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What do we know about startup-valuation drivers?

A systematic literature review¹

Max Berre², Benjamin Le Pendeven³

ABSTRACT

Startup-valuation is a critical area of research within entrepreneurial finance, but research on this topic is less consistent and thorough than overall valuation research. Peer-reviewed studies express a range of divergent views and approaches, and the focus varies widely. To bring clarity to this fragmented field, we conduct a systematic literature review, examining 87 peer-reviewed studies published between 1985 and 2020. We analyze these publications in detail and identify 36 startup-valuation drivers and cluster them into five macro-themes: Entrepreneur Characteristics; Firm Characteristics; Investor Characteristics; Market Conditions; and Deal Conditions. We then describe the valuation-impact of these drivers on startups. The range of drivers identified in the literature gives rise to construction of an integrative meta-model based on the macro-themes, placed into appropriate chronological position in the valuation process. Our study also identifies key research-gaps and highlights promising directions for exploring the startup-valuation field.

Keywords *Valuation, Startup, Systematic Literature Review, Venture Capital, Entrepreneurial Finance*

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1. Introduction

Extreme startup-valuations make headlines. Consequently, startup-valuation has become a topic-of-interest in entrepreneurial-finance literature and the startup-ecosystem. Located at the heart of discussion between among early-stage investors, startup-valuation symbolizes negotiation-power of parties to startup equity transactions. Its evolution reflects trends in relations between valuation-drivers. In doing so, startup-valuation is crucial not only at micro-level for entrepreneurs and equity-investors, but also at macro-level for policy-makers and professional-associations. In this respect, Grind (2015), for example, points-out that the US Securities and Exchange Commission recently became interested in valuation-practices applied to startups.

Given opacity, short histories, and array of intangible assets, startups are notoriously difficult to value, as outlined by Damodaran (2009). Over the past thirty years, scholars have been attempting to “open the black box” and formalize valuation-drivers of startups. While overall published knowledge is sparse and dispersed across several academic fields, Bellavitis et al. (2017) concur on the importance of focusing on startup-valuations as a key avenue of research, outlining that a number of emergent theoretical perspectives are related to new research questions, which include valuation-impacts driven by the mix of different investors. Overall, potential synergies between potentially competing sources of funding can lead to higher valuations, driving the emergence of unicorns.

The Wall Street Journal reported that there were 45 unicorn companies (i.e., with valuation above \$1 billion) in 2014. By September 2016, the figure was 150. By January 2020, TechCrunch reported 558 unicorns with combined valuation of \$1.9 trillion. This dramatic growth explains why startup-valuation has become a much-debated topic. Moreover, valuation trends during recent events, have shown the importance of understanding startup-valuations and their drivers.

To understand the debate surrounding this topic, we undertook a Systematic Literature Review (SLR). We examine the role and impact of various valuation-drivers and provide coherent overview of the current state-of-the-art of peer-reviewed research.

Given the interest shown by industry-practitioners and the academic debate on the topic, this literature review caters to many practical and theoretical needs. To this end, we examined 87 peer-reviewed contributions on startup-valuation published between 1985 and 2020.

This study contributes to the advancement of research in several ways. First, we analyze development of the literature, identifying thematic-trends and valuation-drivers. Second, we highlight research-themes, exploring their implications. Third, this study not only examines peer-reviewed literature on startup-valuation, but also develop a bespoke model to describe the process by which valuation emerges, and which drivers play deterministic roles throughout various stages. Fourth, we identify under-reported valuation-drivers and prominent research-gaps.

The rest of this study is organized as follows: Section 2 describes the papers examined, as well as search and selection methodology. Section 3 analyzes publication-trends on the topic and conveys our findings. Section 4 provides discussion about primary gaps and under-researched topics. Section 5 concludes and highlights a number of research avenues.

2. Method

2.1. The systematic literature approach

This study maps knowledge about startup-valuations, identifies gaps in existing research, analyzes trends in peer-reviewed and provides deeper understanding of what we know about startup-valuation drivers. To this end, we employ systematic literature review methodology.

Tranfield, Denyer and Smart (2003) explain that systematic literature reviews feature transparent, replicable process; this aims to minimize bias by means of exhaustive searches of published and unpublished literature, and by providing an audit-trail of procedures and conclusions. Indeed, a systematic review of content, quality, and diversity of sources of startup-valuation literature can detect divergences, as well as gaps in published literature. Along lines of Mochkabadi and Volkmann (2018), this study provides clear overview of literature development and emerging

themes. applying an SLR variant that bases literature-exploration on content-based publication evaluation. Furthermore, we employ thematic coding across our literature sources, leading to the construction of tables demonstrating associations between the drivers and startup-valuations, making possible the construction of a grounded theory meta-model to grant wholistic insight on startup valuation

2.2. Key concepts

Legal descriptions of startups exist in both the US and EU. While the US Startup Act references firms younger than five years, Art. 22(2) of EU Commission Regulation No. 651/2014 describes startups as unlisted small-enterprises that have existed for less than five years, have not taken-over activity of another firm, have not yet distributed profits, and were not formed as result of merger. Inspired by Cumming and Dai (2010), we define startup-valuation as: the startup-price (or price-of-shares) paid by equity-investors for early-stage investment. Our definition is specific to valuations observed in VC deals and excludes exit-events such as trade-sales or IPOs, which cannot be considered to belong to the firm's emerging phase.

Valuation drivers are the measurable variables that act as information-subsets to influence startup-valuation. This goes beyond a firm's balance sheet, income statement, and financial disclosures, including both external information, such as market structure, and privileged information and access held by stakeholders. Whereas Fama (1970) described prices as reflecting information-subsets ranging from historical-values to disclosures and privileged-information, this study renames these subsets *valuation-drivers* for purposes of startup and entrepreneurial-finance markets.

2.3. Keywords and sources

2.3.1 Theme-clustered search-keywords

The initial literature-search focused on keywords relevant to startup-valuation , venture capital, and price. Keywords were tested for unique-results, the first twenty papers identified by a Google

Scholar search using the term “startup-valuation drivers” and close synonyms of these words. To minimize redundancy, search-keywords with three unique-results were retained.⁴ Table 1 displays search-keywords for literature on startup-valuation in seven languages. It was decided to conduct multilingual searches owing to potential added-value of research published in these languages.

Table 1 Theme-clustered keywords in alphabetical-order

ENGLISH	DUTCH	FRENCH	GERMAN	ITALIAN	PORTUGUESE	SPANISH
"Start-up" valu*	Waard* "start-up"	Valoris* "start-up"	Bewertung "start-up"	Valuta* "start-up*" Valor* "start-up"	val* "empresa emergente"	val* "empresa emergente"
"Start-up" price	Prijs "start-up*"	Prix "start-up"	Preisgestaltung "start-up*"	Prezzo "start-up" Valore "start-up"	Preço "empresa emergente"	Precio "empresa emergente"
"Start-up" valuation	Waarden "start-up", Waardebepaling "start-up"	Valorisation "start-up"	Bewertung "start-up"	Valutazione "start-up", valorizzazione start-up,	Valorização "empresa emergente"	Valuación "empresa emergente"
"Young Venture" valuation	Waarden "jonge bedrijf", Waardebepaling "jonge bedrijf"	Valorisation "jeune entreprise"	Bewertung Jungunternehmen	Valutazione di giovane impresa, valorizzazione giovane impresa,	Valorização "jovem empresa"	Valuación "joven empresa"
"Venture Capital" valu*	Waard* durfkapitaal, Waard* risicokapitaal,	Valoris* "Capitale risque"	Bewertung risikokapital Bewertung Venture Capital	Valuta* di capitale di rischio Valorize* capitale di rischio	Val* "capital de risco", Val* de "capital emprendedor"	Val* de "capital riesgo" Val* de "capital emprendedor"
"Venture Capital" price	Prijs durfkapitaal Prijs risicokapitaal	Valeur "capital risque"	Risikokapitalfinanzierung Preis	Prezzo "capitale di rischio" Valore "capitale di rischio"	Preço "capital de risco" Preço "capital emprendedor"	Precio "capital riesgo" Precio de "capital emprendedor"
"Venture Capital" valuation	Waarden durfkapitaal Waarden risicokapitaal	Valorisation "Capitale risque"	Bewertung risikokapital	Valutazione "capitale di rischio"	Valorização "capital de risco" Valorização "capital emprendedor"	Valuación "capital riesgo" Valuación "capital emprendedor"

These search-strings were used to explore peer-reviewed on 31 March 2019 and on 01 December 2021.

2.3.2 Databases searched for peer-reviewed studies

⁴ The search-keywords not retained are: Startup Price, Young Venture Valu*, Young Venture Price, SME Valu*, SME Price, and SME Valuation.

This study uses several sources to ensure comprehensive-coverage of peer-reviewed literature, including both web-based sources and academic databases. The primary academic databases were EBSCO and Web of Science. Choice of these databases is consistent with SLR best-practices in the fields entrepreneurship and small-business-management (see Köhn (2018)), and finance (see Mochkabadi and Volkmann, 2018). Both executed their search via two separate peer-review aggregator-databases, consisting of EBSCO and a secondary-database. Our second database was Web of Science, which is also used by entrepreneurship studies, such as Champenois et al. (2020) and Aliaga-Isla and Rialp (2013).

Google Scholar was employed as a complement to secure studies identified, but not accessible via academic library-sources. According to Mochkabadi and Volkmann (2018), Google Scholar provides coverage of non-English publications and unpublished-contributions.

2.3.3 Journal ranking systems

Field-specific journal-rankings as presented by the Chartered Association of Business Schools (ABS) act as a lens through which to examine peer-reviewed studies. The decision to limit scope through quality criteria—articles published in ABS-ranked journals are peer-reviewed prior to publication—is consistent with SLR protocol-guides, principally Tranfield et al. (2003), as well as examples of published SLR-papers such as Champenois et al. (2020).

2.4. Search methods

Peer-reviewed contributions for 1990-to-2020 were drawn from academic databases and publicly-available resources. Additionally, snowball-tracking as per Horsley et al. (2011) was done for each generation of literature-search. Quality was assured by filtering for journal-relevance, journal-rating, and topical-relevance as per our selection-criteria.

2.5. Selection criteria

As suggested in the SLR protocol guidelines, inclusion criteria and exclusion criteria were applied to search results in the academic-papers database.

2.5.1 Inclusion Criteria

- 1) The study was published in an ABS-ranked peer-reviewed business and/or economics journal, ranging from the oldest of the database's sources to 2019.
- 2) Additionally, the study used at least one of the search-keywords in the title, abstract or listed keywords.
- 3) Book chapters that included the keywords as their primary focus examined for inclusion.
- 4) Sources using several keywords received first attention and priority.

2.5.2 Exclusion Criteria

- 1) Papers in peer-reviewed journals that were either book reviews or editorials were not considered primary sources and were excluded in order to focus on scientific papers.
- 2) Papers published in journals that are not ABS-ranked were excluded.
- 3) Master's theses were excluded. These might not constitute original-research.
- 4) Papers whose research field was not entrepreneurial finance were excluded in order to focus specifically on the topic of this study.
- 5) Papers in English, French, Spanish, German, Portuguese, Italian, or Dutch, considered.
- 6) Duplicate articles were removed in favor of the most-recently published version.
- 7) Papers dealing with valuation-techniques (which are of peripheral interest to this study) but not with valuation drivers were excluded.

