HOW KNOWLEDGE SCALING RESHAPES STRATEGIC HUMAN CAPITAL MANAGEMENT: EVIDENCE FROM ACQUISITIONS IN PRIVATE HIGHER EDUCATION

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Abstract
This paper addresses how knowledge scaling–the simultaneous deployment of the same knowledge resource across multiple organizational units–reshapes human capital management. Specifically, we examine acquisitions as sharp opportunities for organizations to scale knowledge and to reconfigure resources. The main argument in this paper is that knowledge scaling may create incentives for organizations to specialize workers on tasks that complement the knowledge being scaled while also weakening the worker-organization relationship when if such tasks rely less on worker-level knowledge that is less specific to the worker (e.g. tacit knowledge and experience). We articulate and find empirical support for these ideas in the context of private post-secondary education in Brazil, where educational groups engaged in a wave of acquisitions between 2006 and 2014 and scaled standardized courseware, pedagogical practices, and managerial processes to target units. Empirically, we combine in-depth interviews to econometric analyses using a unique dataset with information about characteristics of universities, faculty labor contracts, and acquisitions in the Brazilian private higher education market. Our results show that beyond performance gains, knowledge scaling increased the specialization of faculty work arrangements around teaching and led to a sustained increase in turnover rate. This paper contributes to the literatures on resource reconfiguration and on the multi-level nature of strategic human capital by advancing how a firm-level strategy to scale knowledge resources reshapes the nature of how organizations deploy workers as valuable resources.

Keywords: resource reconfiguration, strategic human capital, knowledge scaling, acquisitions, education

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1. INTRODUCTION

Examining the performance and organizational implications of how organizations strategically deploy resources is a foundational objective of strategic management research (Folta, Helfat, & Karim, 2016; Karim & Capron, 2016; Penrose, 1959; Wang, He, & Mahoney, 2009). In particular, the digital revolution and the rise of the knowledge-based economy has heightened the need to understand how "resource scaling" – a strategy characterized by the simultaneous deployment of the same resource across distinct operational units and/or to multiple ends – reshapes how firms do and organize business (Brynjolfsson & McAfee, 2014; Giustiziero, Somaya, & Wu, 2020). Knowledge is a strategic resource that is particularly prone to scaling as organizations can deploy the same knowledge at multiple locations, at the same time, and at a low cost (Anand, Kim, & Lu, 2016; Levinthal & Wu, 2010; Zhao & Anand, 2009). Instances of knowledge scaling within firms are the dissemination of common systems of managerial practices (Capron, Dussauge, & Mitchell, 1998; Lawrence, 2020), the replication of templates in chain firms (Jensen & Szulanski, 2007; Jonsson & Foss, 2011), and even the use of virtual learning to upskill thousands of workers (Fuller, 2018). Furthermore, leveraging the scaling potential of knowledge may imply reshaping how organizations manage other resources that become either more or less valuable in the presence of the knowledge being scaled (Anand et al., 2016).

However, the relationship between knowledge scaling and the deployment of other organizational resources can be often elusive as organizations may continuously adapt their operations to knowledge inflows and even be redesigned to facilitate knowledge creation. Some contexts, nonetheless, provide sharp events where organizations scale a stock of valuable knowledge and reshape existing operations accordingly. One such context is that of horizontal acquisitions (Capron et al., 1998; Capron & Guillén, 2009; Karim, 2006). Following an acquisition, the acquiring firm has the opportunity to scale its core capabilities, processes, and stock of knowledge resources to the acquired firm while also reshaping which and how they deploy existing resources (Capron et al., 1998; Karim & Mitchell, 2004). Using the context of acquisitions, this paper partially sheds light on the relationship between knowledge scaling and

other strategic resources. Specifically, we address how knowledge scaling following horizontal acquisitions reconfigures a key interrelated resource: strategic human capital (Coff & Kryscynski, 2011; Wright, Coff, & Moliterno, 2014).

A growing literature at the intersection of corporate strategy and strategic human capital has examined how, post-acquisition, organizations engage in layoffs, hiring, or even worker mobility between target and acquiring firms (Bodner et al., 2019; Capron & Guillén, 2009; Kapoor & Lim, 2007; Kim, 2020a; Paruchuri, Nerkar, & Hambrick, 2006). An instance that is less explored by the existing literature is how knowledge scaling following an acquisition affects the value of worker-level knowledge and skills as valuable organizational resources (Coff & Kryscynski, 2011; Wright et al., 2014) and incentivizes organizations to redefine work arrangements and their relationships with workers. The main argument in this paper is that beyond hiring, layoff, and mobility, knowledge scaling may reshape strategic human capital management by incentivizing organizations to specialize work arrangements and to weaken their relationship with workers. We advance that these effects occur when scaling knowledge increases the relative value of deploying workers to tasks that do not rely on worker-level knowledge and skills that are worker-specific (e.g. worker's tacit knowledge and experience). When knowledge scaling incentivizes organizations to specialize work arrangements on such tasks, organizations become less dependent on the human capital from a particular worker even if the total return to deploying human capital resources increases. As a result, the relationship between worker and organizations will weaken.

We articulate and test hypotheses reflecting these ideas in a context where both knowledge and human capital resources are consequential to organizational performance: private higher education. Namely, we focus on the Brazilian private post-secondary education sector. This is a suitable setting for our purposes for three reasons. First, in the Brazilian private higher education market, educational groups operate multiple establishments and their business models focus on centrally designing and simultaneously deploying knowledge resources under the form of digital courseware, common pedagogical methods, and systems of managerial practices across educational units. These educational groups also co-exist and compete with institutions that do not

engage in knowledge scaling. Second, higher education institutions employ faculty to conduct a series of tasks, each of which require different types of worker-level knowledge and skills and whose value may vary in business models relying on knowledge scaling. Examples of such tasks are course development, teaching, and research. Third, a wave of acquisitions by educational groups enables us to observe the same establishment before and after being exposed to knowledge scaling strategies. Furthermore, because there are changes in ownership that are unrelated to educational groups, the setting enables us to compare acquisitions coupled with knowledge scaling to those without knowledge scaling.

Empirically, we benefit from a unique 2004-2017 panel dataset that joins administrative panel data on all universities in Brazil, a large restricted panel dataset with information about all formal labor contracts in the country, and a hand-collected dataset on all acquisitions in the Brazilian private higher education sector between 2006 and 2014. We combine econometric evidence from panel data event-study analyses with evidence drawn from in-depth interviews. Our results support that acquisitions by groups that engage in knowledge scaling increase the performance of target units in terms of scale of service provision without harming educational quality. Furthermore, our results support that knowledge scaling simultaneously increased the value of a subset of some while reducing the organizational value of other subset of other worker-level attributes. These changes led to the specialization of work arrangements around teaching, a task that utilizes worker-level attributes whose value creation and capture potential are complemented by the knowledge being scaled. Knowledge scaling also led to a sustained increase in turnover, reflecting weaker organization-worker relationships.

This paper's main contribution is to extend the resource reconfiguration literature (Dickler & Folta, 2020; Karim & Capron, 2016; Stadler, Helfat, & Verona, 2021) and the literature on the post-acquisition deployment of human capital resources (Bodner et al., 2019; Capron & Guillén, 2009; Kapoor & Lim, 2007; Kim, 2020a; Paruchuri et al., 2006) by examining how knowledge scaling may affect the nature of work arrangements following an acquisition. Furthermore, this paper advances the literature on the micro-foundations of strategic human capital (Coff &

Kryscynski, 2011; Wright et al., 2014) by connecting knowledge scaling as a firm-level strategy to changes in the value and management of workers as strategic organizational resources. This paper also addresses the call for research on private firms operating in public-oriented sectors such as healthcare and education (Eaton, Howell, & Yannelis, 2020; Eliason, Heebsh, McDevitt, & Roberts, 2020; Gandhi, Song, & Upadrashta, 2020; Mahoney, McGahan, & Pitelis, 2009; Mawdsley & Somaya, 2016). We show that knowledge scaling enables private enterprises to cater to a larger demand and even to increase the diversity of services provided without harming quality. However, such performance gain may require a larger debate about the trade-offs in terms of the effects of knowledge scaling on stakeholders such as workers and service providers.

2. THEORY AND HYPOTHESES DEVELOPMENT

2.1 Background: Resource Reconfiguration and Knowledge Scaling

Resource-based and dynamic capabilities-based theories in strategic management suggest that an organization's growth and sustained competitive advantage depend not only on the access to distinct resources (Barney, 1991; Mahoney & Pandian, 1992; Wernerfelt, 1984), but also on the reconfiguration of such resources over time (Chandler, 1990; Folta et al., 2016; Karim & Capron, 2016; Penrose, 1959; Teece, Pisano, & Shuen, 1997). Resource reconfiguration entails decisions about the addition, redeployment, recombination, and divesting of resources and business units in order to align the synchronous allocation of resources across multiple ends (Anand et al., 2016; Chandler, 1990; Montgomery & Wernerfelt, 1988) or to facilitate future withdrawing and reallocation of resources (Dickler & Folta, 2020; Folta et al., 2016; Helfat & Eisenhardt, 2004; Karim & Capron, 2016; Sakhartov & Folta, 2014).

A subset of the resource reconfiguration literature proposes that one strategy that enables multi-unit and/or multi-business organizations to achieve superior performance is resource scaling - the sharing and simultaneous use of resources across distinct operational and business units (Giustiziero et al., 2020; Levinthal & Wu, 2010; Wu, 2013). Resource scaling is a strategy that should be considered, however, only when resources are both fungible and scale-free. A fungible

resource is a resource which retains its value when moved to an alternative use, with a completely fungible resource holding the same value regardless of the business, market, or organizational unit where it is utilized (Levinthal & Wu, 2010). A scale-free resource maintains its productive value as the sheer magnitude of its use increases, i.e. scale-free resources are not (or at least minimally) subject to capacity constraints (Anand et al., 2016; Giustiziero et al., 2020; Levinthal & Wu, 2010; Wu, 2013). While organizations must *allocate* resources non-scale-free resources across a single or few competing ends, resources that are scale-free enable can be shared across multiple units or businesses. As a result, the objective of resource scaling is to leverage economies of scale and economies of scope out of resources which can simultaneously produce economic value across multiple operational units, markets, or businesses (Anand et al., 2016).

Knowledge resources – resources imbued with information that describes what something is and the know-how about how to perform activities – are one type of resource which is particularly suitable for scaling (Argote, Lee, & Park, 2020; Kogut & Zander, 1992; Levinthal & Wu, 2010; Stadler et al., 2021; Teece et al., 1997; Winter & Szulanski, 2001; Zhao & Anand, 2009). Indeed, much of the recognition of knowledge resources as a strategic asset rests on its potential to be deployed and to create value at multiple locations at the same time and at a low cost (Levinthal & Wu, 2010). Due to its information-like nature, knowledge is not subject to capacity constraints and its use at one establishment does not preclude the simultaneous use of the same knowledge at another establishment (Levinthal & Wu, 2010; Winter & Szulanski, 2001). Moreover, while some knowledge resources have their value associated to specific settings (e.g. knowledge that is specific to a local market, such as local consumer preferences), a plethora of valuable knowledge resources are fungible, such as know-how about general-purpose technologies (Gambardella & McGahan, 2010), professional management practices (Bloom, Genakos, Sadun, & Van Reenen, 2012; Capron et al., 1998) and activity templates (Chliova & Ringov, 2017; Jensen & Szulanski, 2007; Lawrence, 2020). Indeed, an extensive body of research has provided examples of how knowledge scaling enables organizations to achieve superior performance, such as IKEA's replication of a common store-design worldwide (Jensen & Szulanski, 2007; Jonsson & Foss,

2011), the dissemination of best-practices in retail and chain organizations (Lawrence, 2020), and the scaling of planning and performance management techniques within educational system (Rosa, 2015).

Beyond its performance implications, knowledge scaling may also entail further resource reconfiguration of resources that are either complemented, replaced, or even indirectly affected by knowledge scaling (Anand & Kim, 2018; Capron et al., 1998; Karim & Capron, 2016; Karim & Mitchell, 2004; Levinthal & Wu, 2010; Teece, 1982). Particularly, knowledge scaling creates opportunity costs associated with dedicating other resources that are not scale-free but that are required to deploy the knowledge being scaled (Anand et al., 2016; Teece, 1982). For instance, imagine an organization's headquarters created an online repository with information on performance management practices which are valuable to managers from all businesses and establishments of the organization. Even if all managers had access to such repository, they would need to allocate limited cognitive resources and limited time to absorb and utilize such knowledge. Furthermore, while the new knowledge could render redundant establishment-specific workflows employed to track the performance of their local teams, it could also increase the productivity of workers due to better monitoring post-knowledge scaling. In the case above, knowledge scaling can lead to resource reconfiguration via the divestment of redundant resources (establishment-specific workflows) and to the increase in value of existing resources whose use can be intensified (increased worker productivity).

The relationship between knowledge scaling and resource reconfiguration can be subtle and manifest itself as a stream of changes in an organizations' resource base as a result of adaptation to the development, acquisition, and deployment of valuable knowledge (Argote et al., 2020; Karim & Mitchell, 2004). Beyond such dynamic process through which organizations may engage in continuous knowledge scaling and resource reconfiguration, organizations also have sharp opportunities to seek performance gains via the scaling of a stock of accumulated knowledge. One such opportunity emerges in the context of horizontal acquisitions.

2.2 Horizontal Acquisitions as Opportunities to Scale Knowledge

Organizations constantly demand new resources and seek for opportunities to achieve greater efficiency to scale their operations to survive in a competitive environment. Whereas internal resource development is one path through which organizations can achieve their growth objectives, organizations may have scarce core capabilities or face internal and/or market frictions that undermine a timely development of strategic resources (Rosenkopf & Nerkar, 2001)(. When faced with internal constraints to resource development, organizations seek access to valuable resources on the external market via many forms such as licensing, contracting, alliances, and acquisitions, each of which has different benefits and costs to organizations (Capron, 2018; Capron & Mitchell, 2012). Particularly, a quick path for an organization to overcome resource deficiencies and obtain new opportunities to create value in the existing line of business is to acquire already developed resources via horizontal acquisitions (Ahuja & Katila, 2001; Capron, 2018; Capron et al., 1998).

Horizontal acquisitions, the acquisition of another corporation or of a business from an ongoing corporation within the same industry, enable organizations to create value via resource reconfiguration(Capron, 1999; Karim, 2006). Post-acquisition value creation occurs when the acquiring organization recombines its own resources and the acquired resources to create synergies in such a way that the total value created post-acquisition is higher than the value that the units would have created independently (Anand et al., 2016; Capron, 1999).

Cost-based synergies emerge from organizations exploiting economies of scale and scope from redeploying resources post-horizontal acquisition. Economies of scale arise when the merged firm either reduces total cost as it increases the scale of a given activity or when it can spread a fixed cost over a higher total volume of services/production. Economies of scope arise then the merged firm saves cost by increasing the variety of activities it performs. These economies of scope involve the sharing and deployment of a factor of production which was under-utilized and in excess capacity across multiple ends (Anand et al., 2016; Teece, 1982). Both economies of scale and scope are likely to exist in horizontal acquisitions, as units in overlapping businesses may have redundant processes and resources that could be divested or related activities that could be shared

and more efficiently managed, thus increasing the performance of the acquired firm (Anand et al., 2016; Capron et al., 1998; Capron, Mitchell, & Swaminathan, 2001; Vidal & Mitchell, 2015).

Alternatively, revenue-based synergies emerge when organizations can share their core competencies with the target unit and when the post-acquisition resource recombination creates complementarities between the resources from acquiring and target units (Capron, 1999; Penrose, 1959). Such synergies can take many forms, including the geographic extension of the company's market, extending existing and sharing new product lines, exploitation of the target units' reputation in local markets (Amit & Schoemaker, 1993; Capron, 2018; Capron et al., 1998; Montgomery & Hariharan, 1991).

Because the value of horizontal acquisitions originates from recombining resources, acquisitions present a sharp opportunity for organizations to increase performance by scaling its stock of valuable knowledge resources. The potential fungibility of knowledge resources across units within the same business and the scale-free property of knowledge make knowledge scaling a particularly suitable strategy to create both cost-based and revenue-based synergies. The scale-free property implies that knowledge is in constant excess capacity and that thus organizations can benefit from scope economies by sharing its existing stock of valuable knowledge to target units. The acquiring organization can also dilute the fixed cost of developing knowledge and divest other resources that become redundant in the target unit in the presence of the knowledge being scaled. Furthermore, in markets where knowledge-based resources are a crucial aspect of the services and/products provided by the organization, post-acquisition knowledge scaling will also work as a new source of revenue, as the organization will be able to deploy an existing valuable knowledge base, such as the provision of a knowledge-based service to customer or as supporting managerial capabilities, into a new geographic market. Because the scaling of (valuable) knowledge can lead to both cost-based and revenue-based synergies following an acquisition, we define the following baseline hypothesis:

Hypothesis 1 (baseline): Following an acquisition, knowledge scaling will increase the performance of target organizations units.

