A Framework for Assessing Municipal High-Growth High-Technology Entrepreneurship Policy

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February 6, 2021

Abstract

This paper advances a framework for making rudimentary need, impact, and cost-benefit assessments of municipal high-growth high-tech entrepreneurship policy. The framework views ecosystem support organizations like accelerators, incubators, and hubs as components in a city's venture pipeline. A component's pipeline size, raise rate, and cost per raise measure its performance. In total, the framework consists of eight objective and reproducible measures based on quantities and qualities of venture capital investment and 16 definitions of related terms-of-the-art. These measures and definitions are illustrated in 26 real-world policy examples, which assess initiatives in Houston and St. Louis over the last 20 years. The examples reveal an enormous variation in welfare effects, and some policies appear welfare destroying. Many non-profit organizations claim success (and win awards and acclaim) using non-standard measures despite performing at less than half benchmark levels. Policy cartels, which control startup policy in many U.S. cities, also engage in non-market actions to protect their rents.

Keywords: Entrepreneurship, Ecosystem, Measurement, High-Growth High-Technology, Venture Capital, Ecosystem Support Organization, Pipeline, Raise Rate, Policy Cartel

*I am grateful to the Ewing Marion Kauffman Foundation for their generous support of related work through grant RG-201806-4536. I thank Bryan Ayash, Jim Brander, and participants at the Kauffman Foundation's 2nd Uncommon Metrics and Measures Conference for their constructive comments. This work would not have been possible without the efforts of Dr. Anne Dayton, Diana Carranza, Will Cleland, Dylan Dickens, Hira Farooqi, Catherine Kirby, Julia Wang, and other researchers at the McNair Center for Entrepreneurship and Innovation at Rice University's Baker Institute, as well as Libby Bassini, Anne Freeman, and Yi Ma at Georgetown University. The contents of this work are solely the responsibility of author. Please address all correspondence to: ed@edegan.com.

1 Introduction

Venture capital (VC) investment is no longer just a Silicon Valley or Route 128 phenomenon. There are now promising high-growth high-technology ('high tech') entrepreneurship ecosystems across America's Rust Belt, Heartland, and in the Deep South, as well as maturing, if not established, ecosystems in most major U.S. cities. Two hundred and five U.S. cities have had more than $10 million of venture capital in a single year since 1985, and America will likely see around $1 trillion of venture investment in the next decade.[1] If startups in this new wave prosper, they will bring economic diversification, social change, and community development to their home towns and have a profound collective effect on the nation's economy.

The extraordinary positive externalities of nascent high-growth high-tech (HGHT) firms provide a normative justification for their public subsidy. Nevertheless, large or frequent policy interventions could result in an inefficient over-supply of new ventures or venture financing. Moreover, startup policy may create ineffective or even destructive non-profit institutions that crowd-out superior private organizations.[2] So the admonition that spontaneous order can create "a more efficient allocation of societal resources than any design could achieve" (Hayek 1978) may apply.

Most direct startup policy focuses on pre-venture firms (i.e., those that have yet to receive venture capital) and occurs at the municipal level. Thus, America's future technological economy is in the hands of its city governments. Unfortunately, most municipal interventions in startup markets are ad hoc, and it is an open empirical question as to whether they improve or destroy welfare.

In this paper, I take a crucial step towards addressing this question. Specifically, I advance eight new measures and articulate 16 definitions of terms-of-the-art, which together describe a framework for assessing municipal HGHT entrepreneurship policy. I then illustrate the application of the framework with 26 real-world examples.

Any conceived standardized framework is not necessarily better than nothing, and not all frameworks are of equal value. A framework operationalizes measures of a conceptual phenomenon. This operationalization is necessarily reductive, so choosing a framework involves choosing noisy and possibly biased metrics and their incentives. In practice, however, policymakers currently endogenous select from various frameworks to assess their municipal startup policies. Standardization on almost any reasonable framework would, therefore,

[1] This 10-year cumulative venture capital estimate uses linear extrapolation from the previous decade's trend.

[2] Cumming and MacIntosh (2006), Brander et al. (2010), and others provide evidence of crowding-out in government interventions in venture capital markets.

likely be better than the status quo.

I use an inductive approach to propose a measurement framework for assessing municipal startup policy, which I argue would be a good standard. The framework reflects how successful founders and professional venture capitalists (i.e., experts) practice HGHT entrepreneurship. Startup policy initiatives are supposed to affect the frequency and quality of these experts' venture capital investments.[3]

The framework also has characteristics that are desirable in a standard: Its measures are objective, reproducible, and intentionally simple. Non-experts can use it to make rudimentary need and impact assessments and cost-benefit calculations from any venture capital database and a list of startups associated with an initiative. The framework's measures can also be used as dependent variables in empirical analyses of higher-level constructs by academics. As such, the framework provides an extensible foundation for further research.

Three of the new measures – pipeline size, raise rate, and cost per raise – underpin the framework. These measures quantify the impact of ecosystem support organizations (ESOs) and other programs and activities that help transform pre-venture startups into venture-backed startups. Three other measures provide alternative ways to create quality quantiles for venture capital. I argue that raise rates from top-quartile venture capitalists are particularly important, as these VCs generate disproportionate value. Two final measures add another ESO quality metric and a proxy for raise rates when investment information is unavailable.

Collectively, the 26 real-world examples provide case studies of startup policy in Houston and St. Louis over the last 20 years. The examples demonstrate practical applications of the framework. They also give a sense of the enormous variation in welfare effects among policies and shed light on the underlying economics of interventions into startup markets. These economics are rooted in information problems and heterogeneous expertise.

In startup markets, expertise is strongly tied to value creation but is a scarce resource. Experts and non-experts are distinct types who sort into for-profit and non-profit organizations. Municipal policy initiatives are run by non-profits and so are almost always governed and managed by non-experts.[4]

Low-quality startup policy initiatives often obfuscate their performance by engaging in idiosyncratic activities, reporting non-standard metrics, withholding information, and other-

[3]For example, a municipal fund-of-funds aims to increase the supply of venture capital, and an accelerator program trains a startup to pitch to a VC. Goldfarb et al. (2009) point out that other forms of capital do not substitute for venture capital, particularly at large amounts.

[4]Theoretical expertise requires a Ph.D. in entrepreneurship economics, or a related discipline, and a body of research its HGHT sub-topic. Universities often participate in HGHT entrepreneurship policy, but administrators and staff, not expert faculty, usually lead their efforts.

wise increasing information asymmetries with outsiders. Naive entrepreneurs, policymakers, donors, members of the press, and others are (absent standardized measures) unable to discern quality. However, experts are largely capable of resolving information asymmetries concerning other market participants. So, experts tend to match with experts, leading to quality reinforcement among market participants, for both good and ill. At the bottom of the quality distribution are initiatives that may be welfare-destroying. These initiatives are only possible because they are run by non-profits who can report non-standard performance metrics and do not depend on their objective quality for their survival. Such initiatives deter experts from considering their deal flow and, as their reputations spill over into communities, deter investment in their local ecosystems.

The remainder of this paper is organized into three main sections. In section 2, I define and provide examples of the underlying venture capital based concepts and measures, such as growth and transactional venture capital, market and non-market money, an anchor fund, the Money-Out-Over-Money-In (MOOMI) ratio, and an expert. In section 3, I examine ecosystem support organizations, including accelerators, incubators, and hubs, and I explain and illustrate the framework's central measures. In section 4, I provide a positive theory of policy cartels, which control the majority of U.S. municipal startup policy, and discuss their measurement and reporting incentives. I conclude with a discussion of how the examples provided in this paper represent the broader population of policy initiatives.

2 Venture Capital

Definition 1 (Venture Capital)**.** Venture capital (VC) is equity-based finance together with value-added services provided in staged investments to (predominantly) high-growth, high-tech, privately-held startup firms using capital raised from outside investors.

Venture capitalists specialize in mitigating information asymmetry problems inherent in startup firms (see Amit et al. 1998) and work closely with the startups that they invest in.[5] As a consequence, venture capital investment provides observable, multi-dimensional quality metrics for high-growth high-tech entrepreneurship. Da Rin et al. (2013) provides a review of the large and well-developed literature on venture capital.