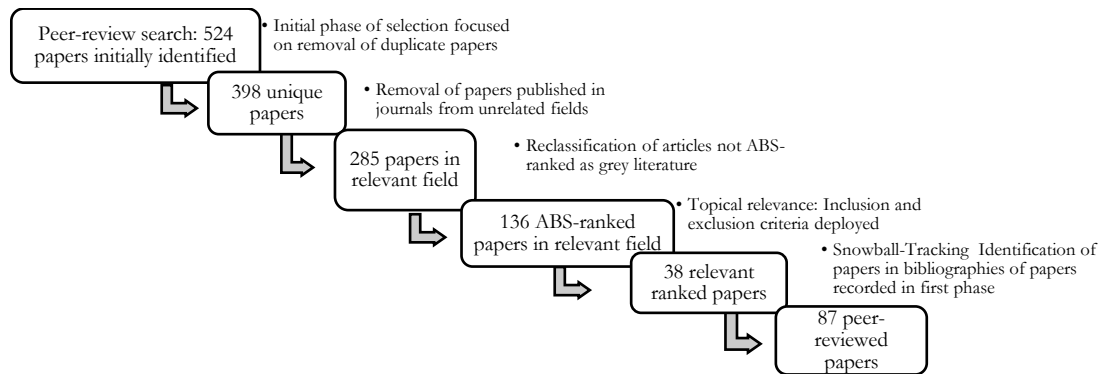
The first-phase consisted of recording papers meeting the inclusion-criteria. Secondary-screening consisted of assessing entrepreneurial-finance relevance.

2.5.3 Selection and snowball-tracking

Initially, 524 peer-reviewed papers were identified. To include both foundational papers and recent research, a thirty-year time-horizon (1990-2020) was used. The first two selection-phases focused on removal of duplicate-papers and papers published in unrelated fields.

The next phase identified relevant papers cited in bibliographies of papers identified in the first phase. Extra attention was given to papers cited by several studies already included under our criteria. The selection-process yielded 87 peer-reviewed studies.

Fig. 1 Selection of peer-reviewed literature



This result was reached after several phases of search-and-examination of peer-reviewed literature, as outlined in Figure 1. Of 524 identified papers, three-fourths survived elimination of duplicates; of these, only one-third had been published in topically-relevant ABS-ranked journals. Nearly half ultimately survived the remaining selection-criteria. Subsequently, 40 papers identified by snowball-tracking were excluded because their focus was on divergent topics, such as: startup-selection, investment-round-determination, or contract-determination. Lastly, a few highly relevant academic working papers discovered to have peer-reviewed iterations were included.

3. Results

The production of literature about startup-valuation is presented and explained in the first part of this section. Subsequently, an overview of drivers describes the extent to which drivers identified are heterogeneous. For each category that emerged from thematic coding, we explain the driver's valuation-impact. Finally, we develop a unified meta-model demonstrating the multi-step mechanics of the valuation process.

3.1. Themes and drivers of startup-valuation in literature

3.1.1 Journals of publication

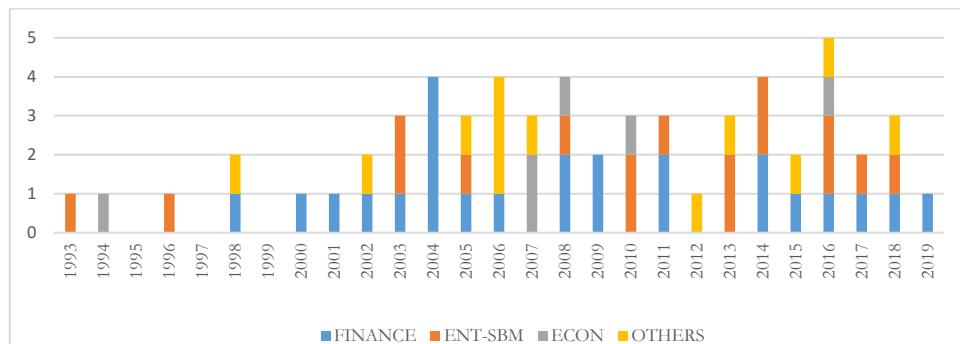
Table 2 outlines the top-eight journals in which selection-criteria-meeting publications appear. 50 of the peer-reviewed papers are drawn from these. In terms of publication field, the journals either deal with small business and entrepreneurship or with finance.

Table 2 Top-eight journals publishing research on startup-valuation

Journal	Field	No. of Papers	Share of Total
Journal of Business Venturing	ENT-SBM	16	17.8%
Journal of Financial Economics	FINANCE	11	12.2%
Venture Capital	ENT-SBM	5	5.6%
Review of Financial Studies	FINANCE	4	4.4%
Journal of Finance	FINANCE	4	4.4%
Journal of Financial Intermediation	FINANCE	4	4.4%
Small Business Economics	ENT-SBM	3	3.3%
Entrepreneurship Theory and Practice	ENT-SBM	3	3.3%
TOTAL		50	55.6%

Figure 2 outlines evolution of peer-reviewed papers. Most were published in Finance, which saw the fastest growth. This is followed by Entrepreneurship-Small Business Management, which experienced a post-2003 publication-boom, after the dotcom-bubble. Economics, meanwhile, saw fast 2006-2009 publication-growth. The oldest paper to survive the selection process dates to 1993. During some years, no studies survived the selection process.

Fig. 2 ABS publication-fields in which startup-valuation research appears



3.1.2 Thematic coding

Following selection, double-reading of abstracts was undertaken to identify key-themes. After via inductive-search, we classify startup-valuation-drivers along thematic-lines. Table 3 outlines the resulting classification: Drivers are categorized as specific to entrepreneur, firm, investor, or external environment. Five themes were identified: *Entrepreneur Characteristics*; *Firm Characteristics*;

Investor Characteristics; Market Conditions; and Deal Conditions. This approach is similar to Hand (2005), who segments valuation-drivers into financial and non-financial, while Sievers et al. (2013) segment drivers into financial, non-financial, and deal-conditions.

Table 3 Thematic classification of 36 startup-valuation drivers

Entrepreneur Characteristics	Firm Characteristics	Investor Characteristics	Market Conditions	Deal Conditions
Entrepreneur- gender	Assets - IP	Nature of the investor	Macro-Economic situation	Syndication and Investor Competition
Entrepreneur- experience	Assets - others	Quantity of cash under management	Sectorial economic situation	Shareholder's agreement clauses
Entrepreneur - education	Performance - sales	Investor's nationality	Quantity of cash on the VC market	Funding Round
Entrepreneur - background other	Performance - EBIT and EBITDA	Investor's reputation	Business Cycle	Timing of the deal
	Performance - others	Investor's history/exp	Agency Costs and Asymmetric Information	Duration of the deal
	Impact of the country	Potential other interest (corporate relation, etc)		Preference shares in the deal?
	Impact of the sector	Investment strategy		Other mechanisms for investor's protection ROI
	Impact of the business-model	Sector Specialization of VC		Exit expectations and strategies
	Stage of the start-up			
	Complementarity and Business Alliances			

3.1.3 Methodologies and authors

Figure 3 examines methodologies used in peer-reviewed contributions. We classified methodologies into: qualitative case study; literature review/meta-study; narrative, qualitative non case-study; regression analysis; survey/questionnaire; and theoretical.

Overall, studies relying on “regression analysis”, which we used to label papers whose methodology depends primarily on OLS, logit, or probit regressions, and whose dataset does not come from surveys or questionnaires, constitute nearly two-thirds of selected peer-reviewed literature. This is followed by “theoretical contributions”, which establish formal theoretical models to describe valuation. These papers constitute one-fifth of the total, while a small minority are either case-studies or qualitative studies.

Fig. 3 Methodologies used in peer-reviewed literature

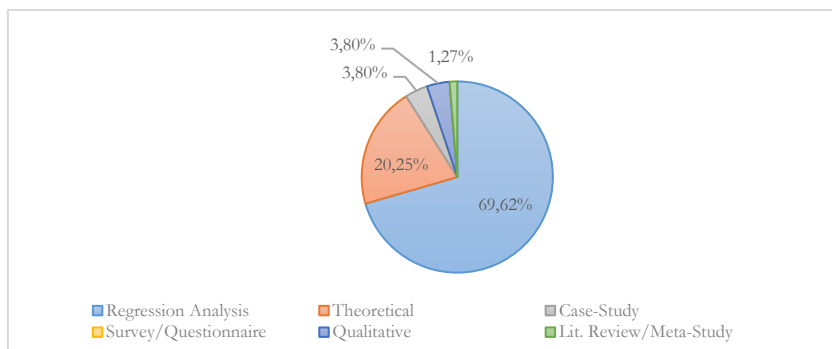


Table 4 Methodologies in peer-reviewed literature

Methodology	Studies	Share of total
Regression Analysis	55	69.62%
Theoretical	16	20.25%
Case-Study	3	3.80%
Survey/Questionnaire	0	0.00%
Qualitative	3	3.80%
Lit. Review/Meta-Study	1	1.27%

Figure 4 outlines countries in which peer-reviewed authors (and their institutions) are based.

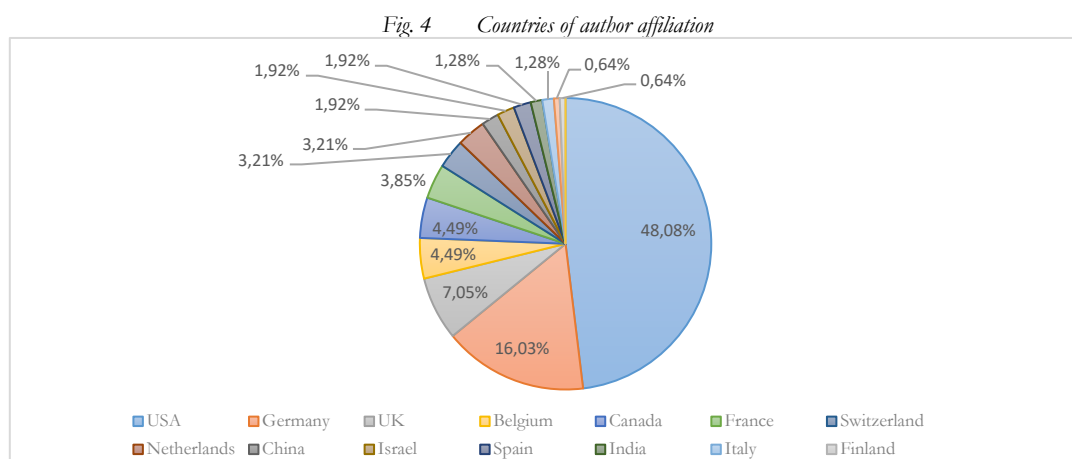


Table 5 Author-affiliations

Author's country affiliation	Number of studies	Share of total
USA	75	48.08%
Germany	25	16.03%
UK	11	7.05%
Belgium	7	4.49%
Canada	7	4.49%
France	6	3.85%
Switzerland	5	3.21%
Netherlands	5	3.21%
China	3	1.92%
Israel	3	1.92%
Spain	3	1.92%

The US is the most prolific source of peer-reviewed literature. Following the US are Germany and UK, where 16.03% and 7.05% of authors are based.

3.2. Entrepreneur characteristics

Entrepreneur Characteristics consist of four drivers: Gender, Experience, Education, and Other Entrepreneur Background. Inclusion of these is driven by input-based valuation approaches, which explicitly include entrepreneurial human-resources as a valuation-driver.

3.2.1 Entrepreneur gender

Two peer-reviewed papers explore gender's valuation-impact. Poczter and Shapsis (2011), the most-cited study, finds that female entrepreneur-teams receive less capital and provide more equity, even when controlling for determinants of investment such as industry and prior company success. Other studies, such as Murnieks et al. (2016), who control for Gender, either do not find substantial value-impact or find impact to be very mild.

3.2.2 Entrepreneur experience

Relevant entrepreneur-experience has positive valuation-impact. Sievers et al. (2012) consider founder-team experience—both prior startup-experience and prior management-experience—to be a primary non-financial valuation-driver. Miloud and Cabrol (2011), who explore industry-experience, entrepreneurial-experience, and managerial-experience, explain that experience consists of both quantitative and qualitative dimensions.