Nonetheless, as argued before, knowledge scaling may imply the realignment of other resources in order to achieve economies of scope, economies of scope, and revenue-enhancing opportunities (Anand & Kim, 2018; Levinthal & Wu, 2010; Teece, 1982; Vassolo, Anand, & Folta, 2004). Indeed, organizations often restructure target units as they redeploy valuable resources towards them (Capron et al., 1998, 2001; Karim, 2006). Particularly, a resource whose redeployment has been increasingly examined in corporate strategy research (Chauvin & Poliquin, 2020; Dickler & Folta, 2020; Stadler et al., 2021), in particular in the context of acquisitions (Arnold, 2019; Bodner et al., 2019), and whose value and deployment may be affected by knowledge scaling is human capital resources (Coff & Kryscynski, 2011; Wright et al., 2014).

2.3 Knowledge Scaling, Resource Reconfiguration and Human Capital: A Multi-Level Approach

Knowledge Scaling and the Reconfiguration of Worker's Human Capital as an Organizational Resource

From the beginning of the field of strategic management, scholars have recognized the importance of *human capital* for an organization's competitive advantage (Barney, 1991; Coff, 1997; Mahoney & Pandian, 1992; Peteraf, 1993). While early human capital theory in economics and organizational behavior had defined human capital as a micro-level concept used to understand processes associated with individual decision to acquire, and the returns to, knowledge, skills, and abilities (Becker, 1962; Schultz, 1972; Spearman, 1927), strategy theory had focused on a macro-level definition where human capital is a unit-level resource that is a potential source of competitive advantage (Barney, 1991; Coff, 1997, 1999; Mahoney & Pandian, 1992). Nonetheless, recent calls to understand the micro-foundations connecting resources to an organization's competitive advantage (Abell, Felin, & Foss, 2008; Barney & Felin, 2013; Felin, Foss, & Ployhart, 2015) motivated strategy scholars to conceptualize a multi-level definition of human capital

resources (Coff & Kryscynski, 2011; Ployhart, Nyberg, Reilly, & Maltarich, 2013; Wright et al., 2014). At the worker-level, *human capital* comprises of an individual's stock of knowledge, skills, and abilities (hereafter, worker-level attributes) which are relevant for achieving economic outcomes (Lazear, 2009). At the unit-level, a *human capital resource* represents an worker- or unit-level capacity to access worker-level attributes for unit-defined purposes (Coff & Kryscynski, 2011; Ployhart et al., 2013; Wright et al., 2014).

The potential benefits of alternative corporate strategies intertwine with human capital management because the value of workers as a human capital resources depend on such interaction between worker-level attributes and unit-level strategies. For instance, even if workers have specific knowledge which is fungible and valuable across multiple business and units, an organization still needs to engage in resource reconfiguration under the form of worker rotation or worker redeployment to create value out of such worker's human capital (Chauvin & Poliquin, 2020; Dickler & Folta, 2020; Stadler et al., 2021). Indeed, worker redeployment is particularly beneficial when worker-level skills and knowledge are highly technical, non-codifiable, and/or only transferred through practice or interaction because moving workers across plants and establishments may facilitate knowledge transfer (Greenwood, Carnahan, & Huang, 2018; Nonaka, 1994; Stadler et al., 2021; Szulanski, 1996; Szulanski, Ringov, & Jensen, 2016).

Acquisitions and knowledge scaling are instances of a corporate strategy that are connected to the reconfiguration of human capital resources. For instance, technology organizations often engage in "acqui-hiring", operations through which an organization purchases another firm to recruit and acquire employees with valuable worker-level knowledge, skills, and abilities (Kim, 2020b). Despite the primary purpose of acqui-hiring being the recruitment of talented workers, organizations struggle with greater rates of turnover for the subset of workers recruited by such means (Kim, 2020b). In this context, organizational-level strategies to build stronger relationships between the organization and the worker may be crucial to leverage human capital benefits post-acquisition. Mobilizing managers from the acquired unit to target units to transfer knowledge and practices can also be crucial for a successful post-merger integration (Bodner & Capron, 2018).

Indeed, the failure to integrate can lead to both increased employee turnover and lower post-integration performance (Bodner et al., 2019; Kapoor & Lim, 2007). When an organization engages in knowledge scaling and transfers information-like knowledge to its multiple businesses and organizational units, such organization will change not only the resource endowments available to each unit, but also the potential value of a worker's human capital as a unit-level resource. These changes will reflect how the knowledge being scaled complements or replaces the target unit's capacity to access worker-level knowledge to reach their performance objectives. Nonetheless, the unique features of human capital as a multi-level resource may imply that knowledge scaling leads to the reconfiguration of human resources in ways that go beyond hiring, layoff, or mobility decisions.

Workers are endowed with many different and potentially divisible pieces of knowledge, each of which may be of different value within the same organizational context (Crocker & Eckardt, 2014; Lazear, 2009; Ployhart et al., 2013; Wright et al., 2014). The value of a unit of human capital – i.e. a worker – as an organizational resource depends on how these multiple pieces of knowledge aligns with a unit's capacity to deploy them towards its objectives. As a result, changes in unit-level factors – such as performance objectives or complementary/substitute resources (Anand & Kim, 2018; Crocker & Eckardt, 2014; Vassolo et al., 2004) - will affect the value and utilization of human capital resources even when such factors affect only a subset of the knowledge imbued in a worker. Because worker's human capital is comprised by a set of worker-level attributes, the effect of knowledge scaling on the value of workers as human capital resources is multifaceted. On the one hand, some knowledge of that worker may become redundant in the presence of new knowledge, or even be sub-additive to the knowledge being scaled (Anand & Kim, 2018; Vassolo et al., 2004). On the other hand, other types of worker-level knowledge may gain relevance in the presence of the new knowledge due to complementarities (Crocker & Eckardt, 2014) or a better alignment with a strategy based on the knowledge being scaled. Effectively, such complementarities may even induce unit-level demand for new worker-level knowledge following knowledge scaling. As a result, knowledge scaling may not necessarily

decrease the value of workers as human capital resources, but rather the composition of which type of worker's human capital is a valuable resource. We hypothesize:

Hypothesis 2: Knowledge scaling will…

- *Intensify the use of worker-level attributes as an organizational resource for those attributes that complement the knowledge being scaled (H2a).*
- *Decrease the use of worker-level attributes as an organizational resource for those attributes that do not complement the knowledge being scaled (H2b).*

Knowledge Scaling and the Reshaping of Human Capital Management

Although the value of human capital resources originates from worker-level knowledge, skills, and abilities, human capital resources are unlike information-like knowledge because they are non-scale free (Levinthal & Wu, 2010; Teece, 1982). If workers can become valuable resources by creating, disseminating, and implementing valuable knowledge, they also have time, cognitive, and sometimes even geographical constraints that prevent them from being utilized to multiple ends simultaneously (Levinthal & Wu, 2010; Teece, 1982). A consequence of human capital resources having capacity constraints is that when knowledge scaling changes the relative value of worker-level knowledge, skills, and abilities, organizations will face opportunity costs in terms of where to best allocate workers (Levinthal & Wu, 2010).

However, unlike non-human resources, organizations do not "own" workers. Rather, workers and organizations are tied by contractual relationships which are amenable to negotiation, renegotiation, and cease (Chadwick, 2017; Coff, 1999). These contractual arrangements define aspects such as payment schemes, tasks, intensity of utilization (example: full-time versus part-time contracts), and potentially even the location of deployment. As a result, neither layoffs are the only strategy to divest redundant human capital resources following acquisitions and knowledge scaling, nor is hiring the only strategy to intensify the use of human capital resources that complement the knowledge being rather. Rather, a potential human capital management strategy following knowledge scaling is to redesign work arrangements in order to utilize the human capital that creates economies of scope, of scale, and revenue-based synergies in the context

of knowledge scaling. In particular, organizations can benefit from "divesting" tasks using worker-level knowledge, skills, and abilities that are redundant post-knowledge scaling while, at the same time, intensifying tasks that rely on worker-level knowledge, skills, and abilities that are complemented by (or support the deployment of) the knowledge being scaled. Furthermore, if workers utilized a larger proportion of their set of knowledge, skills, and abilities prior to knowledge scaling, but then the knowledge being scaled complemented some while rendered other worker-level attributes redundant, organizations will benefit from increasing the specialization of work arrangements only around tasks complemented by the knowledge being scaled. This logic leads to the following hypothesis in the context of knowledge scaling post-acquisition:

Hypothesis 3 (H3): Knowledge scaling will increase the propensity of organizations to engage in specialized work arrangements.

The strategic human capital literature has long studied how characteristics of an workers' human capital, such as its specific applicability to a firm or to multiple contexts (Campbell, Coff, & Kryscynski, 2012; Wang et al., 2009), its specialization or general-purposefulness (Chen, Huang, Meyer-Doyle, & Mindruta, 2020; Datta & Iskandar-Datta, 2014), or its tacitness or codifiability (Stadler et al., 2021) shape whether and how organizations can leverage human capital resources to achieve superior performance (Campbell et al., 2012; Chen et al., 2020; Datta & Iskandar-Datta, 2014; Morris, Alvaraz, Barney, & Molloy, 2016; Stadler et al., 2021; Wang et al., 2009). The literature has underscored how different types of knowledge are heterogenous on whether organizations or workers can capture more value out of the value that is created (Coff, 1999; Molloy & Barney, 2015). The more a worker's human capital is specific to a worker while also being valuable at alternative contexts, the less the hiring organization can capture the value created by such human capital. Alternatively, the more an organization deploys a worker's human capital that is more abundant in the labor market or that is valuable only within the organization,

the more organizations can capture the value created by deploying such human capital(Coff, 1999; Molloy & Barney, 2015).

The reason for differences in the value capture potential of human capital is that workers will have a greater bargaining power over how to split the value created out of human capital resources if their contribution to the value creation process is unique and hard to replace. Considering how the value created by human capital resources is split between worker and organization post knowledge scaling is important because changes in who captures the value out of human capital resources may determine the strength of the worker-organization relationship.

In particular, because knowledge scaling can have different effects on the subset of worker-level knowledges, skills, and abilities that are deployed as resources by organizations, the scaling of knowledge resources will also affect how the value created by human capital resources is split between worker and organization. If the knowledge being scaled replaces previously valuable knowledge that was specific to the worker while complementing worker-level knowledge that is more abundant in the labor market, knowledge scaling can increase the total value created out of human capital resources while also reducing the share of value that is captured by workers. In this situation, the worker-organization relationship is weakened as organizations depend less on worker-specific knowledge to create value. This logic motivates our last hypothesis:

> *Hypothesis 4 (H4): The worker-organization relationship will weaken when knowledge scaling makes worker-specific attributes relatively less valuable..*

3. CONTEXT: ACQUISITIONS AND KNOWLEDGE SCALING IN BRAZILIAN PRIVATE HIGHER EDUCATION

We investigate our hypotheses in where knowledge scaling can be consequential to private organizations providing services that are of public interest: private higher education. Specifically, we focus on the Brazilian private higher education sector. This context is suitable to examine our hypotheses for three reasons. Firstly, amongst the enterprises that provide private higher education

in Brazil, there are educational groups that operate multiple educational units across the country and that have as a core strategy the scaling of knowledge resources developed in their headquarters and deployed simultaneously in their multiple units. Indeed scaling knowledge resources about pedagogical practices or courseware is an established though heterogeneously adopted practice in this sector, especially with the rise of multi-unit educational enterprises (Deming, Goldin, & Katz, 2012). Secondly, the core services of post-secondary education institutions employ knowledge workers (faculty) to conduct a series of knowledge-intensive tasks such as course development, teaching, and research. The value of faculty as a human capital resource can be linked to multiple pieces of worker-level knowledge, such as knowledge accumulated via experience, teaching skills, or specialized knowledge in a field of research. Finally, educational groups engaged in a growth-through-acquisition strategy between 2006 and 2014. These successive acquisitions by educational groups provide a suitable context to study acquisitions as an opportunity to scale knowledge, and thus verify their effects on the performance and human capital management of target units. Furthermore, because there are changes in ownership that are unrelated to educational groups, the setting enables us to compare acquisitions coupled with knowledge scaling to those without knowledge scaling.

3.1. Brazilian Private Higher Education and the Growth of Educational Groups

The landscape of Brazilian postsecondary education has been transformed since the late 1990s. In 1996, there were 922 higher education institutions in Brazil catering to 1.8M students, but by 2019, 2,608 institutions were in operation catering to 8.6M students (MEC/INEP, 2019) Although the causes for this remarkable growth are multifaceted, its trajectory was arguably set in 1997, when the federal government authorized for-profit entities to manage higher education institutions. Ever since, the private higher education sector in Brazil has grown very rapidly. In

2019, 88.4% of active higher education institutions were private, and accounted for 75.4% of all undergraduate enrollments (MEC/INEP, 2019).

Private higher education in Brazil is regulated by the Ministry of Education. Enterprises must go through a series of accreditation processes to open new institutions, campuses, and offer new degree programs. The legal deadline for a new higher education institution to open a new branch and obtain program permit is 15 months, with the deadline also applying for institutions wishing to open a program even if the institution is already accredited – though the deadline can be reduced to 8 months if the institution had received a high enough quality index in the Ministry Education's annual evaluation process. Further, transferring authorization to open new degree programs between institutions is not allowed.

The combination of growth opportunities to cater the unmet demand for higher education in Brazil with regulatory barriers that hamper swift organic growth incentivized for-profit private enterprises to engage in a strategy of growth-through-acquisition (Capron, 2018). Between 2006 and 2014, a group of 9 firms, of which 5 have had IPOs since then,[2] acquired 182 private universities across the country. Specialists in private higher education in Brazil call these 9 multi-unit private educational enterprises, along with three other three multi-unit educational firms that exhibited substantial organic growth in large economic centers, as the private large educational conglomerates, hereafter referred as educational groups (Hoper Educação, 2019). Figure 1 shows that the growth of educational groups was heavily based on acquisitions (more than 60% of the universities owned by educational groups in 2014 were the target of an acquisition). Furthermore,

[2] The following groups were publicly listed at some point between 2006 and 2014: *Anhanguera Educacional*, *Kroton Educacional* (now renamed as Cogna), *Estácio Educação* (now renamed as *Yduqs*), *Ser Educacional*, and *Anima Educacional*. In May 2014, the Brazilian Antitrust Agency approved the merger between Anhanguera and Kroton. For the purposes of this paper, we only consider acquisitions until 2014 and prior the merger of Kroton and Anhanguera.

Figure 2 shows that acquisitions were linked to a strategy of rapid geographic expansion by showing the different micro-regions in Brazil where educational groups operated at least one establishment in 2005, before the wave of acquisitions, and in 2015, after the wave of acquisitions.

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

Partially because of these acquisitions, educational groups in Brazil exhibited substantial growth since 2003, when they enrolled 313,797 students in in-person undergraduate courses (8.1% of all students in such courses). By 2017, the number of students had grown more than 5 times, jumping to 1,8M students, which now represented 28.1% of all undergraduate students in in-person courses in the country.

Upon acquiring a new establishments, educational groups have a sharp opportunity to scale existing knowledge resources from the headquarters to target units. In the next section, we use qualitative interviews and descriptive evidence to characterize such knowledge scaling by educational groups in the Brazilian private higher education market.

3.2. Knowledge Scaling in Educational Groups

We collected qualitative data to characterize knowledge scaling in the context of private educational groups operating in the Brazilian private higher education market. We conducted 10 in-depth interviews with current and former employees from four large educational groups, as well as consultants in the private higher education sector in Brazil. Interviews lasted between 45 and 90 minutes, were conducted in Portuguese, and were not recorded. All evidence reported in the paper comes from interview notes.

Interviews focused on three key aspects related to how our theory would be applicable in the context of private higher education in Brazil: (1) the existence of practices, materials, or other (knowledge-based) resources that educational groups scale to establishments, (2) the perceived

differences in the value of faculty for educational units due to knowledge that is centrally-deployed by educational groups, and (3) how being within an educational group affects the performance of an educational units.

All interviewees reported that educational groups scale pedagogical knowledge under the form of standardized pedagogical methods, courseware (e.g. books, activities, and presentations) and even tools to support teaching (e.g. class plans). Some examples follow:

- A former faculty member of an educational groups reported that the group "designed its own pedagogical method and deployed it to establishments via standardized books, slides, and suggested activities (Interviewee 2)".
- An interviewee reported that in the unit he worked at "faculty had access to class plans that defined which content had to be covered at every time window in a class (Interviewee 7)". The same interviewee also reported that educational groups enforced the use of a standardized template for exams.
- A course coordinator from one educational group reported that "even when a faculty needs to adapt the standard material, these adaptations are usually minor, such as using examples from a different state-level legislation. (Interviewee 6)"; and
- A junior faculty working in another educational group reported that "the educational group defines the content that needs to be covered and I submit a standardized template to show that my classes align with the centrally-defined plan (Interviewee 8)".

Educational groups also scaled practices associated with 'hybrid learning' – the use of distance activities to complement in-person classes. The use of hybrid learning enables the "catering as many students as possible in an efficient manner and with little variation in quality is easier when activities are partially pre-recorded (Interviewee 3)". Moving to hybrid learning is coupled with the design of video-lessons and distance-based activities that could be replicated in many organizational units simultaneously. Data from the Brazilian Educational Census supports the reports about educational groups scaling knowledge associated with hybrid pedagogical practices. The average institution from an educational group had 78.5% of their enrollments in courses some distance-based activity in 2017, the analogous share was of 33.4% for other private universities.

