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ORIGINAL EMPIRICAL RESEARCH

# Does the CMO's personality matter for web traffic? Evidence from technology-based new ventures

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## Abstract

This study investigates whether the personalities of Chief Marketing Officers (CMOs) of technology-based new ventures affect how the increasing maturity of new ventures translates into web traffic. Drawing on upper echelon theory and the interactionist theory of job performance, we explain how certain personality traits from the five-factor model are relevant to the job demands a CMO faces in technology-based new ventures. We build a multi-source dataset on 627 new ventures and use a novel approach to measuring personality that is based on computer text analysis—specifically, the LIWC application—which we apply to the CMOs' Twitter accounts. Our findings indicate that a CMO's extraversion positively moderates the relationship between a new venture's maturity and web traffic, while a CMO's conscientiousness is a negative moderator of this relationship. These results have useful theoretical and practical implications for the role of the CMO and for marketing new ventures in general.

**Keywords** Chief marketing officer · Technology-based new ventures · Personality · Firm maturity

## Introduction

Chief Marketing Officers (CMOs)[1] are marketing functions' representatives in top management teams (TMTs), so they are of significant interest to academic research and practice. Research shows that the presence of a CMO affects firm performance positively in both established and new firms (Germann et al. 2015; Homburg et al. 2014), so now scholars have moved from examining whether the CMO matters to investigating the characteristics of a successful CMO, considering human capital, such as the CMO's experience and education (e.g., Boyd et al. 2010), and social capital, such as the CMO's position in his or her networks (e.g., Wang et al. 2017).

However, the impact of the CMO's *personality* has hardly been examined so far. Upper echelon theory and broader management and psychology research on executive personality argue theoretically and find empirically that personality is a major factor in shaping executives' actions and decisions (Hambrick 2007; Nadkarni and Herrmann 2010), indicating that our current understanding of CMOs is incomplete. Practitioners as well often observe that successful CMOs share personality traits, as shown in Newman (2016), who argues that successful CMOs are outgoing and persuasive; Rampton (2014), who finds that CMOs are "people persons"; and Samson (2017), who believes that successful CMOs adapt well to new situations and do not cling to the status quo. However, academic research has not provided systematic evidence of whether there is such a thing as a successful CMO personality. The purpose of this research is to identify the personality traits, if any, that make CMOs successful in their jobs.

To address this topic, we investigate CMOs in technology-based new ventures and offer a research model that states as a baseline that increasing maturity, as manifested in a new venture's increasing age, size, and resources (Hanks et al. 1993), leads to increased web traffic, a common goal for little-known new ventures (DeKinder and Kohli 2008) to which financial

[1] In line with the extant CMO research (e.g., Nath and Mahajan 2008), the term CMO refers to the top marketing executive in a TMT, regardless of the actual title.

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metrics like profitability are not yet applicable (Lodish et al. 2001). Upper echelon theory suggests that executives at the top of their organizations, such as CMOs, impact organizational decision making, which can strengthen or weaken firm-level relationships like our baseline relationship (Hambrick and Mason 1984; Carpenter et al. 2004). While upper echelons theory generally suggests that top executives' individual backgrounds affect firm-level relationships, we build on Judge and Zapata's (2015) interactionist model of the link between personality and job performance so we can predict which personality traits, as conceptualized in the prominent five-factor model (FFM; e.g., Funder 2001), affect venture maturity's association with web traffic. The model suggests that there are no universally effective personality traits for CMOs, as whether a particular personality trait is useful is determined by the setting in which the new venture's CMO acts and by the job demands that setting imposes.

Technology-based new ventures provide a useful sample for this research because such ventures' executives tend to have high levels of discretion since their firms tend to have few formal rules and little inertia (Brush and Chaganti 1996; Jung et al. 2017), which increases the influence of personality on firm-level phenomena (Judge and Zapata 2015). In addition, technology-based new ventures provide a context from which we can derive clear job demands for the CMO position (Bjerke and Hultman 2002; Gruber 2004), allowing us to determine the direction of personality traits' effects (Tett and Burnett 2003). In this way, our research addresses the following research question: *Which CMO personality traits strengthen or weaken the relationship between a technology-based new venture's level of maturity and web traffic?* We test the derived research model empirically by means of a multi-source sample of 627 new ventures during the period from 2013 to 2016, combining data from Crunchbase (a database of technology-based new ventures), Twitter, and Amazon Alexa's web information services.

We contribute to research in three major ways. First, we contribute to the growing CMO research, which focuses on the human and social capital aspects of CMOs (Homburg et al. 2014; Wang et al. 2017). While human and social capital can be shaped at least in the medium run, personality traits remain relatively stable throughout adulthood (McCrae and Costa 1987). Therefore, we suggest that successful CMOs are not only "made" (e.g., by gathering certain experiences) but are also at least in part "prepackaged" because of their personality traits.

Second, we contribute to the marketing-entrepreneurship interface. While research on the marketing-related success factors of new ventures often examines outcomes like the stock market's reactions to firms' IPOs (Saboo and Grewal 2013) or private firms' ability to attract venture capital (Homburg et al. 2014), we examine what drives web traffic as a goal that is the immediate responsibility of the marketing function and that is often used to measure marketing success when financial success measures are not yet on the agenda.

Third, we contribute to the broader management literature. While upper echelons theory points out the role of personality in executives' decisions and behaviors (Hambrick and Mason 1984), empirical studies mostly rely on demographic variables (Priem et al. 1999). We extend recent studies' findings that CEO personality affects various firm-level outcomes (e.g., Malhotra et al. 2018) by arguing theoretically and showing empirically that the personalities of the executives who report to the CEOs—in our case, the CMO—also affect these outcomes.

## Literature review and hypothesis development

Our research model's baseline relationship links new ventures' level of maturity with their web traffic. A new venture's maturity refers to the degree to which a company no longer struggles with liabilities of newness, such as the lack of name recognition and resources (Rao et al. 2008). Quinn and Cameron (1983) argue that maturity is achieved when the organization has built a stable internal organizational structure and earned a reputation among its stakeholders. As a quantitative measure of maturity, the extant research tends to refer to organizations that are older than ten years as "mature" (Jin et al. 2017).

At its inception, a new venture's maturity is low, but organizational life cycle models indicate that either the new venture develops towards a mature company that is established and acknowledged by its stakeholders, or it disappears (Hanks et al. 1993; Kazanjian 1988; Quinn and Cameron 1983). Hence, increasing maturity is paramount for firm survival. These models suggest that this transformation manifests as the new venture increases in age, size, and resource availability (Hanks et al. 1993). Even without professional marketing efforts, these three factors ensure that recognition of the new venture grows at least to a degree, which results in increased web traffic. Web traffic is an important metric in the context of new ventures, where profitability and even sales metrics are absent or unreliable indicators in the ventures' early stages (Tyebjee et al. 1983).

While increasing maturity sets the stage for growing a new venture's web traffic, the CMO can strengthen maturity's impact on web traffic by addressing marketing-related issues. This notion is rooted in upper echelons theory, which suggests that firm-level relationships like our baseline relationship are affected by top executives' mindsets and decisions (Carpenter et al. 2004; Hambrick and Mason 1984; Yadav et al. 2007). Given marketing's relevance to our baseline relationship, we expect that the CMO's personality characteristics influence that relationship. More specifically, although empirical

research often employs executive demographics as proxies (Priem et al. 1999), upper echelons theory expects that executives' personalities are major drivers of firm-level decisions and activities (Hambrick and Mason 1984; Chatterjee and Hambrick 2007), as personality traits are dispositions that result in consistent cognitive, emotional, and behavioral responses to stimuli (Tett and Burnett 2003). In this vein, the broader management literature recently investigates and finds empirical evidence for the CEO personality's impact on firm-related outcomes (see Table 1).

The present study conceptualizes personality through the FFM, which encompasses the personality dimensions of openness to experience, extraversion, conscientiousness, neuroticism, and agreeableness (Nadkarni and Herrmann 2010; Barrick and Mount 1991; Funder 2001).

While the upper echelons theory generally suggests that the CMO's personality affects firm-level outcomes, we draw on the interactionist model of the relationship between personality and job performance from Judge and Zapata (2015) and the related theory of trait activation from Tett and Burnett (2003) as theoretical underpinnings for *why* certain personality traits impact outcomes. The model has two main tenets: In keeping with the upper echelon theory's expectation that the CMO's personality matters to firm-level outcomes, the first is that personality is a stronger predictor of firm-level decisions when the situation is "weak"—that is, when it has little clarity and consistency with respect to responsibilities and a high degree of freedom in decision making (Judge and Zapata 2015; Meyer et al. 2009)—than when it is not. New ventures' environments typically come with weak situations, as there are no formal marketing processes in place on which managers can rely for decision making (Hills et al. 2008), no established brand, only a few customers at best, and no historical data on which to base decisions.

The second key tenet of Judge and Zapata's (2015) model provides guidance on the *direction* of personality's effect on outcomes and relationships. The effects of a personality are not universally positive or negative but depend on the demands of the job. Only when an individual has the personality traits that are *relevant to the tasks and goals of his or her particular role* can that individual be expected to be more successful than others are (Tett and Burnett 2003).[2]

[2] This notion suggests that a personality dimension can also cover traits that are not relevant to the specific situation of new ventures that we investigate but might cause a detrimental response for other outcomes. This concept is rooted in the trait activation concept from Tett and Burnett (2003), which is part of interactionist model from Judge and Zapata (2015) that we employ. The trait activation concept argues that personality traits are expressed as responses to cues, such that, if a situation does not "wake up" a specific trait by means of cues, it is not relevant to the situation. Since we embed the CMO's personality in the situation of new ventures whose maturity is increasing, we seek traits in the context of this specific situation and discuss (in the section on future research) scenarios in which a personality dimension that we derive as being favorable for CMOs for our purposes (i.e., transforming increasing maturity into web traffic) may be detrimental in other situations.

Marketing's place in the entrepreneurial process determines the CMO's task profile in a new venture (Stokes 2000). Boyd et al. (2010) argue that a CMO fulfills three roles: an *informational* role, which consists of acting as a "bridge" between product ideas and the marketplace and spotting opportunities in the marketplace to offer the new venture's products to appropriate customers (Gruber 2004); a *decisional* role, which consists of making the new venture's market-related decisions, such as a decision on the venture's market-entry strategy (Gruber 2004), including choosing the target market, the competitive strategy, initial pricing, and sales channels, and deciding how to address the first customers; and a *relational* role, which consists of building relationships with external stakeholders (e.g., customers, alliance partners) and building the new venture's brand with those stakeholders to obtain credibility and legitimacy (Rao et al. 2008).

Therefore, with increasing maturity, new ventures become older and larger and have better access to resources, all of which are associated with more web traffic. While increasing maturity sets the stage for the new venture to be recognized, the CMO can leverage the manifestations of increasing maturity (age, size, resources) by approaching his or her roles in a way that corresponds to the venture's specific conditions. When new ventures' CMOs have the personality traits that help them fulfil their roles, the relationship between maturity and web traffic is strengthened, while the opposite applies when CMOs do not have these traits. Figure 1 summarizes our research model.

## Baseline relationship between the maturity of technology-based new ventures and web traffic

A new venture's maturity is low at founding and subsequently, as organizational life cycle models indicate (Hanks et al. 1993), it grows, which manifests in increasing age, size, and resource availability. An organizational age of zero implies that there is no recognition among stakeholders (Kazanjian 1988). When the new venture develops its first product(s), stakeholders' interest in the new venture increases, and the venture morphs from a mere "business plan" to an organization from which customers can purchase products, which opens market opportunities (Lodish et al. 2001; Timmons 1999). This transformation increases interest in the new venture from stakeholders, who might even find it on their own initiative, such as by visiting the website.

