

Health as Human Capital in Entrepreneurship: Individual, Extension and Substitution Effects on Entrepreneurial Success

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Abstract

This study investigates how entrepreneurial health and spousal health influence monetary and non-monetary entrepreneurial success. Drawing on human capital theory in combination with a family embeddedness perspective on entrepreneurship and applying actor-partner interdependence models to longitudinal data, we conclude that overall spousal health constitutes an important extension of entrepreneurs' human capital influencing entrepreneurial success. This study further contributes to human capital research by offering interesting insights and novel theorizing on substitution effects for different types of entrepreneurial human capital, and adds to a biological perspective on entrepreneurship by considering the differential role of biological sex in the health–success relationship.

Introduction

For nearly half a century, researchers have devoted considerable resources to understanding health in entrepreneurship, mainly focusing on examining differences in health between entrepreneurs and employees and/or the general population. While we have learned much about how the distinctive characteristics of entrepreneurs and their task environment help them to improve their health (for an overview see Stephan, 2018), recent research suggests that entrepreneurs' mental health and physical health may also have implications for entrepreneurial success (see e.g., Gorgievski, Bakker, Schaufeli, Veen & Giesen, 2010; Hessels, Rietveld, Thurik & van der Zwan, 2018).

At the same time, it seems unlikely that entrepreneurial success is an all-or-nothing heroic outcome associated with the unique features of the individual entrepreneur (Aldrich & Cliff, 2003). Business and private spheres are inextricably intertwined in entrepreneurship, with the family and particularly the spouse of the entrepreneur constituting an important source of resources that can contribute to entrepreneurial success (e.g., Powell & Eddleston, 2013; Werbel & Danes, 2010). For example, when asked about his private life and spouse, Joan, Virgin Group founder Sir Richard Branson said, “Joan is my rock, my confidant and my guiding light (...) she has always stood by me mentally, emotionally and spiritually” (Branson, 2015). Branson’s success, in terms of both income and well-being, might be symptomatic of interdependencies between the entrepreneur’s health and the health of the spouse, and imply that those interdependencies affect entrepreneurial success. In fact, owing to the strongly interconnected life spheres of entrepreneurs, spousal health may constitute a form of human capital that can be leveraged in the business sphere, extending, or potentially even substituting for, entrepreneurs’ own health capital supporting entrepreneurial success.

This study builds on recent conceptualizations of entrepreneurial success comprising both monetary and non-monetary accomplishments, that is entrepreneurial income and subjective well-being respectively (Shepherd, Wennberg, Suddaby & Wiklund, 2019), and seeks to answer a straightforward research question: How do the mental and physical health of entrepreneurs and that of their spouses affect entrepreneurial success? Embedded in human capital theory (Becker, 2007; Schultz, 1961; Schultz, 1997) combined with a family embeddedness perspective on entrepreneurship (Aldrich & Cliff, 2003; Powell & Eddleston, 2017), this study uses a series of *actor-partner interdependent models* (APIMs) (Kenny, Kashy & Cook, 2006) to advance understanding of how entrepreneurs’ mental and physical health and that of their spouses, in serving as human capital, make contributions to entrepreneurial success.

Our novel theorizing and empirical analysis make key contributions to the entrepreneurship literature. First, we expand theory on health in entrepreneurship by examining health at the couple or dyad level. Applying APIMs to seven consecutive waves of survey data (2002–2015) drawn from the German Socio-Economic Panel (SOEP), our findings illustrate differences between the independent roles of entrepreneurial health (the actor model) and spousal health (the partner model), and the interdependent roles of entrepreneurial health and spousal health (the actor-partner model) on entrepreneurial success. Indeed, this dyadic approach extends beyond the existing focus on the individual entrepreneur to advance a more complete understanding of the success-relevant embeddedness of the entrepreneur in the (un)healthy family.

Second, we refine traditional theorizing on health as human capital (Becker, 2007; Schultz, 1961). Human capital researchers have so far disproportionately focused on the productivity of general health or specific bodily health indicators such as height and nutritional status. By focusing on both monetary and non-monetary aspects of entrepreneurial success, and by differentiating between physical health and mental health, we are able to challenge the assumption that robust entrepreneurial and spousal health are always the best-case scenario for the productive and satisfied entrepreneur. In addition, the current research enriches the family embeddedness perspective on entrepreneurship not only by considering both partners in a cohabitating dyad, but also by suggesting the need to consider the physical health of a spouse a key instrumental support factor in entrepreneurship.

Third, we contribute to recent entrepreneurship literature on mental health impairments and the associated person-environment-fit tenet by uncovering boundary conditions under which health influences entrepreneurial success. Specifically, acknowledging sex differences in cognition that are rooted in biology (Ngun, Ghahramani, Sánchez, Bocklandt & Vilain, 2011), we enhance the discussion of differences between male and female entrepreneurs in the

health–success relationship. Moreover, this study offers interesting insights and novel theorizing on substitution effects for different types of entrepreneurial human capital (health versus education, individual versus family/organizational human capital for solo self-employed and employer entrepreneurs, respectively), in addition to contributing to the overall novel understanding of spousal health as an important extension of an entrepreneur’s human capital, which has important implications for entrepreneurs and their families.

Theory and Hypotheses

Entrepreneurial Success, Family Embeddedness, and Human Capital

Entrepreneurial success is defined as “the accomplishments (or lack thereof) from exploiting a potential opportunity or multiple potential opportunities” (Shepherd et al., 2019, p. 174). While early research tended to equate success in entrepreneurship with monetary outcomes, recent research has taken a more nuanced approach to entrepreneurial success, observing that entrepreneurs also consider non-monetary outcomes to be accomplishments (Wach, Stephan & Gorgievski, 2016; Wiklund, Nikolaev, Shir, Foo & Bradley, 2019). Reflecting this success diversity in entrepreneurship, we distinguish between monetary and non-monetary success. In line with recent entrepreneurship research, we view monetary success as income comprising financial returns from entrepreneurship (Kautonen, Kibler & Minniti, 2017) and non-monetary success as subjective well-being (Shepherd et al., 2019; Wiklund et al., 2019), defined as the general level of life satisfaction (e.g., Diener, 1984; Kibler, Wincent, Kautonen, Cacciotti & Obschonka, 2018).

