital, investment rate in physical capital, investment rate in intangible capital, inputs in valuation equation } (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P	θ_K	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)
Australia		2.61	12.40	0.31	0.30	0.27
	s.e.	(0.41)	(0.80)			
Canada		3.63	12.55	0.50	0.39	0.24
	s.e.	(0.25)	(0.79)			
China		2.37	37.69	0.27	0.17	0.27
	s.e.	(0.96)	(3.23)			
France		7.69	6.59	0.35	0.19	0.27
	s.e.	(1.06)	(0.65)			
Germany		7.93	7.32	0.43	0.25	0.29
	s.e.	(1.35)	(1.09)			
Hong Kong		1.89	8.70	0.29	0.23	0.29
	s.e.	(0.34)	(0.89)			
India		4.71	20.41	0.38	0.15	0.30
	s.e.	(0.52)	(1.25)			
Indonesia		5.59	14.31	0.35	0.32	0.24
	s.e.	(0.54)	(1.54)			
Israel		2.81	9.91	0.21	0.14	0.27
	s.e.	(0.45)	(0.73)			
Japan		1.65	1.98	0.10	0.07	0.23
	s.e.	(0.41)	(0.34)			
Malaysia		3.14	12.17	0.29	0.19	0.24
	s.e.	(0.68)	(1.06)			
Poland		3.84	4.35	0.33	0.33	0.22
	s.e.	(0.49)	(0.39)			
Singapore		2.34	6.75	0.23	0.23	0.25
	s.e.	(0.32)	(0.55)			
South Korea		2.00	3.67	0.16	0.18	0.16
	s.e.	(0.28)	(0.56)			
Taiwan		4.74	15.01	0.34	0.25	0.20
	s.e.	(0.46)	(1.01)			
Thailand		4.58	10.71	0.36	0.28	0.24
	s.e.	(0.47)	(1.07)			
UK		6.25	8.95	0.39	0.35	0.24
	s.e.	(0.54)	(0.68)			
USA		8.54	16.35	0.50	0.48	0.21
	s.e.	(0.73)	(0.84)			
Summary of Point Estimation, Model Fitness						
	Average	4.24	11.66	0.32	0.25	0.25
	S.E.	2.12	7.80	0.10	0.10	0.03

Table 34: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification, as in Table 6. The estimation uses 60 portfolios sorted based on proxies of the lagged firm-level variables, {valuation ratio, book-share of intangible capital, investment rate in physical capital, investment rate in intangible capital, inputs in valuation equation } (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. The results are reported for the sample of all firms. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P (1)	θ_I (2)	XS-R^2 (3)	TS-R^2 (4)	$m.a.e./\overline{VR}$ (5)
Southern Asia		3.88	20.15	0.49	0.45	0.20
	s.e.	(0.54)	(1.80)			
South-eastern Asia		3.92	13.42	0.32	0.24	0.24
	s.e.	(0.63)	(1.33)			
Western Asia		8.60	16.25	0.25	0.22	0.25
	s.e.	(1.22)	(1.88)			
Eastern Europe		1.32	4.68	0.13	0.10	0.24
	s.e.	(0.30)	(0.56)			
Northern Europe		3.80	12.37	0.43	0.34	0.27
	s.e.	(0.50)	(0.72)			
Southern Europe		3.92	11.24	0.43	0.39	0.26
	s.e.	(0.59)	(0.84)			
Western Europe		6.34	10.47	0.31	0.23	0.29
	s.e.	(0.85)	(0.98)			
Africa		11.69	10.45	0.33	0.36	0.23
	s.e.	(1.15)	(0.69)			
L.Amer. & Carib.		3.28	7.73	0.37	0.34	0.21
	s.e.	(0.44)	(0.87)			
Summary of Point Estimation, Model Fitness						
	Average	5.19	11.86	0.34	0.30	0.24
	S.E.	2.99	4.26	0.10	0.10	0.03

Table 35: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification as in Table 5. For firms with different incorporation location from its headquarter location, they are excluded from the sample. The estimation uses 20 portfolios sorted based on proxies of the lagged inputs in valuation equation (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. We calculate model fit for the 2006-2020 sample for which most of the countries have data. Estimation in Hong Kong is excluded because there isn't sufficient size of sample for firms with identical incorporation location and headquarter location.