The objective of scaling pedagogical knowledge is to enable educational groups to cater to more students while keeping service quality constant and costs low, even when catering to heterogeneous students. For instance, an interviewee who had developed standardized courseware for one of the educational groups reported that:

> "All material that I created had to be validated by the headquarters, including the language, examples, and content flow. The headquarters emphasized that the writing should be simple and easy because the content would be used in many different establishments, including those where students were from low-income areas." (Interviewee 5)

Beyond the scaling of pedagogical resources and changes in the value of faculty-level knowledge, the interviews revealed that educational groups engage in the scaling of managerial knowledge under the form of new operational processes and routines associated with student support and performance management. In particular, the interviews highlighted the scaling of knowledge associated to supporting students to submit and access loans from the government program financing program (*Fundo de Financiamento Estudantil* - Fies). In Brazil, despite many students being eligible for loan program, filling out the paperwork is time-consuming and there are informational and cognitive barriers for students to assess eligibility and financial conditions. Data from the Brazilian Higher Education Census shows that three years after being acquired by an educational group, institutions more than double the share of their students that receive support from the Fies program (from 5.4% to 22.4% of all students).

Beyond access to public financing programs, interviewees raised that educational groups restructure the management of establishments that were an acquisition target, by professionalizing management and standardizing processes. For instance, some of the reports highlighted that:

> "When a university is acquired by an education group, the group often works to increase the managerial efficiency of otherwise non-professionally managed establishments." (Interviewee 1); and

> "Whenever an establishment undergoes evaluations by the Ministry of Education, the headquarters sends a standard template to be simply filled out with establishment-specific information. (Interviewee 3)."

4. DATA AND METHODS

4.1. Data sources and dataset construction

In this study, we employed a mixed-method approach that draws on the interviews described in the previous section to inform econometric analyses. Empirically, we benefit from a unique dataset that combines hand-collected, public administrative, and restricted administrative data. Firstly, we constructed a dataset with information about all higher education institutions that were the target of an acquisition by an educational group or the target of acquisitions unrelated to educational groups (2006-2014). This is an important piece of the information as acquisitions by educational groups represent acquisitions with knowledge scaling whereas acquisitions unrelated to educational groups represent acquisitions without knowledge scaling. We collected information on acquisitions in the private higher education market in Brazil on multiple sources, including acquisitions reported to the Brazilian competition Authority, websites of educational groups, and specialized newspapers in Brazil. We also collected information about university ownership using the the Brazilian Education Census – which started to report university ownership information from 2009 onwards – and manual search on the *Diário Oficial*, a federal government publication which features instances of when universities changes their ownership.

Secondly, we used information from the Brazilian Census of Higher Education (2003-2017), an annual publication conducted by the National Institute of Studies and Educational Research Anisio Teixeira (Inep), an independent agency under the Ministry of Education (MEC), that provides detailed information about all private higher education institutions in Brazil, including all undergraduate courses they offer, and students enrolled in such courses (by municipality), and faculty employed by the institutions (by university, without differentiating place of work). In all our analyses, we will only use information pertaining to in-person undergraduate courses and private higher education institutions.

Thirdly, we used the *Relação Anual de Informações Sociais* (RAIS) dataset (2003-2017), a restricted employer-employee panel dataset of formal labor contracts collected annually by the Brazilian Ministry of Labor, which contains information on all formal labor contracts in Brazil. Each labor contract in the dataset is linked to a firm by a tax-ID. For each labor contract we observe the location of work (municipality), occupation, wage, and contracted hours. For ours analyses, for every worker-tax-ID pair, we only kept the latest active labor contract within an establishment within any given year. For the purposes of this analyses, we average characteristics of labor contracts at the level of the "educational units", as defined in the next section.

Finally, we complement the dataset with municipality-year level demographic variables that originate from several public administrative datasets.

4.2. Defining educational units

While the dataset on acquisitions and the Higher Education Census provide information about private higher education institution, firms in the RAIS dataset are identified by a corporate tax ID (CNPJ). Using a unique crossover dataset between university IDs as reported in the Census of Higher Education and the tax-ID as reported in the RAIS dataset – which we gained access to via the Ministry of Education – we extracted information about all formal labor contracts associated to universities. Furthermore, we identified faculty labor contracts in the RAIS database according to the employee's occupation based on the 2002 Brazilian Occupational Classification System (CNBO) and the Brazilian National Classification of Economic Activities (CNAE). Specifically, we defined faculty contracts as all labor contracts associated with a teaching occupation (CBO code 23) and linked to an establishment that provides higher education services as its main activity (CNAE code 853).

Although we can identify tax-ID for each institution at each year, institutions can change their tax IDs over time without such change being associated to an acquisition. Furthermore, a single educational group can have multiple tax IDs simultaneously or different universities within the same group may have the same tax ID. This implies that if a tax ID nestles more than one institution, it is not possible to identify which institutions is associated to the labor contract unless

the institutions are in different municipalities. For these reasons, we created an aggregated unit of analysis that bundles universities within a municipality that are owned by a common enterprise, which we call "educational unit". We defined educational units in two steps. First, we grouped all tax-IDs that had ever been associated to common university. We used this to define "ownership units". The institution is that these ownership units would capture cases where tax IDs change without a truthful change in university ownership. On a second step, we defined the "educational unit" as all universities within the same municipality that had ever shared the same "ownership unit". With this aggregation, we can match labor contracts from several tax IDs to a single educational unit within the same municipality even if educational units change tax IDs over time without reflecting changes in ownership.

4.3. Defining the treatment and control groups

Most educational units comprise of a singular university-municipality pair. However, a subset of educational units nest more than one university within a municipality, and if only some of such universities were targets of acquisitions, an educational unit will bundle acquired and non-acquired universities. We drop these cases of "partial treatment" and retain only educational units in which either no university had ever changed ownership between 2006 and 2014, or all universities were targets of an acquisition by the same group within the same year.

Within the educational units that were the target of some acquisition, we only keep those that are observed in all three years preceding the acquisition, in the year of acquisition, and in all three years following the acquisition. These restrictions leave us with 94 educational units that were the target of an acquisition involving knowledge scaling (i.e. an acquisition by an educational group) and 32 educational units that were the target of an acquisition that did not involve knowledge scaling (i.e. any change in ownership unrelated to educational groups).

To define the control group, we employed propensity score matching to match each unit target of an acquisition to a control unit that was never and acquisition target but that shared similar characteristics to the acquired unit in the pre-treatment years. This approach is commonly used to study the effects of mergers and acquisition in the performance of acquired units (Eaton et al.,

2020; Gandhi et al., 2020). Before conducting the matching process, we first defined a sample of potential control units defined as all educational units that have never belonged to an educational group and that have never changed their ownership between 2006 and 2014. Using the sample of units that were the target of acquisitions with knowledge scaling and all potential control units, we estimated a linear probability model on the probability of a unit being the target of an acquisition with knowledge scaling as a function of a municipality-level control variables and the average of the pre-treatment outcome variables in the three years preceding the acquisition. We matched each treated unit with the control unit with the closest predicted probability of being the target of an acquisition with knowledge scaling. We repeated this process for units that were the target of an acquisition without knowledge scaling. The processes found a control unit for each of the 126 treated units (94 targets of acquisitions with knowledge scaling and 32 targets of acquisitions without knowledge scaling).

4.4. Main Variables

Dependent Variables

We used the insights extracted from the interviews to define performance and human capital-related variables that reflect both the objective of educational groups in terms of performance (expansion of operations) and the worker-level human capital that complements or is replaced by the knowledge being scaled upon an acquisition.

To test hypothesis H1, we measure unit-level performance in terms of their attractivity to students and scale of their operations. More specifically, we use the *number of students in in-person courses* and the *number of freshmen in in-person courses* (as well as their logarithmic forms) to capture both the stock and the flow of new consumers to educational units. We only utilize in-person undergraduate courses because online education courses are not associated to any municipality, and thus are not linked to educational units.

To test hypothesis H2a, on the intensity of use and productivity of worker-level human capital that complements knowledge scaling, we measure the *freshman-to-faculty-labor-contract ratio*, and the *log of average faculty wage adjusted for a 40h/week labor contract* at the educational

unit-year level. These measures reflect both the intensity of faculty utilization per new student and the unit-level value of such faculty adjusted by the amount of time they work.

To test hypothesis H2b, on the use of faculty experience as a human capital resources following knowledge scaling, we use the *average faculty experience* at the educational unit-year level. We compute this measure in two steps. First, for each year, we compute the cumulative hours that any faculty worker had ever worked as a faculty in any post-secondary institution since 2003 until the focal year. Next, we average this cumulative experience across all faculty labor contracts from a single educational unit-year pair.

To test hypothesis H3 about the specialization of work arrangements following knowledge scaling, we use measures based on the context of the Brazilian private higher education sector. Part-time faculty contracts often represent that a faculty will have a teaching-only contract with an educational unit and not engage in non-teaching tasks such as research and extension. The lower the number of contracted hours in a work arrangement, the more a hired faculty is expected to have a hyper-specialized relationship with the educational unit and be hired to teach a single or few courses. For that reason, we measure the *share of faculty labor contracts with less than 16 hours per wee*k, and the *average hours in a faculty labor contract* at the educational unit-year level to evaluate the degree of specialization in faculty labor contracts.

Finally, to test hypothesis H4, on the effect of knowledge scaling on the strength of the worker-organization relationship, we use the *annual turnover rate* of faculty labor contract to assess the strength of the relationship between faculty and educational unit

Main Independent Variables

As explained below, we adopt an event-study differences-in-differences design with a full set of educational unit and period fixed effects. We also separate our analyses of acquisitions associated to knowledge scaling (acquisitions by educational groups) from analyses of acquisitions not associated to knowledge scaling (other acquisitions). In both cases, the main independent variables are dummy variables receiving value 1 for an educational unit-year observation in years after such

educational unit was the target of an acquisition (and zero otherwise). Educational units who were never changed ownership will always receive value zero.

Main Control Variables

In all specifications, beyond unit-level and year-level fixed effects, we control for the following set of control at the municipality-year levels: annual real gross domestic product per capita, average wage for individuals with less that high school degree, average wage for individuals with high school but no college degree, share of labor contracts associated to individuals with high school but no college degree, population between the ages of 20 and 24, and number of high school students.

4.5. Econometric Method

For our econometric analyses, we divide our dataset in two samples: (1) the subsample of treated and control units associated to acquisitions with knowledge scaling, and (2) the subsample of treated and control units associated to acquisitions without knowledge scaling. We always estimate and report the results for these subsamples separately.

Within the sample of treated and control units, we estimate the effects of acquisition with and without knowledge scaling using a differences-in-differences approach. First, we estimate a static differences-in-differences specifications of the form:

$$Y_{umt} = \beta D_{ut} + \delta X_{mt} + \alpha_{um} + \alpha_t + e_{umt}, \quad (1)$$

where Y_{umt} is one of the outcome variables of interest for educational unit u, located at municipality m, and period t (centralized so that the period representing the year of the acquisition is year $t = 0$), $D_{ut} = \mathbf{1}(t_u \leq t)$ is an indicator value that assumes value 1 for periods at or after target educational unit u was acquired, and zero otherwise, α_{um} are educational unit fixed-effects, α_t are period fixed-effects, X_{mt} are socioeconomic controls at the municipality-year levels, and e_{umt} is an error term. All standard errors are clustered at the educational unit level level.

To examine the dynamics of the effects, we also estimate the effects of acquisitions (with and without knowledge scaling) on the variables of interest using a panel event-study specification:

$$Y_{umt} = \beta_{t\leq -4} D_{ut}^{t\leq -4} + \sum_{k=t-3}^{t+3} \beta_k D_{ut}^{k} + \beta_{t\geq +4} D_{ut}^{t\geq +4} + \delta X_{mt} + \alpha_{um} + \alpha_t + e_{umt}, \quad (2)$$

where most variables are defined as in equation (1), but now $D_{ut}^{k} = \mathbf{1}(t = t_u + k)$ indicates a period that is k years in the past (or future) relative to the period of the acquisition of university u (t_u). In this specification, we omit the year prior to the acquisition ($t = t_u - 1$) so that each estimate $\beta_k$measures the average effect of the acquisition on the outcome variable Y_{umt} relative to values on period $t = t_u - 1$. In particular, the main specifications only use treated and control units observed in all three years preceding the acquisition of the treated unit ($t \in \{-3, -2, -1\}$), in the year of the acquisition ($t = \{0\}$), and in all three years following the acquisition ($t \in \{+1, +2, +3\}$). Thus, all coefficients reported in the main specifications use a balanced sample of educational units for periods -3 to +3. To account for educational units observed before the balanced period, we add two dummy variables indicating periods that are four years before ($D_{ut}^{t\leq -4}$) or four years after ($D_{ut}^{t\geq +4}$) an acquisition event for university u. Whenever reporting results using equation (2), tables will display the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k /4$) and test whether this linear combination is different than zero. The individual β_k coefficients are reported graphically.

5. RESULTS

Table 1 presents the descriptive statistics about the main variables used in our analyses. Columns 1-3 display the comparison between educational units that were target of acquisitions involving knowledge scaling to the matched control group of educational units. Columns 4-6 display the analogous comparison of treatment of control units for the complementary set of educational units

that were target of acquisitions that did not involve knowledge scaling. Across both samples, there are no statistical differences between acquired and matched control units.

[INSERT TABLE 1 HERE]

5.1. Knowledge Scaling and the Performance of Target Units

Table 2 displays the results of the specifications testing our baseline hypothesis H1, on how acquisitions associated with knowledge scaling have the potential to increase the performance of target units. It reports the effects of knowledge scaling on four performance variables: number of students in in-person courses (in levels and in logarithmic form) and number of freshmen in in-person courses (in levels and in logarithmic form). Panel A reports estimates considering the treatment group of educational units that were the target of acquisitions involving knowledge scaling. Panel B displays the analogous results, but for educational units that were the target of acquisition that did not involve knowledge scaling. Columns [1] to [4] report the treatment coefficient associated to estimating the static differences-in-differences estimator as delineated by equation (1). Columns [5] to [8] report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event and testing whether this average treatment effect is different from zero. All columns report results that account for educational unit and time-period fixed effects, as well as for municipality-level control variables. All standard errors are clustered at the unit-level.

[INSERT TABLE 2 HERE]

Columns 1 and 5 from Panel A show that units acquired by educational groups increased the number of students in in-person courses by +2,167 if we consider the static differences-in-differences model (column 1, p-value < 0.01) or by an average of +1,057 students if we consider the average effects of the three years following the acquisition as estimated by the panel event-study specification (column 5, p-value < 0.01). Columns 2 and 6 from Panel A show that these results also hold if we consider new students joining the university (+1,246 freshman when considering the static differences-in-differences estimate on column 2, p-value < 0.01; +658

freshman when considering the average increase in the three years following the acquisition as reported on column 6, p-value < 0.01). Considering the estimates of the panel event-study design, (columns 5 and 6), the effects correspond to an increase of +23.2p.p. and of +35.4p.p. on the pre-acquisition number of students and on the pre-acquisition number of freshmen in in-person undergraduate courses in target units. The estimates on columns 3, 4, 7, and 8 show that the results hold if we use the natural logarithm of the same dependent variables. The results on Panel B suggest that acquisitions without knowledge scaling led to no improvement in performance in terms of service scale and attraction of new students.

Figure 3 reports the dynamic effects of acquisitions with and without knowledge scaling on the performance of target units. These results underlie the specifications reported on Table 2, columns 5 and 6. Figure 3 shows both the parallel pre-trend between treatment and control groups pre-acquisition for both types of acquisitions and it shows that the performance of target units is increasing over time when the acquisition led to knowledge scaling. When the acquisition did not involve knowledge scaling, performance in terms of number of total students in in-person courses or in attracting new students did not increase.

[INSERT FIGURE 3 HERE]

The results reported in Table 2 and Figure 3 are aligned with hypothesis H1: target units of acquisitions involving knowledge scaling increased their performance in terms of attracting students and increasing the scale of their operations.

5.2. Knowledge Scaling and the Reconfiguration of Worker's Human Capital as an Organizational Resource

Table 3 displays the results of the specifications testing hypotheses H2a and H2b, on the reconfiguration how target units deploy distinct aspects of worker's human capital as organizational resources following acquisitions with (Panel A) and without (Panel B) knowledge scaling. Columns 1 through 8 have an analogous specification as those reported in Table 2, but using dependent variables associated with a faculty's human capital.

[INSERT TABLE 3 HERE]

On Panel A, columns 1-2 and 4-5 shows the post-knowledge scaling changes in the intensity and productivity of faculty in target units. Columns 1 and 5 show that the ratio of freshman to faculty labor contracts increases by +5.9 considering the static differences-in-differences specification (column 1, p-value < 0.05) and by +8.0 considering the average of the effects estimated separately for years 0, 1, 2, and 3 following the acquisition (column 5, p-value < 0.1). Column 2 reports that faculty hourly increased by 15.7p.p. following acquisitions with knowledge scaling (p-value < 0.05), a result which is robust to the panel event-study specification (+17.5p.p., p-value < 0.01, column 6). Panel B shows only a marginal intensification of the use of faculty for teaching (+3.9 increase in freshmen per faculty labor contract, p-value = 0.107, column 1) and no effect on faculty productivity as measured by hourly wage.

