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RESEARCH ARTICLE

# The Entrepreneurial University's Impact on Regional Socioeconomic Development: The “Alumni Policymaker” Mechanism

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## Abstract

Research has examined the impact of the “entrepreneurial university” on regional socioeconomic development by focusing on the entrepreneurial intentions and performance of alumni, staff, and students. The study of impact, to date, has focused on direct and short-term mechanisms, such as alumni's entrepreneurial activities, faculty spin-outs, and active public engagement with policy agendas. Our point of departure is in conceptualizing and empirically testing a longer-term and more systemic mechanism. We theorize and empirically test how the entrepreneurial university imprints on its graduates, some of whom take on leadership positions in innovation policymaking years later. We test this relationship by employing a text-as-data approach to examine the extent to which innovation policy leaders speak about startup-centric innovation, comparing the media coverage of entrepreneurial university alumni relative to their peers. Our original dataset comprises the 485 individuals who held senior innovation policy positions in East Asia's eleven largest economies from 1998 to 2019, detailing their educational background and media coverage (10,816 documents). We conceptualize the “alumni policymaker” mechanism, which constitutes entrepreneurial university alumni shaping the future of national innovation policy by referring to startup-centric innovation three times more than their peers. Those who completed MBAs at entrepreneurial universities express an even greater preference for startup-centric innovation policy.

**Keywords:** economic development; entrepreneurial universities; innovation; policy; text-as-data analysis

## Introduction

The “entrepreneurial university”<sup>1</sup> fosters startup activity and innovative mindsets through its teaching and learning, research, service, spin-outs, and technology transfer activities.<sup>2</sup> To date, the impact of the entrepreneurial university been conceptualized and studied at the level of individual entrepreneurs (e.g., alumni, staff, or students founding high-profile startups) and institutions (e.g., incubator-university collaborations and technology transfer offices).<sup>3</sup> The prevailing understanding of the entrepreneurial university's impact on regional socioeconomic development focuses on direct and short-term mechanisms, such as alumni entrepreneurial activities, faculty spin-outs, and active public engagement with policy agendas.<sup>4</sup>

Our point of departure is in conceptualizing and empirically testing a more systemic and long-term mechanism. We study how the entrepreneurial university imprints on its graduates, some of whom

<sup>1</sup>Etzkowitz (1983); Muscio and Ramaciotti (2019); Sánchez (2013).

<sup>2</sup>Binks, Starkey, and Mahon (2006).

<sup>3</sup>Guerrero, Urbano, and Gajón (2020); Audretsch (2014).

<sup>4</sup>Etzkowitz and Zhou (2021); Klofsten et al. (2019). We note that there are cognate terms and research streams to the entrepreneurial university. These include “academic entrepreneurship” (Shane 2004; Wong 2011; Geothner and Wyrwich 2020), “professorial entrepreneurship” (Kenney and Goe 2004), “university entrepreneurship” (Rothaermel, Agung, and Jiang 2007), and, to a lesser extent, research on the triple helix model (Etzkowitz 2008).

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take on leadership positions in innovation policymaking years later. These entrepreneurial university alumni shape the way that innovation policy is conceived, with a preference for startups as essential drivers of innovation. We theorize an “alumni policymaker” mechanism, which constitutes a more systematic impact on regional socioeconomic development than the effects acknowledged to date. This adds evidence of a new knowledge spillover mechanism of the entrepreneurial university in delivering societal value, or its “third mission.”

Theoretically, we extend state-of-the-art research on the impact of the personal characteristics of leaders on policy preferences.<sup>5</sup> This body of scholarship finds that personal characteristics—such as the location of the university and the subject that policymakers study—shape policy preferences for years to come. We combine this approach with state-of-the-art scholarship on “imprinting,” in which formative experiences leave a long-lasting impact on preferences.<sup>6</sup> Imprinting is defined as exposure that “establishes persistent organizational routines and structures that sustain traditions, vested interests, and ideologies” and occurs when people are “most susceptible to influence” in their life.<sup>7</sup> We explore the extent to which studying at an entrepreneurial university—a formative experience early in one’s adult life—could imprint persistent preferences for a startup-centric form of innovation. Such imprinting as a spillover mechanism of the entrepreneurial university reveals an additional social return to higher education, which poses an interesting avenue for further research given the ongoing public debate about the societal value of universities.

Our core research question is: to what extent does studying at an entrepreneurial university affect graduates’ long-term preference for startup-centric innovation? We study this “alumni policymaker” preference in the context of innovation policy and conceive of startup-centric innovation policies as a form of national innovation system (NIS) policy,<sup>8</sup> which focus on the starting and scaling up of high-growth, technology-centric entrepreneurs.<sup>9</sup> We define *startup-centric innovation policy* in accordance with Klingler-Vidra and Pacheco Pardo,<sup>10</sup> who specify that the term refers to policies that are “focused exclusively on the aim of creating more, and higher quality, startups in a bid to advance a Silicon Valley-styled innovation cluster.” As we explain in the Data and methods section, we operationalize the language of startup-centric innovation policy in terms of eight categories of instruments used, which include funding, taxation, education, and training.

We operationalize *entrepreneurial university* by identifying the cohort of universities that, according to Crunchbase,<sup>11</sup> boast the most graduates creating startups that raise venture capital funding of \$1 million or more. This is consistent with other state-of-the-art studies on the entrepreneurial university<sup>12</sup> in that we use established rankings to establish the set of entrepreneurial universities. We then assess the extent to which the alumni of these most active entrepreneurial universities speak about startup-centric innovation relative to their policy-leading peers who did not attend an entrepreneurial university. We do so using text-as-data methods to analyze our original dataset of education and media coverage for the 485 innovation policy leaders responsible for innovation policy between 1998 and 2019 for the largest eleven economies (in terms of gross domestic product in 2019) in the East Asian region: China, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, and Vietnam. The dataset details each policy leader’s university education (including university, country, and degree level, across undergraduate [UG], master’s, MBA, and PhD programs<sup>13</sup>) as well as news media coverage. We analyze

<sup>5</sup>Chalmers et al. (2021); Mercier (2016); Hayo and Neueier (2014); Besley, Montalvo, and Reynal-Querol (2011); Dreher et al. (2009); Chwioroth (2007); Gohlman and Vaubel (2007).

<sup>6</sup>See Cooman (2022).

<sup>7</sup>Alakent, Goktan, and Khoury (2020, 4).

<sup>8</sup>Schot and Steinmueller (2018); Edler and Fagerberg (2017); Linden (2004).

<sup>9</sup>See Siegel et al. (2003); Audretsch et al. (2020).

<sup>10</sup>We employ the taxonomy delineated in Klingler-Vidra and Pacheco Pardo (2022, 4) and Pacheco Pardo and Klingler-Vidra (2019).

<sup>11</sup>The Crunchbase data can be accessed at <https://www.crunchbase.com/>.

<sup>12</sup>Notably, our approach is similar to that of Guerrero, Cunningham, and Urbano (2015), in that we use rankings rather than survey data.

<sup>13</sup>Here, UG includes bachelor of arts and bachelor of science degrees. Master’s includes master of arts and master of science. MBA is a distinct category, as graduates can (and often do) obtain both a master’s degree and an MBA; therefore, we separate the two types of degrees. Finally, we capture data on PhD degrees.

10,816 media documents to assess how frequently policy leaders reference startup-centric innovation in the media.

We find evidence that innovation policy leaders who are entrepreneurial university alumni are three times more likely to speak about startup-centric innovation policy than their peers. Those who completed MBAs at entrepreneurial universities express an even greater preference for startup-centric innovation policy. Evidence of this preference occurs years after their university studies, suggesting imprinting upon its policymaker alumni, leaving an indelible impact on how they conceive of innovation—with startups playing a key role.

Through our approach and findings, the article makes three contributions. First, the article contributes to research examining the relationship between the entrepreneurial university and regional economic activity,<sup>14</sup> potentially illuminating a new mechanism by which entrepreneurial universities deliver societal impact. We do so by delineating expectations about how studying for certain degree types, at certain universities, may imprint upon graduates, leading to more or less of a preference for startup-centric innovation, which is expressed when alumni take an innovation policy leadership role later in life.<sup>15</sup> This “policymaker alumni” mechanism constitutes a new empirical area (innovation policy) for research into the relationship between personal characteristics and policy preferences.

The second contribution is methodological, as we bring a text-as-data approach<sup>16</sup> further into to the mainstream study of the relationship between education and policy preferences.<sup>17</sup> We theorize and measure media coverage in the years during which each policy leader held their leadership role, which, while imperfect, is the closest indicator of the policymakers’ expressed preferences. This approach of measuring media coverage as evidence of preference is well established in studies of how personal characteristics shape the preferences of politicians<sup>18</sup> and central bankers.<sup>19</sup> However, it has not been applied to the empirical area of innovation policy. To study this nexus, we developed a set of startup-centric innovation n-grams, based upon state-of-the-art literature on innovation policy. This approach offers an empirically grounded, specialized method for corpus-based dictionary generation in research using natural language processing.<sup>20</sup>

Third, we offer an original dataset of the educational backgrounds of the leaders of innovation policy for East Asia’s eleven largest economies over a twenty-year period (1998–2019). In addition to detailing who these policymakers are and their educational profiles, the dataset includes each policymaker’s media engagement during the years they were in office.

This article is structured as follows. The following section reviews the literature on how the entrepreneurial university is hypothesized to shape the entrepreneurial intentions of its alumni, as well as scholarship on personal characteristics, imprinting, and policy preferences. Next, we present the data and methods, including data collection and coding and the text-as-data method on which the analysis is based. The next section presents an analysis of the extent to which entrepreneurial university graduates invoke coverage about startup-centric innovation policies relative to their peers who did not study at one of these universities over the 1998–2019 period. Then, we discuss the implications of our findings. The last section concludes by discussing the limitations of our study and future research.<sup>21</sup>

<sup>14</sup>Arroyabe, Schumann, and Arranz (2022); Forliano, De Barnardi, and Yahiaoui (2021); Klofsten et al. (2019).

<sup>15</sup>We conceive of startup-centric innovation policy as a form of national innovation system policy focused on the creation and growth of early-stage, high-growth firms, consistent with Audretsch et al. (2020), Klingler-Vidra and Wade (2020), and Breznitz (2006).

<sup>16</sup>Panagis (2021); Gentzkow, Kelley, and Taddy (2019); Riffe et al. (2019); Loughran and McDonald (2016).

<sup>17</sup>Prüfer and Prüfer (2020); Gentzkow, Kelley, and Taddy (2019); Johnson, Arel-Bundock, and Portniaguine (2019); Riffe et al. (2019); Loughran and McDonald (2016); Benoit and Herzog (2017).

<sup>18</sup>See Schwarz, Traber, and Benoit (2017); Benoit and Herzog (2017).

<sup>19</sup>Johnson, Arel-Bundock, and Portniaguine (2019).

<sup>20</sup>See Rice and Zorn (2021).

<sup>21</sup>Norris et al. (2022).