		Point Estimate		Model Fit		
		θ_P (1)	θ_K (2)	XS-R^2 (3)	TS-R^2 (4)	$m.a.e./\overline{VR}$ (5)
Australia		2.83	11.08	0.61	0.36	0.21
	s.e.	(0.45)	(0.86)			
Canada		3.79	11.33	0.86	0.48	0.18
	s.e.	(0.28)	(0.78)			
China		3.72	39.01	0.30	0.15	0.23
	s.e.	(0.90)	(3.24)			
France		6.76	6.98	0.74	0.21	0.20
	s.e.	(0.89)	(0.73)			
Germany		6.28	8.30	0.76	0.25	0.23
	s.e.	(1.31)	(1.34)			
Hong Kong		-	-	-	-	-
	s.e.	-	-			
India		4.75	19.15	0.78	0.13	0.25
	s.e.	(0.52)	(1.26)			
Indonesia		5.72	13.08	0.85	0.50	0.17
	s.e.	(0.72)	(1.59)			
Israel		2.97	9.22	0.39	0.10	0.21
	s.e.	(0.43)	(0.71)			
Japan		0.87	2.41	0.20	0.10	0.16
	s.e.	(0.49)	(0.41)			
Malaysia		2.82	11.78	0.73	0.23	0.16
	s.e.	(0.65)	(1.22)			
Poland		3.37	4.42	0.78	0.48	0.16
	s.e.	(0.51)	(0.37)			
Singapore		2.05	6.45	0.56	0.32	0.17
	s.e.	(0.31)	(0.48)			
South Korea		1.80	3.71	0.56	0.41	0.10
	s.e.	(0.33)	(0.54)			
Taiwan		4.99	14.10	0.85	0.33	0.13
	s.e.	(0.38)	(0.80)			
Thailand		4.44	10.37	0.78	0.33	0.20
	s.e.	(0.67)	(1.38)			
UK		6.34	8.46	0.83	0.53	0.18
	s.e.	(0.68)	(0.80)			
USA		8.67	15.73	0.89	0.69	0.15
	s.e.	(0.78)	(0.82)			
Summary of Point Estimation, Model Fitness						
	Average	4.25	11.50	0.67	0.33	0.18
	S.E.	1.98	8.07	0.20	0.16	0.04

Table 35: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification, as in Table 6. For firms with different incorporation location from its headquarter location, they are excluded from the sample. The estimation uses 20 portfolios sorted based on proxies of the lagged inputs in valuation equation (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS - R^2$ is the cross-sectional R^2, $TS - R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. The results are reported for the sample of all firms. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P (1)	θ_I (2)	XS-R^2 (3)	TS-R^2 (4)	$m.a.e./\overline{VR}$ (5)
Southern Asia		4.31	18.22	0.94	0.75	0.12
	s.e.	(0.54)	(1.10)			
South-eastern Asia		3.99	12.36	0.66	0.33	0.18
	s.e.	(0.91)	(1.73)			
Western Asia		7.50	16.72	0.14	0.19	0.19
	s.e.	(1.09)	(2.15)			
Eastern Europe		0.94	4.27	0.51	0.18	0.17
	s.e.	(0.36)	(0.42)			
Northern Europe		4.66	11.13	0.80	0.47	0.21
	s.e.	(0.65)	(0.74)			
Southern Europe		5.42	9.49	0.81	0.59	0.19
	s.e.	(0.76)	(0.99)			
Western Europe		6.93	9.73	0.67	0.29	0.23
	s.e.	(1.07)	(1.30)			
Africa		9.30	11.56	0.71	0.49	0.16
	s.e.	(1.19)	(1.01)			
L.Amer. & Carib.		2.63	8.11	0.84	0.62	0.13
	s.e.	(0.43)	(1.05)			
Summary of Point Estimation, Model Fitness						
	Average	5.08	11.29	0.68	0.43	0.18
	S.E.	2.41	4.00	0.22	0.19	0.03

