Intangible Assets and the Permanence of Unexpected Earnings

by

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Abstract

I study whether the greater scalability of intangible assets results in a positive relation between firms' use of intangible assets and shareholders' perception of the permanence of earnings innovations (the earnings response coefficient or ERC). After documenting that ERCs increase with the use of intangible assets, I examine cross-sectional variation in the relationship. All else constant, the positive link between the use of intangibles and perceived earnings permanence attenuates when firms' ownership of the intangible assets is less certain. This attenuation is manifest when the firm is at risk of losing intangible capital embodied in its most valuable employees, particularly when faced with weak enforcement of non-compete agreements, or when the firm is at risk of losing control of codified intellectual capital, especially in jurisdictions known for subverting intellectual property rights. Takeover defenses reinforce the positive link between the use of intangible assets and perceived earnings permanence. This effect is consistent with the view that takeover defenses lower the cost of investments in firm-specific human capital.

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Chapter 1: Introduction

The properties of assets used by firms have changed as the economy transitioned from an industrial to knowledge-based footing. The notion that assets primarily exhibit physical or financial characteristics lost ground as businesses developed information-based assets. This shift in the asset base of firms is remarkable because the economic characteristics of intangible assets differ from that of physical assets in two important ways. First, intangible assets are more scalable compared to physical assets because most intangibles are reusable at relatively lower marginal costs.[1] Second, the difficulties of securing ownership of the knowledge underlying intangible assets impair their usefulness in some settings, whereas the ownership of physical assets is less contested. These special characteristics of intangible assets have important and contrasting implications for the perceived permanence of earnings innovations.

In this work, I focus on intangible assets created internally by the research and development (R&D) and selling, general, and administrative (SG&A) activities of the firm. Prior studies document that expenditures related to these activities are sources of long-term economic benefits (e.g., Lev and Sougiannis 1996; Banker, Huang, and Natarajan 2011; Enache and Srivastava 2018; Banker, Huang, Natarajan, and Zhao 2019). I study the impact of these internally generated intangible assets on shareholders' perception of the permanence of earnings innovations considering the fundamental economic characteristics of intangibles.

[1] I discuss the concept of scalability in more detail in the next section.

The greater scalability or reusability of intangible assets suggests that shareholders' perception of the permanence of earnings innovations increases with the use of intangible assets. I assess the permanence of new earnings information using the earnings response coefficient (ERC). The ERC is a measure of the extent to which shareholders incorporate new earnings information into stock price. It is estimated as the slope coefficient from a linear regression of the abnormal stock returns on a measure of contemporaneous unexpected earnings. To the extent that intangible assets are scalable, I expect the stock price response to new earnings information to be an increasing function of the use of intangible assets. The empirical tests of my study affirm that the stock of existing intangible capital, new investments in intangibles, and the scaling of existing intangible capital over newly purchased assets, all have a positive effect on shareholders' perception of the permanence of earnings innovations.[2] These results also support the view that investors comprehend the implications of the scalability of intangible assets for the permanence of new earnings information.

Considering the appropriability of intangible assets, I also hypothesize that shareholders' perception of the scalability of intangible assets will vary in cross-section with the ability of the firm to safeguard the knowledge underlying intangibles. This is because the firm may lose competitive advantages derived from intangible assets with the mobility or mortality of highly skilled workers, or because of misappropriation or unauthorized use of proprietary information and technologies by rival firms. Therefore, I investigate whether the risk of losing control of the

[2] I explain these measures of intangible intensity in more detail in the third section.

knowledge underlying intangibles attenuates or eliminates the positive effect of the scalability of intangible assets on the permanence of earnings innovations.

The hypotheses of my study draw on the literature in organization theory that classifies knowledge underlying intangibles as either tacit or explicit (e.g., Polanyi 1966; Winter 1998). Tacit knowledge is hard to capture because it is embodied in the key personnel of the firm. When key talent walks out the door, so does a large proportion of tacit knowledge of the firm. The firm in effect "rents" tacit knowledge of the key personnel, and therefore, the key personnel may also have opportunities to claim a larger share of economic benefits derived from their unique and non-transferable skills. The firm is at risk of not possessing vital tacit knowledge when it cannot attract, recruit, retain, train, and motivate qualified personnel. In contrast, explicit knowledge is embedded in the systems and processes of the firm. However, the firm is still at risk of losing control over explicit knowledge when it cannot effectively secure ownership of its codified intellectual capital or proprietary information and technologies. I expect the risk of losing tacit knowledge embodied in key personnel and explicit knowledge imprinted in codified intellectual capital, to weaken the positive effect of the scalability of intangible assets on the permanence of earnings innovations. I use the disclosure of the risk of loss of key talent in the annual 10-K filings of the firm as an indicator of the risk of loss of tacit knowledge and the disclosure of the risk of inadequate intellectual property rights in foreign jurisdictions as an indicator of the risk of loss of explicit knowledge.[3]

[3] I explain the procedure followed to develop these indicators for loss of knowledge in more detail in the fourth section and in Appendix C.

The results of my study show that the risk of loss of tacit knowledge embodied in key personnel attenuates the positive effect of the scalability of intangible assets on the permanence of earnings innovations. Further, I expect the attenuating effect of the risk of loss of tacit knowledge to be more pronounced in some settings than others. First, firms in the early stages of their life cycle are more likely to have tacit knowledge concentrated in a few key individuals than firms in the later stages of life cycle.[4] The concentration of tacit knowledge is due to the slow and unpredictable diffusion of tacit knowledge in the early stages of firm life cycle. Therefore, I hypothesize and find that the attenuating effect of the risk of loss of tacit knowledge is more pronounced for firms in the introduction or growth stages of their life cycle than in later stages. Second, the embodiment of tacit knowledge in key employees means that weak enforcement of non-compete agreements makes it difficult for the firm to retain key employees, which exacerbates the risk of losing tacit knowledge. Consistent with the relation hypothesized above, my results show that the attenuating effect owing to concerns about losing key talent is more pronounced for firms headquartered in jurisdictions with weak enforcement of non-compete agreements.

The tests also show that the risk of loss of explicit knowledge or codified intellectual capital attenuates the positive effect of the scalability of intangible assets on the permanence of earnings innovations. Here also, I expect the attenuating effect of the risk of loss of explicit knowledge to be more apparent in some situations than others. First, explicit knowledge makes up a larger

[4] In the introduction stage of firm life cycle, firms enter the market with new innovations and make large investments to deter entry; in the growth stage, firms maximize profit margins and increase investments to deter entry; in the mature stage, firms maximize efficiency using knowledge about their markets and operations, while some investments become obsolete; in the shake-out stage, established processes or routines hamper the competitive flexibility of firms; and in the decline stage, slowing growth rates lead to declining prices. See Dickinson (2011) for a more complete discussion.

proportion of the knowledge underlying intangible assets as the firm matures. This is because tacit knowledge spreads more widely as the firm matures and the firm codifies a larger proportion of its knowledge. Therefore, I hypothesize and find that the attenuating effect of the risk of loss of explicit knowledge is more pronounced for firms in the mature or shake-out stages of their life cycle than in other stages. Second, the likelihood of misappropriation of explicit knowledge is greater when the firm has business interests in countries known for subverting intellectual property rights. I predict and find that the attenuating effect of the risk of loss of explicit knowledge is more pronounced for firms with significant business interests in countries placed on watch lists by the office of the United States Trade Representative (USTR).

I also investigate whether takeover defenses affect the positive effect of the scalability of intangible assets on the permanence of new earnings information. The increased use of takeover defenses such as dual class share structures, unequal voting rights, and supermajority voting provisions among technology companies has drawn attention from the business press, shareholder advisory services, activist investors, policymakers, and academics.[5] The proponents of antitakeover provisions argue that such provisions promote long-term stewardship and encourage firm-specific investments in human capital, despite widespread criticism that such provisions entrench controlling shareholders or managers. So long as takeover defenses promote long-term stewardship without entrenching controlling shareholders, I expect the positive effect of the scalability of intangible assets to be more pronounced. The tests reveal that the adoption of

[5] For example, technology companies such as Alphabet, Facebook, Pinterest, Slack, Snap, Lyft, and Zoom disregard the one share, one vote principle, while Tesla follows supermajority voting rules.

takeover defenses reinforce the positive effect of the scalability of intangible assets on the permanence of earnings innovations.

This work contributes to the literature in the following ways. First, it adds to the ERC literature by documenting the significant implications of the nature and composition of inputs to firms' production functions for the earnings/return relation. This contribution is remarkable in view of the broader shift of the economy, from investments in physical assets to intangible investments providing information and services. The results are also robust to including control variables conventionally used in the ERC literature. Second, this study extends and complements the literature highlighting the asset-like properties of resources created by R&D and SG&A expenditures (e.g., Lev and Sougiannis 1996; Banker et al. 2011; Enache and Srivastava 2018; Banker et al. 2019), providing evidence corroborating the positive effect of the scalability of internally generated intangibles on the perceived permanence of earnings innovations. In addition, I also identify settings where the perceived appropriability of intangible assets attenuates the positive effect of the scalability of internally generated intangibles. Third, this work provides evidence consistent with the argument that takeover defenses lower the cost of inducing firm-specific investments in knowledge on the part of employees and also help firms to focus more on long-term performance goals.

The remainder of this work is structured as follows. Section II discusses the increasing significance of intangible assets, problems with their measurement, and their salient economic features. Section III describes the hypotheses concerning the impact of the scalability and appropriability of intangible assets and takeover defenses on the earnings/return relation. Section

IV describes the sample, construction of variables, and model specification, and section V presents the empirical tests. Section VI concludes the paper.

Chapter 2: Background

Intangible assets play an increasingly important role in the economy. In the United States, tangible investments as a share of the private sector GDP peaked in the late 1970s. The growth of intangible investments as a share of the private sector output sped up in the same period (Nakamura 2001; Corrado, Hulten, and Sichel 2009). By the mid-to-late 1990s, the share of investments in intangibles surpassed the share of tangible investments (Corrado and Hulten 2010). In 2014, investments in intangibles contributed to 14.3% of the private sector output compared to 9.5% from tangible investments (Wall Street Journal 2016). Lev and Gu (2016) report that the rate of investments in intangibles increased by 60% over the period from 1977 to 2014, while the rate of tangible investments decreased by 35% in the same period. A study by Ocean Tomo (2019), an intellectual property merchant bank, reports that intangible assets accounted for 84% of the market value of S&P 500 firms in 2015, up from 68% in 1995 and 17% in 1975. The Economist (2020) reports that 32% of the S&P 500 firms invest more in intangible assets than tangibles and assets related to research and development, network effects, brands, and data account for 61% of the market value of these firms.

The rapid surge in intangible investments since the late 1970s also marked a decline in direct production costs or costs of goods sold (COGS), as expenses shifted more towards R&D and SG&A activities (Nakamura 2001). Although sectors such as technology, health, and drugs were the first to focus on intangibles (Peters and Taylor 2017), tangible intensive sectors such as

agriculture, manufacturing, mining, and utilities also shifted their asset base towards intangibles in due course (Atkeson and Kehoe 2005; Corrado, Haskel, Jona-Lasinio, and Iommi 2012).

Despite the growing significance of intangible assets, the measurement of the stock of intangibles is still less straightforward compared to physical assets. This is mainly because accounting conventions surrounding most internal investments in intangibles require their immediate expensing owing to concerns about the reliability and objectivity of capitalizing intangible investments (Lev and Sougiannis 1996; Lev and Zarowin 1999). Current research circumvents this problem by applying perpetual-inventory methods to expenditure streams linked to intangibles to estimate their stock (e.g., Lev and Radhakrishnan 2005; Corrado, Hulten, and Sichel 2009; Corrado and Hulten 2010, 2014; Eisfeldt and Papanikolaou 2013; Peters and Taylor 2017). In this study, I follow Peters and Taylor (2017) to estimate the stock of intangible capital as the total of knowledge capital and organization capital. Peters and Taylor (2017) consider R&D spending as an investment in knowledge capital, and the fraction of SG&A spending allocated to develop human capital, brands, reputation, customer relationships, supplier networks, distribution alliances, software, unique organizational designs, and business processes as investments in organization capital.[6] I measure the intangible intensity of the firm as the ratio of intangible capital to total assets.[7]

[6] I explain the procedure followed to measure intangible capital in the fourth section.

[7] I define the measure of intangible intensity more precisely in the third section.

More important for the hypotheses of my study is the idea that the economic properties of intangible assets differ from that of physical assets in at least two dimensions: intangibles are more scalable and more appropriable compared to physical assets. (Lev 2001; Haskel and Westlake 2018). I discuss the scalability of intangible assets first. While firms deploy physical assets in one place, at a time, they can scale and deploy most intangible assets over multitudes of operations, across geographical locations, at the same time. Hence the marginal costs of production after initial investment are less significant or sometimes even close to zero for many intangible assets. For this reason, intangible assets are also known as "non rival" goods as consumption by an individual or organization does not exhaust the amount available for others (Arrow 1972). Further, network effects enhance the scalability of intangible assets. Network effects mean that the value of a good for a consumer increases with the increase in the number of consumers using it. Firms owning such networks have significant competitive advantages. Intangible assets are also sources of synergies or complementarities when deployed in the right combinations. For example, investments in technology and organizational development complement each other (Brynjolfsson, Hitt, and Yang 2002). Bloom, Sadun, and Van Reenen (2012) find that European firms could not match the productivity gains of their American counterparts from technology investments because of less developed organizational and management practices.