Focusing on entrepreneurial success as a multidimensional construct, the literature adopting a family embeddedness perspective can be of particular value. The family embeddedness perspective on entrepreneurship highlights the importance of considering the interrelatedness of the business and family spheres to understanding monetary and non-

monetary accomplishments in entrepreneurship (Aldrich & Cliff, 2003). This perspective proposes that entrepreneurial success is significantly influenced by both the resources of entrepreneurs and those of their family members (see also Jennings & McDougald, 2007; Powell & Eddleston, 2013), which suggests that entrepreneurs' monetary and non-monetary success will be affected by their own health and also their spouses' health. When referring to health, we mean both physical health—"the physiological and physical status of the body"—and mental health—"the state of the mind, including basic intellectual functions" (Ware, Brook, Davies & Lohr, 1981). In order to explain the specific manner in which entrepreneurial success can be influenced by spousal health in addition to entrepreneurs' own health, we invoke human capital theory.

Human capital theory was originally developed to explain economic benefits that individuals and societies derive from investments in humans (Sweetland, 1996). The theory has attracted considerable interest among entrepreneurship researchers (for an overview see Marvel, Davis & Sproul, 2016). In fact, a substantial body of research provides empirical evidence that human capital generates economic benefits in entrepreneurship (for an overview see Unger, Rauch, Frese & Rosenbusch, 2011). Following Schultz (1961), we understand human capital as a capacity to adapt, which is particularly useful in dealing with situations of disequilibrium; hence, human capital can be pivotal to successfully dealing with the uncertainty inherent in entrepreneurship.

Human capital is a multifaceted concept; for example, Schultz (1961) conceptualized human capital by reference to five core types: formal education, adult education, training, migration, and health. Similarly, Becker (2002, p. 3) defined human capital as "knowledge, information, ideas, skills, and health of individuals." While education and training have been extensively studied by entrepreneurship scholars and found to be positively related to entrepreneurial success (Unger et al., 2011), there have been far fewer discussions on health as

human capital (Becker, 2007) and, to the best of our knowledge, none in the realm of entrepreneurship, although the study of health in entrepreneurship is attracting increasing scholarly interest (see e.g., Stephan, 2018). In line with human capital theory's main purpose, that is "to remove a little of the mystery from the economic and social world that we live in" (Becker, 1994, p. 25) and entrepreneurship's purpose of sustained value generation, the present research explores whether and how entrepreneurial health and spousal health as human capital affects valuable entrepreneurial outcomes (i.e., monetary success in the form of income and non-monetary success in the form of subjective well-being).

Entrepreneurial Health as Human Capital

Human capital theory postulates that individuals attempt to receive a compensation for their investments in human capital (Becker, 1964); thus, individuals aim to maximize their utility given their human capital (Unger et al., 2011). Consequently, entrepreneurs who have invested more in their human capital are likely to strive for more entrepreneurial success compared to those who have invested less in their human capital (Cassar, 2006); simply because they want to receive more compensation for their capital investments. According to human capital theory, entrepreneurial health as human capital should therefore lead to entrepreneurial success.

Moreover, entrepreneurial health should also improve the ability to perform the entrepreneurial tasks critical to success. First, mental health can help entrepreneurs broaden the range of ideas they have for their business (Stephan, 2018) and strengthen the focus on opportunities (Gielnik, Zacher & Frese, 2012) such as those for firm growth (Rietveld, Bailey, Hessels & van der Zwan, 2016). Additionally, physical health has been linked to improvements in creativity (Akinola, Kapadia, Lu & Mason, 2019), which, in turn, is positively related to

monetary success in entrepreneurship (Baron & Tang, 2011) and subjective well-being (Helzer & Kim, 2019).

Second, mental health is a prerequisite for learning, with absorption of direct and vicarious experience and transforming that experience into knowledge increasing monetary entrepreneurial success and subjective well-being (Hessels et al., 2018). Moreover, when running their ventures, entrepreneurs face high cognitive demands so that the quality of their judgments typically becomes more dependent on mental health (Rauch, Fink & Hatak, 2018), and aspects of mental health such as positive affect increase entrepreneurial success. This is because the positive affect associated with mental health fosters entrepreneurs' cognitive flexibility (Baron & Tang, 2011), allowing them to make more efficient and effective decisions.

Third, health as human capital supports obtaining and protecting other utilitarian resources such as social capital (Gielnik et al., 2012), which, in turn, positively influences both monetary (Stam, Arzlanian & Elfring, 2014) and non-monetary aspects of success (Bjørnskov, 2003).

Finally, health improves entrepreneurs' subjective well-being by increasing the probability of surviving in the future (Becker, 2007). Overall, entrepreneurs with better mental health and physical health should achieve greater monetary and non-monetary entrepreneurial success.

Hypothesis 1: There is a positive relationship between entrepreneurial health and subsequent entrepreneurial success.

Spousal Health as an Extension of Entrepreneur's Human Capital

Human capital can create competitive advantages if it is different from that held by competitors. A way to differentiate entrepreneurs' health as human capital is to venture beyond individual boundaries in the form of the entrepreneurs' mind and body to also leverage their

spouses' health as human capital in the business sphere. Based on integrated theorizing on health as human capital (Schultz, 1997) and the family embeddedness perspective on entrepreneurship (Aldrich & Cliff, 2003) that views the business and private spheres as inextricably intertwined, those entrepreneurs that have a healthy spouse are likely to strive for more income and well-being—simply because they want to receive more compensation for their stock of overall human health capital. That compensatory focus should increase entrepreneurial success. In other words, the entrepreneur's private sphere is a multi-person unit that employs a production function to secure what it wants in output, that is, maximal utility commensurate to the inputs such as health (Stigler & Becker, 1977).

Moreover, spousal health should also strengthen the entrepreneur's ability to accomplish entrepreneurial tasks, thereby increasing entrepreneurial success. First, having a physically and mentally healthy spouse provides the entrepreneur with a sense of comfort and security that matters not only for well-being (Lyubomirsky, King & Diener, 2005; Powdthavee, 2009), but also allows the entrepreneur to focus intently on identifying new business ideas and opportunities (Powell & Eddleston, 2017). Additionally, a physically healthy spouse can reduce the household obligations facing an entrepreneur (Eddleston & Powell, 2012), leading to an associated reduction in family-to-business interference and increased time being positively associated with creativity (Amabile et al., 2002), which, in turn, can be productively harnessed in the business sphere.