Table 36: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification as in Table 5. The estimation procedure didn't include the rolling-window aggregation. The estimation uses 20 portfolios sorted based on proxies of the lagged inputs in valuation equation (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS-R^2$ is the cross-sectional R^2, $TS-R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P	θ_K	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)
Australia		2.54	11.20	0.58	0.31	0.24
	s.e.	(0.37)	(0.80)			
Canada		3.37	12.07	0.90	0.42	0.21
	s.e.	(0.26)	(0.78)			
China		4.29	31.87	0.19	-0.03	0.31
	s.e.	(0.91)	(3.29)			
France		4.94	8.08	0.63	0.12	0.23
	s.e.	(0.75)	(0.69)			
Germany		4.64	10.02	0.73	0.18	0.26
	s.e.	(1.23)	(1.27)			
Hong Kong		2.31	7.11	0.72	0.28	0.26
	s.e.	(0.37)	(0.69)			
India		4.41	19.43	0.73	0.19	0.28
	s.e.	(0.46)	(1.28)			
Indonesia		4.58	14.26	0.82	0.41	0.22
	s.e.	(0.59)	(1.44)			
Israel		2.35	9.45	0.46	0.08	0.26
	s.e.	(0.32)	(0.69)			
Japan		0.42	2.63	0.20	0.07	0.18
	s.e.	(0.42)	(0.39)			
Malaysia		2.35	12.30	0.70	0.20	0.19
	s.e.	(0.55)	(1.08)			
Poland		3.44	4.54	0.77	0.23	0.28
	s.e.	(0.66)	(0.50)			
Singapore		1.21	7.61	0.62	0.23	0.25
	s.e.	(0.37)	(0.55)			
South Korea		1.13	4.24	0.56	0.28	0.13
	s.e.	(0.25)	(0.45)			
Taiwan		3.67	15.70	0.77	0.13	0.18
	s.e.	(0.41)	(0.92)			
Thailand		3.33	11.60	0.74	0.24	0.23
	s.e.	(0.57)	(1.26)			
UK		5.42	9.14	0.83	0.47	0.19
	s.e.	(0.55)	(0.73)			
USA		7.08	16.84	0.87	0.59	0.17
	s.e.	(0.68)	(0.89)			
Summary of Point Estimation, Model Fitness						
	Average	3.42	11.56	0.66	0.24	0.23
	S.E.	1.63	6.54	0.20	0.15	0.05

Table 36: Parameter Estimates and Model Fit

This table reports the parameter estimates and measures of fit for the baseline model specification, as in Table 6. The estimation procedure didn't include the rolling-window aggregation. The estimation uses 20 portfolios sorted based on proxies of the lagged inputs in valuation equation (10 portfolios for each input). θ_P and θ_I are, respectively, the physical capital and intangible capital adjustment cost parameters. s.e. stands for Newey-West standard errors with three lags. $XS - R^2$ is the cross-sectional R^2, $TS - R^2$ is the time-series R^2, and $m.a.e./\overline{VR}$ is the mean absolute valuation error scaled by the absolute value of the ratio. The results are reported for the sample of all firms. We calculate model fit for the 2006-2020 sample for which most of the countries have data.

		Point Estimate		Model Fit		
		θ_P	θ_I	XS-R^2	TS-R^2	$m.a.e./\overline{VR}$
		(1)	(2)	(3)	(4)	(5)
Southern Asia		3.10	19.43	0.94	0.62	0.17
	s.e.	(0.47)	(0.99)			
South-eastern Asia		2.72	13.68	0.43	0.13	0.25
	s.e.	(0.80)	(1.53)			
Western Asia		5.19	20.05	0.12	0.09	0.23
	s.e.	(0.98)	(2.11)			
Eastern Europe		0.66	4.80	0.48	0.10	0.22
	s.e.	(0.30)	(0.48)			
Northern Europe		3.28	12.57	0.81	0.37	0.24
	s.e.	(0.50)	(0.74)			
Southern Europe		2.68	11.64	0.71	0.40	0.25
	s.e.	(0.53)	(0.90)			
Western Europe		4.62	11.40	0.58	0.19	0.27
	s.e.	(0.78)	(1.12)			
Africa		8.36	11.86	0.65	0.42	0.20
	s.e.	(0.98)	(0.89)			
L.Amer. & Carib.		2.17	8.51	0.84	0.50	0.17
	s.e.	(0.35)	(0.91)			
Summary of Point Estimation, Model Fitness						
	Average	3.64	12.66	0.62	0.31	0.22
	S.E.	2.08	4.52	0.24	0.18	0.03

Table 37: Data Construction Statistics for Countries

This table reports statistics of constructing the sample for the benchmark estimation. **Pre-obs** and **Pre-firm** report the number of observations, the number of firms in the initial sample of data constructed with Compustat Global and Compustat North-America. **Sample-obs** and **Sample-firm** report the number of observations, the number of firms in the formal sample of data, after the quality requirement documented in the appendix of data construction. **Sale, Asset, Physical** and **Intangible** report the coverage of nominal dollar amount of sale, Compustat Item-AT, physical capital stock, intangible capital stock, during the 2nd stage of sample preparation, where extrene firm-year observations are excluded from the sample. All ratios are in percentage (%).