Some practitioners advocate measuring HGHT startup performance using mergers and acquisitions (M&As) and initial public offerings (IPOs). Venture investment is a complement to a startup growth process that results in these successful 'exit' events (i.e., events where

[5]Gompers et al. (2020) finds that a venture capitalist partner spends an average of 18 hours per week working with their portfolio companies.

investors can exit their positions).[6] However, exit metrics are much more volatile than VC investment metrics and have substantial lags. Only about 17% of venture-backed firms achieve an M&A (38% of which have disclosed values), and about 5% achieve an IPO. The average successful startup achieves an exit five years and eight months after its first venture investment.

Data on venture capital are available from various sources, including VentureXpert, Pitchbook, Crunchbase, Preqin, and CBInsights. Aggregate data is also available from the National Venture Capital Association (NVCA) and PWC's Moneytree website. Although there are minor differences in coverage (for example, Crunchbase provides better data on informal venture investments), all sources give approximately the same results provided their data is suitably processed. Comparisons between cities or over time using the same data source are also valid with minimal processing.[7]

2.1 Prevalent Frameworks

Municipalities usually delegate entrepreneurship policy to non-profit and non-government organizations, which in turn commission reports from consulting firms. These entities have incentives to generate favorable media coverage and increase their financial, operational, and political support. Their incentives affect the activities they engage in, the frameworks they use, and the metrics they report. This issue is exacerbated when initiatives are controlled by a policy cartel of larger non-profits and NGOs (discussed in section 4).

Accordingly, most high-growth high-tech policy initiatives use unspecified economic impact frameworks and report numbers like jobs created or development dollars invested. Such numbers are indirect consequences of HGHT entrepreneurship and often not normative economic objectives in themselves. They also usually rely on private models with unknown assumptions. Another common set of reported numbers, which reflect vague notions of value created, allows mixing direct and indirect outcomes, double counting, and other obscurifications. Examples include 'money raised' and 'organizations helped.' Lastly, organizations sometimes report absurd numbers using (often poorly specified) venture capital based metrics.

[6] In recent years, venture capitalists have participated in around 90% of all IPOs and more than 95% of all disclosed value acquisitions of private companies. The third type of exit, a secondary sale, can, by definition, only happen if there was a primary venture investor.

[7] This paper uses data from VentureXpert, which is studied in Kaplan et al. (2002), unless otherwise stated. Some organizations complain that their performance would be higher if analysts used another data source. Actual discrepancies usually occur because of very low-value deals, deals using non-standard instruments, or deals involving non-market VCs (see definition 7) or investors that are not VCs. As such, complaints usually originate from low-quality organizations.

Definition 2 ($2 billion fallacy)**.** The $2 billion fallacy is when an organization reports numbers for jobs, investment, economic impact, or other measures, which cannot be verified or recreated using publicly-accessible client company information, or which otherwise have no foundation in reality.[8]

Example 1 ($2 billion fallacy)**.** Examples include: "Cortex will likely generate $2 billion of development and create 13,000 jobs," Wagner (2016). "The [HTC] reports having helped companies create more than 6,000 jobs and raise more than $3.5 billion in capital," Leinfelder (2018). And "Houston Exponential's goals are to ... create 10,000 technology jobs ... and lure $2 billion in venture capital investment to Houston-based startups in 2022 alone," Leinfelder (2018).

Most for-profit organizations and some of the better non-profit initiatives report measures based on how they affect venture capital deal flow. I refer to this approach as the venture pipeline framework. Venture pipeline measures include client counts (on a per-program or per-output basis) and venture investment raised by clients post-treatment. Venture investment can be expressed in rounds, deals, or dollars, in total or by other appropriate characteristics.

Example 2 (Venture pipeline measures)**.** Examples include: "The Techstars portfolio of 1,900 companies currently attracts an annual $2 billion in downstream investment from the venture capital industry," Techstars (2019). And "[At Cintrifuse] more than 700 startups have gone through our pipeline, with one-third of these having attracted seed and later-stage investment," Molski (2019)

The use of venture pipeline measures and the open provision of client lists that allow independent verification of claims are both a cause and a consequence of expert participation. As a result, both the type of metrics reported and the extent of any information asymmetry signal an organization's quality. One objective of this paper is to allow journalists and other non-experts to calculate a policy's impact. However, low-quality initiatives may withhold, censor, or obfuscate their client lists.

Example 3 (Obfuscating client lists)**.** JLabs@TMC's initial cohorts included Bellicum Pharmaceuticals, which traded on the NASDAQ. JLabs@TMC has since removed Bellicum from their publicly-accessible client list.

[8]The amount does not need to be $2 billion, and some examples are not dollar amounts, but $2 billion is mentioned with sufficient regularity to make it immediately suspect.

2.2 Growth vs. Transactional VC

Not all venture capital goes to nascent high-growth high-tech firms, and so not all venture capital makes for an appropriate measure of startup activity. When measuring an HGHT entrepreneurship ecosystem, one should consider only growth venture capital.[9]

Definition 3 (Growth Venture Capital)**.** Growth venture capital entails investment at the seed, early, or later stage in nascent, privately-held, high-growth high-tech firms (i.e., 'startups') to support a milestone-based growth process, which should lead to an exit event for early-stage investors.

In the 1980s, venture capitalists leveraged their experience with startups to provide investments to mature firms from a wide variety of sectors. Such investment is called transactional VC. Most venture investment databases mix transactional VC and growth VC, and some end-user expertise is required to separate the two.

Definition 4 (Transactional Venture Capital)**.** Transactional venture capital investments support specific transactions, such as bridge loans to get to an IPO, acquisition finance, and funding for expansion or restructuring. Many transactional VC recipients never receive growth VC and are mature (even publicly-traded) firms from non-high-tech sectors. Private equity firms, investment banks, and some hedge funds, as well as venture capitalists, make these kinds of investments.

If the proportion of transactional VC were the same everywhere every year, the distinction between growth and transaction VC would not matter. Unfortunately, the proportion of transactional VC to growth VC is much higher in cities with large non-high-tech sectors and has been trending down since the dot-com crash.

Example 4 (Transactional VC)**.** Houston and St. Louis both had around $140m of growth VC in 2015. In the same year, Houston's transactional VC, which supports M&A activity among oil and gas firms, totaled over $150m, while St. Louis', which provides bridge loans to life science firms, totaled about $60m.

2.3 Rankings

Profits go hand-in-hand with social welfare in entrepreneurship and innovation: Private firms that make more money tend to create more social value. This principle applies to startups, venture capitalists, and ecosystem support organizations. Non-profit or government-sponsored organizations, however, need a way to measure their impact. Accordingly, poli-

[9]Egan and Carranza (2018)) discuss growth venture capital in a policy report. Practitioners use stage-of-investment terms to identify growth venture investments.

cymakers and practitioners often turn to ecosystem rankings, which reflect a city's relative performance.

Example 5 (Policymakers use rankings)**.** When Houston's startup hub, Station Houston, became a non-profit in 2018, its new CEO said that she would use the Kauffman Index of Entrepreneurial Activity to judge Station's impact going forward.[10]

There are just two reoccurring high-growth high-tech rankings of U.S. ecosystems based on near-population venture capital data. These are the City Lab/Martin Prosperity Institute reports (see Florida and King 2016), which ranks metropolitan statistical areas (MSAs) using the amount of growth and transactional VC, and the U.S. Startup Cities ranking (see Egan 2020), which ranks cities using three measures of growth VC.[11] Crunchbase, Pitchbook, and other data providers also put out reports on venture activity that sometimes include cities or MSAs, and researchers can assemble rankings themselves using these sources. Any venture capital based ranking can be used to examine the variation in a city's startup performance over time, and most will give highly-correlated rankings for cities each year. In the examples that follow, I use the U.S. Startup Cities ranking as it uses only growth VC, is available from 1985 through to 2020, and has an entirely open methodology.

Rankings are a simplistic policy analysis tool and are particularly prone to endogenous self-selection: policymakers tend to pick sources that show their cities and policies in a good light. Yet, high-growth high-tech entrepreneurship policies that result from municipal initiatives can have a sustained and material effect on a city's rankings. Of course, not every policy initiative is large enough to change a city's rankings, and some policies are associated with ranking declines. Moreover, a ranking change, or lack thereof, does not identify a causal effect.