In Miloud and Cabrol's input-driven model, industry-experience, entrepreneurial-experience, and management-experience impact valuation differently, with management-experience having the largest coefficient. Hsu (2007) also attributes experience-related valuation-divergences to founder-experience: Experienced entrepreneurs are better at negotiating and can raise equity-funds with higher valuation. Chatterji et al (2009) examine medical-device-industry startups and also find that incumbent-firm entrepreneur-experience leads to higher valuation in the last round of private-financing. Additionally, Yoo et al. (2012) find that entrepreneur expertise also positively impacts

startup-valuation. A prominent dissenting view is Gompers et al. (2010), who outline that serial-entrepreneurs do not benefit from higher valuations for their new startups.

In further nuance, Zacharakis and Shepard (2005), argue that VCs value entrepreneurial-experience in complement to other valuation-drivers, such as leadership-experience, proprietary technology, and market familiarity. The greater an entrepreneur's previous startup-experience, the less important their general leadership-experience. While human-capital inputs behave as complements, the specific type of human-capital input plays a role in the importance given by venture capital firms to entrepreneurs. This view is reinforced by Siegel et al (1993), who stress the role of a manager's industry-experience and by Hsu (2007), who outlines that entrepreneurs without prior founding-experience may have difficulty regarding both *actual* and *perceived* new venture development-ability. This undermines valuation.

3.2.3 Entrepreneur education

Concerning education, Hsu (2007) finds that impacts of education on VC-valuations are specific to the internet industry, while divergences exist between managerial educational backgrounds on one hand, and technical or scientific backgrounds on the other. In emerging-industry contexts, the signal-value of PhD-holders is important in attracting the attention of VCs (and receiving a better pre-money valuation), whereas MBA-holders invest more into developing ties with the VC community at large. Other studies find that educational-effects are industry-specific. Miloud and Cabrol (2011) explore impacts of industry-expertise on pre-money valuation. The literature indicates that scale of human-capital valuation-impacts depend on specialization.

An alternate view, Pollock et al. (2010), outline that education and experience have prestige-signaling effects. Studies point to differences between education-types, suggesting elite-education (Pollock et al. 2010) or specialized-education, such as PhD or MBA training (Hsu 2007), as the value-adding factor.

3.2.4 Other entrepreneur-characteristics

This parameter consists of drivers ranging from easy-to-measure size and entrepreneur team-completeness, to intangible drivers, such as organizational and social capital, tenacity, motivation, and willingness-to-take-risks. Some of these interact with other drivers, as shown by Franke et al. (2008), where age, education, mutual-acquaintance, and experience are more appreciated by experienced VC investors. Subjective entrepreneurial qualities, such as strong ties, outlined by Batjargal and Liu (2004), or perceived tenacity and perseverance, outlined by Murnieks et al. (2016), also have positive valuation-impacts. Entrepreneur cultural-background can also impact valuation. Bengtsson and Hsu (2015) find that cultural similarities between investors and entrepreneurs in the US lead to higher valuations.

Several studies outline that more-complete entrepreneurial founder-teams lead to higher valuations. Miloud and Cabrol (2011) and Wasserman (2016) indicate this explicitly.

Table 6 describes valuation-impacts of Experience, Education, and Other Entrepreneur-Characteristics as positive. The latter is the most-positive driver. While no studies communicate neutral or negative-findings, interactive-effects are also present. Valuation-impact of gender is neutral. Studies that explore this driver find neutral or mild impact.

Table 6 Entrepreneur characteristics

Author	Year	Entrepreneur-gender	Entrepreneur-experience	Entrepreneur - education	Entrepreneur - background other
Batjargal, B.; Liu, M.	2004				P
Berk, J. B.; Green, R. C.; Naik, V.	2004		P		
Chatterji, A. K.	1998		Neut		P
Colombelli, A.	2010		Neut	Neut	P
Cumming, D. J.	2008				P
Davila, A.; Foster, G.; Jia, Ning	2015		Control, Neutral		
Dhochak, M.; Doliya, P.	2000		P		P
Dittmann, I.; Maug, E.; Kemper, J.	2004		P		P
Franke, N.; G., M.; Harhoff, D.; Henkel, J.	2008		P	P	Interactive
Gompers, P.; Gornall, W.; Kaplan, S. N.; Strebulaev, I. A.	2020		P		
Gompers, P.; Lerner, J.	2013				
Greenberg, G.	2013		Neut		
Hsu, D. H.	2007		MP	P	P
Lall, S. A.; Chen, L.; Davidson, A.	2019				P
Manigart, S.; De Waele, K.; Wright, M.; Robbie, K.; Desbrières, P.; Sapienza, H.; Beekman, A.	2000		P	P	
Manigart, S.; Wright, M.; Robbie, K.; Desbrières, P.; De Waele, K.	1997		P	P	P
Miloud, T.; Cabrol, M.	2011		P	P	Interactive, P
Munnieks, C. Y.; Cardon, M. S.; Sudek, RR; White, T. D.; Brooks, W.T.	2016	Control, Neut			P
Pintado, T.R.; de Lema, D. G. P.; Van Auken, H.	2007		P		MP
Pocster, S.; Shapsis, M.	2018	N		Neut	
Pollock, T. G.; Chen, G.; Jackson, E. M.; Hambrick, D. C.	2010		P	P	P
Siegel, R.; Siegel, E.; MacMillan, I. C.	1993		VP		P
Sievers, S.; Mokwa, C. F.; Keienburg, G.	2013		P		P
Tyebjee, T. T.; Bruno, A.V.	1984	P	P		
Yoo, C.; Yang, D.; Kim, H.; Heo, E.	2012		P		P
Zacharakis, A.; Shepherd, D. A.	2005		VP, Interactive		
Zhang, J.	2011		P		
Totals: Peer-review literature		2	21	9	17
<i>Summarized Driver Direction in Model</i>		=	+	+	++

Legend: P = Positive; MP = Mildly-Positive; VP = Very Positive; N = Negative; MN = Mildly-Negative; VN = Very Negative; NC= Not Clear; Neut. = Neutral or Non-significant

3.3. Firm characteristics

Firm characteristics, such as assets and performance-indicators are inputs in established valuation-models. We coded ten *Firm Characteristics*, more drivers than any other thematic-category. This is due to popularity of classical valuation-models (and variations thereof). *Firm Characteristics* consists of: Intellectual Property and Intangible Assets; Other Assets; Performance—Sales and Revenue; Performance—EBIT and EBITDA; Performance—Other Performance Metrics; Country; Sector; Business-model; Stage of startup; and, Complementarity and Business Alliances.

3.3.1 Intangible assets and intellectual property

Intangible assets and intellectual property, which proxy knowledge-generation-capability, are among the most-salient firm-characteristics. Baum and Silverman (2017), Hoenen et al. (2014), and Czarnitzki et al. (2016) find that number of patents and patent-applications drives valuations. This

emerges regardless of patent-value, as also demonstrated by Greenberg (2013). A divergent-view is Hand (2005): In biotech-startups, round-by-round value-relevance of patents is low.

An important aspect of IP-related assets is asset-complementarity (including with IP-assets). Zhou et al. (2016) find that patents and trademarks not only have direct-effects on VC-financing, but also synergetic-effects. Meanwhile, trademarks signal market-access and marketing-capabilities— thus increasing VC-funding—but both acting in-unison have positive valuation-synergies.

3.3.2 Financial information: sales, EBIT, EBITDA and management control systems

While EBIT and sales are Discounted-Cash-Flow (DCF) model-inputs, Manigart et al. (2000) outlines that EBIT and earnings are scaling-denominators used in relative valuation. Sievers et al. (2013) find both revenues and cash to have positive valuation-impact, pointing explicitly to relative-valuation approaches. Similarly, Wright and Robbie (1996), Hand (2005), and Smith and Cordina (2014) find financial-statement performance-measures increasingly-impactful as startups mature. Conversely, Davila and Foster (2005), find that explanatory-power of firm-size outweighs that of revenue. Administrative-expenses also undermine valuation (Armstrong et al., 2005). Management control systems have positive valuation-impact, according to Davila et al. (2003, 2015), who highlight that valuation is especially impacted in highly-competitive or high-growth environments.

3.3.3 Country and sector

Country and Sector impacts are captured in relative-valuation models. Gompers and Lerner (2000) find that valuations are higher in computer hardware, communications, medical, and semiconductor industries, as well as in key geographic regions of the US. Meanwhile, Gompers et al. (2018) argue that while team is important to startup success, technology, business model, and industry also play an important role. Dealing with both country-impact and sector-impact, Helmann and Thiele (2015), identify explicitly both cross-country and cross-sector differences in

legal investor-protections. In equilibrium, lower investor-protection would lead—theoretically—to a thinner angel-market, lower valuations, and therefore less entrepreneurial-entry.

The legal view is reinforced by Kaplan et al (2007), who find that pre-money startup-valuations vary across legal regimes; weaker outside investor-protection leads to smaller and less-liquid capital-markets, more concentrated corporate-ownership, lower corporate-dividends, and lower valuations.

Keuschnigg and Nielsen (2004), explore how capital-gains taxes and subsidies to startup costs affect venture capital-backed entrepreneurship. Because venture-returns determine incentives to found firms and add value in the startup-phase, tax-levels negatively-impact startup-valuation even if only collected from mature firms.

Another way Country impacts startup-valuation is via local-preferences in valuation-approaches, (Lockett et al. 2002, Manigart et al. 2000). For example, late-stage UK investors emphasize P/E multiples, while late-stage French investors place emphasis on third-party bids or on book-values (Manigart et al. 2000). Meanwhile, Wright et al. (2004) find DCF-valuation more prominent in German civil-law jurisdictions than common-law jurisdictions. Popularity of DCF-valuation is also expressed by Dittmann et al. in Germany, Pintado et al. (2007) in Spain, Sander and Koomagi (2007) in Estonia, and Karsai et al. (1997) and (1998) in Hungary and Poland.

Manigart et al. (1997) discuss national-level investor-focus on different information-sources, with French VCs placing emphasis on personal-references and entrepreneur track-record, while Belgian, British, and Dutch VCs attach more weight to their due-diligence reports.

Additionally, these can interact with and complement other valuation-drivers. For example, Zheng et al. (2010), who find sector-coefficient largest in the biotechnology-sector's protein-engineering segment, also describe sector-specific human-capital (i.e., human-capital that interacts with sector and industry-effects to drive firm-value).

3.3.4 Stage of startup and product development

Hsu (2004) points out that early-stage investors weigh heavily in determining subsequent-investors (via referrals or reputation), which positively impacts valuation directly and also via network-access and coaching, indirectly impacting valuation. Zheng et al. (2010) examine relative temporal-impact of innovative-capability and inter-firm network, finding that the positive-effect of network-status diminishes as firms mature, an interactive valuation-impact.

Yoo et al. (2012) outline that product-development-stages have valuation-impact. Stage of Startup has positive valuation-impact, owing to lower information-asymmetries and discount-factors, innovative-capability-sensitivity and inter-firm network fades as firms mature.

3.3.5 Business model

Issues covered include product-diversity: Stretzki and Schulte (2013), control-for and find mildly-positive non-significant effects. Siegel et al (1993) find that high-growth firms are characterized as more-likely to have diversification-plans. Another issue is B2B vs. B2C focus, which is controlled-for by Rohm et al. (2018), while innovation-strategy is explored by Schwienbacher (2008), whose model describes valuation driven by profit-maximization-effects of innovation-level-choice.