	Sample Size				2nd-stage Coverage (%)			
	Pre-obs (1)	Pre-firm (2)	Sample-obs (3)	Sample-firm (4)	Sale (5)	Asset (6)	Physical (7)	Intangible (8)
Australia	33676	2690	6150	1143	94.88	77.57	88.00	98.29
Canada	39981	3621	10187	1382	96.56	90.30	96.53	94.06
China	64919	5668	27696	3162	79.89	64.41	93.94	83.71
France	16354	1217	4657	539	94.73	86.75	94.37	96.91
Germany	16047	1112	5050	572	92.95	88.69	91.11	93.75
Hong Kong	20977	1474	9966	1106	96.53	89.21	97.10	97.45
India	66824	3879	21309	2316	88.99	89.23	87.79	93.48
Indonesia	8121	652	4990	478	90.42	90.33	86.62	93.36
Israel	7774	616	2750	363	95.16	89.66	92.62	95.73
Japan	82035	4489	41668	2531	86.37	64.48	82.13	85.72
Malaysia	18959	1176	9190	930	94.48	88.96	94.96	95.94
Poland	9773	829	3586	444	88.97	81.87	86.75	94.00
Singapore	11966	811	5407	625	93.55	88.55	86.95	96.39
South Korea	21149	2185	9057	1114	94.43	62.03	96.40	94.49
Taiwan	31682	2297	19640	1897	95.18	90.17	96.17	95.11
Thailand	10533	713	7030	603	96.56	90.17	95.90	96.90
U.K.	40655	3313	15139	1855	94.47	87.11	94.91	95.81
U.S.A.	166234	15860	82283	8982	97.05	90.33	93.72	97.04

Table 38: Data Construction Statistics for Regions

	Sample Size				2nd-stage Coverage (%)			
	Pre-obs	Pre-firm	Sample-obs	Sample-firm	Sale	Asset	Physical	Intangible
Cote Divoire	291	22	137	19	97.40	79.65	91.77	99.60
Ghana	203	15	88	13	100.00	69.29	100.00	100.00
Kenya	584	37	257	31	100.00	84.82	100.00	100.00
Morocco	1060	60	526	51	99.12	84.16	99.65	98.60
Mauritius	391	38	72	19	81.99	40.00	68.64	92.87
Nigeria	1692	113	771	96	93.96	83.35	97.69	93.85
Tunisia	676	49	367	42	81.14	84.37	80.97	77.35
South Africa	5837	406	1958	253	73.96	75.51	82.83	65.68
Zambia	243	14	56	12	95.93	46.28	94.63	68.18
Argentina	1244	78	613	59	96.75	76.63	97.28	94.10
Brazil	6146	432	2597	285	90.23	74.03	94.49	90.94
Cayman Islands	858	123	269	72	92.19	77.30	84.84	85.73
Chile	2832	152	1601	133	90.78	89.34	90.60	89.19
Colombia	658	45	332	32	100.00	89.25	100.00	100.00
Jamaica	514	50	205	30	99.74	80.08	99.75	99.43
Mexico	2581	166	1362	114	97.50	83.66	98.25	98.15
Peru	1599	90	889	79	96.74	88.81	97.93	98.08
Bangladesh	2149	218	781	129	96.88	90.08	96.23	91.91
Sri Lanka	3039	201	1580	152	78.81	88.12	93.80	84.84
Pakistan	6044	348	2834	262	91.47	90.17	85.26	83.49
Philippines	3133	182	1157	131	99.43	85.77	99.01	98.96
Viet Nam	5326	494	2273	343	85.83	90.16	86.84	84.05
U.A.E.	892	73	481	54	85.15	85.28	92.98	69.75
Bahrain	296	18	154	16	100.00	83.70	100.00	100.00
Cyprus	1078	81	527	59	81.26	84.86	88.62	62.27
Jordan	2035	120	798	89	98.27	91.41	97.91	96.74
Kuwait	1448	97	670	82	98.26	83.75	96.95	98.43
Oman	1086	69	572	51	98.63	87.73	99.30	99.02
Palestine	202	16	95	15	100.00	92.23	100.00	100.00
Qatar	280	21	175	16	100.00	81.02	100.00	100.00
Saudi Arabia	1963	161	1252	120	97.68	89.94	96.41	97.06
Turkey	4751	352	2999	278	94.20	89.79	95.83	92.86