## Personal characteristics and the entrepreneurial university imprinting of startup-centric innovation preferences

Researchers have examined the impact of personal characteristics on a variety of policy and political decisions and outcomes. The approach is underpinned by the assumption that endowments of cultural, human, and social capital—such as family background and socioeconomic status,<sup>22</sup> university education,<sup>23</sup> and work experience<sup>24</sup>—affects actors’ policymaking preferences. The degree subject studied, as well as occupation, have been found to inform preferences.<sup>25</sup>

Studying at certain universities impacts graduates’ long-term economic,<sup>26</sup> financial,<sup>27</sup> trade,<sup>28</sup> and legal<sup>29</sup> policymaking preferences. The causal mechanism underpinning this relationship is the shared, intensive training, which creates “strong professional identities and shared norms” that shape long-lasting views.<sup>30</sup> Seminal work on the role of university education in forming policymaking preferences, such as the “Chicago boys,” has revealed that socialization, rather than course curriculum alone, informs shared beliefs that later manifest in policymaking contexts.<sup>31</sup>

Existing scholarship on the personal characteristics of East Asian political leaders anecdotally suggests that education may affect preferences. China’s think tanks, which play a central role in national policy advisory groups, are found to hire US-trained graduates who have brought in “the American model, particularly the ‘Chicago model.’”<sup>32</sup> Historical accounts of the backgrounds of the regions’ scientific leaders reveal that large numbers of them graduated from elite universities. This includes Tokyo University for Japan’s Ministry of International Trade and Industry leaders,<sup>33</sup> Korea’s prestigious “SKY” universities,<sup>34</sup> and leading technical universities in China, particularly Peking University and Tsinghua University.<sup>35</sup> Research has also shown a lasting impact on those who studied in the former Soviet bloc. Tsai, for instance, asserts that Chiang Ching-kuo’s state-led industrialization policies in Taiwan were probably attributable to his training in the Soviet Union.<sup>36</sup>

Drawing together these insights on the relationship between personal characteristics and policy preferences, we hypothesize that the subject studied and the university attended may have a lasting impact on graduates’ preferences. Cognate scholarship, in the context of how funding from a venture capital fund influences the growth of a startup, conceives of the notion of “imprinting,” in which the values of investors are transposed onto startups during their nascent stage.<sup>37</sup> Applying the same logic to the lives of policy leaders, we hypothesize that studying at an entrepreneurial university could constitute imprinting, in which the accumulation of particular cultural, human, and social capital derived from studying at the entrepreneurial university shapes the worldviews and values of graduates for years to come. Studies of imprinting in the startup–venture capital nexus draw on seminal imprinting scholarship.<sup>38</sup> Marquis and Tilcsik advance a general theory of imprinting, delineated in the context of individuals as “institutional conditions (e.g., an organization’s culture) influence the norms, schemas, and skills that early-career individuals develop and carry with them in subsequent

<sup>22</sup>Hayo and Neumeier (2016).

<sup>23</sup>Besley, Montalvo, and Reynal-Querol (2011).

<sup>24</sup>Chalmers et al. (2021); Gohlmann and Vaubel (2007).

<sup>25</sup>Dreher et al. (2009).

<sup>26</sup>Chwioroth (2007).

<sup>27</sup>Chwioroth (2015).

<sup>28</sup>Weymouth and Macpherson (2012).

<sup>29</sup>Dezalay and Garth (2010).

<sup>30</sup>Weymouth and Macpherson (2012).

<sup>31</sup>Becker (1997).

<sup>32</sup>Li, (2016, 15–16).

<sup>33</sup>Callon (1995).

<sup>34</sup>B. Lee, “How the ‘SKY’ Universities Dominate,” *Korea JoongAng Daily*, 27 January 2003.

<sup>35</sup>Cao (2004).

<sup>36</sup>Tsai (1999, 77).

<sup>37</sup>Alakent, Goktan, and Khoury (2020); Cooiman (2022).

<sup>38</sup>Stinchcombe (1965); Meziars (1990).

periods.”<sup>39</sup> This conceptualization informs our expectation that studying at an entrepreneurial university imprints a veneration of Schumpeterian modes of innovation, in which risk-taking innovators form new technology-oriented firms that drive society’s economic growth.<sup>40</sup>

This stems from the variety of entrepreneurship-related activities undertaken within the entrepreneurial university, to raise awareness, educate and train, and foster social networks. This collectively drives the accumulation of cultural, human, and social capital, which informs the generation of what Audretsch calls the “entrepreneurial capital” of the university.<sup>41</sup> To be more precise about the ways in which the institutional setting of the entrepreneurial university imprints upon graduates, we briefly develop our treatment of each form of capital.<sup>42</sup>

First, the entrepreneurial university’s cultural capital is conceived in terms of the promotion of shared values around entrepreneurship, including creativity, grit, mindset, perseverance, problem-solving, and risk-taking.<sup>43</sup> This valorization stems from activities such as the organization of clubs and events that foster dispositions in favor of entrepreneurship, as well as the universities’ production of (marketing) materials that reinforce these values.<sup>44</sup> Outside the classroom, entrepreneurship clubs invite successful founders and venture capitalists to give guest talks, raising awareness of, and veneration for, high-growth entrepreneurship.<sup>45</sup> Second, human capital comprises (formal) education and training<sup>46</sup> related to entrepreneurship.<sup>47</sup> In addition, research has shown that the American MBA curriculum has become increasingly centered on entrepreneurship.<sup>48</sup> MBA teaching that heavily employs the “case study method” cultivates entrepreneurial intentions and capabilities.<sup>49</sup> Third, social capital theory has been applied to study how being embedded in the entrepreneurial university shapes entrepreneurial intentions and performances.<sup>50</sup> Taking a Granovetterian tack,<sup>51</sup> in which social capital is primarily conceived of in terms of social networks, the activities of the entrepreneurial university foster “community engagement and networking/professional social skills”<sup>52</sup> through mentorship and coaching by “alumni entrepreneurs, experienced volunteers, and professors with prior academic entrepreneurship experience.”<sup>53</sup>

Table 1 synthesizes these points about accumulated cultural, human, and social capital that may imprint on entrepreneurial university students, leaving alumni with a sustained preference for startup-centric forms of innovation.

Based on the cultural, human, and social capital accumulation expectations of students embedded in the entrepreneurial university, as illustrated in Table 1, we hypothesize that studying at an entrepreneurial university, especially completing an MBA, is most likely to imprint startup-centric preferences upon alumni. Our central expectation is that policy leaders who are graduates of an entrepreneurial university, especially those who obtained an MBA, are especially likely to express a preference for startup-centric innovation. We hypothesize that they will speak about startups in their media engagement with greater frequency than their peers who did not attend one of these universities.<sup>54</sup>

<sup>39</sup>Marquis and Tilcsik (2013, 58).

<sup>40</sup>Arroyabe, Schumann, and Arranz (2022).

<sup>41</sup>Audretsch (2014).

<sup>42</sup>Bourdieu (1986); Coleman (1988); Becker (1993).

<sup>43</sup>Hulen and Tumunbayarova (2020).

<sup>44</sup>Geothner and Wyrwich (2020).

<sup>45</sup>Pittaway et al. (2011).

<sup>46</sup>Becker (1993, 17).

<sup>47</sup>Uslu et al. (2019).

<sup>48</sup>Binks, Starkey, and Mahon (2006).

<sup>49</sup>R. Jack, “Why Harvard’s Case Studies Are Under Fire,” *Financial Times*, 29 October 2018.

<sup>50</sup>Salamzadeh, Sangosanya, and Salamzadeh (2022); Redondo and Camarero (2019); Fengqiao and Dan (2015).

<sup>51</sup>Granovetter (1973).

<sup>52</sup>Martínez-Martínez and Ventura (2020, 10).

<sup>53</sup>Klofsten et al. (2019, 153).

<sup>54</sup>Bloch et al. (2017).

**Table 1.** Cultural, human, and social capital imprinting on entrepreneurial university students.

	Meaning	Activities
Cultural capital	Awareness and values	<ul style="list-style-type: none"> <li>• Events, fairs, festivals, prizes</li> <li>• Marketing campaigns</li> <li>• Role models and success stories</li> </ul>
Human capital	Education	<ul style="list-style-type: none"> <li>• Entrepreneurship-focused degree programs (majors and minors), concentrations, and modules</li> <li>• Guest lectures and speeches by entrepreneurs</li> <li>• Teaching of entrepreneurship case studies</li> </ul>
	Training	<ul style="list-style-type: none"> <li>• Accelerators and incubators</li> <li>• Boot camps and hackathons</li> <li>• Commercialization and technology transfer</li> <li>• Internships and jobs placements in startups and venture capital firms</li> <li>• Spin-offs and spin-outs</li> </ul>
Social capital	Social networking	<ul style="list-style-type: none"> <li>• Café and coworking space</li> <li>• Coaching and mentoring schemes</li> <li>• Competitions (ideas, business plans, pitches)</li> <li>• Entrepreneurship-themed clubs and activities</li> <li>• Networking events</li> </ul>

## Data and methods

To comprehensively cover the range of senior leaders responsible for a country's innovation policy, we first identified the leading innovation policymaking organizations in the eleven largest economies in East Asia.<sup>55</sup> We identified flagship innovation policies in each country to determine the set of policymaking organizations. To capture high-profile innovation policies, we canvassed the Global Entrepreneurship Monitor's Startup Nations Atlas of Policies (SNAP) platform,<sup>56</sup> the Innovation Policy Platform (IPP), and policy studies produced by the Organisation for Economic Co-operation and Development, World Bank, European Union,<sup>57</sup> and national governments for the 2014–2019 period.<sup>58</sup> The appendix presents a full list of the agencies that we identified through this process.

We then identified the two most senior positions (e.g., director and deputy director) in each organization. This required searching government websites to specify which two titles were the most senior in each organization. This approach is consistent with studies of leaders' personal characteristics in other empirical realms, such as that by Chwiero, who mapped the two most senior positions; in that case, they were the finance minister and the head of the central bank.<sup>59</sup> The difference, for us, is that the nature of innovation policymaking meant we needed to identify the two top leadership posts across several organizations in each country. We mapped these two senior positions from the East Asian financial crisis in 1998 to 2019; 1998 is the starting point for this analysis, given the evidence that the crisis acted as a critical juncture, shaking up postwar economic development approaches and instigating interest in alternative models.<sup>60</sup>

Next, we identified the individuals who held these posts from 1998 to 2019. To do this, we conducted in-depth desk research using social media (e.g., LinkedIn, Japan's Line, and China's Weibo), media coverage, and government websites to find the names of each position holder. The result of

<sup>55</sup>The countries with the largest gross domestic product in East Asia are China, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, and Vietnam.

<sup>56</sup>For more on the Global Enterprise Monitor's SNAP platform, visit <https://www.genglobal.org/startup-nations/snap#:~:text=The%20Startup%20Nations%20Atlas%20of,public%2Dsector%2Dsupported%20programs>. Audretsch et al. (2020) also use the SNAP database.

<sup>57</sup>The European Union funds the China Innovation Funding project: <http://chinainnovationfunding.eu/china-innovation-policies/>.

<sup>58</sup>OECD (2016); OECD and World Bank (2014); Ambashi (2018).

<sup>59</sup>See Chwiero (2007).

<sup>60</sup>Pempel (2021); Callon (1995).

these efforts is a dataset of 485 innovation policy leaders. The appendix provides full details, and the Independent variable section explains how this dataset was compiled.