While the scalability of intangible assets enhances the usefulness of intangibles, the appropriability of intangible assets diminishes their usefulness in some settings. Firms use patents, copyrights, trade secrets, non-disclosure agreements, and non-compete clauses to secure the ownership of intellectual property. The laws of some foreign countries, however, including that of many emerging markets, do not protect intellectual property rights to the same extent as the laws

of the United States. The unauthorized use of intellectual property in jurisdictions that do not provide adequate protection or enforcement of intellectual property rights could reduce or eliminate firms' competitive advantages, increase overheads to thwart infringement, or reduce their market share. The Commission on the Theft of American Intellectual Property (2017) estimates that the annual cost of intellectual property theft to the U.S. economy is worth up to $600 billion a year.[8] Because of the contested nature of ownership, intangible assets are also known as "non excludable" goods because ownership by an individual or organization does not prohibit appropriation by others (Arrow 1972).

The ability of the firm to secure ownership of intangible assets also depends on the characteristics of the knowledge underlying intangibles. Firms draw knowledge from the cognitive processes of individuals, and the knowledge is further enhanced and preserved by organizational processes (Nonaka 1994). The literature in organizational theory classifies this knowledge as having either tacit or explicit characteristics (e.g., Polanyi 1966; Winter 1998). Individuals develop tacit knowledge by observation, imitation, experimentation, reflection, and internship or apprenticeship (Nelson and Winter 1982). Tacit knowledge is embodied in the key personnel of the firm, and therefore, this knowledge is not transferable on demand (Polanyi 1966; Nonaka and Takeuchi 1995). In contrast, explicit or codified knowledge is more formal and organized, and this knowledge is easily transferable. The standard procedures, manuals, blueprints, specifications,

[8] https://ustr.gov/sites/default/files/301/2017%20Special%20301%20Report%20FINAL.PDF

systems, processes, computer programs, databases, and checklists of the organization are repositories of explicit knowledge.

According to knowledge creation theory, progression and propagation of tacit knowledge is vital to the organizational knowledge creation process (Nonaka 1994). However, the diffusion of tacit knowledge is often slow and unpredictable, whereas the retention and replication of explicit knowledge is inexpensive and fast (Kogut and Zander 1992). Recent developments in artificial intelligence exemplify some difficulties of codifying tacit knowledge. Although supercomputers have made tremendous advances with board games involving explicit rules and strategies, technologies such as self-driving cars are yet to master "edge cases" that require more tacit judgment and decision making. The specialized and non-transferable nature of tacit knowledge means that the availability or continued services of key talent is crucial for transforming tacit knowledge into explicit knowledge, replicating explicit knowledge on a larger scale, and creating new knowledge.

Chapter 3: Hypothesis Development

3.1 The Effect of Scalability of Intangible Assets on the ERC

The stock price response to new or unexpected earnings information of firms deploying intangible assets increases to the extent that shareholders view intangible assets as sources of economies of scale, network effects, and synergies. Testing my hypotheses requires a measure of intangible intensity. The contemporaneous ratio of intangible capital to total assets is a straightforward and intuitive measure of intangible intensity. However, while this measure increases as the firm invests more in intangible capital, it decreases as the firm purchases more

physical assets and scales or applies its existing stock of intangible capital over a larger asset base. To see this, consider the following decomposition of the contemporaneous ratio of intangible capital (IC) to physical assets (AT).

$$
\begin{aligned}
\frac{IC_t}{AT_t} &= \frac{IC_{t-2}}{AT_{t-2}} + \left(\frac{IC_t}{AT_t} - \frac{IC_{t-2}}{AT_{t-2}} \right) \\
&= \frac{IC_{t-2}}{AT_{t-2}} + \left(\frac{IC_t AT_{t-2} - IC_{t-2} AT_t}{AT_t AT_{t-2}} \right) \\
&= \frac{IC_{t-2}}{AT_{t-2}} + \left(\frac{IC_t AT_{t-2} - IC_{t-2}\left(AT_{t-2} + \Delta AT_t^{t-2} \right)}{AT_t AT_{t-2}} \right) \\
&= \frac{IC_{t-2}}{AT_{t-2}} + \left(\frac{AT_{t-2}\left(IC_t - IC_{t-2} \right) - IC_{t-2}\left(\Delta AT_t^{t-2} \right)}{AT_t AT_{t-2}} \right) \\
&= \frac{IC_{t-2}}{AT_{t-2}} + \left(\frac{AT_{t-2}\left(\Delta IC_t^{t-2} \right)}{AT_t AT_{t-2}} - \frac{IC_{t-2}\left(\Delta AT_t^{t-2} \right)}{AT_t AT_{t-2}} \right) \\
&= ICI + DICI1 + DICI2 \\
ICI &= \frac{IC_{t-2}}{AT_{t-2}}; \qquad DICI1 = \frac{\Delta IC_t^{t-2}}{AT_t}; \qquad DICI2 = \frac{\%\Delta AT_t^{t-2} IC_{t-2}}{AT_t}
\end{aligned}
\tag{1}
$$

The first term, ICI, is a measure of the firm's relative stock of intangible capital in a base period (i.e., t-2). When ICI increases, the contemporaneous ratio of intangible capital to physical assets or intangible intensity also increases. The second term, DICI1, is a measure of new investments in intangibles. Similarly, as DICI1 increases, contemporaneous intangible intensity increases. The last term, DICI2, captures the scaling of existing stock of intangible capital over changes in the stock of physical assets. Unlike ICI and DICI1, as DICI2 increases, contemporaneous intangible intensity decreases. This shows that the contemporaneous ratio of intangible capital to physical assets creates a measure of intangible intensity that is negatively related to an activity that improves the scaling of existing stock of intangible capital.

To address this measurement problem, I consider all three components of intangible intensity decomposed above in my tests and predict that the lagged stock of intangible capital, new investments in intangibles, and the scaling of existing stock of intangible capital over newly purchased physical assets, will all have a positive effect on the permanence of earnings innovations. Note that although DICI2 lowers the contemporaneous ratio of intangible capital to physical assets, I predict that it increases the perceived permanence of earnings innovations. This is because DICI2 is a measure of the reusability of existing stock of intangible capital over newly purchased physical assets.

I state the first hypothesis as follows.

H1: The ERC increases with the stock of intangible capital, new investments in intangibles, and the scaling of existing stock of intangible capital over newly purchased assets.

I also expect the effect of these three different components of intangible intensity on the permanence of earnings innovations to vary differentially with the risk of loss of tacit or explicit knowledge. I discuss these hypotheses in the following sections.

3.2 Loss of Tacit Knowledge and the Effect of Intangible Assets on the ERC

Hedlund (1994) remarks that "tacit knowledge probably comes packaged most efficiently in the form of individuals." Likewise, Eisfeldt and Papanikolaou (2013) state that "organization capital is embodied in highly specialized labor inputs." Therefore, the mobility, mortality, or retirement of individuals embodying highly specialized and non-transferable skills can impair the scalability of intangible capital found in tacit knowledge (Romer 1986; Bloom, Schankerman, and

Van Reenen 2013). The loss of key personnel involved in projects with long gestation periods can cause severe disruption, productivity loss, and increase in labor adjustment costs for the firm (Oi 1962; Williamson 1985; Manning 2003; Donangelo 2014). When key talent leaves the firm, so does a large share of tacit knowledge. The firm in effect rents the tacit knowledge of key employees, while it owns physical assets wholly or substantially. Moreover, the key personnel may also have opportunities to hold-up the firm, whereby they demand a larger share of cash flows accrued from their specialized and non-transferable human capital (Huson, Scott, and Wier 2001; Eisfeldt and Papanikolaou 2014).

Further, the departure of key employees hampers efforts to convert tacit knowledge into explicit knowledge, deploy explicit knowledge on a larger scale, and spur innovation. For these reasons, shareholders' perception of the scalability of intangible assets diminishes with the risk of loss of tacit knowledge. Accordingly, I predict that the risk of loss of tacit knowledge will weaken the positive effect of the scalability of intangible assets on the permanence of earnings innovations. I consider the disclosure of the risk of loss of key personnel in the annual 10-K filings of the firm as an indicator of the risk of loss of tacit knowledge.

I state the second hypothesis as follows.

H2: The risk of loss of tacit knowledge will attenuate the positive effect of the scalability of intangible assets on the ERC.

3.3 Intensifiers of Loss of Tacit Knowledge

The hypothesized attenuating effect of the risk of loss of tacit knowledge is likely to be more intense for firms in the early stages of their life cycle and for firms headquartered in jurisdictions with weak enforcement of non-compete agreements. I consider these two settings next.

3.3.1 Early Stages of Firm Life Cycle

Firms rely more on tacit knowledge embodied in key personnel in the early stages of their life cycle than in later stages. This is because the dispersal of tacit knowledge is less tractable in the early stages of firm life cycle. The organizational learning model proposed by Nonaka (1994) suggests that employees gain tacit knowledge from each other through mentoring, learning-by-doing, on-the-job training, internship, or apprenticeship in the early stages of organizational learning. A few key employees may embody considerable proportions of tacit knowledge in the early stages of organizational learning. Therefore, the departure of key personnel in the early stages of life cycle could result in the loss of valuable knowledge for the firm. Given the prediction that the risk of loss of tacit knowledge weakens the positive effect of the scalability of intangible assets on the permanence of earnings innovations, I expect the weakening to be more pronounced for firms in the introduction or growth stages of their life cycle than in later stages. I develop the indicator for the state of being in the introduction or growth stages of firm life cycle using cash flows from operations, investing and financing (Dickinson 2011).

I state the third hypothesis as follows.

H3: The attenuating effect of the risk of loss of tacit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms in the introduction or growth stages of their life cycle.

3.3.2 Enforcement of Non-Compete Agreements

Non-compete agreements have become ubiquitous in the employment contracts of highly skilled executives, R&D staff, and salespeople. Marx (2011) notes that 43% of electrical engineers signed a non-compete agreement over the 10-year period of his survey. Garmaise (2011) reports that about 70% of firms on the ExecuComp database required their senior executives to sign non-compete agreements. Non-compete agreements allow firms to restrict key employees from furthering the interests of competitors using knowledge accumulated from prior employment stints (Valiulis 1985; Gilson 1999) and to minimize recruiting costs. Garmaise (2011) finds that executives employed in jurisdictions that adopt stricter non-compete policies are paid less and are less likely to change jobs. Younge and Marx (2016) find a positive relation between strong enforcement of non-compete agreements and firm value.

However, the level of enforcement of non-compete agreements is not the same across jurisdictions. For example, the enforcement of non-compete agreements is weak in the state of California, whereas the enforcement is strong in Massachusetts. Consistently, Almeida and Kogut (1999) and Fallick, Fleischman, and Rebitzer (2006) find evidence of greater mobility of inventors and technologists in California. Conversely, Saxenian (1994) finds evidence of lower mobility of skilled workers in Massachusetts. Further, Stuart and Sorenson (2003) report evidence of increased

entrepreneurial activity in the biotech sector concomitant with weak state-level enforcement of non-compete agreements.

The differences in state-level enforcement of non-compete agreements mean that the firm is at greater risk of losing tacit knowledge embodied in key personnel in jurisdictions with weak enforcement of non-compete agreements, and vice versa. Given the prediction that the risk of loss of tacit knowledge weakens the positive effect of the scalability of intangible assets on the permanence of earnings innovations, I expect the weakening to be more pronounced for firms headquartered in states with weak enforcement of non-compete agreements.

I state the fourth hypothesis as follows.

H4: The attenuating effect of the risk of loss of tacit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms headquartered in states with weak enforcement of non-compete agreements.

3.4 Loss of Explicit Knowledge and the Effect of Intangible Assets on the ERC

Firms aim to codify or make explicit ever larger proportions of knowledge to achieve scale and to mitigate reliance on tacit knowledge embodied in key talent. While the retention and replication of explicit knowledge is inexpensive and fast, the risk of misappropriation increases in some institutional settings, depending on factors such as the quality of intellectual or other property rights, judicial independence, and political transparency. Consequently, the protection of explicit knowledge is costly and uncertain in foreign jurisdictions that do not provide adequate and effective intellectual property rights.

In contrast, strong intellectual property laws in advanced economies and their predictable enforcement offer protection against threats of infringement. Further, strong intellectual property rights provide ownership advantages; encourage innovation and offer the option of legal recourse against violation of proprietary rights (Jaffe and Lerner 2011). However, many emerging economies attempt to counterbalance the need to encourage the inbound flow of knowledge from sophisticated foreign firms, while permitting domestic firms to profit from knowledge spillovers from their foreign rivals through forced technology transfers, counterfeiting, or espionage. These conflicting incentives often result in less predictable enforcement of intellectual property laws, even when laws governing the ownership of intellectual property are strong.

Ineffective protection or enforcement of intellectual property rights could adversely affect the competitive position of foreign firms, cause them to lose sales, or increase costs of erecting barriers against potential infringement. For these reasons, shareholders' perception of the scalability of intangible assets reduces with the risk of loss of explicit knowledge or codified intellectual capital. I predict that the risk of loss of explicit knowledge will weaken the positive effect of the scalability of intangible assets on the permanence of earnings innovations. I use the disclosure of the risk of inadequate protection or enforcement of intellectual property rights in foreign jurisdictions in the annual 10-K filings of the firm as an indicator of the risk of loss of explicit knowledge.

I state the fifth hypothesis as follows.

H5: The risk of loss of explicit knowledge will attenuate the positive effect of the scalability of intangible assets on the ERC.

3.5 Intensifiers of Loss of Explicit Knowledge

I expect the hypothesized attenuating effect of the risk of loss of explicit knowledge to be more intense for firms in the mature or shake-out stages of their life cycle and for firms with significant business interests in countries known to subvert intellectual property rights. I look at these two settings next.

