Imprints, Legacies, and Research Development: A Comparative Study of Four Private Universities in Latin America

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This comparative case analysis aims to understand what organizational conditions are related to the differences in the development of research among four traditional private universities in Latin America. Based on imprinting theory, the study analyzes how historical events and the founding conditions of each case study influence the processes of adaptation to local and global institutional pressures related to research development. Findings of the qualitative analysis of interviews with authorities of each case show that adaptative responses related to their policies and plans, allocation of universities' resources, tenure rules, and the development of a critical mass of professors with research capacities are influenced by their historical legacies: elements such as founding values, the stamps that the founders imprint, and the routines of selection of their members are maintained over time, intervening in the choice of the different options for the research development.

Introduction

In Latin America, the development of scientific research and the contribution to the generation of knowledge, measured in terms of indexed publications and patents, remains modest (Horta et al. 2016). According to the Network for Science and Technology Indicators (RICYT 2021), despite the fact that in the last 20 years the governments of various countries in the region have implemented policies and stimulus programs for the development of research, science, and technology, progress compared to other emerging economy countries shows lower performance in terms of investment, researchers, scientific publications, and patents. In most of these cases, regulation and public resources have been largely or exclusively allocated to public universities, where most research activity originates, as can be seen in the cases of

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Brazil, Mexico, and Argentina (Shin et al. 2014; Gregorutti and Delgado 2015). In countries that opted for the liberalization of higher education between the 1980s and 1990s, including Chile, Colombia, and Peru, the governments have invested in research selectively and in a limited way in a few public and private universities, configuring a different panorama (Brunner and Villalobos 2014; Pineda 2015; Bernasconi and Celis 2017). As a consequence, there are few Latin American universities that stand out in global higher education rankings, among them a group of elite private universities. (Gregorutti and Delgado 2015). With regard to this phenomenon, Brunner and Villalobos (2014) pointed out that, in these countries, a truly academic organization was absent, which is manifested in the diversification of higher education provision, where many universities are "purely teaching" and very few have developed the capacities to conduct research under international quality standards, among them a select group of private universities (Rama and Gregorutti 2015; Bernasconi and Celis 2017).

Second, it is necessary to recognize that in the context of the Emerging Global Model (EGM) of the research university in the twenty-first century (Mohrman et al. 2008; Powell et al. 2017), not only public universities but increasingly also private institutions play an important role in discovering new knowledge and developing the next generation of scholars, so our research focuses on the conditions that have made this possible in four case studies in Chile, Colombia, and Peru. These four private universities are nonprofit; were founded between 50 and 100 years prior to the liberal reforms in their respective countries; and stand out in their local and regional rankings for their reputation, significant increases in their research productivity, the qualifications of their faculty, their diversified funding strategies, and their collaboration with similar institutions abroad. Seen from the perspective of their scientific production, the four selected case studies have achieved significant growth in academic and scientific publications between 1998 and 2017. However, when analyzed in a comparative manner—taking into consideration their scientific production, their universities' statutes and rules, and their faculty profile—they reveal significant differences that merit their study. Consequently, our research aims to identify and understand what organizational conditions explain the differences among these cases in relation to their adaptation to local and global institutional pressures in order to increase scientific production under international quality standards and to develop a critical mass of professors with research capacities. In particular, given the strong traditions of the university institution, and of these universities in particular, our objective is to answer the following question: how do the historical legacies of each university case study influence research development?

Unlike previous studies on the research development in Chile, Colombia, and Peru that have paid less attention to the organizational dimension, and even less on the role of universities' historical legacies that stimulate them, we started our study following the case studies developed by Krücken (2003),

Ramirez (2006), and Ramirez and Christensen (2013) supported by the Path dependence approach; however, we found that the mechanisms and elements proposed by imprinting theory allowed a more suitable analysis of the role of persistence conditions stamped in the past (Johnson 2007; Oertel and Söll 2017; Oertel 2018). Understanding that imprints are mechanisms that maintain traditions or the initial conditions of an organization's foundation, influencing the structures and processes at later stages or eventually replicating patterns from the past, we study how these elements intervene in research development, concerning the existence of policies, rules, and strategies, the allocation of resources, and the research capacities of its faculty. Using a comparative framework for analysis, we examined the role of imprints in four universities: the Pontificia Universidad Católica de Chile, the Universidad de los Andes de Colombia, the Pontificia Universidad Católica del Perú, and the Universidad Peruana Cayetano Heredia. (See table A1 for more details.)

Case Studies

The Pontificia Universidad Católica de Chile (PUC Chile) was founded in the late nineteenth century, in the context of complex relations between the Catholic Church and the state due to the increasing emphasis on secularism in education, with the aim of creating a free Catholic university for the training of scientists and professionals, like the Catholic universities of Louvain, Lyon, and Washington, and aspiring to be more than a professional school, as it was "called to be the custodian of the truth." At its founding, the university offered law and mathematics programs, which led to the creation of the law school and a bachelor's degree in mathematics. The next programs to be offered, as part of the mathematics and physics disciplines, were engineering and architecture (Krebs et al. 1989). In the 1970s, the university adopted the idea of the university as a center of scientific research, which led to the creation of the schools of biological sciences and social sciences. In the 1980s, the first elected lay chancellor defined PUC Chile as a "complex university" due to its mission of professional training and its strategic interest in strengthening scientific research and postgraduate programs (PUC Chile 2020).