### **Dependent variable: Startup-centric innovation**

Our dependent variable is policymakers' preference for startup-centric innovation. There are two approaches to studying such preferences as a result of personal characteristics: one is to consider policy change or economic performance as the indicator of preference. Such studies link policy change<sup>61</sup> and economic outcomes<sup>62</sup> to personal characteristics. In so doing, they assume that the policy change or economic outcome reflects the leader's preference. Others pursue a more causally proximate strategy for testing the relationship between personal characteristics and preferences expressed by studying the speeches and media data of leaders.<sup>63</sup>

We take this second approach—focusing on speech as expressed in media as the best indicator of policy preference—for three reasons. First, innovation policies are often authored and led by multiple organizations,<sup>64</sup> and so it is difficult to reliably filter out the impact of any single policymaker. For example, China's 1999 "Opinions on Establishing a Venture Investment System" was coauthored by the Ministry of Science and Technology, the State Development Planning Commission, the State Economic and Trade Commission, People's Bank of China, the State Administration of Taxation, and the China Securities Regulatory Commission. While China's Ministry of Science and Technology was likely the lead author, the other entities and their leaders undoubtedly influenced the regulations, and so the resultant policy is unlikely to clearly reflect the preferences of the minister of science and technology alone.

Second, studying policy change or economic outcomes as the dependent variable presumes that those other determinants, such as the organizational structure, policymaking process, political environment, and broader economic context, matter relatively less. We, and others using the speech and media data approach, contend that what leaders say "is relatively unconstrained" in comparison to their policies.<sup>65</sup> Said differently, although media coverage may of course be constrained by the broader context, there is relatively more freedom for policy leaders to indicate their preferences in their speech than in the policies or initiatives they enact.

Third, and relatedly, we choose to study media data based on the observation that policy leaders may launch initiatives that have been years in the making, and, similarly, that policies may not be implemented until after they leave office. In Taiwan, for instance, some policy leaders are only in their position for a year; their preferences are unlikely to translate into policies within that (short) period.<sup>66</sup>

For these reasons, our dependent variable, *startup-centric innovation*, is the frequency with which policy leaders communicate about startup-centric innovation policies in the media. In short, we contend that the way policy leaders talk about policy is a more robust measure *if* our goal is to understand and explain the relationship between personal characteristics and policy preferences. Therefore, we argue that media coverage of policymakers' activities in regard to startup-centric innovation policies provides the best—although not a perfect—measure of the expressed preferences of individual policy leaders.

To collect the data for our dependent variable, we used Factiva,<sup>67</sup> a searchable index of global media and communications data. Following best practices established in text-as-data research,<sup>68</sup> we created n-grams specific to what we are testing, rather than using a large "off-the-shelf" dictionary, to aid

<sup>61</sup>Mercier (2016); Chwioroth (2007, 2015).

<sup>62</sup>Hayo and Neumeier (2014); Besley, Montalvo, and Reynal-Querol (2011).

<sup>63</sup>Johnson, Arel-Bundock, and Portniaguine (2019); Schwarz, Traber, and Benoit (2017); Benoit and Herzog (2017).

<sup>64</sup>Breznitz, Ornston, and Stamford (2018).

<sup>65</sup>Schwarz, Traber, and Benoit (2017).

<sup>66</sup>Jones and Olken (2005) showed this with respect to tenure in office.

<sup>67</sup>Available at <https://professional.dowjones.com/factiva/>.

<sup>68</sup>Loughran and McDonald (2016).



the robustness of testing for the prevalence of startup-centric innovation. We generated this list of n-grams by situating startup-centric innovation policies within the state-of-the-art literature. Within wider industrial policy analysis, the literature describes three primary types of innovation policy: (1) invention- or R&D-focused, (2) national innovation system (NIS), and (3) transformational or mission-oriented.<sup>69</sup>

Within these three types, scholars refer to startup-centric innovation policies as a specific variety of NIS policy—one that is focused on elements such as entrepreneurial skills, incubators and accelerators, unicorns, and venture capital.<sup>70</sup> Startup-centric innovation policies strive to create an enabling environment for startups across their life cycle—from antecedents, through founding conditions, to scaling up, and, ultimately, outcomes. We adopt a typology that distinguishes policies according to instrument type: (1) funding; (2) taxation; (3) regulation; (4) clusters, networks, and institutes; (5) attracting talent and investment; (6) stock market access; (7) technology infrastructure and public procurement; and (8) education and training.<sup>71</sup> The typology specifies the kinds of specific tools that make up these instrument types, including coaching, mentorship, coaching and training for founders, cultivation of entrepreneurial finance (equity funding—particularly angels and venture capital funds), and the provision of physical infrastructure (such as coworking spaces, subsidized office space, incubators).

Applying techniques used in state-of-the-art natural language processing research,<sup>72</sup> we identified thirty terms, or “n-grams”—that is, a set of words (grams) that are most referenced in the aforementioned scholarship on startup-centric innovation policies. The resulting set of n-grams included the following terms: accelerat\*, angel, cluster, coworking, coach, cohort, early-stage, early-stage finance, ecosystem, entrepreneur, entrepreneurial finance, equity funding, founder, hi-tech, incubat\*, mentor, network, new firms, risk-taking, Silicon Valley, startup, startup ecosystem, survival, tax breaks, technolog\*, training, unicorn, venture, and venture capital.

We used these n-grams in our search strings in Factiva media data for each of the 485 innovation policy leaders. Each policy leader had a unique search string, including their name, our n-grams,<sup>73</sup> and a search time corresponding to the years during which they were in their post—from the beginning of the year (e.g., 1 January) they took office until the end (31 December) of their last year in post. For policy leaders currently in their role, we used 31 May 2020 as the end date. The result was 10,816 individual media documents.

It should be noted that our search strings were limited to English-language media coverage in each country. This approach is consistent with existing studies.<sup>74</sup> We acknowledge that this could exclude relevant domestic media sources from our analysis. Nevertheless, by focusing on English-language media, we ensure a level of consistency and reliability in our search strings and n-grams that would otherwise be lost or complicated in translation (especially across eight national languages). An analysis of the news media sources used in our analysis supports this claim. In most cases, the media sources used in our analysis are among the English news sources with the highest circulation in each country (or *the* leading news source) and, often, the English-language version of the highest-circulation local language newspaper. A full overview of our assessment of news sources can be found in Table A4 in the appendix.

Next, we employed a text-as-data approach using the R package *tidyr*<sup>75</sup> to analyze the documents and assess the extent to which the policymakers referred to startup-centric innovation initiatives in the media. For the purposes of our study, a mention of any of our n-grams constitutes a reference to

<sup>69</sup>See research that delineates innovation policy types, notably, Schot and Steinmueller (2018); Edler and Fagerberg (2017).

<sup>70</sup>Autio and Rannikko (2016); Audretsch et al. (2020).

<sup>71</sup>Klingler-Vidra and Pacheco Pardo (2022, 5); Pacheco Pardo and Klingler-Vidra (2019).

<sup>72</sup>See Loughran and McDonald (2016).

<sup>73</sup>A subset of n-grams was used in our initial search because of limits on search string length in Factiva. Ultimately, we intentionally employed terms that would ensure that our initial media search cast our net wider to avoid unwittingly omitting relevant documents.

<sup>74</sup>See Massey and Chang (2002) as an example of another East Asian regional study that uses English-language sources in its media analysis.

<sup>75</sup>The *tidyr* package can be found at <https://cran.r-project.org/web/packages/tidyr/index.html>.

startup-centric innovation policy, our dependent variable. We test these n-grams against our entire news media corpus using a dictionary approach. In short, we examine the term frequency of our n-grams relative to each document and the total corpus of documents per policymaker. This is commonly referred to as a *term frequency-inverse document frequency* (TFIDF) score.<sup>76</sup> In other words, TFIDF assesses the importance of terms relative to all other terms in each document within an entire corpus of documents.<sup>77</sup> Because we have data for the entire duration of each policymakers' tenure as well as n-grams, we calculate our dependent variable, *startup-centric innovation*, as the sum of all TFIDF scores per policymaker. The higher the score, the more the policy leader mentions startup-centric innovation policies.<sup>78</sup>

### Independent variable

Our independent variable is based on the university education of the 485 innovation policy leaders in East Asia for the period 1998–2019. Our main interest lies in determining whether policy leaders obtained degrees from a leading entrepreneurial university. To this end, we operationalized our main independent variable, being an alumni of an *entrepreneurial university*, using the combined 2017 and 2018 startup activity rankings from Crunchbase. This is a list of universities whose current students or recent graduates founded the most startups that had raised venture capital funding of \$1 million or more in the academic years in which the rankings were conducted. Combining data for these two periods (2017 and 2018) resulted in a list of thirty-three entrepreneurial universities.<sup>79</sup> Our reliance on an existing ranking is consistent with the approach of Guerrero and colleagues; in their study focused on the United Kingdom, they used the Russell Group set of twenty universities to determine the country's (most) entrepreneurial universities.<sup>80</sup> Rather than relying on university rankings, we use the Crunchbase list to identify the universities with graduates who have created the most venture-capital-backed startups. In doing so, we strive to disentangle the entrepreneurial nature of the university from its elite status. In comparing our list with the thirty-three top-ranked *US News & World Report* national universities in 2022,<sup>81</sup> we find that fifteen of the thirty-three (45.5 percent) elite-ranked universities are not included in our Crunchbase-generated list. For instance, the University of Chicago, Johns Hopkins University, and Vanderbilt University are all highly ranked by *US News & World Report*, but they are not included in our entrepreneurial university list.<sup>82</sup>

An alternative means of identifying a cohort of entrepreneurial universities would be survey results, such as the Global University Entrepreneurial Spirit Students (GUESS) Survey, which reflects spirit across the university community.<sup>83</sup> However, the GUESS captures entrepreneurship in a wide sense, including family firm takeover intentions, rather than the technologically oriented startup-centric orientation that we are interested in assessing. Thus, we opted for the Crunchbase ranking, which is more focused on high-growth startups and not only universities' wider rankings.

We contend that attendance at one of these entrepreneurial universities may shape graduates' likelihood of speaking of startup-centric innovation activities later in their career as policymakers. In

<sup>76</sup>Gentzkow, Kelley, and Tabby (2019, 538).

<sup>77</sup>TFIDF ( $t, d$ ) =  $TF(t, d) * IDF(t)$ , where  $t$  = "term" and  $d$  = "document."

<sup>78</sup>Haggard and Zheng (2013) and Keller and Pauly (2009).

<sup>79</sup>The following thirty-three universities, and in some cases just their business schools, are the entrepreneurial universities identified: Berkeley-Haas; Brown; Carnegie Mellon; Columbia; Columbia Business School; Cornell; Dartmouth; Duke; Harvard; Kellogg (Northwestern University); MIT; MIT-Sloan; Northwestern; NYU; NYU-Stern; Penn State; Princeton; Stanford; UC Berkeley; UCLA; UCLA-Anderson; University of Colorado; University of Illinois; University of Michigan; University of Pennsylvania; University of Southern California (USC); University of Virginia; University of Washington; UC San Diego; USC-Marshall; UW Madison; Wharton; Yale.

<sup>80</sup>Guerrero, Cunningham, and Urbano (2015, 752–53).

<sup>81</sup>The *US News & World Report* 2022 rankings are available at <https://www.usnews.com/best-colleges/rankings/national-universities>.

<sup>82</sup>The full list of the top thirty-three ranked *US News & World Report* universities in 2022, in comparison to our Crunchbase-determined set of entrepreneurial universities, is included in Table A5 in the appendix.

<sup>83</sup>Lechuga Sancho et al. (2021) and Meek and Gianiodis (2020) used this survey, for example.

entrepreneurial university settings, such as the MBA program at Stanford University, students would have been immersed in an environment in which their peers were more likely to be taking entrepreneurship-themed courses, discussing entrepreneurial ideas, planning to build their businesses, or planning to work for a startup after graduation. It logically follows that this accumulated cultural, human, and social capital increases the propensity for graduates to form a preference for startup-centric modes of innovation. A potential limitation is that rankings have only recently begun to identify these universities, and the rankings are a US-centric list. Most of our policy leaders attended these universities before such identification began. However, the prevalence of startup activity on these campuses has developed over time. Thus, we contend that it is reasonable that the recent Crunchbase rankings reflect a long-standing ethos—one that would have been accumulating when our policy leaders attended these universities.