3.5.1 Later Stages of Firm Life Cycle

Firms develop and deploy explicit knowledge or codified intellectual capital more in the later stages of organizational learning than in the earlier stages (Nonaka 1994). In other words, firms are more reliant on explicit knowledge during the mature or shake-out stages of their life cycle than in other stages. Moreover, firms in the mature or shake-out stages of their life cycle are more likely to scale their sales and operations to export markets in search of new growth opportunities and to take advantage of lower marginal costs of production and lower export related transportation costs. Therefore, the ability of mature and shake-out stage firms to protect codified intellectual capital against potential infringement depends on the quality of intellectual property rights in foreign jurisdictions. Given the prediction that the risk of loss of explicit knowledge weakens the positive effect of the scalability of intangible assets on the permanence of earnings innovations, I expect the weakening to be more pronounced for firms in the mature or shake-out stages of life cycle. I develop the indicator for the state of being in the mature or shake-out stages of firm life cycle using cash flows from operations, investing and financing (Dickinson 2011).

I state the sixth hypothesis as follows.

H6: The attenuating effect of the risk of loss of explicit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms in the mature or shake-out stages of their life cycle.

3.5.2 USTR Watch Lists

The USTR publishes an annual report on the Special 301 review of the protection and enforcement of intellectual property rights in foreign countries. Following the Special 301 provisions in the Omnibus Trade and Competitiveness Act of 1988 and the Uruguay Round Agreements Act, the USTR identifies countries that "deny adequate and effective protection for intellectual property or deny fair and equitable market access for persons that rely on intellectual property protection." The USTR assesses the level to which countries comply with their obligations under the multilateral agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) and other bilateral agreements. The USTR places countries subverting intellectual property rights on a Priority Watch List, Watch List, or Priority Foreign Country List.[9]

Given the prediction that the risk of loss of explicit knowledge weakens the positive effect of the scalability of intangible assets on the permanence of earnings innovations, I expect the weakening to be more pronounced for firms with substantial business interests in countries placed

[9] In the most recent review in 2020, the USTR placed China, Indonesia, India, Algeria, Saudi Arabia, Russia, Ukraine, Argentina, Chile, and Venezuela on the priority watch list, and Thailand, Vietnam, Pakistan, Turkmenistan, Uzbekistan, Egypt, Kuwait, Lebanon, United Arab Emirates, Romania, Turkey, Barbados, Bolivia, Brazil, Canada, Colombia, Dominican Republic Ecuador, Guatemala, Mexico, Paraguay, Peru, and Trinidad & Tobago on the watch list.

on the USTR watch lists. I use the disclosure of segment level financial reporting for a foreign country as an indicator of the firm having substantial business interests in that country.

I state the seventh hypothesis as follows.

H7: The attenuating effect of the risk of loss of explicit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms with significant business interests in countries on the USTR watch lists.

3.6 Takeover Defenses and the Effect of Intangible Assets on the ERC

The conventional view of agency theory considers the market for corporate control as a governance mechanism that disciplines managers (e.g., DeAngelo and Rice 1983; Jensen and Ruback 1983; Jensen 1986). According to this view, takeover defenses insulate managers from the market for corporate control, exacerbate existing agency problems and increase wasteful spending (e.g., Manne 1965; Jensen 1988, 1993; Masulis, Wang, and Xie 2009). In contrast, other strands of literature argue that takeover defenses allow managers and key personnel to focus more on long-term market dominance and less on short-term performance goals (e.g., Stein 1988, 1989; Chemmanur and Jiao 2012).

More important for my study is the argument that takeovers trigger the breach of implicit contracts between the firm and key employees (Shleifer and Summers 1988). Firms build and sustain competitive advantages as key employees develop and deploy firm-specific knowledge (Kogut and Zander 1992). The threat of violation of implicit contracts and resultant career concerns discourage employees from investing in firm-specific human capital. This is because firm-specific

human capital cannot be transferred across business settings without suffering diminution in value (Becker 1964; Williamson 1985). Takeover defenses allay career concerns of key employees, induce bonding with the employer, and thus encourage investments in firm-specific human capital (Wang, Zhao, and He 2016).

Several studies examine the relation between the strength of takeover defenses, firm value, and operating performance. Most firms establish their takeover defenses at the time of initial public offering (IPO), as the likelihood of takeovers increases post-IPO. Field and Karpoff (2002) show that firms having more takeover defenses report better operating performance than firms with fewer takeover defenses. Chemmanur, Paeglis, and Simonyan (2011) report that IPO firms with higher quality management and more takeover defenses have better IPO valuation, and superior post-IPO stock and operating performance than other firms. They also note that IPO firms with higher quality management deploy more takeover defenses than other firms. Johnson, Karpoff, and Yi (2015) show that takeover defenses help IPO firms establish long-term contracts and relationships with key stakeholders, and thus enhance IPO valuation and future operating performance. Likewise, Cremers, Litov, and Sepe (2017) report a positive association between the adoption of staggered boards and firm value, especially for innovative firms.

The discussion above suggests that takeover defenses promote long-term stewardship and foster the development and deployment of firm-specific human capital and thus improve the long-term operating performance of the firm. To the extent that takeover defenses promote long-term stewardship more than they entrench controlling shareholders, I predict that takeover defenses will augment the positive effect of the scalability of intangible assets on the permanence of earnings innovations.

I state the eighth hypothesis as follows.

H8: The adoption of takeover defenses will reinforce the positive effect of the scalability of intangible assets on the ERC.

Chapter 4: Data, Variables, and Model Specification

4.1 Sample

The sample includes all firms on Compustat for the years 1970-2019 with non-missing values for earnings before interest and taxes (EBIT) for the current and previous year, opening book value of total assets and market value of equity, for which the stock return data is available on the Center for Research in Security Prices (CRSP) database. I begin with 242,712 firm-year observations that have Compustat data (EBIT for the current and previous year, opening book value of total assets and market value of equity). Requirements for EBIT, SG&A or R&D expenditure history, and stock return data to calculate the persistence coefficient of earnings, intangible capital, abnormal stock returns, and the standard deviation of stock returns reduce the sample to 120,180 firm-year observations.

4.2 Measurement of Intangible Capital

Following Eisfeldt and Papanikolaou (2013) and Peters and Taylor (2017), I calculate the stock of intangible capital (IC) as follows.

$$IC_{it} = (1-\delta) * IC_{it-1} + K_{it} + O_{it} \quad (2)$$

IC_{it-1} is the opening stock of intangible capital, δ is the depreciation rate of intangible capital, K_{it} and O_{it} are the current period investments in knowledge capital and organization capital, respectively. Following Peters and Taylor (2017), I consider R&D expenditure as an investment in knowledge capital, and 30% of SG&A expenditure (excluding R&D expenditure) as an investment in organization capital.

I calculate the initial stock of intangible capital following the procedure employed by Eisfeldt and Papanikolaou (2013).

$$IC_{i0} = \frac{(K_{i1} + O_{i1})}{(g + \delta)} \tag{3}$$

K_{i1} and O_{i1} are the first period investments in knowledge capital and organization capital, respectively; g is the average real growth rate of firm-level SG&A expenditure, which equals 10% (Eisfeldt and Papanikolaou 2013); and δ is the depreciation rate of intangible capital, which equals 20% (Peters and Taylor 2017). The results of my study are robust to the choice of depreciation rate between 10% and 25%. I calculate the contemporaneous intangible intensity of the firm as the ratio of intangible capital (IC) to total assets (AT) at the end of the current fiscal period.

4.3 Indicators of Loss of Tacit and Explicit Knowledge

Campbell, Chen, Dhaliwal, and Lu (2014) report evidence that firms' disclosure of qualitative risk factors are meaningful indicators of actual risks faced. I run textual analysis of the disclosure of qualitative risk factors in the annual 10-K filings accessible on the Securities and Exchange Commission (SEC), Electronic Data Gathering and Retrieval (EDGAR) database to

construct the indicators for the risk of loss of tacit knowledge (LTK) and the risk of loss of explicit knowledge (LEK). These disclosures typically appear in one of the following sections of the annual 10-K filings – Item 1A or Risk Factors, Item 1 or Business, Item 7 or Management Discussion and Analysis, Item 7A or Market Risk. The SEC requires all firms to include a new section in their annual 10-K filings that disclose "the most significant factors that make the company speculative or risky" (Regulation S-K, Item 305 (c), SEC 2005). However, several firms in my sample started disclosing qualitative risk factors from the mid-to-late 1990s. So, I construct the LTK and LEK indicators for the sub-sample of firm-years from 1998 to 2019, for which the annual 10-K filings are available on the SEC EDGAR website. This requirement reduces the sample size for analysis using these indicators to 54,233 firm-years. I provide some excerpts of the disclosure of qualitative risk factors from sample annual 10-K filings in Appendix B.

I consider the risk of losing key members of staff and failure to attract and retain qualified personnel as factors that exacerbate the risk of loss of tacit knowledge for the firm. Similarly, I consider the risk of inadequate protection or enforcement of intellectual property rights in foreign jurisdictions as an indicator of the risk of loss of explicit knowledge. I use Python scripts to parse sentences in the annual 10-K filings for the occurrence of words that reflect these qualitative risks factors in order to populate these indicators. I describe this procedure in more detail in Appendix C. I also verify the accuracy of this procedure by manually examining and comparing the annual 10-K filings of over 300 firms in my sub-sample against the indicators of the risk of loss of tacit and explicit knowledge. These indicators correctly identify the disclosure of relevant qualitative risk factors in over 95% of the cases.

4.4 Stages of Firm Life Cycle

Dickinson (2011) develops a parsimonious measure of firm life cycle using the statement of cash flows, considering different cash flows as indicators of growth, risk, and profitability of the firm. Following Dickinson (2011), I use operating cash flow (OANCF), investing cash flow (IVNCF), and financing cash flow (FINCF) to identify the stage of firm life cycle as: introduction, growth, mature, shake-out, or decline. I set the indicator IG as 1 for firms in the introduction or growth stages of their life cycle and 0 otherwise. Similarly, I set the indicator MS as 1 for firms in the mature or shake-out stages of their life cycle and 0 otherwise.

(1) Introduction: when OANCF < 0, IVNCF < 0 and FINCF > 0.

(2) Growth: when OANCF > 0, IVNCF < 0 and FINCF > 0.

(3) Mature: when OANCF > 0, IVNCF < 0 and FINCF < 0.

(4) Decline: when OANCF < 0, IVNCF > 0 and FINCF ≤ or ≥0; and

(5) Shake-out: the remaining firm-years are classified as in shake-out stage.

4.5 Enforcement of Non-Compete Agreements

According to the Brookings Institution (Marx 2018), the enforcement of non-compete agreements is weak in the states of California, Oklahoma, and North Dakota. The remaining states enforce non-compete agreements at varying levels, while Utah and New Mexico are undecided on their enforcement policy. I classify firms based on whether the firm headquarters is in a state with weak (or undecided) enforcement of non-compete agreements. I set the indicator NCW as 1 for

firms headquartered in states with weak (or undecided) enforcement of non-compete agreements and 0 otherwise. I do not consider time-variation for this indicator at state-level because laws governing the treatment of non-compete agreements are static for the most part as only three states reported significant changes in the enforcement of non-compete agreements between 1992 and 2004 (Garmaise 2011).

4.6 USTR Watch Lists

I examine the Special 301 Report annually published by the USTR which identifies countries that do not provide adequate intellectual property rights or fair market access relying upon intellectual property rights. The report places countries subverting intellectual property rights on a priority watch list or watch list based on their level of compliance with their obligations under the TRIPS or other bilateral agreements. I set the indicator WL as 1 for firm-years that disclose segment level financial reporting for a country placed on the priority watch list or watch list in both 2011 and 2020 and 0 otherwise. The requirement of segment level financial reporting data reduces the sample size for analysis using this indicator to 19,788 firm-years.

4.7 Takeover Defenses

I obtain information about takeover defenses employed by firms such as dual class share structures, unequal voting rights, and supermajority voting provisions from the corporate governance database of Institutional Shareholder Services (ISS). In my first analysis concerning takeover defenses, I set the indicator TD as 1 for firms with dual class share structures or unequal voting rights and 0 otherwise. In the second analysis, I set the indicator TD as 1 for firms with

supermajority voting provisions and 0 otherwise. The requirement for takeover defenses data reduces the sample size for analysis using this indicator to 17,956 firm-years.

4.8 Control Variables

Collins and Kothari (1989) show that the ERC varies with firm size, depending on the time interval over which the stock return is measured. They also show that the ERC is positively related to growth opportunities and the persistence of earnings and negatively related to risk. Dhaliwal, Lee, and Fargher (1991) show that the ERC is lower for highly levered firms. I control for these variables to demonstrate that the stock of intangible capital, new investments in intangibles, and the scaling of existing stock of intangible capital over newly purchased assets, play an incremental role in altering the earnings/return relation.

I use standard measures employed in the literature for most of these control variables (see Appendix A for definitions of control variables). The exception is that I consider two proxies for growth opportunities. The first is the ratio of market value of equity to book value of equity measured at the beginning of the fiscal year (Collins and Kothari 1989). For the second measure, I follow Peters and Taylor (2017), and use the ratio of firms' market value to the sum of total assets and intangible capital. I consider the second proxy because several studies document the existence of a positive relation between firms' market value and internally generated intangibles (e.g., Griliches 1981; Barth, Clement, Foster, and Kasznik 1998; Hall, Jaffe, and Trajtenberg 2005). Since the denominator of the first proxy does not account for the book value of internally generated intangibles and the numerator subsumes the market value of these intangibles, this proxy reflects the market value of internally generated intangibles not recognized on firms' balance sheet.