Example 6 (Single policy impact)**.** In 1998, the City of Houston created a non-profit incubator called the Houston Technology Center (henceforth the "HTC"). The HTC's inaugural promotional material stated that "entrepreneurial ventures often fail or relocate outside of Houston," and it sought to reverse those trends. Houston had been ranked 6$^{\text{th}}$ among startup cities in 1990 and had dropped to 15$^{\text{th}}$ by 1998. In the following 18 years, during most of which HTC had a near-monopoly on high-growth high-tech entrepreneurship support in the city, Houston's rank decline accelerated drastically. Houston was ranked 54$^{\text{th}}$ in 2016 when a competitor finally challenged the HTC's market dominance.

Policies are often multifaceted, and sometimes multiple different policy initiatives occur

[10]The Kauffman Index was not available in 2018 and does not measure high-growth high-tech entrepreneurship activity.

[11]Startup Genome (see example 10) provide reports on select cities using proprietary measures and limited samples.

at the same time. In these cases, ranking changes provide a quick overall evaluation, and a venture pipeline analysis (discussed in section 3.1) of the individual initiatives can attribute the aggregate effect.

Example 7 (Multi-policy ranking impact)**.** In 2011, St. Louis opened its T-Rex entrepreneurship hub in a disused downtown building. Then, in the following year, St. Louis broke ground on its Cortex Innovation Community (CIC) innovation district, launched its $50,000 Arch Grants program, and endorsed the creation of the Prosper Women Entrepreneurs (PWE) accelerator. St. Louis rose from being ranked 224$^{\text{th}}$ for startups in the U.S. in 2010 to 50$^{\text{th}}$ in 2013.

2.4 Measuring VC Quality

Not all venture capital is equal: Venture capitalists, and the finance and value-added support they provide, vary considerably in quality. See, for example, Sahlman (1990), Lerner (1995), Hellmann and Puri (2002), and Bottazzi et al. (2008). Kaplan and Schoar (2005) show that the quality of a venture capitalist is persistent, and Hsu (2004) documents how entrepreneurs pay a premium to partner with higher quality venture capitalists. This VC quality variation provides the foundation for measuring the quality of startups, programs, policy initiatives, and ecosystems.

The financial measure of a VC's quality is its returns, although return quartiles provide sufficient information to make policy decisions. Kaplan and Schoar (2005) show that top-quartile VCs massively outperform second-quartile VCs and that bottom-quartile VCs probably lose money. Regrettably, venture capitalists' returns are generally not publicly available information. Researchers and practitioners need to use proxy measures instead.

Fund size has a well-documented inverted-U relationship with fund performance. Likewise, older firms tend to have bigger funds, higher sequence numbers, and better performance due to competitive selection.[12] However, these measures only crudely predict performance quartiles.

Therefore, I propose three proxy measures for returns that can be used to calculate performance quartiles from publicly-available data: apportioned investment values, apportioned exit values, and MOOMI ratios. These measures include information about a VC's investments into its portfolio companies and the value that those companies generate.

Measure 1 (Apportioned investment value)**.** *Venture capitalists participate in syndicates to provide a round of investment to a startup firm. Most datasets on venture investments*

[12]Funds run by older venture capital firms tend to favor later-stage deals. This age effect might arise due to capacity constraints on partner time or because partners' risk preferences change with their tenure or both.

only disclose the aggregate round amount and the syndicate membership. The 'apportioned investment value' allocates aggregate investment equally among syndicate members to estimate their contributions.[13]

Measure 2 (Apportioned exit value)**.** *Exit values are the total proceeds of an initial public offering or the transaction value, less any outstanding debt, of an acquisition. The apportioned exit value uses apportioned investment fractions to allocate exit values among venture capital investors.*

Measure 3 (MOOMI ratio)**.** *The Money-Out-Over-Money-In (MOOMI) ratio of a startup is its value at exit divided by its total venture capital investment received. Aggregated apportioned MOOMI ratios provide quality metrics for VC funds and firms, ecosystem support organizations, and cities.*

Measures based on investments and exits are subject to issues with self-reporting and selective disclosure. Exit values are always disclosed for initial public offerings. But, while some acquirers voluntarily disclose acquisition values, most only do some when required to by the Securities and Exchange Commission or other bodies.[14] Hence, many low-value acquisitions or acquisitions where the acquirer is a privately-held firm do not have disclosed values.[15] Some alternative measures, including the fraction of portfolio companies that achieved an exit, suffer from a related issue that some failures (i.e., fire sales) are reported as acquisitions.

Apportioned exit value additionally suffers from biases related to the stage of investment. Some firms specialize in investing at the seed stage. Later stage investors sometimes do not disclose their investment amounts, leading to very large apportionments of exit values to comparatively small investments. In a similar vein, small funds with only a few investments and a high proportion of exits can have extraordinary MOOMI ratios.[16]

Nevertheless, an inspection of fund league tables, industry-led awards, and industry-produced Top 100 Fund tables suggests that these measures convey useful information about firm performance, particularly at the coarse quantile-level. The apportioned MOOMI is arguably the best measure, as its construction mimics that of actual returns, albeit with noise and biases.

Another measure of a venture capitalist's quality is related to their ability to mitigate

[13]In reality, most VCs in a syndicate receive the same terms for their investment but invest differing amounts (see Da Rin and Hellmann 2020).

[14]Exit proceeds from private secondary offerings are confidential and omitted entirely from exit value calculations.

[15]An apportioned MOOMI ratio below one does not reflect a loss because of these issues.

[16]In the measures reported in the examples, I limit the sample to the 1,124 U.S. based venture capital firms that invested in 20 or more U.S. startups from 1980 to 2020. In this sample, an apportioned MOOMI ratio of one occurs at the 87^{th} percentile of VC firms.

information asymmetries. At least one member of an investing syndicate is usually local to a portfolio company, and there is strong evidence of local effects in venture capital. Cumming and Dai (2010) and others consider the 'the 20-minute rule' where a startup is local if it is within a 20-minute drive. A narrower definition would consider local to be within the same agglomeration. Egan (2020) finds that the median U.S. startup city is home to two startup agglomerations, each covering around 12 hectares, separated by around 3km. The defacto standard is to refer to any VC in the same city as local.[17]

Definition 5 (Local VC)**.** A venture capitalist is local if it operates in the same city as its portfolio company.

There is little evidence that a fund's focus affects its returns. Venture funds can be specialists (i.e., they target specific industries) or generalists. They can also have preferences over stage-of-development, geography, new deals versus follow-on deals, and whether they will lead a syndicate.

Anecdotally, a city needs at least one 'anchor fund' to build an ecosystem.

Definition 6 (Anchor Fund)**.** A local, generalist, mid-sized, first or second quartile, private venture capitalist that will lead on new early-stage deals is referred to as an "anchor fund".

2.5 Market and Non-market Money

Another important way in which venture capitalists differ in quality concerns the source of their money. Participating in a market for capital disciplines venture capitalists, ensuring that they select high-quality ventures and then provide superior value-added services to improve them. During market-based fundraising, expert limited partners (LPs) evaluate a fund's investment strategy, team, and prior performance; and fund managers who do not live up to their potential may be unable to raise subsequent capital. None of this is true for non-market funds, many of which exhibit notably inferior performance. Therefore, a fund's source of capital is a leading indicator of its future behavior and performance.

Definition 7 (Market and non-market money)**.** Venture capitalists manage other people's money.

- Expert limited partners, who operate in competitive markets, provide 'market money,' which is efficiently, or near-efficiently, priced in terms of a required rate of return.
- Non-market money is raised in a non-competitive process from non-expert capital providers. These capital providers demand inefficiently low rates of return for their

[17] U.S. states provide too broad an area, and cities within the same state are often competing ecosystems.

capital.