*Entrepreneurial university* is measured as a binary variable, taking the value of 1 if a policy leader obtained any degree from our list of universities and 0 otherwise. Based on our data, about 28 percent of our policy leaders have at least one entrepreneurial university degree. To examine how an entrepreneurial university experience differs from obtaining degrees elsewhere, we include two further binary variables: whether a policy leader studied abroad at an *international university* (31 percent) or at a *domestic university* (82 percent). It should be noted that these categories overlap because most of our policy leaders have multiple degrees at different levels. We also add a series of control variables reflecting the level (UG, master's, MBA, and PhD) at which they studied.<sup>84</sup> Because individuals can have more than one of the same kind of degree (e.g., two master's degrees), we code degree level as a series of individual dummy variables.

Finally, we include the following control variables in our analysis: the *gender* (1 = female; 0 = male) of policy leaders, the *agency* where they work(ed), and the *country* in which the agency is located. Lastly, to capture unobserved time variance, we include a variable, *Year*, based on the year when the policy leader joined the agency. Table 2 presents summary statistics for all variables.

## Analysis

Before presenting our regression results, we first reveal where East Asia's innovation policy leaders studied. Figure 1 presents (1) the twenty most-attended universities on the left-hand side and (2) the twenty most-attended universities, excluding domestic universities, on the right-hand side. Entrepreneurial universities are indicated by dark navy bars. We can see that, when considering all 311 universities in our dataset, policy leaders overwhelmingly attend their country's high-ranking national universities, especially to complete a bachelor's degree.<sup>85</sup> A number of entrepreneurial universities also appear to be some of the most-attended universities, with Stanford (2.46 percent) and Harvard (2.03 percent) Universities leading the pack and the University of California, Cornell University, University of Pennsylvania, and University of Illinois following. Results are far more striking, however, when we look only at policy leaders who studied abroad, as illustrated on the right-hand side of Figure 1.

Entrepreneurial universities dominate the top of this list, as illustrated in Figure 1. Nearly 28 percent of the degrees obtained at nondomestic universities came from one of the entrepreneurial universities, making these universities a popular destination for the policy leaders.

To answer our central question about the extent to which the place one studies, and the degree that is completed, affects leaders' preference for startup-centric innovation, we estimate a series two-stage least squares (2SLS) regression models with additional dummies controlling for *agency* and *time*. 2SLS

<sup>84</sup>This coding of university studies at four distinct levels is consistent with the approach taken in Klingler-Vidra et al. (2021, 2022).

<sup>85</sup>QS World Rankings 2020 name the top university for each country (with global ranking indicated), as follows: China (Tsinghua University, #16), Hong Kong (University of Hong Kong, #25), Indonesia (Universitas Indonesia, #296), Japan (University of Tokyo, #22), Korea (Seoul National University, #37), Malaysia (Universiti Malaya, #70), Philippines (University of the Philippines Manila, #365), Singapore (National University of Singapore, #11), Taiwan (National Taiwan University, #69), Thailand (Mahidol University, #316), Vietnam (Vietnam National University, #801-1000).

**Table 2.** Summary statistics.

Variable	Obs	Mean	S.D.	Min	Max
Startup-centric innovation (ln)	370	0.29	0.17	0.03	1.12
Entrepreneurial university	332	0.26	0.44	0	1
International university	508	0.31	0.46	0	1
Domestic university	425	0.82	0.37	0	1
UG	508	0.74	0.43	0	1
Master's	508	0.43	0.49	0	1
MBA	508	0.62	0.48	0	1
PhD	508	0.39	0.48	0	1
Gender	508	0.88	0.31	0	1
Agency	507	67.66	36.64	1	132
Year	479	1996	6.49	1988	2019
Country	508	5.98	3.08	1	11

Note: There are 508 observations because some of the 485 individuals identified as innovation policy leaders held more than one leadership role over the period studied.

regression is a widely used approach for addressing endogeneity.<sup>86</sup> In our study, there is some concern about endogeneity between our dependent variable, *startup-centric innovation*, and one main explanatory variable, *entrepreneurial university*. Our argument is that attending an entrepreneurial university has a positive impact on the how policymakers talk about startup policy. There is, at the same time, a reasonable possibility that individuals with a propensity for using language around startup-centric innovation in their normal speech may be more inclined to select and attend an entrepreneurial university, and they may, in turn, continue to use startup-leaning language in their speech acts as policymakers. 2SLS addresses concerns about endogeneity by including an instrumental variable in the regression equation. The instrumental variable is selected because it is independent from the dependent variable but related to the explanatory variables. Our instrumental variable is *country dummy*. We argue that country dummies may shape where individuals in our dataset attend university but are unlikely to shape individual speech acts as their pertain to startup-centric language. Finally, there is, unsurprisingly, a perfect negative correlation between *international university* and *domestic university*. Therefore, we present the results of two regression models in which these additional explanatory variables are included separately. The results are presented in Table 3.

Our regression results provide considerable evidence supporting our central expectation. As shown in Models 1 and 2, obtaining at least one degree at an entrepreneurial university is strongly and positively correlated with reference to startup-centric innovation policy in the media. Specifically, the regression coefficients suggest that the mean difference between policymakers with an entrepreneurial university degree and those without is about 0.37 (Model 1) to 0.35 (Model 2). We also see no statistically significant differences for individuals obtaining degrees either from international or domestic universities. The effect appears to be unique to those with a degree from an entrepreneurial university. Plotting marginal effects (as we do in Figure 2) for this variable as well as *international university* and *domestic university* helps put this in context.

Figure 2 indicates that the predicted value for *startup-centric innovation* for those with an entrepreneurial university degree is about 0.56 and, for those without, it is only 0.19. This is a sizeable increase of roughly three orders of magnitude or 194 percent. Critically, these differences are much smaller when we examine those with degrees from international universities (middle figure), where the

<sup>86</sup>See Terza, Basu, and Rathouz (2009).

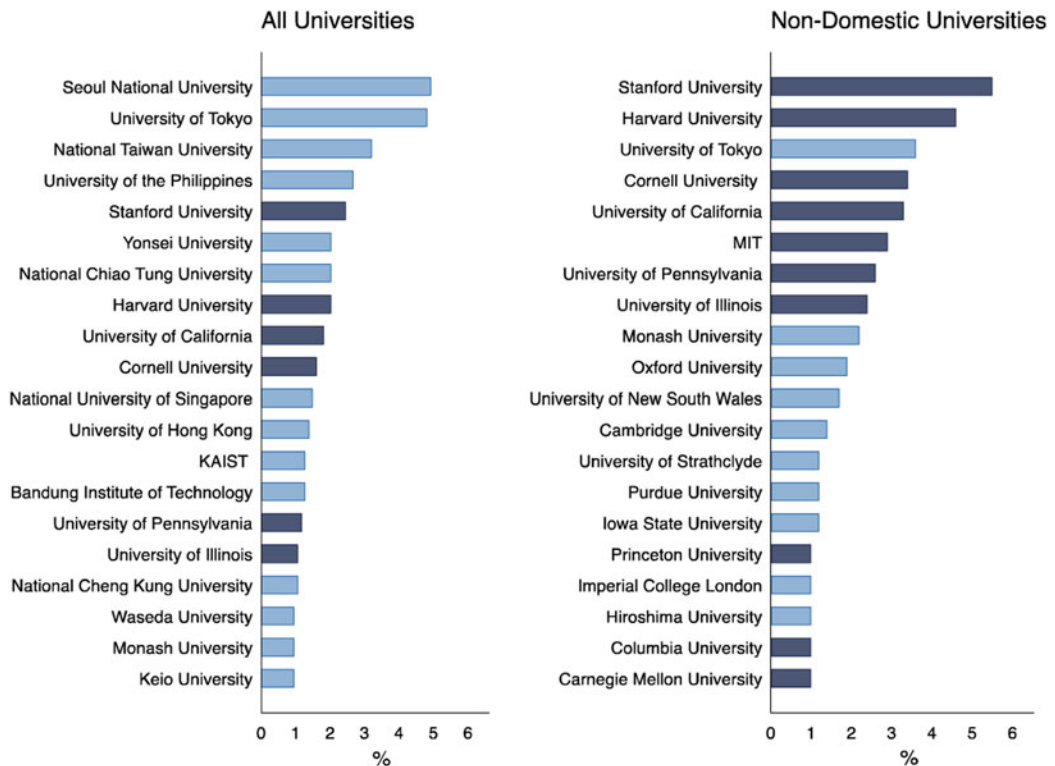


Figure 1. Percentage of degrees obtained at the twenty most-attended universities. Entrepreneurial universities are indicated by dark blue bars. All other universities indicated by light blue bars.

mean difference is  $-0.07$ . Similarly, those with degrees from domestic universities show a negligible negative mean difference of  $-0.08$ . Results for both international and domestic universities are not statistically significant. An example of a policy leader's media coverage helps show the causal mechanism in action. Tony Tan, a senior minister in Singapore and MIT graduate, provides an example. He was quoted in the media stating, "While it is not possible to replicate Silicon Valley in Singapore, there are many lessons we can learn from Silicon Valley and elsewhere that can be adapted to our local environment."<sup>87</sup> Tan, like the other entrepreneurial university alumni, used Silicon Valley as a reference point when discussing innovation more than his peers who did not graduate from entrepreneurial universities.

Turning back to Table 3, our regression analysis also revealed that having an entrepreneurial university MBA is positively correlated with referring to startup-centric innovation, and this is consistent across both models. The mean difference between those with an MBA and those without is about 0.04 to 0.06. To investigate this further, we estimated new regression models with interaction terms between our main independent variables (*entrepreneurial university*, *international university*, and *domestic university*) and an MBA degree specifically. In this case, we used ordinary least squares (OLS) regression to ease the interpretation of the interaction effects.<sup>88</sup> Results for the interaction terms are presented in Figure 3 as a series of coefficient plots with 95 percent confidence intervals. A full regression table is available in the appendix.

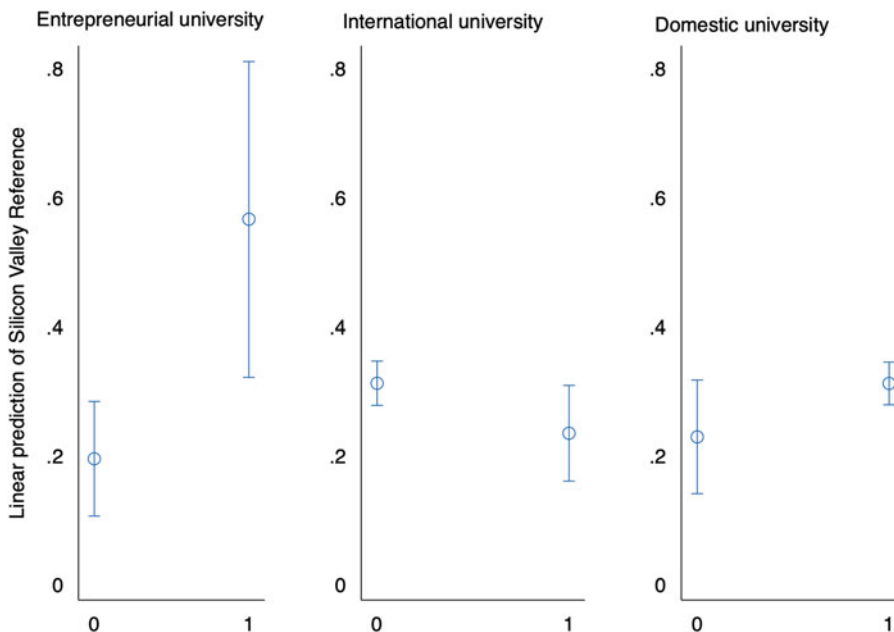
<sup>87</sup>Ramchandani (2007).