Because of this mismeasurement, using the first growth proxy could result in a spurious relation between ERCs and the components of contemporaneous intangible intensity. Peters and Taylor (2017) address this problem in their measure of investment opportunities by controlling for internally generated intangibles in the denominator. This measure also helps to gauge the effect of growth opportunities on the ERC better.

Table 1 presents the descriptive statistics for the sample firm-years. Panel A presents the distributional characteristics, and Panel B presents the Pearson and Spearman correlations for continuous variables used in the analysis. All dollar values are inflation-adjusted to 2015 dollars, using the U.S. Department of Labor, Consumer Price Index. I also winsorize all variables at 1% and 99% levels. The correlation matrix shows that firms having higher stock of intangible capital relative to physical assets (ICI) are smaller in size, lower in leverage and riskier, with more variable stock returns. However, firms with more recent intangible investments relative to physical assets and that which scale their existing stock of intangible capital over newly purchased assets are larger in size and have higher persistence of earnings.

Table 2 presents the distributional characteristics of the components of intangible intensity of firm-years by Fama-French classification of industries. Panel A presents these characteristics for the full sample (1970-2019) and Panel B presents this information for the sub-sample of firm-years from 1998 to 2019. This table shows that on average firm-years in the computer, software, and electronic equipment and healthcare, medical equipment, and drugs sectors have the highest stock of intangible capital relative to total assets and firm-years in utilities, finance, and energy are relatively less intangible intensive. This pattern holds true for new investments in intangibles relative to total assets as well.

Table 3 presents the distributional characteristics of the indicators used in the analysis concerning the risk of loss of knowledge underlying intangible capital. Panel A shows that more than half of the firm-years in the business equipment industry disclose risks related to the loss of tacit and explicit knowledge. While about half of the firm-years in the health industry disclose the risk of loss of key personnel, a third of these firm-years disclose the risk of inadequate intellectual property rights in foreign jurisdictions. Not surprisingly, firm-years in the utility industry disclose these risks less frequently than firm-years in other industries. In Panel B, I also present the 2x2 frequency distribution of these indicators, which shows reasonable cross-sectional variation.

4.9 Model Specification

I use the following regression model to test H1, which predicts a positive coefficient on the two-way interaction of unexpected earnings with the stock of intangible capital, new investments in intangibles, and the scaling of existing stock of intangible capital over newly purchased assets (i.e. β_1, β_2 and $\beta_3 > 0$). The model also includes industry-year fixed effects.

$$CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it};$$
$$\beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it}. \quad \text{(Model 1)}$$

CAR_{it} is the monthly stock return for firm i adjusted by the Fama-French three-factor model return, cumulated over a 12-month period, ending three months after the current fiscal year. I use the first difference in EBIT as the proxy for unexpected earnings, and scale by the opening market value of equity to create $DIFFEARN_{it}$. I define all other variables as described above.

To test H2, I augment Model 1 so that the effect of the components of intangible intensity on the ERC varies with the risk of loss of tacit knowledge (LTK). I show this model, including the indicator for the risk of loss of tacit knowledge below. The coefficients of interest are the three-way interactions of unexpected earnings and the components of intangible intensity with LTK. H2 predicts a negative coefficient on the three-way interaction of DIFFEARN, ICI, and LTK (i.e., $\Upsilon_1 < 0$), DIFFEARN, DICI1, and LTK (i.e., $\mu_1 < 0$), and DIFFEARN, DICI2, and LTK (i.e., $\rho_1 < 0$).

$$
\begin{aligned}
&CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * YEAR)FE + \varepsilon_{it};\\
&\quad \beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} +\\
&\qquad \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};\\
&\quad \beta_0 = \eta_0 + \eta_1 LTK_{it};\\
&\quad \beta_1 = \gamma_0 + \gamma_1 LTK_{it};\\
&\quad \beta_2 = \mu_0 + \mu_1 LTK_{it};\\
&\quad \beta_3 = \rho_0 + \rho_1 LTK_{it}.
\end{aligned}
\qquad \text{(Model 2)}
$$

To test H3, I augment Model 2 to include the indicator for firms in the introduction or growth stages of their life cycle (IG). I show this model, including the indicators for the risk of loss of tacit knowledge and firms in the introduction or growth stages of their life cycle below. The coefficients of interest are those of the interactions of unexpected earnings and the components of intangible intensity with LTK and IG.

$$
\begin{aligned}
&CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * YEAR)FE + \varepsilon_{it};\\
&\quad \beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} +\\
&\qquad \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};\\
&\quad \beta_0 = \eta_0 + \eta_1 LTK_{it} + \eta_2 IG_{it} + \eta_3 LTK_{it} * IG_{it};\\
&\quad \beta_1 = \gamma_0 + \gamma_1 LTK_{it} + \gamma_2 IG_{it} + \gamma_3 LTK_{it} * IG_{it};\\
&\quad \beta_2 = \mu_0 + \mu_1 LTK_{it} + \mu_2 IG_{it} + \mu_3 LTK_{it} * IG_{it};\\
&\quad \beta_3 = \rho_0 + \rho_1 LTK_{it} + \rho_2 IG_{it} + \rho_3 LTK_{it} * IG_{it}
\end{aligned}
\qquad \text{(Model 3)}
$$

To test H4, I replace the indicator for firms in the introduction or growth stages of their life cycle in Model 3 with the indicator for firms headquartered in states with weak enforcement of non-compete agreements (NCW) for Model 4.[10]

To test H5, I replace the indicator for the risk of loss of tacit knowledge in Model 2 with the indicator for the risk of loss of explicit knowledge (LEK) for Model 5. The coefficients of interest are the three-way interactions of unexpected earnings and the components of intangible intensity with LEK. H5 predicts a negative coefficient on the interaction of DIFFEARN, ICI, and LEK (i.e., $\Upsilon_1 < 0$), DIFFEARN, DICI1, and LEK (i.e., $\mu_1 < 0$), and DIFFEARN, DICI2, and LEK (i.e., $\rho_1 < 0$). To test H6, I replace the indicator for the risk of loss of tacit knowledge and the indicator for firms in the introduction or growth stages of their life cycle in Model 3 with the indicator for the risk of loss of explicit knowledge and the indicator for firms in the mature or shake-out stages of their life cycle (MS) for Model 6. To test H7, I replace the indicator for firms in the mature or shake-out stages of their life cycle in Model 6 with the indicator for firms disclosing segment level financial reporting for countries placed on the USTR watch lists (WL) for Model 7.

To test H8, I replace the indicator for the risk of loss of tacit knowledge in Model 2 with the indicator for takeover defenses (TD) for Model 8. H8 predicts a positive coefficient on the interaction of DIFFEARN, ICI, and TD (i.e., $\Upsilon_1 > 0$), DIFFEARN, DICI1, and TD (i.e., $\mu_1 > 0$), and DIFFEARN, DICI2, and TD (i.e., $\rho_1 > 0$).

[10] I present all models not included in the body of the paper in the tables' headers.

Chapter 5: Results

5.1 The Effect of Scalability of Intangible Assets on the ERC

Table 4 presents the test of H1, which predicts the positive scaling effect of intangible assets on the ERC. I estimate Model 1 for the entire sample of firm-years pooled over 1970-2019 and partitioned by decades. In Panel A, the proxy for growth opportunities is the ratio of market value of equity to book value of equity of the firm. The results for both the pooled sample and partitions support H1. In Panel B, the proxy for growth opportunities is the ratio of market value of the firm to the sum of total assets and intangible capital, following Peters and Taylor (2017). The results in Panel B are comparable to Panel A and they also support H1.[11]

Using the pooled sample in Panel B, the coefficient estimate of the two-way interaction of unexpected earnings and the stock of intangible capital is positive and significant (coefficient estimate of DIFFEARN * ICI = 0.541 and p-value < 0.01), the coefficient estimate of the two-way interaction of unexpected earnings and new investments in intangibles is also positive and significant (coefficient estimate of DIFFEARN * DICI1 = 0.878 and p-value < 0.01), and the coefficient estimate of the two-way interaction of unexpected earnings and the scaling of existing stock of intangible capital over newly purchased assets is also positive and significant (coefficient estimate of DIFFEARN * DICI2 = 0.631 and p-value < 0.01). The typical firm with mean values for all control variables would have an estimated ERC of 1.299. An increase by one standard

[11] The results using both proxies for growth opportunities are comparable for all tests. Hereafter, I report results using only the proxy for growth opportunities following Peters and Taylor (2017).

deviation of ICI, DICI1, and DICI2 would cause an increase of the ERC by 16.65%, 6.56%, and 9.96%, respectively.

The sign and significance of the coefficients of the interactions of unexpected earnings with the other control variables are largely consistent with the results of prior studies. Following the adjustment for the measurement of growth opportunities (Peters and Taylor 2017), the magnitude of the coefficient estimate of the interaction of unexpected earnings and growth opportunities is greater in Panel B. In sum, the results establish that the stock of intangible capital, new investments in intangibles, and the scaling of existing stock of intangible capital over newly purchased assets, all have a positive effect on shareholders' perception of the permanence of earnings innovations.[12]

5.2 Loss of Tacit Knowledge and the Effect of Intangible Assets on the ERC

Table 5 presents the test of H2, which predicts that the risk of loss of tacit knowledge weakens the positive scaling effect of intangible assets on the ERC. For this test, I consider the sub-sample of firm-years from 1998 to 2019, for which the annual 10-K filings are available on the SEC EDGAR website. I consider pooled sample of firm-years because Table 3 does not reveal any significant temporal shifts in the relation between unexpected earnings and stock return, tempered by the components of contemporaneous intangible intensity. Model 2 extends Model 1

[12] I calculate the components of contemporaneous intangible intensity following the decomposition of intangible intensity expressed as the sum of intangible intensity at (t-2) and the change in intangible intensity from (t-2) to t. The test results are largely consistent with results obtained when intangible intensity is expressed as the sum of intangible intensity at (t-3) [or (t-1)] and the change in intangible intensity from (t-3) [or (t-1)] to t.

to include the indicator for the risk of loss of tacit knowledge (LTK*)*. The LTK firms are those which disclose the risk of loss of key talent and failure to attract and retain qualified personnel in the current or previous fiscal year.

In the estimation of Model 2, the risk of loss of tacit knowledge does not have a direct effect on the persistence of unexpected earnings. Consistent with previous results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.685 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * LTK = -0.272 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * ICI and DIFFEARN * ICI * LTK = 0.413 and p-value < 0.01). This shows that the stock of intangible capital continues to have a positive effect on the persistence of unexpected earnings, despite the attenuating effect of the risk of loss of tacit knowledge.

Further, new investments in intangibles also increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.782 and p-value < 0.01). But the risk of loss of tacit knowledge does not change the increase in persistence significantly. A possible explanation for this result is that new investments in intangibles serve as incentives for key employees to continue their services as these investments provide more opportunities to develop their knowledge and skills.

In addition, the scaling of existing stock of intangible capital also increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 0.903 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly

(coefficient estimate of DIFFEARN * DICI2 * LTK = -0.291 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * LTK = 0.612 and p-value < 0.01). Again, this shows that the scaling of existing stock of intangible capital continues to have a positive effect on the persistence of unexpected earnings, despite the attenuating effect of the risk of loss of tacit knowledge. Overall, these results support H2, or in other words, the risk of loss of tacit knowledge attenuates shareholders' perception of the increased permanence of earnings innovations with higher stock of intangible capital and scaling of existing stock of intangible capital.

5.3 Intensifiers of Loss of Tacit Knowledge

Table 6 presents the results of tests for which I consider indicators designed to capture situations that intensify the effect of risk of loss of tacit knowledge on shareholders' perception of the permanence of the earnings innovations. The first column presents the test of H2 using Model 2 (Table 5) for comparison with the tests for H3 and H4.

5.3.1 Early Stages of Firm Life Cycle

H3 predicts that the weakening effect of the risk of loss of tacit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms in the introduction or growth stages of life cycle than in later stages. While Model 2 examines the cross-sectional variation of the positive effect of intangible assets on the ERC with the risk of loss of tacit knowledge, Model 3 probes deeper with a 2x2 comparison by considering both the effects of the risk of loss of tacit knowledge (LTK) and the state of being in the introduction or growth stages of firm life cycle (IG).

The second column of Table 6 presents the test of H3. The state of being in the introduction or growth stages of life cycle does not have a direct effect on the persistence of unexpected earnings. Consistent with prior results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.757 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * LTK = -0.166 and p-value < 0.10), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * ICI and DIFFEARN * ICI * LTK = 0.591 and p-value < 0.01). The state of being in the introduction or growth stages of firm life cycle does not affect the increase in persistence significantly. However, the state of being in the introduction or growth stages of firm life cycle exacerbates the attenuating effect of the risk of loss of tacit knowledge (coefficient estimate of DIFFEARN * ICI * LTK * IG = -0.217 and p-value < 0.10). Neither the risk of loss of tacit knowledge nor the state of being in the introduction or growth stages of firm life cycle eliminate the positive effect of the stock of intangible capital on the ERC (the sum of the coefficient estimates of DIFFEARN * ICI, DIFFEARN * ICI * LTK, DIFFEARN * ICI * IG, and DIFFEARN * ICI * LTK * IG = 0.266 and p-value < 0.01).