Second, a mentally healthy spouse may support the entrepreneur's learning by providing new knowledge and valuable feedback on business ideas (Powell & Eddleston, 2013), with such combinations of new and existing knowledge resulting in heightened entrepreneurial success (Schumpeter, 1934). Moreover, a mentally healthy spouse can provide mental sustenance through an unconscious process of "emotional contagion" (Gorgievski-Duijvesteijn, Giesen & Bakker, 2000). Such positive affect crossover enhances not only the

entrepreneur's well-being (Song, Foo & Uy, 2008), but also encourages entrepreneurs to be persistent in pursuing their entrepreneurial goals (Powell & Eddleston, 2017).

Finally, a healthy spouse can help the entrepreneur acquire further utilitarian resources critical to the success of the enterprise by, for example, undertaking unpaid work in the entrepreneur's business (Gudmunson, Danes, Werbel & Loy, 2009) or sharing social network resources. Accordingly, we argue that entrepreneurs with healthy spouses may be more successful.

Hypothesis 2: In addition to entrepreneurial health, spousal health is positively related to subsequent entrepreneurial success.

Data and Method

Data Source and Sample

Data Source. To examine our proposed hypotheses, we utilize longitudinal panel data from the German Socio-Economic Panel (SOEP), which is administered by the German Institute for Economic Research, DIW Berlin. The SOEP is a comprehensive representative longitudinal study of private households. The survey harvests data on each individual member of a household aged 16 years and above annually and requests information on various topics, such as, demographics, education, training and qualifications, occupational dynamics, wages and income, health, values, and satisfaction indicators, in addition to household issues (Schupp, 2009; Wagner, Frick & Schupp, 2007). The fieldwork in each wave consists of face-to-face interviews using pre-tested questionnaires. Every year since 1984, around 30,000 individuals in nearly 11,000 households have participated in the panel study. The value of the SOEP data to entrepreneurship research has been established previously (see e.g., Nikolova, 2018; van der Zwan, Hessels & Rietveld, 2018).

The longitudinal SOEP data is suitable for the present study because it allows us to link individual information such as occupation, health, income, and subjective well-being to households and thereby to spousal information. We can thus examine interdependent effects within entrepreneur–spouse couples in a given household, using dyadic data analysis.

Sample. We utilize panel data from the yearly waves of 2002 to 2015 (panel version 32.1) to analyze established health variables, which were integrated in 2002 in an additional health module by the SOEP and have been captured every two years since. We construct a longitudinal data set that includes the dependent variables in year $t+1$ and the lagged independent variables in year t , with the latter coming from the preceding waves and the available waves of the health module. Accordingly, our final data set consists of seven consecutive waves (2002–2003, 2004–2005, 2006–2007, 2008–2009, 2010–2011, 2012–2013, 2014–2015). Given that we are interested in the effects of spousal health on subsequent entrepreneurial success in addition to the effects of entrepreneurial health, we sorted the data by households and first restricted our sample to individuals who are married and living in the same household. We only kept the observations that contain information on both individuals in the married dyad. This resulted in 54,555 married couples and 109,110 individuals over the seven consecutive waves. Because the objective of our study is to examine interdependent health effects for entrepreneur–spouse couples, we restricted our sample to the married couples where at least one of the partners in the cohabiting dyad was self-employed, that is, working full-time, and either employing others or working alone (see e.g., Nikolova, 2018). This results in a subsample of 5,608 entrepreneur–spouse couples and 11,216 individuals. As is customary in economics research, SOEP uses the term *self-employment* to operationalize the concept of entrepreneurship. In line with previous entrepreneurship research using the SOEP data (see e.g., Nikolova, 2018; van der Zwan et al., 2018), the current study generally uses the term *entrepreneurship*, except for individuals who work on their own account and do not employ

others, who we refer to as the solo self-employed. Finally, for the purpose of our dyadic data analysis using the APIM (Kenny, 1996), we organized the data set into a pairwise structure, where one dyad (couple level) has two individual entries from each member of the dyad so that each entrepreneur's outcome score is associated with his or her own predictor score and his or her spouse's predictor score (for pairwise data structure see, Kenny et al., 2006).

Variables

Dependent Variables. This study uses two dependent variables: monetary entrepreneurial success and non-monetary entrepreneurial success. Monetary entrepreneurial success refers to the subsequent economic benefits of the entrepreneur ($t+1$) and is measured as the annual income (in Euro) received from entrepreneurship. Because the variable is skewed, we use its natural logarithm in the analysis. Our choice of the monetary success measure was inspired by prior work. First, income from entrepreneurship functions as an important utility underlying individuals' entrepreneurial intention (Douglas & Shepherd, 2002). Second, income from entrepreneurship objectively reflects entrepreneurs' self-referent criteria to measure career success (Toft-Kehler, Wennberg & Kim, 2014; Wach et al., 2016). Third, compared to other venture-level performance variables such as sales growth or number of patents, income has the advantage of being comparable across different industries (Toft-Kehler et al., 2014).

Non-monetary entrepreneurial success refers to the subsequent subjective well-being of the entrepreneur ($t+1$). We followed recommendations in the literature (e.g., Binder & Coad, 2016; Kibler et al., 2018) and measured subjective well-being as the entrepreneur's general level of life satisfaction on a scale of 0 (completely dissatisfied) to 10 (completely satisfied) at the time of the survey. The direct and single-item measure of life satisfaction reflects individuals' self-referent assessment of their lives as a whole. The measure is neither affected by different weights that individuals place on different aspects of their lives, nor biased by

criteria that researchers deem relevant (Diener, 1984), and is thus consistent with the understanding of life satisfaction as a component of subjective well-being (Kibler et al., 2018; Wiklund et al., 2019). The reliability and validity of the single-item life-satisfaction measure have been established in recent empirical research, for example, based on the analysis of four major household panel datasets in Australia, Germany, Great Britain, and Switzerland (Lucas & Donnellan, 2012) and when comparing the single-item scale with the psychometrically established satisfaction-with-life scale (Cheung & Lucas, 2014).

Independent Variable. Entrepreneurial health and spousal health are measured using the well-established Short Form (SF)-12 health questionnaire, a 12-item, two-domain (mental health, physical health) scale by Ware, Kosinski and Keller (1996). The reliability and validity of the SF-12 have been established and the scale is regularly adopted in large national surveys (Salyers, Bosworth, Swanson, Lamb-Pagone & Osher, 2000).