D Data Appendix

D.1 Construction of Data

D.1.1 Summary of Data

1. Firm Fundamental
   - Data Source: Compustat Global, Compustat North America
   - Main data fields: Capital Stock, Capital Expenditure, Depreciation
   - Granularity: Firm
2. Stock Price
   - Data Source: Compustat Global-Security Daily, Compustat-CRSP linked
   - Main data fields: Capital Stock, Capital Expenditure, Depreciation
   - Granularity: Firm
3. Deflator
   - Data Source: CPI in OECD statistic
   - Main data fields: Capital Price
   - Granularity: Country
4. Tax Rate of Corporate Income
   - Data Source: Tax Foundation, Compustat Global -Economic Indicators
   - Main data fields: Corporate Tax
   - Granularity: Country

D.1.2 Main Measure

Variable	Measure	Alternative Measure
Price, Physical Capital	OECD CPI	UN stat
Price, SGA Capital	OECD CPI	UN stat
Quantity, Physical Capital	Compustat, PPENT	-
Quantity, SGA Capital	Compustat, XSGA	-
Value of Equity	Compustat-Security Daily	Datastream
Value of Debt	Compustat, Book Debt	
Home Country	Headquarter	Incorporation

D.1.3 Harmonization

- Currency specification

Home Country	Currency
All	USD

- Currency definition in each data source

Dataset	Currency
Compustat-Fundamental	Currency Reported
Compustat-Security Daily	Currency Reported

- Currency Crosswalk

Dataset	From	To
Compustat Global-Exchange Rate	Currency Reported	USD

- Region Crosswalk

Dataset	From	To
UNSD-M49 standard	ISO code	Sub-region code

D.2 Detailed Construction of Variable

D.2.1 Firm-level Data

We use Compustat Global from Capital IQ to collect the accounting information of listed firms incorporated in United Kindom and Continental European countries. We use the information in the annual financial report.

Definition of Country: We use the location of incorporation as the country of a firm. For robustness check, we also consider defining the location of firm as the location of headquarter.

Sample Quality Control: we remove firms in financial service industry (SIC:6000-6999), utility industry (SIC: 4900-4999), and public service industry (SIC: 9000-9999). For firms with both international version of financial report (DATFMT as HIST) and domestic version of financial report (DATFMT as Standard) in the same fiscal year, we use the international-version of financial report. For firms with restatement of financial reports, we use the most recent version of financial report.

Industry Code: The primary industry code is NAICS 6-digit code. For firm-year observations without the historical industry information `NAICSH`, we impute it with the nearby industry information, if none of these information is available, we use the current industry information `NAICS`. We also consider the production input market linked by SIC 4-digit code. Similarly, we use the historical industry information imputed with the nearby industry information.

Corporate Event: We check the firm-year observations with major acquisition event, using the footnote variables `SALE_FN`. For firms with major merge and acquisition event, the `SALE_FN` is flagged as AC. Based on this criteria, this situation is rare for the European countries, hence, we didn't implement this filter.

D.2.2 Currency Conversion

We do the currency conversion for all nominal variables, in order to be consistent with the currency of production input price index. We use the sub-dataset Exchange Rate provided by Compustat Global to convert the currency of financial reports intonominal USD amount.

We use the 12-month (backward) moving-average exchange rate to convert the currency. For example, if a firm reports its income statement on Dec-31st-2010, we use the average month-end exchange rate during Jan-2010 and Dec-2010.

We use the sub-dataset Security Daily provided by Compustat Global to calculate the market value of outstanding common stock issued by the firms. Each firm in Compustat Global has the unique identifier `GVKEY`, a unique identifier `PRIROW` for the primary issued common stock. Each common stock in Security Daily has a unique identifier `IIN` and a unique firm identifier `GVKEY`. We require the security `IIN` matched with the firm `PRIROW`, and the identical firm identifier `GVKEY`.

We calculate the market value as the market-close price multiplied by the outstanding shares $\mathrm{V} = \mathrm{PRCCF} \cdot \mathrm{CSHOC}$.

We use the month-end market value in the month of financial report date. We convert the market value into the nominal USD amount, in the similar method with the firm fundamental variables.