Further, new investments in intangibles increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.501 and p-value < 0.05). The risk of loss of tacit knowledge accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * LTK = 0.512 and p-value < 0.10). Again, this result lends support to the notion that key employees are less likely to leave when the firm continues to invest in intangibles. The state of being in the introduction or growth stages of firm life cycle also accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * IG = 0.872 and

p-value < 0.05). However, the joint effect of the risk of loss of tacit knowledge and the state of being in the introduction or growth stages of firm life cycle does not accentuate the increase in persistence significantly (the sum of the coefficient estimates of DIFFEARN * DICI1 * LTK, DIFFEARN * DICI1 * IG, and DIFFEARN * DICI1 * LTK * IG = 0.577 and p-value = 0.11).

In addition, the scaling of existing stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 1.136 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * LTK = -0.350 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * LTK = 0.786 and p-value < 0.01). The state of being in the introduction or growth stages of firm life cycle also attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * IG = -0.669 and p-value < 0.1), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * IG = 0.467 and p-value < 0.01). The results also suggest that the attenuating effect of the risk of loss of tacit knowledge on the positive effect of the scaling of existing stock of intangible capital is offset for firms in the early stages of their life cycle (coefficient estimate of DIFFEARN * DICI2 * LTK * IG = 0.402 and p-value < 0.05). Neither the risk of loss of tacit knowledge nor the state of being in the introduction or growth stages of firm life cycle eliminate the positive effect of the scaling of existing stock of intangible capital on the ERC (the sum of the coefficient estimates of DIFFEARN * DICI2, DIFFEARN * DICI2 * LTK, DIFFEARN * DICI2 * IG, and DIFFEARN * DICI2 * LTK * IG = 0.519 and p-value < 0.01).

5.3.2 Enforcement of Non-Compete Agreements

The third column of Table 6 presents the test of H4, which predicts that for firms with headquarters in states with weak enforcement of non-compete agreements, the weakening effect of the risk of loss of tacit knowledge on the positive effect of intangible assets on the ERC is more pronounced. Similar to Model 3, Model 4 considers both the effects of the risk of loss of tacit knowledge (LTK) and the firm being headquartered in a state with weak enforcement of non-compete agreements (NCW).

The state of firm headquarters does not have a direct effect on the persistence of unexpected earnings. Consistent with previous results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.691 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * LTK = -0.191 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * ICI and DIFFEARN * ICI * LTK = 0.500 and p-value < 0.01). The state of firm headquarters does not affect the increase in persistence significantly. However, when the firm is headquartered in a state with weak enforcement of non-compete agreements, the attenuating effect of the risk of loss of tacit knowledge is exacerbated (coefficient estimate of DIFFEARN * ICI * LTK * NCW = -0.310 and p-value < 0.05). The joint effect of the risk of loss of tacit knowledge and the firm headquarters being located in a state with weak enforcement of non-compete agreements eliminates the increase in persistence (the sum of the coefficient estimates of DIFFEARN * ICI, DIFFEARN * ICI * LTK, DIFFEARN * ICI * NCW, and DIFFEARN * ICI * LTK * NCW = 0.139 and p-value = 0.12).

Further, new investments in intangibles increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.933 and p-value < 0.01). The risk of loss of tacit knowledge does not change the increase in persistence significantly. However, the firm headquarters being located in a state with weak enforcement of non-compete agreements attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * NCW = -0.815 and p-value < 0.01). This shows that when the enforcement of non-compete agreements is weak, the risk of key talent leaving the firm is possibly higher even when the firm continues to invest in intangibles. The joint effect of the risk of loss of tacit knowledge and the firm headquarters being located in a state with weak enforcement of non-compete agreements does not eliminate the increase in persistence (the sum of the coefficient estimates of DIFFEARN * DICI1, DIFFEARN * DICI1 * LTK, DIFFEARN * DICI1 * NCW, and DIFFEARN * DICI1 * LTK * NCW = 0.739 and p-value < 0.05).

In addition, the scaling of existing stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 0.842 and p-value < 0.01). However, the risk of loss of tacit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * LTK = -0.191 and p-value < 0.10), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * LTK = 0.651 and p-value < 0.01). The firm headquarters being located in a state with weak enforcement of non-compete agreements accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * NCW = 0.331 and p-value < 0.10). However, when the firm headquarters is located in a state with weak enforcement of non-compete agreements, the attenuating effect of the risk of loss of tacit knowledge is exacerbated (coefficient estimate of

DIFFEARN * DICI2 * LTK * NCW = -0.407 and p-value < 0.10). Neither the risk of loss of tacit knowledge nor the firm headquarters being located in a state with weak enforcement of non-compete agreements eliminate the positive effect of the scaling of existing stock of intangible capital on the ERC (the sum of the coefficient estimates of DIFFEARN * DICI2, DIFFEARN * DICI2 * LTK, DIFFEARN * DICI2 * NCW, and DIFFEARN * DICI2 * LTK * NCW = 0.575 and p-value < 0.01).

5.4 Loss of Explicit Knowledge and the Effect of Intangible Assets on the ERC

Table 7 presents the test of H5, which predicts that the risk of loss of explicit knowledge weakens the positive scaling effect of intangible assets on the ERC. Model 5 extends Model 1 to include the indicator for the risk of loss of explicit knowledge (LEK*)*. The LEK firms are those which disclose the risk of inadequate protection or enforcement of intellectual property rights in foreign jurisdictions in the current or previous fiscal year.

In the estimation of Model 5, the risk of loss of explicit knowledge has a direct positive effect on the persistence of unexpected earnings (coefficient estimate of DIFFEARN * LEK = 0.324 and p-value < 0.01). This is possibly because firms disclosing the risk of inadequate intellectual property rights in foreign jurisdictions are concentrated in intangible intensive sectors such as technology and healthcare (Table 3, Panel A). Consistent with previous results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.661 and p-value < 0.01). However, the risk of loss of explicit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * LEK = -0.482 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates

of DIFFEARN * ICI and DIFFEARN * ICI * LEK = 0.179 and p-value < 0.01). This shows that the stock of intangible capital continues to have a positive effect on the persistence of unexpected earnings, despite the attenuating effect of the risk of loss of explicit knowledge. Further, new investments in intangibles increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.880 and p-value < 0.01). The risk of loss of explicit knowledge does not change the increase in persistence significantly.

In addition, the scaling of existing stock of intangible capital also increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 0.905 and p-value < 0.01). However, the risk of loss of explicit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * LEK = -0.356 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * LEK = 0.549 and p-value < 0.01). Again, this shows that the scaling of existing stock of intangible capital continues to have a positive effect on the persistence of unexpected earnings, despite the attenuating effect of the risk of loss of explicit knowledge. These results support H5, or in other words, the risk of loss of explicit knowledge attenuates shareholders' perception of the increased permanence of earnings innovations with higher stock of intangible capital and scaling of existing stock of intangible capital.

5.5 Intensifiers of Loss of Explicit Knowledge

Table 8 presents the tests where I consider indicators designed to capture settings that intensify the effect of the risk of loss of explicit knowledge on shareholders' perception of the

permanence of earnings innovations. The first column presents the test of H5 using Model 5 (Table 7) for comparison with the tests for H6 and H7.

5.5.1 Later Stages of Firm Life Cycle

H6 predicts that the weakening effect of the risk of loss of explicit knowledge on the positive effect of intangible assets on the ERC is more pronounced for firms in the mature or shake-out stages of their life cycle than other stages. While Model 5 examines the cross-sectional variation of the positive effect of intangible assets on the ERC with the risk of loss of explicit knowledge, Model 6 probes further with a 2x2 comparison by considering both the effects of the risk of loss of explicit knowledge (LEK) and the state of being in the mature or shake-out stages of firm life cycle (MS).

The second column of Table 8 presents the test of Model 6. The state of firm life cycle does not have a direct effect on the persistence of unexpected earnings. Consistent with prior results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.478 and p-value < 0.01). However, the risk of loss of explicit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * LEK = -0.241 and p-value < 0.05), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * ICI and DIFFEARN * ICI * LEK = 0.237 and p-value < 0.01). The state of being in the mature or shake-out stages of firm life cycle accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * MS = 0.537 and p-value < 0.01). However, the state of being in the mature or shake-out stages of firm life cycle exacerbates the attenuating effect of the risk of loss of explicit knowledge (coefficient estimate of

DIFFEARN * ICI * LEK * MS = -0.406 and p-value < 0.05). Neither the risk of loss of explicit knowledge nor the state of being in the mature or shake-out stages of firm life cycle eliminate the positive effect of the stock of intangible capital on the ERC (the sum of the coefficient estimates of DIFFEARN * ICI, DIFFEARN * ICI * LEK, DIFFEARN * ICI * MS, and DIFFEARN * ICI * LEK * MS = 0.367 and p-value < 0.01).

Further, new investments in intangibles increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.591 and p-value < 0.05). The risk of loss of explicit knowledge does not change the increase in persistence significantly. The state of being in the mature or shake-out stages of firm life cycle accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * MS = 0.545 and p-value < 0.10). However, the joint effect of the risk of loss of explicit knowledge and the state of being in the mature or shake-out stages of firm life cycle does not accentuate the increase in persistence (the sum of the coefficient estimates of DIFFEARN * DICI1 * LEK, DIFFEARN * DICI1 * MS, and DIFFEARN * DICI1 * LEK * MS = 0.109 and p-value = 0.83).

In addition, the scaling of existing stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 0.914 and p-value < 0.01). The risk of loss of explicit knowledge attenuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2 * LEK = -0.480 and p-value < 0.01), but does not eliminate it (the sum of the coefficient estimates of DIFFEARN * DICI2 and DIFFEARN * DICI2 * LEK = 0.434 and p-value < 0.01). The state of being in the mature or shake-out stages of firm life cycle does not change the increase in persistence significantly. Neither the risk of loss of explicit knowledge nor the state of the firm being in the mature or shake-out stages of firm life

cycle eliminate the positive effect of the scaling of existing stock of intangible capital on the ERC (the sum of the coefficient estimates of DIFFEARN * DICI2, DIFFEARN * DICI2 * LEK, DIFFEARN * DICI2 * MS, and DIFFEARN * DICI2 * LEK * MS = 0.707 and p-value < 0.01).

5.5.2 USTR Watch Lists

The third column of Table 8 presents the test of H7, which predicts that having significant business interests in countries placed on the USTR watch lists exacerbate the weakening effect of the risk of loss of explicit knowledge on the positive effect of intangible assets on the ERC. Similar to Model 6, Model 7 considers both the effects of the risk of loss of explicit knowledge (LEK) and the firm disclosing segment level financial reporting for countries on the USTR watch lists (WL).

In the estimation of Model 7, the disclosure of segment level financial reporting for countries on the USTR watch lists does not have a direct effect on the persistence of unexpected earnings. Consistent with previous results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * ICI = 0.269 and p-value < 0.01). However, the risk of loss of explicit knowledge eliminates the increase in persistence (the sum of the coefficient estimates of DIFFEARN * ICI and DIFFEARN * ICI * LEK = 0.024 and p-value = 0.83). The disclosure of segment level financial reporting for countries placed on the USTR watch lists accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * ICI * WL = 1.460 and p-value < 0.01). However, the disclosure of segment level financial reporting for countries on the USTR watch lists exacerbates the attenuating effect of the risk of loss of explicit knowledge (coefficient estimate of DIFFEARN * ICI * LEK * WL= -0.727 and p-value < 0.05). The joint effect of the risk of loss of explicit knowledge and the disclosure of

segment level financial reporting for countries on the USTR watch lists accentuate the increase in persistence (the sum of the coefficient estimates of DIFFEARN * ICI * LEK, DIFFEARN * ICI * WL, and DIFFEARN * ICI * LEK * WL = 0.489 and p-value < 0.05).

Further, new investments in intangibles increase the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI1 = 0.708 and p-value < 0.05). The risk of loss of explicit knowledge accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * LEK = 0.856 and p-value < 0.10). The disclosure of segment level financial reporting for countries on the USTR watch lists also accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI1 * WL = 3.306 and p-value < 0.05). However, the effect of the disclosure of segment level financial reporting for countries on the USTR watch lists subdues the accentuating effect of the risk of loss of explicit knowledge (the sum of the coefficient estimates of DIFFEARN * DICI1 * LEK and DIFFEARN * DICI1 * LEK * WL= -4.204 and p-value < 0.01). The joint effect of the risk of loss of explicit knowledge and the disclosure of segment level financial reporting for countries on the USTR watch lists eliminate the increase in persistence (the sum of the coefficient estimates of DIFFEARN * DICI1, DIFFEARN * DICI1 * LEK, DIFFEARN * DICI1 * WL, and DIFFEARN * DICI1 * LEK * WL = -0.190 and p-value = 0.83).

In addition, the scaling of existing stock of intangible capital increases the persistence of unexpected earnings (coefficient estimate of DIFFEARN * DICI2 = 0.752 and p-value < 0.01). The risk of loss of explicit knowledge does not alter the increase in persistence significantly. The disclosure of segment level financial reporting for countries placed on the USTR watch lists accentuates the increase in persistence significantly (coefficient estimate of DIFFEARN * DICI2

* WL = 0.859 and p-value < 0.10). Similarly, the joint effect of the risk of loss of explicit knowledge and the disclosure of segment level financial reporting for countries on the USTR watch lists also accentuate the increase in persistence (the sum of the coefficient estimates of DIFFEARN * DICI2 * LEK, DIFFEARN * DICI2 * WL, and DIFFEARN * DICI2 * LEK * WL = 0.950 and p-value < 0.05).