<sup>88</sup>2SLS regression links the instrumental variable to our explanatory variable, making the interpretation of interaction effects on that same explanatory variable rather difficult. Therefore, we instead reran our regression models using OLS but with fixed effects for *agency* and *year*. Furthermore, we assessed consistency in the results of our 2SLS models and OLS models. The results are presented in the appendix.

**Table 3.** Two-stage least squares regression analysis of startup-centric innovation and education

	(1)	(2)
Entrepreneurial university	0.371**	0.349**
	(0.168)	(0.167)
International university	-0.0776	
	(0.0489)	
Domestic university		0.0829
		(0.0553)
UG	-0.0252	0.000495
	(0.0390)	(0.0391)
MA/MSc	-0.0445	-0.0491
	(0.0364)	(0.0381)
MBA	0.0448*	0.0600**
	(0.0265)	(0.0287)
PhD	-0.0417	-0.0375
	(0.0278)	(0.0268)
Gender	-0.0770*	-0.0835*
	(0.0437)	(0.0436)
Agency dummies	Yes	Yes
Year dummies	Yes	Yes
Constant	0.234	-0.408
	(4.548)	(4.822)
<i>N</i>	326	306

Notes: Regression coefficients with standard errors in parentheses. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .



**Figure 2.** Marginal effects of education on startup-centric innovation references.

The interaction terms show no significant differences between policy leaders who obtain international degrees and those who hold domestic degrees. However, there is a sizeable positive and statistically significant effect for those with entrepreneurial university MBAs. These results suggest a mean difference between those receiving an MBA from an entrepreneurial university and those who hold an MBA from anywhere else, of 0.12 ( $p < .001$ ). Thus, we conclude that while the MBA degree is important for speaking about startup-centric innovation, it is far more important when it is obtained at an entrepreneurial university. This supports our expectation that individuals with entrepreneurial university MBAs exhibit the greatest preference for startup-centric innovation as particularly desirable when they later take on policy leader positions.

### Discussion: Entrepreneurial university alumni prefer startup-centric innovation

The results of our study reveal that 28 percent of East Asia's innovation policy leaders obtained degrees from an entrepreneurial university. Analyzing the media coverage of the full set of East Asian policy leaders, we find evidence that the entrepreneurial university alumni speak more frequently about startup-centric innovation than their peers who did not study at these entrepreneurial universities. Graduates of MBA programs at these universities go on to express startup-centric innovation policy preferences the most. This finding augurs well for a more systemic (e.g., national innovation policymaking) and longer-term (e.g., years later, when taking on policy leadership roles) mechanism for the entrepreneurial university to impact regional socioeconomic development.

This finding offers a new “alumni policymaker” mechanism by which innovation policy is shaped—namely, through graduates of entrepreneurial universities who later lead national innovation policymaking. Existing research on the entrepreneurial university has focused on more direct and shorter-term mechanisms that drive regional socioeconomic development, such as university-government interactions.<sup>89</sup> Research has also shown that returnee entrepreneurs can motivate innovation policy toward high-growth startups,<sup>90</sup> and that study visits undertaken while policymakers are in office act as mechanisms for the proliferation of startup-centric innovation policies.<sup>91</sup> Our findings suggest that the 28 percent of East Asia's innovation policy leaders who are alumni of the most active entrepreneurial universities in the United States form an additional mechanism for shaping regional socioeconomic development. While their peers who did not attend these entrepreneurial universities are almost certainly aware of the role of Schumpeterian entrepreneurship in innovation, our findings suggest that these entrepreneurial university alumni speak more often than their peers about partnerships or programs that they initiate with accelerators, investors, and startups.

Our empirical setting focused on the transmission of preferences through East Asia's policy leaders studying at entrepreneurial universities in the United States. It is worth noting that local universities in East Asia are also increasingly entrepreneurial.<sup>92</sup> We found, however, that graduates of domestic universities do not refer to startup-centric innovation to the same extent as those who studied—especially an MBA—at one of the United States' most entrepreneurial universities. The potential for this US-based education to shape national policy directions raises important questions about the desirability of such an orientation. We do not contend that an innovation policy preference for or against this startup-centric innovation policy type is desirable; we simply suggest that the potential for innovation leaders' academic background informing their preferences warrants policymaking organizations to give due consideration to this aspect of individuals background, and, especially, the diversity of educational backgrounds across policy leadership teams.

<sup>89</sup>Etzkowitz (2008).

<sup>90</sup>Kenney, Breznitz, and Murphree (2013).

<sup>91</sup>Klingler-Vidra (2018).

<sup>92</sup>Park and Jeong (2015); Mok (2005, 2013).

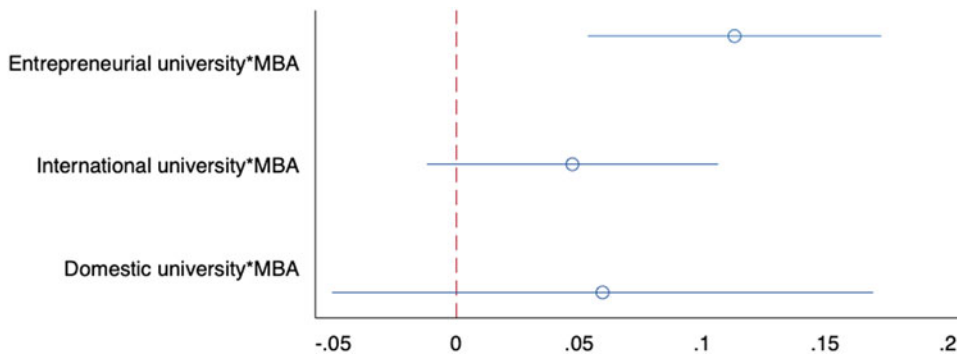


Figure 3. Multilevel OLS regression of startup-centric innovation and educational backgrounds with interaction effects.

## Conclusion

This article offers a novel investigation of the impact of leaders' personal characteristics, especially the potential imprinting on alumni of entrepreneurial universities, on their innovation policy preferences. It strives to invigorate a new line of research into the relationship between entrepreneurial universities and national innovation policy, suggesting that policy leaders' university education imprints long-lasting valorization of startup-centric innovation. In so doing, the imprinting may act as a spillover mechanism, thus extending the effects of the entrepreneurial university beyond direct collaboration between government and university, and beyond individual-level entrepreneurial pursuits of alumni, staff and students. Similar to the mechanisms driving the influence of education at particular universities on policy, we offer initial evidence that policy leaders' studying at entrepreneurial universities could be contributing to the rise of startup-centric innovation policy across East Asia. We hope that this finding will invigorate further studies of this relationship between the entrepreneurial university and policy preference, in accordance with research in other domains that has shown that leaders' personal characteristics, such as family status,<sup>93</sup> education and occupational background,<sup>94</sup> and migration experience<sup>95</sup> affect policy preferences.

Three important issues emerge when interpreting these results, which could serve as avenues for research that takes this line of inquiry further. First, media coverage has limitations in that it includes both what policymakers say and what is said about them. This is not unique to our study, and other researchers have explained that it offers benefits in the form of capturing issues of reverse causality: how the media frames coverage of policymakers based on their background characteristics.<sup>96</sup> By analyzing media data, while we predominantly analyze the text of speeches and quotes made by policy leaders, we also capture the media's framing. This weakness is at least partially mitigated by the fact that we studied the same national media outlets for entrepreneurial university alumni and other policymakers, so the same narrative and sociotechnical systems are present for policy leaders operating in the same country at similar periods. Thus, while imperfect, we conclude that media coverage is a robust way of testing for policy preferences, as what policy leaders speak about is closer to their preferences than the policies implemented during their tenure.

The second limitation has to do with the set of entrepreneurial universities studied. The very nature of the Crunchbase rankings lends a US focus to our operationalization of the entrepreneurial university. We tried to mitigate this effect by differentiating international and domestic universities in the sample, so that we were testing for this set of entrepreneurial universities, and not transnational education (especially in the United States) more broadly. However, it would be ideal to have the most entrepreneurial universities identified in a more global way. Third, we note that there is an endogeneity issue here, in that individuals who choose to study certain programs, at certain universities, may have a

<sup>93</sup>Hayo and Neumeier (2014).

<sup>94</sup>Dreher et al. (2009); Chwioroth (2007, 2015); Gohlmann and Vaubel (2007).

<sup>95</sup>Mercier (2016).

<sup>96</sup>See Riffe et al. (2019); Gentzkow and Shapiro (2010).



proclivity toward embracing startups. We performed a 2SLS regression to help test for endogeneity but note that there may still be individual characteristics that are otherwise shaping innovation policy preferences.

Despite these limitations, we hope that our findings encourage scholars to take this line of research forward. First, in this initial test, we offer a new avenue for studying the impact of the entrepreneurial university—through the potential imprinting of cultural, human, and social capital in favor of high-growth startups—on public policymaking. Future research can extend this by interrogating what, precisely, about the entrepreneurial university experience shapes long-term preferences in this way. For instance, interviews or surveys with policy leaders could help unpack which aspects of the experience most affected their veneration of startup-centric innovation. Second, it also offers a novel approach to explaining the rising prevalence of startups in innovation policymaking. Our findings offer evidence that “alumni policymakers” from entrepreneurial universities may themselves, as a result of imprinting, act as a spillover mechanism for shaping regional socioeconomic development in favor of startup-centric modes of innovation. Additional research is needed to further unpack how the entrepreneurial university is shaping the future of innovation, and how innovation policymaking organizations consider the human resources implications of the finding.