The Pontificia Universidad Católica del Perú (PUC Peru) was founded at the beginning of the twentieth century at the initiative of the Catholic Church in response to prevailing positivist ideas in public universities and was recognized as a "Free University" in 1917, receiving its first students in its school of liberal arts (Hampe 1989). According to its authorities, the university was conceived of as a teaching university because of its "general studies" and undergraduate studies. Throughout the first 50 years, the government of the university was in the hands of prominent intellectuals from the disciplines of history, jurisprudence, politics, and diplomacy (PUC Peru 2017). In this period, the schools of political and economic sciences, commercial sciences, and

accounting were created, as well as the school of engineering with a civil engineering program. It was only in the late 1960s that the department of basic sciences and the programs of mathematics, physics, and chemistry were created as part of the school of engineering (MacGregor 1988).

The Universidad de los Andes de Colombia (Los Andes) was founded in 1948 in Bogotá. According to Melo-Becerra et al. (2017), private universities in Colombia emerged as a response to the poor development of public higher education in the postconflict context of separation from Panama between 1920 and 1930. Due to this, the government took the initiative to strengthen the links between the universities and the economic and industrial development of the country, and in the 1940s founded various regional universities and authorized the creation of the first private university in Colombia: Los Andes was founded in 1948 as a nonprofit private university, independent of the government, political parties, creeds, and economic groups. According to Pizano (2016), from its origins, its founders established that their actions would be oriented toward the search and dissemination of knowledge. In this regard, Pineda (2015) points out that, given the education of its founders, this university was conceived under the model of an "entrepreneurial" North American university with the aspiration of reorienting and modernizing Colombian higher education.

The Universidad Peruana Cayetano Heredia (UPCH) was founded in 1962 when a group of professors split from the medical school at the Universidad Nacional Mayor de San Marcos. This separation of the medical school happened in the context of the 1961 University Reform that established university cogovernment with representation of academic peers and student representatives. The process of electing the dean of the school of medicine without the participation of the student representatives led to a student strike that culminated in the resignation of 400 professors from the school. These professors, represented by their elected dean, founded the Cayetano Heredia Teaching Medical Union, which in 1967 was recognized as the Universidad Peruana Cayetano Heredia (Porturas 1994). Since its inception, UPCH has been a university focused on disciplines related to the life sciences; thus, between 1970 and 1980, stomatology, veterinary medicine, biology, chemistry, pharmacy and biochemistry, psychology, and nursing were added to the specialty of medicine. UPCH was the first university in Peru to create the position of vice president for research in 1994 (Guerra 2010).

Development of Research in the Four Case Studies (1998–2017): An Initial Descriptive Analysis

In order to have a comparable understanding of research development in the four university case studies, our study started with an approximation of scientific academic production as measured by the total number of publications affiliated with the four universities that were registered between 1998

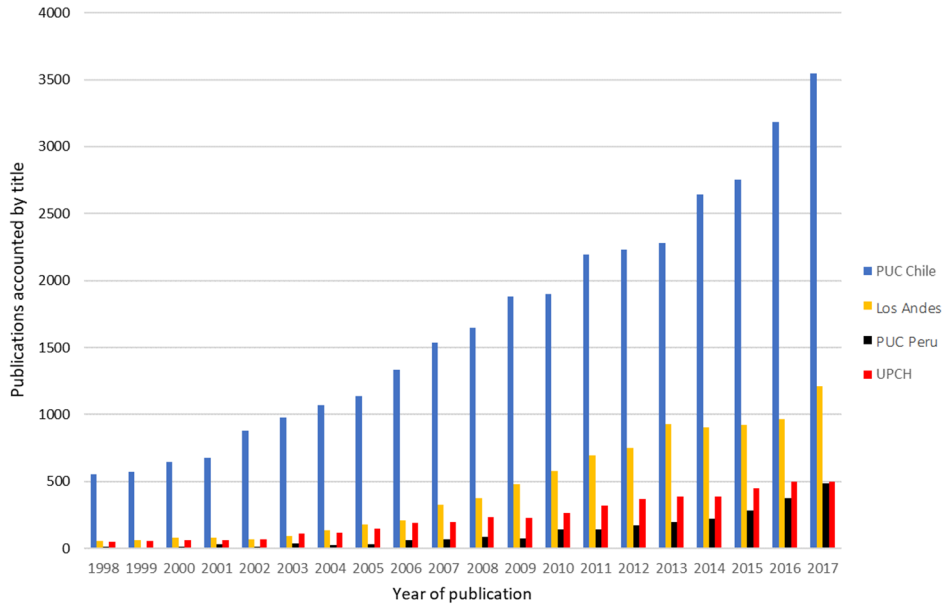

FIG. 1.—Publications of case studies among all areas. SOURCE.—Scopus, 1998–2017.

and 2017 in the Scopus database, which was selected for its coverage and in particular for its annual growth rate (Harzing and Alakangas 2016).

First observations showed a similar positive growth trend in all four cases, but in considerably different magnitudes (see fig. 1). This initial count included all the publications in all areas of knowledge, without considering the differences in production between specialties or if they corresponded to professors appointed and in service as of 2019, our study's cutoff date.