5.6 Takeover Defenses and the Effect of Intangible Assets on the ERC

Table 9 presents the test of H8, which predicts that takeover defenses augment the positive effect of the scalability of intangible assets on the ERC. I estimate Model 8 for those firm-years that have takeover defenses data available on the ISS corporate governance database. Model 8 extends Model 1 to include the indicator for the use of takeover defenses (TD). In the first column, TD is an indicator for firms with dual class share structures or unequal voting rights, and in the second column, TD is an indicator for firms with supermajority voting provisions.

The estimation of Model 8 in both columns shows that the market perceives unexpected earnings of firms with takeover defenses as less persistent (coefficient estimates of DIFFEARN * TD in column I and II are -0.485 and -0.370, respectively, and p-value < 0.01). These results are consistent with the classical view of agency theory, suggesting that takeover defenses exacerbate existing agency problems and lead to wastage or consumption of private benefits by controlling shareholders. Consistent with previous results, higher stock of intangible capital increases the persistence of unexpected earnings (coefficient estimates of DIFFEARN * ICI in column I and II are 1.363 and 1.216, respectively, and p-value < 0.01). The positive effect of takeover defenses with higher stock of intangible capital dominates the direct attenuating effect of takeover defenses

on the persistence of unexpected earnings (coefficient estimates of DIFFEARN * ICI * TD in column I and II are 2.159 and 1.297, respectively, and p-value < 0.01) for a standard deviation increase in ICI. The scaling of existing stock of intangible capital also increases the persistence of unexpected earnings (coefficient estimates of DIFFEARN * DICI2 in column I and II are 1.689 and 1.593, respectively, and p-value < 0.01). Again, the positive effect of takeover defenses with the scaling of existing stock of intangible capital offsets the direct attenuating effect of takeover defenses on the persistence of unexpected earnings (coefficient estimates of DIFFEARN * DICI2 * TD in column I and II are 2.046 and 1.601, respectively, and p-value < 0.10) for a standard deviation increase in DICI2. These results support H8, or in other words, takeover defenses promote long-term stewardship and encourage firm-specific investments in human capital, and thus protect and reinforce shareholders' perception of the increased permanence of earnings innovations with higher stock of intangible capital and scaling of existing stock of intangible capital.

Chapter 6: Conclusion

The last few decades have witnessed an unprecedented surge in the development and deployment of intangible assets. The greater scalability and appropriability of intangible assets compared to physical assets suggest that these economic properties may have contrasting effects on shareholders' perception of the permanence of new earnings information for intangible intensive firms. This study documents that the positive effect of the scalability of intangible assets on the perceived permanence of new earnings information dominates the negative effect of the appropriability of intangibles significantly. I also narrow down to settings where the negative effect of the appropriability of intangible assets is more pronounced, including particular stages of

firm life cycle and institutional environments. The first setting is when the firm is at risk of losing valuable intangible capital embodied in its key employees, more so in the early stages of its life cycle and when faced with weak enforcement of non-compete agreements. The second situation is when the firm is at risk of misappropriation of its codified intellectual capital or proprietary information and technologies by rival firms, especially in foreign jurisdictions known for subverting intellectual property rights and in the later stages of its life cycle.

I also investigate whether takeover defenses influence the positive effect of the scalability of intangible assets on the perceived permanence of earnings innovations. I find takeover defenses reinforce shareholders' perception of the increased permanence of earnings innovations with the use of intangible assets. This result is consistent with the argument that takeover defenses promote long-term stewardship and lower the cost of investments in firm-specific human capital that provides competitive advantages.

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Appendix A: Variable Definition and Measurement

Variables	Definition and measurement
Independent Variable	
CAR	Monthly stock return adjusted by the Fama-French three factor model return, cumulated over a 12-month period, ending three months after the end of the current fiscal year.
Key Dependent Variables	
DIFFEARN	First difference in annual earnings before interest and taxes (EBIT), scaled by the opening market value of equity.
ICI	The ratio of the stock of intangible capital to total assets at the end of fiscal year (t-2).
DICI1	The change in the stock of intangible capital from the end of fiscal year (t-2) to t, scaled by total assets at the end of fiscal year t.
DICI2	The percentage change in total assets from the end of fiscal year (t-2) to t multiplied by the stock of intangible capital at the end of fiscal year (t-2), scaled by total assets at the end of fiscal year t.
LTK	The indicator is set as 1 if the firm discloses the risk of loss of key personnel and failure to attract and retain qualified personnel, either in the current or previous fiscal year and 0 otherwise.
LEK	The indicator is set as 1 if the firm discloses the risk of inadequate protection of intellectual property rights in foreign jurisdictions, either in the current or previous fiscal year and 0 otherwise.
IG	The indicator is set as 1 if the firm is in the introduction or growth stages of life cycle and 0 otherwise.
MS	The indicator is set as 1 if the firm is in the mature or shake-out stages of life cycle and 0 otherwise.
NCW	The indicator is set as 1 if the firm is headquartered in a state with weak (or undecided) enforcement of non-compete agreements and 0 otherwise.
WL	The indicator is set as 1 if the firm discloses segment level financial reporting for a country placed on the USTR watch lists and 0 otherwise.

TD	The indicator is set as 1 if the firm uses a takeover defense (case 1. dual class share structure or unequal voting rights, case 2. supermajority voting provisions) and 0 otherwise.
Control Variables	
Size	The log of opening market value of equity.
Growth	(1) The ratio of market value of equity to book value of equity of the firm at the beginning of the current fiscal year and (2) the ratio of market value of the firm to the sum of total assets and intangible capital at the beginning of the current fiscal year.
Leverage	The ratio of the total of current portion of long-term debt and long-term debt to total assets at the beginning of the current fiscal year.
Risk	The standard deviation of monthly stock returns calculated over a 36-month period, ending three months after the beginning of the current fiscal year.
Persistence	IMA(1,1) persistence coefficient of earnings (the measure of earnings used is EBIT divided by the average of beginning and end of the year total assets) for firms with requisite earnings history.

Appendix B: Sample Excerpts from Disclosures

The Loss of Key Senior Management Personnel or the Failure to Hire and Retain Highly Skilled and Other Key Personnel Could Negatively Affect Our Business.

We depend on our senior management and other key personnel, particularly Jeffrey P. Bezos, our President, CEO, and Chairman. We do not have "key person" life insurance policies. We also rely on other highly skilled personnel. Competition for qualified personnel in the technology industry has historically been intense, particularly for software engineers, computer scientists, and other technical staff. The loss of any of our executive officers or other key employees or the inability to hire, train, retain, and manage qualified personnel, could this harm our business.

AMAZON.COM,INC., 10-K Filing (December 31, 2019)

If we cannot adequately protect our technology or other intellectual property in the United States and abroad, through patents, copyrights, trade secrets, trademarks and other measures, we may lose a competitive advantage and incur significant expenses.

We rely on a combination of protections provided by contracts, including confidentiality and nondisclosure agreements, copyrights, patents, trademarks and common law rights, such as trade secrets, to protect our intellectual property. However, we cannot assure you that we will be able to adequately protect our technology or other intellectual property from third-party infringement or from misappropriation in the United States and abroad. Any patent licensed by us or issued to us could be challenged, invalidated or circumvented or rights granted there under may not provide a competitive advantage to us.

Furthermore, patent applications that we file may not result in issuance of a patent or, if a patent is issued, the patent may not be issued in a form that is advantageous to us. Despite our efforts to protect our intellectual property rights, others may independently develop similar products, duplicate our products or design around our patents and other rights. In addition, it is difficult to monitor compliance with, and enforce, our intellectual property on a worldwide basis in a cost-effective manner. In jurisdictions where foreign laws provide less intellectual property protection than afforded in the United States and abroad, our technology or other intellectual property may be compromised, and our business would be materially adversely affected.

ADVANCED MICRO DEVICES INC., 10-K Filing (December 28, 2019)

If we are unable to attract or retain key personnel, it could have an adverse effect on our business, financial condition and results from operations.

In our industry, there is substantial competition for key personnel in the regions in which we operate, and we may face increased competition for such employees, particularly in emerging markets as the trend toward globalization continues. Our business depends to a significant extent on the continued service of senior management and other key personnel, the development of

additional management personnel and the hiring of new qualified employees. There can be no assurance that we will be successful in retaining and developing existing personnel or recruiting new personnel. The loss of one or more key employees, our ability to attract or develop additional qualified employees or any delay in hiring key personnel could have material adverse effects on our business, financial condition or results of operations.

BOSTON SCIENTIFIC CORPORATION, 10-K Filing (December 31, 2019)

FAILURE TO RETAIN AND RECRUIT KEY PERSONNEL WOULD HARM OUR ABILITY TO MEET KEY OBJECTIVES.

Our success has always depended in large part on our ability to attract and retain highly skilled technical, managerial, sales, and marketing personnel. Competition for these personnel is intense, especially in the Silicon Valley area of Northern California. Stock incentive plans are designed to reward employees for their long-term contributions and provide incentives for them to remain with us. Volatility or lack of positive performance in our stock price or equity incentive awards, or changes to our overall compensation program, including our stock incentive program, resulting from the management of share dilution and share-based compensation expense or otherwise, may also adversely affect our ability to retain key employees. As a result of one or more of these factors, we may increase our hiring in geographic areas outside the United States, which could subject us to additional geopolitical and exchange rate risk. The loss of services of any of our key personnel; the inability to retain and attract qualified personnel in the future; or delays in hiring required personnel, particularly engineering and sales personnel, could make it difficult to meet key objectives, such as timely and effective product introductions. In addition, companies in our industry whose employees accept positions with competitors frequently claim that competitors have engaged in improper hiring practices. We have received these claims in the past and may receive additional claims to this effect in the future.

CISCO SYSTEMS INC., 10-K Filing (July 27, 2019)

The enforcement and protection of our intellectual property rights may be expensive, could fail to prevent misappropriation or unauthorized use of our intellectual property rights, could result in the loss of our ability to enforce one or more patents, and could be adversely affected by changes in patent laws, by laws in certain foreign jurisdictions that may not effectively protect our intellectual property rights and by ineffective enforcement of laws in such jurisdictions.

We rely primarily on patent, copyright, trademark and trade secret laws, as well as nondisclosure and confidentiality agreements, international treaties and other methods, to protect our proprietary information, technologies and processes, including our patent portfolio. Policing unauthorized use of our products, technologies and proprietary information is difficult and time consuming. The steps we have taken have not always prevented, and we cannot be certain the steps we will take in the future will prevent, the misappropriation or unauthorized use of our proprietary information and technologies, particularly in foreign countries where the laws may not protect our proprietary intellectual property rights as fully or as readily as U.S. laws or where the enforcement of such laws may be lacking or ineffective.

QUALCOMM Incorporated, 10-K Filing (September 29, 2019)

If we are unable to attract and/or retain key employees and hire qualified personnel, our ability to compete could be harmed.

The loss of the services of any of our key employees could disrupt our operations, delay the development and introduction of our vehicles and services, and negatively impact our business, prospects and operating results. In particular, we are highly dependent on the services of Elon Musk, our Chief Executive Officer.

Tesla, Inc., 10-K Filing (December 31, 2019)

Our performance depends in part on our ability to enforce our intellectual property rights and to maintain freedom of operation.

We actively enforce and protect our own intellectual property rights. However, our efforts cannot prevent all misappropriation or improper use of our protected technology and information, including, for example, third parties' use of our patented or copyrighted technology, or our trade secrets in their products without the right to do so, or third parties' sale of counterfeit products bearing our trademark. The risk of unfair copying or cloning may impede our ability to sell our products. The laws of countries where we operate may not protect our intellectual property rights to the same extent as U.S. laws.

TEXAS INSTRUMENTS INCORPORATED, 10-K Filing (December 31, 2019)

Appendix C: Construction of Indicators of Risk of Loss of Knowledge

Risk of Loss of Tacit Knowledge

I parse sentences in the annual 10-K filings for the occurrence of words that reflect the disclosure of risks related to the loss of key members of staff and failure to attract and retain talent using Python scripts. I use the following keyword lists for the construction of the LTK indicator: (1) "loss of", "lose", "loses", "lost"; (2) "key"; (3) "person", "personnel", "employee(s)", "member(s)", "individual(s)", "professional(s)", "people", "staff", "talent", "advisor(s)", "consultant(s)", "engineer(s)", "programmer(s)", "developer(s)", "technical", "technology", "technological", "scientific", "scientist(s)", "research(er)", "medical", "designer(s)", "artist(s)", "worker(s)", "workforce", "leader(s)", "executive(s)", "officer(s)", "manager(s)", "management"; (4) "attract(ing)", "hire", "hiring", "recruit(ing)"; (5) "retain(ing)"; (6) "key", "best", "top", "qualified", "capable", "competent", "knowledge", "skill", "experience", "talent". First, I examine whether a sentence contains a word from each of the keyword lists 1, 2 and 3. Second, I examine whether a sentence contains a word from each of the keyword lists 3, 4, 5 and 6. If there is at least one sentence that satisfies the first condition and at least one sentence that satisfies the second condition, either in the annual 10-K filing for the current or previous fiscal year, the indicator LTK is set as 1 and 0 otherwise.

Risk of Loss of Explicit Knowledge

I parse sentences in the annual 10-K filings for the occurrence of words that reflect the disclosure of risks related to ineffective protection or enforcement of intellectual property rights in foreign jurisdictions. I examine whether a sentence contains a word from each of the following keyword lists: (1) "intellectual property", "proprietary information", "proprietary technology", "proprietary rights", "trade secrets"; (2) "protect(ion)", "enforce(ment)"; (3) "country", "countries", "jurisdiction"; (4) "not", "less", "loss", "fail", "inability", "unable", "unavailable", "reduce(d)", "repeal", "lack", "limit(ed)", "little", "undeveloped", "diminish(ed)", "narrow", "ineffective", "inadequate", "insufficient", "weak", "minimal", "difficult", "impossible", "preclude", "expensive", "costly", "risk", "change", "vary", "uncertain", "unpredictable", "violate", "violation". If there is at least one sentence that satisfies this condition, either in the annual 10-K filing for the current or previous fiscal year, the indicator of the risk of loss of explicit knowledge (LEK) is set as 1 and 0 otherwise.