3.3.6 Complementarity and strategic alliances

Firm-level complementarity between firm and acquirer/investor drives both idiosyncratic valuation and investor-firm relations. Complementarity is a factor when acquirer/investor strategy and synergy-potential are considered. Literature exploring the corporate-venture-capital (CVC) landscape often elaborates on complementarity in CVC-selection and CVC-valuation. According to Chemmanur et al. (2014), CVCs pursue strategic-objectives of parent-companies and their fund managers' compensation is tied to parent-company performance (providing incentive for CVCs to select highly-complementary startups, which positively-impact valuation). According to Masulis and Nahata (2009), complementary CVC investors have substantial strategic-incentives to provide

active support, since CVCs are not only concerned with a startup's share-valuation, but also with parent-company-impact. This drives startup-growth and accelerates valuation-development-rate. Chemmanur et al. (2014) support the idea that synergies play positive roles in CVC valuation. Startups enjoying technological-synergies with a CVC's parent-firm generate more patents than independent venture capital (IVC)-backed firms. These findings are reinforced by Rohm et al. (2018), who find that CVCs with strategic-motivations can help investees aggressively-scale by providing complementary-assets for startups. In exchange, investee startups are prepared to accept valuation-discounts. Potential value-enrichment from complementary-investors is thus paid-for by valuation-discount. Masulis and Nahata (2009) observe higher startup purchase-prices by competing CVCs relative to complementary CVCs, corroborating Chemmanur et al. (2014). Strategic alliances between startups and suppliers, distributors, or other parts of supply-chains also increase valuation, as outlined by Nicholson et al. (2005), Miloud and Cabrol (2011), Sievers et al. (2013), and Hand (2005). However, Zhang et al. (2010) find that valuation-impact of alliances diminishes as startups mature.

Table 7 indicates that *Firm Characteristics* have generally-positive or mildly-positive valuation-impact. The exception to this is Business Model, whose valuation-impact is tracked as "Not Clear".

Table 7 Firm characteristics

Author	Year	Assets - IP	Assets - others	Performance - sales	Performance - EBIT and EBITDA	Performance - others	Impact of the country	Impact of the sector	Impact of the business-model	Stage of the start-up	Complementarity and Business Alliances
Armstrong, C.; Davila, A.; Foster, G.	2006	MP	P	P		P				P	
Audretsch, David B.; Link, Albert N.	2012	P						N			
Baeyens, K.; Vanacker, T.; Manigart, S.	2006						P	NC			
Batjargal, B.; Liu, M.	2004		Interactive								
Bayar, O.; Chemmanur, T. J.	2002							P			P
Berk, J. B.; Green, R. C.; Naik, V.	2004					P				P	
Birch, K.; Chiappetta, M.; Artyushina, A.	2020	P	P			P			P		
Black, B. S.; Gilson, R. J.	1998						N	P			
Black, E.	2003		P	Interactive	Neut	P				Interactive	
Block, J. H.; De Vries, G.; Schumann, J. H.; Sandner, P.	2014	P, Interactive		Control, P		Parabolic		Control	Parabolic	P	
Boucher, C.	2009			P							
Bygrave, W. and Timmons, J.	1985						P				
Chemla, G.; Habib, M. A.; Ljungqvist, A.	2015										
Chemmanur, T. J.; Chen, Z.	2014							P		P	
Chemmanur, T. J.; Loutskina, E.; Tian, X.	2014	Dependent	Control	Control		NC		P			VP
Collewaert, Veronique; Manigart, Sophie	2016	MP	P							P	
Colombelli, A.	2010	P						Control	P	Control, N	
Cumming, D. J.	2005						N	P	N		
Cumming, D. J.	2008						NC	Control		Neut	
Cumming, D. J.; Dai, N.	2011							Control		P	
Cumming, D. J.; Zambelli, S.	2017			Dependent	Dependent		N	Control			
Davila, A.; Foster, G.; Jia, Ning	2015							P			
de Rassenfosse, Gaetan; Fischer, Timo	2016	P				P		Control	Control		
Dhochak, M.; Doliya, P.	2020							P			P
Dittmann, I.; Maug, E.; Kemper, J.	2004		P	P	P	P					
Erraert, F.	2006		P	P	P						
Fitza, M.; Matusik, S. F.; Mosakowski, E.	2009							Neut			
Fulghieri, P.; Sevilir, M.	2009							P			Neut
Gompers, P.; Gornall, W.; Kaplan, S. N.; Strebulaev, I. A.	2020	P						P	P	NC	
Gompers, P.; Kovner, A.; Lerner, J.; Scharfstein, D.	2008							Interactive			
Gompers, P.; Lerner, J.	2000			P				P		P	
Greenberg, G.	2013	VP, Interactive		VP				Dependent		Interactive	
Hand, J. R. M.	2005	N		MP		Neut					
Hellmann, T.	2002	P						NC			P
Hellmann, T.; Thiele, V.	2015	Dependent					P				
Hering, T.; Toll, Christian; Schneider, J.	2012							N	N		
Heughebaert, A.; Manigart, S.	2012	Control, Neut				Neut		P			
Hoenen, S.; Kolympiris, C.; Schoenmakers, W.; Kalaitzandonakes, N.	2014	P								Interactive, P	
Hottenrott, H.; Hall, B. H.; Czamitzki, D.	2016	VP				P		P			
Houlihan Valuation Advisors; Venture One	1998							P		P	
Hsu, D. H.	2007	Control	P					P			
Hsu, D. H.	2004	Control, MP								P	

Janney, J. J.; Folta, T. B.	2003	P										
Kaplan, S.; Martel, F.; Stromberg, P.	2007						P					
Keeley, R. H.; Punjabi, S.; Turki, L.	1996			Neut				P				
Keuschnigg, C.; Nielsen, S. B.	2004							N				
Korteweg, A.; Sorensen, M.	2010			P	P						Interactive	
Lerner, J.	1994	P							Control			
Lockett, A.; Wright, M.; Sapienza, H.; Pruthi, S.	2002		P			P		Interactive			Interactive	
Manigart, S.; De Waele, K.; Wright, M.; Robbie, K.; Desbrières, P.; Sapienza, H.; Beekman, A.	2000		P	P	P			NC				
Manigart, S.; Wright, M.; Robbie, K.; Desbrières, P.; De Waele, K.	1997		P	P				Interactive				
Masuis, R. W.; Nahata, R.	2009	P					P		Control		N	N
Mills, R. W.	1998				P				P	P		
Miloud, T.; Cabrol, M.	2011								P		P	
Moghaddam, K.; Bosse, D. A.; Provance, M.	2016											Parabolic
Norbäck, Pehr-Johan; Persson, Lars	2009									P	P	P
Palan, R.	2013		P	P	P							
Pintado, T.R.; de Lema, D. G. P.; Van Auken, H.	2007			NC	NC						NC	
Pocztar, S.; Shapis, M.	2018			Control, N					Interactive, N			
Pollock, T. G.; Chen, G.; Jackson, E. M.; Hambüick, D. C.	2010			Control, P					Control			
Röhm, P.; Köhn, A.; Kuckertz, A.; Dehnen, Hermann S.	2018								P	Control	P	N
Schwienbacher, A.	2008		N						P	NC		
Schwienbacher, A.	2013										N	
Siegel, R.; Siegel, E.; MacMillan, I. C.	1993		P				P		P	P		
Sievers, S.; Mokwa, C. F.; Keienburg, G.	2013	P	P	P			P		Control		Neut	P
Smith, J.A.; Cordina, R.	2014	P, Interactive	P, Interactive									
Streletzki, J.G.; Schulte, R.	2013	MP							Control, P	MP	N	P
Tyebjee, T. T.; Bruno, A.V.	1985	P							P			
Tyebjee, T.; Vickery, L.	1988							P	P			
Wright, M.; Robbie, K.	1996		P	P	P	P			P		Interactive	
Wright, M.; Robbie, K.	1998		P	P								
Yang, Yi; Narayanan, V. K.; Zahra, Shaker A.	2009										NC	NC
Yoo, C.; Yang, D.; Kim, H.; Heo, E.	2012											P
Zacharakis, A.; Shepherd, D. A.	2005	P							P			
Zhang, J.	2011										P	
Zheng, Y.; Liu, J.; George, G.	2010	VP							Control, P		Not interactive, MN	VP
Zhou, H.; Sandner, P. G.; Martinelli, S. L.; Block, J.H.	2016	VP, Interactive	P, Interactive						P	N		
Totals : Peer-review literature			27	16	21	12	16	10	44	14	31	12
<i>Summarized Driver Direction in Model</i>		++	+	+	+	+	+	+/=	+	NC	+/=	+/=

Legend: P = Positive; MP = Mildly-Positive; VP = Very Positive; N = Negative; MN = Mildly-Negative; VN = Very Negative; NC= Not Clear; Neut. = Neutral or Non-significant

3.4. Investor characteristics

The role played by *Investor Characteristics* in startup-valuation is another major theme in the literature (Köhn (2018)). Investor characteristics affect valuations observed in VC deals via specialization, synergies, network-value, coaching, and reputational-effects. Another investor characteristic is the relationship among investors. Since coaching plays a role in startup development, involvement of investors specializing in specific industries or early-stage firms increase the startup's value to subsequent investors, and mitigate failure-risk.

Investor Characteristics consist of eight drivers: Nature of the Investor, Quantity of Cash under Management, Investor Nationality, Investor Reputation, Investor History and Experience, Potential Other Interest, Investment Strategy, and Sector Specialization of VC.

3.4.1 Nature of the investor

Masulis and Nahata (2009) observe significantly-higher purchase-prices per startup share paid by competing CVCs—where startup and CVC parent are potential competitors—compared with complementary CVCs where startup and CVC parent have clear operational synergies. Additionally, Masulis and Nahata (2009) also outline that CVCs are willing to give up board seats and pay higher prices for access to new ventures compared to independent VCs. This finding is reinforced by Hand (2005), where positive valuation-effects derive from CVC investment in the biotech landscape. Sievers et al. (2013), meanwhile, find that CVC lead-investors do not significantly impact valuations in the German startup landscape from which their sample is drawn. Hornuf and Neuenkirch (2017), who examine pricing of equity crowdfunding shares, find that investor sophistication influences backers' willingness to pay.

Business angels also have their own outlook. Block et al (2014), who explore the effects of trademarks on startup-valuation, find that controlling for business angels demonstrates the robust positive valuation-impacts of business angel participation. This is reinforced by Hellman and Thiele (2015), who describe strong investor-side complementarity of value-adding activities subsequent

to business angel involvement in a startup, positively impacting valuation. In contrast, Heughebaert and Manigart (2012) explains that investors with stronger bargaining-power are able to impose lower valuations.

3.4.2 Quantity of cash under management

Scale of investor-assets impacts valuation. While Cumming and Zambelli (2017) find that larger cash under management means less VC direct-monitoring, Cumming and Dai (2010) find a convex (U-shaped) relationship between fund size and firm-valuation. Both findings indicate potential VC industry diseconomies-of-scale.

3.4.3 Investor reputation

Table 8 describes Reputation as the second-most extensively-covered investor-characteristic within peer-reviewed literature. Overall, its valuation-impact is ambiguous. Investor reputation drives valuation via signaling-effect. According to Hsu (2004), entrepreneurs pay a premium to “lease” the VC's reputation in order to access external resources. This view is reinforced by Cumming and Dai (2011) and Bengtsson and Sensoy (2011). Zheng et al. (2010) explain that, when faced with uncertainty and incomplete information about technology startups, investors rely on prestige of partners (i.e., network status) to infer quality. Although the ensuing early-stage positive impact is substantial, the effect diminishes as the startup matures. Essentially, early-stage startups with prestigious investors attract higher valuations from subsequent investors.

3.4.4 Investor history and experience

Gompers et al. (2010) outline that more experienced VCs assign higher valuations. Keuschnigg and Nielsen (2004) find that experienced VCs add to startup value via coaching. Examples also include interactive-effects such as Gompers et al. (2008) and Nikolaus et al. (2008), who find that

experienced investors are more sensitive to sectoral-market-signals and entrepreneur experience, respectively. With experienced investors, these drivers have stronger positive impacts.