In terms of size, a new venture is small at the beginning, often consisting only of the founders (Beckman and Burton 2008). When it grows, organizational structures develop and the head count grows, as does specialization (Hanks et al. 1993), which increases the odds that the new venture has expertise in marketing or, more specifically, in how to attract web traffic.

**Table 1** Overview of the literature on executive personality's impact on firm outcomes

| Authors | Independent variable(s) | Moderator variable(s) | Dependent variable(s) | Sample, size, characteristics | Key findings related to personality |
|---|---|---|---|---|---|
| Part A: Studies that employ FFM | | | | | |
| Gupta et al. (2018) | - CEO liberalism<br>- CEO conservatism | - CEO extraversion<br>- CEO narcissism | - CSR activities of the firm<br>- Firm downsizing | - U.S.<br>- Study 1: 302 CEOs and 1282 firm-year observations; Study 2: 333 marketing professionals<br>- Primary & secondary | - CEO extraversion & narcissism strengthen the positive effect of liberalism on CSR practices.<br>- CEO extraversion strengthens the positive effect of conservatism on downsizing. |
| Herrmann and Nadkarni (2014) | - CEO Big Five personality traits<br>- Implementation of strategic change | - CEO Big Five personality traits | - Initiation of strategic change<br>- Firm performance | - Ecuador<br>- 120 companies<br>- Primary | - All CEO personality traits are associated with the initiation of strategic change.<br>- Conscientiousness, emotional stability, and agreeableness moderate the effect of implementing strategic change on firm performance. |
| de Jong et al. (2013) | - Lead founder's Big Five personality traits | N/A | - New venture performance<br>- Task conflict (mediator)<br>- Relationship conflict (mediator) | - U.S.<br>- 323 companies<br>- Primary | - Openness, agreeableness, and conscientiousness are associated with new ventures' performance via task conflict.<br>- Personality traits except agreeableness are associated with new ventures' performance via relationship conflict. |
| Malhotra et al. (2018) | - CEO extraversion | - Industry competitiveness<br>- Managerial entrenchment | - firm's M&A likelihood<br>- firm's M&A deal size<br>- Shareholder reactions<br>- CEO's board network size (mediator) | - U.S.<br>- 2381 unique CEOs matched with 1710 deals (2002–2013)<br>- Secondary | - Extraverted CEOs are more likely to conduct acquisitions and conduct bigger acquisitions.<br>- These effects are strengthened by managerial entrenchment. |
| Nadkarni and Herrmann (2010) | - CEO Big Five personality traits | N/A | - Firm performance<br>- Strategic flexibility (mediator) | - India<br>- 195 firms<br>- Primary & secondary | - All five personality traits are associated with firm performance; the relationships are mediated by strategic flexibility. |
| Zhao et al. (2010) | - Big Five personality traits<br>- Risk propensity | N/A | - Entrepreneurial intention<br>- Firm performance | - 60 studies with 15,423 individuals<br>- Meta-analytic study | - All four personality traits (except for agreeableness) are associated with entrepreneurial intention and performance; risk propensity is positively associated with entrepreneurial intentions. |
| Part B: Studies that employ related personality constructs (narcissism, humility & modesty, overconfidence & hubris) | | | | | |
| Buyl et al. (2017) | - CEO narcissism | - CEO stock options<br>- Block ownership<br>- Outside director with banking experience | - Riskiness of policies (mediator)<br>- Drop in performance<br>- Recovery to pre-shock performance level | - U.S.<br>- 92 bank CEOs (2006–2014)<br>- Secondary | - Narcissism has a positive effect on the riskiness of bank policies.<br>- Banks led by narcissistic CEOs recovered more slowly after the collapse in 2008. |

**Table 1** (continued)

| Authors | Independent variable(s) | Moderator variable(s) | Dependent variable(s) | Sample, size, characteristics | Key findings related to personality |
|---|---|---|---|---|---|
| Chatterjee and Hambrick (2007) | - CEO narcissism | | - Dynamism of company strategy<br>- Number & size of acquisitions<br>- Extremity & fluctuation of firm performance | - U.S.<br>- 111 CEOs in 105 firms (1992–2004)<br>- Secondary | - CEO narcissism is positively associated with strategic dynamism, extreme firm performance, and fluctuating firm performance. |
| Chatterjee and Hambrick (2011) | - Firm performance<br>- Social praise for CEO | - CEO narcissism | - Risk taking | - U.S.<br>- Study 1: 152 CEOs in 134 firms (1992–2006); Study 2: 131 acquisitions (2001–2008)<br>- Secondary | - Narcissism weakens the positive relationship between firm performance and risk-taking.<br>- Narcissism strengthens the positive relationship between social praise and risk-taking. |
| Engelen et al. (2016) | - Entrepreneurial orientation | - CEO narcissism<br>- Market concentration<br>- Market dynamism | - Shareholder value | - U.S.<br>- 41 companies and 41 CEOs (2005–2008)<br>- Secondary | - Narcissistic CEOs weaken the relationship between entrepreneurial orientation and performance except in highly concentrated and dynamic markets. |
| Galasso and Simcoe (2011) | - CEO overconfidence | - Product market competition | - Firm innovation | - U.S.<br>- 627 CEOs in 290 firms (1980–1994)<br>- Secondary | - Overconfidence is positively related to firm innovation.<br>- This effect is stronger in competitive industries. |
| Gerstner et al. (2013) | - CEO narcissism<br>- Degree of audience engagement with the technology | - Degree of audience engagement with the technology | - Company's adoption of discontinuous technology<br>- Managerial attention to discontinuous technology (mediator) | - U.S.<br>- 72 CEOs in 33 firms (1980–2008)<br>- Secondary | - CEO narcissism is positively associated with adoption of discontinuous technologies and managerial attention.<br>- Audience engagement strengthens this effect. |
| Li and Tang (2010) | - CEO hubris | - Managerial discretion | - Firm's risk-taking | - China<br>- 2790 firms<br>- Primary | - CEO hubris is positively associated with firm risk-taking, a relationship that is strengthened by CEO managerial discretion. |
| Ou et al. (2018) | - CEO humility | N/A | - Firm performance<br>- TMT vertical pay disparity (mediator)<br>- TMT integration (mediator)<br>- Ambidextrous strategic orientation (mediator) | - U.S.<br>- 105 companies<br>- Primary & secondary | - CEO humility positively influences firm performance.<br>- The effect is mediated by the TMT's vertical pay disparity, the TMT's integration, and an ambidextrous strategic orientation. |
| Patel and Cooper (2014) | - CEO narcissism | N/A | - Performance at onset of crises<br>- Performance in post-crisis period | - U.S.<br>- 392 CEOs<br>- Secondary | - Firms with narcissistic CEOs face greater decline at the onset of the crisis.<br>- Narcissistic CEOs can improve performance in the post-crisis period. |

**Table 1** (continued)

| Authors | Independent variable(s) | Moderator variable(s) | Dependent variable(s) | Sample, size, characteristics | Key findings related to personality |
|---|---|---|---|---|---|
| Petrenko et al. (2014) | - CEO narcissism<br>- Prior philanthropy media profile<br>- Corporate social responsibility (CSR) | - CEO narcissism | - CSR<br>- Current corporate philanthropy media profile<br>- Firm performance | - U.S.<br>- 911-1051 CEO-year observations<br>- Secondary | - CEO narcissism is positively associated with CSR.<br>- CEO narcissism negatively moderates the relationship between CSR and firm performance. |
| Ridge and Ingram (2017) | - TMT modesty | N/A | - Abnormal returns<br>- Organizational performance | - U.S.<br>- 453 companies (2007–2011)<br>- Secondary | - TMT modesty positively influences abnormal returns and firm performance. |
| Tang et al. (2015) | - CEO hubris | - Firm size & slack<br>- Market uncertainty & competition | Firm engagement in<br>- socially responsible activities<br>- socially irresponsible activities | - U.S.<br>- 464 CEOs in 397 firms (2001–2010)<br>- Secondary | - CEO hubris is negatively associated with socially responsible activities and positively associated with socially irresponsible activities. |
| Tang et al. (2018) | - CEO narcissism<br>- CEO hubris | - Number of board-interlocked firms with a higher (lower) level of CSR | - Corporate social responsibility (CSR) | - U.S.<br>- 266 unique CEOs in 235 firms (2003–2010)<br>- Secondary | - CEO narcissism is positively associated with CSR and CEO hubris is negatively associated with CSR.<br>- The number of peer firms with a higher (lower) level of CSR moderates these effects. |
| Zhu and Chen (2015a) | - CEO power<br>- CEO narcissism | - Demographic difference btw. CEO & new directors<br>- Similarity of new director's narcissism to that of the CEO<br>- New director's experience with CEOs whose level of narcissism is similar to that of the new CEO | - Similarity of new director to the CEO's level of narcissism<br>- New director's experience with other CEOs who are similarly narcissistic<br>- Risk-taking | - U.S.<br>- 292 companies and 1849 firm-year new director observations (1998–2006)<br>- Secondary | - A new director's similarity to the focal CEO's level of narcissism and the new director's prior experience with other similarly narcissistic CEOs positively moderate the relationship between CEO narcissism and risk-taking. |
| Zhu and Chen (2015b) | - Corporate strategy CEO witnessed at other firms<br>- Corporate strategy other directors witnessed at other firms | - CEO narcissism<br>- Status of the other firms with which the CEO was associated<br>- CEO's power | - Corporate strategy at the focal firm | - U.S.<br>- 196 firms' acquisition decisions and 199 firms' internationalization decisions (1997–2006)<br>- Secondary | - Narcissistic CEOs are heavily influenced by strategies they witnessed at other firms.<br>- Relatively narcissistic CEOs pursue corporate strategies that are opposite other directors' experiences. |

The following leading management journals were taken into account: *Academy of Management Journal*, *Administrative Science Quarterly*, *Management Science*, *Strategic Management Journal*, *Journal of Management* (all for the period from 2003 on)

At founding, organizational resources are low, and the founding team is occupied with many basic tasks, such as developing a product and recruiting first employees (Beckman and Burton 2008), so running marketing campaigns to increase web traffic is seldom at the top of the list. When organizational resources increase, marketing budgets to boost public recognition and brand awareness become available (Lodish et al. 2001) to attract external stakeholders, who learn about the new venture and increase web traffic. Overall, then:

**H1:** A new venture's maturity in terms of (i) age, (ii) size, and (iii) resource availability is positively related to its web traffic.

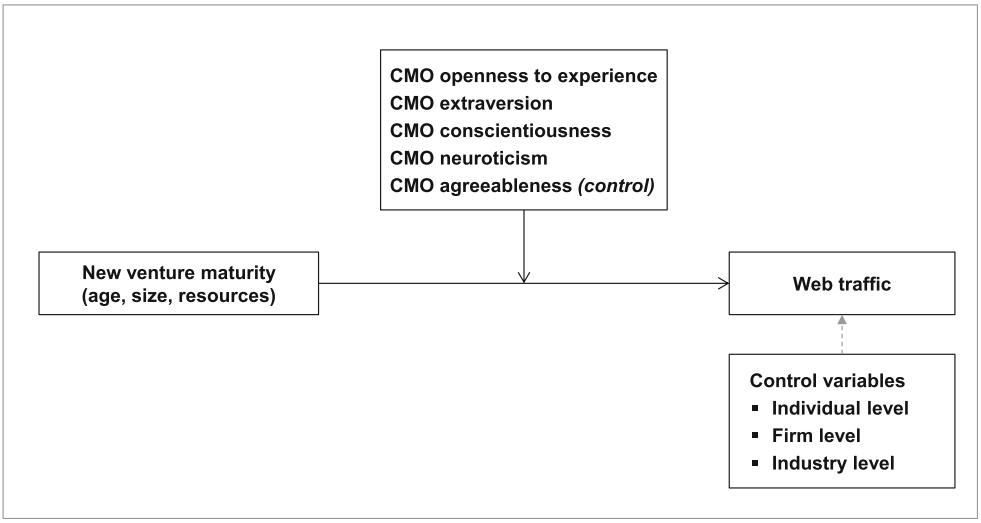



**Fig. 1** Overview of research model

## The moderating effects of the CMO's personality traits

**Openness to experience** People with strong openness to experience accept new and unconventional ideas, pursue novel kinds of action, show imagination, and display intellectual curiosity (e.g., Zhao et al. 2010). Openness to experience is closely related to facets of intelligence that involve creativity, especially divergent thinking (McCrae and Costa 1987). People who score low in openness to experience can be perseverant but can also be closed-minded and conventional.