D.3 Classification of Region

The United Nations Statistics Division (UNSD) classify 17 Sub-regions: Northern Africa, Northern America, Eastern Asia, Southern Asia, South-eastern Asia, Southern Europe, Australia and New Zealand, Melanesia, Micronesia, Polynesia, Central Asia, Western Asia, Eastern Europe, Northern Europe, Western Europe, Sub-Saharan Africa, Latin America and the Caribbean. We decide pooling the observations into the region following the procedure below:

- We impose the basic quality requirement for the firm-level observations, summarize the sample by each country.
- When the number of firm-level observation inside the country surpass 9 observations, we start to include the country in our sample.
- If the average number of firm-level observations surpass 200 observations, we label the country as an independent large economy. For the remaining observations, we use the Sub-region code of UNSD to pool the observations. Considering the economic inequality, we consider the country Israel separately, despite the average number of observations is less than 200.
- Due to the extreme years of hyper-inflation, the sample of Egypt and the sample Zimbabwe are discontinued after the preliminary sample quality requirement. For construction of stationary sample, we remove these two contries. Further, we pool the two Sub-regions, Northern Africa and Sub-Saharan Africa together as Africa, to obtain the sufficient size of sample.

After implementing above procedure, we end up with 18 large countries and 9 regions.

The 18 large economies are Australia, Canada, China, Germany, France, UK, Hong Kong, India, Indonesia, Israel, Japan, South Korea, Malaysia, Poland, Singapore, Thailand, Taiwan, USA.

For the 4 regions as Melanesia, Micronesia, Polynesia, Central Asia, we don't have valid observations of listed firms locating in these regions. For the 3 regions as Northern America, Eastern Asia, Australia and New Zealand, we don't have valid observations of listed firms locating in these regions after the large economies such as Canada, China, Japan, India, Australia are selected out.

After these steps, we arrive to the 9 regions: Southern Asia, South-eastern Asia, Western Asia, Eastern Europe, Northern Europe, Southern Europe,Western Europe, Africa, Latin America and the Caribbean.

D.4 Sample Requirement

The sample requirement refer (Belo et al, 2022). Specifically, we intensify the quality requirement for firm-level observations, to address the firm-level noise in economies with small scope of sample. We decide the firm-year observations qualified for the sample following the criteria and procedure below: In the 1st stage, we require non-missing firm variables and minimal nominal amount of capital stock.

- We require non-missing and positive sale $Y_{i,t}$, previous-period sale $Y_{i,t-1}$, 2-period lagged sale $Y_{i,t-2}$, similarly for physical capital $K^P_{i,t}$ and intangible capital $K^I_{i,t}$.
- We require non-missing firm valuation $Q_{i,t}$ (equity valuation plus net debt value), investment rate in physical capital $i^P_{i,t}$, investment rate in intangible capital $i^I_{i,t}$, corporate income tax rate $\tau_{i,t}$.
- We require the physical capital greater than 1 million USD dollars, the intangible capital greater than 1 million USD dollars, to avoid the extreme firm-year observations among tiny firms.

In the 2nd stage, we exclude extreme firm-year observations based on the distribution of firm variables within each country.

- We require the change of firm sale $\frac{Y_{i,t}-Y_{i,t-1}}{Y_{i,t-1}}$ within the percentile $(2\%, 98\%)$ with respect to its country-year panel, to avoid the extreme firm-year observations.
- We require the firm size (physical capital and intangible) within the percentile $(2\%, 100\%)$ with respect to its country-year panel, to avoid the high idiosyncraticn noise among tiny firms. In particular, the firm size is required to be within the $(30\%, 100\%)$ with respect to its country-year panel among China, Japan and South Korea. We checked the coverage of aggregate sale, physical capital and intangible capital, removal of tiny-small firms generates negligible impact.
- We require the ratio of firm valuation $\frac{Q_{i,t}}{K^P_{i,t}+K^I_{i,t}}$ within the percentile $(2\%, 98\%)$ with respect to its country-year panel, to avoid the extreme observations of firm valuation in the left-tail and right-tail of Q-distribution. In particular, this requirement is $(10\%, 98\%)$ with respect to its country-year panel among Israel and Turkey.
- In Compustat, certain firms keep reporting zero XSGA-expense. To avoid these abnormal firm-year observation, we require firm-year observations with non-zero intangible investment rate in the current year and previous year.

Aside from above general requirement of sample quality. We adopt country-specific requirement for countries with small size of sample, in Latin America, Africa, Western Europe and Eastern Europe.