Collewaert and Manigart (2016) find that while business-angel experience drives startup-valuations, different types of experience have diverging valuation-impact, with years of entrepreneurial-experience and prior angel-investments having largest valuation-impact, while legal or financial-experience have no impact.

3.4.5 Investment strategy

While investors may undertake strategies to specialize, maximize revenues, optimize investment or market-timing, and manage risks, valuation-impact on early-stage firms can be more easily influenced by investor-strategy than more mature firms. Hellmann and Thiele (2015) argue that investor preference for early-stage exists (i.e., low-risk-low-return strategies), and can negatively-impact startup-valuation. In contrast, Heughebaert and Manigart (2012) find that higher-risk investment strategies explain lower valuations observed for university and government-VC firms.

3.4.6 Sectoral specialization of investors

Investor-specialization drives startup-valuations. Gompers et al. (2008) outline that industry-specialization is associated with higher investment-levels, once investor-experience is controlled-for. Additionally, Bayar and Chemmanur (2011) outline that investor-specialization has positive valuation-impact via the acquisition process, since specialized investors have more industry-expertise than IPO-investors, allowing them to better-identify high-value investments. Furthermore, Ali et al. (2014) find that withdrawal of specialist-VCs has smaller negative valuation-impact than generalist-VCs.

Table 8 Investor characteristics

Author	Year	Nature of the investor	Quantity of cash under management	Investor's nationality	Investor's reputation	Investor's history/exp	Potential other interest (corporate relation, etc.)	Investment strategy	Sector Specialization of VC
Baeyens, K.; Vanacker, T.; Manigart, S.	2006							NC	
Bayar, O.; Chemmanur, T. J.	2011					P			P
Beugtsen, O.; Sensoy, B. A.	2011				P	P			
Berk, J. B.; Green, R. C.; Naik, V.	2004					P			
Black, B. S.; Gilson, R. J.	1998				P				
Block, J. H.; De Vries, G.; Schumann, J. H.; Sandner, P.	2014	MN				P			
Brander, J. A.; Amit, R.; Antweiler, W.	2002				P				
Broughman, B. J.; Fried, J. M.	2012				MN				
Chan, Y.	1983					P			P
Chemmanur, T. J.; Chen, Z.	2014	N			NC	NC			
Chemmanur, T. J.; Loutsikina, E.; Tian, X.	2014	P			Control, MN	Control, MN	P	P	Control, MP
Collewaert, Veronique; Manigart, Sophie	2016				NC	P			
Cumming, D. J.	2008				P				
Cumming, D. J.	2005	NC		NC					
Cumming, D. J.; Dai, N.	2011		Parabolic		N				
Cumming, D. J.; Zambelli, S.	2017	N	N			MP	Control		
Fitza, M.; Matusik, S. F.; Mosakowski, E.	2009	P							
Franke, N.; G. M.; Harhoff, D.; Henkel, J.	2008					Interactive, P			
Fulghieri, P.; Sevilir, M.	2009								P
Gompers, P.; Kovner, A.; Lerner, J.; Scharfstein, D.	2008					Interactive, P			MP
Greenberg, G.	2013				P				
Hellmann, T.	2002	NC				Modeled		P	
Hellmann, T.	2006				N				
Hellmann, T.; Thiele, V.	2015	P				P		N	
Heughebaert, A.; Manigart, S.	2012	P		Control, Neut	Control, Neut		Neut	N	
Hornuf, L.; Neuenkirch, M.	2017	Neut				P			
Hsu, D. H.	2007				N				
Hsu, D. H.	2004				N	N			N
Kannianen, V.; Keuschnigg, C.	2003					P			
Keuschnigg, C.; Nielsen, S. B.	2004					P			
Masulis, R. W.; Nahata, R.	2009	P			N		P	P	
Mutnieks, C. Y.; Cardon, M. S.; Sudek, R.R.; White, T. D.; Brooks, W.T.	2016					MP			
Norback, Pehr-Johan; Persson, Lars	2009	P							
Pintado, T.R.; de Lema, D. G. P.; Van Auker, H.	2007					Neut			
Pollock, T. G.; Chen, G.; Jackson, E. M.; Hambrick, D. C.	2010				P	P			
Röhm, P.; Köhn, A.; Kuckertz, A.; Delnen, Hermann S.	2018	P			N	N	N	N	
Schwiebacher, A.	2008				Dependent				
Schwiebacher, A.	2013	N			P	P		P	
Sievers, S.; Mokwa, C. F.; Keienburg, G.	2013	Neut							
Smith, J.A. Cordina, R.	2014					P, Interactive			
Tykvová, T.	2007				Dependent				
Wright, M.; Robbie, K.	1996	Interactive							
Wright, M.; Robbie, K.	1998				NC				
Zacharakis, A.; Shepherd, D. A.	2005							NC	
Zheng, Y.; Liu, J.; George, G.	2010				P				
Zhou, H.; Sandner, P. G.; Martinelli, S. L.; Block, J.H.	2016					P			
Totals : Peer-review literature		19	2	2	21	26	7	11	7
<i>Summarized Driver Direction in Model</i>		-/=	=	NC	-	+	+/=	-/=	=

Legend: P = Positive; MP = Mildly-Positive; VP = Very Positive; N = Negative; MN = Mildly-Negative; VN = Very Negative; NC= Not Clear; Neut. = Neutral or Non-significant

While coverage of *Investor Characteristics* is limited, valuation-impact is mixed overall. Whereas Investor History and Experience have positive valuation-impacts, Sector Specialization and Quantity of Cash under Management are neutral. Each is the object of studies tracking their valuation-impacts as positive, while others track them as negative, neutral, or parabolic. Investor Reputation is tracked as having negative valuation-impact.

3.5. Market conditions

Market Conditions consists of six drivers, which describe context: Macroeconomic Situation, Sectoral Economic Situation, Quantity of Cash on Market, Business Cycle, Type of Market, and Agency Costs and Asymmetric-Information.

3.5.1 Macroeconomic situation

Macroeconomic situation is expressed via output levels, risk-free rates, and financial-market returns. While output levels and financial market-returns serve as benchmarks for investments at all risk-levels, risk-free rates drive discounting. Examples include Gornall and Strebulaev (2020) on the valuation-role of risk-free rates, as well as Hsu (2007), who uses year dummies and observes that valuations tend to be higher when fund inflows are high. Armstrong et al. (2006) control for a benchmark financial index, finding its valuation-impact positive and significant. Moreover, a quarter of peer-reviewed studies that include macroeconomic conditions do so as control variables to examine other factors. Examples include Armstrong et al. (2006) and Block et al. (2014).

3.5.2 Sectoral economic situation

Classically-oriented sources such as Cumming and Zambelli (2017) control for industry-level book-to-market ratios, while Mills (1998) elaborates on sectoral technological-innovations for case-study purposes and more recent literature explores the role of sectoral-effects and sectoral economic situation. Assessments of growth-potential and strategic-potential in a given market are drivers of both valuation-measurement and VC selection. Industry growth rates are taken into account by several studies, including Sievers et al. (2013), Miloud and Cabrol (2011), and Dittmann et al (2004). Aside from sectoral-multipliers, valuations of publicly-traded firms in the same industry contain valuation-relevant information. Hand (2005, 2007) and Lerner (1994) both find that biotech venture valuations are driven by valuations of publicly-traded biotech firms. Sectoral Economic Situation also includes examining market-structure and sectoral-competition. Hellman and Thiele (1998) outline that sector-level product-market competition and intellectual-property landscape, including the rate at which IP becomes obsolete, are considered by investors when assessing valuation and startup-failure-likelihood.

3.5.3 Quantity of cash on market

Quantity of cash on market has an unambiguously-positive valuation-impact, as shown in Table 9. Specific examples include theoretical models, such as Inderst and Muller (2004), where the model predicts that pre- and post-money valuations are positively-related to level of capital-supply and capital-market competition, investment profitability, and capital-market transparency, while negatively-related to entry costs. Empirical examples include Fulghieri and Sevilir (2009), where Quantity of Cash affects entrepreneur-effort, driving future-valuations.

3.5.4 Business cycle

The role played by business-cycles is explored in-detail in the literature. Examples include Gompers and Lerner (2000), who characterize the early internet-bubble period by higher average public equity-values and weaker inflows to VC funds, as well as Gompers et al. (2008), who find correlation between Q and investment-activity very high throughout their observation-period, and Schwiabacher (2013), who finds that during boom-periods, institutional investors channel large amounts of capital to VC funds. Also, some studies find that other drivers interact with Business Cycle. Examples include Gaviols and Schwartz (2011), who find valuation-impacts of financial variables to be business-cycle dependent, because reliance on multiples-valuation systematically under-values or over-values firms in an industry or capital-market, as business-cycles evolve.

3.5.5 Agency costs and information asymmetry

This driver negatively influences investor-returns and risk-levels. Examples include Schwiabacher (2013), who outlines that, similar to adverse-selection theory, funding by generalists demands larger risk-compensation, implying lower valuations. Some contributions qualify information-asymmetry and agency costs as “not clear”, since a sizable share of literature examines their role in relation to investor-behavior and contracting rather than valuation. While indirect-impact is clear (via effect on contracting and investor-behavior), scale and scope is not made-explicit in some studies.