Taking into consideration these differences and to reach a better understanding of the differences of research output between the cases, we defined the following comparison parameters: production would be analyzed for the same disciplines in the four cases and only for tenured and tenure-track faculty to 2019. To do this, we created a database of professors in the four cases working in six disciplines (biology, physics, chemistry, medicine, engineering, and psychology), which includes information on 1,551 active professors (assistant, associate, and full) as of 2019, with data on their academic degree and place of training, category, gender, and publications in Scopus between 1998 and 2017. This database made it possible to analyze the production according to the characteristics of the professors' sample, reducing the bias by discipline, while the bias by sample size per case was controlled by counting the professors with one or more publications and the median number of publications registered in Scopus for each case. In this way, we could analyze how the cases differ,

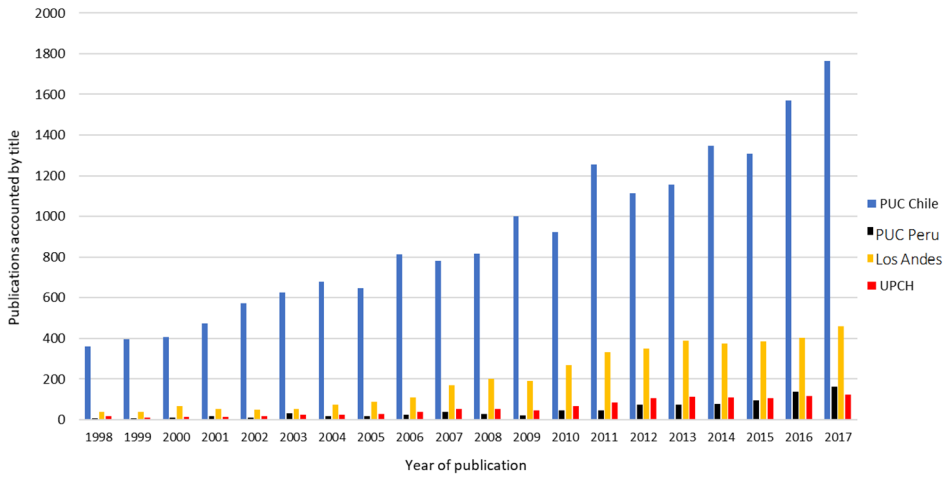

FIG. 2.—Publications of the case studies: biology, physics, and chemistry. SOURCE.—Scopus, 1998–2017.

not only due to the amount of their scientific production, but above all due to the existence or not of a critical mass of university professors and due to their greater or lesser endogeneity, elements raised by the literature to analyze organizational differences in research development (Horta 2013; Bonifaz 2021a).

In the subsequent analysis by disciplines, using accounting by titles with at least one appointed professor as of 2019 with affiliation from each of the case

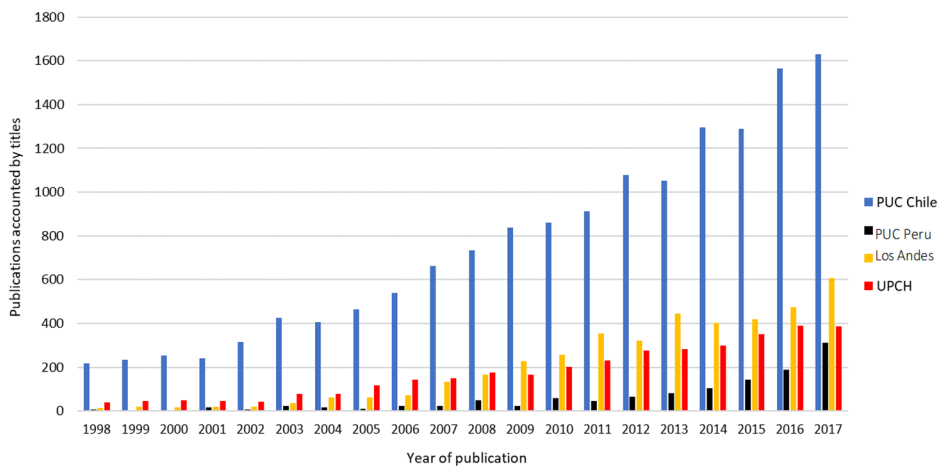

FIG. 3.—Publications of the case studies: engineering, medicine, and psychology. SOURCE.—Scopus, 1998–2017.

studies, a similar trend observed in the general count for each case was verified, but with differences by groups of specialties, in natural and applied sciences, and with significant dissimilarities between the production totals in each university, as shown in figures 2 and 3.

The literature that studies the differences in research capacities resort to the critical mass analysis (Heitor et al. 2013). This analysis proves that the existence of a "greater" number of professors with the capacity to publish one or more indexed articles produces greater influence in the community than a minority or an "elite" group—in the sense that the greater the common interests, the greater the willingness of the members of the community to achieve said interests (Oliver and Marwell 2001; Torchia et al. 2010).

To verify whether in the analysis period (1998–2017) the case study universities managed to form a critical mass of professors with the capacity to produce knowledge and promote research, the logarithmic distribution (ln^10) of the sample of professors with one or more publications in the period was analyzed. Lognormal allowed us to examine the probability distribution of variables that can take very large values, like the total publications by professor. This made it possible to observe that PUC Chile and Los Andes had managed to constitute a critical mass of professors, with median publications of 24 and 17, respectively, while, in the two cases of the Peruvian universities, the research