Beyond the intensification of the use of teaching-related human capital, columns 3 and 6 on Panel A show that upon acquisition, knowledge scaling leads target units to decrease the use of experienced faculty as a human capital resource. Following acquisitions associated to knowledge scaling, the average experience of faculty hired by target educational units drops by -989 less hours of accumulated experience (column 3, p-value < 0.01) when considering the static differences-in-differences model. The analogous estimate using the panel data event-study method is a reduction in -818 less hours of accumulated experience when compared to the matched control group (column 6, p-value < 0.01). These estimates are equivalent, respectively, to a reduction of -15.2% and -12.5% in comparison to the mean faculty experience in the year immediately before the acquisition. Another way to interpret this reduction is that if ones assumes a faculty contract of 20 hours/week (the sample average), knowledge scaling following acquisitions by educational groups leads to a reduction in faculty average experience by approximately 10 months. Panel B reveals that there is no change on the use of experienced faculty as an organizational resource when target units experience acquisitions unrelated to knowledge scaling.

Figure 4 shows that detailed estimates associated with the panel event-study specifications reported on Table 3, columns 5 and 6. Beyond providing evidence of parallel pre-trends between

treatment and control groups, Panel A shows that the increase in average faculty hourly wage following an acquisition with knowledge scaling is sustained in the three years following the acquisitions. Panel B shows that the use of experienced faculty as an organizational resource is decreasing over time and reaches a reduction of 1,486 hours three years after the acquisition (p-value < 0.010, a 22.9% reduction in comparison to the pre-treatment year). For acquisitions without knowledge scaling, the target unit experiences no change in the use of experienced faculty nor in average hourly wage.

[INSERT FIGURE 4 HERE]

The results on Table 3 and Figure 4 are aligned with H2a and H2b: knowledge scaling intensifies the use of a subset of worker-level attributes as organizational resources when such attributes complement the knowledge being scaled (e.g. teaching-related human capital) and decreases the use of potentially previously valuable human capital that becomes redundant upon knowledge scaling (e.g. faculty experience).

5.3. Knowledge Scaling and the Reshaping of Human Capital Management

Table 4 presents the results associated with the relationship between knowledge scaling and the specialization of work arrangements (hypothesis H3), and between knowledge scaling and the strength of the worker-organization relationship (hypothesis H4). Panel A displays the results associated with acquisitions involving knowledge scaling whereas Panel B displays the results of acquisitions that did not involve knowledge scaling. Specifications reported in columns 1-3 and 4-6 are analogous to those from Tables 2 and 3.

[INSERT TABLE 4 HERE]

Columns 1, 2, 4, and 5 on Panel A report that upon being subject to knowledge scaling, educational units are more prone to engage in specialized work arrangements with faculty via contracts with reduced number of hours. Considering estimates from the static differences-in-differences specification, there is a 7.4p.p. increase in the fraction of faculty contracts with less than 16 hours per week (p-value < 0.05, column 1) and an average decrease of -2.9 hours in the

weekly number of hours worked by faculty (p-value < 0.05, column 2). Estimating the results via the panel event-study specification produce similar results: an increase of +8.9p.p. on the fraction of faculty labor contracts with less than 16 hours per week of work (p-value 0.05, column 4) and a decrease of -3.4 hours in the weekly number of hours worked by faculty (p-value < 0.05, column 5). In the context of private higher education in Brazil, these results are consistent with educational units specializing faculty work in teaching activities while reducing the need for faculty to engage in activities such as course development or research activities.

The results on columns 3 and 6 suggest that the specialization of faculty work due to knowledge scaling weakened the relationship between faculty and organization. Following acquisitions with knowledge scaling (panel A), our results of the static differences-in-differences model indicate that faculty turnover rate increased by 25.7p.p. (column 1, p-value < 0.01). These results are similar to average the estimates of a panel event-study design (averaging the effects for years 0, 1, 2, and 3 following the acquisition leads to an increase in turnover rate of 30.3p.p., p-value < 0.01). On Panel B, we show that there are no effects on specialization or on worker-organization relationship when studying the effects of acquisitions without knowledge scaling.

Figure 5 shows that dynamic effects of knowledge scaling on the specialization (Panel A) and strength of the worker-organization relationship (Panel B) which underlie the specifications on columns 4 and 6 of Table 2. Upon acquisitions that involved knowledge scaling, target units have a sustained reduction in the average weekly hour worked by faculty and a sustained increase in faculty turnover rate. These results contrast with those of acquisitions without knowledge scaling. Target units of acquisitions without knowledge scaling experienced no change in faculty specialization and experienced a punctuated increase in turnover rate increased immediately following the acquisition, which then returned to pre-acquisition levels. We interpret these results as suggesting that while knowledge scaling changed the nature of the work arrangement between organizational unit (target educational units) and workers (faculty), acquisitions without knowledge scaling only led to short term post-merger adjustments.

[INSERT FIGURE 5]

When taken together, the results on Table 4 and Figure 4 are aligned with hypotheses H3 and H4: knowledge scaling led to the reshaping of human capital management in terms of further specializing work arrangements and in weakening the worker-organization relationship.

5.4. Additional and Robustness Analyses

Additional evidence of knowledge scaling. Beyond the qualitative and descriptive evidence associated with how educational groups engage in a strategy of knowledge scaling, Table 5 brings additional econometric evidence that acquisitions are an opportunity for educational groups to scale knowledge to target units. Table 5 reports the effects of acquisitions with knowledge scaling (Panel A) and without knowledge scaling (Panel B) on outcome variables related to the following types of managerial and pedagogical knowledge resources that emerged in our interviews: (1) processes to facilitate student access to a government financing program (FIES), (2) opening of new undergraduate courses and utilization of standardized courseware, and (3) pedagogical approaches that involve 'hybrid' teaching methods (bringing distance-based activities to in-person courses). On Panel A, columns 1 and 5 show that upon acquisitions by educational groups, there is an increase in the share of students that have a public financing to support college fees (+10.7p.p. in the static differences-in-differences specifications and +5.2p.p. in the panel event-study specification, both with p-value<0.01). Columns 2 and 6 show that upon acquisitions with knowledge scaling, target units broaden the scope of their courses. Finally, using information about whether courses had some distance-based activity for a subset of years when such information became available (2009-onwards), columns 3, 4, 7, and 8 show that target units increase the share of undergraduate courses with at least some distance-based activity and increase the share of students enrolled in an in-person undergraduate courses with at least some distance-based activity. Panel B shows that acquisitions unrelated with knowledge scaling exhibit no such effects.

[INSERT TABLE 5 HERE]

Qualitative evidence on proposed mechanisms relating knowledge scaling to the reconfiguration of human capital resources. Beyond characterizing the type of knowledge that is scaled by educational groups, the interviews also provided evidence aligned with our proposed hypotheses. Reports support our results and suggest that knowledge scaling intensifies teaching and reduces the use of faculty-specific knowledge entailing tasks such as course development and research. Indeed, several passages support this interpretation:

> "[…] to the headquarters, a good faculty is a faculty that has good presentation skills and is able to teach. Research does not matter. Internal awards and careers plan are essentially linked to student ratings (Interviewee 3)."

> "When I was first hired, I tried to adapt the course content to my taste. However, there was a strong pressure from coordinators and students for me to stick to the centrally-deployed material. In the end, I agreed. Adapting the material would be too costly and would bring little benefits to me" (Interviewee 7)".

> "I believe that the changes in pedagogical approach brought by educational groups are related to the tasks demanded from faculty. Educational groups want to be able to rely on junior faculty while also being able to deliver educational content. […] There is an attempt to focus faculty in teaching tasks while, at the same time, reduce how many class-hours a professor would work. […] The objective was to get as many students being catered by as few faculty-hours as possible. (Interviewee 2)"

> "Faculty are not be specialized in a single topic or course, but rather specialized in teaching. It is common for us to teach many courses and the group considers valuable if a faculty can teach courses outside narrow areas of expertise. (Interviewee 6)".

Origin of turnover and targeted changes in the management of workers' human capital as an organizational resource. Because turnover considers the flow of labor contracts in an educational unit and because target units increase their scale following the acquisitions, our measure of turnover could be capturing exclusively the entry of new faculty rather than the weakening of worker-organization relationships. To account for that, we re-estimated our main specifications using the annual share of labor contracts that started within each year and the annual

share of labor contracts that ceased within each year as additional dependent variables. Furthermore, because our context implies that the reconfiguration of human capital resources focuses on faculty, we also used the analogous measures considering all labor contracts within an educational unit that are not associated to a teaching occupation. Table 6 presents these results. Results on Panel A shows that the increase in the turnover rate following acquisitions with knowledge scaling is driven both by the increased share of new labor contracts (+6.8p.p., p-value < 0.01) and by the increased share of ceased labor contracts (+4.7p.p., p-value < 0.01). Moreover, as target units gained scale, while the increased the share of new labor contracts in non-faculty positions, there was no increase in the termination of labor contracts in non-faculty positions (columns 3, 4, 8, and 9). We interpret these results as showing that knowledge scaling only weakened the worker-organization relationship for those workers that had at least some part of their human capital replaced by the knowledge being scaled. Columns 5 and 10 further shows that non-faculty positions had no reduction in their weekly working hours, signaling no further specialization in the work arrangement. Finally, Panel B shows that acquisitions without knowledge scaling led to increased hiring of non-faculty individuals, but no other consistent pattern throughout. These results further support our hypotheses H2a-H4, that knowledge scaling leads to the reconfiguration of human capital resources.

[INSERT TABLE 6 HERE]

In an appendix, we report a series of additional robustness analyses.

Knowledge scaling and higher demand for professional management knowledge as a complementary human capital. We conducted an analysis to show that knowledge scaling may also have led to the demand of new types of human capital. Particularly, educational groups require professional managers to coordinate activities with the headquarters and to implement lean management techniques often not present in organizations operating in socially-oriented sectors (Bloom, Lemos, Sadun, & Van Reenen, 2015). Indeed, we found that within three years of an

acquisition with knowledge scaling, target educational units were 11.9p.p. more likely to report a labor contract associated to an executive or senior manager position than control units. Target units of acquisitions without knowledge scaling experienced no such increase.

Effects not being driven by a single educational group. As our specifications rely on acquisitions by a selected number of nine educational groups to identify the effect of knowledge scaling on human capital management and performance, it is possible that a single group could be driving all our results. To mitigate this concern, we conducted a series of "leave-one-out" specifications where we iteratively dropped all acquisitions form one educational group at a time and re-estimated all our main results using the subsample of remaining target and respective control educational units. The results remained qualitatively and quantitatively similar.

Service scale vs. service quality trade-off. Because our main performance variable is related to the scale of service provision and attraction of students to target units, there may be concerns that knowledge scaling did not increase performance, but simply refocused target units towards a low cost-low quality strategy. If that were the case, target units would experience a reduction in their service quality. However, in additional analyses, we used two difference service quality indicators independently developed by the Brazilian Ministry of education to show that there is no decrease in service quality following acquisitions. The indicators represent an institutions' overall quality, bundling aspects as pedagogical plans, performance in standardized test-scores, and infrastructure and another representing the average quality of undergraduate courses. Because one of the indicators is reported at the university (rather than at the educational unit-level), we conduct all regressions at the university-level and control for municipality-level controls for the municipality where the university's main building is located. Our results show that upon acquisitions with knowledge scaling, target universities neither increased nor decreased their educational quality scores. We interpret these results, and in our context, as implying that knowledge scaling led to a more efficient service provision.

Robustness to changes in university brand. A competing explanation to the results on the performance of educational units following acquisitions is that other scale-free resources, such as

brand name, could have driven demand for services provided by the target units. However, not all universities change their brand following an acquisition. We use this difference to re-estimate the results on knowledge scaling and performance only for the subset of universities that have never changed their names between 2003 and 2017. The results show that the performance effects occur even for universities that do not change their brand.

Faculty composition: professional vs. academic degrees and engagement in research activities. The last set of additional analyses use a subset of information only available at the university (rather than at the educational unit levels) and for a subset of years. Using data that is only available from 2010 onwards on the Brazilian Higher Education Census, we found that there is a 7.6p.p. decrease in the share of faculty that engage in research activities in target units acquired after 2010. Furthermore, there is an increase in 5.2p.p. in the share of faculty that have at most a professional extension degree ("specialization") rather than an academic degree (masters or PhD). These patterns only occur for educational units that were target of acquisitions with knowledge scaling, and not for targets of acquisitions without knowledge scaling. We interpret these results as providing further support about the specialization of faculty's human capital as a human capital resource.

6. DISCUSSION

6.1. Contributions

The main contribution of this study is to advance that knowledge scaling following acquisitions creates incentives to specialize workers on tasks that complement the knowledge being scaled, and that knowledge scaling may also weaken the strength of the worker-organization relationship. This argument extends the existing literature on resource reconfiguration (Dickler & Folta, 2020; Karim & Capron, 2016) and human capital management in the context of corporate strategy (Bodner et al., 2019; Capron & Guillén, 2009; Kapoor & Lim, 2007; Kim, 2020b; Stadler et al., 2021) by integrating it to the recent literature on the micro-foundations of strategic human capital (Crocker & Eckardt, 2014; Ployhart et al., 2013; Wright et al., 2014). We theorize and provide empirical evidence supporting that the contemporaneous sharing of knowledge resources across multiple

organizational units leads to the reconfiguration of which aspect of a worker's human capital is utilized as an organizational resource. Because a single worker's human capital comprises of multiple pieces of knowledge, skills, and abilities, strategies based on 'knowledge scaling' will not necessarily substitute workers, but rather incentive the reshaping of work arrangements in ways that reflect which aspects of human capital better complement the knowledge being scaled. Particularly, in the context of acquisitions in the Brazilian private higher education sector, we show that the scaling of knowledge in the form of standardized courseware, hybrid learning techniques, and practices to facilitate student enrollment increased the use of human capital associated to teaching while, at the same time, led to redundancies in terms of using faculty-level experience as a strategic resource. These effects incentivized the specialization of contracts around teaching tasks and to increased faculty turnover.

By considering how centralized resource deployment strategies define the management of strategic human capital in multi-unit organizations, this study extends the literature on examining human capital management in the context of multi-unit organizations (Mawdsley & Somaya, 2016; Stadler et al., 2021). We add to this literature by going beyond the analysis of human capital management practices as mechanisms to transfer valuable knowledge to study how strategies that transfer valuable knowledge outside workers will lead to the reconfiguration and redefinition of workers as human capital resources. This inversion is important because it shows that the mechanisms connecting resource deployment strategies or human capital management to organizational performance are incomplete without a joint consideration about the connections between firm-level resource deployment and the value of human capital as a strategic resource.

This paper also adds to the literature about how worker-level knowledge becomes a unit-level human capital resources (Crocker & Eckardt, 2014; Nyberg, Moliterno, Hale, & Lepak, 2014; Wright et al., 2014). We examine a new mechanism through which knowledge scaling, a firm-level strategy, enables units to access worker-level knowledge towards reaching their performance objective, Particularly, we theoretically argue and empirically show that knowledge scaling strategies will not only affect the value of workers, but also that the strategic value of different

types of worker-level knowledge, skills, and abilities change when organizations engage in knowledge scaling. Our paper also goes beyond the connection of unit-level context to the value of workers as a monolithic figure. Rather, we connect changes to firm-level strategies with changes in the relative value of different types of within-worker knowledge. Such extension towards verifying the effects of firm-level strategies on the deployment of different types of human capital enables the researcher to understand the origins of different work arrangements, such as specialized jobs (Wilmers, 2020).

Another contribution of this paper is to add to the expanding research that examines strategic management phenomena in the context of private organizations operating in socially-oriented settings (Cabral, Mahoney, McGahan, & Potoski, 2019; Eaton et al., 2020; Eliason et al., 2020; Gandhi et al., 2020; Klein, Mahoney, McGahan, & Pitelis, 2010; Mawdsley & Somaya, 2016). Particularly, we examine how knowledge scaling can enable post-secondary institutions to increase their scale of operations. This is a specially timely and relevant topic as the organizations increasingly requires individuals to possess complex skills, a phenomenon that disproportionally disenfranchises low income individuals (Autor & Dorn, 2013; Autor, Levy, & Murnane, 2003; Goos, Manning, & Salomons, 2014). In this context, upskilling low-income segments of the population may be a task that falls upon private enterprises that are responsive to market demands for the provision of new specialized skills (Deming et al., 2012; Deming, Goldin, & Katz, 2013; Dixit, 2002; MEC/INEP, 2019; Williamson, 1999). However, our results suggest that knowledge scaling may also require create trade-offs in terms of the relationship with a broader set of stakeholders that are not shareholders. Particularly, we show that knowledge scaling increases turnover and specialization of faculty labor contracts, which may be detrimental to faculty (Wilmers, 2020). This paper thus raises questions about the possibility of organizations to achieve scale and scope economies via knowledge scaling while also managing the relationship with core stakeholders.

6.2. Limitations and Suggestions for Future Research

This study has limitations that encourage further investigation about the interaction between resource deployment strategies and the management of human capital resources. First, although this study provides an overall theoretical framework, we test our hypotheses in a particular context of educational services. A first line of research could thus explore whether knowledge scaling also leads to adjustments in human capital management in different socially-oriented or profit-driven contexts. In different contexts, it is possible that different complementarities and substitutions effects between knowledge scaling and human capital emerge, thus leading to different forms of human capital reconfiguration. Examining such contexts, as well as further theorizing about when such different outcomes are more likely to occur is an exciting research path.