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## Appendix

**Table A1.** Innovation agency name (and abbreviation) by country.

Agency name	Country
Ministry of Communications and Information/MIIT	China
China Association for Science and Technology/CAST	China
Chinese Academy of Sciences/CAS	China
Ministry of Industry and Information Technology/Ministry of Industry and Information Technology/MIIT	China
State Council of China/Chinese Academy of Engineering/CAE	China
National Development and Reform Commission/State Development Planning Commission/NDRC	China
Ministry of Science and Technology/MOST	China
Cyberspace Administration of China/CAC	China
Innovation and Technology Bureau/ITB	Hong Kong
Innovation and Technology Commission/ITC	Hong Kong
Hong Kong Science and Technology Parks Corporation/Hong Kong Science and Technology Parks Corporation/HKSTP	Hong Kong
Policy Innovation and Co-ordination Office/Policy Innovation and Coordination Office/PICO	Hong Kong
Hong Kong Applied Science and Technology Research Institute/ASTRI	Hong Kong
Hong Kong Productivity Council/HKPC	Hong Kong
Government Information Office/Information Services Department/Government Information Services	Hong Kong
Hong Kong Cyberport Management Company/Cyberport	Hong Kong
Ministry of Research and Technology/Ministry of Research, Technology and Higher Education/Ministry of Research, Technology, and Higher Education/RISTEK	Indonesia
Center for Innovation, Entrepreneurship, and Leadership/CIEL	Indonesia
Centre for Science and Technology Development Studies, Indonesian Institute of Sciences/Centre for Science and Technology Development Studies/PAPPIPTEK-LIPI	Indonesia
Government's Innovation Centers for Micro, Small, and Medium Enterprises (PI-UMKM), Ministry of Research and Technology	Indonesia
National Innovation Committee/KIN	Indonesia
Presidential Delivery Unit for Development Monitoring and Oversight/UKP-PPP	Indonesia
Indonesian Institute of Sciences/LIPI	Indonesia
Ministry of Cooperatives and Small and Medium Enterprises/Ministry of Cooperatives and Small and Medium Enterprises	Indonesia
National Development Planning Agency/BAPPENAS	Indonesia
Ministry for Economic Affairs/Minister for Creative Economy, Entrepreneurship, and Cooperatives and SMEs Competitiveness	Indonesia
Ministry of Industry	Indonesia
Indonesian Academy of Sciences/AIPI	Indonesia
Ministry of Industry/Agency for Research and Development of Industry	Indonesia
Innovation 25/Minister of State for Innovation	Japan
National Institute of Science and Technology Policy/NISTEP	Japan
Ministry of Economy, Trade and Industry/Ministry of Economy, Trade and Industry/METI	Japan
Minister of State for Science and Technology policy/Minister of State for Science and Technology Policy/Science and Technology Policy/Science and Technology Policy	Japan

(Continued)

Table A1. (Continued.)

Agency name	Country
Japan Innovation Network/JIN	Japan
Council for Science and Technology Policy/Council for Science and Technology Policy/CSTP	Japan
Council for Science, Technology and Innovation/CSTI	Japan
Council for Science, Technology and Innovation Policy/Council for Science, Technology and Innovation/ Council for Science, Technology and Innovation/CSTI	Japan
Japan External Trade Organization/JETRO	Japan
Small and Medium Enterprise Agency/SME Agency/SMEA	Japan
Ministry of Science and ICT/MSIT	Korea
Ministry of Science, ICT and Future Planning/Ministry of Science ICT and Future Planning	Korea
Ministry of Education, Science, and Technology/Ministry of Education Science and Technology/Ministry of Education, Science and Technology	Korea
Ministry of Information and Communication/MIC	Korea
Presidential Council of Science and Technology/Council of Science and Technology/Council of Science and Technology/NSTC	Korea
Korea Institute of Science and Technology Information/Korea Institute of Science and Technology Information/Korea Institute of Science and Technology/KISTI/KIST	Korea
Korea Institute of S&T Evaluation and Planning/Korea Institute of S&T Evaluation and Planning/KISTEP	Korea
Korea Advanced Institute of Science and Technology Venture Investment Holdings/KAIST/KVI	Korea
National Science and Technology Council/National Science and Technology Council/NSTC	Korea
Korean Technopark Association/Korean Techno-park Association/KTA	Korea
Ministry of SMEs and Startups/Ministry of SMEs and Startups/MSS	Korea
Korea Investment Corporation/KIC	Korea
Korea Technology Finance Corporation/Korea Technology Finance Corp/KOTEC	Korea
Korea Venture Investment Corporation/Korea Venture Investment Corp./KVIC	Korea
Centre for Creative Economy and Innovation/Creative Economy Innovation Center/CCEI	Korea
Science and Technology Policy Institute/Science and Technology Policy Institute/STEPI	Korea
Malaysian Industry-Government Group for High Technology/MIGHT	Malaysia
Malaysian Technology Development Corporation/MTDC	Malaysia
Ministry of Energy, Science, Technology, Environment and Climate Change/MESTECC/Technology Park Malaysia Corporation/TPM	Malaysia
Ministry of Energy, Science, Technology, Environment and Climate Change/Ministry of Energy, Science, Technology, Environment and Climate Change/MESTECC	Malaysia
SME Corporation Malaysia/SME Corp. Malaysia	Malaysia
National Innovation Agency/AIM	Malaysia
Malaysian Global Innovation and Creativity Centre/MaGIC	Malaysia
Malaysia Digital Economy Corporation/MDEC	Malaysia
Ministry of Science, Technology and Innovation/MOSTI/NanoMalaysia	Malaysia
Department of Science and Technology/Department of Science and Technology/DOST/DST	Philippines
Department of Information and Communications Technology/Department of Information and Communications Technology/DICT	Philippines
Commission on Information and Communications Technology/CICT	Philippines

(Continued)

Table A1. (Continued.)

Agency name	Country
Department of Science and Technology/Philippine Council for Industry, Energy and Emerging Technology Research and Development/DOST-PCIEERD/PCIEERD	Philippines
Department of Science and Technology/DOST/Industrial Technology Development Institute/ITDI	Philippines
Department of Trade and Industry/DTI/National Industry Cluster Capacity Enhancement Project/NICCEP	Philippines
Agency for Science, Technology and Research/A*STAR	Singapore
Standards, Productivity and Innovation Board/SPRING Singapore	Singapore
International Enterprise Singapore/IE Singapore	Singapore
Ministry of Trade and Industry/MTI/Enterprise Singapore/ESG	Singapore
NUS Enterprise	Singapore
SG-Innovate/SGInnovate	Singapore
National Research Foundation/NRF	Singapore
Infocomm Media Development Authority/IMDA/Ministry of Information, Communications and the Arts/ Ministry of Communications and Information	Singapore
Smart Nation/Digital Government Office	Singapore
Digital Government Office/Government Technology Agency/GovTech	Singapore
Government Technology Agency/GovTech	Singapore
Economic Development Board/EDB	Singapore
Ministry of Science and Technology/Ministry of Science and Technology/MOST	Taiwan
National Science Council/NSC	Taiwan
Ministry of Economic Affairs/MOEA	Taiwan
National Development Council/NDC	Taiwan
Executive Yuan/National Development Council/Council for Economic Planning and Development/NDC/ CEPD	Taiwan
Industrial Development Bureau/IDB	Taiwan
Industrial Technology Research Institute/ITRI	Taiwan
Institute for Information Industry/III	Taiwan
Council for Economic Planning and Development/Council for Economic Planning and Development/ CEPD	Taiwan
Taiwan Institute of Economic Research/TIER	Taiwan
Ministry of Economic Affairs/Department of Industrial Technology/DoIT	Taiwan
National Science Technology and Innovation/NSTI	Thailand
National Research Council of Thailand/NRCT	Thailand
Ministry of Science and Technology/Ministry of Science and Technology/MOST	Thailand
Ministry of Higher Education, Science, Research and Innovation/MHESI	Thailand
National Innovation Agency/NIA	Thailand
National Science and Technology Development Agency/National Science and Technology Development Agency/NSTDA	Thailand
Thailand Science Park/TSP	Thailand
National Science Technology and Innovation Policy Office/STI	Thailand
Digital Economy Promotion Agency/DIPA	Thailand
Software Industry Promotion Agency/SIPA	Thailand

(Continued)

Table A1. (Continued.)

Agency name	Country
Ministry of Digital Economy and Society/MDES	Thailand
Ministry of Information and Communication Technology/Ministry of Information and Communication Technology/MICT	Thailand
Ministry of Science and Technology/MoST	Vietnam
Ministry of Science and Technology/MoST/National Foundation for Science and Technology Development/NAFOSTED	Vietnam
Ministry of Science and Technology/MoST/NISTPASS/National Institute for Science and Technology Policy and Strategy Studies	Vietnam
Ministry of Science and Technology/MoST/SATI/State Agency for Technology Innovation	Vietnam
Ministry of Science and Technology/MoST/NATEC/National Agency for Technology Entrepreneurship and Commercialization Development	Vietnam
Ministry of Science and Technology/MoST/NATIF/National Technology Innovation Fund	Vietnam
Hanoi University of Science and Technology/HUST	Vietnam
Ministry of Planning and Investment/MPI	Vietnam
Ministry of Planning and Investment SME/SME Development Fund	Vietnam
Vietnam Chamber of Commerce and Industry/VCCI	Vietnam
Bank for Investment and Development of Vietnam/BIDV	Vietnam
Agency for Small and Medium Enterprises Development/Enterprise Development Agency/ASMED	Vietnam
Vietnam Academy of Science and Technology/VAST	Vietnam
Ministry of Industry and Trade/MOIT	Vietnam
Ministry of Information and Communications/MIC	Vietnam



**Table A2.** List of policy leaders.

#	Name
1	Lim Chuan Poh
2	Chan Lai Fung
3	Frederick Chew Chih Chiang
4	Tan Sze Wee
5	Philip Yeo
6	Philip Yeo*
7	Png Cheong Boon
8	Seah Moon Ming
9	Lee Ark Boon
10	Chong Lit Cheong
11	Teo Eng Cheong
12	Peter Ong Boon Kwee
13	Png Cheong Boon*
14	Ted Tan Teck Koon
15	Wong Poh-Kam
16	Lily Chan
17	Freddy Boey
18	Steve Leonard
19	Heng Swee Keat
20	Teo Chee Hean
21	Tony Tan Keng Yam
22	Tan Kiat How
23	Lim Meng Liang Gabriel
24	Koh Lin-Net
25	Aubeck Kam
26	Teo Chee Hean*
27	Chan Cheow Hoe
28	Vivian Balakrishnan
29	Ng Chee Khern
30	Janil Puthuachery
31	Jacqueline (Mae-Jean) Poh
32	Kok Ping Soon
33	Swan Gin Beh
34	Chu Ngoc Anh
35	Nguyen Quan
36	Hoang Van Phong
37	Tran Quoc Khanh
38	Pham Cong Tac
39	To Dinh Huyen
40	Phan Hong Son

*(Continued)*

Table A2. (Continued.)

#	Name
41	Do Tien Dung
42	Nguyen Quang Thuan
43	Hoang Minh
44	Quan Manh Nguyen
45	Ta Viet Dung
46	Pham Hong Quat
47	Pham Duc Nghiem
48	Tran Xuan Dich
49	Tran Van Tung
50	Nguyen Dinh Binh
51	Huynh Thi Thanh Binh
52	Nguyen Thanh Huy
53	Nguyen Thi Phuong
54	Nguyen Chi Dung
55	Hoang Thi Hong
56	Vu Dai Thang
57	Đặng Huy Đông
58	Le Quang Manh
59	Vu Tien Loc
60	Doan Duy Khuong
61	Can Van Luc
62	Ho Sy Hung
63	Nguyen Hoa Cuong
64	Chau Van Minh
65	Nguyen Van Hieu
66	Tran Tuan Anh
67	Nguyen Bac Son
68	Truong Minh Tuan
69	Nguyen Manh Hung
70	Nguyen Thanh Hung
71	Mohamad Nasir
72	Muhammad Dimyati
73	Jumain Appe
74	Patdono Suwignjo
75	Gusti Muhammad Hatta
76	Suharna Surapranata
77	Kusmayanto Kadiman
78	Hatta Rajasa
79	Ainun Na'im

(Continued)

Table A2. (Continued.)