Table 1: Descriptive Statistics for Firm-Years from 1970-2019

Panel A: Distributional Characteristics of Continuous Variables

Variable	N	Mean	P25	Median	P75	StdDev
CAR	120,180	-0.009	-0.280	-0.045	0.194	0.488
DIFFEARN	120,180	0.018	-0.024	0.010	0.049	0.165
ICI	120,180	0.392	0.111	0.288	0.527	0.400
DICI1	120,180	0.021	-0.002	0.013	0.053	0.097
DICI2	120,180	0.000	-0.020	0.004	0.051	0.205
Size	120,180	5.607	4.007	5.483	7.109	2.138
Leverage	120,180	0.221	0.064	0.200	0.337	0.180
Growth (1)	120,180	2.428	0.920	1.522	2.632	3.067
Growth (2)	120,180	1.182	0.724	0.974	1.318	0.813
Risk	120,180	0.134	0.085	0.118	0.163	0.070
Persistence	120,180	-0.227	-1.000	-0.169	0.207	0.592

All variables are defined in Appendix A.

Panel B: Correlation coefficients between variables used in the analysis of the effect of scalability of intangible assets on the earnings/return relation. P-values are in parentheses. Pearson correlations are above the diagonal, and Spearman correlations are below the diagonal.

	CAR	DIFFEARN	ICI	DICI1	DICI2	Size	Leverage	Growth (1)	Growth (2)	Risk	Persistence
CAR		0.274	0.016	0.005	0.083	-0.023	-0.026	-0.028	-0.039	-0.051	-0.002
		(0.000)	(0.000)	(0.068)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.426)
DIFFEARN	0.327		0.017	-0.061	-0.027	-0.077	0.048	-0.016	-0.050	0.061	-0.040
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICI	-0.013	0.002		-0.159	-0.027	-0.234	-0.248	0.216	-0.069	0.315	-0.022
	(0.000)	(0.593)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DICI1	0.008	-0.020	0.192		0.405	0.168	-0.056	0.107	0.205	-0.051	0.041
	(0.006)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DICI2	0.098	0.095	0.133	0.385		0.180	-0.036	-0.081	0.236	-0.081	0.028
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.040	-0.052	-0.228	0.154	0.205		-0.001	0.205	0.342	-0.428	0.155
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.655)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	-0.029	0.057	-0.251	-0.088	-0.107	0.022		0.000	-0.154	0.011	-0.022
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.931)	(0.000)	(0.000)	(0.000)
Growth (1)	-0.024	-0.046	0.153	0.257	0.332	0.417	-0.118		0.705	0.026	0.044
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Growth (2)	-0.016	-0.070	-0.243	0.240	0.365	0.518	-0.095	0.833		0.126	0.022
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
Risk	-0.123	0.037	0.268	0.044	-0.043	-0.467	0.001	-0.141	-0.020		-0.095
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.720)	(0.000)	(0.000)		(0.000)
Persistence	0.006	-0.029	0.002	0.052	0.042	0.157	-0.023	0.075	0.063	-0.088	
	(0.034)	(0.000)	(0.474)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Table 2: Distributional Characteristics of the Components of Intangible Intensity by Industry

Panel A: Full Sample of Firm-Years (1970-2019)

Full Sample (1970-2019)		ICI		DICI1		DICI2	
Fama-French Industry Classification	N	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1. Consumer NonDurables: Food, Tobacco, Textiles, Apparel, Leather, Toys	10,338	0.404	0.299	0.016	0.076	-0.001	0.157
2. Consumer Durables: Cars, TVs, Furniture, Household Appliances	4,504	0.373	0.252	0.020	0.074	0.000	0.160
3. Manufacturing: Machinery, Trucks, Planes, Office Furniture, Paper, Printing	20,675	0.324	0.255	0.014	0.063	0.002	0.138
4. Energy: Oil, Gas, and Coal Extraction and Products	5,473	0.102	0.124	0.002	0.039	-0.002	0.087
5. Chemicals and Allied Products	4,014	0.445	0.341	0.026	0.082	0.013	0.153
6. Business Equipment: Computers, Software, and Electronic Equipment	19,981	0.657	0.491	0.036	0.143	-0.014	0.318
7. Telephone, and Television Transmission	1,873	0.231	0.346	0.012	0.078	0.005	0.165
8. Utilities	391	0.047	0.056	0.001	0.020	0.000	0.030
9. Wholesale, Retail, and Some Services (Laundries, Repair shops)	14,732	0.512	0.370	0.033	0.094	0.006	0.193
10. Health Care, Medical Equipment, and Drugs	8,949	0.638	0.533	0.047	0.155	0.025	0.325
11. Money, Finance	13,144	0.083	0.207	0.000	0.050	0.000	0.102
12. Others	16,106	0.263	0.314	0.011	0.080	-0.005	0.168
13. All Industries	120,180	0.392	0.400	0.021	0.097	0.000	0.205

Panel B: Sub Sample of Firm-Years (1998-2019)

Sub-Sample (1998-2019)		ICI		DICI1		DICI2	
Fama-French Industry Classification	N	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1. Consumer NonDurables: Food, Tobacco, Textiles, Apparel, Leather, Toys	3,234	0.435	0.350	0.016	0.080	0.004	0.178
2. Consumer Durables: Cars, TVs, Furniture, Household Appliances	1,613	0.417	0.316	0.023	0.080	0.000	0.190
3. Manufacturing: Machinery, Trucks, Planes, Office Furniture, Paper, Printing	6,676	0.340	0.288	0.012	0.063	0.002	0.148
4. Energy: Oil, Gas, and Coal Extraction and Products	2,120	0.079	0.122	0.006	0.030	0.004	0.081
5. Chemicals and Allied Products	1,438	0.392	0.339	0.015	0.072	0.009	0.156
6. Business Equipment: Computers, Software, and Electronic Equipment	10,582	0.701	0.531	0.029	0.146	-0.022	0.342
7. Telephone, and Television Transmission	1,011	0.250	0.367	0.011	0.080	-0.005	0.177
8. Utilities	180	0.044	0.063	0.000	0.017	0.001	0.026
9. Wholesale, Retail, and Some Services (Laundries, Repair shops)	6,181	0.484	0.362	0.036	0.079	0.006	0.175
10. Health Care, Medical Equipment, and Drugs	5,315	0.668	0.567	0.048	0.161	0.025	0.345
11. Money, Finance	9,495	0.061	0.173	0.002	0.036	0.002	0.077
12. Others	6,388	0.263	0.323	0.015	0.075	-0.009	0.173
13. All Industries	54,233	0.397	0.446	0.020	0.099	-0.001	0.223

Table 3: Distributional Characteristics of Indicators

Panel A: Percentage of Firm-Years for which the Indicator is 1 by Industry

Fama-French Industry Classification	N	LTK	LEK	IG	NCW	MS	N	WL
1. Consumer NonDurables: Food, Tobacco, Textiles, Apparel, Leather, Toys	3,234	22.45%	17.29%	28.42%	14.66%	68.65%	962	26.61%
2. Consumer Durables: Cars, TVs, Furniture, Household Appliances	1,613	25.23%	20.89%	31.31%	5.46%	64.35%	576	38.19%
3. Manufacturing: Machinery, Trucks, Planes, Office Furniture, Paper, Printing	6,676	27.55%	17.26%	31.10%	7.40%	65.17%	2,136	38.90%
4. Energy: Oil, Gas, and Coal Extraction and Products	2,120	27.74%	2.03%	50.90%	11.23%	46.93%	867	23.30%
5. Chemicals and Allied Products	1,438	22.95%	21.84%	26.98%	8.48%	69.61%	530	38.68%
6. Business Equipment: Computers, Software, and Electronic Equipment	10,582	56.88%	51.96%	39.29%	32.66%	51.77%	3,543	32.40%
7. Telephone, and Television Transmission	1,011	32.44%	16.91%	30.76%	13.06%	63.90%	441	9.75%
8. Utilities	180	16.67%	0.00%	67.22%	44.44%	31.11%	76	14.47%
9. Wholesale, Retail, and Some Services (Laundries, Repair shops)	6,181	28.68%	8.04%	31.90%	11.97%	65.23%	1,990	20.05%
10. Health Care, Medical Equipment, and Drugs	5,315	47.11%	33.72%	43.46%	25.32%	42.03%	1,946	14.90%
11. Money, Finance	9,495	35.92%	2.51%	47.55%	12.03%	34.77%	4,379	2.53%
12. Others	6,388	34.86%	10.25%	35.60%	11.35%	59.11%	2,342	20.96%
13. All Industries	54,233	37.21%	20.76%	38.04%	37.27%	49.86%	19,788	21.26%

Panel B: 2x2 Frequency Distribution of Indicators

Loss of Tacit Knowledge	Introduction or Growth Stage of Firm Life Cycle		
	IG		
LTK	0	1	Total
0	21,904	12,147	34,051
1	11,701	8,481	20,182
Total	33,605	20,628	54,233

	Weak Enforcement of Non-Compete Agreements		
	NCW		
LTK	0	1	Total
0	29,820	4,231	34,051
1	15,376	4,806	20,182
Total	45,196	9,037	54,233

Loss of Explicit Knowledge	Mature or Shake-out Stage of Firm Life Cycle		
	MS		
LEK	0	1	Total
0	19,741	23,236	42,977
1	5,364	5,892	11,256
Total	25,105	29,128	54,233

	Business Interests in Countries on USTR Watch Lists		
	WL		
LEK	0	1	Total
0	11,867	2,609	14,476
1	3,714	1,598	5,312
Total	15,581	4,207	19,788

The indicator LTK identifies firm-years reporting the risk of loss of tacit knowledge embodied in key personnel, LEK indicates firm-years disclosing the risk of loss of explicit knowledge in foreign jurisdictions, IG indicates firm-years in the introduction or growth stages of life cycle, NCW indicates firm-years headquartered in states with weak enforcement of non-compete agreements, MS indicates firm-years in the mature or shake-out stages of life cycle, and WL indicates firm-years with significant business interests in countries placed on watch lists by the USTR. All variables are defined in Appendix A.

Table 4: The Effect of Scalability of Intangible Assets on the ERC

Model 1 tests whether the ERC is an increasing function of the stock of intangible capital (ICI), new investments in intangibles (DICI1), and the scaling of existing stock of intangible capital over newly purchased assets (DICI2).

$$CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it;}$$
$$\beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it}. \quad \text{(Model 1)}$$

Panel A: Proxy for growth opportunities is Growth (1) (or the ratio of opening market value of equity to book value of equity of the firm)

	Model 1 All	Model 1 1970-1979	Model 1 1980-1989	Model 1 1990-1999	Model 1 2000-2009	Model 1 2010-2019
DIFFEARN	1.078	1.202	0.743	1.281	1.469	1.038
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*ICI	0.434	0.139	0.527	0.372	0.478	0.403
	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*DICI1	0.864	1.090	1.384	0.448	0.441	1.109
	(0.000)	(0.000)	(0.000)	(0.006)	(0.004)	(0.000)
DIFFEARN*DICI2	0.721	0.861	0.602	0.736	0.781	0.841
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*Size	0.036	-0.002	0.039	0.053	0.021	0.065
	(0.000)	(0.842)	(0.000)	(0.000)	(0.079)	(0.000)
DIFFEARN*Leverage	-0.633	-0.605	-0.611	-0.727	-0.626	-0.339
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
DIFFEARN*Growth	0.020	0.019	0.010	0.003	0.027	0.023
	(0.000)	(0.035)	(0.136)	(0.623)	(0.001)	(0.004)
DIFFEARN*Risk	-1.442	-1.768	0.157	-1.437	-2.608	-2.519
	(0.000)	(0.000)	(0.541)	(0.000)	(0.000)	(0.000)
DIFFEARN*Persistence	0.118	0.077	0.144	0.186	0.117	0.077
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)
Industry x Year FE	YES	YES	YES	YES	YES	YES
R-Squared	0.133	0.197	0.162	0.128	0.123	0.104
Observations	120,180	17,547	23,268	26,317	29,851	23,197

All variables are defined in Appendix A, and p-values are in parentheses.

Panel B: Proxy for growth opportunities is Growth (2) (or the ratio of opening market value of the firm to the sum of total assets and intangible capital)

	Model 1 All	Model 1 1970-1979	Model 1 1980-1989	Model 1 1990-1999	Model 1 2000-2009	Model 1 2010-2019
DIFFEARN	0.846	0.845	0.396	1.074	1.318	0.955
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*ICI	0.541	0.344	0.702	0.472	0.552	0.446
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*DICI1	0.878	1.087	1.273	0.483	0.503	1.102
	(0.000)	(0.000)	(0.000)	(0.003)	(0.001)	(0.000)
DIFFEARN*DICI2	0.631	0.716	0.480	0.628	0.731	0.812
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DIFFEARN*Size	0.012	-0.037	0.000	0.016	0.010	0.064
	(0.026)	(0.001)	(0.973)	(0.286)	(0.417)	(0.000)
DIFFEARN*Leverage	-0.633	-0.861	-0.741	-0.742	-0.588	-0.295
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.010)
DIFFEARN*Growth	0.463	0.875	0.827	0.472	0.246	0.105
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.082)
DIFFEARN*Risk	-1.667	-2.039	-0.682	-1.796	-2.618	-2.503
	(0.000)	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)
DIFFEARN*Persistence	0.123	0.080	0.148	0.191	0.121	0.075
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.030)
Industry x Year FE	YES	YES	YES	YES	YES	YES
R-Squared	0.135	0.202	0.167	0.130	0.123	0.104
Observaions	120,180	17,547	23,268	26,317	29,851	23,197

All variables are defined in Appendix A, and p-values are in parentheses.