Mental health is a weighted score (0–100) covering four dimensions: mental health, role-emotional, vitality, and social functioning (Ware et al., 1996). Mental health (2 items) measures how often the individuals felt (1) down and gloomy, and (2) calm and relaxed in the past four weeks. Role-emotional (2 items) measures how often the individuals felt they were (1) achieving less than expected, and (2) carrying out tasks less thoroughly than usual due to mental health problems in the past four weeks. Vitality (1 item) measures how often the individual felt energetic in the past four weeks. Social functioning (1 item) measures how often the individuals felt themselves limited socially due to physical and mental health problems in the past four weeks. Following the recommendation by Andersen and colleagues (2007), exploratory factor analysis was conducted to compute a weighted combination of the mental health items and standardized to have a mean of 50 and a standard deviation of 10. Higher values correspond to better mental health. In our sample, the scale has a Cronbach's alpha of 0.966.

In a similar vein, physical health is a weighted score (0–100) covering four dimensions including general health, bodily pain, role-physical, and physical functioning (Ware et al., 1996). General health (1 item) reflects the individual’s current health. Bodily pain (1 item) measures how often the individuals felt strong physical pain in the past four weeks. Role-physical (2 items) measures how often the individuals felt they were (1) achieving less than expected, and (2) carrying out tasks less thoroughly than usual due to physical health problems in the past four weeks. Physical functioning (2 items) assesses whether the individuals’ health status affects their ability to (1) climb several floors on foot, and (2) lift heavy objects or in other situations requiring agility. Following the recommendation by Andersen et al. (2007), exploratory factor analysis was conducted to compute a weighted combination of the physical health items and standardized to have a mean of 50 and a standard deviation of 10. Higher values correspond to better physical health. In our sample, the scale has a Cronbach’s alpha of 0.976.

Control Variables. We include several control variables at both the individual- and household-level as they may be associated either with the dependent variable or the treatment variable. At the individual level, we control for the following personal characteristics of entrepreneurs; biological sex as a dummy with the value of 1 assigned to female entrepreneurs, age, and education as a dummy with the value of 1 assigned to entrepreneurs who have completed tertiary education. Previous research indicates that *biological sex* explains differences between women and men in terms of entrepreneurial perceptions (e.g., Shinnar, Giacomini & Janssen, 2012), intentions (e.g., Gupta, Turban, Wasti & Sikdar, 2009), actions (e.g., Shinnar, Hsu, Powell & Zhou, 2018), monetary and non-monetary performance (e.g., Justo, DeTienne & Sieger, 2015) as well as health (e.g., Altemus, Sarvaiya & Epperson, 2014). Considering *age* and *education*—the latter being one of the most important investments in human capital—research consistently finds that they are important determinants of

entrepreneurial behavior and of outcomes such as income and subjective well-being (Blanchflower & Oswald, 2004; Lévesque & Minniti, 2006; Unger et al., 2011).

In addition, we control for variables related to work characteristics, that is, the number of actual *weekly working hours* and *entrepreneur status*, a dummy variable that was coded with a value of 1 for entrepreneurs employing others, and with a value of 0 for the solo self-employed. Entrepreneurs do not always aim to maximize financial returns or business growth (Meager, 2015). Some entrepreneurs may operate lifestyle firms and spend less time at work. Furthermore, the amount of time individuals spend at work also affects their subjective well-being (e.g., Bardasi & Francesconi, 2004). Moreover, the role of entrepreneurs' human capital in entrepreneurial success is likely to differ and possibly be less important in the case of an employer entrepreneur (Hsu, Wiklund, Anderson & Coffey, 2016).

At the household level, we control for *the number of children under 14*. Entrepreneurs' family lives may influence their business and personal outcomes (Jennings & McDougald, 2007) and the number of young children accounts for general life satisfaction (Margolis & Myrskylä, 2011). Finally, we also include spousal occupation dummies, industry dummies and observation year dummies in the empirical model to account for their influences on entrepreneurial success.

Method

To investigate how spousal health affects entrepreneurial success in addition to entrepreneurial health, we applied dyadic data analysis (Kenny et al., 2006). In a dyadic dataset, data exists on two levels. At the individual level (Level 1, or the within-couple level), there are variables on which the members of the same dyad may differ. In the present study, a married couple may differ from each other with respect to their socio-demographic characteristics and also mental and physical health. At the couple level (Level 2, or the between-couple level),

there are measures on which both members of a dyad have the same value, which may differ from other couples. In the present study, each partner in a married couple may report the same household-related information such as the number of children under 14 in the household.

Associations between the health of an entrepreneur and of the spouse and entrepreneurial success are estimated by applying a series of APIMs (Kenny, 1996). The APIM is a framework widely used for analyzing dyadic data in psychology and posits that both an individual and his or her partner can simultaneously affect the outcome of interest (Kenny & Ledermann, 2010; Loeys, Cook, de Smet, Wietzker & Buysse, 2014). In the present study, APIMs are estimated using multilevel modeling (MLM) (Ledermann & Kenny, 2017). Multilevel models produce coefficients that are analogous to those produced in fixed-effects regressions while accounting for the non-independence of observations with separate residual terms that are estimated to reflect variance in the outcome occurring at the between-dyad level and the between-individual level (Kenny & Cook, 1999).

Our APIMs consist of two-level multilevel models comprising entrepreneurs and their spouses (Level 1) nested within married couples (Level 2). Through pairwise structuring of the data as described in the sample subsection, we sequentially modeled the associations between entrepreneurial health and spousal health, and entrepreneurial success. In the first step, the APIM estimates the direct effects of socio-demographic covariates and entrepreneurial health (i.e., the actor effect). In the second step, the APIM estimates the direct effects of socio-demographic covariates and spousal health (i.e., the partner effect). The final step includes the direct effects of socio-demographic covariates, entrepreneurial health and corresponding spousal health, reflecting the interdependent nature of the relationships (Kenny et al., 2006). Specifically, the equation of our APIM takes the following form:

$$\text{Equation 1: } Y_{ij} = b_0 + b_1X_{ij} + b_2Z_{ij} + b_3C_{ij} + e_{ij}$$

where Y denotes the outcome variables: monetary entrepreneurial success (log) and non-monetary entrepreneurial success. X denotes the actor effect for the health variables related to entrepreneurs: entrepreneurial mental and physical health. Z denotes the partner effect for the health variables related to the corresponding spouses: spousal mental and physical health. C denotes the individual- and household-level control variables of the entrepreneur: biological sex, age, education, actual weekly working hours, entrepreneur status, number of children under 14, spousal occupation dummies, industry dummies and year dummies. e denotes the error terms that are correlated between entrepreneurs and their spouses. i indicates the i^{th} observation in the j^{th} group.