#	Name
80	Dwi Larso
81	Donald Crestofel Lantu
82	Trina Fizzanty
83	Kristanto Santosa
84	Freddy Permana Zen
85	Kuntoro Mangkusubroto
86	Heru Prasetyo
87	Laksana Tri Handoko
88	Anak Agung Gede Ngurah Puspayoga
89	I Wayan Dipta
90	Bambang Permadi Soemantri Brodjonegoro
91	Armida Salsiah Alisjahbana
92	Rudy Salahuddin
93	Airlangga Hartarto
94	Satryo Soemantri Brodjonegoro
95	Sangkot Marzuki
96	Ngakan Timur Antara
97	Tan Sri Zakri Abdul Hamid
98	Tan Sri Dr. Ir. Ahmad Tajuddin Ali
99	Dato' Latt Shariman Abdullah
100	Tan Sri Abd. Rahman bin Mamat
101	Datuk Abu Samah Bachik
102	Ahmad Fauzi Zahari
103	Mohd Azman Shahidin
104	M. Raja Datuk Zaharaton Binti Raja Zainal Abidin
105	Sharbani Harun
106	Dat Seri Panglima Wilfred Madius Tangau
107	Dat Wira Dr. Abu Bakar Mohamad Diah
108	DatSeri Dr. Mohd Azhar Bin Haji Yahaya
109	Yeo Bee Yin
110	Isnaraissah Munirah Majilis
111	Mohd Nor Azman Hassan
112	Hafsah Hashim
113	Noor Azmi Mat
114	Rizal Nainy
115	Mohamed Al-Amin Abdul Majid
116	Mohd. Bin Atan
117	Mark Rozario
118	Naser Jaafar

(Continued)

Table A2. (Continued.)

#	Name
119	Mohammad Irwan Serigar bin Abdullah
120	Abdul Rahman
121	Cheryl Yeoh Sew Hoy
122	Ashran Ghazi
123	Dzuleira Abu Bakar
124	Aditya Tuli
125	Sumitra Nair
126	Rezel Ahmad
127	Hock Koon Song
128	Surina Shukri
129	Yasmin Mahmood
130	Badlisham Ghazali
131	Nicholas Wei-hsiung Yang
132	David Wai-keung Chung
133	Ivan K.B. Lee
134	Ng Kiang Mei Nei
135	Cheuk Wing Hing
136	Annie Choi Suk-han
137	Eddy Chan Yuk-tak
138	Janet Wong Wing-chen
139	Nicholas Brooke
140	Fanny Law Fan Chiu Fun
141	Sunny Chai Ngai-chiu
142	Anthony Tan
143	Allen Kam-Sing Ma
144	Albert Wong Hak-keung
145	Betty Fung Ching Suk Yee
146	Wong Ming Yam
147	Patrick Wang Shui-chung
148	Chow Hin Poon Hugh
149	Franklin Tong Fuk-kay
150	Nim-Kwan Cheung
151	Lawrence Cheung Chi-chong
152	Mohamed Din Butt
153	Willy Lin Sun Mo
154	Allen Yeung Tak Bun
155	Victor Lam Wai-kiu
156	Peter Yan
157	Herman Lam

(Continued)

Table A2. (Continued.)

#	Name
158	Paul Man-yiu Chow
159	Lee George Lam
160	Kiyoshi Kurokawa
161	Sanae Takaichi
162	Kaisuke Isogai
163	Hiroshi Tsuboi
164	Wada Tomoaki
165	Motohide Konaka
166	Hideyuki Tsunoda
167	Naoki Saito
168	Hiroshige Seko
169	Motoo Hayashi
170	Yoichi Miyazawa
171	Yuko Obuchi
172	Toshimitsu Motegi
173	Yukio Edano
174	Yoshio Hachiro
175	Banri Kaieda
176	Akihiro Ohata
177	Masuyuki Naoshima
178	Toshihiro Nikai
179	Akira Amari
180	Toshihiro Nikai*
181	Shoichi Nakagawa
182	Takeo Hiranuma
183	Hiroyui Suematsu
184	Hisayoshi Ando
185	Takuya Hirai
186	Masaji Matsuyama
187	Yosuke Tsuroho
188	Aiko Shimajiri
189	Yamaguchi Shunichi
190	Yamamoto Ichita
191	Seiji Maehara
192	Furukawa Horohisa
193	Genba Koichiro
194	Banri Kaieda
195	Tatsuo Kawabata
196	Naoto Kan

(Continued)

Table A2. (Continued.)

#	Name
197	Seiko Noda
198	Fumio Kishida
199	Sanae Takaichi
200	Matsuda Iwao
201	Tanahashi Yasufumi
202	Toshimitsu Motegi*
203	Noboru Konno
204	Hitoshi Funahashi
205	Hiro Nishiguchi
206	Takeshi Matsumoto
207	Fujiyo Ishiguru
208	Taizo Yakushiji
209	Yuo Harayama
210	Takahiro Ueyama
211	Yumiko Kajiwara
212	Motoko Kotani
213	Yoshimitsu Kobayashi
214	Hikomichi Shinohara
215	Kazuhito Hashimoto
216	Seiichi Matsuo
217	Kazuo Kyuma
218	Yuko Harayama
219	Takeshi Uchiyamada
220	Toshio Hirano
221	Hiroaki Nakanishi
222	Takashi Onishi
223	Taizo Yakushiji
224	Nabuhiko Sasaki
225	Hiroyuki Ishige
226	Yasuo Hayashi
227	Osamu Watanabe
228	Satoshi Hatakeyama
229	O Tasaki
230	Maeda Yasuhiro
231	Hisayoshi Ando
232	Miyamoto Satoshi
233	Atsushi Toyonaga
234	Kitagawa Shinsuke
235	Suzuki Masanori

(Continued)

Table A2. (Continued.)

#	Name
236	Ichiro Takahara
237	Eiichi Hasegawa
238	Fukumizu Takefumi
239	Ishige Hiroyuki
240	Mochizuki I Harufumi
241	Shuji Sugiyama
242	Kamada Atsushi
243	Akihiko Morota
244	Nobutaka Yasui
245	You Young-min
246	Kim Sung-soo
247	Mun Mi-ock
248	Min Won-ki
249	Lim Dae-sik
250	Kim Yong-soo
251	Chang Whan Ma
252	Lee Jin-gyu
253	Choi Yang-hee
254	Choi Mun-gi
255	Lee Joo-ho
256	Ahn Byeong-man
257	Kim Do-yeon
258	Noh Jun-hyeong
259	Jin Dae-je
260	Lee Sang-chul
261	Yeom Han-woong
262	Lee Myeong-cheol
263	Shin Syung-cheol
264	Cho Moo-je
265	Park Sang-dae
266	Choi Hee-yoon
267	Hahn Sun-hwa
268	Park Young-seo
269	Yang Byeon-tae
270	Cho Yeong-hwa
271	Kim Sang-seon
272	Lim Gi-cheol
273	Park Young-ah
274	Lee Byung-tae

(Continued)

Table A2. (Continued.)

#	Name
275	Oh Deok-hwan
276	Lee Jang-Moo
277	Park Jong-hyun
278	Lee Jae-hoon
279	Pyeon Gwang-ui
280	Park Young-sun
281	Kim Hak-do
282	Hong Jong-hak
283	Choi Su-gyu
284	Choi Hee-nam
285	Eun Seong-su
286	Ahn Hong-chul
287	Jung Yun-mo
288	Kim Han-Chul
289	Ju Hyeong-cheol
290	Lee Yeong-min
291	Jung Jin-woo
292	Ju Yeong-beom
293	Lee Kyeong-jun
294	Ihm Jong-Tae
295	Choi Hwang-hee
296	Song Jong-guk
297	Kim Suk-joon
298	Chung Sung-chul
299	Choi Young-rak
300	Kang Gwang-nam
301	Jang Mun-ho
302	Kim In-su
303	Wang Zhigang
304	Wan Gang
305	Xu Guanhua
306	Zhu Lilan
307	Huang Wei
308	Wang Zhigang
309	Cao Jianlin
310	Liu Yanhua
311	Xu Guanhua
312	Wan Gang
313	Han Qide

(Continued)



Table A2. (Continued.)

#	Name
314	Zhou Guangzhao
315	Ma Weiming
316	Shang Yong
317	Li Jinghai
318	Wei Yu
319	Qi Rang
320	Wang Lianzheng
321	Bai Chunli
322	Lu Yongxiang
323	Ding Zhongli
324	Zhang Yaping
325	Bai Chunli
326	Miao Wei
327	Li Yizhong
328	Wang Xudong
329	Wu Jichuan
330	Chen Zhaoxiong
331	Xu Dazhe
332	Miao Wei
333	Xi Guohua
334	Lou Qinjian
335	Li Xiaohong
336	Zhou Ji
337	Xu Kuangdi
338	Song Jian
339	Chen Zuoning
340	Gan Yong
341	Liu Depei
342	Zhu Gaofeng
343	He Lifeng
344	Xu Shaoshi
345	Zhang Ping
346	Ma Kai
347	Zeng Peiyuan
348	Zhang Yong
349	Lian Weiliang
350	He Lifeng
351	Zhu Zhixin
352	Peng Sen

(Continued)

Table A2. (Continued.)

#	Name
353	Ou Xinqian
354	Wang Yang
355	Hao Jianxiu
356	Liang-Gee Chen
357	Hung-duen Yang
358	Jyuo-min Shyu
359	Yi-Bing Lin
360	San-cheng Chang
361	Fong-Chin Su
362	Yu-Han Tsou
363	Yu-Chin Hsu
364	Cyrus Chu
365	Louis Luoquan Lee
366	Jianren Chen
367	Maokun Wu
368	Zhengyi Weng
369	Zhentai Huang
370	Jing-Yang Jou
371	Qingfeng Zhang
372	Jong-chin Shen
373	Chih-Kung Lee
374	Chen-Chung Deng
375	Tyzz-jiun Duh
376	Chia-juch Chang
377	Yen-shiang Shih
378	Chii-ming Yiin
379	Ruey-long Chen
380	Ing-san Huang
381	Chen Mei-Ling
382	Tain-Jy Chen
383	Chu-chia Lin
384	Tyzz-jiun Duh
385	Chung-ming Kuan
386	Leu Jang-Hwa
387	Jong-chin Shen
388	Ming-ji Wu
389	Leu Jang-Hwa (Lu Zhenghua)
390	Jong-chin Shen (Shen Rongjin)
391	Tyzz-jiun Duh (Du Zijun)

(Continued)

Table A2. (Continued.)

#	Name
392	Shih Yen-shiang (Shi Yanxiang)
393	Yakang Wang
394	Chii-ming Yiin
395	Zhaoyi Chen
396	Bogeng Yang
397	Zhiqing Yang
398	Jang-hwa Leu
399	Jong-chin Shen
400	Jong-Min Liu
401	Jyuo-Min Shyu
402	John-See Lee
403	Chin-Tay Shih
404	Pei-zen Chang
405	Chih-Kung Lee
406	Chin-Tay Shih*
407	Chih-Kung Lee
408	Yau-Hwang Kuo
409	Dasheng Luo
410	Jin-fu Chang
411	Chin-Tay Shih*
412	Ruey-Long Chen
413	F. C. Lin
414	Heming Huang
415	Chao-Ming Wang
416	Cheng-Hong Cho
417	Po Jen Hsiao
418	Yu Xiaobin
419	Jonq-Min Liu
420	Ruey-Beei Wu
421	Zhisheng He
422	Chih-Kung Lee
423	Zhisheng He*
424	Ming-Syan Chen
425	Zhisheng He*
426	F. C. Lin*
427	Yun Guo
428	Baozhong He
429	Chung-ming Kuan
430	Chii-ming Yiin

(Continued)

Table A2. (Continued.)