A second limitation of this work is that we rely on observational data to infer knowledge scaling from post-acquisition phenomena. Although we provide qualitative and quantitative evidence that knowledge scaling occurs in educational groups, and we conducted many robustness tests to rule out potential alternative explanations for the results we report, we are not able to fully disentangle effects from knowledge scaling from other effects that could be associated with acquisitions. Future studies could attempt to collect detailed intra-firm data on knowledge scaling across organizational units to provide further evidence on the effects of knowledge scaling that are unrelated with changes in ownership.

Another limitation of this work is its focus on knowledge scaling, which is only but one type of resource deployment strategy which could affect the value of strategic human capital. For instance, other resources such as an organizations' brand or relational capital could also affect the value of worker-level knowledge. For instance, the pre-existence of relational capital between a firm and suppliers could reduce the needs for workers to have social skills, and enable them to specialize in service quality. Exploring how the scaling of other types of resources affects the management of human capital is another research opportunity. Analogously, different strategies to scale the use of knowledge resources are also an exciting research agenda. As new business models focused on high-capacity digital resources emerge (example: services based on data analytics, or even distance learning), there may be economies of scale to be gained by utilizing the same

resource to cater to diverse customers even within the same establishments. Examining how knowledge scaling across organizational units differ from knowledge scaling within the same unit, as well as their repercussions to strategic human capital management, are topics worth future research. Finally, a future research direction is to explores the boundary conditions that enable firms to leverage the performance potential of knowledge scaling, as well as the conditions under which there would be adjustments to strategic human capital management (e.g. labor market conditions).

7. CONCLUDING REMARKS

This paper coalesces the resource reconfiguration and the recent literature on the micro-foundations of strategic human capital to advance how knowledge scaling leads to the reconfiguration of human capital resources by specializing and potentially weakening the relationship between employees and organizations. We employ a mixed-method approach that combines qualitative interviews to econometric analyses in the context of acquisitions by educational groups in the Brazilian private higher education sector.. Our results show that knowledge scaling changes the pool of worker-level knowledge that is valuable for units to achieve their performance objectives, thus also incentivizing the specialization of work arrangements around tasks that are related to worker's knowledge, skills, and abilities that complement the knowledge being scaled. These changes reflected a new set of human capital that becomes valuable as an organizational resource. When taken together with previous findings showing that worker redeployment is a valuable strategy to transfer knowledge, our results show that the relationship between human capital management and resource deployment strategies is bidirectional. If worker-level knowledge incentivizes firms to engage in worker redeployment, knowledge scaling reshapes the value and management of workers as organizational resources. Ultimately, although knowledge scaling has the potential to increase unit-level performance and create social value by broadening service provision in socially oriented sectors, this practice may weaken the ties between workers and institutions. This shows that even resource deployment strategies that could expand service provision in socially-oriented sectors also lead to costs in terms groups of

stakeholders. Strategic management scholars should thus embrace these tensions and build theory about how and when to minimize such trade-offs.

REFERENCES

Abell, P., Felin, T., & Foss, N. J. (2008). Building Micro-foundations for the Routines, Capabilities, and Performance Links. *Managerial and Decision Economics*, *29*, 489–502.

Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal*, *22*(3), 197–220.

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46.

Anand, J., Kim, H., & Lu, S. (2016). Resource Characteristics and Redeployment Strategies: Toward a Theoretical Synthetis. *Advances in Strategic Management*, *35*, 155–184.

Anand, J., & Kim, S. (2018). Sub-additivity. In *The Palgrave Encyclopedia of Strategic Management* (pp. 1674–1676). London: Palgrave Macmillan UK.

Argote, L., Lee, S., & Park, J. (2020). Organizational Learning Processes and Outcomes: Major Findings and Future Research Directions. *Management Science*, mnsc.2020.3693.

Arnold, D. (2019). Mergers and Acquisitions, Local Labor Market Concentration, and Worker Outcomes. *SSRN Electronic Journal*.

Autor, D. H., & Dorn, D. (2013). The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market. *The American Economic Review*, *103*(5), 1553–1597.

Autor, D. H., Levy, F., & Murnane, R. J. (2003). The Skill Content of Recent Technological Change: An Empirical Exploration. *The Quarterly Journal of Economics*, *118*(4), 1279–1333.

Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120.

Barney, J. B., & Felin, T. (2013). What are microfoundations? *Academy of Management Perspectives*, *27*(2), 138–155.

Becker, G. S. (1962). Investment in Human Capital: a theoretical analysis. *Journal of Political Economy*, *70*(5), 9–49.

Bloom, N., Genakos, C., Sadun, R., & Van Reenen, J. (2012). Management Practices Across Firms and Countries. *Academy of Management Perspectives*, *26*(1), 12–33.

Bloom, N., Lemos, R., Sadun, R., & Van Reenen, J. (2015). Does Management Matter in schools? *Economic Journal*, *125*(584), 647–674.

Bodner, J., & Capron, L. (2018). Post-merger integration. *Journal of Organization Design*, *7*(1), 3.

Bodner, J., Marchetti, A., Graebner, M., La Forgia, A., Ng, W., Vuori, N., … Stuart, T. E. (2019). Paving the Road to M&A Success: Antecedents, Processes, and Outcomes of Post- Merger Integration. *Academy of Management Proceedings*, *2019*(1), 17121.

Brynjolfsson, E., & McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W. W. Norton & Company.

Cabral, S., Mahoney, J. T., McGahan, A. M., & Potoski, M. (2019). Value Creation and Value Appropriation in Public and Non-Profit Organizations. *Strategic Management Journal*, *40*(4), smj.3008.

Campbell, B. A., Coff, R. W., & Kryscynski, D. (2012). Rethinking Sustained Competitive Advantage from Human Capital. *Academy of Management Review*, *37*(3), 376–395.

Capron, L. (1999). The long-term performance of horizontal acquisitions. *Strategic Management Journal*, *20*(11), 987–1018.

Capron, L. (2018). Growth Through Acquisitions. In *The Palgrave Encyclopedia of Strategic*

Management (pp. 648–654). London: Palgrave Macmillan UK.
Capron, L., Dussauge, P., & Mitchell, W. (1998). Resource deployment following horizontal acquisition in Europe and North America. *Strategic Management Journal*, *19*(7), 631–661.
Capron, L., & Guillén, M. (2009). National corporate governance institutions and post-acquisition target reorganization. *Strategic Management Journal*, *30*(8), 803–833.
Capron, L., & Mitchell, W. (2012). *Build, Borrow, or Buy: Solving the Growth Dilemma*. Cambridge, MA: Harvard Business Review Press.
Capron, L., Mitchell, W., & Swaminathan, A. (2001). Asset divestiture following horizontal acquisitions: A dynamic view. *Strategic Management Journal*, *22*(9), 817–844.
Chadwick, C. (2017). Towards a More Comprehensive Model of Firms' Human Capital Rents. *Academy of Management Review*, *42*(3).
Chandler, A. D. (1990). *Scale and Scope: The Dynamics of Industrial Capitalism.* The Belknap Press.
Chauvin, J., & Poliquin, C. (2020). *Worker Redeployment in Multi-Business Firms*.
Chen, G., Huang, S., Meyer-Doyle, P., & Mindruta, D. (2020). Generalist versus specialist CEOs and acquisitions: Two-sided matching and the impact of CEOcharacteristics on firm outcomes. *Strategic Management Journal*, smj.3258.
Chliova, M., & Ringov, D. (2017). Scaling Impact : Template Development and Replication at the Base of the Pyramid. *Academy of Management Perspectives*, *31*(1), 44–62.
Coff, R. W. (1997). Human Assets and Management Dilemmas: coping with hazards on the road to resource-based theory. *Academy of Management Review*, *22*(2), 374–402.
Coff, R. W. (1999). When Competitive Advantage Doesn't Lead to Performance: The Resource-Based View and Stakeholder Bargaining Power. *Organization Science*, *10*(2), 119–133.
Coff, R. W., & Kryscynski, D. (2011). Drilling for Micro-Foundations of Human Capital-Based Competitive Advantages. *Journal of Management*, *37*(5), 1429–1443.
Crocker, A., & Eckardt, R. (2014). A Multilevel Investigation of Individual- and Unit-Level Human Capital Complementarities. *Journal of Management*, *40*(2), 509–530.
Datta, S., & Iskandar-Datta, M. (2014). Upper-Echelon Executive Human Capital and Compensation: generalist vs specialist skills. *Strategic Management Journal*.
Deming, D. J., Goldin, C., & Katz, L. F. (2012). The For-Profit Postsecondary School Sector: Nimble Critters or Agile Predators? *Journal of Economic Perspectives*, *26*(1), 139–164.
Deming, D. J., Goldin, C., & Katz, L. F. (2013). For-Profit Colleges. *The Future of Children*, *23*(1), 137–163.
Dickler, T. A., & Folta, T. B. (2020). Identifying internal markets for resource redeployment. *Strategic Management Journal*, *41*(13), 2341–2371.
Dixit, A. K. (2002). Incentives and Organizations in the Public Sector: an interpretative review. *The Journal of Human Resources*, *37*(4), 696–727.
Eaton, C., Howell, S. T., & Yannelis, C. (2020). When Investor Incentives and Consumer Interests Diverge: Private Equity in Higher Education. *The Review of Financial Studies*, *33*(9), 4024–4060.
Eliason, P. J., Heebsh, B., McDevitt, R. C., & Roberts, J. W. (2020). How Acquisitions Affect Firm Behavior and Performance: Evidence from the Dialysis Industry*. *The Quarterly Journal of Economics*, *135*(1), 221–267.
Felin, T., Foss, N. J., & Ployhart, R. E. (2015). The Microfoundations Movement in Strategy and Organization Theory. *Academy of Management Annals*, *9*(1), 575–632.
Folta, T. B., Helfat, C. E., & Karim, S. (2016). Examining Resource Redeployment in Multi-Business Firms. *Advances in Strategic Management*, *35*, 1–17.
Fuller, J. (2018). How Google.org is helping workers close the digital skills gap.
Gambardella, A., & McGahan, A. M. (2010). Business-model innovation: General purpose technologies and their implications for industry structure. *Long Range Planning*, *43*(2–3), 262–271.
Gandhi, A., Song, Y., & Upadrashta, P. (2020). Private Equity, Consumers, and Competition: Evidence from the Nursing Home Industry. In *SSRN Electronic Journal*.
Giustiziero, G., Somaya, D., & Wu, B. (2020). A Resource-Based Theory of Hyperspecialization

and Hyperscaling. *SSRN Electronic Journal*, 1–41.
Goos, M., Manning, A., & Salomons, A. (2014). Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, *104*(8), 2509–2526.
Greenwood, B. N., Carnahan, S., & Huang, L. (2018). Patient–physician gender concordance and increased mortality among female heart attack patients. *Proceedings of the National Academy of Sciences*.
Helfat, C. E., & Eisenhardt, K. M. (2004). Inter-temporal economies of scope, organizational modularity, and the dynamics of diversification. *Strategic Management Journal*, *25*(13), 1217–1232.
Hoper Educação. (2019). *Análise Setorial da Educação Superior Privada 2019*. Foz do Iguaçí.
Jensen, R. J., & Szulanski, G. (2007). Template Use and the Effectiveness of Knowledge Transfer. *Management Science*, *53*(11), 1716–1730.
Jonsson, A., & Foss, N. J. (2011). International expansion through flexible replication: Learning from the internationalization experience of IKEA. *Journal of International Business Studies*, *42*(9), 1079–1102.
Kapoor, R., & Lim, K. (2007). The impact of acquisitions on the productivity of inventors at semiconductor firms: A synthesis of knowledge-based and incentive-based perspectives. *Academy of Management Journal*, *50*(5), 1133–1155.
Karim, S. (2006). Modularity in organizational structure: the reconfiguration of internally developed and acquired business units. *Strategic Management Journal*, *27*(9), 799–823.
Karim, S., & Capron, L. (2016). Reconfiguration: Adding, redeploying, recombining and divesting resources and business units. *Strategic Management Journal*, *37*(13), E54–E62.
Karim, S., & Mitchell, W. (2004). Innovating through acquisition and internal development: A quarter-century of boudary evolution at Johnson & Johnson. *Long Range Planning*, *37*(6), 525–547.
Kim, J. D. (2020a). *Startup Acquisitions as a Hiring Strategy: Worker Choice and Turnover*.
Kim, J. D. (2020b). Startup Acquisitions as a Hiring Strategy: Worker Choice and Turnover. In *SSRN Electronic Journal*.
Klein, P. G., Mahoney, J. T., McGahan, A. M., & Pitelis, C. (2010). Resources, Capabilities, and Routines in Public Organizations. *SSRN Electronic Journal*.
Kogut, B., & Zander, U. (1992). Knowledge of the Firm , Combinative Capabilities , and the Replication of Technology. *Organization Science*, *3*(3), 383–397.
Lawrence, M. (2020). Replication Using Templates: Does the Unit Learn from Itself, the Template, or Both? *Strategic Management Journal*, smj.3206.
Lazear, E. P. (2009). Firm-Specific Human Capital: A Skill-Weights Approach. *Journal of Political Economy*, *117*(5), 914–940.
Levinthal, D. A., & Wu, B. (2010). Opportunity Costs and Non-Scale Free Capabilities: Profit Maximization, Corporate Scope, and Profit Margins. *Strategic Management Journal*, *31*, 780–801.
Mahoney, J. T., McGahan, A. M., & Pitelis, C. N. (2009). The Interdependence of Private and Public Interests. *Organization Science*, *20*(6), 1034–1052.
Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal*, *13*(5), 363–380.
Mawdsley, J. K., & Somaya, D. (2016). Employee Mobility and Organizational Outcomes: an integrative conceptual framework and research agenda. *Journal of Management*, *42*(1), 85–113.
MEC/INEP, M. da E.-I. N. de E. e P. E. A. T. (2019). *Censo da Educação Superior (1996-2019)*. Brasília.
Molloy, J. C., & Barney, J. B. (2015). Who Captures the Value Created with Human Capital? A Market-Based View. *Academy of Management Perspectives*, *29*(3), 309–325.
Montgomery, C. A., & Hariharan, S. (1991). Diversified expansion by large established firms. *Journal of Economic Behavior and Organization*, *15*(1), 71–89.
Montgomery, C. A., & Wernerfelt, B. (1988). Diversification, Ricardian Rents, and Tobin's q. *The RAND Journal of Economics*, *19*(4), 623.

Morris, S. S., Alvaraz, S. A., Barney, J. B., & Molloy, J. C. (2016). Firm-Specific Human Capital Investments as a Signal of General Value: revisiting assumptions about human capital and how it is managed. *Strategic Management Journal*.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, *5*(1), 14–37.

Nyberg, A. J., Moliterno, T. P., Hale, D., & Lepak, D. P. (2014). Resource-Based Perspectives on Unit-Level Human Capital. *Journal of Management*, *40*(1), 316–346.

Paruchuri, S., Nerkar, A., & Hambrick, D. C. (2006). Acquisition Integration and Productivity Losses in the Technical Core: Disruption of Inventors in Acquired Companies. *Organization Science*, *17*(5), 545–562.

Penrose, E. T. (1959). *The Theory of the Growth of the Firm*. New York, NY: Oxford University Press.

Peteraf, M. A. (1993). The Cornerstones of Competitive Advantage: a Resource Based View. *Strategic Management Journal*, *14*, 179–191.

Ployhart, R. E., Nyberg, A. J., Reilly, G., & Maltarich, M. A. (2013). Human Capital Is Dead; Long Live Human Capital Resources! *Journal of Management*, *40*(2), 371–398.

Rosa, L. S. N. (2015). *Avaliação de impacto do Programa Jovem de Futuro* (Biblioteca Digital de Teses e Dissertações da Universidade de São Paulo). Biblioteca Digital de Teses e Dissertações da Universidade de São Paulo, São Paulo.

Rosenkopf, L., & Nerkar, A. (2001). Beyond local search: boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal*, *22*(4), 287–306.

Sakhartov, A. V., & Folta, T. B. (2014). Resource relatedness, redeployability, and firm value. *Strategic Management Journal*, *35*(12), 1781–1797.

Schultz, T. W. (1972). Human Capital : Policy Issues a nd Research Opportunities. In *Economic Research: Retrospect and Prospect. Volume 6: Human resources*: *Vol. I* (pp. 1–84). Bostom: UMI.

Spearman, C. (1927). The Abilities of Man their Nature and Measurement. *Nature*, *120*(3014), 181–183.

Stadler, C., Helfat, C. E., & Verona, G. (2021). Transferring Knowledge by Transferring Individual: innovative technology usage and organizational performance in multi-unit firms. *Organization Science*, *Online*.

Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal*, *17*(S2), 27–43.

Szulanski, G., Ringov, D., & Jensen, R. R. (2016). Overcoming Stickiness: how the timing of knowledge transfer methods affects transfer difficulty. *Organization Science*, *27*(2), 304–322.

Teece, D. J. (1982). Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior & Organization*, *3*(1), 39–63.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533.

Vassolo, R. S., Anand, J., & Folta, T. B. (2004). Non-additivity in portfolios of exploration activities: a real options-based analysis of equity alliances in biotechnology. *Strategic Management Journal*, *25*(11), 1045–1061.