With increasing maturity, the venture introduces products, and the CMO's informational role of seeking market opportunities comes into play (Tyebjee and Bruno 1984). In the venture context, these opportunities are often not discovered through a structured search processes (Read et al. 2009) but by pursuing unconventional ideas. CMOs who have a high degree of openness excel in such creative activities and so can reap the full benefits of product ideas.

Even when increasing maturity provides first products or the resources to run marketing activities, the right target market and messages often remain unclear, so finding them often requires trial and error (Hills and LaForge 1992), and adjustments and corrections (Bhave 1994). CMOs who are open to correcting course find it comparatively easy to play their decisional role in shaping the details of the new venture's market entry (e.g., market segments). However, CMOs who have little openness to experience often stick to their initial plans rather than pivoting, a tendency that both theory and practice identify as a major reason for failure in new ventures (Politis 2005). As a result, the effects of a new venture's increasing maturity (e.g., growing resources) are impaired as the new venture continues communicating with the wrong market.

CMOs who are open to experience are also prepared to play their relational role by exploiting maturity's benefits by building connections with external stakeholders, which can help to spread the message about the new venture's offering and build a brand. Openness to experience helps the CMO manage this task (e.g., "selling" the emerging product idea), as creating brands with limited resources requires imagination (Hills and LaForge 1992; Josephson et al. 2016). The creativity of CMOs who are open to experience helps them create a lasting impression on early stakeholders and increases the likelihood that these stakeholders will keep the venture in mind, facilitating the association between the venture's maturity and web traffic. Overall, then:

**H2a:** The relationship between a new venture's maturity and web traffic is stronger when the CMO has a high degree of openness to experience than when he or she does not.

**Extraversion** Highly *extraverted* people enjoy social interactions and attention, tend to be outgoing and talkative (McCrae and Costa 1987; Zhao and Seibert 2006), have good social skills, and excel in building social connections (de Jong et al. 2013). People who are more introverted tend to be quiet and often prefer to work alone (Barrick and Mount 1991).

With increasing maturity, new ventures tend to become more widely recognized and better able to run marketing campaigns, but CMOs can impact how and where recognition emerges (informational role) and where and how activities are pursued (decisional roles). Extraverted CMOs are more likely than introverted CMOs are to recognize the business opportunities that can originate from an informational advantage (Shane 2000) and entrepreneurial alertness (Ailawadi and Farris 2017), both of which an extraverted CMO's social connections are likely to foster (Klotz et al. 2014). These social connections can be the primary way for a new venture to access unique information that is not available through other channels (Mabey et al. 2015) so they can put their scarce marketing resources in the most promising markets and make most of their increasing maturity.

With increased maturity, a venture has more to offer, such as a first marketable product. In performing their relational role, CMOs must educate their customers and other stakeholders (e.g., potential distribution partners), who might not be ready for the product or who fail to see the need for it (Bhave 1994). The CMO must convince interested stakeholders and encourage them to purchase a product or at least stay in touch, tasks that extraverted CMOs find easier than introverted CMOs do (Brown et al. 2002; Ciavarella et al. 2004). Extraverted CMOs build new connections easily and quickly, enabling them to air their ventures' messages about new offerings in a variety of markets—even those in which they do not yet have relationships. Therefore:

**H2b:** The relationship between a new venture's maturity and its web traffic is stronger when the CMO is highly extraverted than when he or she is not.

**Conscientiousness** People who are highly *conscientious* are organized, disciplined, and achievement-oriented, and they take responsibility for completing their tasks (Brown et al. 2002; Zhao et al. 2010). Conscientious people also tend to be cautious, accept only moderate risk, avoid ambiguity, and need structure and rules (Nadkarni and Herrmann 2010).

Conscientiousness is often shown to be positively related to job performance (Barrick and Mount 1991). When superiors in corporate settings assess job performance, they tend to prefer those who follow rules and use perseverance and attention to detail in accomplishing goals. However, some of the facets of conscientiousness that are related to a preference for order and structure might be negatively related to the successful accomplishment of some tasks. Herrmann and Nadkarni (2014) show that highly conscientious CEOs become stuck in too much detail, control, and rules and are unlikely to initiate necessary changes. Since marketing in new ventures usually does not entail "clear and identifiable steps" (Schjoedt 2009, p. 622), the negative aspects of conscientiousness can unfold.

When positioning a new venture's emerging offerings, building an internal marketing organization, or allocating first marketing budgets (all facets of increasing maturity), conscientious CMOs who are performing their informational role might miss the chances that often appear in uncommon places for technology-based new ventures (Politis 2005). Nadkarni and Herrmann (2010) point out that too much conscientiousness narrows the executive's field of vision and leads them to pursue the tried-and-true. Conscientiousness is associated with a reluctance to embrace unfamiliar or ambivalent situations, which decreases the inclination to look for product applications in uncommon industries that may hold attractive market opportunities and limits how a CMO can leverage increasing maturity.

When a new venture matures, its CMO uses the decisional role to decide who the venture's first customers in a target market will be (Lodish et al. 2001). CMOs who cling to pre-defined plans can be at a loss with the many uncertainties about a new venture's market, as it is difficult to establish generally applicable rules for successful market entry. The flexibility of CMOs who score low on conscientiousness is useful in leveraging the venture's increasing maturity since these CMOs feel comfortable with trial-and-error, which is often a success factor when new businesses enter the market (Timmons 1999).

We also expect conscientious CMOs to be less prepared for their relational role than are those who are less conscientious. Conscientious executives rely on approaches they have already applied (Nadkarni and Herrmann 2010), but building brands from scratch requires unproven solutions (Lodish et al. 2001). As a result, we expect that CMOs who score low in conscientiousness to be better than conscientious CMOs in addressing relational tasks when maturity increases and resources for marketing become available. Therefore:

**H2c:** The relationship between a new venture maturity's and its web traffic is stronger when the CMO has a low degree of conscientiousness than it is when the CMO is highly conscientious.

**Neuroticism** Neurotic individuals find it difficult to adjust emotionally to stressful and challenging situations and to remain balanced when they occur (McCrae and Costa 1987). They often appear to be thin-skinned and defensive and to behave impulsively (Peterson et al. 2003).

Nadkarni and Herrmann (2010, p. 1054) point out that emotionally stable executives are prepared to "process adverse and ambiguous information objectively and rationally," which enables them to evaluate uncertain situations and, as relates to the CMO's informational role in new ventures, to find opportunities to spend marketing budgets effectively. Further, neurotic CMOs do not enjoy experimenting (de Jong et al. 2013), so they might stick to their initial ideas even when it becomes clear that those decisions require revision. As a result, maturity's benefits (e.g., effective use of marketing budgets, recruiting of marketing employees) do not materialize.

For CMOs, performing the decisional and relational roles of finding an attractive and accessible segment or customer group demands perseverance, since there are likely to be many setbacks and frustrating interactions with customers (Peterson et al. 2003). CMOs need emotional stability to remain calm enough to correct course and turn a crisis into success (Tett and Burnett 2003). Neurotic CMOs, on the other hand, are likely to feel upset in these difficult situations, which limits their ability to take the right actions and remain motivated. Therefore:

**H2d:** The relationship between a new venture's maturity and web traffic is stronger when the CMO has a low degree of neuroticism than it is when the CMO is highly neurotic.

**Agreeableness** The effect of agreeableness, a trait that is associated with altruism, modesty, and caring (Zhao and Seibert 2006), is less clear. People who are agreeable tend to show empathy for others, to create a cooperative working environment, and to avoid conflict, all of which can benefit the marketing efforts of a maturing new venture. On the other hand, Klotz and Neubaum (2017) argue, that less agreeable entrepreneurs in new ventures can be beneficial, since such entrepreneurs are tougher negotiators. Since the absence of a clear rationale for a positive or negative impacts of agreeableness is also reflected in inconclusive empirical studies (Zhao et al. 2010; Nadkarni and Herrmann 2010), we do not formulate a hypotheses for a CMO's level of agreeableness, although we control for the variable in our models.

## Methodology

### Sample

Our empirical analysis builds on three main sources of data: Crunchbase, the official Twitter application programming interface, and Amazon's Alexa Web Information Service (Alexa). We started with Crunchbase (www.crunchbase.com), a database operated by one of the world's leading tech blogs, TechCrunch, that contains information on organizations and people from the new technology venture ecosystem (Homburg et al. 2014; Ter Wal et al. 2016).

We identified all new ventures in the database that were founded in 2003 and later, so they were not more than ten years old at the beginning of the 2013–2016 observation period (Jin et al. 2017; DeKinder and Kohli 2008). Companies were included that listed at least one member of the leadership team, the number of employees, the industry category, and the location of their headquarters. We excluded firms that had more than 1000 employees since new ventures that grow that quickly in a short period of time are unlikely to be facing the conditions that our theoretical reasoning suggests are typical for new ventures. This process yielded 69,391 firms. Then we relied on the validated method of identifying CMOs by using the list of CMO-related titles from Menz (2012) to search managerial role descriptions for key words (Germann et al. 2015). We manually checked all titles and removed managers whose role descriptions indicated that they were not the firms' top marketing managers. CMOs were listed in the TMTs of 4724 companies at some point during our observation period.

We required an original writing sample from Twitter to measure personality, so we collected text samples from the CMOs' profiles through the official Twitter application programming interface. The links to the Twitter profiles were contained in the Crunchbase data. Using this method, we collected data on the CMO's personality for 788 firms (2290 firm years), but missing data on other variables reduced the sample to 632 firms (1504 firm years). Finally, we dropped outlier observations that were outside three standard deviations from the mean of the dependent variable (Nath and Mahajan 2011), which resulted in a sample of 627 new ventures and 613 unique CMOs, for a total of 1482 firm years.[3] (Some CMOs had worked for more than one of the companies.) Sixty-nine percent of the companies are based in the United States. This data was gathered during the first half of 2017. Web Appendix A gives an overview of the sampling process.

### Measures

**Dependent variable** We obtained data on the daily web traffic to the top domain level of a new venture's website through Alexa, a website that collects web traffic and related metrics (Edelman and Brandi 2015). We measured the new venture's web traffic as the share of its homepage views among the total number of page views on a given day, measured as the firms' website visits per one million total visits and only counting unique visitors, and then taking the yearly median value. We ran robustness checks with the new venture's web traffic as the web traffic relative to the new venture's peer group in our sample, defined as firms with the same two-digit SIC code. Findings were not affected by this adaption. For models that build on a linear link between regressors and web traffic, we used its natural logarithm, taking into account the highly skewed distribution (Luo and Zhang 2013). Our dataset provides evidence for a positive association between web traffic and a more generally conceived indicator of firm performance: Specifically, 18 firms in our sample achieved an IPO and they had significantly more web traffic in the years preceding the IPO than the other firms ($t = 2.64$, $p < .05$).