Table 5: Risk of Loss of Tacit Knowledge and the Effect of Scalability of Intangible Assets

Model 2 tests whether the risk of loss of tacit knowledge (LTK) attenuates the positive effect of the scalability of intangible assets on the ERC.

$$
\begin{aligned}
CAR_{it} &= \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it;} \\
\beta &= \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \\
&\quad \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it;} \\
\beta_0 &= \eta_0 + \eta_1 LTK_{it;} \\
\beta_1 &= \gamma_0 + \gamma_1 LTK_{it;} \\
\beta_2 &= \mu_0 + \mu_1 LTK_{it;} \\
\beta_3 &= \rho_0 + \rho_1 LTK_{it.}
\end{aligned}
\qquad \text{(Model 2)}
$$

	Model 2
DIFFEARN	1.091
	(0.000)
DIFFEARN*LTK	0.034
	(0.410)
DIFFEARN*ICI	0.685
	(0.000)
DIFFEARN*ICI*LTK	-0.272
	(0.000)
DIFFEARN*DICI1	0.782
	(0.000)
DIFFEARN*DICI1*LTK	0.246
	(0.320)
DIFFEARN*DICI2	0.903
	(0.000)
DIFFEARN*DICI2*LTK	-0.291
	(0.002)
Control Variables	YES
Industry x Year FE	YES
R-Squared	0.118
Observations	54,233

All variables are defined in Appendix A, and p-values are in parentheses.

Table 6: Firm Life Cycle Stages, Enforcement of Non-Compete Agreements, and the Effect of Risk of Loss of Tacit Knowledge

Model 3 tests whether the state of being in the introduction or growth stages of firm life cycle (IG) exacerbates the attenuating effect of the risk of loss of tacit knowledge (LTK) on the positive effect of intangible assets on the ERC.

Model 4 tests whether the firm headquarters being located in a state with weak enforcement of non-compete agreements (NCW) exacerbates the attenuating effect of the risk of loss of tacit knowledge (LTK) on the positive effect of intangible assets on the ERC.

$$CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it};$$
$$\beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};$$

$$\beta_0 = \eta_0 + \eta_1 LTK_{it} + \eta_2 IG_{it} + \eta_3 LTK_{it} * IG_{it};$$
$$\beta_1 = \gamma_0 + \gamma_1 LTK_{it} + \gamma_2 IG_{it} + \gamma_3 LTK_{it} * IG_{it};$$
$$\beta_2 = \mu_0 + \mu_1 LTK_{it} + \mu_2 IG_{it} + \mu_3 LTK_{it} * IG_{it};$$
$$\beta_3 = \rho_0 + \rho_1 LTK_{it} + \rho_2 IG_{it} + \rho_3 LTK_{it} * IG_{it}$$

(Model 3; Intensifier = IG)

$$\beta_0 = \eta_0 + \eta_1 LTK_{it} + \eta_2 NCW_{it} + \eta_3 LTK_{it} * NCW_{it};$$
$$\beta_1 = \gamma_0 + \gamma_1 LTK_{it} + \gamma_2 NCW_{it} + \gamma_3 LTK_{it} * NCW_{it};$$
$$\beta_2 = \mu_0 + \mu_1 LTK_{it} + \mu_2 NCW_{it} + \mu_3 LTK_{it} * NCW_{it};$$
$$\beta_3 = \rho_0 + \rho_1 LTK_{it} + \rho_2 NCW_{it} + \rho_3 LTK_{it} * NCW_{it}$$

(Model 4; Intensifier = NCW)

All variables are defined in Appendix A, and p-values are in parentheses.

	Model 2	Intensifier Introduction or Growth Stage	Intensifier Weak Enforcement of Non-Competes
DIFFEARN	1.091	1.081	1.074
	(0.000)	(0.000)	(0.000)
DIFFEARN*LTK	0.034	0.008	0.008
	(0.410)	(0.873)	(0.863)
DIFFEARN*Intensifier		-0.004	0.120
		(0.944)	(0.103)
DIFFEARN*LTK*Intensifier		0.062	0.170
		(0.481)	(0.158)
DIFFEARN*ICI	0.685	0.757	0.691
	(0.000)	(0.000)	(0.000)
DIFFEARN*ICI*LTK	-0.272	-0.166	-0.191
	(0.000)	(0.059)	(0.009)
DIFFEARN*ICI*Intensifier		-0.109	-0.051
		(0.227)	(0.650)
DIFFEARN*ICI*LTK*Intensifier		-0.217	-0.310
		(0.091)	(0.042)
DIFFEARN*DICI1	0.782	0.501	0.933
	(0.000)	(0.017)	(0.000)
DIFFEARN*DICI1*LTK	0.246	0.512	0.164
	(0.320)	(0.096)	(0.578)
DIFFEARN*DICI1*Intensifier		0.872	-0.815
		(0.018)	(0.061)
DIFFEARN*DICI1*LTK*Intensifier		-0.806	0.457
		(0.120)	(0.428)
DIFFEARN*DICI2	0.903	1.136	0.842
	(0.000)	(0.000)	(0.000)
DIFFEARN*DICI2*LTK	-0.291	-0.350	-0.191
	(0.002)	(0.005)	(0.086)
DIFFEARN*DICI2*Intensifier		-0.669	0.331
		(0.000)	(0.052)
DIFFEARN*DICI2*LTK*Intensifier		0.402	-0.407
		(0.046)	(0.062)
Control Variabes	YES	YES	YES
Industry x Year FE	YES	YES	YES
R-Squared	0.118	0.119	0.119
Observations	54,233	54,233	54,233

Table 7: Risk of Loss of Explicit Knowledge and the Effect of Scalability of Intangible Assets

Model 5 tests whether the risk of loss of explicit knowledge (LEK) attenuates the positive effect of the scalability of intangible assets on the ERC.

$$
\begin{aligned}
CAR_{it} &= \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it};\\
\beta &= \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} +\\
&\quad \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};\\
\beta_0 &= \eta_0 + \eta_1 LEK_{it};\\
\beta_1 &= \gamma_0 + \gamma_1 LEK_{it};\\
\beta_2 &= \mu_0 + \mu_1 LEK_{it};\\
\beta_3 &= \rho_0 + \rho_1 LEK_{it}.
\end{aligned}
\qquad \text{(Model 5)}
$$

	Model 5
DIFFEARN	1.089
	(0.000)
DIFFEARN*LEK	0.324
	(0.000)
DIFFEARN*ICI	0.661
	(0.000)
DIFFEARN*ICI*LEK	-0.482
	(0.000)
DIFFEARN*DICI1	0.880
	(0.000)
DIFFEARN*DICI1*LEK	-0.161
	(0.549)
DIFFEARN*DICI2	0.905
	(0.000)
DIFFEARN*DICI2*LEK	-0.356
	(0.000)
Control Variables	YES
Industry x Year FE	YES
R-Squared	0.119
Observations	54,233

All variables are as defined in Appendix A, p-values are in parentheses.

Table 8: Firm Life Cycle Stages, Business Interests in USTR Watch List Countries, and the Effect of Risk of Loss of Explicit Knowledge

Model 6 tests whether the state of being in the mature or shake-out stages of firm life cycle (MS) exacerbates the attenuating effect of the risk of loss of explicit knowledge (LEK) on the positive effect of intangible assets on the ERC.

Model 7 tests whether having significant business interests in countries placed on the USTR watch lists (WL) exacerbate the attenuating effect of the risk of loss of explicit knowledge (LEK) on the positive effect of intangible assets on the ERC.

$$CAR_{it} = \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it};$$
$$\beta = \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};$$

$$\beta_0 = \eta_0 + \eta_1 LEK_{it} + \eta_2 MS_{it} + \eta_3 LEK_{it} * MS_{it};$$
$$\beta_1 = \gamma_0 + \gamma_1 LEK_{it} + \gamma_2 MS_{it} + \gamma_3 LEK_{it} * MS_{it};$$
$$\beta_2 = \mu_0 + \mu_1 LEK_{it} + \mu_2 MS_{it} + \mu_3 LEK_{it} * MS_{it};$$
$$\beta_3 = \rho_0 + \rho_1 LEK_{it} + \rho_2 MS_{it} + \rho_3 LEK_{it} * MS_{it}$$

(Models 6; Intensifier = MS)

$$\beta_0 = \eta_0 + \eta_1 LEK_{it} + \eta_2 WL_{it} + \eta_3 LEK_{it} * WL_{it};$$
$$\beta_1 = \gamma_0 + \gamma_1 LEK_{it} + \gamma_2 WL_{it} + \gamma_3 LEK_{it} * WL_{it};$$
$$\beta_2 = \mu_0 + \mu_1 LEK_{it} + \mu_2 WL_{it} + \mu_3 LEK_{it} * WL_{it};$$
$$\beta_3 = \rho_0 + \rho_1 LEK_{it} + \rho_2 WL_{it} + \rho_3 LEK_{it} * WL_{it}$$

(Models 7; Intensifier = WL)

All variables are defined in Appendix A, and p-values are in parentheses.

	Model 2	Intensifier Mature or Shake-out Stage	Intensifier USTR Watch List Countries
DIFFEARN	1.089	1.007	1.121
	(0.000)	(0.000)	(0.000)
DIFFEARN*LEK	0.324	0.040	0.330
	(0.000)	(0.686)	(0.010)
DIFFEARN*Intensifier		0.029	-0.146
		(0.487)	(0.159)
DIFFEARN*LEK*Intensifier		0.575	-0.043
		(0.000)	(0.847)
DIFFEARN*ICI	0.661	0.478	0.269
	(0.000)	(0.000)	(0.000)
DIFFEARN*ICI*LEK	-0.482	-0.241	-0.244
	(0.000)	(0.011)	(0.054)
DIFFEARN*ICI*Intensifier		0.537	1.460
		(0.000)	(0.000)
DIFFEARN*ICI*LEK*Intensifier		-0.406	-0.727
		(0.017)	(0.038)
DIFFEARN*DICI1	0.880	0.591	0.708
	(0.000)	(0.003)	(0.031)
DIFFEARN*DICI1*LEK	-0.161	0.357	0.856
	(0.549)	(0.270)	(0.099)
DIFFEARN*DICI1*Intensifier		0.545	3.306
		(0.078)	(0.014)
DIFFEARN*DICI1*LEK*Intensifier		-0.793	-5.060
		(0.192)	(0.002)
DIFFEARN*DICI2	0.905	0.914	0.752
	(0.000)	(0.000)	(0.000)
DIFFEARN*DICI2*LEK	-0.356	-0.480	-0.051
	(0.000)	(0.000)	(0.779)
DIFFEARN*DICI2*Intensifier		0.053	0.859
		(0.672)	(0.059)
DIFFEARN*DICI2*LEK*Intensifier		0.220	0.141
		(0.324)	(0.830)
Control Variabes	YES	YES	YES
Industry x Year FE	YES	YES	YES
R-Squared	0.118	0.121	0.111
Observations	54,233	54,233	19,788

Table 9: Takeover Defenses and the Effect of Scalability of Intangible Assets

Model 8 tests whether the adoption of takeover defenses (TD) affects the positive effect of the scalability of intangible assets on the ERC. In the first column, the indicator TD is 1 when the firm has dual class share structures or unequal voting rights and 0 otherwise. In the second column, the indicator TD is 1 when the firm has supermajority voting provisions and 0 otherwise.

$$
\begin{aligned}
CAR_{it} &= \alpha + \beta DIFFEARN_{it} + \Theta(Industry * Year)FE + \varepsilon_{it};\\
\beta &= \beta_0 + \beta_1 ICI_{it} + \beta_2 DICI1_{it} + \beta_3 DICI2_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} +\\
&\quad \beta_6 Leverage_{it} + \beta_7 Risk_{it} + \beta_8 Persistence_{it};\\
\beta_0 &= \eta_0 + \eta_1 TD_{it};\\
\beta_1 &= \gamma_0 + \gamma_1 TD_{it};\\
\beta_2 &= \mu_0 + \mu_1 TD_{it};\\
\beta_3 &= \rho_0 + \rho_1 TD_{it}.
\end{aligned}
\qquad \text{(Model 8)}
$$

	TD = Dual Class Shares	TD = Super Majority Provisions
DIFFEARN	3.018	3.158
	(0.000)	(0.000)
DIFFEARN*TD	-0.485	-0.370
	(0.009)	(0.000)
DIFFEARN*ICI	1.363	1.216
	(0.000)	(0.000)
DIFFEARN*ICI*TD	2.159	1.297
	(0.000)	(0.000)
DIFFEARN*DICI1	0.800	0.963
	(0.155)	(0.094)
DIFFEARN*DICI1*TD	3.835	1.534
	(0.091)	(0.392)
DIFFEARN*DICI2	1.689	1.593
	(0.000)	(0.000)
DIFFEARN*DICI2*TD	2.046	1.601
	(0.062)	(0.019)
Control Variables	YES	YES
Industry x Year FE	YES	YES
R-Squared	0.140	0.140
Observations	17,956	17,956

All variables are defined in Appendix A, and p-values are in parentheses.