Table 9 Market conditions

Author	Year	Macro Economic situation	Sectorial economic situation	Quantity of cash on the VC market	Business Cycle	Agency Costs and Asymmetric Information
Aggarwal, V. A.; Hsu, D. H.	2007		MP	Interactive		
Armstrong, C.; Davila, A.; Foster, G.	2006	Control, P				
Audretsch, David B.; Link, Albert N.	2012	N				
Baeyens, K.; Vanacker, T.; Manigart, S.	1998		NC			
Bayar, O.; Chemmanur, T. J.	2011		NC			NC
Bengtsson, O.; Sensory, B. A.	2011		P			
Benquet, Foureault, F., and Lagneau-Ymonet	2018				NC	
Berk, J. B.; Green, R. C.; Naik, V.	2004	P				
Bickers, C.	2010		Control			
Black, E.	2003	P	P			
Block, J. H.; De Vries, G.; Schumann, J. H.; Sandner, P.	2014	Control, P	P	Control, P		
Boucher, C.	2003		P			
Brander, J. A.; Amit, R.; Antweiler, W.	2002		P			
Broughman, B. J.; Fried, J. M.	2012	Control, Neut				
Bygrave, W. and Timmons, J.	1985	P			P	
Chan, Y.	1983					NC
Chemla, G.; Habib, M. A.; Ljungqvist, A.	2007					N
Chemmanur, T. J.; Chen, Z.	2014		P			N
Chemmanur, T. J.; Loutskina, E.; Tian, X.	2014		Control			
Cochrane, J. H.	2005	MP	Control, Neut			
Collewaert, Veroniek; Manigart, Sophie	2016	Neut.			Neut.	
Colombelli, A.	2010		NC			
Cumming, D. J.	2005	MN				N
Cumming, D. J.; Dai, N.	2011		Control			
Cumming, D. J.; Zambelli, S.	2017	Control				N
Davila, A.; Foster, G.; Jia, Ning	2015		Interactive			
Dittmann, I.; Mang, E.; Kemper, J.	2004	P	P			
Dhochak, M.; Dolva, P.	2020		P			
Ewens, Michael; Jones, Charles M.; Rhodes-Kropf, Matthew	2013		P			N
Fitza, M.; Matusik, S. F.; Mosakowski, E.	2004		Neut		P	
Fulghieri, P.; Sevilir, M.	2009			P		
Gariou, I.; Schwartz, D.	2011	Interactive, P			Interactive	
Gompers, P.; Gornall, W.; Kaplan, S. N.; Strebulaev, I. A.	2020		P			
Gompers, P.; Kovner, A.; Lerner, J.; Scharfstein, D.	2008	Interactive, P	Interactive, P		Variable	
Gompers, P.; Lerner, J.	2000	P	P	P	P	
Gornall, W.; Strebulaev, I. A.	2020	P				
Hand, J. R. M.	2005		P	Neut		
Hand, J. R. M.	2007		P			
Hellmann, T.	2002					NC
Hellmann, T.	2006				N	N
Hellmann, T.; Thiele, V.	2015	Control	Control	P		
Henghebaert, A.; Manigart, S.	2012	P	N			
Hornuf, L.; Neuenkirch, M.	2017	P				
Houlihan Valuation Advisors; Venture One	1998		P			
Hsu, D. H.	2007	MP				
Inderst, R.; Müller, H. M.	2004	P	P	P	P	
Keeley, R. H.; Punjabi, S.; Turki, L.	1996	P				
Kirilenko, A. A.	2001					NC
Korteweg, A.; Sorensen, M.	2010			P	P	
Korteweg, A.; Nagel, S.	2016	P				
Lerner, J.	1994		Control, P			P
Lockett, A.; Wright, M.; Sapienza, H.; Pruthi, S.	2002					
Manigart, S.; De Waele, K.; Wright, M.; Robbie, K.; Desbrières, P.; Sapienza, H.; Beekman, A.	2000			P		
Masulis, R. W.; Nahata, R.	2009					P
Mills, R. W.	1998	P	P			
Miloud, T.; Cabrol, M.	2011		P			
Moghaddam, K.; Bosse, D. A.; Provance, M.	2016				P	
Norbäck, Pehr-Johan; Persson, Lars	2009		P			
Palan, R.	2013				VP	
Pintado, T.R.; de Lema, D. G. P.; Van Auker, H.	2007		Neut			
Rohm, P.; Köhn, A.; Kuckertz, A.; Dehnen, Hermann S.	2018					N
Schwienbacher, A.	2008		P			
Schwienbacher, A.	2013			MP	P	N
Siegel, R.; Siegel, E.; MacMillan, I. C.	1993		P			
Sievers, S.; Mokwa, C. F.; Keienburg, G.	2013		Control, Neut	P		
Tvebjee, T. T.; Bruno, A.V.	1984	P	P			
Tvebjee, T.; Vickery, L.	1988	P	P	P		
Wright, M.; Robbie, K.	1998					N
Zacharakis, A.; Shepherd, D. A.	2005		VP, interactive			
Zheng, Y.; Liu, J.; George, G.	2010	Control, P	Control, P			
Zhou, H.; Sandner, P. G.; Martinelli, S. L.; Block, J.H.	2016		Control			
Totals: Peer-review literature		27	45	13	14	20
Summarized Driver Direction in Model		++	++	++	+	--

Legend: P = Positive; MP = Mildly-Positive; VP = Very Positive; N = Negative; MN = Mildly-Negative; VN = Very Negative; NC= Not Clear; Neut. = Neutral or Non-significant

Both Macroeconomic Situation and Sectoral Economic Situation have strong positive valuation-impacts, while Agency Costs and Asymmetric have a strongly-negative impact. Business Cycle, however, has milder, positive impact.

3.6. Deal conditions

Deal Conditions include clauses of investment and shareholder agreements. Their relationship with startup-valuation is endogenous and often-indirect rather than strictly-deterministic. *Deal Conditions* aggregates eight drivers that affect observed valuations: Syndication and Investor Competition; Shareholder Agreement Clauses; Funding Rounds; Timing of Deal; Preferential Shares; Other Mechanisms for Investor & ROI Protection; and Exit Expectations and Strategies. *Deal Conditions* are primarily mentioned in peer-reviewed studies published in finance journals.

3.6.1 Syndication and investor competition

Table 10 describes Investor Syndication as a major literature-topic. Cumming (2005) explains that syndication offers several benefits. In terms of monitoring and mitigation of information-asymmetries, they share screening-capacity to mitigate adverse-selection costs and manage risks, impacting valuation positively. Syndication also enables risk-sharing. Mitigation of information-asymmetries and risks increases valuation. Cumming (2005) also outlines a positive-relationship between number of a firm's capital-suppliers and growth-opportunities, increasing future-value.

3.6.2 Shareholder agreement clauses

Startup-valuations can be affected by investors paying for control-rights, as described by Kirilenko (2001). This is also outlined by Black and Gilson (1998) and by Kannianen and Keuschnigg (2003). Startup success and value depend on entrepreneur-effort and investor-effort, a dynamic described by Hellmann (2006). In terms of risk-management, Chemala et al. (2007) outline that Shareholder Agreement Clauses act as implicit put-and-call options (for which investors would essentially pay a valuation premium), while Gornall and Strebulaev (2020) add that Preferential Shares drive startup-over-valuation via strong cashflow-rights.

3.6.3 Funding rounds and follow-on financing

Table 10 indicates that Funding Rounds emerges in literature very often: in 17 times peer-reviewed studies. Studies that use rounds, or the dynamics thereof consider it a driver with positive valuation-impact. For example, Hellmann and Thiele (2015), examine business angel and VC interaction, and find that VCs award higher valuations when a startup has experienced previous business angel rounds. Houlihan Valuation Advisors/VentureOne (1998) reinforces this view, logically finding earlier financing rounds to be associated with lower startup-valuations. Broughman and Fried (2012) argue that inside-rounds (i.e., subsequent funding-rounds including only prior investors) also take place at relatively-higher valuations.

Faust (2013) describes how completed funding rounds are seen as milestones that add value to the firm, while Hellmann (2001) points out that multiple rounds affect the firm's discount-rate. Essentially, an indirect, positive valuation-impact may be inferred in these cases.

3.6.4 Timing of deal

Although sparsely-covered in the literature, Timing of Deal—the matter of *when* investment-deals are made relative to the internal needs of entrepreneurs and investors' constraints—has a mildly-positive valuation-impact. Examples in the literature include Korteweg and Nagel (2011), who outline that funding rounds occur irregularly, being driven by cashflows of VC funds arriving at irregular intervals throughout the life of the fund, which influences the stochastic discount-factor. According to Janney and Folta (2003), firms experience higher abnormal returns on VC placements when the last private equity placement was issued a long time earlier. Essentially, firms have stronger performance with respect to VC investment—hence higher valuations—when the startup has operated longer without any further VC investment.

3.6.5 Preferential shares

While Preferential Shares are employed by investors, their coverage in literature is underwhelming. While investor-side risk-management implications are clear, given uncertainties modeled by Akerlof (1970), and their use detailed by Kaplan and Stromberg (2002), valuation-effects are seldom-explored. Chemmanur and Chen (2014) outline that under equilibrium-contracts, which can be implemented via convertible debt (or, debt with warrants) or via convertible preferred equity, investors exert less effort than in later-stage financing. Nevertheless, Gornall and Strebulaev (2020) argue that strong cashflow-rights in preferential shares drive unicorn valuations.

3.6.6 Other mechanisms for investor & ROI protection

This driver consists of various investor-protection mechanisms, such as arm's-length licensing (Aggarwal and Hsu 2007); board-presence (Bengtsson et al. 2011); and fixed-fraction contracts, whereby inside-VCs provide a fraction of future capital required by the firm and then receives the same fraction of the firm's total payoffs (Cumming 2005), which has a neutral valuation-impact. Novel theoretical examples include Kirilenko (2001), who investigates how optimal-allocation of control-rights can be implemented through indirect mechanisms, either via a competitive market for control or bilateral bargaining procedures. Here, valuation would be impacted as investors pay for control. Entrepreneurs value control and demand that price compensates for loss-of-control, whereas investors are interested in future payoffs and are willing to pay a premium.

3.6.7 Exit expectations and strategies

A key topic explored by the literature is likelihood of IPO-exit *vis-à-vis* likelihood of acquisition-exit. While entrepreneurs prefer IPO-exits, which keeps firms independent and allows entrepreneurs control-retention after VC-exit, investors prefer acquisition-exits, yielding higher returns. By ceding exit-rights, VCs require more cashflow-rights, according to Schwienbacher (2008). Essentially, investors might pay higher valuations to secure acquisition-exit.

Table 10 Deal Conditions

Author	Year	Syndication and Investors Competition	Shareholder's agreement clauses	Funding Round	Timing of the deal	Duration of the deal	Preference shares in the deal?	Other mechanisms for investor's protection ROI	Exit expectations and strategies
Aggarwal, V. A.; Hsu, D. H.	2007							Interactive	
Armstrong, C.; Davila, A.; Foster, G.	2006			NC					
Bayar, O.; Chemmanur, T. J.	2011								Dependent
Bengtsson, O.; Sensor, B. A.	2011	P	Dependent					NC	N
Berglof, E.	1994		Dependent					P	NC
Black, B. S.; Gilson, R. J.	1998		P						P
Block, J. H.; De Vries, G.; Schumann, J. H.; Sandner, P.	2014	control, P		Interactive					
Brander, J. A.; Amit, R.; Antweiler, W.	2002	P				Neut			
Broughman, B. J.; Fried, J. M.	2012					P			
Chemla, G.; Habib, M. A.; Ljungqvist, A.	2007		P						
Chemmanur, T. J.; Chen, Z.	2014		Dependent	P	P		N		
Chemmanur, T. J.; Loutskina, E.; Tian, X.	2014			N					
Cochrane, J. H.	2005			Dependent					
Collewaert, Veroniek; Manigart, Sophie	2016			Control, Neut.					
Cumming, D. J.	2005	P	NC	P			Dependent	P	
Cumming, D. J.	2008		P	control, P					Dependent
Cumming, D. J.; Zambelli, S.	2017		Control, Neut						
Davila, A.; Foster, G.; Jia, Ning	2015			control					
de Rassenfosse, Gaetan; Fischer, Timo	2016	Dependent		Dependent					
Dittmann, I.; Maug, E.; Kemper, J.	2004					P			
Gompers, P.; Gornall, W.; Kaplan, S. N.; Strebulaev, I. A.	2020	Dependent							NC, P
Gompers, P.; Lerner, J.	2000				P				
Gornall, W.; Strebulaev, I. A.	2020		P				VP	P	P
Greenberg, G.	2013			Interactive, MP					
Hellmann, T.	2006		VN						VN
Hellmann, T.; Thiele, V.	2015			P					N
Heughebaert, A.; Manigart, S.	2012	P							
Hoenen, S.; Kolympiris, C.; Schoenmakers, W.; Kalaitzandonakes, N.	2014	P							
Hornuf, L.; Neuenkirch, M.	2017				P				
Houlihan Valuation Advisors; Venture One	1998			P					
Hsu, D. H.	2007			MN					
Hsu, D. H.	2004			Dependent					
Inderst, R.; Müller, H. M.	2004		Variable						
Janney, J. J.; Folta, T. B.	2003			MP	P				
Kannianen, V.; Keuschnigg, C.	2003		P						
Keuschnigg, C.; Nielsen, S. B.	2004		P						
Kuzlenko, A. A.	2001		P					NC	
Korteweg, A.; Nagel, S.	2016			Dependent	NC				
Masulis, R. W.; Nahata, R.	2009	control, MN		N				Dependent	
Pollock, T. G.; Chen, G.; Jackson, E. M.; Hambnick, D. C.	2010	control, P, N							control, N
Schwienbacher, A.	2008		P						N
Schwienbacher, A.	2013		N						
Sievers, S.; Mokwa, C. F.; Keienburg, G.	2013			P					
Tvebjæ, T. T.; Bruuno, A.V.	1984							P	P
Tykvová, T.	2007	P	P	P		NC	P	Interactive	Dependent
Zhou, H.; Sandner, P. G.; Martinelli, S. L.; Block, J.H.	2016	P		P					
Totals : Peer-review literature		16	18	17	5	4	6	13	14
<i>Summarized Driver Direction in Model</i>		+	-	++	+/=	+/=	NC	=	+