**Independent variables** We measured firms' maturity along maturity's three major manifestations: firm age, firm size, and resource availability (Hanks et al. 1993). While measuring age is straightforward, many metrics that are meant to capture size, such as revenue (Shu et al. 2005), can be misleading or are not applicable or not available in the new-venture context (e.g., market capitalization). Because of the sparse historical data that is available on new ventures, we measure their size in terms of the number of employees for 2016, taking the natural logarithm of the mean of the number of employees and

[3] The ten most frequent Crunchbase categories in the sample are: software, mobile, enterprise software, software as a service, internet, analytics, advertising, e-commerce, social media, and apps.

linearly scaling the growth in (logarithmic) numbers of employees from the new venture's inception to 2016.

Resource availability is strongly driven by the funding the new venture receives from external sources, particularly from venture capitalists, which are the main investors in technology-based new ventures (Fried and Hisrich 1994). Since venture capital firms apply a staged funding structure, providing new ventures only with the financial resources that are necessary to reach the next milestone only when prior financial resources have been successfully employed (Hellmann and Puri 2002; MacMillan et al. 1985), so the number of funding rounds reflects how much total external funding the new venture has received and how many milestones have been successfully accomplished, each increasing the new venture's resource base (Tyebjee and Bruno 1984). Thus, we employ the number of funding rounds to capture the resources available to the new venture.

**Moderator variables** We used computer-aided text analysis to measure the CMOs' personalities, building on a methodological tradition that exploits the deep connections between individual psychological differences and the use of language (e.g., Malhotra et al. 2018; Tausczik and Pennebaker 2009). The method has been used to capture and quantify emotions, sentiment, mood, and charisma (Mairesse et al. 2007).

We used the LIWC application, the most popular program for these analyses (Park et al. 2015). (For a detailed description of the method, see Pennebaker et al. (2015).) The application extracts more than eighty linguistic features that are linked to psychological processes and are validated in more than 100 empirical studies (Pennebaker et al. 2015). LIWC's commercial version, Receptiviti, also provides measurements of the FFM personality dimensions using the LIWC metrics, machine-learning technologies, and empirical knowledge from research on the psychology of personality (Obschonka et al. 2017). The algorithm is proprietary, but research that compares its scores with established questionnaire-based measures provides a strong indication of its validity: Yarkoni (2010) shows that more than 40% of the (then 66) LIWC dimensions have statistically significant correlations with the FFM traits, and Obschonka et al. (2017) compare Receptiviti with survey measurements and find positive correlations that, except for extraversion, where the correlation is "only" .40, are all higher than .65.

We removed tweets that were retweets of other people's content and cleaned the text samples by removing hyperlinks and extra-linguistic characters. Receptiviti takes into account that the text samples originate from Twitter, which has peculiarities in language use (Pennebaker et al. 2015; Receptiviti Inc. 2017). Receptiviti requires a minimum of 300 words for a valid measurement (Receptiviti Inc. 2017), so observations with smaller writing samples were discarded. Since there is also an upper limit of 10,000 words for a single measurement, we calculated the personality scores with three randomly drawn subsamples. Doing so allowed us to conduct another validation of the measurement method by comparing these three subsamples for the 287 CMOs for which we had more than 15,000 words, which indicated high stability in the measurements. The share of the variance in the scores that was due to differences between CMOs and not to differences in the CMOs' subsamples ranged from 90% for openness to experience to 95% for agreeableness. The average number of words per person used for measurement was 15,700. Web Appendix B provides further robustness tests we ran to ensure the validity of this measure.

**Control variables** We controlled for a variety of factors that prior research on CMOs shows or argues will influence outcomes. On the individual level, Homburg et al. (2014) show that an executive education and marketing- and industry-specific experience increase the chances that new ventures succeed. We included variables coded as 1 if a CMO holds an MBA degree and if a CMO has held marketing- or industry-related positions before the current position, as research discusses the CMO's tenure as a factor in identifying the antecedents and consequences of CMO-related relationships (Homburg et al. 2014; Nath and Mahajan 2011). We also added as controls the CEOs' equivalents of all factors related to the CMO's human capital.

On the firm level, we controlled for the size of the TMT, counting CEOs, CTOs, COOs, CMOs, and CFOs in the definition of the TMT, as TMTs' size is shown to influence new ventures' success (Jin et al. 2017). Since companies that operate in business-to-customer (B2C) environments have larger customer bases than do business-to-business (B2B) companies, the distinction is included as a control in many studies on CMOs, with each firm coded as B2C or B2B based on its description on Crunchbase and, in ambiguous cases, that on its homepage. Some companies were acquired, went public, or received venture capital funding during the observation period, all of which changes the resources a new venture has at its disposal (Homburg et al. 2014). Since all three statuses can apply to a new venture in a year, we included three dummy variables for the firms' status (backed by venture capital, public, acquired). Notably, venture capital backing serves as a proxy for the existence of commerciable products and marketing budgets, since venture capital is typically only obtained when commerciable products are available or at least very close to being finalized (Ramsinghani 2014; Roberts 1991; Tyebjee and Bruno 1984). Further, in most cases, only when venture capital funding has been acquired do relevant marketing budgets become realistic (Lodish et al. 2001). Finally, we used a dummy variable to indicate whether the new venture is based in the United States.

**Table 2** Overview of measures and data sources

| Variables | Construct | Measurement | Data source |
|---|---|---|---|
| Dependent | Web traffic | Median of daily page views per one million website visits | Amazon Web Information Services |
| Independent | Age | Age of new venture in years | Crunchbase |
| | Size | Natural logarithm of the mean of the number of employees in 2016, linearly scaled from the new venture's inception to 2016 | Crunchbase |
| | Number of funding rounds | Cumulated number of equity funding rounds | Crunchbase |
| Moderator | CMO's personality traits | LIWC/Receptiviti predictive measure of five factor personality scores based on CMOs' content posted on Twitter | Twitter, LIWC/Receptiviti |
| Control | CMO/CEO education | 1 if CMO/CEO has an MBA degree, 0 else | Crunchbase |
| | CMO/CEO marketing experience | 1 if CMO/CEO has had a marketing related job before, 0 else | Crunchbase |
| | CMO/CEO industry experience | 1 if CMO/CEO has had a job in the same industry category before, 0 else | Crunchbase |
| | CMO/CEO tenure | Tenure of CMO/CEO in years | Crunchbase |
| | TMT size | Size of TMT (CEO, CMO, CTO, COO, CFO) | Crunchbase |
| | B2C | 1 if new venture is primarily selling to end customers, 0 else | Manual coding based on Crunchbase description and company websites |
| | Acquired | 1 if new venture has been acquired by another company, 0 else | Crunchbase |
| | Public | 1 if new venture is publicly traded, 0 else | Crunchbase |
| | VC backed | 1 if new venture has obtained financing by a venture capital firm, 0 else | Crunchbase |
| | US based | 1 if new venture is based in the United States, 0 else | Crunchbase |
| | Market concentration | Herfindahl–Hirschman index of market concentration on 2-digit SIC code level | Compustat |
| | Technological turbulence | Percentage of R&D expenses over sales on 2-digit SIC code level | Compustat |
| | Demand instability | Variance in 3 year lagged sales growth on 2-digit SIC code level | Compustat |

We controlled on the industry level for demand instability, market concentration, and technological turbulence (Nath and Mahajan 2008, 2011). We calculated industry-related variables using Compustat data by mapping the Crunchbase-specific industry categories to SIC codes and taking averages when a company's list of categories is mapped to more than one 2-digit code.[4] We also included year fixed effects, which control for factors that affect all companies in a given year, including changes in website browsing behavior and traffic-measurement methodology.

Table 2 presents an overview of measures and data sources, and Table 3 shows the (pooled) descriptive statistics and correlations. In line with organizational life cycle models, new venture age is correlated with size (r = .68), age is correlated with number of funding rounds (r = .36) and number of funding rounds is correlated with size (r = .52), indicating these variables to be related yet distinct measures of firm maturity. Also, companies in our sample have a mean age of 4.78.

## Model

**General modelling approach** Given the complex nature of this empirical setting (a panel dataset with potential heteroskedasticity and autocorrelation, non-random sample selection and a nonlinear relationship between the dependent variable and the regressors), we did not try to find *the* right model but considered as robust evidence the results from various models that address the data's challenges.

**Accounting for sample selection–based endogeneity** With our set-up and measurement approach, our focal variables are available only when firms have a CMO with a Twitter account, so this non-random sample selection could lead to endogeneity (Wooldridge 2010). Therefore, we started with a representative sample of the entire population and estimated the likelihood that a company was in the final sample because it had a tweeting CMO. From this probit regression we

[4] While one must account for variations in the data that stem from factors that affect all companies of a certain type, we caution against interpreting these variables as "classic" industry measures. Our sample consists of technology-based new ventures, which are often characterized as combining digital technologies with an industry specialization. For example, Uber (not in our sample) has the SIC code 4111—"local and suburban transit"—but it is also affected by trends in the "computer-related services" industry (SIC code 7370). Not surprisingly, the 2-digit SIC code 73 is the most frequent code in our sample.