Previous work has explored specific categories of non-market funds. For example, Cumming and MacIntosh (2006), Brander et al. (2010), and others document the poor performance of government-sponsored venture capital (GSVC) funds and find that they may 'crowd-out' private venture capitalists. Likewise, Dushnitsky and Lenox (2005), and others, find corporate venture capitalists' (CVCs') primary objective is to build absorptive capacity for their parent company, as opposed to generating returns.[18]

Example 8 (Non-market fund)**.** In 2005, Texas Governor Rick Perry announced a GSVC fund called the Texas Emerging Technology Fund (TETF). Texas allocated $200m to the TETF, which was later expanded to $500m. The TETF made investments in exchange for warrants and issued grants through regional innovation centers, including one at the HTC. A 2011 report to the State Legislature found the fund "lacked transparency and that the state had not properly tracked its performance." It is unclear how and by whom TETF investments were selected. Some TETF investment recipients were not nascent high-growth, high-tech firms. The TETF was a bottom quartile fund (using apportioned and total MOOMI ratios, apportioned and total exit value, and other measures) and very likely not cost-benefit positive (i.e., $\frac{benefit}{cost} > 1$). Anecdotal evidence suggests that it crowded-out private venture capital investment.

The most well-known, top-quartile private venture capital (PVC) funds are almost all market-based funds. However, many traditional PVCs opt, presumably due to market pressure, to raise funds from non-expert LPs, particularly non-expert high net-worth individuals, family offices, and non-expert fund-of-funds. Aside from GSVCs and CVCs, types of wholly non-market funds include micro-funds that are too small to attract investment from professional limited partners (LPs), most evergreen funds, and venture funds financed by draw-downs from endowments and parent (mostly private equity and hedge) funds. There are also venture funds supported by issues on stock exchanges.

2.6 Expertise

Academics and practitioners alike put a strong emphasis on the importance of experiential learning in high-growth high-tech entrepreneurship. Gompers et al. (2006), Hsu (2007), and others, use 'serial' entrepreneurship as an observable certification of this learning. Because venture capital is as much a growth process as it is a type of investment, mentors without experience 'sitting at the table,' whether raising venture capital or investing it, lack key

[18] CVCs have a semi-competitive market for talent, which disciplines them somewhat.

expertise needed to advise the next generation properly.[19]

Definition 8 (Expert)**.** An expert in high-growth high-tech entrepreneurship has raised market-based venture capital for a startup they (co-)founded or has managed a venture capital fund that raised market money. Some practitioners and academics require entrepreneurs to have achieved a $50m acquisition or an initial public offering to qualify as an expert.

Specialized expertise is also required to process data on startups and their investments appropriately, and build models and interpret findings on this topic. Fortunately, a recent wave of new economists who research high-growth high-tech entrepreneurship includes former HGHT entrepreneurs and venture capitalists. Though many academics specializing in HGHT entrepreneurship do not meet the practical definition of an expert and certifying academic expertise in this area is problematic.[20]

Many policymakers, pundits, and journalists incorrectly assume that individuals involved with a non-market fund or a non-profit ecosystem support organization, or working with an organization developing or enacting high-growth high-tech policy, are experts. Only a tiny minority of such individuals might later meet the definition of an expert.

In the high-growth high-tech world, information problems are rife and searching for and examining opportunities is costly. Experts can mostly resolve these information problems, which leads to sorting: when experts observe inefficient behavior that might restrict or contaminate their deal flow, they frequently direct their efforts elsewhere. Public demonstrations of incompetence can also cause reputational damage that extends beyond an organization's boundaries and into the broader ecosystem.

Example 9 (Sorting and Reputations)**.** In 2016, a team of serial entrepreneurs and venture capitalists with historical ties to Houston organized a meeting with 60 local entrepreneurs, investors, and expert academics to pitch a new startup hub called 'Station Houston.' At this meeting, the participants unanimously rejected any engagement with the dominant non-expert ecosystem support organization, the HTC, describing it as "cultural cancer".

Non-experts, on the other hand, are unable to resolve the information problems and will often spread bad information to other non-experts.

Example 10 (Information from non-experts)**.** In 2018, the then Director of Strategy

[19]Bengtsson and Hsu (2015), Hegde and Tumlinson (2014), and Cherry et al. (2018) find support for homophily in venture investing, in terms of ethnicity, culture, and gender, respectively. Because homophily matters, there are likely advantages to having women mentoring women, entrepreneurs of color mentoring entrepreneurs of color, and so forth.

[20]It is not sufficient to have taught courses or published papers about HGHT entrepreneurship, let alone entrepreneurship more broadly.

at Houston Exponential, a non-expert who was formerly at the Greater Houston Partnership (henceforth the "GHP") and now leads MassChallenge Houston, stated that Houston only had a single venture fund in 2017 (see McDowell 2019). Startup Genome, a non-expert survey firm, used the director's claim as data in a report endorsed by Inc. magazine, Forbes, and other media. Houston Exponential then leveraged the Startup Genome report and materials from Inc. magazine in their public messaging. The claim's origin was likely a report from Accenture on Houston's startup ecosystem, which the GHP had commissioned the previous year. The Accenture report (erroneously) stated that Houston had one "Tier 1 Venture Investment Firm", citing an unspecified Houston Business Journal article.[21] There were at least 46 venture funds active in Houston in 2017.[22] (The Accenture report listed 10 and three VCs held board seats at Houston Exponential at the time.)

2.7 Policy to Increase Venture Capital

A popular type of high-growth high-tech policy explicitly attempts to increase the local supply of growth venture capital, especially early-stage venture capital.[23] The natural unit of analysis for such policy is a city, and example policies include municipal funds-of-funds (discussed below), GSVCs, and local venture associations, facilities, competitions, and events.

Policymakers considering these initiatives should assess the *qualities* of supply *and* demand to assess a potential shortage of growth capital.[24] It is not sufficient to assess quantities alone, and investment levels do not provide information about an inefficient under- or over-supply.[25]

Example 11 (Growth capital assessment)**.** Houston had at least 46 venture funds and 54 actively-funded venture-backed startups in 2017. A ratio of funds to startups of 4:5 prima facie reflects an over-supply of capital.

From 1995 to 2017, only 7.5% of the recorded venture capital invested in Houston startups came from Houston-based venture capitalists. Likewise, Mercury Fund, the city's best-

[21]The Houston area's best venture capitalist is arguably Essex Woodlands Management (the 'Woodlands' is a planned community north of Houston). Essex Woodlands, a life science specialist, is a second quartile firm (using apportioned MOOMI ratios) and self-reports its headquarters location as Palo Alto.

[22]VentureXpert records 21 Houston headquartered venture capital funds active in 2017. Contemporaneous interviews and online data collection found an additional 25 Houston headquartered funds self-reporting as venture capitalists.

[23]Future demand for later-stage venture capital can be forecast from the current use of early-stage VC. Future demand for early-stage VC can be forecast using a pipeline analysis (see section 3.1).

[24]Policymakers are often unaware of quality distinctions in venture capital or their importance.

[25]Most assessments rely solely on claims from non-experts concerning the demand for capital. Entrepreneurs frequently complain about a shortage of capital, which is not evidence that one exists. The extramarginal deal should not receive investment.

known mid-sized generalist fund, had invested in just nine Houston startups since its inception in 2005.[26] These numbers imply a shortage of quality deal flow in Houston, an implication confirmed in interviews with local VCs.

Houston had eight of the world's leading energy-focused corporate venture funds and non-market funds dominated its venture industry. Mercury Fund raises some non-market money (including from municipal funds-of-funds) and another of Houston's three mid-sized private funds raised solely from European LPs. So, Houston might benefit from 'upskilling' its local fund managers.

Cities sometimes need to transition capital from non-market to market-based funds or micro to small to mid-size funds. This process is called upskilling.

Definition 9 (Upskilling)**.** Upskilling helps fund managers to develop the selection and value-added skills necessary to compete in the market for expert limited partner money.

A city can upskill its venture community by attracting top-quartile venture capitalists to syndicate deals with local partners.[27] Organizing events for VCs, as well as creating a local venture capital association to share best practices, may provide mechanisms for upskilling. Although, events and associations can become captured by policy cartels (discussed in section 4) and become harmful to ecosystems too.

Definition 10 (Municipal Fund-of-Funds)**.** A municipal fund-of-funds raises capital from large local incumbent firms and invests it in venture capital funds that offer to consider deals in the city.

There are two normative economic rationales for a municipal fund-of-funds: increasing the supply of early-stage capital, if it is underprovided, and stimulating engagement between local incumbents and local startups. A municipal fund-of-funds should not affect its venture capitalists' return profiles (i.e., it should not *require* investment in the city). It can incentivize ecosystem participation by asking VCs to open branch offices, visit regularly, or otherwise establish and maintain local relationships. The inducement of new engagement between local incumbents, which commit capital to the fund, and local startups is likely the primary driver of a municipal fund-of-funds' effect. A municipal fund-of-funds can also contribute to upskilling if it brings in suitable syndicate partners.