Legend: P = Positive; MP = Mildly-Positive; VP = Very Positive; N = Negative; MN = Mildly-Negative; VN = Very Negative; NC= Not Clear; Neut. = Neutral or Non-significant

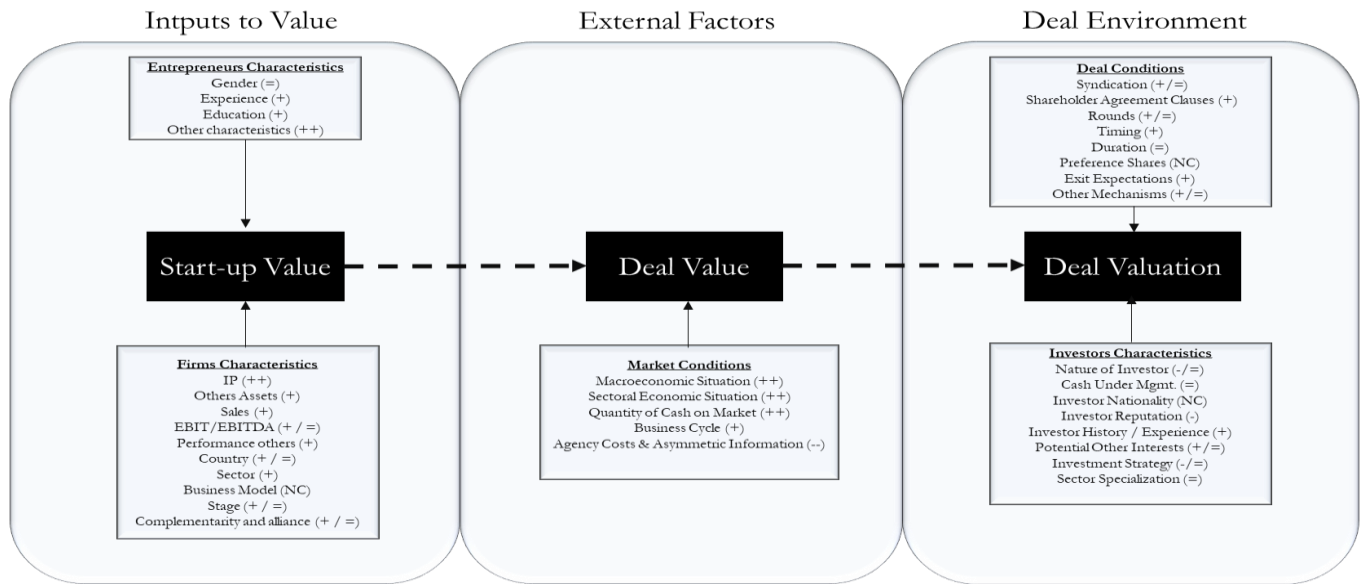
Compared to other driver-families, valuation-impact of *Deal Conditions* is mild. Shareholder Agreement Clauses, Timing of Deal, and Exit Expectations have positive valuation-impacts, while Preferential Shares have unclear impact. Funding Rounds, Syndication, and Other Mechanisms have mildly-positive valuation-impacts.

3.7. A meta-model for startup-valuation

According to Köhn (2018), future studies should take into account the comparative relevance of determinants over time because respective impacts of identified determinants might change over time, while Heughebaert and Manigart (2012) outline the need for future studies to directly examine the valuation process. Mechanically, this can be achieved by examining periodicity, temporal variation, and chronological order of contextual drivers affecting valuation. Taking into consideration the drivers identified in the literature, which outline not only the valuation-drivers and their specific relationship to the startup, but also the interaction they have with each other, the construction of a valuation model, placing the thematic-families into appropriate chronological positions in the valuation process effectively summarizes the process described in the literature. In principle, this is a valuation-process consisting of multiple steps.

The first step considers the startup's value-inputs ("Value-Startup"); both *Entrepreneur Characteristics* and *Firm Characteristics* are included. Thereafter, deal-opportunities navigate contextual external factors, such as Macroeconomic situation and Quantity of cash on market. These drivers stress the environment (*Market Conditions*) within which deals takes place. This is the "Deal Value". Finally, investment opportunities are challenged by characteristics of valuers (*Investor Characteristics*) and *Deal Conditions* affecting investors and entrepreneurs. This ultimately generates "Deal Valuation".

Fig. 5 Integrative meta-model for valuing startups



This three-stage valuation-emergence process is expressed using functional-form taken from Sievers et al. (2013) and Hand (2005), while conceptually inspired by Hurley (2018)’s view on the entrepreneurial field. We describe pre-money startup-valuation as a function of *Startup Value*, as well as the way *Value* is acted-upon by *Deal Value* and by *Deal Valuation*.

Formally, these three steps are described with the following functional form, whereby the aggregate of firm-level *Startup Value* drivers are acted upon by external market condition *Deal Value* drivers, and subsequently by investor-side *Deal Valuation* drivers:

Eq. 1 Integrative meta-model for valuing startups

$$Pre - Money Valuation = f(\left(\sum Startup Value\right) \sum Deal Value) \sum Deal Valuation)$$

This captures interaction among drivers literature identifies as impacting startup-valuation, as well as indirect driver valuation-impacts, and critically, the order in which each driver plays its role in impacting startup-valuation.

4. Discussion

4.1. Gaps and Critical Issues: An Agenda for Future Studies

At present, our study addresses currently-existing research gaps in the literature. Whereas Köhn (2018) outlines that future studies should take into account the periodicity of contextual factors on valuation, given that respective driver valuation-impacts might change over time. Meanwhile, Budhwar et al. (2022) outlines that methodological approaches in entrepreneurial finance can be – and are actively being – improved by further diversification, elaborating further that at a theoretical level considerable opportunities to develop syntheses between macro and micro-theorizing, as well as the internal dynamics of the entrepreneurial finance ecosystem. This paper’s methodological approach, relying on coding, thematic coding across multiple evidence sources, leading to the construction of tables which demonstrates associations between the valuation-drivers and startup-valuations, according to the authors cited, making possible the construction of grounded theory to provide a wholistic view of startup valuation contributes to addressing these needs.

Budhwar et al. (2022) also outlines the need for develop syntheses between macro and micro-theorizing in entrepreneurial finance. In the field of startup valuation, this can be approached via the modeling of valuation-impacts of macroeconomic market-conditions such as business cycle and changes in sovereign risk conditions, as well as the impact that these may have not only directly on valuations, but also on valuation drivers such as revenues, growth rates, and discount rates. Additionally, the modeling of the valuation-impact of deal conditions serves to capture governance and regulatory conditions, thereby further synthesizing micro and macro theory in entrepreneurial finance.

In addition, thematically-speaking, *Investor Characteristics*, *Entrepreneur Characteristics*, *Market Conditions*, and *Deal Conditions* are known to be under-researched within the peer-reviewed literature on startup-valuation, in comparison with *Firm Characteristics*. In principle, they likely constitute critical research-gaps that need examination to better understand the startup-valuation field.

We identify limitations in current literature and suggest research avenues in entrepreneurial finance. As highlighted by Köhn (2018), Gompers and Lerner (2000), and Damodaran (2009), research on startup-valuation may suffer from lack-of-contextualization. Aiming to generalize results, authors often do not take into account sample-period, nature-of-investors, or locations where deals take place. While many empirical studies do use control variables as fixed-effects on their datasets, authors do not specificities of their settings into account. For instance, it makes little sense to compare valuation-impact research concerning startups raising funds in US biotech between 1995 and 2005 with those concerning startups raising funds in Baltic-region software-industry markets from 2010 to 2015.

On the other hand, our study explicitly mentions the role of business cycles (i.e., the periodicity of market-conditions). In other words, our study directly addresses a key point that Köhn (2018) claims that future studies should mention.

The impact-scale of drivers varies across time, location, and industry. Concurring with Köhn (2018), we identify a research-avenue in comparing driver-impact across time-periods; but we would widen this towards more comparative studies, to identify differences between sectors, geographic settings, and investor-contexts. Just a few papers adopt this perspective (Wright et al. 2004, 2005; Manigart et al. 1997, 2000).

4.2. Methodology

Overall, the majority of selected peer-reviewed papers rely on regression-analysis, a situation which Budhwar et al. (2022) describe as being able to be improved by methodological diversification. While 69 peer-reviewed studies rely on regression-analysis and 14 are theoretical quantitative studies, three are case studies without interviews, and two employ interview-based qualitative methods. Scholars rely on publicly-accessible data, which are mainly *Firm Characteristics*. While *Entrepreneur Characteristics* are also publicly-accessible and play a deterministic role in investment-

criteria literature (e.g., Kaplan et al. 2009; Silva 2004; Hall and Hofer 1993; Macmillan et al. 1985, 1987), they constitute an under-reported macro-theme, especially concerning drivers other than experience and education.

Approaches like Murnieks et al. (2016), who examine subjective entrepreneur characteristics using qualitative methods should develop further, incorporating subjective valuation-drivers such as passion or tenacity into economic-theory.

The majority of quantitative studies explored do not stimulate research on valuation-processes either (Köhn (2018)). Large empirical-samples consider statistically-significant drivers but omit role and process of drivers emerging along different steps of the negotiation-process. Do equity-investors and entrepreneurs debate EBITDA factor? Can entrepreneurs take advantage of investor-competition before, during, or after the start of exclusive-negotiations? Our article invites the academic community in entrepreneurial finance to better consider less used methods – such as the qualitative ones – to investigate new fruitful questions about the start-ups valuations.

4.3 Investor Characteristics

At present, *Investor Characteristics* remain under-researched. Among the five macro-themes, this is the second least-covered family of valuation drivers.

This is an issue for the academic community, firstly because potential theoretical contributions of the characteristics of investors are significant. Contrary to most assets, whose value is intrinsic, the startup ecosystem—where supply of cash, funding demand, information asymmetries, and external factors are substantial —impacts the valuator. This gives rise to a unique context and reality. This issue is often overlooked in the literature.

The second reason is that diversity among equity-investors has increased tremendously over the past ten years (Cumming and Johan 2017; Quas et al. 2020; Bellavitis et al. 2017) but we suffer from a lack of knowledge about the resulting diversity in approaches to startup-valuation drivers. To our knowledge, many types of investor have never been studied *per se* in terms of their impact

on startup-valuation. This includes accelerators, equity funding incubators, search funds, family offices, independent business angels (BAs) versus BA networks, and governmental-venture-capitalists. As already highlighted by Köhn (2018), Masulis and Nahata (2009), and Röhm et al. (2017), the CVC landscape is sufficiently-diverse in terms of practices and investor-characteristics as to impact valuations of funded portfolio companies.

4.4 Context Matters: Market Conditions and Deal Conditions

In addition, *Market Conditions* are under-researched, particularly Quantity of Cash on Market. According to KPMG (2019), claims in industry-literature and the press outline that the 2016–2020 worldwide upsurge in startup-valuations seems influenced by cash-quantities on VC markets, to the extent that some established US or European VCs (Jerusamy, 2019) publicly declared that they were now decelerating investments related to “crazy valuations” and would re-invest after the potential bubble’s end, after quantity of cash-on-market decreased. The issue seems critically-important for practitioners and policy-makers alike, yet is under-researched—with only six papers in peer-reviewed literature.