Results

Descriptive Statistics

Descriptive statistics and correlations are found in Table 1. The mean of monetary entrepreneurial success in terms of annual income from entrepreneurship is 49,581 Euro (SD 62,197 Euro). The mean of non-monetary entrepreneurial success in terms of subjective well-being is 7.36 (SD 1.59). The average entrepreneurial mental health and physical health scores are 51.88 (SD 8.77) and 52.14 (SD 8.09), respectively. The average spousal mental health and physical health scores are 51.14 (SD 9.13) and 51.42 (SD 8.61), respectively. A review of the socio-demographic characteristics of our sampled entrepreneurs reveals 67% of them to be male. The age of the surveyed entrepreneurs ranges from 25 to 88 years, with a mean age of 51 (SD 10) years. Among the entrepreneurs 45% had completed tertiary education according to the CASMIN educational classification (Comparative Analysis of Social Mobility in Industrial Nations; Brauns, Scherer & Steinmann, 2003; Kerekhoff, Ezell & Brown, 2002). Half of the entrepreneurs employ staff (53%), and 37% of the entrepreneurs in our sample are living with at least one child aged under 14 in the same household. On average, the sampled entrepreneurs

work 44 (SD 18) hours per week, and 75% work in professional service fields (NACE-93 code G, H, I, J, K, L, M, N, O-Q), which is the largest industry category in the sample, followed by construction (14.4%; NACE-93 code F), the industrial sector (9.7%; NACE-93 code C, D, E), and agriculture (1%; NACE-93 code A, B).

--- *Insert Table 1 about here* ---

The correlation matrix shows that the maximum correlation is -0.52 between *age* and *the number of children under 14*. The latter is the household-level variable, which is controlled for at the dyad level (Level 2) to estimate random effects; consequently, multicollinearity is not a concern.

Hypothesis Tests

Table 2 presents the APIM results for the effects of entrepreneurial health and spousal health on entrepreneurial success. More precisely, Models 1 and 2 report the independent and interdependent effects for entrepreneurial and spousal health on both monetary and non-monetary entrepreneurial success, each comprising three sequential sub-models (a–c). In the actor model (Model 1a), we find that both entrepreneurial mental health and physical health positively affect subsequent monetary entrepreneurial success in terms of annual income from entrepreneurship. Similarly, both entrepreneurial mental health and physical health are positively related to subsequent subjective well-being in terms of life satisfaction (Model 2a). These findings support Hypothesis 1.

--- *Insert Table 2 about here* ---

To examine the interdependent effect as hypothesized in H2, we first examined the partner models. We find that spousal mental health and physical health is positively associated with both subsequent monetary (Model 1b) and non-monetary entrepreneurial success (Model 2b). In the next step, we drew on APIM to examine the dyadic effects of both entrepreneurial

health and spousal health. With regard to subsequent monetary entrepreneurial success (Model 1c), we find that the significant effect of spousal mental health identified in the partner model disappears. The effect sizes of entrepreneurial mental and physical health and also spousal physical health become smaller, albeit remaining significant at a 99% confidence interval level. In terms of subjective well-being (Model 2c), we find that both spousal mental health and physical health exhibit a positive association, in addition to the positive effects of entrepreneurial mental health and physical health, even though the effect sizes are smaller than those of the actor and partner model. Consequently, Hypothesis 2 is partially supported.

With regard to the control variables, our results indicate that being older, being male, having completed tertiary education, and being an employer entrepreneur positively relate to monetary entrepreneurial success. In terms of non-monetary aspects of entrepreneurial success, we find that tertiary education and being an employer entrepreneur positively relate to subjective well-being, fueling discussions on well-being differences between opportunity- and necessity-driven entrepreneurs (see e.g., Stephan, 2018). Our results further indicate that female entrepreneurs achieve greater subjective well-being and that the age of the entrepreneur is not related to the level of life satisfaction. While the entrepreneur's number of weekly work hours positively influences monetary entrepreneurial success, it is negatively associated with subjective well-being.

Robustness Check

We tested the robustness of our results by employing Structural Equation Modeling (SEM) to perform cross-lagged analysis to check the reversed effect between entrepreneurial success and entrepreneurial health and spousal health. Following the same procedure as described in the methods section, we added additional waves on future health status ($t+2$) to the current consecutive waves. Specifically, our dataset comprises both entrepreneurial and

spousal health variables in year t and in year $t+2$, and entrepreneurial success variables in year $t+1$. We hypothesized that entrepreneurial health and spousal health in the preceding year t influence entrepreneurial success in year $t+1$ (i.e., as postulated in H1 and H2), and now also examine whether entrepreneurial success in year $t+1$ results in better entrepreneurial health in year $t+2$ (i.e., the reverse effect).

The path model of our cross-lagged analysis is provided in Appendix A, with SEM producing fairly similar results on the effects of both entrepreneurial health and spousal health on entrepreneurial success (Models 1a and 2a), as predicted by our APIMs. Thus, our empirical findings are robust. Our examination of the reversed effects of entrepreneurial success on future entrepreneurial mental health and physical health (Models 1b, 1c, 2b, 2c) suggests that both monetary and non-monetary entrepreneurial success positively influence subsequent entrepreneurial mental and physical health, with a significance at a 99% confidence interval level. Therefore, based on our findings, the causal relationship between entrepreneurial health and spousal health, and entrepreneurial success is established.