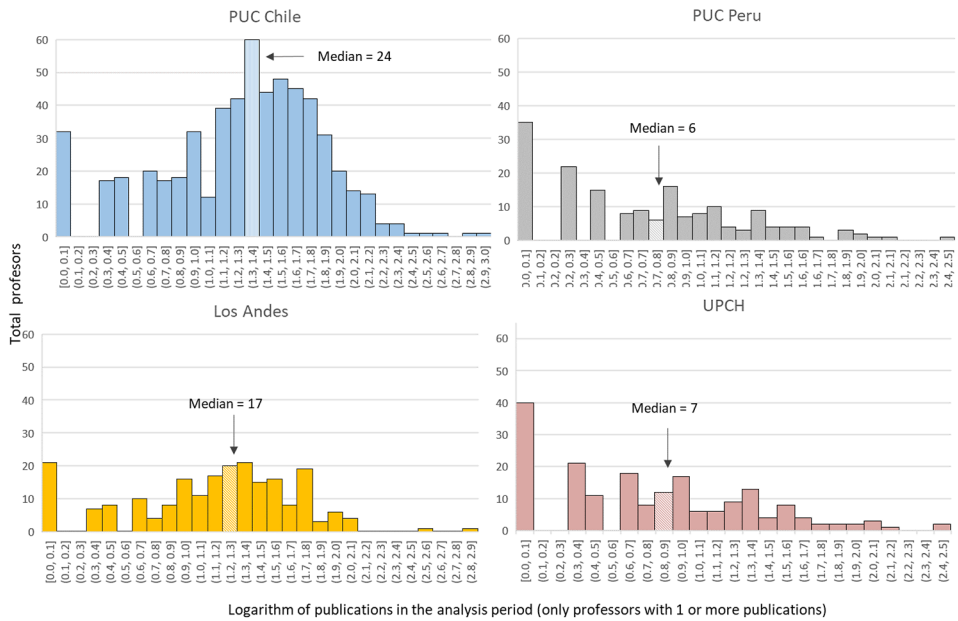

FIG. 4.—Logarithmic distribution of publications of the sample of professors (1998–2017)

depended on small groups of professors with the capacity to produce 10 or more publications in the study period (see fig. 4).

In this regard, Heitor et al. (2013) pointed out that the development of a critical mass of professors with research skills is associated with the ability to attract and mobilize academics with a PhD awarded by a university different than the one they work for. Therefore, we proceeded to examine the relation between the profile of the sample of professors in terms of their maximum degree and the place where they obtained it—with the aim of studying both the disposition of each of the case studies to hire professors with the highest degree and the place where they obtained such degree. It is understood that the willingness to hire professors with foreign degrees is related to the understanding that the research networks established during the international training and trajectory allow for greater research activity and, therefore, greater capacity to produce and communicate knowledge (Pelz and Andrews 1966; Horta 2013). This analysis, shown in figure 5, allowed us to observe that in those cases with a greater number of professors with the highest degree from abroad, there was a greater capacity to produce knowledge and publish it.

This situation would reflect, in each case study, different forethoughts to implement internal policies and tenure regulations in favor of hiring professors with research capabilities and international experience, or the existence of endogenous practices that favor the selection of graduates from the

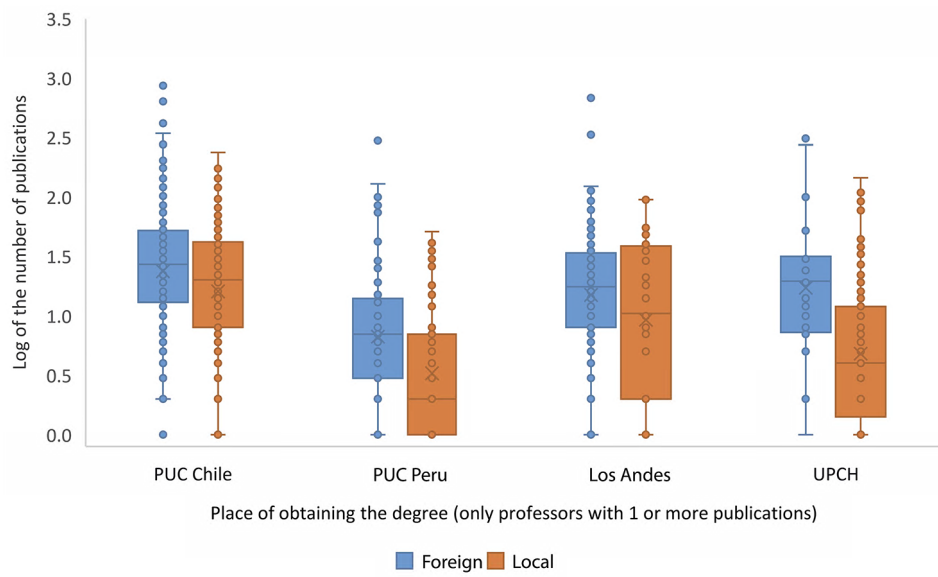

FIG. 5.—Logarithm distribution of publications of the sample of professors with foreign or local degrees (1998–2017).

same university, which would consequently explain the differences in the development of research in each case.

Framework for Analysis

The literature on the rise of the research university emphasizes global and local institutional pressures and reforms in higher education, considering their homogenizing effects and their consequences (Meyer and Rowan 2006; Powell et al. 2017; Altbach and De Wit 2018), but not the organizational processes that explain the differences in adaptation responses between universities. In this regard, Kerr (1984) pointed out that institutional pressures created tensions between the past and the future of universities and that their response capacities were influenced by their accumulated heritage. These inheritances could be advantageous if the universities had a history linked to research and technological development; otherwise tensions would arise between the opportunities and the skills available to the universities to take advantage of them.

To explain this response capacity in the face of institutional changes, two predominant approaches in the social sciences were found: *path dependence* and *imprinting theory*.[1] Although both have been conceived to explain the inertia or rigidity of structures or of long-standing practices, recent studies in higher education institutions (Oertel and Söll 2017; Oertel 2018; Zapp et al. 2021) show that imprinting theory allows a better identification of mechanisms of a restrictive nature. While path dependence proponents emphasize random past events (Sydow et al. 2009), including "happenings dominated by chance elements rather than systematic forces" (David 1985, 332), imprinting theory emphasizes how foundational environmental conditions and specific historical events affect persistent internal dynamics, associated with different adaptive responses and organizational performances (Marquis and Tilcsik 2013).