Vidal, E., & Mitchell, W. (2015). Adding by subtracting: The relationship between performance feedback and resource reconfiguration through divestitures. *Organization Science*, *26*(4), 1101–1118.

Wang, H. C., He, J., & Mahoney, J. T. (2009). Firm-Specific Knowledge Resources and Competitive Advantage: the roles of economic and relationship-based employee governance mechanisms. *Strategic Management Journal*, *30*, 1265–1285.

Wernerfelt, B. (1984). A Resource-Based View of the Firm. *Strategic Management Journal*, *5*(2), 171–180.

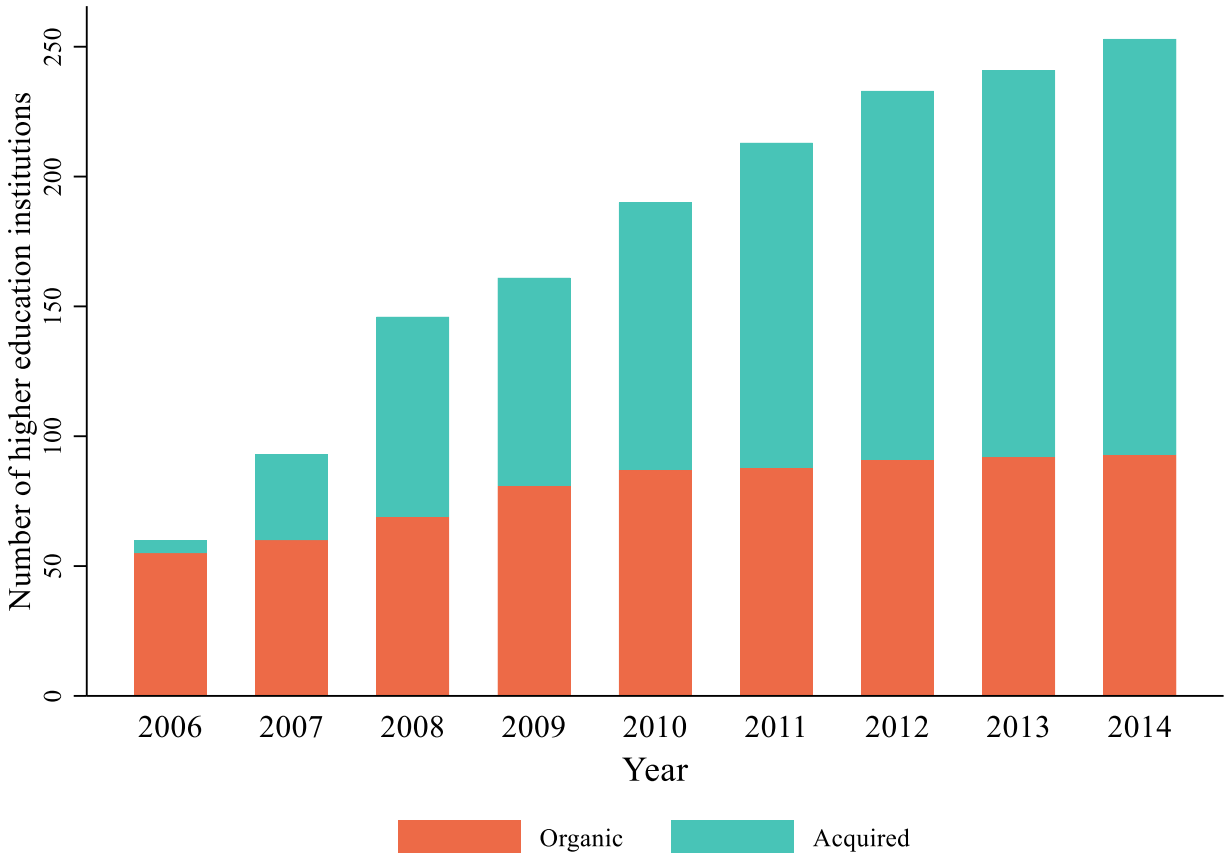
Williamson, O. E. (1999). Public and private bureaucracies: A transaction cost economics perspective. *Journal of Law Economics & Organization*, *15*(1), 306–342.

Wilmers, N. (2020). Job Turf or Variety: Task Structure as a Source of Organizational

Inequality. *Administrative Science Quarterly*.
Winter, S. G., & Szulanski, G. (2001). Replication as Strategy. *Organization Science*, *12*(6), 730–743.
Wright, P. M., Coff, R. W., & Moliterno, T. P. (2014). Strategic Human Capital: Crossing the Great Divide. *Journal of Management*, *40*(2), 353–370.
Wu, B. (2013). Opportunity Costs, Industry Dynamics, and Corporate Diversification: Evidence from the Cardiovascular Medical Device Industry, 1976-2004. *Strategic Management Journal*, *34*, 1265–1287.
Zhao, Z. J., & Anand, J. (2009). A Multilevel Perspective on Knowledge Transfer: evidence from the Chinese automotive industry. *Strategic Management Journal)*, *30*, 959–983.

FIGURES AND TABLES

Figure 1 – Number of Higher Education Institutions Owned by Educational Groups, by Origin

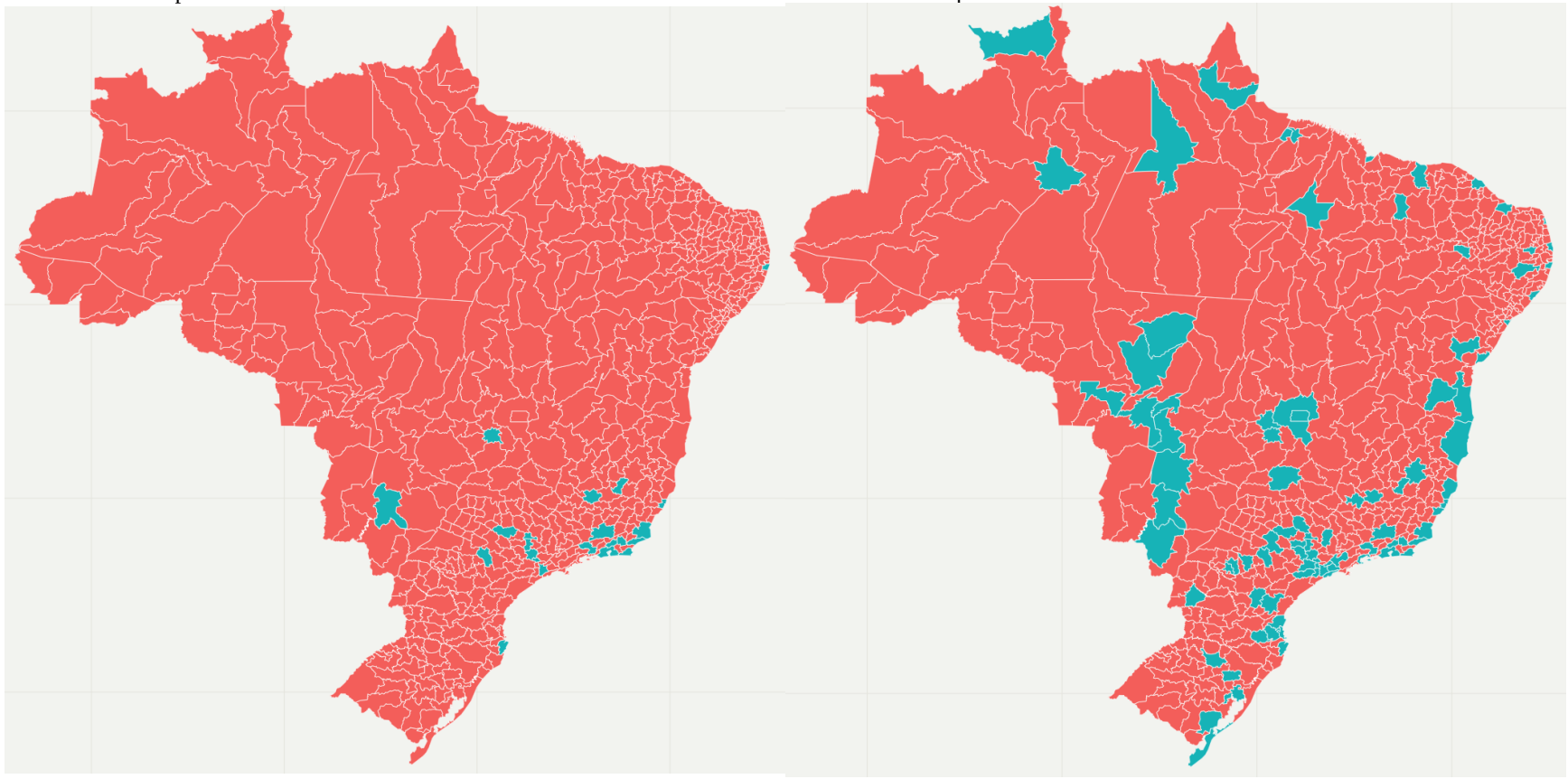


Note: in 2006, 12 private educational groups owned 60 higher education institutions in Brazil, 55 of which originated from organic growth or from acquisitions prior to 2003. By 2014, the same 12 groups had expanded and owned 253 institutions, 160 of which were a result of acquisitions.

Figure 2 – Growth-by-Acquisition Strategy Deployed by Educational Groups

Panel A – Geographic Dispersion of Higher Education Institutions Owned by Educational Groups in 2005

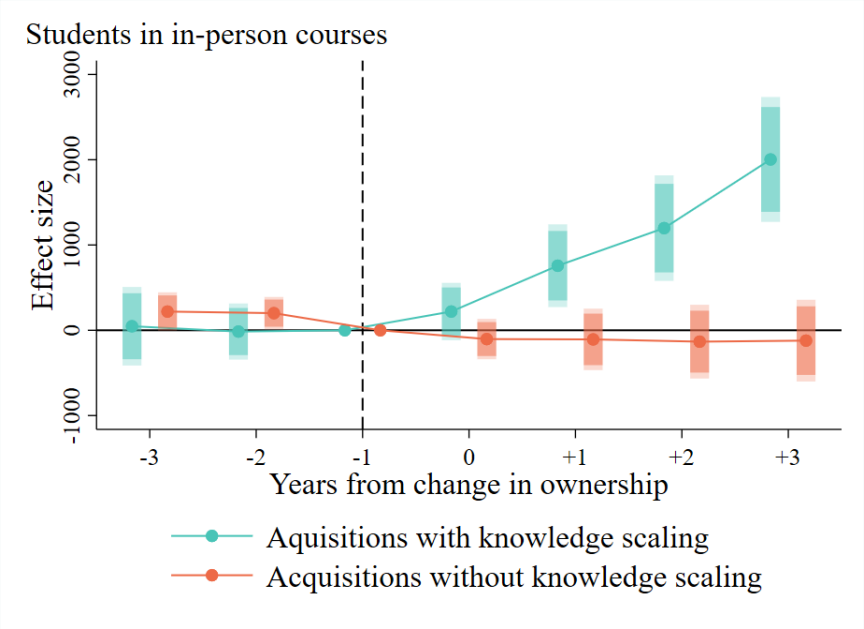
Panel B – Geographic Dispersion of Higher Education Institutions Owned by Educational Groups in 2015



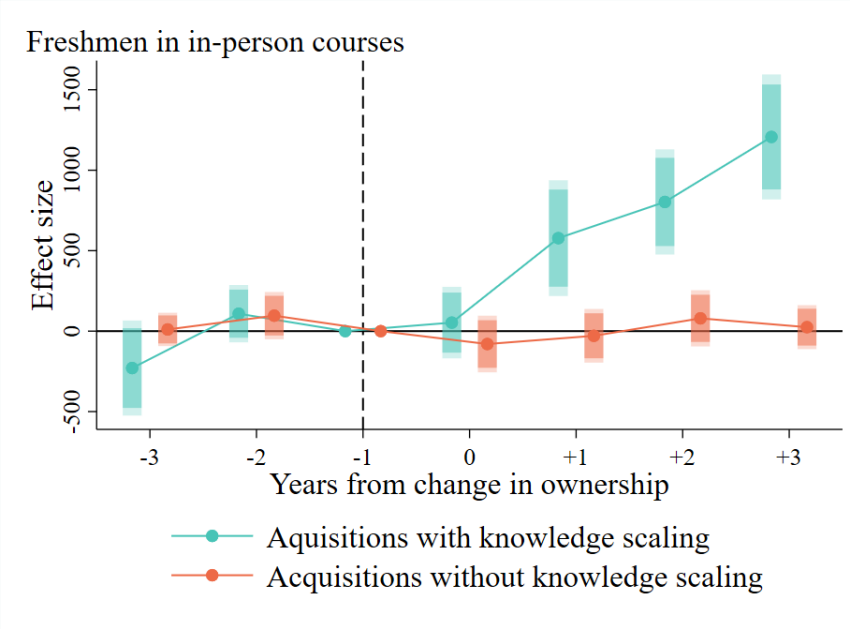
Note: green areas represent Brazilian microregions where there is at least one higher education institution owned by an educational group.

Figure 3 – Panel Data Event Study on Knowledge Scaling and Performance of Target Educational Units

Panel A – Increase in Scale of Service Provision following Acquisitions with and without Knowledge scaling



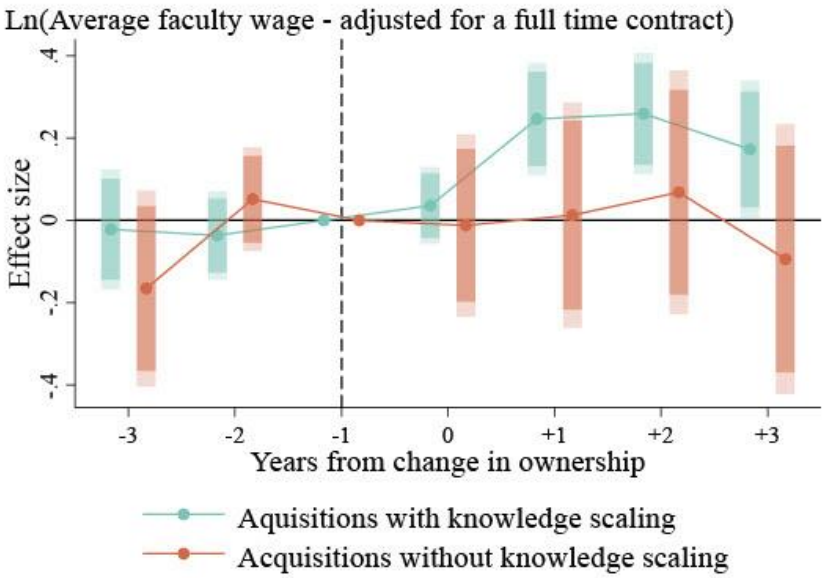
Panel B – Increase in Attraction of New Students following Acquisitions with and without Knowledge Scaling



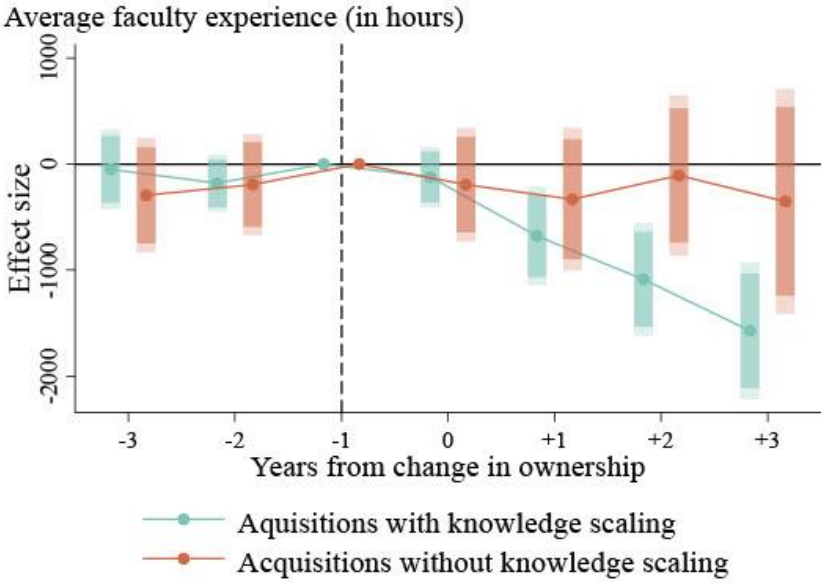
Notes: [1] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [2] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [3] The estimates correspond to the panel event-study analysis, as delineated by equation (2) in the text. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text

Figure 4 – Panel Data Event Study on Knowledge Scaling, Value of Faculty Experience, and Teaching Intensity

Panel A – Increase in the Productivity of Workers following Acquisitions with and without Knowledge scaling