Municipal funds-of-funds often have insufficient capital to gain access to top-quartile venture capitalists, particularly from the Bay Area and Route 128 (i.e., Boston, Cambridge,

[26]Mercury Fund is a 4$^{\text{th}}$ quartile VC firm based on apportioned MOOMI, total MOOMI, or total exit value, but is often regarded as Houston's anchor fund.

[27]Many of New York's local funds successfully upskilled in the late 1990s and early 2000s. Internationally, Israel's Yozma initiative in 1993 is oft-touted as a superlative example of importing VCs and upskilling a local venture community.

and their surroundings) where there is the greatest concentration of value-added expertise (see Chen et al. 2010). They also impose a second level of fees, which further dilute returns.[28] Furthermore, corporate investors need to receive, in expectation, their weighted-average cost of capital as a net return, which may not be possible given a fund-of-funds' characteristics.[29]

There are three ways to measure the quality of a municipal fund-of-funds: i) by its conformity to normative design and policy analysis principles; ii) through the characteristics of its investments; and iii) indirectly through its comparative effect on the local supply of venture capital (which suffers from attribution issues).

Example 12 (Fund-of-funds assessment)**.** In 2018, Houston Exponential announced that it had raised $25m for a municipal fund-of-funds, lead by a Mercury Fund advisor. The fund-of-funds' lead investor, Insperity, had a long history of providing services to the HTC. The next most prominent investors were Chevron and Shell, both of which have local corporate venture funds. In 2017, Houston-based venture capitalists raised six new funds (including two from existing local VCs). In 2019, the fund-of-funds made its first investment into a fund in Austin, the city most responsible for Houston's 20-year startup drain. That year just four new funds (including two from existing locals) raised money in Houston.

3 Ecosystem Support Organizations

Once a startup receives venture capital, it is easy to track. Pre-VC startups are generally only visible through their association with an ecosystem activity or entity. Accordingly, researchers strive to identify which activities and entities to observe; and how to estimate the number, quality, and characteristics of the next period's startups from them. Industry experts do much the same thing – to them, these activities and entities generate potential deal flow. A quintessential class of these entities is the ecosystem support organization (ESO).

Definition 11 (Ecosystem Support Organization)**.** Ecosystem support organizations specialize in providing services to nascent high-growth high-tech firms. ESOs include accelerators, incubators, hubs, coworking spaces, cofounders, business plan competitions, HGHT program providers, and startup event organizers. They can be for-profit or non-profit, as well as affiliated with a corporate parent or a university.

[28] A typical funds-of-funds charges another '2 and 20' fee structure on top of its venture funds' fees: 2% of capital as an annual management fee and 20% of the carried interest.

[29] Corporate officers may owe shareholders a fiduciary duty not to undertake actions that reduce stockholder value.

The first three types of ecosystem support organizations are defined as follows:

Definition 12 (Accelerator)**.** Cohen and Hochberg (2014) defines an accelerator as "A fixed-term, cohort-based program, including mentorship and educational components, that culminates in a public pitch event or demo day." I refine this definition by excluding virtual accelerators and those focusing exclusively on types of entrepreneurship other than high-tech high-growth, including social entrepreneurship.

Techstars Boulder, which opened in 2007, is a prototypical accelerator.[30] It accepts around 10 startups into each of its cohorts, which run for three months.

Definition 13 (Hub)**.** A hub is a large, membership-based coworking flex-space with specialized services and resources for nascent high-growth high-tech firms, which engages in the active management of a startup community. Membership in a hub is by application and subject to capacity constraints. Most hubs encourage startups to leave when they reach a certain size (e.g., 16 employees). Hubs often have internal venture funds and accelerator programs.

Prototypical hubs first formed in the late 2000s and include the Capital Factory in Austin, Texas, 1776 in Washington, DC, and 1871 in Chicago. The Capital Factory has around 800 members working at about 500 startups in 100,000 square feet of space. It has an in-house accelerator and venture fund, and it provides offices to other ESOs and venture capitalists.

Definition 14 (Incubator)**.** A high-growth, high-tech incubator is an organization that provides workspace, mentorship, and other specialized resources to support the growth of startup firms for variable durations. Incubators do not have fixed cohorts, but many have a cap on their maximum duration. Incubators curate their clients.

The HTC in Houston was an incubator, though through its monopoly position, it also partially managed its local startup community as if it were a (small) hub. In practice, many ESOs blur the lines between definitions.

Expert management disproportionately occurs within for-profit ecosystem support organizations. Experts can better locate and deploy value-added services for an ESO, and their management is strongly associated with superior performance. [31] Non-profit ESOs receive funding from grants or philanthropists, who give credence to non-standard performance metrics. As such, non-profit ESOs can operate at lower quality levels and continue operation longer than for-profit organizations subject to market forces.

[30] Techstars now runs almost 50 different accelerator programs.

[31] ESOs generally provide services to pre-venture startups, and many take equity in their client companies in exchange for their services, either instead of, or as well as, charging fees. Accordingly, the tie between performance and profit-motives is weaker than for VCs, and markets for for-profit ESO services are only long-run efficient.

Policymakers and other non-experts often regard "any activity as better than nothing". Yet, every policy should be judged against its opportunity cost and an initiative can be welfare destroying. First, as with non-market venture capitalists, non-profit ESOs can crowd out their for-profit counterparts.[32] Second, and perhaps more importantly, growth in startups is path-dependent and poor training, advice, or support could lower a startup's odds of achieving its necessary next steps. For example, an ESO may use inappropriate investment instruments that deter venture capitalists; they may encourage startups to pursue development strategies that preclude venture capital; or startups may spend too long with an ESO and miss their opportunity to raise venture capital. A startup that does not raise venture capital when it could have done, or one that raises a lower quality of venture capital, is value to society destroyed.[33]

3.1 Pipelines of Startups

To an expert practitioner, the venture pipeline view of startup ecosystems measures the drivers of deal flow in a city. To an economist, it simplifies a more nuanced economic model, where startups have a stochastic arrival process, and the environment influences the process's distributional parameters.

The pipeline view computes the product of a set of factors, and so is analogous to the Drake equation.[34] In aggregate, the expected volume (V) of a city's next wave of venture-backed firms is equal to the size of the city's pipeline (P) multiplied by the fraction of local startups within that pipeline (L), multiplied by the pipeline's raise rate (R).[35] This aggregate is then separated into additive components for each activity or initiative (i).

Ecosystem support organizations are just the most visible pipeline institutions. Universities, corporate engagement programs, government and private research labs, and many other types of organizations can and do participate in some cities' venture pipelines. It can be challenging to identify pipeline components correctly, and neglecting components can lead to a biased understanding of an ecosystem.

$$V_i = P_i \times L_i \times R_i \tag{1}$$

[32]Crowding-out is akin to Gresham's law, where bad money drives out good. For crowding-out to occur, bad suppliers (i.e., ESOs, VCs, etc.) must charge lower prices than good suppliers, and there must be an information asymmetry that prevents buyers (i.e., entrepreneurs) from correctly discerning quality.

[33]Until the distribution of welfare effects is known, the burden of proof should lie with those seeking to reject the hypothesis that the typical non-profit ESO is welfare destroying.

[34]The Drake equation (see Burchell 2006) estimates the number of local actively-communicating extraterrestrial civilizations.