Imprinting theory, based on the observations of Stinchcombe (1965) regarding the differences between organizations created at certain moments in history and under certain technological, social, and economic contexts, postulates that the initial conditions of the foundation of an organization persist for a long period of time. In the same way, other elements persist related to the characteristics of their founders or their constituent cognitive schemes that are impregnated in the structures and processes of organizations, eventually replicating patterns and practices of the past.[2] These elements are specific to an organization and intervene in the processes of change or response to institutional pressures.

Given the nature of the university, its character as an institutionalized organization (Meyer and Rowan 2006), and the strong attachment to its traditions and founding conditions, the principles proposed by imprinting

[1] On path dependence, see Mahoney (2000); Page (2006); Schreyögg and Sydow (2011); Vergne and Durand (2011); on imprinting theory, see Johnson (2007); Marquis and Tilcsik (2013); Simsek et al. (2015).

[2] Marquis (2003); Marquis and Tilcsik (2013); Simsek et al. (2015); De Cuyper et al. (2020).

theory allow a better analysis of the mechanisms that explain the persistence of organizational forms or structural arrangements created at the time of foundation, which have the ability to resist new pressures from their environment (Bonifaz 2021b).

Consequently, in a global and local context influenced by EGM that explains the increase in research production within the four cases in the study period, we propose that historical roots, as well as the values and identity imprinted by the first members of each case study, remain over time with the capacity to affect the development of the research. Although recent studies on imprints point to the explanatory value of historical legacies on future adaptation capacities (Oertel and Söll 2017; Oertel 2018; Zapp et al. 2021), we propose that imprints do not determine the research development but intervene previously and influence the effects of institutional pressures in relation to the development of scientific research under international quality standards (Etchebarne et al. 2008).

As a result, to address how the historical legacies of each university case study influence research development, we argue that foundational conditions, values, and processes imprinted by the first members influence the effects of institutional pressures and explain the different adaptative responses in favor of the research development among the four case study universities.

Method and Data

We used the qualitative approach of multiple compared cases (Rowley 2002; Bryman 2012) based on the "structured and focused comparison" method proposed by Levy (2008). With this method we applied a defined set of questions or theoretical propositions, identical for all the case studies. For the four cases, a deliberate sample of informants was projected by quotas, among academics and administrators, in government and management positions, with responsibility at the decision or implementation level of policies and regulations of research development. Twenty-eight respondents were interviewed confidentially based on their informed consent: 17 in academic governance positions such as presidents, vice presidents, deans, and faculty representatives and 11 in managerial positions such as directors of planning, accreditation, research support, and academic staff. They were interviewed in person in Chile, Colombia, and Peru between June and September 2019. For gathering information, an interview guide was used with questions referring to the dimensions proposed in table 1. Thematic content analysis was applied through categorization based on previously defined items and the coding of text segments (Kuckartz, 2014). For internal reliability, a second coder was incorporated for "consensus coding," with the aim of reducing bias in the assignment of theoretically defined codes and facilitating the identification of possible emerging codes specific to each case. The interviews were

TABLE 1
DIMENSIONS AND ITEMS DERIVED FROM THE FRAMEWORK FOR ANALYSIS

Constructs	Dimensions	Prior Items (Codes)
Imprinting	Historical legacies	Identity and founding values; Imprints of the founders; Ways of doing things (teaching and research); Processes of selection and self-selection of members.
Research development	Institutional policies	Research policies, development plans; institutional regulations.
	Structure and support mechanisms	Research structure and management; Research budget; Research support systems.
	Faculty qualifications and tenure rules	Academic career requirements; Research requirements; Evaluation processes.

literally transcribed and data were processed with Atlas Ti v9 software, using the code system for interviews' quotations that allow classifying which category of codes and subcodes they represent; between 345 and 431 quotations per case were processed under four groups of codes defined ex ante by the framework for analysis.

The imprints or historical legacies were analyzed from the constituent elements proposed by imprinting theory (Marquis and Tilcsik 2013; Simsek et al. 2015). These were recorded from the declarations on the identity at the time of the foundation or in significant stages, the role of the founders, the values, the way of doing things, the way of selecting the members in each university, and the declared importance of the culture of research or teaching. And the research development was defined from the normative literature on the subject (Bosch and Taylor 2011; Edgar and Geare 2013), in relation to the statements about the existence and importance of policies, regulations, and strategies on research in universities, the allocation of resources to stimulate or strengthen it, and the requirements and capacities demanded of the faculty (see table 1).

In order to make the analysis more robust, access to institutional documents relevant to the study were requested from each case, which allowed us to give additional background to the qualitative analysis of interviews.