**Table 3** Pooled correlations and summary statistics

| Variables | Mean | S.D. | Min | Max | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Web traffic | 2.64 | 10.42 | 0.02 | 105 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Age | 4.78 | 2.97 | 0 | 13 | 0.21 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Size | 3.04 | 1.62 | 0 | 8.92 | 0.25 | 0.68 | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Number of funding rounds | 2.73 | 2.25 | 0 | 18 | 0.17 | 0.36 | 0.52 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 5. CMO openness | 1.15 | 0.36 | −0.09 | 2.52 | 0.01 | 0.01 | −0.04 | 0.03 | 1 | | | | | | | | | | | | | | | | | | | | | |
| 6. CMO extraversion | 0.84 | 0.48 | −0.56 | 2.68 | 0.03 | 0.04 | 0.10 | 0.12 | 0.32 | 1 | | | | | | | | | | | | | | | | | | | | |
| 7. CMO conscientiousness | 1.46 | 0.75 | −0.82 | 3.03 | −0.05 | 0.13 | 0.23 | 0.15 | −0.31 | 0.4 | 1 | | | | | | | | | | | | | | | | | | | |
| 8. CMO neuroticism | 1.61 | 0.39 | 0.43 | 3.09 | 0.03 | 0.01 | 0.02 | 0.09 | 0.24 | −0.01 | −0.25 | 1 | | | | | | | | | | | | | | | | | | |
| 9. CMO agreeableness | −5.36 | 1.30 | −9.48 | −0.17 | 0.01 | −0.15 | −0.24 | −0.20 | −0.09 | −0.25 | −0.49 | −0.5 | 1 | | | | | | | | | | | | | | | | | |
| 10. CMO education | 0.21 | 0.40 | 0 | 1 | 0.03 | 0.07 | 0.18 | 0.14 | 0.00 | 0.05 | 0.21 | −0.02 | −0.19 | 1 | | | | | | | | | | | | | | | | |
| 11. CMO marketing experience | 0.72 | 0.45 | 0 | 1 | 0.05 | 0.09 | 0.23 | 0.17 | 0.03 | 0.17 | 0.23 | 0.06 | −0.23 | 0.19 | 1 | | | | | | | | | | | | | | | |
| 12. CMO industry experience | 0.32 | 0.46 | 0 | 1 | 0.09 | 0.14 | 0.20 | 0.16 | 0.02 | −0.01 | 0.12 | 0.05 | −0.17 | 0.13 | 0.24 | 1 | | | | | | | | | | | | | | |
| 13. CMO tenure | 2.41 | 2.37 | 0 | 13 | 0.07 | 0.51 | 0.28 | 0.06 | 0.03 | −0.03 | −0.02 | −0.06 | 0.06 | −0.02 | −0.22 | −0.04 | 1 | | | | | | | | | | | | | |
| 14. CEO education | 0.17 | 0.36 | 0 | 1 | 0.03 | 0.06 | 0.12 | 0.14 | 0.06 | 0.06 | 0.04 | 0.01 | −0.09 | 0.08 | 0.04 | 0.07 | 0.02 | 1 | | | | | | | | | | | | |
| 15. CEO marketing experience | 0.21 | 0.41 | 0 | 1 | 0.08 | 0.10 | 0.14 | 0.10 | 0.01 | −0.03 | 0.02 | −0.03 | −0.02 | 0.03 | 0.07 | 0.09 | 0.05 | 0.15 | 1 | | | | | | | | | | | |
| 16. CEO industry experience | 0.28 | 0.45 | 0 | 1 | 0.04 | 0.11 | 0.19 | 0.20 | −0.09 | 0.11 | 0.15 | 0.02 | −0.14 | 0.04 | 0.17 | 0.21 | 0.06 | 0.07 | 0.18 | 1 | | | | | | | | | | |
| 17. CEO tenure | 3.90 | 2.70 | 0 | 13 | 0.18 | 0.75 | 0.53 | 0.26 | 0.02 | 0.03 | 0.05 | 0.02 | −0.1 | 0.04 | 0.03 | 0.09 | 0.47 | −0.01 | −0.03 | 0.03 | 1 | | | | | | | | | |
| 18. TMT size | 3.23 | 0.95 | 2 | 5 | 0.15 | 0.31 | 0.42 | 0.35 | −0.01 | 0.02 | 0.11 | 0.04 | −0.12 | 0.09 | 0.17 | 0.08 | 0.03 | 0.02 | 0.11 | 0.11 | 0.23 | 1 | | | | | | | | |
| 19. B2C | 0.46 | 0.50 | 0 | 1 | 0.03 | −0.15 | −0.13 | −0.08 | 0.14 | −0.04 | −0.26 | 0.11 | 0.11 | 0.04 | −0.13 | −0.23 | −0.04 | −0.01 | −0.11 | −0.19 | −0.12 | −0.04 | 1 | | | | | | | |
| 20. Aquired | 0.04 | 0.19 | 0 | 1 | −0.03 | 0.06 | 0.06 | 0.06 | 0.00 | 0.01 | 0.00 | 0.03 | −0.01 | −0.01 | 0.06 | −0.04 | 0.10 | 0.04 | 0.01 | 0.07 | 0.04 | 0.04 | 0.03 | 1 | | | | | | |
| 21. Public | 0.02 | 0.14 | 0 | 1 | 0.25 | 0.17 | 0.23 | 0.15 | −0.01 | 0.00 | 0.03 | 0.05 | −0.05 | 0.02 | 0.08 | 0.06 | 0.11 | 0.08 | 0.12 | 0.17 | 0.13 | 0.17 | −0.06 | −0.03 | 1 | | | | | |
| 22. VC backed | 0.60 | 0.49 | 0 | 1 | 0.16 | 0.37 | 0.48 | 0.56 | 0.04 | 0.08 | 0.11 | 0.07 | −0.19 | 0.17 | 0.27 | 0.23 | 0.08 | 0.11 | 0.13 | 0.18 | 0.27 | 0.29 | −0.08 | 0.05 | 0.11 | 1 | | | | |
| 23. US based | 0.69 | 0.46 | 0 | 1 | −0.06 | 0.11 | 0.16 | 0.20 | 0.09 | 0.18 | 0.23 | 0.19 | −0.36 | 0.13 | 0.21 | 0.19 | −0.05 | 0.11 | 0.07 | 0.16 | 0.03 | 0.05 | −0.15 | 0.01 | 0.04 | 0.18 | 1 | | | |
| 24. Market concentration | 0.06 | 0.05 | 0.01 | 0.48 | −0.05 | −0.04 | −0.07 | −0.13 | 0.07 | −0.03 | −0.15 | −0.02 | 0.10 | 0.05 | −0.02 | −0.15 | 0.01 | 0.06 | −0.03 | −0.12 | −0.06 | −0.06 | 0.39 | −0.01 | −0.06 | −0.06 | −0.11 | 1 | | |
| 25. Technology turbulence | 0.11 | 0.06 | 0 | 0.63 | 0.01 | 0.06 | 0.05 | 0.05 | −0.12 | −0.01 | 0.10 | −0.06 | −0.01 | −0.03 | 0.04 | 0.08 | −0.01 | 0.01 | 0.03 | 0.05 | −0.01 | −0.03 | −0.29 | −0.05 | 0.01 | 0.02 | 0.01 | −0.34 | 1 | |
| 26. Demand instability | 0.02 | 0.02 | 0.01 | 0.11 | −0.03 | −0.12 | −0.22 | −0.07 | −0.03 | −0.09 | −0.04 | −0.02 | 0.03 | −0.01 | −0.04 | −0.06 | −0.07 | 0.01 | −0.01 | −0.02 | −0.11 | 0.02 | 0.13 | −0.02 | −0.01 | −0.06 | −0.03 | 0.09 | −0.11 | 1 |

$n$ = 1482 firm-years (627 companies)

obtained an inverse Mills ratio (IMR) that we entered into our models. We followed recommended econometric practice (Wooldridge 2010; Certo et al. 2016) and the CMO literature (Germann et al. 2015) in including in the selection equation variables that are primarily related to the selection and are not part of the main equation. In particular, we included for each company the number of tweets from the company account, the propensity of similar firms to have a CMO, and their propensity to have a CMO with an active Twitter account (see Germann et al. 2015 for a discussion about why variables so defined fulfill the exclusion restriction required for the correction procedure at work). The full selection equation can be found in the Web Appendix C. We defined "similar firms" as those with which a given firm shares a two-digit SIC code (Germann et al. 2015). We chose at random a sample of equal size out of the 69,391 firms in our Crunchbase sample and then used a probit regression to estimate the likelihood that a firm would enter the final sample.

**Other sources of endogeneity** Even if it were possible to obtain personality scores for all CMOs in the sample, the threat of endogeneity would remain if there were unobserved factors that are related to both the CMO's personality and web traffic. Given the stability of personality and its determinants, it is difficult to imagine unobserved factors that could cause endogeneity *beyond* the one introduced by sample selection. Personality is often considered a truly exogeneous source of variation, and it is even recommended as a possible instrumental variable in certain contexts (Antonakis et al. 2010).

Model 1, a simple pooled regression model estimated with OLS, assumes that all possible correlations between the CMO personality variables and the error term are captured by the set of control variables (Germann et al. 2015). Given that the panel nature of the data might introduce heteroskedasticity, we used robust standard errors to obtain a conservative but consistent estimate of the standard errors.

Model 2 is a between effects model that exploits only the between variability of the data by taking the firm-average of each variable. Such models are not often employed in the literature, but since they are a valid approach when dealing with short periods of time and are used (and debated) in research on the performance consequences of having a CMO (Nath and Mahajan 2008), we include them to facilitate comparison.

Model 3 is a random effects model whose results are similar to those of model 2 because of the high intra-class correlations among some of the independent variables, especially the focal personality variables, which exhibit within-firm variation only when there is a change in the CMO position itself.[5] Since models 1, 2, and 3 invoke a linear link between the predictors and the skewed dependent variable, we use its natural logarithm.

Model 4 is a generalized linear model that considers the distribution of the dependent variable by using a negative binomial distribution and a link function that relates the linear prediction to the outcome. Since the empirical standard deviation is much greater than the mean, a negative binomial model is preferred over a Poisson model (Gruber et al. 2010). This approach is usually used for count outcomes. Although our dependent variable is not, strictly speaking, a count since it is scaled (e.g., it allows for non-integer values), it is based on an actual count (website visits) and has a similar distribution.

To summarize, the covariates are related to the outcome via the following equation:

$$\begin{aligned}\text{Web traffic}_{it} = {} & \beta_0 + \beta_1 \cdot \text{age}_{it} + \beta_2 \cdot \text{size}_{it} + \beta_3 \cdot \text{number\_of\_funding\_rounds}_{it} + \\ & \beta_4 \cdot \text{CMO\_openness}_{it} + \beta_5 \cdot \text{CMO\_extraversion}_{it} + \beta_6 \cdot \text{CMO\_conscientiousness}_{it} + \\ & \beta_7 \cdot \text{CMO\_neuroticism}_{it} + \beta_8 \cdot \text{CMO\_agreeableness}_{it} + \beta_9 \cdot \text{CMO\_education}_{it} + \\ & \beta_{10} \cdot \text{CMO\_mark\_experience}_{it} + \beta_{11} \cdot \text{CMO\_ind\_experience}_{it} + \beta_{12} \cdot \text{CMO\_tenure}_{it} + \\ & \beta_{13} \cdot \text{CEO\_education}_{it} + \beta_{14} \cdot \text{CEO\_mark\_experience}_{it} + \beta_{15} \cdot \text{CEO\_ind\_experience}_{it} + \\ & \beta_{16} \cdot \text{CEO\_tenure}_{it} + \beta_{17} \cdot \text{sizeTMT}_{it} + \beta_{18} \cdot \text{B2C}_{i} + \beta_{19} \cdot \text{acquired}_{it} + \beta_{20} \cdot \text{public}_{it} \\ & \beta_{21} \cdot \text{VC\_backed}_{it} + \beta_{22} \cdot \text{US\_based}_{i} + \beta_{23} \cdot \text{market\_concentration}_{it} \\ & + \beta_{24} \cdot \text{tech\_turbulence}_{it} + \beta_{25} \cdot \text{demand\_instability}_{it} + \beta_{26} \cdot \text{IMR}_{it} + \varepsilon_{it},\end{aligned}$$

where $\text{IMR}_{it}$ is the inverse Mills ratio and interaction terms as well as the year dummies are not shown to enhance readability. In models 1, 2, and 3, the natural logarithm of web traffic is used. Model 4 builds on the same set of variables but invokes a non-linear model and a link function to model the relationship between the predictors and dependent variable. All time-variant variables are indexed with *t*. While CMO personality is constant as long as the CMO does not change, there are CMO changes in our observation period, which is why we also indexed this observation with *t*. All independent and moderator variables are standardized. Also, all controls were standardized except for count and binary variables and the inverse Mills ratio.

[5] Web Appendix D provides a more detailed explanation of the application of the between effects model and the random effects model.