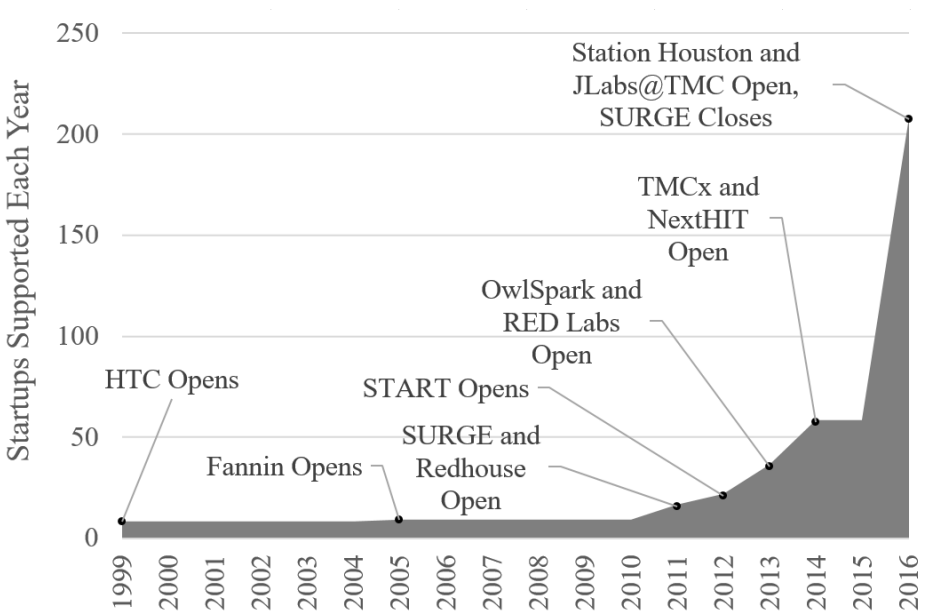
[35]While being a temporary host to non-local firms may provide indirect benefits to an ecosystem, it is the local startups that directly impact an ecosystem's venture pipeline.

$$V = \sum_{i=1}^{N} V_i \tag{2}$$

Measure 4 (Pipeline)**.** *An initiative's pipeline, P_i, is the number of nascent high-growth, high-tech firms that it processes each year. Typically, pipeline counts are restricted to startups that have not already raised venture capital and applied to initiatives that serve nascent firms that are at risk of raising venture capital.*

Example 13 (Pipeline components)**.** From 1999 through to 2005, the HTC was Houston's only notable ecosystem support organization. It supported around 8.3 startups per year (abbreviated as s/y), listing a total of 149 clients when it closed in January 2018. Houston's pipeline grew slowly until 2012, adding Fannin Innovation Studio (1 s/y) in 2006 and the SURGE Accelerator (6.4 s/y) and Redhouse (<1 s/y) in 2011. Then over the next few years, it added START (5.4 s/y), OwlSpark at Rice and RED Labs at the University of Houston, NextHIT (2.6 s/y), and the Texas Medical Center accelerator TMCx (20 s/y). Station Houston, a hub, and JLabs@TMC (21 startups in its 1st year) opened in 2016. Within a single year, 'Station' reported 129 members working in its space.

Figure 1: Venture Pipeline in Houston, TX, 1998-2016



The issues with measuring a pipeline include: the delineation of participation (i.e., was a startup a client or did it receive help in passing, attend one or more events, etc.); variation in objectives (e.g., some initiatives may include programs or activities that contribute value without affecting venture capital investment); and biases inherent in self-reporting. Pipeline

analyses should supplement publicly-available client lists with press releases, news reports, and other information to assess self-reporting biases.

3.2 Raise Rates

A 'raise rate' measures a venture pipeline's quality.

Measure 5 (Raise rate)**.** *A raise rate, R_i, is the fraction of startups that raise investment from venture capitalists after they begin participating in some initiative. ESO raise rates generally exclude internal money (i.e., money invested from funds associated with the ESO).*[36] *Raise rates are typically calculated for only the first round of venture capital. They can also be calculated for VC performance quartiles, market vs. non-market money, local or Bay Area/Boston VCs, seed, Series A, or Series B rounds, et cetera.*

The industry, stage-of-development, and other characteristics of an initiative's clients and location affect its raise rates. For instance, semiconductor ventures tend to require large investments, and biotech startups often have to establish partnerships, which affect the raise rates of institutions that specialize in them. Moreover, some organizations take on clients that have difficulty getting into other programs, while others are intentionally highly-competitive. A more sophisticated approach would measure selection and treatment effects separately.

Having different benchmarks for different types of entities or activities partially addresses these issues. Minor deviations from benchmarks are not concerning, but the large, sustained differences are, and an institution's raise rate rank within an ecosystem can be informative.

Techstars and Y Combinator have raise rates around 25% and provide well-known benchmarks for accelerators and incubators. Chicago's New Venture Challenge (NVC) provides a benchmark academic accelerator, with a raise rate just below 6%. Academic accelerators have lower raise rates as student startups are generally inferior to their commercial counterparts. Anecdotally, the benchmark raise rate for a hub is around 7% or 8%.[37] Hubs support a much broader range of undertakings and are home to 'wannapreneurs' between projects. Gompers et al. (2020) estimates that around 1.5% of nascent firms that approach a VC eventually secure their financing. Assuming multiple approaches with non-independent draws, this would suggest that the background raise rate is around 5%.

Example 14 (Raise rates)**.** In 2017, Houston's raise rates were all well below industry benchmarks (see Figure 2).[38] The best performing ESO in Houston was the SURGE

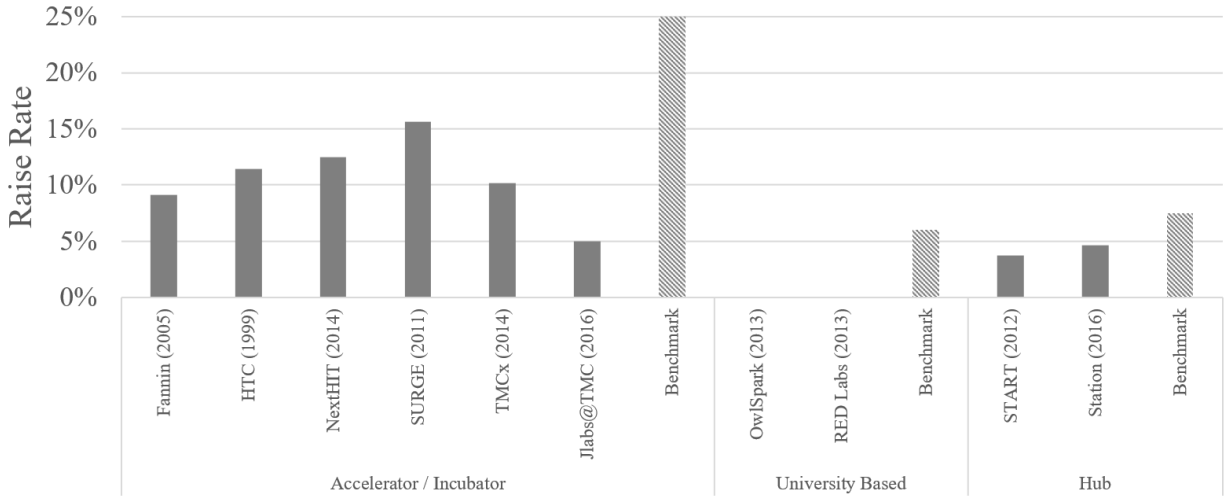
[36] Some ESOs take equity in their client companies, and it can be challenging to distinguish participation fees from venture investment in data.

[37] An estimate requires complete membership lists of correctly delineated firms.

[38] TMC@Labs had six startups that had already received VC in its first cohort.

accelerator, which focused on energy startups, had a raise rate of 16%, and closed its doors on April 8th, 2016 when the oil price was $39.72 per barrel. SURGE was a for-profit firm. START, a small for-profit hub, also closed its doors in 2017; and Station Houston, which started as a for-profit, became a non-profit in 2018 (despite its rising raise rate). All of the other ESOs in Houston were non-profits and had half-benchmark or lower raise rates.

Figure 2: Ecosystem Organization Raise Rates in Houston, TX, 2017



3.3 Pipeline analysis

A pipeline analysis computes $V_i = P_i \times L_i \times R_i$ (i.e., equation 1) for a particular initiative, i. In some cases, such as relocation grants or long-term incubators, the fraction of startups that are local, L_i, is assumed to be one.

Example 15 (Simple pipeline analysis)**.** In 2017, St. Louis's Arch Grant program had over 100 recipients. None of them had gone on to receive venture capital, implying that St. Louis may have given away $5 million without affecting its venture pipeline.

Some policies aim to stimulate entrepreneurship within a particular focal group (i.e., veterans, women, minorities, et cetera) or within a specific geographical area or industry segment. These policies can be assessed using tailored volume calculations.