Findings

Imprints and Historical Legacies Dimension

The findings of the qualitative analysis by dimensions show that, in three of the four case studies (PUC Chile, Los Andes, and UPCH), the foundational and historical backgrounds and the values imprinted by their founders account for an identity that values and privileges research as a constitutive part of its teaching functions and service to society, which is consistent with most of the interviewees' declarations:

> I arrived in 1984 and I knew already that one of the most important academic activities here was research. It has to do with the history of our country, with the history of the

> promoters of science at the university. . . . teaching and teaching about what is researched, that is also a hallmark of the university. (PUC Chile academic authority, July 4, 2019)

This identity, in the case of Los Andes and that of UPCH, is consistently linked to the education of its founders in foreign universities of the "North American model":

> We as a university have since we were established emulated the American model. We pay close attention to the American model of the research university, so many of the things that we as a university decide also have that emphasis, they have that brand, so to speak. (Los Andes academic authority, July 16, 2019)

> Our founders were trained in foreign universities where the priority was research, so, for many years, since the foundation in 1962 or 1963, it was already established in the pillars, mainly in the medical and biomedical areas and later in the areas of basic sciences, such as biology, chemistry. (UPCH academic authority, August 20, 2019)

Furthermore, a significant element documented in the history of these three case studies is associated with the early creation of programs, schools, and departments in different branches of the "pure and applied sciences," engineering and medicine. Only in the case of PUC Peru did we observe a solid historical legacy in teaching and a tradition of what the interviewees call the "essence of teaching" in liberal arts in "an undergraduate university" and of "general studies":

> The essence of the university is teaching; if we lose teaching, we become a research center and that is not wanted. So, we must not lose sight of what the role of the university is and how research contributes to that role. (PUC Peru administrative authority, August 20, 2019)

In all four cases, the social structure at the time of their foundation, as well as in subsequent sensitive periods (e.g., military government of Chile in the 1970s; university reforms in Peru in 1961 and 1996), has influenced the dynamics of governing and organizing the academic work. In the same sense, their documented history and the discourse of the interviewees reinforce the idea of the ability of the past to influence future decisions—that is, the persistence of the founding values, as well as its traditions and cultures (teaching and research) in the process of adapting to the institutional and technological changes of EGM in the twenty-first century (table 2).

Institutional Policies for Research Development

Regarding this dimension, the interviewees from PUC Chile agreed that the university has consolidated a long-term institutional policy in which research is the basis of its training model and its contribution to society. Since 2000, the so-called 5-year institutional development plans have established

TABLE 2
SUMMARY OF IMPRINTS AND HISTORICAL LEGACIES OF CASE STUDIES

Case	Imprints
PUC Chile	High reference to Catholic foundational values; emphasis on research culture, search for the truth and generation of knowledge; high reference to the commitment to the training of quality professionals and to society.
PUC Peru	High reference to founding values; emphasis on the teaching culture (of general and undergraduate studies) and its commitment to society; high reference to traditional ways of doing things.
Los Andes Colombia	High reference to the identity and values impregnated by the founders; emphasis on research culture and its commitment to society based on generation of knowledge and the training of quality professionals.
UPCH Peru	High reference to the identity and values impregnated by the founders; emphasis on research culture in medicine and life sciences; foundational identity of high commitment to society.

NOTE.—Authors' elaboration based on the analysis of quotations and codes processed with Atlas Ti v9.

research as one of the three main strategic axes, an essential function leading to the resolution of social and environmental problems; research is also the basis of its teaching mission expressed in the policy "here is taught what is investigated." The interviewees pointed out that the policies and plans were pivotal instruments to implement the necessary regulations and structures to support the development of research:

> Research has been a pillar of the institutional development plan, which has always been maintained at the university and not only in the institutional development plan, but also exists in different policy instruments where the relevance of research is reflected, in the academic regulations and many bylaws. (PUC Chile academic authority, July 1, 2019)

Similarly, the interviewees from Los Andes recognized and valued the political decision to strengthen research and to establish plans, programs, and rules that have allowed its development in the last 15 years; among these are programs for financing doctoral studies for their professors with the university's own resources, conditional on the professors' return and their exclusive dedication to the university; the creation of the vice presidency for research, with the mission of promoting doctorates and research groups and networks; and the regulation of curricular flexibility so that undergraduate training benefits from the research of its professors and a balance between research and training is achieved, understanding that "we are a university that lives from teaching":

> Clearly there was an intention and a policy and an institutional strategy to be able to increase the capacity of the faculty, . . . at the time I called it a critical mass of professor, which would ensure that we continue to be leaders in teaching but that will also mark a growth in research. (Los Andes academic authority, July 16, 2019)

According to interviewees from the UPCH, its institutional research policy is fundamentally based on the areas of medicine and biology and on a group

of "elite" researchers in these disciplines. Regarding that, most of them indicated that policies and programs are still weak in relation to their scope in all specialties and that they cannot ensure sufficient resources for research. Furthermore, they stated that their university does not have sufficient managerial capacities to promote research in a sustained manner for all its academic staff ("we are scientists, not managers"). Additionally, and consistently, the interviewees pointed out that the university depends on its educational role, in the same way that scientific research depends on the "elite researchers, researchers who have effectively published all their lives, with or without university law, with or without accreditation, or whether or not there is a licensing mandate" (UPCH academic authority, August 20, 2019).

On the contrary, the PUC of Peru, although it declares in its statute that research is one of its essential functions, it was only after the creation of the vice presidency for research in 2009 (which it established in its institutional strategic plan for 2011–17) that research became one of its strategic objectives. According to those interviewed, the conception of research as a strategic axis would respond, above all, to the university's concern regarding its position in the rankings, which would explain the "absence of an institutional policy and a clear definition of scientific research, and not just strategic plans":

> It is obvious that we have to have a more sustained process in a mid- and long-term policy to convert the teaching university into a research and teaching university, because i believe that we will not be able to abandon teaching. (PUC Peru academic authority, August 1, 2019)

Despite the advances made since 2009, research continues to be a matter of discussion at this university because of the understanding of its community that the university is a training university whose "cultural legacy is to be a good professional school supported by a long teaching tradition."