**Table 4** Regression coefficients for models 1 (OLS) and 2 (Between effects panel model) (dependent variable: web traffic)

| | (1) OLS[a] | | | | | (2) Between effects panel model | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (a) Controls only | (b) Direct effects only | (c) Interaction with age | (d) Interaction with size | (e) Interaction with NFR | (a) Controls only | (b) Direct effects only | (c) Interaction with age | (d) Interaction with size | (e) Interaction with NFR |
| Age | | .20 (.09)* | .20 (.08)* | .21 (.08)* | .20 (.09)* | | .31 (.11)** | .29 (.11)** | .32 (.11)** | .31 (.11)** |
| Size | | .54 (.08)*** | .57 (.07)*** | .52 (.08)*** | .52 (.08)*** | | .65 (.11)*** | .68 (.11)*** | .61 (.11)*** | .62 (.11)*** |
| Number of funding rounds (NFR) | | .08 (.05) | .11 (.05)* | .07 (.05) | .06 (.05) | | .09 (.08) | .13 (.08) | .08 (.08) | .08 (.08) |
| CMO openness | | -.04 (.05) | -.06 (.05) | -.04 (.05) | -.05 (.05) | | -.04 (.07) | -.05 (.07) | -.04 (.07) | -.05 (.08) |
| CMO extraversion | | .15 (.05)** | .16 (.05)** | .17 (.05)*** | .17 (.05)*** | | .16 (.07)* | .19 (.07)** | .20 (.07)** | .19 (.08)* |
| CMO conscientiousness | | -.25 (.08)** | -.25 (.08)** | -.25 (.08)*** | -.26 (.08)*** | | -.17 (.11) | -.18 (.11) | -.18 (.11) | -.19 (.11) |
| CMO neuroticism | | -.04 (.06) | -.03 (.06) | -.03 (.06) | -.03 (.06) | | .03 (.09) | .04 (.09) | .03 (.09) | .02 (.09) |
| CMO agreeableness | | .11 (.07) | .11 (.07) | .08 (.07) | .07 (.07) | | .12 (.10) | .11 (.10) | .07 (.10) | .08 (.10) |
| CMO education | -.21 (.11)* | -.15 (.10) | -.15 (.10) | -.15 (.10) | -.16 (.10) | -.14 (.16) | -.11 (.15) | -.09 (.15) | -.11 (.15) | -.11 (.15) |
| CMO marketing experience | .06 (.10) | .03 (.09) | .03 (.09) | .03 (.09) | .02 (.09) | .07 (.15) | .02 (.15) | .01 (.14) | .02 (.15) | .02 (.15) |
| CMO industry experience | .21 (.10)* | .15 (.10) | .12 (.09) | .16 (.10) | .16 (.10) | .11 (.14) | .08 (.13) | .06 (.13) | .09 (.13) | .09 (.13) |
| CMO tenure | -.00 (.02) | -.04 (.02) | -.04 (.02) | -.03 (.02) | -.03 (.02) | -.04 (.03) | -.09 (.03)** | -.08 (.03)* | -.08 (.03)* | -.08 (.03)* |
| CEO education | .17 (.11) | .13 (.11) | .14 (.11) | .13 (.11) | .14 (.11) | .03 (.17) | .02 (.16) | .03 (.16) | .03 (.16) | .04 (.16) |
| CEO marketing experience | .07 (.11) | -.06 (.10) | -.04 (.10) | -.04 (.10) | -.06 (.11) | .14 (.15) | -.02 (.15) | .02 (.15) | .01 (.15) | -.01 (.15) |
| CEO industry experience | .11 (.10) | .05 (.10) | .04 (.09) | .05 (.10) | .05 (.10) | .25 (.14) | .16 (.14) | .14 (.14) | .15 (.14) | .16 (.14) |
| CEO tenure | .13 (.02)*** | .03 (.03) | .03 (.03) | .03 (.03) | .03 (.03) | .12 (.03)*** | -.02 (.03) | -.02 (.03) | -.02 (.03) | -.02 (.03) |
| TMT size | -.49 (.10)*** | -.43 (.10)*** | -.43 (.09)*** | -.45 (.10)*** | -.44 (.10)*** | -.51 (.13)*** | -.49 (.13)*** | -.48 (.13)*** | -.52 (.13)*** | -.50 (.13)*** |
| B2C | .28 (.09)** | .23 (.09)** | .22 (.09)* | .24 (.09)** | .24 (.09)** | .30 (.14)* | .28 (.13)* | .28 (.13)* | .30 (.13)* | .29 (.13)* |
| Acquired | -.02 (.21) | -.15 (.21) | -.14 (.20) | -.11 (.21) | -.19 (.21) | -.15 (.35) | -.24 (.33) | -.16 (.33) | -.15 (.33) | -.26 (.33) |
| Public | 1.15 (.42)** | .66 (.45) | .66 (.47) | .69 (.46) | .70 (.45) | 1.37 (.50)** | .56 (.48) | .44 (.47) | .55 (.48) | .60 (.48) |
| VC backed | .19 (.10) | -.03 (.10) | -.07 (.10) | -.05 (.10) | -.03 (.10) | .26 (.17) | -.06 (.17) | -.11 (.17) | -.09 (.17) | -.08 (.17) |
| US based | -.46 (.09)*** | -.45 (.09)*** | -.40 (.09)*** | -.42 (.09)*** | -.44 (.09)*** | -.37 (.14)** | -.41 (.13)** | -.37 (.13)** | -.39 (.13)** | -.41 (.13)** |
| Market concentration | -.06 (.05) | -.05 (.05) | -.02 (.04) | -.04 (.05) | -.04 (.05) | -.00 (.07) | .01 (.06) | .03 (.06) | .00 (.06) | .01 (.07) |
| Technological turbulence | -.03 (.04) | -.02 (.04) | -.01 (.04) | -.02 (.04) | -.02 (.04) | -.04 (.07) | -.05 (.07) | -.03 (.07) | -.04 (.07) | -.05 (.07) |
| Demand instability | .08 (.07) | -.03 (.07) | -.06 (.07) | -.04 (.07) | -.03 (.07) | -.01 (.13) | -.12 (.12) | -.15 (.12) | -.12 (.12) | -.12 (.12) |
| CMO openness x age | | | .09 (.05) | | | | | .13 (.07) | | |
| CMO extraversion x age | | | .11 (.05)* | | | | | .17 (.08)* | | |
| CMO conscientiousness x age | | | -.19 (.06)** | | | | | -.20 (.08)* | | |
| CMO neuroticism x age | | | .01 (.04) | | | | | .04 (.06) | | |
| CMO openness x size | | | | .00 (.05) | | | | | .04 (.08) | |
| CMO extraversion x size | | | | .16 (.05)** | | | | | .21 (.08)** | |
| CMO conscientiousness x size | | | | -.06 (.06) | | | | | -.04 (.08) | |
| CMO neuroticism x size | | | | .08 (.04) | | | | | .09 (.06) | |
| CMO openness x NFR | | | | | -.07 (.06) | | | | | -.03 (.08) |
| CMO extraversion x NFR | | | | | .15 (.06)** | | | | | .18 (.08)* |
| CMO conscientiousness x NFR | | | | | -.00 (.06) | | | | | -.02 (.08) |
| CMO neuroticism x NFR | | | | | .07 (.04) | | | | | .04 (.06) |
| Year-dummies | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| Inverse Mills ratio | -2.09 (.24)*** | -1.54 (.24)*** | -1.55 (.24)*** | -1.59 (.24)*** | -1.58 (.24)*** | -2.07 (.32)*** | -1.53 (.32)*** | -1.50 (.31)*** | -1.59 (.32)*** | -1.57 (.32)*** |
| Firm-Years | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 |
| Companies | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 |
| Model Fit | $R^2$: .231 | $R^2$: .296 | $R^2$: .314 | $R^2$: .304 | $R^2$: .302 | $R^2$: .256[b] | $R^2$: .345[b] | $R^2$: .374[b] | $R^2$: .360[b] | $R^2$: .352[b] |

*** $p < .001$, ** $p < .01$, * $p < .05$ | Standard errors in parentheses; all standard errors robust except for between effects model | a: Highest variance inflation factor (VIF) for OLS models a-e is 6.50, the mean VIF ranges from 2.22 to 2.52. | b: Between $R^2$ (accounting for the variance between firms)

**Table 5** Regression coefficients for models 3 (Random effects panel model) and 4 (Negative binomial model) (dependent variable: web traffic)

| | (3) Random effects panel model | | | | | (4) Negative binomial model | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (a) Controls only | (b) Direct effects only | (c) Interaction with age | (d) Interaction with size | (e) Interaction with NFR | (a) Controls only | (b) Direct effects only | (c) Interaction with age | (d) Interaction with size | (e) Interaction with NFR |
| Age | | .39 (.11)*** | .40 (.11)*** | .39 (.11)*** | .40 (.11)*** | | .42 (.11)*** | .28 (.10)** | .43 (.11)*** | .41 (.11)*** |
| Size | | .37 (.09)*** | .38 (.08)*** | .39 (.08)*** | .36 (.09)*** | | .62 (.11)*** | .76 (.11)*** | .59 (.11)*** | .56 (.11)*** |
| Number of funding rounds (NFR) | | .27 (.07)*** | .29 (.07)*** | .26 (.07)*** | .24 (.07)*** | | .05 (.07) | .09 (.06) | .03 (.07) | -.00 (.07) |
| CMO openness | | -.03 (.07) | -.06 (.07) | -.04 (.07) | -.04 (.07) | | -.10 (.08) | -.21 (.08)** | -.10 (.08) | -.14 (.08) |
| CMO extraversion | | .14 (.07)* | .15 (.07)* | .14 (.07)* | .15 (.07)* | | .25 (.07)*** | .26 (.08)** | .25 (.08)** | .25 (.07)*** |
| CMO conscientiousness | | -.20 (.11) | -.21 (.11) | -.21 (.11) | -.21 (.11) | | -.58 (.11)*** | -.51 (.11)*** | -.58 (.11)*** | -.58 (.11)*** |
| CMO neuroticism | | -.03 (.09) | -.03 (.09) | -.04 (.09) | -.03 (.09) | | -.18 (.09)* | -.17 (.09)* | -.21 (.09)* | -.17 (.09) |
| CMO agreeableness | | .06 (.10) | .06 (.10) | .06 (.11) | .04 (.11) | | .20 (.11) | .21 (.11) | .15 (.12) | .16 (.12) |
| CMO education | -.13 (.15) | -.06 (.13) | -.02 (.13) | -.01 (.13) | -.01 (.13) | -.47 (.17)** | -.18 (.15) | -.18 (.15) | -.18 (.15) | -.20 (.16) |
| CMO marketing experience | .24 (.13) | .17 (.12) | .15 (.12) | .15 (.12) | .17 (.12) | -.01 (.17) | .09 (.15) | .06 (.15) | .09 (.15) | .10 (.15) |
| CMO industry experience | .09 (.13) | 02 (.13) | -.00 (.13) | .01 (.13) | .03 (.13) | .57 (.14)*** | .35 (.13)** | .32 (.13)* | .38 (.13)** | .42 (.13)** |
| CMO tenure | -.02 (.03) | -.05 (.03) | -.05 (.03) | -.05 (.03) | -.05 (.03) | -.01 (.03) | -.05 (.03) | -.03 (.03) | -.04 (.03) | -.04 (.03) |
| CEO education | .09 (.16) | .03 (.15) | .03 (.15) | .03 (.15) | .04 (.15) | -.13 (.18) | .03 (.18) | .10 (.17) | .07 (.17) | .10 (.18) |
| CEO marketing experience | .23 (.17) | .06 (.16) | .05 (.15) | .04 (.16) | .04 (.16) | .71 (.18)*** | .42 (.14)** | .42 (.14) ** | .37 (.14)** | .39 (.14)** |
| CEO industry experience | .21 (.14) | .06 (.12) | .06 (.13) | .09 (.13) | .08 (.13) | .11 (.17) | -.08 (.14) | -.08 (.14) | -.07 (.14) | -.02 (.14) |
| CEO tenure | .12 (.03)*** | -.01 (.03) | -.02 (.03) | -.01 (.03) | -.01 (.03) | .16 (.03)*** | .03 (.03) | .03 (.03) | .03 (.03) | .04 (.03) |
| TMT size | -.20 (.11) | -.11 (.10) | -.12 (.10) | -.12 (.11) | -.11 (.11) | -.94 (.19)*** | -.84 (.20)*** | -.88 (.19)*** | -.83 (.20)*** | -.83 (.20)*** |
| B2C | .32 (.13)* | .27 (.13)* | .26 (.12)* | .27 (.13)* | .28 (.13)* | .72 (.15)*** | .55 (.14)*** | .54 (.14)*** | .59 (.14)*** | .65 (.13)*** |
| Acquired | -.03 (.14) | -.17 (.13) | -.20 (.13) | -.19 (.13) | -.24 (.12) | -.25 (.29) | -.47 (.31) | -.53 (.28) | -.47 (.31) | -.53 (.34) |
| Public | .66 (.23)** | .52 (.24)* | .54 (.26)* | .52 (.25) * | .51 (.25)* | 1.15 (.31)*** | 1.26 (.40)** | 1.52 (.44)*** | 1.27 (.41)** | 1.29 (.38)*** |
| VC backed | .24 (.10)* | .11 (.10) | .08 (.10) | .07 (.10) | 10 (.10) | .34 (.19) | -.00 (.18) | -.10 (.17) | .00 (.18) | .05 (.18) |
| US based | -.35 (.14)* | -.42 (.13)** | -.39 (.13)** | -.41 (.13)** | -.43 (.13)** | -.78 (.15)*** | -.44 (.14)** | -.39 (.15)** | -.36 (.13)** | -.39 (.14)** |
| Market concentration | -.01 (.06) | .02 (.06) | .03 (.06) | .02 (.06) | .02 (.06) | -.21 (.09)* | -.22 (.09)* | -.17 (.09)* | -.22 (.09)* | -.21 (.10)* |
| Technological turbulence | -.03 (.03) | -.02 (.03) | -.02 (.03) | -.02 (.03) | -.02 (.03) | -.04 (.08) | -.05 (.08) | -.01 (.08) | -.06 (.08) | -.06 (.08) |
| Demand instability | .02 (.05) | -.05 (.04) | -.04 (.04) | -.04 (.04) | -.04 (.04) | .08 (.13) | -.10 (.13) | -.05 (.13) | -.11 (.13) | -.08 (.13) |
| CMO openness x age | | | -.02 (.06) | | | | | .06 (.07) | | |
| CMO extraversion x age | | | .11 (.06) | | | | | .20 (.07)** | | |
| CMO conscientiousness x age | | | -.21 (.06)*** | | | | | -.44 (.08)*** | | |
| CMO neuroticism x age | | | -.00 (.04) | | | | | -.04 (.07) | | |
| CMO openness x size | | | | -.07 (.05) | | | | | -.09 (.07) | |
| CMO extraversion x size | | | | .10 (.05)* | | | | | .24 (.07)*** | |
| CMO conscientiousness x size | | | | -.14 (.05)** | | | | | -.17 (.08)* | |
| CMO neuroticism x size | | | | -.01 (.03) | | | | | .11 (.06) | |
| CMO openness x NFR | | | | | -.10 (.06) | | | | | -.02 (.08) |
| CMO extraversion x NFR | | | | | .18 (.05)*** | | | | | .31 (.08)*** |
| CMO conscientiousness x NFR | | | | | -.13 (.06)* | | | | | -.07 (.09) |
| CMO neuroticism x NFR | | | | | .02 (.05) | | | | | .02 (.06) |
| Year-dummies | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| Inverse Mills ratio | -1.23 (.27)*** | -.53 (.25)* | -.58 (.25)* | -.58 (.25)* | -.56 (.25)* | -3.83 (.54)*** | -2.96 (.59)*** | -3.07 (.57)*** | -2.97 (.59)*** | -2.97 (.60)*** |
| Firm-Years | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 | 1482 |
| Companies | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 | 627 |
| Model Fit | $R^2$: .211[a] | $R^2$: .261[a] | $R^2$: .277[a] | $R^2$: .266[a] | $R^2$: .263[a] | 423.38[b] | 653.78[b] | 764.31[b] | 697.19[b] | 703.58[b] |