Example 16 (Focal pipeline analysis)**.** The Prosper Women Entrepreneurs (PWE) accelerator was created in response to studies from the Kauffman Foundation and American Express OPEN, where St. Louis was ranked last for women's entrepreneurship. Two of PWE's 26 clients are based in St. Louis and have gone on to secure venture capital, and

neither had an all-female management team (one was all male and the other was mixed gender).[39]

The cost per raise provides a simplistic cost-benefit metric.

Measure 6 (Cost per raise)**.** *The average cost per raise for an initiative is its volume of expected ventures, V_i, divided by its cost.*

When client lists are unavailable, researchers may be able to use geographic proximity to estimate a policy's pipeline volume. Likewise, it is often extremely difficult to correctly identify and attribute the costs of a policy. Comparing the rough costs of two or more policies can then be informative.

Example 17 (Proximity-based cost-benefit comparison)**.** The St. Louis's Cortex Innovation Corridor (CIC) innovation district and the five-block radius around the T-Rex facility were home to six and seven startups, respectively, before their almost contemporaneous introductions. Subsequently, both areas have become home to an additional 23 startups. The CIC received $167 million of tax increment finance in 2012 and has received tens of millions more since. The T-Rex facility, on the other hand, has likely received a few million dollars of public support over its history.[40] The T-Rex facility, therefore, appears one to two magnitudes more efficient at generating venture-backed firms than the CIC.[41]

The enormous variation in cost-benefit metrics suggests that initiatives can maintain considerable information asymmetries with their constituents.

Pipelines have a delayed impact as it takes time for a startup to grow to the point where it could secure seed or early-stage venture investment: Startups are on average 17 months old when they receive their first seed round, and startups that skip the seed round are on average 31 months old when they receive their first early-stage round.[42] Likewise, the raise rate of an ESO is a function of its age. It takes time for an ESO to develop its services, and its raise rate will be volatile when its historic client count is low. An accelerator's raise rate will also fluctuate as it takes in and graduates new cohorts.

Example 18 (Pipeline impact)**.** It was events between 2014 and 2016, not policy initiatives in 2017 or 2018, that led to Houston's rise to 27$^{\text{th}}$ place in the rankings in 2018. When Station Houston, the TMCx, and NextHIT entered the market, they had

[39]PWE won the SBA Growth Accelerator Competition in 2014, 2015, and 2016.

[40]The T-Rex facility is a part of the Downtown St Louis Community Improvement District, which provides a wide range of services, including the Arch Grants program. The only T-Rex line items in 990 filings are for $50,000 to its executive director.

[41]Brookings Institution scholar Bruce Katz frequently celebrates the CIC as a prototypical example of an 'anchor-plus' innovation district.

[42]By convention, this round is called Series A.

an average raise rate of 5.5% and a total pipeline of 150 startups per year. These figures imply they would create around eight additional venture capital deals in 2018 (i.e., $150 \times 5.5\% = 8.25$). Houston saw nine more VC deals in 2018 than in 2016.

3.4 Additional ESO Measures

ESOs develop relationships with their startup's investors. A useful measure of these relationships, and so ESO quality, is the rate at which VC's return to do business again.

Measure 7 (Repeat VC)**.** *Repeat venture capital is the percentage of investments, by count or amount, from returning venture capitalists at a single institution. The repeat investment rate of local and top-quartile VCs is particularly instructive, as these VCs generate disproportionate value.*

Different VCs have different propensities and abilities to support additional deal flow at an institution. For example, local, large venture capitalists, or venture capitalists with some other association with an institution, are more likely to return. Consequently, this measure has potential biases, particularly when comparing across cities that have different innate characteristics.

Pipeline and raise rate calculations can sometimes be prohibitively complicated. In such cases, measures of an ESO's expertise in its operations, leadership, and governance provide alternative, near-sufficient statistics of its quality.

Attracting mentors to an ESO is subject to adverse selection: expert mentors are in short supply and have many demands on their time, while non-expert mentors are in abundance and are eager to put themselves forward. However, expert leaders can assess mentor quality, which (again) leads to sorting. Expert leaders also naturally pair with expert board members and tend to be governed by smaller boards.

Measure 8 (ESO expertise)**.** *The fraction of experts (see definition 8) among its mentors, leadership, and board members and the size of governing board measure an ESO's expertise. A quick rule-of-thumb is that any ESO with more than a dozen board members or a board with less than one-third experts is a low-quality non-profit organization.*

Other ready measures of ESO performance concern their operational use of best practices. For instance, an ESO could use a bottom-up (including 'lean startup'), by-example, or top-down (i.e., economic modeling) development methodology. Which methodology they choose and how well their implementation matches a normative process provide measures of the organization's quality. More broadly, ESOs that make unnecessary valuations, use inappropriate and/or suboptimal financial instruments, engage in financial engineering, describe their programs using non-standard terminology, offer highly atypical programs, or

otherwise engage in inefficient behavior are disproportionately likely to be non-profits with poor performance.

Example 19 (Proxy measures)**.** The HTC's performance was poor: i) Its external raise rate was around 11% and its cost per raise was more $3m.[43] ii) Its VC quality was low (on every measure), and during the its operation none of the 21 Houston-based startups that received investment from top-quartile venture capitalists attended the HTC.[44] iii) Its external repeat venture capital rate was very low (around 4%) and came exclusively from non-market funds. And iv) Only one HTC client company went on to an initial public offering, and just four had disclosed-value acquisitions, two of which were for more than $50m.[45] One client, which the HTC celebrated as a success, underwent a reverse takeover of an over-the-counter traded firm.

Observations of the HTC are consistent with inefficient behavior: i) None of its 18 energy mentors were experts. ii) Its board of 57 contained few, if any, experts. iii) It rented half a floor to a law firm that had nothing to do with startups. And iv) It opened branch offices to "literally spread its city's startups to the points of the compass" (see Egan 2020), undermining Houston's startup agglomeration economies.

Imposing non-expert mentors is likely sufficient to move startups off their high-growth path and reduce their odds of venture investment, especially from top-quartile VCs. More inefficient activities may deter investment altogether and have material adverse effects on welfare, both directly and through reputational spillovers.

Example 20 (Adverse effects)**.** In late 2014, the HTC and a local philanthropist's investment group created the McNair Houston Ignition Fund. This fund set aside $1m each year and gave $25,000 to each client accepted to the HTC's 'acceleration' program on an opt-in basis. Clients gave the fund warrants on 2.5% of their companies in exchange for the money. Thus, the fund unnecessarily valued its startup firms at $1m post-money ($V_{post} = \frac{Inv}{F_{inv}} = \frac{25000}{0.025}$).[46] More importantly, the fund suffered from adverse selection as any firm worth less than $975,000 pre-money ($V_{pre} = V_{post} - Inv$) would opt-in and any firm worth more would not, so every recipient was immediately over-valued deterring future investment. Finally, recipients were unsure whether they had received investment from a private fund or a non-profit philanthropic organization, and some of the warrants were

[43] Extrapolating from it's available 990 filings, the HTC received more than $50m from governments and philanthropy. Seventeen of 149 HTC clients raised a total of $508m venture capital. Many of these firms may have secured comparable (or even better) investment without the HTC.

[44] Ten VCs have invested in Houston and are in the top quartile on almost every performance measure. All 10 are non-local and routinely appear in Top 100 VC lists.

[45] The HTC's sole IPO was Bellicum Pharmaceuticals (see example 3).

[46] They could have used convertible notes or SAFE instruments to avoid making a valuation.

recorded in the HTC's name in Crunchbase, giving the impression of fraud.

4 Policy Cartels

> "The first of the classical problems that stall progress in a startup community is the patriarch problem. These patriarchs are the old white guys who run the show... you have to wait for a bunch of people to die [or] the leaders of the startup community should simply ignore the patriarchs."
>
> (Brad Feld in Startup Communities: Building an Entrepreneurial Ecosystem in Your City — 2012)

No study of high-growth, high-tech entrepreneurship measures would be complete without considering who should use them and why. Reform in the use of currently available measures is currently much more important than the development of new and more sophisticated measures.

So far, I have differentiated between for-profit and non-profit firms in terms of their expertise and incentives. I now add an extra layer of considerations for non-profits: whether policy cartels control them. Almost all of Houston's and St. Louis' municipal HGHT policies have been initiated and controlled by policy cartels.

Svaleryd and Vlachos (2009) points out that, even in first-world nations and absent corruption, there are legal rents available to politicians and that these rents decrease when competition or information increases. I extend this observation to groups of organizations that extract rents from policymaking, which I name policy cartels.