Furthermore, *Deal Conditions* remain substantially under-investigated, despite being a major theme in the business-environment. Much of the coverage given to deal-conditions in entrepreneurial finance literature focuses on topics other than startup-valuation. Examples of this include Kaplan and Stromberg (2002), who examine the role of *Market Conditions* and *Firm Characteristics* in determining or influencing *Deal Conditions*. While data on this driver exist and are used for research other than valuation, the valuation-impact that specific deal-conditions have, remains under-researched. What needs development are concrete theoretical-models describing relationships between deal-conditions and startup-valuation. In particular, understanding the valuation-consequences of shareholder agreement-clauses is crucial. As the preliminary results of Gornall and Strebulaev (2020) show, US startups create on average eight different share-types, each with different rights, protections, preferential liquidation-rights, and so on. Sophistication of

contractual- relations and shareholder agreements between entrepreneurs and VCs seems key to driving startup-valuations.

4.5 Startup Selection

Sixth, an overlapping topic within entrepreneurial finance literature is startup selection, with research on this topic published by numerous scholars who examine startup-valuation, including Kaplan, Wright, Manigart, and Zacharakis. Many macro-themes are similar, including *Entrepreneur Characteristics*, *Investor Characteristics*, and *Market Conditions* (see for instance, Kaplan et al. 2009; Manigart et al. 1997; and Zacharakis and Meyer 1998). Similar drivers include objective entrepreneur characteristics, such as entrepreneur management-experience (Macmillan et al. 1985, 1987) and synergies between different types of entrepreneurial-background (Mason and Harrison 1996), but also subjective entrepreneur characteristics, such as passion and willingness-to-sacrifice (Silva 2004).

Entrepreneur Characteristics play a more prominent role in startup selection literature than in valuation literature. In selection literature, *Firm Characteristics* and *Investor Characteristics* relate more closely to startup-development-stage and to its products or services (for example Macmillan 1985, Maxwell et al. 2011), as well as investor specialization. Empirical studies on both topics reveal that *Entrepreneur Characteristics*, while critical to investment-selection, have limited-impact once investors have decided to invest, and negotiate pre-money valuation.

Furthermore, time has come to conduct research on changes concerning impacts of startup selection-criteria used by equity-investors on startup-valuation.

4.6 Recent Developments Concerning Startup Valuation

Lastly, zooming-in on the most recently published papers in the field informs of emerging trends, published in the last five years of our time period (from November 2016 to 2020). Eight papers have been published during the last five years of our time-period, providing substantial insight on

startup valuation, some of which were published by highly prestigious authors, including Gompers, Cumming, Kaplan, and Strebulaev, and in high impact journals (e.g. *Journal of Financial Economics* and *Small Business Economics* each published two post-2016 studies examined here), thereby substantially expanding the field. While these eight studies examine drivers in all five of the macro-level drivers we identify, these studies in particular, expand the field by examining largely market conditions and deal conditions, two areas described by Budhwar et al. (2022) as being areas where substantial publication opportunities exist due to their ability to tie together micro and macro theory.

Perhaps the most prestigious and highly-cited post-2016 study that we analyze is Gompers et al. (2020), is noteworthy as a substantial source of market condition, deal condition, and firm-characteristic valuation determinants. This study is also noteworthy for having multiple highly-cited second-authors, and can broadly be considered a successor-study to the research work of several of the paper's authors.

A second highly-relevant post-2016 publication analyzed by our study is Cumming and Zambelli (2017), which examines the relationship between investor size and monitoring.

Third, is Röhm et al. (2018), which focuses on the role of corporate venture capitalists. In principle, corporate venture capital represents another avenue by which Budhwar (2022)'s call to develop syntheses between macro and micro-theorizing going forward.

Overall, it would appear that this field may have moved forward more during the past five years than during many other periods during the topic's history.

5. Limitations and conclusion

5.1. Limitations

This study examines a range of publications on startup-valuation. Using an SLR protocol, we cast a wide net to identify and select relevant literature. This study nevertheless does suffer from several

limitations. The first relates to databases. Even using robust databases complemented by snowball-tracking, Google and Google Scholar searches, one can never be completely certain of identifying all relevant publications.

5.2. Conclusion

This study systematically reviewed the literature on startup-valuation and examined emergent trends. We identify five macro-categories (or themes) of drivers: *Entrepreneur Characteristics*, *Firm Characteristics*, *Investor Characteristics*, *Market Conditions*, and *Deal Conditions*.

The valuation impact of *Entrepreneur Characteristics*, *Firm Characteristics*, and *Market Conditions* are mostly positive, and are extensively, given that these three macro-categories serve as inputs for classical models, including DCF-valuation, multiples-valuation, and input-based valuation. Nevertheless, the literature also points to nuanced valuation impacts, such as complementary and interactive effects of different types of intellectual property (Block et al. 2014), or the description of patents as a signal of a startup's ability to generate new knowledge (Zheng et al. 2010). Another example is Black (2003)'s finding that valuation at different maturity stages reacts differently to financial statement components.

For their part, *Investor Characteristics* and *Deal Conditions* have a more ambiguous impact and receive less coverage.

The analysis section explores the nature of impacts on startups outlined in the literature, and explores incentives, goals, and divergences, while the appendices elaborate on details of the trends, evolution, and structure. The discussion section identifies limitations of established on startup-valuation literature. Therein, we highlight primary research-avenues along which further investigation could advance.

While each macro-theme contributes relevant drivers to understanding to startup-valuation, divergent coverage levels are driven by practical issues such as data-availability, novelty, measurability, methodology, and context. In particular, future published research is likely to see an

expansion in coverage of under-represented entrepreneur, firm-characteristic, and deal-condition drivers such as intellectual property, shareholder agreement-clauses, and subjective entrepreneur-characteristics, as methodology and data-access evolve.

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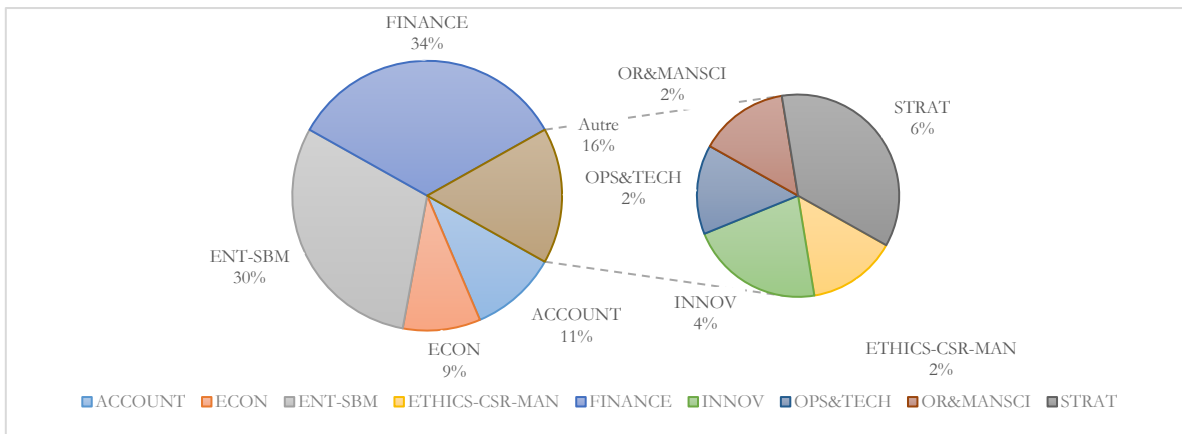
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7. Appendices

Appendix I: Classification of Peer-Reviewed Literature

Peer-reviewed studies meeting inclusion criteria can be classified by source, theme, and publication-field, given that most are published within a narrow range of fields. For the most part, peer-reviewed studies were published in finance journals, economics journals, or ENT-SBM journals. While this accounts for four-fifths of peer-reviewed papers, the rest were published in six fields dominated by accounting journals, as seen in Figure 6.

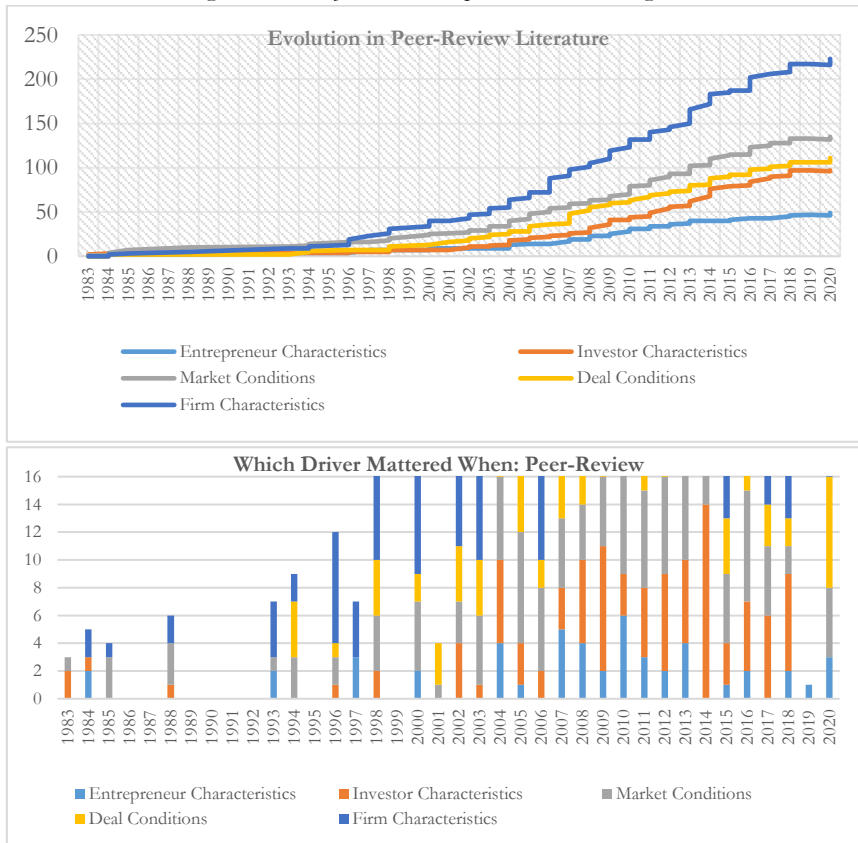
Fig. 6 ABS fields of journal publications



Appendix II: Driver Evolution and Trends

Figure 7 demonstrates content-evolution of the five thematic macro-categories. While *Firm Characteristics* dominate across all studies and time-frames, the post-2007 period has seen their dramatic acceleration across all literature.

Fig. 7 Evolution of thematic startup-valuation macro-categories



Because both DCF and multiples-valuation make extensive use of firm characteristics, this dominance is understandable. *Market Conditions* and *Deal Conditions* evolved along similar trajectories in peer-reviewed literature, both experiencing similar increases in 2002 and 2007. *Deal Conditions* saw their largest increase in peer-reviewed coverage in 2002. Moreover, publication trends emerged in waves, with 2000, 2006/07, 2014, and 2018 as pivotal-years for peer-reviewed literature.

Appendix III: Content-Differences Among Publication-Fields

Thematic-content can be grouped along lines of publication-fields. Table 11 outlines per-field totals for peer-reviewed literature. Distinct schools-of-thought on valuation-drivers appear within the literature.

Tables 11 Per-Field Content Totals: Percentages and No. of Quotes

Per Field Totals	Entrepreneur Characteristics	Firm Characteristics	Investor Characteristics	Market Conditions	Deal Conditions
ENT-SBM	11% (18)	39% (66)	13% (22)	22% (37)	15% (26)
FINANCE	3% (7)	27% (58)	21% (45)	25% (52)	24% (51)
ECON	10% (5)	31% (15)	6% (3)	18% (9)	35% (17)
OTHERS	10% (17)	46% (77)	14% (24)	20% (33)	10% (17)

Figure 8 outlines shares of thematic-categories expressed in peer-reviewed papers. The percentages represent the coded-content covered within the literature. Overall, *Entrepreneur Characteristics* and *Firm Characteristics* receive most attention within peer-reviewed literature.

Fig. 8 Thematic macro-categories: peer-reviewed literature