*** $p < .001$, ** $p < .01$, * $p < .05$ | Standard errors in parentheses; all standard errors robust except for between effects model. | a: Overall $R^2$ (accounting for the overall variance); b: Wald chi$^2$

## Results

Tables 4 and 5 report a model including (a) only control variables, (b) a model including only direct effects for testing of H1 and (c-e) three models including interaction effects for testing H2a–H2d for all four types of regression models. Findings reported in columns 1b, 2b, 3b, and 4b indicate that firm age (at least at $p < .05$; coefficients ranging between .20 and .42) and firm size (all $ps < .001$; coefficients ranging between .37. and .65) are positively related to web traffic, across regression specifications, lending support to H1 (i) and (ii). H1 (iii) relates funding rounds to web traffic and is only supported for the random effects panel model (.27; $p < .001$). With regard to (unhypothesized) direct effects of the personality variables on web traffic, we find that extraversion is positively related to web traffic across specifications (at least $p < .05$; coefficients ranging between .14 and .25). Conscientiousness is negatively related to web traffic for the OLS and negative binomial regression models (at least $p < .01$). Neuroticism is negatively related to web traffic ($p < .05$) only in the negative binomial model, and openness and agreeableness are not significantly associated with web traffic when the model including only direct effects (b) is considered.

As columns 1c-e, 2c-e, 3c-e and 4c-e in Tables 4 and 5 indicate, the interactions of CMO's openness to experience and the facets of firm maturity are not significantly related to web traffic in any of the relevant regression models, which leads to the rejection of H2a. However, the interactions between the facets of firm maturity and CMO extraversion are significantly and positively related to web traffic in almost all regression models, with significance levels of $p < .05$ or better (coefficients ranging between .10 and .31), supporting H2b. Similarly, the interactions between the CMO's conscientiousness and firm age are negatively related to web traffic with significance levels of at least $p < .05$ (coefficients ranging between −.44 and − .19), lending support to H2c. Support for H2c is mixed when considering firm size and funding rounds in interaction with the CMO's conscientiousness, since only some regression coefficients are significant and negative (e.g., in the random effects model for the interaction between firm size and conscientiousness; −.14; $p < .01$). H2d is rejected, since there are no significant relationships between the interaction of the CMO's neuroticism and the facets of firm maturity.

Figures 2 and 3 illustrate the relevant slopes with coefficients and standard errors based on the random effects panel model. Slopes with extraversion as moderator indicate that slopes between the maturity facets and web traffic are (in most cases) flat, unless there is a CMO with extraversion; in these cases, increased maturity translates into growing web traffic. Specifically, for Panel A in Fig. 2, simple slope tests indicate that size is positively related to web traffic (.50; $p < .001$) when extraversion is high (1 SD above the mean) and positively related to web traffic (.29; $p < .001$) when extraversion is low (1 SD below the mean). For Panel B in Fig. 2, simple slope tests indicate that the number of funding rounds is positively related to web traffic (.42; $p < .001$) when extraversion is high, whereas the relationship between number of funding rounds and web traffic is not significant when extraversion is low (.07; $p > .05$).

For conscientiousness as a moderator, simple slope analysis generally indicates that the relationships between maturity facets and web traffic are rather flat, unless there is a CMO with low conscientiousness. Specifically, for Panel A in Fig. 3, simple slope tests indicate that age has a positive effect on web traffic (.61; $p < .001$) when conscientiousness is low (one SD below the mean), whereas the relation between age and web traffic is not significant (.19; $p > .05$) when conscientiousness is high (one SD above the mean). For Panel B in Fig. 3, simple slope tests indicate that size is positively related to web traffic when conscientiousness is low (.53; $p < .001$) and when conscientiousness is high (.25; $p < .01$). For Panel C in Fig. 3, simple slope tests indicate that number of funding rounds has a positive effect on web traffic when conscientiousness is low (.37; $p < .001$), whereas it is not significant when conscientiousness is high (.11; $p > .05$). The simple slope tests are very similar for the other models.

In practical terms, for instance, when CMO extraversion is high (one SD above the mean), an increase in size from one standard deviation below the mean to one standard deviation above the mean is associated with an increase in web traffic of 2.01 page views per million,[6,7] whereas the same increase in size is associated with an increase in web traffic of only .47 page views per million when CMO extraversion is low (one SD below the mean). Hence, for a venture with a CMO with high (vs. low) extraversion, the same increase in size results in an average of four times more web traffic. Also, when CMO conscientiousness is high, an increase in size from one standard deviation below the mean to one standard deviation above the mean is associated with an increase in web traffic

[6] These results are based on the negative binomial model, since prediction of logged dependent variables is not straightforward (Wooldridge 2013, pp. 212–213). Predictions were calculated using the Stata command *margins*, keeping all other variables at their mean value.

[7] When interpreting the economic magnitude of the effect, it is important to keep in mind that web traffic is not measured in absolute numbers but rather in page views per one million website visits (as provided by Alexa to measure the relevance of a website on a given day, relative to the traffic volume on that day; see also Zhang et al. (2011) and Edelman and Brandi (2015)). To illustrate, two page views per million for a given URL can be interpreted as follows: If one randomly selects 1000,000 website visits, two of those visits would be directed to that particular URL. To put this in perspective, in the United States, 77% of the adult population uses the Internet at least once a day (Perrin and Jiang 2018), and most of these users likely visit multiple webpages each day. This implies that the absolute number of page views is much higher. Hence, when interpreting the effect, the focus should instead lie on the increase or decrease in web traffic from low to high values of the moderator.

of only .41 page views per million, whereas the same increase in size is associated with an increase in web traffic of 2.51 page views per million when CMO conscientiousness is low. Hence, for a venture with a CMO with low (vs. high) conscientiousness, the same increase in size results in an average of six times more web traffic.

We compare the models including interaction terms (1c-e, 2c-e, 3c-e, and 4c-e) with restricted models only including direct effects (1b, 2b, 3b, and 4b) and restricted models including only controls (1a, 2a, 3a, 4a) using Wald tests. Since most of our models use clustered standard errors, we used Wald tests to test for the difference between full models with interaction terms and restricted nested models without interaction terms using the Stata command *test*. Comparison between models including interaction terms (1c-e, 2c-e, 3c-e, and 4c-e) with models including only direct effects (1b, 2b, 3b, and 4b) indicated a significant difference (at least $p < .05$) between models except for two cases: The difference between random effects regression models with and without interaction terms of size and personality (3d vs. 3b) is significant at $p < .10$, while the difference between between effects regression models with and without interaction terms of number of funding rounds and personality (2e vs. 2b) is not significant ($p = .21$). Also, comparison between models including interaction terms (1c-e, 2c-e, 3c-e, and 4c-e) with models including only controls (1a, 2a, 3a, 4a) indicated a significant difference with at least $p < .05$ between the models for all four model types and all three maturity facets. Hence, overall, we conclude that including the interaction terms improves model fit. Additional analyses including further moderator analyses and additional and alternative measures are provided in Web Appendix E.

## Discussion

### Research-related implications

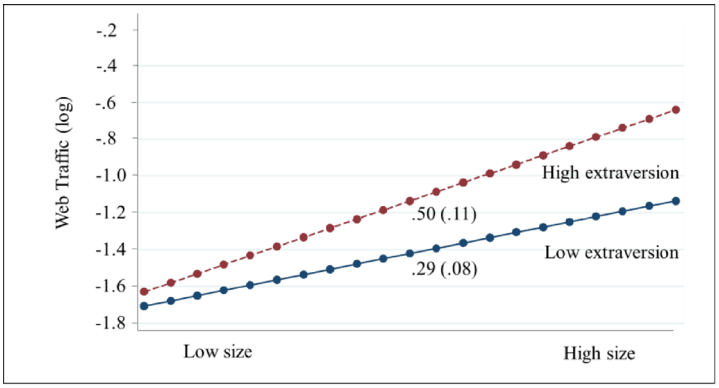
Our findings have several implications for the CMO literature, for research at the interface of marketing and entrepreneurship, and for the broader management literature. First, we add to studies that link human capital–related and social capital–related CMO characteristics to firm-level variables or relationships. We contribute to this research by finding that the CMO's personality can explain variances in how a new venture's maturity transforms into web traffic, adding a new perspective to what makes a successful CMO. A CMO has some ability to influence his or her human and social capital by, for example, obtaining a degree in marketing, gaining practical experience in a particular industry, or building more network relationships. Thus, a marketer can work toward becoming a great CMO. However, our findings also indicate that what makes a good CMO contains an element—personality—that is *not* manageable in the same way since it is a stable factor at least in the short to medium run (Stewart 1996).