Definition 15 (Policy cartel)**.** A policy cartel is a group of non-profit and/or non-government organizations that band together to extract 'policy rents' from enacting or controlling policy on a topic. Policy cartels often use state resources to maintain or enhance their positions.

Definition 16 (Policy rents)**.** Policy rents include favorable media, increased public profiles, and control over or access to financial, operational, and/or political support, particularly from the government and philanthropy. When enacted policy distorts markets, cartel members may also extract economic rents.

High-growth high-tech entrepreneurship is a value-creating and zeitgeist topic with no natural incumbents in its policy space. It has transient constituents and is challenging to measure, with diffuse, long-term economic impacts that often have unclear attribution. Expertise is also scarce and seldom found outside of for-profit ventures and their financiers.

These features make HGHT entrepreneurship an attractive space for policy cartels to capture rents.

Policy cartels and the non-profit organizations they control frequently use their influence over the press and other market participants, their relationships with local institutions and government, and the $2 billion fallacy to generate rents.

Example 21 (Policy rents)**.** The HTC was created by the dominant Houston policy cartel, which includes two local universities and the GHP.[47] Despite spear-heading the largest rank decline of any former top 20 U.S. city, the HTC received nearly 400 complimentary media articles, directed the expenditure of more than $50m, and partnered with NASA. A legion of officials and captains-of-industry, from mayors to presidential candidates, were associated with HTC events, or vice versa. In 2010, Forbes named the HTC one of "Ten Technology Incubators Changing the World," saying it "has spawned 1,000 entrepreneurs who have raised $1 billion."

4.1 Membership

Municipal governments have incentives to endorse entrepreneurship policy cartels and delegate policymaking to them. They then share in the policy rents without having to undertake costly effort or incur accountability.[48] On the other side, cartel members often lead large organizations or represent commanding accumulations of private wealth. When the members are non-profits, they typically have governing boards made up of highly-overlapping groups of local leaders and benefactors who have extraordinary influence with elected officials and, through their organizations, considerable local policy influence.

Example 22 (Cartel membership overlap)**.** The chairperson of the GHP's executive committee is the chairperson of Rice's board of trustees, and the president of Rice is on the GHP's executive committee. Many of the GHP's executive committee and Rice University's board of trustees also served on the HTC's board of directors. Shell and Chevron had seats on all of these organizations. In February 2018, following the dissolution of the City of Houston Task Force on Technology and Innovation, the GHP repurposed the HTC's 501(c)(3) into a policy organization named Houston Exponential. A director of the GHP chairs Houston Exponential's 20-member governing board, and the GHP chairperson, Rice's president, the University of Houston's president, and representatives from Shell and Chevron all have seats.

[47] St. Louis has two dominant policy cartels. The composition of the largest one mirrors the Houston cartel.

[48] There are also ego rents to both cartel leaders and local officials from completing large transactions using public resources.

4.2 Non-market Actions

Cartel managers are usually well-intentioned. However, policy cartels do not have the expertise or incentives to design and enact efficient policy. As with other non-profits, expertise is scarce and costly, and rents do not depend on policy quality.

Policy cartels also add two further efficiency issues. First, they are long-lived and often entrenched under the guise of ecosystem development.[49] There is no waiting for them to die or ignoring them: They can maintain their presence indefinitely by adding new initiatives, expanding current policies, and rebranding and repurposing their unpopular undertakings.

Second, policy cartels frequently control resources other market participants may need. This control allows them to engage in non-market actions to suppress competition and preserve their rents.[50] For example, when new community leaders arise or arrive, policy cartels can often assimilate or remove them. The new leader's organization then either exits the market or is down skilled (i.e., converted to a non-profit or a non-market money organization, or otherwise reduced in scope and/or scale).

Example 23 (Foreclosing competition)**.** In 2018, Station Houston entered negotiations with Rice University to locate in a Rice owned property, subsequently named 'The Ion'.[51] Shortly after these negotiations began, rumors circulated that Station's CEO, a former serial entrepreneur, was viewed by Houston's establishment as disruptive.[52] Station's board then voted to replace its CEO with a former high-school principal and become a 501(c)(6) non-profit.[53] In 2019, Station's new leader was appointed the executive director of the Ion, and, in the following year, she announced that Station's operations would be outsourced to the Capital Factory, a rival from Austin.

Policy cartels can also control policy outcomes through a combination of agenda-setting, information management, and process management.

Example 24 (Controlling policy outcomes)**.** As the City of Houston's Innovation and Technology Task Force prepared its final report (see City of Houston 2017), two sets of data on Houston's startup ecosystem were circulated: one commissioned from Accenture by the GHP, the other produced by academic experts. The GHP endorsed the Accenture

[49] An entrepreneurship community requires a critical mass of activity before it can self-organize.

[50] Teece (1986) refers to such resources as (co-)specialized assets. Examples include official certification, access to government and non-profit programs, and (through their influence on private organizations) partnership opportunities and positive press.

[51] Egan (2020) finds that The Ion's innovation district is "both in the wrong place and is much too big", and so damages Houston's economy.

[52] The choice of the word "disruptive" sheds light on the divide between the startup community where disruption is good, and the establishment (i.e., policy cartel members) where disruption is bad.

[53] The deciding vote was likely from a Mercury Fund VC and former HTC director (subsequently an adjunct professor at Rice).

data, which relied on claims by non-experts and conflated venture capital with private equity (see Egan and Carranza 2018) but showed Houston in a positive light. Responsibility for policy was then passed to Houston Exponential, which largely ignored the task force recommendations and decided Houston's startup policy behind closed doors.

5 Concluding Remarks

Effective startup policy is crucial for nations embracing an innovation economy as today's newly-founded high-growth high-tech firms are the drivers of tomorrow's economic growth. Yet, many of the examples in this paper describe suboptimal, perhaps even welfare destroying, policy initiatives.

I would stress that some U.S. cities have created effective startup policies. One example is Cincinnati.

Example 25 (Effective startup policy)**.** Cincinnati was ranked 239$^{\text{th}}$ among startup cities in 2011 when it launched its 'Cintrifuse' initiative. Cintrifuse identified a measurable shortage of early-stage capital in the city and addressed it with a fund-of-funds (among other programs) that followed normative design principles and attracted top-quartile venture capitalists.[54] Cincinnati was ranked 63$^{\text{rd}}$ in 2014 in large part because of Cintrifuse's success.

Future research should attempt to determine the distribution of welfare effects created by startup policy. In the meantime, my sense is that Cincinnati's policy is an outlier and that Houston's is not. Many highly-lauded programs do not measure up when evaluated with the venture pipeline framework. The reasons are straight-forward: non-experts do the lauding; perception and not performance is rewarded in non-profits; and with expertise so scarce, most initiatives imitate others without understanding whether or why the originals work.

Poorly performing initiatives have strong incentives to withhold useful information and push flattering alternative narratives. Moreover, good news hides poor choices: On average venture investment increases drastically within a city each year and the positive welfare effects of private efforts can be claimed by any (even loosely) concurrent policy.[55] So, poor quality startup policy is likely to persist for many years to come. Nevertheless, this paper provides both a useful first step toward reducing the information asymmetries between policymakers and constituents and essential insights into the economics inherent in measuring

[54] Houston Exponential's fund was partly inspired by Cintrifuse, which had invested in Mercury Fund.

[55] Considing city-years with $10m or more of venture capital invested, the average annual increase in U.S. growth venture capital is around 35%.

high-growth high-tech entrepreneurship ecosystems. With these tools in hand, crucial reform should be possible.

Example 26 (Good outcomes, poor choices)**.** In 2019, five accelerators stated that they were opening offices in downtown Houston. In 2020, Station Houston and one of these new accelerators were supposed to move to The Ion. Station's pipeline size and raise rate peaked in 2018 under its former expert leadership. Its change in location, and the outsourcing of its operational management, likely reduced Station's efficacy, but it will be several years before these effects manifest. However, even if the majority of attendees of the new accelerators are non-local, Houston will still have a much greater pipeline of local startups, as well as a materially higher weighted-average raise rate, in say 2025, than it did in 2015. As a result, Houston's prognosis is overwhelmingly positive, despite its abysmal policy history.

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