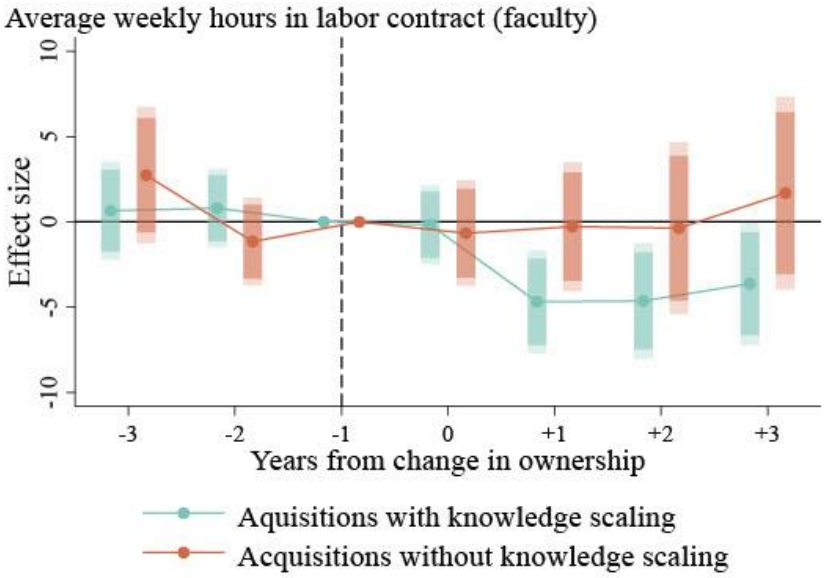
Panel B – Reduction in Worker's Experience as a Human Capital Resource following Acquisitions with and without Knowledge Scaling



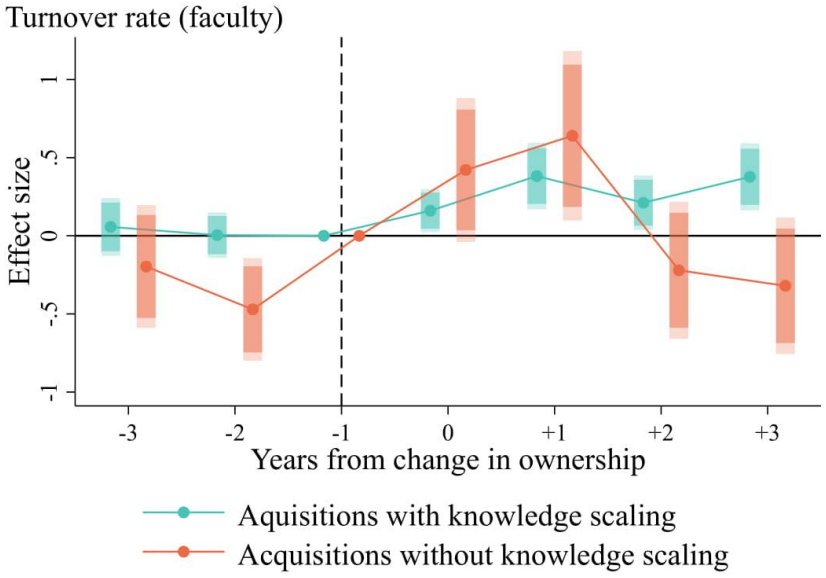
Notes: [1] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [2] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [3] The estimates correspond to the panel event-study analysis, as delineated by equation (2) in the text. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text

Figure 5 – Panel Data Event Study on Knowledge Scaling, Specialization of Work Arrangements, And Weakening of Faculty-Institution Relationship

Panel A – Specialization of Work Arrangements following Acquisitions with and without Knowledge scaling



Panel B – Strength of Worker-Organization Relationship following Acquisitions with and without Knowledge scaling



Notes: [1] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [2] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [3] The estimates correspond to the panel event-study analysis, as delineated by equation (2) in the text. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text

Table 1: Descriptive Statistics within the Matched Sample of Target and Control Educational Units

	Matched control group N = 126		Target Educational Units N = 126		Difference	p-value
	Mean	SD	Mean	SD		
Students in in-person courses	3848.373	6821.557	3666.849	5433.587	-181.524	0.815
Freshmen in in-person courses	1254.127	2018.213	1482.619	2713.376	228.492	0.449
Freshmen per faculty labor contract ratio	10.776	43.429	7.319	15.865	-3.457	0.402
Ln(Average faculty wage - adjusted for a full time contract)	9.078	0.601	9.057	0.548	-0.021	0.770
Experience as a faculty (in hours)	6129.363	4180.660	6215.546	3164.171	86.183	0.854
Share of faculty contracts with less than 16h per week	0.540	0.325	0.556	0.320	0.016	0.701
Avg. weekly hours (faculty)	19.763	11.775	19.809	11.612	0.046	0.975
Turnover rate (faculty)	0.748	0.717	0.756	0.566	0.007	0.928
Annual real gross domestic product per capita (BRL 000s)	33.900	18.389	36.262	21.874	2.362	0.354
Average wage for individuals with less that high school degree (BRL)	1642.855	322.999	1669.208	365.512	26.353	0.545
Average wage for individuals with high school but no college degree (BRL)	2045.054	503.844	2072.533	519.654	27.479	0.670
Fraction of labor contracts associated to individuals with high school but no college degree	0.361	0.101	0.371	0.100	0.010	0.453
Total number of labor contracts in the municipality (000s)	465.9268	1024.146	458.6848	976.0294	-7.242	0.954
Number of high school students (000s)	60.513	115.624	60.023	105.425	-0.490	0.972
Population between the ages of 20 and 24 (000s)	124.452	250.125	117.902	202.917	-6.550	0.820

Note: the sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units.

Table 2: Target Unit Performance Following Acquisitions with and Acquisitions without Knowledge Scaling

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Static Differences-in-Differences				Panel Event-Study			
	Students in in-person courses	Freshmen in in-person courses	Ln(Students in in-person courses)	Ln(Freshmen in in-person courses)	Students in in-person courses	Freshmen in in-person courses	Ln(Students in in-person courses)	Ln(Freshmen in in-person courses)
	Panel A: Acquisitions with Knowledge Scaling							
Post-acquisition	2167.015 [0.000]	1246.265 [0.000]	0.372 [0.000]	0.651 [0.000]	1057.129 [0.000]	658.141 [0.000]	0.207 [0.000]	0.448 [0.000]
Number of treated units	*94*	*94*	*94*	*94*	*94*	*94*	*94*	*94*
Establishment-years	*2952*	*2952*	*2952*	*2952*	*2952*	*2952*	*2952*	*2952*
Mean of Dep. Variable in pre-acquisition year	*4548.032*	*1860.213*	*7.850*	*6.874*	*4548.032*	*1860.213*	*7.850*	*6.874*
	Panel B: Acquisitions without Knowledge Scaling							
Post-acquisition	-642.403 [0.013]	5.886 [0.941]	-0.075 [0.689]	0.119 [0.493]	-67.989 [0.623]	84.776 [0.250]	-0.003 [0.981]	0.197 [0.216]
Number of treated units	*32*	*32*	*32*	*32*	*32*	*32*	*32*	*32*
Establishment-years	*2030*	*2030*	*2030*	*2030*	*2030*	*2030*	*2030*	*2030*
Mean of Dep. Variable in pre-acquisition year	*1057.875*	*425.750*	*6.352*	*5.348*	*1057.875*	*425.750*	*6.352*	*5.348*
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the unit-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] Columns 1 to 4 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 5 to 8 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k /4$) and the t-test of whether this linear combination is different than zero. [5] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table 3: Use of Worker's Human Capital as an Organizational Resource Following Acquisitions with and Acquisitions without Knowledge Scaling

	(1)	(2)	(3)	(4)	(5)	(6)
	Static Differences-in-Differences			Panel Event-Study		
	Freshmen per faculty labor contract ratio	Ln(Average faculty wage - adjusted for a full time contract)	Experience as a faculty (in hours)	Freshmen per faculty labor contract ratio	Ln(Average faculty wage - adjusted for a full time contract)	Experience as a faculty (in hours)
	Panel A: Acquisitions with Knowledge Scaling					
Post-acquisition	5.584	0.157	-989.025	8.016	0.175	-818.653
	[0.022]	[0.017]	[0.001]	[0.071]	[0.005]	[0.000]
Number of treated units	*94*	*94*	*94*	*94*	*94*	*94*
Establishment-years	*2952*	*2952*	*2952*	*2952*	*2952*	*2952*
Mean of Dep. Variable in pre-acquisition year	*7.909*	*9.074*	*6497.422*	*7.909*	*9.074*	*6497.422*
	Panel B: Acquisitions without Knowledge Scaling					
Post-acquisition	3.889	0.063	-183.872	5.451	0.003	-312.137
	[0.107]	[0.516]	[0.654]	[0.163]	[0.975]	[0.267]
Number of treated units	*32*	*32*	*32*	*32*	*32*	*32*
Establishment-years	*2030*	*2030*	*2030*	*2030*	*2030*	*2030*
Mean of Dep. Variable in pre-acquisition year	*6.371*	*9.091*	*5837.227*	*6.371*	*9.091*	*5837.227*
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the unit-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] Columns 1 to 3 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 4 to 6 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k \, /4$) and the t-test of whether this linear combination is different than zero. [5] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table 4: Specialization of Work Arrangement and Strength of Worker-Organization Relationship Following Acquisitions with and Acquisitions without Knowledge Scaling

	(1)	(2)	(3)	(4)	(5)	(6)
	Static Differences-in-Differences			Panel Event-Study		
	Share of faculty contracts with less than 16h per week	Avg. weekly hours (faculty)	Turnover rate (faculty)	Share of faculty contracts with less than 16h per week	Avg. weekly hours (faculty)	Turnover rate (faculty)
	Panel A: Acquisitions with Knowledge Scaling					
Post-acquisition	0.074	-2.874	0.257	0.089	-3.402	0.303
	[0.061]	[0.036]	[0.000]	[0.017]	[0.011]	[0.000]
Number of treated units	*94*	*94*	*94*	*94*	*94*	*94*
Establishment-years	*2952*	*2952*	*2952*	*2952*	*2952*	*2952*
Mean of Dep. Variable in pre-acquisition year	*0.531*	*20.620*	*0.635*	*0.531*	*20.620*	*0.635*
	Panel B: Acquisitions without Knowledge Scaling					
Post-acquisition	0.042	-1.478	0.051	-0.010	0.440	0.075
	[0.406]	[0.405]	[0.553]	[0.824]	[0.783]	[0.614]
Number of treated units	*32*	*32*	*32*	*32*	*32*	*32*
Establishment-years	*2030*	*2030*	*2029*	*2030*	*2030*	*2029*
Mean of Dep. Variable in pre-acquisition year	*0.679*	*16.087*	*1.314*	*0.679*	*16.087*	*1.314*
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the unit-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] Columns 1 to 3 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 4 to 6 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k \, /4$) and the t-test of whether this linear combination is different than zero. [5] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table 5: Evidence of Knowledge Scaling Following Acquisitions with and Acquisitions without Knowledge Scaling

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Static Differences-in-Differences				Panel Event-Study			
	Share of students supported by the FIES federal program	Count of in-person courses	Share of courses 'hybrid' in-person courses	Share of students in 'hybrid' in-person courses	Share of students supported by the FIES federal program	Count of in-person courses	Share of courses 'hybrid' in-person courses	Share of students in 'hybrid' in-person courses
	Panel A: Acquisitions with Knowledge Scaling							
Post-acquisition	0.107	4.306	0.235	0.216	0.052	1.655	0.153	0.169
	[0.000]	[0.000]	[0.012]	[0.000]	[0.001]	[0.002]	[0.051]	[0.001]
Number of treated units	*94*	*94*	*57*	*57*	*94*	*94*	*57*	*57*
Establishment-years	*2952*	*2952*	*1515*	*1515*	*2952*	*2952*	*1515*	*1515*
Mean of Dep. Variable in pre-acquisition year	*0.068*	*16.351*	*0.299*	*0.208*	*0.068*	*16.351*	*0.299*	*0.208*
	Panel B: Acquisitions without Knowledge Scaling							
Post-acquisition	-0.035	-2.400	-0.006	-0.011	-0.009	-0.597	-0.028	-0.051
	[0.096]	[0.004]	[0.959]	[0.892]	[0.605]	[0.294]	[0.792]	[0.556]
Number of treated units	*32*	*32*	*24*	*24*	*32*	*32*	*24*	*24*
Establishment-years	*2030*	*2030*	*1222*	*1222*	*2030*	*2030*	*1222*	*1222*
Mean of Dep. Variable in pre-acquisition year	*0.049*	*6.344*	*0.122*	*0.091*	*0.049*	*6.344*	*0.122*	*0.091*
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls (main building)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the unit-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] Columns 1 to 4 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 5 to 8 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k \, /4$) and the t-test of whether this linear combination is different than zero. [5] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table 6: Robustness - Human Capital Management Following Acquisitions with and Acquisitions without Knowledge Scaling

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Static DiD Model					Panel Event-Study/DiD Model				
	Share of new faculty labor contracts	Share of ceased faculty labor contracts	Share of new non-faculty labor contracts	Share of ceased non-faculty labor contracts	Avg. weekly hours (non-faculty)	Share of new faculty labor contracts	Share of ceased faculty labor contracts	Share of new non-faculty labor contracts	Share of ceased non-faculty labor contracts	Avg. weekly hours (non-faculty)
	Panel A: Acquisitions with Knowledge Scaling									
Post-acquisition	0.068	0.047	0.040	0.018	-0.543	0.110	0.041	0.071	0.026	-0.764
	[0.001]	[0.001]	[0.019]	[0.140]	[0.256]	[0.000]	[0.031]	[0.002]	[0.158]	[0.089]
Number of treated units	*94*	*94*	*94*	*94*	*94*	*94*	*94*	*94*	*94*	*94*
Establishment-years	*2952*	*2952*	*2940*	*2940*	*2952*	*2952*	*2952*	*2940*	*2940*	*2952*
Mean of Dep. Variable in pre-acquisition year	*0.244*	*0.213*	*0.296*	*0.270*	*41.234*	*0.244*	*0.213*	*0.296*	*0.270*	*41.234*
	Panel B: Acquisitions without Knowledge Scaling									
Post-acquisition	0.039	-0.032	0.092	-0.033	0.269	0.103	-0.095	0.157	-0.048	-0.101
	[0.199]	[0.143]	[0.002]	[0.147]	[0.761]	[0.027]	[0.145]	[0.000]	[0.356]	[0.888]
Number of treated units	*32*	*32*	*31*	*31*	*32*	*32*	*32*	*31*	*31*	*32*
Establishment-years	*2030*	*2030*	*2013*	*2013*	*2030*	*2030*	*2030*	*2013*	*2013*	*2030*
Mean of Dep. Variable in pre-acquisition year	*0.376*	*0.304*	*0.408*	*0.323*	*39.005*	*0.376*	*0.304*	*0.408*	*0.323*	*39.005*
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the unit-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired educational units only considers units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] Columns 1 to 4 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 5 to 8 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k \,/4$) and the t-test of whether this linear combination is different than zero. [5] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

APPENDIX/SUPPLEMENTARY MATERIAL

Table A1: Knowledge scaling and higher demand for professional management knowledge as a complementary human capital

	(1)	(2)	(3)	(4)
	Acquisitions with Knowledge Scaling		Acquisitions without Knowledge Scaling	
	=1 if has a labor contract associated to a top manager			
Post-acquisition	0.119		-0.006	
	[0.007]		[0.919]	
Year relative to acquisition: -4 or earlier		-0.019		-0.044
		[0.783]		[0.578]
Year relative to acquisition: -3		-0.007		-0.030
		[0.915]		[0.750]
Year relative to acquisition: -2		-0.018		-0.003
		[0.672]		[0.969]
Year relative to acquisition: +0		0.089		0.051
		[0.053]		[0.183]
Year relative to acquisition: +1		0.100		0.006
		[0.087]		[0.942]
Year relative to acquisition: +2		0.064		0.050
		[0.286]		[0.534]
Year relative to acquisition: +3		0.119		-0.084
		[0.044]		[0.464]
Year relative to acquisition: +4 or after		0.124		-0.077
		[0.052]		[0.425]
Number of treated units	94	94	32	32
Establishment-years	2952	2952	2030	2030
Mean of Dep. Variable in pre-acquisition year	0.787	0.787	0.750	0.750
Establishment FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Municipality controls	Yes	Yes	Yes	Yes

Notes:

Table A2: Service scale vs. service quality trade-off

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Acquisitions with Knowledge Scaling				Acquisitions without Knowledge Scaling			
	University Quality Index		Average Course Quality Index		University Quality Index		Average Course Quality Index	
Post-acquisition	0.109		0.074		0.178	0.167		
	[0.034]		[0.252]		[0.017]	[0.101]		
Year relative to acquisition: -4 or earlier		-0.094		-0.056			-0.096	0.018
		[0.218]		[0.485]			[0.295]	[0.916]
Year relative to acquisition: -3		-0.074		0.027			-0.069	-0.062
		[0.225]		[0.736]			[0.433]	[0.546]
Year relative to acquisition: -2		-0.021		-0.001			-0.010	0.101
		[0.821]		[0.993]			[0.934]	[0.376]
Year relative to acquisition: +0		0.021		-0.021			0.133	0.266
		[0.783]		[0.833]			[0.016]	[0.147]
Year relative to acquisition: +1		0.031		0.071			0.094	0.093
		[0.569]		[0.539]			[0.127]	[0.511]
Year relative to acquisition: +2		0.090		0.142			0.116	0.102
		[0.385]		[0.381]			[0.156]	[0.424]
Year relative to acquisition: +3		0.110		0.080			0.103	0.263
		[0.271]		[0.437]			[0.266]	[0.140]
Year relative to acquisition: +4 or after		0.090		0.056			0.202	0.178
		[0.290]		[0.590]			[0.074]	[0.355]
Number of treated units	109	109	62	62	73	26	73	26
Establishment-years	14335	14335	7104	7104	13899	6794	13899	6794
Mean of Dep. Variable in pre-acquisition year	2.190	2.190	2.262	2.262	2.244	2.276	2.244	2.276
University FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls (main building)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the university-level and the p-values of a t-test are shown in brackets. [2] Columns (1)-(4) report results using all universities acquired by educational groups (acquisitions with knowledge scaling) and all universities that were never owned by educational groups. Columns (5)-(8) report results using all universities acquired by any enterprise other than an educational group (acquisitions without knowledge scaling) and all universities that were never owned by educational groups. [3] The sample only considers acquired universities that appear in all three years prior being acquired by an educational groups and three years after the acquisition. The control group in this specification is any private university that never changed ownership and never belonged to an educational group between 2003 and 2017. [4] All specifications are estimated using ordinary least square regressions and utilize university quality indexes reported by the Brazilian Ministry of Education. [5] All estimates control for university fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table A3: Robustness to changes in university brand (only acquisitions with knowledge scaling)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Static DiD Model					Panel Event-Study/Dynamic DiD Model				
	Count of course-areas	New students in in-person courses)	Students	University Quality Index	Course Quality Index (average)	Count of course-areas	Students	Freshmen	University Quality Index	Course Quality Index (average)
Post-acquisition	2.359 [0.000]	2325.325 [0.000]	1048.939 [0.000]	0.126 [0.009]	0.123 [0.017]	0.873 [0.000]	988.294 [0.000]	517.807 [0.000]	0.106 [0.030]	0.115 [0.084]
Number of treated units	77	77	77	63	41	77	77	77	63	41
Establishment-years	19794	19794	19794	11616	5838	19794	19794	19794	11616	5838
Mean of Dep. Variable in pre-acquisition year	9.857	3838.494	1575.169	2.148	2.204	9.857	3838.494	1575.169	2.148	2.204
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls (main building)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the university-level and the p-values of a t-test are shown in brackets. [2] The sample only considers universities acquired by educational groups that appear in all three years prior being acquired by an educational groups and three years after the acquisition. The control group in this specification is any private university that never changed ownership and never belonged to an educational group between 2003 and 2017. [3] Columns 1 to 5 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 6 to 10 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k /4$) and the t-test of whether this linear combination is different than zero. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Table A4: Faculty composition: professional vs. academic degrees and engagement in research activities.