Structure and Support Mechanisms for Research Development

This dimension, according to the proposed framework, refers to how the university has organized itself to allocate resources and ensure that their structures and procedures are sufficient to support the development of research. In the case of PUC Chile, the interviewees mentioned multiple support mechanisms for research development, including the existence of the vice presidency for research, a research directorate, decentralized support offices in each school, and administrative support systems. These mechanisms facilitate applying for competitive research funds (public and international) and access to seed funds for young researchers, provide economic incentives to professors and research groups, reduce teaching hours, and facilitate access to highly equipped laboratories, among others. A group of interviewees referred to these structures and available resources as a "robust research ecosystem":

> The platform that one has in this university to be competitive is undoubtedly much greater than in any other university. And what do I mean? Let's see, I mean that one is immersed in a university where the majority of people do research, a lot of people do research, there are many centers, there is a lot of support to carry out research internally. (PUC Chile academic authority, July 4, 2019)

In the case of the PUC Peru, as indicated by the interviewees, the investigation has received budgetary support from the university's own private funds and later from competitive public funds, the latter allocated basically to engineering and technology. Although the interviewees recognized the administrative support for research provided by the vice presidency for research, they agreed on more than one occasion on the need to be more efficient and to improve its administrative capabilities. They also recognized the monetary and nonmonetary incentives for professors and research groups, as well as the infrastructure facilities for certain disciplines, like engineering, that have allowed research to be carried out during the period of our study:

> For the first time in Peru, open public competitions were held with a lot of money, and we also allocated money so that teachers could present projects; we created an innovation office to support them, and the first CONCYTEC contests were won only by Católica and Cayetano. (PUC Peru academic authority, August 16, 2019)

In the case of the UPCH, the interviewees highlighted that the existence of the vice presidency for research (the first to be created in Peru) has allowed them to have an office specialized in research management, as well as the "Beca Retorno" a program that has facilitated the repatriation of researchers and the attraction of national and international research funds. Among other aids for research, they pointed out their laboratories, the recognition of research hours, financial aid for publications, and some "minor monetary incentives for indexed publications":

> Having this office of the vice president for research and this directorate for research, having units that look at, for example, issues of innovation, patents, is something that we as a university are also aiming for, which little by little has generated spaces and has been involving more people. (UPCH academic authority, August 20, 2019)

Finally, the case study of Los Andes stands out in this dimension of analysis due to the difficulties mentioned by the interviewees in relation to access to financial resources for the research sustainability. This can be explained by the fact that this is the only case that does not have access to competitive public funds due to the national policy of research funding only for public universities. For this reason, the interviewees emphasize the institutional strategies and regulations necessary to ensure efficiency in the allocation of internal resources "from tuition" as the main source for the research development. This situation, according to the interviewees, represents risks in the short term:

> First, the financing environment is hostile. Relying on undergraduate tuition to do all this is not sustainable, maybe a little [*sic*] but no more. Second, I would say that the risk of neglecting undergraduate teaching is a great and dangerous risk in a country like Colombia or Peru. (Los Andes administrative authority, July 17, 2019)

Faculty Qualifications and Tenure Rules for Research Development

The dimension of analysis referring to the academic staff, their qualifications, and the rules for selection and promotion, as a mechanism for research development, has been the most mentioned by the interviewees in the four case studies, echoing the phrase of one of them who pointed out that "in hiring you risk everything."

In this sense, in the case of the PUCP of Chile, the interviewees agreed that the tenure process has been the instrument that has guaranteed the research development in the university, thanks to the rules derived from the policies of academic staff. These rules, established in faculty's statutes in 2012 and updated in 2018, were decisive in defining the research and teaching requirements necessary for the admission, permanence, promotion, and dismissal of faculty. Additionally, the interviewees referred to two key aspects of this policy: the first was the alignment with the standards established by the competitive public funding programs, and the second, a competitive salary policy that permanently encouraged productivity and the quality of research:

> If we don't have good professors who are internationally connected, who have important publications, who are at the forefront of research, we get nothing out of telling them "have this fund here and apply there." Therefore, the raw material, to put it somehow, I think, is the investment that the university has made in its academics, in the [policy of] hiring academics. (PUC Chile administrative authority, July 3, 2019)

Likewise, in the case of the Universidad de Los Andes, the interviewees agreed that the "faculty statute," in its 2005 and 2015 versions, is at the base of the research development. They pointed out, above individual incentives, two key factors: the first, the high qualifications demanded for recruitment, retention, and promotion processes, and the second, the central role of an attractive salary policy tied to performance, with the capacity "to attract well-paid people to pursue a research career":

> I think that the teaching career has been much more definitive, it is more structural. So, you are saying that you have a career here, a ladder to climb and if you want to climb this ladder, then you have to be reasonably productive within this discipline. (Los Andes academic authority, July 19, 2019)

On the other hand, the interviewees from the UPCH agreed that they are still leaders in research and scientific publications "thanks to the individual efforts

of a small group of professors" in the areas of medicine and biology, since the requirements of the academic career are still lax and show different levels of demand among the different disciplines offered at the university. In addition, the interviewees pointed out that efforts are still focused on meeting the minimum requirements of the 2014 new regulations of the sector, in terms of academic degrees and the minimum percentage of full-time teachers, which has prevented them from being able to develop a critical mass of professors with capacities for research under international quality standards:

> [In] our regulations for admission to Cayetano as tenured professors, there are no requirements such as the number of publications but now we are changing our regulations, in the sense that it is an essential requirement to have had at least one publication indexed. That will give us enough capacity to have a good critical mass of people to research. (UPCH academic authority, August 13, 2019)