Post-hoc Analysis

The findings of this study—including those for the controls—accord with the results of other research in indicating that the relationship between human capital in general and health and entrepreneurial success specifically is complex; that is, the relationship is affected by contextual factors such as the entrepreneur's biological sex, education, and status. We thus examine the effects of these potentially interesting conditions and thus the actor-partner effects by level of these contextual variables in the course of exploratory supplemental analyses, using the two-intercept model of APIMs (Garcia, Kenny & Ledermann, 2015)

The two-intercept model of APIMs is statistically equivalent to the dyadic interaction model, yet allows for clearer interpretations. While the dyadic interaction model only indicates

whether the actor-partner effects differ significantly because of the contextual variables, the two-intercept model provides the actual estimates of the contextual variables for the actor-partner effects (Gao, Du, Davies & Cummings, 2018). To utilize the two-intercept model, we transformed the respective conditional variable into a dummy variable, with both dummy expressions and thus variables being separately included in the model and also as interaction terms together with the actor-partner effects. However, since the correlation of the two dummy variables is -1, we only can include them in the same model by dropping the intercept. For example, to examine the conditional effect of the entrepreneur's biological sex, we coded two dummy variables, that is '1' if female entrepreneur (0 if male entrepreneur), and '1' if male entrepreneur (0 if female entrepreneur). According to Equation 1, we can formulate two separate APIMs for female and male entrepreneurs respectively, where for each model, the intercept and actor-partner effects for entrepreneurial health and spousal health are estimated separately. The two-intercept model of APIMs then allows us to integrate the two separate APIMs for female and male entrepreneurs into one model, relying on two intercepts for male and female entrepreneurs (i.e., biological sex dummies) and therefore requiring dropping the overall intercept. Equation 1 is thus modified and illustrated as follows:

$$\text{Equation 2: } Y_{ij} = b_{0m}(\text{male}) + b_{0f}(\text{female}) + b_{1m}(\text{male} * X_{ij}) + b_{1f}(\text{female} * X_{ij}) + b_{2m}(\text{male} * Z_{ij}) + b_{2f}(\text{female} * Z_{ij}) + b_3 C_{ij} + e_{ij}$$

where b_{0m} and b_{0f} denote the intercepts for male and female entrepreneurs, respectively. The coefficient b_{1m} represents the actor effect among male entrepreneurs and b_{1f} represents the actor effect among female entrepreneurs. The coefficient b_{2m} represents the partner effect among male entrepreneurs and b_{2f} represents the partner effect among female entrepreneurs. The two-intercept models of APIM then simultaneously examine the within-person effects (actor effects) and the cross-person effects (partner effects) of mental health and physical health

and thus their actor-partner effects on entrepreneurial success for female and male entrepreneurs (Gao et al., 2018).

The results of the two-intercept approach for entrepreneur's biological sex are shown in Appendix B. For male entrepreneurs alone, their mental health positively affects monetary success in entrepreneurship (Model 1). For both male and female entrepreneurs, their physical health leads to economic benefits (although for women, the benefits of physical health are nearly twice as great as are indicated by the effect sizes). Moreover, for female entrepreneurs alone, spousal physical health positively contributes to their monetary success in entrepreneurship. With regard to the non-monetary success of men and women (Model 2), both their mental health and physical health show positive associations. However, the well-being effects of entrepreneurial mental health and physical health are stronger for men; while for female entrepreneurs, both the mental and physical health of their spouse promote subjective well-being, only spousal physical health influences the well-being of male entrepreneurs.

The results of the two-intercept approach on the role of tertiary education are shown in Appendix C. For highly educated entrepreneurs, only spousal physical health makes a significant contribution to monetary entrepreneurial success (Model 1). Their well-being, in turn, depends on both their own mental and physical health and their spouse's physical health (Model 2). For entrepreneurs lacking a tertiary education, their own physical and mental health have a greater influence on monetary success than does spousal physical and mental health (Model 1). However, both entrepreneurial health and spousal health positively influence the non-monetary success of entrepreneurs without tertiary education (Model 2).

Appendix D provides the results of the two-intercept approach for entrepreneur status. For employer entrepreneurs, their physical health and both spousal mental and physical health lead to economic benefits (Model 1). For the solo self-employed' monetary success, their own mental and physical health are important, and spousal physical health has a marginal effect. In

terms of non-monetary success (Model 2), for the solo self-employed, entrepreneurial health and spousal physical health show positive associations. Both entrepreneurial and spousal health are positively related to the subsequent non-monetary success of employer entrepreneurs and thus their subjective well-being.

Discussion

Inspired by anecdotal evidence and recent research findings, we set out to examine how entrepreneurial health and spousal health could contribute to both monetary and non-monetary success in entrepreneurship. The current study advances health research in entrepreneurship by suggesting a more complex approach that considers spousal health as an additional important factor in entrepreneurial success (beyond the entrepreneur's own health). We drew from human capital theory and the family embeddedness perspective of entrepreneurship, and used APIMs to explore the notion of dyadic health effects in entrepreneurship.

Theoretical Implications

Our results support the prior theorizing in demonstrating that *entrepreneurs' mental health and physical health lead to higher levels of monetary entrepreneurial success and subjective well-being*. In addition to their own health, entrepreneurs report higher levels of subjective well-being when their spouse is mentally and physically healthy. Interestingly, we did not find support for our initial hypothesis that better spousal mental health would relate to greater monetary success in entrepreneurship. This result runs contrary to the indications from prior research that failed to consider both partners in a cohabiting dyad. The divergent results for dyadic health effects regarding monetary success thus have important implications for health and human capital research in entrepreneurship. By demonstrating differences between the independent models considering either entrepreneurial health or spousal health, and the

interdependent models considering the dyadic interplay between entrepreneurial and spousal health, our introduction of APIM to entrepreneurship research delivers a more nuanced view of the effects of health in entrepreneurship. In particular, the interdependent effect offers a more precise understanding of the productive entrepreneur embedded in the physically (un)healthy family.

Moreover, as regards theorizing on human capital more generally, our study suggests that there is a difference in the predictors of monetary and non-monetary outcomes in entrepreneurship. We believe continued differentiation between economic and non-economic benefits of human capital (Becker, 2007) and increased consideration of mental health as an addition to physical health, which has traditionally been in the focus of human capital research, will advance our understanding of health as human capital in general, and in entrepreneurship in particular. Our results indicate that situations in which the entrepreneur reports high levels of mental and physical health accompanied by his/her spouse being physically healthy may actually be economically more beneficial than situations in which the spouse is also mentally healthy. Because spousal mental health may be less strongly related to the entrepreneur's task environment, our results suggest that this type of health capital cannot generally be directly exploited in the business sphere.

The present research also contributes to our understanding of family-to-business support (Powell & Eddleston, 2017), and more generally to the family embeddedness perspective on entrepreneurship (Aldrich & Cliff, 2003). Specifically, our findings provide support for conceptualizing spousal physical health as a form of instrumental family-to-business support. Powell and Eddleston (2017, p. 625) suggest that instrumental support, which can include "the handling of household responsibilities that would take entrepreneurs' time and attention away from the business, may assist them in concrete and tangible ways that are more beneficial than emotional support, which is more affective in nature." Our study adds to this

perspective by suggesting that *spousal physical health is an important extension of the entrepreneur's human capital* that can be used to enhance competitive advantages in the business sphere.