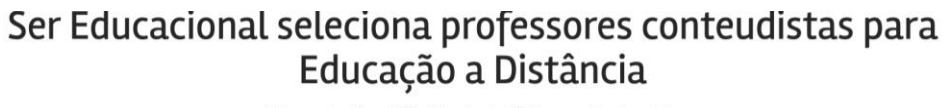
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Static DiD Model				Panel Event-Study/Dynamic DiD Model			
	% faculty engaged in research	Share of faculty with Professional Grad. Degree	Share of faculty with Academic Master's degree	Share of faculty with Academic Doctoral degree	% faculty engaged in research	Share of faculty with Professional Grad. Degree	Share of faculty with Academic Master's degree	Share of faculty with Academic Doctoral degree
	Panel A: Acquisitions with Knowledge Scaling							
Post-acquisition	-7.609	5.242	-3.741	0.529	-5.136	3.048	-3.209	1.802
	[0.010]	[0.002]	[0.004]	[0.579]	[0.034]	[0.042]	[0.018]	[0.067]
Number of treated units	54	135	135	135	54	135	135	135
Establishment-years	12831	24355	24355	24355	12831	24355	24355	24355
Mean of Dep. Variable in pre-acquisition year	7.135	42.452	42.656	8.341	7.135	42.452	42.656	8.341
	Panel B: Acquisitions without Knowledge Scaling							
Post-acquisition	0.032	-4.141	-0.840	3.740	1.527	-2.893	0.644	1.931
	[0.986]	[0.035]	[0.528]	[0.012]	[0.593]	[0.162]	[0.555]	[0.376]
Number of treated units	70	89	89	89	70	89	89	89
Establishment-years	12951	23591	23591	23591	12951	23591	23591	23591
Mean of Dep. Variable in pre-acquisition year	6.880	40.747	43.960	12.638	6.880	40.747	43.960	12.638
Establishment FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality controls (main building)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: [1] All standard errors are clustered at the university-level and the p-values of a t-test are shown in brackets. [2] Panel A reports results using the matched sample of treated units acquired by educational groups (with knowledge scaling). Panel B reports the same specifications considering the matched sample of treated units that changed ownership without being acquired by an educational group (without knowledge scaling). [3] The sample only considers acquired universities that appear in all three years prior being acquired by an educational groups and three years after the acquisition. The control group in this specification is any private university that never changed ownership and never belonged to an educational group between 2003 and 2017. [3] Columns 1 to 4 report the coefficients of a static differences-in-differences model, as delineated by equation (1) in the text. Columns 5 to 8 report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3} \beta_k /4$) and the t-test of whether this linear combination is different than zero. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Figure A1 – Examples of Knowledge Scaling by Educational Groups

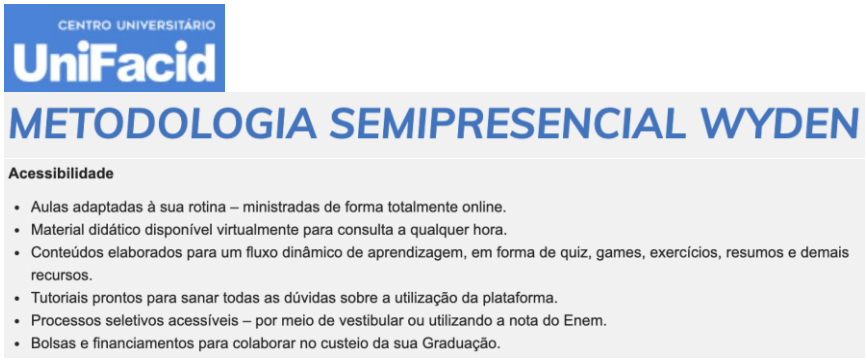
Website with standard course material for one large group (Estácio/Yduqs)

Newspaper headline: ""[…] Education experts are afraid that the group [Kroton] will lead to a more standardized education"



"Ser Educacional hires content-oriented faculty for Distance Learning" [process to create standardized course material]

Headline about Unique Teaching Ecosystem from Group "Ânima"



Description about Hybrid Method disseminated by the Wyden group

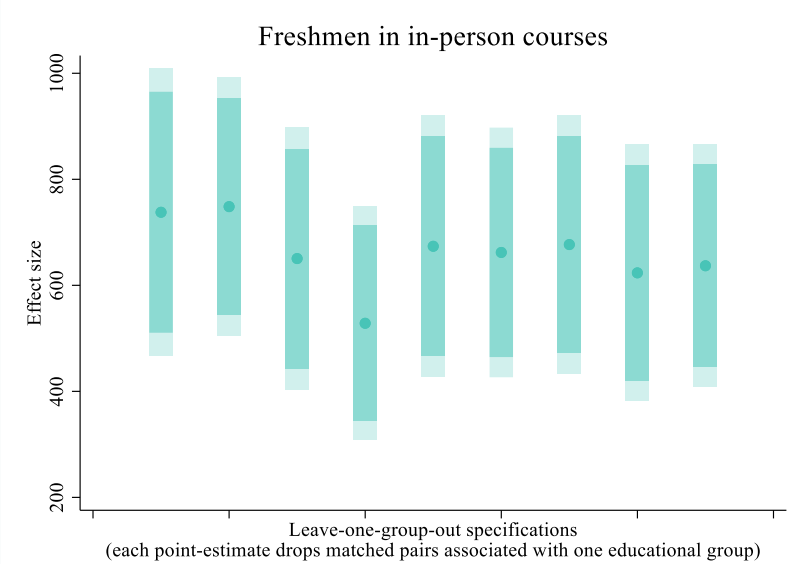
Figure A1 (cont.) – Examples of Knowledge Scaling by Educational Groups

Explanation about Learning Method Implemented by Kroton Group

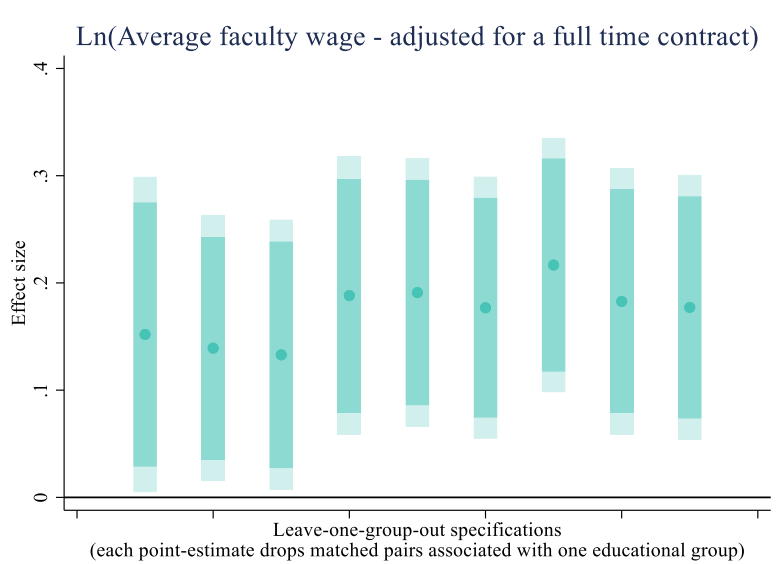
Website mention to digital material provided by Estácio/Yduq group

Figure A2 - Effects not being driven by a single educational group (leave-one-out specifications)

Panel A - Freshmen in in-person courses



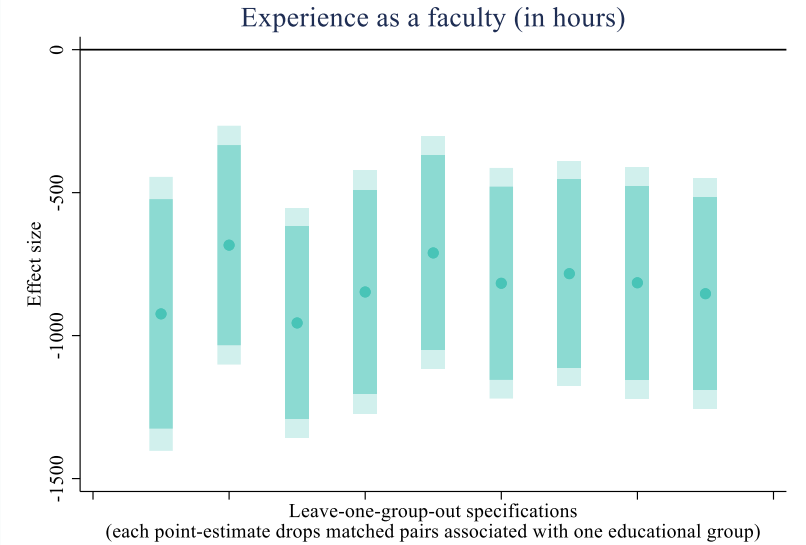
Panel B - Ln(Average faculty wage - adjusted for a full time contract)



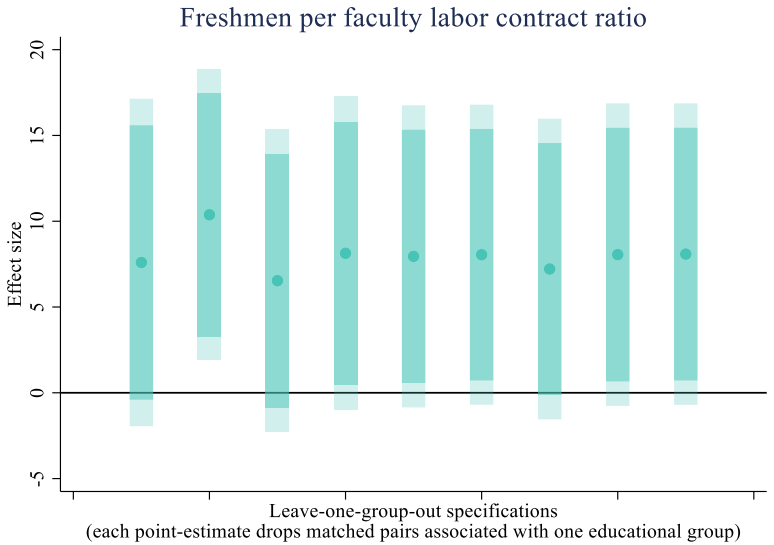
Notes: [1] Each bar corresponds to a separate specification of the effects of being acquired by an educational group whose business models relies on knowledge scaling. In each bar, we estimate the may results as reported in tables 2-4, but removing all acquisitions related to one out of the 9 educational groups. We repeat this process for each group. We report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3}\beta_k\ /4$) and the t-test of whether this linear combination is different than zero. [2] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [3] The sample only considers acquired educational units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Figure A2 (cont.) - Effects not being driven by a single educational group. (leave-one-out specifications)

Panel C - Experience as a faculty (in hours)



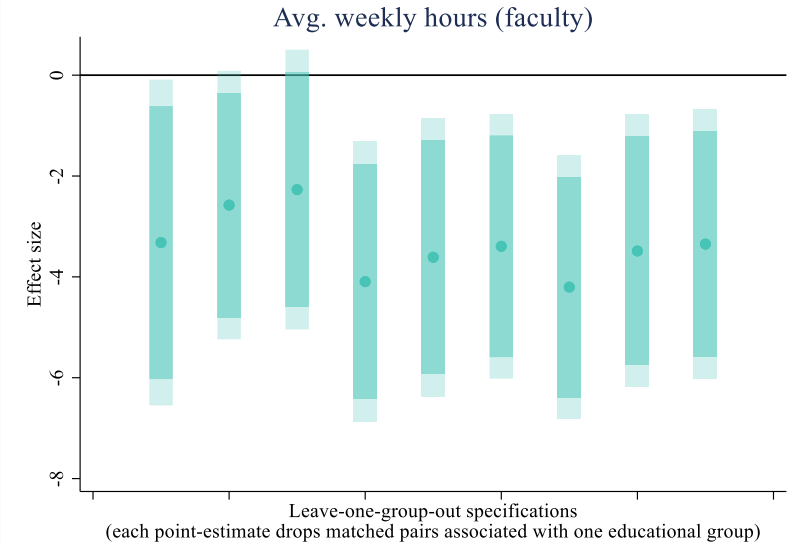
Panel D - Freshmen per faculty labor contract ratio



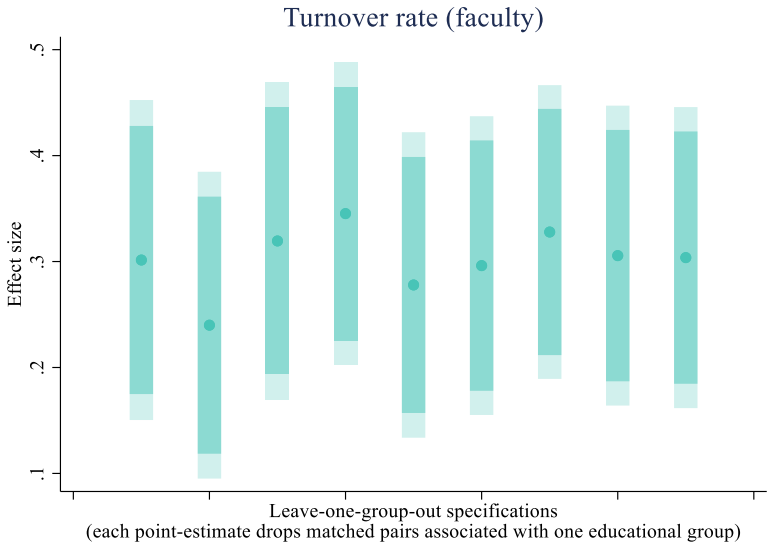
Notes: [1] Each bar corresponds to a separate specification of the effects of being acquired by an educational group whose business models relies on knowledge scaling. In each bar, we estimate the may results as reported in tables 2-4, but removing all acquisitions related to one out of the 9 educational groups. We repeat this process for each group. We report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3}\beta_k\ /4$) and the t-test of whether this linear combination is different than zero. [2] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [3] The sample only considers acquired educational units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.

Figure A2 (cont.) - Effects not being driven by a single educational group. (leave-one-out specifications)

Panel E - Avg. weekly hours (faculty)



Panel F - Turnover rate (faculty)



Notes: [1] Each bar corresponds to a separate specification of the effects of being acquired by an educational group whose business models relies on knowledge scaling. In each bar, we estimate the may results as reported in tables 2-4, but removing all acquisitions related to one out of the 9 educational groups. We repeat this process for each group. We report the results from a panel event-study analysis, as delineated by equation (2) in the text, showing the average treatment effect within the balanced window of three years following an acquisition event (i.e., $\sum_{k=0}^{3}\beta_k\,/4$) and the t-test of whether this linear combination is different than zero. [2] All standard errors are clustered at the unit-municipality levels. Confidence intervals of 90% and 95% are represented by the lighter and darker bars, respectively. [3] The sample only considers acquired educational units that appear in all three years prior being acquired and three years after the acquisition, and their respective matched control units. [4] All estimates control for educational unit fixed effects, year fixed effects, and all municipality-year level control reported in the text.