Finally, in the case of PUC Peru, according to the interviewees, the development achieved in research has not been the result of organizational changes, nor of statutes or rules of the academic staff, but of the individual initiative of some professors and a few academic departments. Given this, they agreed that one of the elements of greatest concern is the need for progressive replacement of traditional or senior teachers ("we cannot fire the professors that were there, some are going to gradually retire") along with having strategies to attract young academics with teaching and research skills and complete dedication to the university:

> I believe that it is necessary to incorporate with new rules and with new demands, that is, I am going to demand a high-level doctorate, therefore, those are expensive, and that is why meritocracy also has to do with a practical issue of availability of resources. In other words, the rules have to be general for everyone; if you do A, B, C, you have the right to earn 30 percent or 40 percent more than your neighbors. (PUCP Peru academic authority, July 31, 2019)

In summary, the data from the descriptive analysis of the research production of the four cases and the findings of the qualitative analysis allow us to verify that the case study universities with favorable imprints toward research (e.g., legacies of the founders and founding values in favor of a culture of teaching and research) showed a greater willingness to adopt internal policies and regulations aligned with institutional, local, and global demands in favor of research (see table 3).

In the same way, these cases showed a greater willingness to implement reforms referring to higher demands on professors. In these cases, the development of critical masses of researchers and a greater research development in the study period are observed. In those cases with unfavorable imprints for research (e.g., greater emphasis on the culture of teaching) or where research is carried out by elite groups, we were able to observe a lower

TABLE 3
SUMMARY OF IMPRINTS AND RESEARCH RELATED ADAPTATIVE RESPONSES

	Imprints	Adaptative Responses	Research
PUC Chile	Teaching—research ("search for the truth")	Clear institutional policy and regulations Structure and support systems developed Highly demanding academic career Competitive salary policy	Critical mass of professors with research capacities Median number of publications = 24
PUC Peru	Teaching (general and undergraduate studies)	Institutional policy and regulations in process (science and engineering) Structure and support systems developed Academic career of medium requirement (requirements of law)	Elite professors with research capacities Median number of publications = 6
Los Andes Colombia	Teaching—research ("generation of knowledge")	Clear institutional policy and regulations Structure and support systems developed Highly demanding academic career Competitive salary policy	Critical mass of professors with research capacities Median number of publications = 17
UPCH Peru	Teaching—research (Medicine and life science)	Institutional policy and regulations in process (medicine and science) Structure and support systems under development (few resources) Academic career of medium requirement (requirements of law)	Elite professors with research capacities Median number of publications = 7

NOTE.—Authors' elaboration based on the analysis of citations and codes processed with Atlas Ti v9 and descriptive analysis from the sample of professors.

willingness to adopt significant reforms in favor of research, low academic career requirements, absence of critical masses of researchers, and therefore less development of research.

Conclusion

Our study highlights the importance of imprints in adaptive responses at the organizational level (Marquis and Tilcsik 2013; Simsek et al. 2015). In this sense, we proposed that the historical legacies of the universities intervene in the face of institutional pressures, influencing the capacity of the case study universities to develop research under international standards.

From the perspective of organizational studies, part of the literature on university adaptability to change is based on the path of dependence approach.[3] Our study proposes that it is the constitutive elements provided by imprinting theory that allow a better understanding of the role of the historical legacies of traditional universities in the processes of adaptation to institutional pressures. The findings from the case study universities reveal

[3] Krücken (2003); Ramirez (2006); Meyer (2011); Ramirez and Christensen (2013).

that elements such as the founding values and identity (Marquis and Tilcsik 2013), the stamp that the founders imprint (De Cuyper et al. 2020), and the routines and practices of selection and self-selection of members, imprinted from their origins (Stinchcombe 1965; Simsek et al. 2015) are maintained over time, influencing the choice of different research development options.

Our study presents evidence on cases with historical legacies favorable to research. These cases show a considerable willingness to formalize policies and regulations in favor of the research development and to constitute academic communities (critical masses) with greater capacities for this function (see table 3); therefore, they register a substantial research production in the study period (1998–2017), compared to those that do not.

From these cases, it can be verified that the imprints specific to each university moderate the effects of the different institutional conditions, local and global, which explains to a large extent the differences in research development. It should be noted that it is not possible to affirm that historical legacies are a sufficient condition for research development, at least in these four case study universities (Bonifaz 2021b).

Finally, we believe that, in order to strengthen our understanding of the effects of imprints, it is necessary to conduct research with a much larger number of case studies in Latin America. Universities' government and management will efficiently improve with a greater comprehension of the nature of historical heritage but, more importantly, with better designed public policies and incentive programs for research and the development of science and technology in our region.

Appendix

TABLE A1
Case Studies

	PUC Chile	PUC Peru	Los Andes	UPCH
Foundation year	1889	1917	1948	1962
Legal nature	Legal entity under public law	Nonprofit legal entity under private law	Educational institution of common utility	Nonprofit legal entity under private law
Total professors	3,575	2,579	1,823	1,510
Appointed professors	1,265	933	664	684
Undergraduate students	27,064	23,488	14,398	5,268
Master's students	3,414	6,024	3,366	2,616
PhD students	1,202	392	385	66
THE country ranking	1	2	3*	1

Source.—Authors' elaboration based on the 2019 statistical yearbooks, the statutes in force to date in each university, and the World University Ranking by Times Higher Education (THE) 2019 by research.

* The first two universities are state-owned.

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