In addition to the main findings, our post-hoc analyses, which test the influence of biological sex, education, and entrepreneur status on the relationships between entrepreneurial health and spousal health, and entrepreneurial success, highlight surprising differences between male and female entrepreneurs, and indicate substitution effects for different types of entrepreneurial human capital, mainly in terms of predicting economic benefits in entrepreneurship. The current research provides some convincing potential reasons for such findings at the intersection of biology and entrepreneurship, and human capital (education versus health, individual versus family/organizational human capital) and entrepreneurship. We believe it is exactly this new theorizing that extends prior entrepreneurship and human capital research.

Contributions to Biology & Entrepreneurship – Biological Sex Differences.

Interestingly, we find that the entrepreneur's biological sex; that is, whether the entrepreneur is female or male, affects the relationship between mental health and monetary entrepreneurial success, such that stronger entrepreneurial outcomes associated with mental health are achieved to a greater extent by male than female entrepreneurs. The divergent results for biological sex offer important implications for mental health research going forward in entrepreneurship. In particular, the relationship between mental health and economic benefits in entrepreneurship has been unclear (see e.g., Rauch et al., 2018; Stephan, 2018), and the current study suggests that one reason for this is the understudied role of biological sex; that is, a biological perspective on entrepreneurial success (Nicolaou & Shane, 2014) should be taken into consideration along with a person's level of mental health when relating to monetary outcomes in entrepreneurship.

The findings of the current study are based on research evidence of biological sex differences (Ngun et al., 2011), and indicate women's mental health is not a (direct) economic success factor in entrepreneurship. First, we propose that women's mental health is more fluid and thereby has less direct influence on monetary entrepreneurial success. Indeed, research has repeatedly shown that women's exposure to reproductive hormones and peptides varies during the menstrual cycle, pregnancy, and lactation (for an overview see e.g., Altemus et al., 2014). In turn, men are exposed to relatively stable gonadal hormones during this period. For example, estrogen levels and androgen hormones rise in females for two weeks and a few days surrounding ovulation, with ovulation leading to an increased production of progesterone. If no pregnancy occurs, progesterone levels decrease abruptly to basal levels (Altemus et al., 2014). These developments may explain why women experience premenstrual exacerbation of depression (Haley et al., 2013) even when antidepressant medication is effective during the remainder of the cycle. If pregnancy occurs, estrogen and progesterone and various other hormones and peptides such as prolactin and oxytocin are produced (Altemus et al., 2014). Pregnancy and lactation suppress hypothalamic–pituitary adrenal axis and autonomic responses to stress (Entringer et al., 2010). As a consequence of the more recent development of women spending much of their adult life neither pregnant nor lactating, but experiencing repeated menstrual cycling, their mental health status likely is to be more fluid, and thereby influencing monetary success in entrepreneurship less directly.

Second, we propose that women's mental health might play a lesser role in their ability to perform tasks critical to entrepreneurial success. The expanding literature on biological sex differences demonstrates that some sex differences that promote reproductive success in women are associated with superior social cognition and capacity for attunement with others (Thompson & Voyer, 2014), which, in turn, are critical for monetary entrepreneurial success. However, these same sex differences are also thought to explain why women experience mental

health issues such as depression more often than men (Cyranowski, Frank, Young & Shear, 2000). Such mental health issues in turn hamper attaining entrepreneurial success in monetary terms (Hessels et al., 2018). This study accordingly adds to a biological perspective on entrepreneurship by suggesting that sex differences that promote reproductive success lead to a zero-sum game offsetting the effects of women's mental health on monetary entrepreneurial success. Additionally, this may even explain why spousal physical health has more of a positive influence on female entrepreneurs' monetary success compared to that of their male counterparts. An in-depth study of specific biological differences between men and women would help deepen the understanding of the relationships between health and entrepreneurship.

Contributions to Human Capital & Entrepreneurship – Substitution Effects. The present investigation also contributes to human capital theory. In terms of education, research has demonstrated that high school and college education are one of the most important investments in human capital, increasing individuals' income, even given education's direct and indirect costs, and after adjusting for a better family background and enhanced abilities of people with higher education (Becker, 1994). Nevertheless, as Becker (2007) notes, it is important to consider complementarities between different types of human capital, especially between education and health, if we aim to spur economic and social developments. Our study adds to this perspective by suggesting that *health is an important substitute for education in entrepreneurship*. Contrary to what one might conclude from previous research that failed to consider both education and health as human capital for entrepreneurial success, we find that investment in different types of general human capital is not always better for the productive entrepreneur. In fact, our results show that health capital investments by entrepreneurs, who are highly educated, do not generate (direct) economic benefits in entrepreneurship. In some ways this would be consistent with prior research arguing that the enhancement of general human capital, which can be applied in different contexts, increases the perceived opportunity

costs associated with maintaining a business venture (Rauch & Rijsdijk, 2013). At the same time, our findings call for closer examination of the interplay of different types of general human capital: It seems that it is not the increase in general human capital per se that is unproductive for the entrepreneur, but rather that it is the *portfolio investment in general human capital that may not pay off in the context of entrepreneurship*. Indeed, we find among entrepreneurs lacking higher education, mental health and physical health are more salient for monetary success in entrepreneurship. Accordingly, our study suggests that for an entrepreneur it is worth specializing in investment in general human capital to garner productivity improvements in entrepreneurship. This relates to education-related theorizing about human capital, which suggests that that all types of human capital are perfect substitutes in contributing to productivity improvements (Bils & Klenow, 2001). Continuing research on the interplay between different types of human capital including health will be important to advance our understanding of success in entrepreneurship.