Our findings show that two personality traits from the FFM—a high level of extraversion and a low level of conscientiousness—influence the CMO's ability to transform a new venture's increasing maturity into a desired outcome variable—in this case, web traffic. While the finding of conscientiousness' negative impact on our baseline relationship is in line with our theoretical expectation, it might conflict with some extant research. The observation that a high level of conscientiousness is considered a driver of job performance in many contexts (Barrick et al. 2008) suggests that the job demands imposed on CMOs in new ventures are so specific that the personality traits the job requires differ from those required in most other jobs.

Second, we contribute to research at the marketing–entrepreneurship interface, most of which is driven either by case studies (Hills et al. 2008) or by linking marketing-related characteristics to funding-related outcomes (Saboo and Grewal 2013). These characteristics are typically related to success only after some degree of public recognition, such as increasing web traffic, has appeared (Hills et al. 2008). However, research at the marketing–entrepreneurship interface does not provide systematic, quantitative evidence on what drives such "early-stage" variables. Our research suggests that, in a new venture's uncertain, unstructured, and inertia-free situation, what the individual who oversees marketing believes and decides and how he or she acts influence how much web traffic the new venture with increasing maturity receives.

Since the CMO is likely to be the central driver of marketing decisions in new ventures, our findings on personality's influence on how successful CMOs complete their tasks also indicate how marketing should be approached to generate benefits from the increasing maturity of new ventures. Apart from the general wisdom that marketing in new ventures must differ from that in established corporate settings (Hills and LaForge 1992) and some anecdotal and case study evidence on marketing success stories in the new-venture context (Lodish et al. 2001), the marketing literature establishes few guidelines on what constitutes a successful marketing approach in the context of technology-based new ventures. Among other things, being extraverted means being outgoing to ensure that the new venture's message to external stakeholders is noticed. An extraverted CMO is likely to enjoy networking, traveling to meet people who are interested in the new venture, proactively building networks, finding multipliers and influencers, and personally convincing stakeholders of the venture's value, all of which could be success factors, while an introvert's quiet modesty could result in the venture's remaining under the radar. On the other hand, the negative impact of a CMO's conscientiousness suggests that caution, precision, and attention to detail in new ventures'

a) Interaction between CMO extraversion and size




b) Interaction between CMO extraversion and number of funding rounds

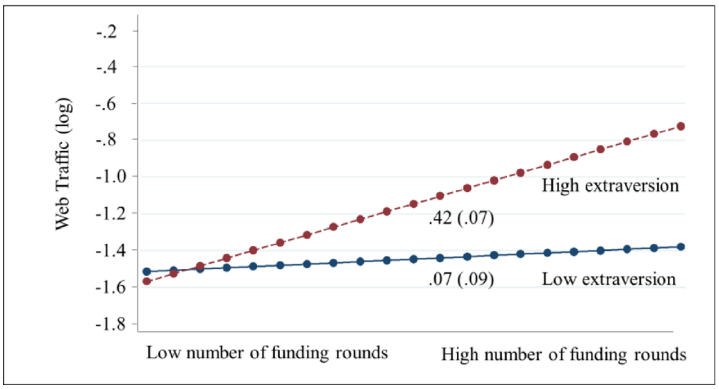



**Fig. 2** Simple slope analysis of CMO extraversion's moderating effect on the relationship between new venture maturity and web traffic based on Model 3 (Random effects panel regression). In all figures, "low" refers to 1 SD below the mean and "high" refers to 1 SD above the mean. Standard errors are displayed in brackets

marketing activities are not necessarily useful; instead, taking risks and seeking out ambivalent and ambiguous situations in which to spot opportunities are important success factors.

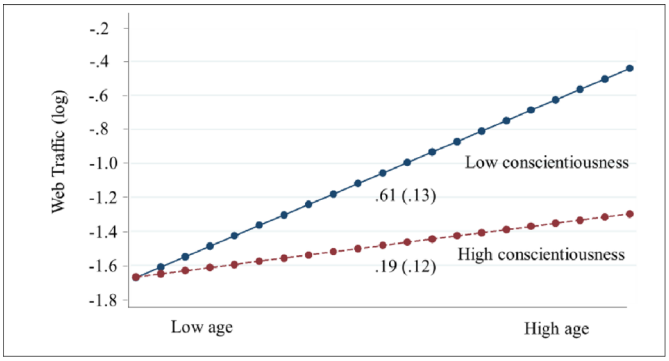
Third, we also contribute to the management literature. As Table 1 indicates, this literature is only starting to investigate and to find empirical evidence for the CEO's personality as driver of firm-level outcomes and relationships (e.g., Malhotra et al. 2018). This notion is in line with upper echelons theory, which has argued conceptually from the beginning that the executive's personality is a major driver behind his or her decisions and actions (Hambrick and Mason 1984). We extend this research by showing that the personalities of top executives with functional responsibilities are also such drivers, especially when the relationship is related to an executive's underlying function, as is the case with the marketing-related baseline relationship between a new venture's maturity and web traffic.

## Managerial implications

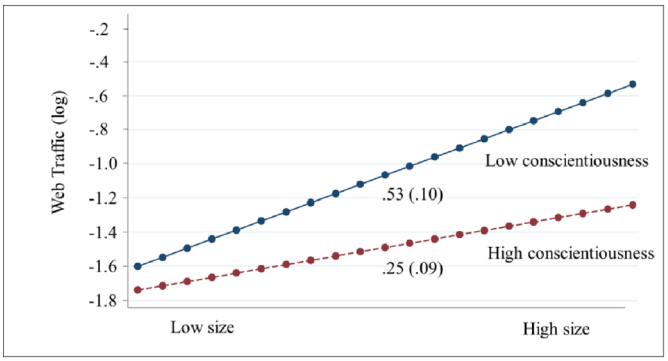
The present findings have practical implications for those who are involved in building new ventures' TMTs, such as entrepreneurs, advisors, and venture capitalists. It is common wisdom that marketing competence is necessary if any new venture is to connect with its target customers and to make the most of its emerging resources (Timmons 1999). Textbooks are rife with claims that marketing expertise is required on new ventures' TMTs, and venture capitalists go to considerable lengths to ensure that the customer perspective is represented on the TMTs of the ventures they back (Ramsinghani 2014). Our research helps those decision makers to make sound recruiting decisions by informing them that they not only ensure that marketing is represented in the TMT, but also consider the CMO's personality and how well it fits with what the CMO's tasks will be in the new venture. The academic literature and practitioner reports indicate that new ventures' recruiting of top managers is often based on personal connections (Leung 2003), as founders tend to appreciate having people around them whose backgrounds and personalities are similar to their own (Ruef et al. 2003). Our findings indicate that this approach can be critical. The FFM appears to be a way to detect the personality traits that are best suited to the tasks of a new venture's CMO—a high level of extraversion and a low level of conscientiousness—to leverage the new venture's increasing maturity.

Our findings indicate that recruiters should evaluate prospective CMO candidates using personality tests, similar to the practice of using personality tests with prospective senior executives in established firms. For startups, which have limited resources and cannot rely on professional executive

a) Interaction between CMO conscientiousness and age




b) Interaction between CMO conscientiousness and size




c) Interaction between CMO conscientiousness and number of funding rounds

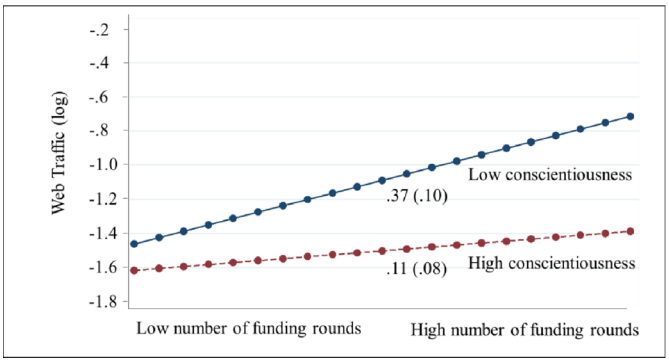



**Fig. 3** Simple slope analysis of CMO conscientiousness' moderating effect on the relationship between new venture maturity and web traffic based on Model 3 (Random effects panel regression). In all figures, "low" refers to 1 SD below the mean and "high" refers to 1 SD above the mean. Standard errors are displayed in brackets

search firms with established procedures to the same extend as large corporations, there are various ways to evaluate CMO candidates' personalities. For example, a candidate who enjoyed travelling and meeting customers in prior jobs indicates extraversion, and a candidate who can change plans easily and is comfortable with unstructured situations and unclear and frequently changing goals indicates a low level of conscientiousness. To get more precise evaluations of candidates' personalities, decision makers can use publicly available online questionnaires that measure the personality dimensions for candidates on a set of academically derived items. (See, for example, the service from the "International Personality Item Pool" based on Goldberg's (1992) work, which is free and whose graphical reports are easy to interpret and apply.)

We also inform CMO candidates and those who provide advice to marketing specialists who aspire to a CMO position with a new venture. Executives can be satisfied with their jobs in the long run only when they are comfortable with the jobs' demands and can achieve success. While a career in the startup world is an option (Robehmed 2013), our findings indicate that marketers with a specific personality profile may be better suited than others for the job of CMO in a new venture. These CMOs' job is to acquire public recognition for what the new venture is doing and to leverage the venture's increasing maturity in an uncertain environment (e.g., increasing, yet limited resources, no established brand), hence it can help to have a personality that is highly extraverted and not so conscientious to be successful. Those who

envisage a marketing career in the startup world can evaluate their personality dimensions with the help of the online services mentioned above. Similarly, CMOs currently working in larger companies who consider applying to a startup could use personality tests to evaluate whether they are a good fit with the company.

## Limitations and avenues for future research

Our study's limitations suggest avenues for future research. First, while firms strive to achieve a certain level of maturity in order to overcome the "liability of newness", some conditions from a low-maturity-stage might become desirable in some instances as new ventures turn into established players. As firms mature, they may lose their initial flexibility and speed due to increasing age and formalization (Sørensen and Stuart 2000). Hence, future studies could examine which CMO personality type may help established firms to revolve certain benefits associated with low maturity to stay competitive.

Second, our results show that CMO personality—as we conceptualized it—becomes more relevant for web traffic as firms mature. However, other CMO traits not captured by our conceptualization might be more important for ventures with very low maturity for outcomes other than web traffic. For instance, research shows that overconfident CEOs are more likely to pursue innovation, since they are more likely to underestimate failure (Galasso and Simcoe 2011). Hence, traits like overconfidence might help CMOs to steer very new ventures in the right direction with regard to which products and markets to pursue and hence might be particularly relevant at very low levels of maturity. Also, researchers could investigate which CMO traits help prepare for a later successful market entry at a very early stage when later market success is not yet visible. Future research should consider such settings of very low maturity with more fine-grained granularity.

Third, accepting that the CMO's personality and her or his human and social capital are relevant to new ventures' outcomes (Homburg et al. 2014), future studies could examine the interplay between these factors to determine whether there are, for example, some human-capital-related variables that impact our core relationships and whether a certain type of education or experience can offset some personality-related disadvantages in CMO candidates.

Fourth, as an investigation into databases for press presence (e.g., Factiva) revealed that early-stage new ventures are rarely treated in press articles. Hence, our study does not control for press presence. Studies looking at established firms might further investigate possible effects of press presence as a control variable or as a mediator. For instance, extraverted CMOs might generate higher awareness through press articles by giving interviews or making public appearances, which in turn could enhance web traffic.

Fifth, we investigate web traffic without differentiating between different channels. CMOs with different personality types might employ different channels to generate web traffic. Specifically, extraverted CMOs might employ paid search more aggressively to drive awareness with regard to the new venture, while organic traffic is still developing. Further research on this topic is needed.

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