#	Name
431	Yih-ju Liu
432	Hsun-hsiung Tsai
433	Mei-yueh Ho
434	Sheng-cheng Hu
435	Hsin-I Lin
436	Po-chih Chen
437	Pin-kung Chiang
438	Hsun-hsiung Tsai
439	Lin Chien-Fu
440	Zhongqiu Huang
441	Ta-Sheng Lo
442	Fortunato "Boy" Tanseco de la Peña
443	Mario Montejo
444	Estrella Fagela Alabastro
445	Filemon A. Uriarte Jr.
446	Graciano P. Yumul Jr.
447	Rogelio A. Panlasigui
448	Amelia Peralta Guevara
449	Rodolfo A. Salalima
450	Eliseo M. Rio Jr.
451	Gregorio Ballesteros Honasan II
452	John Henry Naga
453	Ivin Ronald D. M. Alzona
454	Denis F. Villorente
455	Virgilio L. Peña
456	Ramon P. Sales
457	Ray Anthony Roxas-Chua III
458	Ivan John E. Uy
459	Angelo Timoteo M. Diaz de Rivera
460	Monchito B. Ibrahim
461	Monchito B. Ibrahim**
462	Consuelo S. Perez
463	Francisco S. Perez II
464	Enrico C. Paringit
465	Raul C. Sabularse
466	Carlos Primo David
467	Annabelle V. Briones
468	Maria Patricia V. Azanza
469	Rogelio A. Panlasigui*

(Continued)

Table A2. (Continued.)

#	Name
470	Ramon Lopez
471	Adrian Cristobal Jr.
472	Gregory L. Domingo
473	Jesli Aquino-Lapus
474	Peter Favila
475	Pichet Durongkaveroj
476	Nuttapon Nimmanphatcharin
477	Yada Mukdapitak
478	Kitipong Promwong
479	Sirirurg Songsivilai
480	Soottiporn Chittmittrapap
481	Weerapong Pairsuwan
482	Suvit Maesincee
483	Yongyuth Yuthavong
484	Pichet Durongkaveroj
485	Pornchai Tarkulwaranont
486	Suvit Maesincee*
487	Pun-Arj Chairatana
488	Supachai Lorlowhakarn
489	Krithpaka Boonfueng
490	Pariwat Wongsamran
491	Thitapha Smitinont
492	Yongyuth Yuthavong*
493	Narong Sirilertworrakul
494	Suwipa Wanasathop
495	Janekrishna Kanatharana
496	Kitipong Promwong
497	Kanchana Wanichkorn
498	Nuttapon Nimmanphatcharin
499	Chatchai Khunpitoluck
500	Meetham Naranong
501	Meetham Naranong*
502	Pichet Durongkaveroj*
503	Buddhipongse Punnakanta
504	Uttama Savanayana
505	Anudith Nakornthap
506	Juti Krairiksh
507	Pornchai Rujiprapa
508	Ranongruk Suwunchwee

Notes: 485 individuals, some of which have an asterisk after the first mention, to indicate that they appear more than once because they held more than one top innovation policy position over time.

**Table A3.** Example search string.

Name	Media search string
Lim Chuan Poh	(Lim Chuan Poh near10 "A*STAR" or Chuan Poh Lim near10 "A*STAR" or Lim Chuan Poh near10 "Agency for Science, Technology and Research" or Chuan Poh Lim near10 "Agency for Science, Technology and Research" or Lim Chuan Poh near10 Agency for Science, Technology & Research or Chuan Poh Lim near10 Agency for Science, Technology & Research) and re=singp and (accelerate or accelerator or angel or angel invest* or cluster or entrepreneur* or fund* or incubat* or initiative or innovat* or Silicon Valley or start-up or startup or strategy or unicorn* or venture capital or policy strategy or policy innovation or policy initiative or equity invest*)

**Table A4.** News media sources.

Country	Top English-language newspapers	Found on Factiva?	Notes
Singapore	My Paper	No	
	The New Paper	Yes	Leading English-language newspaper in country
	Today	Yes	Leading English-language newspaper in country
	Business Times	Yes	
	ZbCOMMA	No	
	The Straits Times	Yes	Top-selling newspaper in country
	Good Paper	No	
Vietnam	Saigon Times	Yes	
	Vietnam News	Yes	
	Tuoi Tre	Yes	
Indonesia	The Jakarta Post	Yes	Top English-language newspaper in country
	The Bali Times	No	
	Tempo	Yes	
	Jakarta Globe	No	
Malaysia	New Straits Times	Yes	Leading English newspaper in country
	The Star	Yes	Leading English newspaper in country
	Borneo Post	No	
	Harakah	No	
	Daily Express	Yes	
	New Sabah Times	Yes	
	Malaysiakini.com	No	
	Business Times	No	
	The Edge	No	
	New Sarawak Tribune	No	
The Sun	Yes		
Hong Kong	South China Morning Post	Yes	Leading English newspaper in Hong Kong
	The Standard	Yes	Leading English newspaper in Hong Kong
	Sunday Examiner	No	
	Asia Today	No	
	Asian Correspondent	No	

(Continued)

Table A4. (Continued.)

Country	Top English-language newspapers	Found on Factiva?	Notes
	China Daily Asia Weekly	No	
	Chinese Reporter	No	
	Hong Kong Herald	No	
	The News Lens	No	
	Career Times	No	
	China Daily Hong Kong Edition	No	
	FactWire	No	
	Hong Kong Free Press	No	
	Young Post	No	
Japan	The Japan Times	Yes	#1 English-language newspaper in country
	The Asahi Shimbun	No	Leading English-language newspaper in country
	The Japan News/Yomiuri Shimbun	Yes	Leading English-language newspaper in country
	Mainichi Shimbun	No	Leading English-language newspaper in country
	Okinawa Times	No	
	International Herald Tribune/The Asahi Shimbun	No	
	Nikkei Asian Review	No	
	The Wall Street Asia	No	
	Tokyo Reporter	No	
South Korea	Korea Economic Daily	No	
	Korea JoongAng Daily	Yes	
	The Korea Herald	Yes	Leading English-language newspaper in country
	The Korea Times	Yes	Leading English-language newspaper in country
	Yonhap News Agency	No	
	The Seoul Times	No	
	The Chosun Ilbo	Yes	
	Indigo	No	
China	China Daily	Yes	Leading newspaper
	Global Times	Yes	Leading newspaper
	Shenzhen Daily	Yes	
	The Economic Observer	No	
	Beijing Today	No	
	China Newsday	No	
	International Business Times	No	
	Xinhua Business Weekly	No	
	People's Daily	No	
Taiwan	Taipei Times	Yes	
	Taiwan News	Yes	
	The China Post	Yes	

(Continued)

Table A4. (Continued.)

Country	Top English-language newspapers	Found on Factiva?	Notes
Philippines	Philippine Daily Inquirer	Yes	#1 English-language newspaper in country
	The Philippine Star	Yes	
	Manila Bulletin	Yes	
	The Manila Times	Yes	
	The Manila Standard	Yes	
	Business World	Yes	
	Business Mirror	Yes	
	Malaya	No	
Thailand	Daily Tribune	Yes	
	Bangkok Post	Yes	#1 English-language newspaper in country
	The Nation	Yes	Leading English-language newspaper in country
	Prachatai English	No	
	The Thaiger	No	Leading English-language newspaper in country
	ThaiVisa	No	
	Khaosod English	No	Leading English-language newspaper in country
	Coconuts	No	
	Thailand News	No	
	Chiang Rai Times	No	
	The Pattaya News	No	Among top-ten English-language newspapers
Thai PBS World	No	Prominent government English-language newspaper	



**Table A5.** Entrepreneurial university list in comparison to *US News & World Report* 2022 rankings.

	Entrepreneurial university list (based on Crunchbase rankings)	<i>US News &amp; World Report</i> 2022 top national university rankings
1	Berkeley-Haas	Princeton University
2	Brown University	Massachusetts Institute of Technology
3	Carnegie Mellon University	Harvard University
4	Columbia University	Stanford University
5	Columbia Business School	Yale University
6	Cornell University	University of Chicago
7	Dartmouth College	Johns Hopkins University
8	Duke University	University of Pennsylvania
9	Harvard University	California Institute of Technology
10	Kellogg (Northwestern University)	Duke University
11	Massachusetts Institute of Technology	Northwestern University
12	MIT-Sloan	Dartmouth College
13	Northwestern University	Brown University
14	New York University	Vanderbilt University
15	New York University-Stern	Rice University
16	Penn State University	Washington University in St. Louis
17	Princeton University	Cornell University
18	Stanford University	Columbia University
19	University of California Berkeley	University of Notre Dame
20	University of California Los Angeles	University of California Berkeley
21	UCLA-Anderson	UCLA
22	University of Colorado	Carnegie Mellon University
23	University of Illinois	Emory University
24	University of Michigan	Georgetown University
25	University of Pennsylvania	New York University
26	University of Southern California	University of Michigan
27	University of Virginia	University of Southern California
28	University of Washington	University of Virginia
29	University of California San Diego	University of Florida
30	University of Southern California-Marshall	University of North Carolina at Chapel Hill
31	University of Wisconsin Madison	Wake Forest University
32	Wharton (University of Pennsylvania)	Tufts University
33	Yale University	University of California, Santa Barbara

**Table A6.** Multilevel OLS regression (robustness test against main regression models, Table 3 in the main text).

	(1)	(2)
Entrepreneurial university	0.0591***	0.0613***
	(0.0225)	(0.0232)
International university	-0.00230	
	(0.0233)	
Domestic university		0.00204
		(0.0253)
UG	0.0116	0.00904
	(0.0272)	(0.0317)
MA/MSc	0.00279	-0.000622
	(0.0216)	(0.0221)
MBA	0.0498**	0.0526**
	(0.0209)	(0.0223)
PhD	-0.0263	-0.0270
	(0.0206)	(0.0209)
Gender	-0.0417	-0.0526*
	(0.0303)	(0.0316)
Agency dummies	Yes	Yes
_cons	-1.771***	-1.768***
	(0.0392)	(0.0404)
<i>N</i>	326	306

Notes: Standard errors in parentheses. \*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

**Table A7.** Multilevel OLS regression with interaction terms.

	(1)	(2)	(3)
0. Entrepreneurial university#1.MBA	0.0304		
	(0.0238)		
1. Entrepreneurial university#0.MBA	-0.000103		
	(0.0418)		
1. Entrepreneurial university#1.MBA	0.113***		
	(0.0304)		
0.International university#1.MBA		0.0514**	
		(0.0242)	
1. International university #0.MBA		0.00257	
		(0.0432)	
1. International university #1.MBA		0.0472	
		(0.0302)	
0.Domestic university#1.MBA			0.0589
			(0.0600)
1. Domestic university #0.MBA			0.00798
			(0.0582)
1. Domestic university #1.MBA			0.0594
			(0.0561)
International university	-0.00849		
	(0.0235)		
Entrepreneurial university		0.0597***	0.0609***
		(0.0229)	(0.0235)
BA	0.0118	0.0128	0.00876
	(0.0271)	(0.0286)	(0.0318)
MA	0.00121	0.00241	-0.000433
	(0.0216)	(0.0218)	(0.0221)
PhD	-0.0224	-0.0265	-0.0267
	(0.0206)	(0.0206)	(0.0211)
Gender_	-0.0409	-0.0416	-0.0527*
	(0.0301)	(0.0303)	(0.0317)
Agency	0.000307	0.000352	0.000431
	(0.000263)	(0.000265)	(0.000276)
Constant	-1.776***	-1.771***	-1.769***
	(0.0392)	(0.0392)	(0.0404)
N	326	326	306

Notes: Standard errors in parentheses. \*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

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