In terms of entrepreneur status, the differentiation between the solo self-employed and entrepreneurs employing others delivers a nuanced view of the effects of health as human capital in entrepreneurship. Until now, it has been common for health and well-being research not to differentiate between different types of entrepreneurs (see Stephan, 2018). However, along many contextual dimensions, such as work tasks, resources, stressors, and organizational climate, entrepreneurs display greater variance than can be observed among the conventionally employed (Rauch et al., 2018); and the role of health as a type of human capital may vary between employer entrepreneurs and the solo self-employed. Employer responsibility offers the entrepreneur more options to choose how, what, when, and with whom to work (van Gelderen, 2016) and thereby delivers more autonomy than is available to a solo self-employed. The solo self-employed tend to be more “dependent on others for allocating them tasks over which they have little control” (Standing, 2011, p. 16). Moreover, as the solo self-employed do

not employ others, productivity improvements may depend entirely on their own capacity to adapt. In support of these assumptions, our study shows that health as human capital is more salient for the solo self-employed than for employer entrepreneurs. In fact, we observe that, all other factors being equal, the monetary success effect of the health of the solo self-employed is nearly twice as high as for their employer entrepreneur counterparts. We therefore suggest that human capital research and specifically health research must be more cognizant of differences among different types of entrepreneurship, and in particular distinguish between those individuals that employ others and the solo self-employed.

Interestingly, in the case of employer entrepreneurs, our study suggests that *spousal mental health serves as a substitute for entrepreneurial mental health*. Our finding that employer entrepreneurs' mental health does not lead to better or worse monetary outcomes in entrepreneurship provides support for the person-environment fit tenet stating that what is functional and dysfunctional in terms of mental health characteristics is largely a matter of context (Wiklund, Hatak, Patzelt & Shepherd, 2018). Nevertheless, recent research on mental health impairment in entrepreneurship also points to the need to also consider the spouse in mental health–success relationships. In fact, Wiklund et al. (2018) argue that living with an entrepreneur is generally a mentally challenging experience for the spouse because of uncertainty regarding income levels and the future survival of the business spreading to the family sphere, with the resulting family dynamics bouncing back to the business sphere. Specifically, spouses experiencing negative mood and depression tend to react negatively toward the entrepreneur's efforts, hindering the entrepreneur reaching instrumental business goals (Gorgievski-Duijvesteijn et al., 2000). Our findings provide support for this perspective by suggesting that for employer entrepreneurs, regardless of their own mental health characteristics, good spousal mental health is functional in terms of productivity improvements. The result that spousal mental health is more salient for employer entrepreneurs

than for the solo self-employed may be attributed to entrepreneurial uncertainty, which is likely to be most strongly perceived by entrepreneurs employing others (McMullen & Shepherd, 2006). Entrepreneurs with employees not only have to run their business in line with several stakeholder demands that cannot be predicted *ex ante*, be they economic, social, or institutional in nature. But, to maintain their business venture, they and their employees also need to continuously engage in the uncertain entrepreneurial process, that is exploring and exploiting new opportunities with uncertain outcomes (Shane & Venkatraman, 2000)—potentially putting the business and the family at risk (Aldrich & Cliff, 2003). However, if their spouse is mentally healthy, this may signal to the entrepreneur that the uncertainty inherent in entrepreneurship is tolerated in the family sphere, motivating the entrepreneur to vigorously adopt a success-relevant entrepreneurial orientation—in other words, proactiveness, innovativeness, and risk-taking—in the business sphere. Moreover, good spousal mental health can signal that things are going well in the family sphere and entail encouragement and inspiration (Gorgievski-Duijvesteijn et al., 2000), enabling the entrepreneur to focus more on business-related matters, which appears to be particularly important in the search for economic benefits in employer entrepreneurship. Finally, considering that the human capital of the whole business is relevant to entrepreneurial success (Rauch & Hatak, 2016), employee mental health may potentially substitute for, or at least complement, the employer entrepreneur's mental health. However, given that it proved impossible to link health data on entrepreneurs, spouses and employees, we are cautious about drawing assumptions, and encourage future research to explore interdependencies between the (un)healthy entrepreneur, the (un)healthy spouse and family, as well as the (un)healthy workforce to acquire a holistic understanding of entrepreneurial success and thus the healthy venture.

Strengths, Limitations, and Future Research

Some of the strengths of this research are first, different sources of ratings (entrepreneur and spouse), diminishing concerns related to common method bias (Podsakoff, MacKenzie, Lee & Podsakoff, 2003), at multiple points in time. By examining dyadic health effects across multiple time periods and including cross-lagged outcomes in our model, we were able to precisely test the causal ordering of the variables in our theoretical model. Additionally, controlling for the diversity in the industries in which the entrepreneurs are embedded, as well as the variations in the occupations of their spouses enhances the generalizability of our findings. Moreover, the use of APIM and two-intercept models enabled us to follow recent suggestions from Krasikova and LeBreton (2012) and Wilson and colleagues (2018) to model dyadic theoretical phenomena using dyadic techniques. This approach answers questions that cannot be addressed using traditional analysis methods.

That said, as with all research, a number of limitations warrant mention. First, our sampling restricted the inclusion of certain types of couples (e.g., same sex couples or cohabitating but unmarried couples). Although we anticipate the same pattern of effects that we found in the current study, this needs to be empirically tested. Relatedly, research demonstrates that couples who have a better relationship also experience better health (for a meta-analytical overview see Robles, Slatcher, Trombello & McGinn, 2014). We therefore see the integration of (marital) relationship quality as a fruitful area for future research adopting a family embeddedness perspective on (health in) entrepreneurship.

Second, we posited mechanisms by which entrepreneurial health and spousal health affect entrepreneurial success but did not explicitly examine these mediating mechanisms. While we, for example, controlled for time devoted to the business (i.e., working hours), our study was not able to test the intervening roles of creativity or social capital. Future work may directly test the pathways we suggested. Additionally, considering that human capital may pay

off to an even stronger extent in the early stages of the entrepreneurial process (Dimov, 2010; Marvel et al., 2016; Unger et al., 2011), we recommend such studies consider the age of the business venture.

Third, we were encouraged by recent entrepreneurship research to provide a more holistic picture of entrepreneurial success (e.g., Kautonen et al., 2017; Wach et al., 2016), and we differentiated specifically between monetary success in the form of income and non-monetary success in the form of subjective well-being. Nevertheless, an important step in establishing additional evidence for dyadic health effects in entrepreneurship is testing relationships with other entrepreneurial outcomes. For example, research demonstrates the merit of differentiating between hedonic and eudaimonic well-being in entrepreneurship (Hahn, Frese, Binnewies & Schmitt, 2012; Wiklund et al., 2019). While our measure of life satisfaction captures hedonic well-being—which serves to regulate stability and homeostasis (Vittersø, Søholt, Hetland, Thoresen & Røysamb, 2009)—considering that eudaimonic feelings are generated to regulate change and growth and thereby are more proximal to entrepreneurship, we believe future research may find even stronger dyadic health effects on eudaimonic well-being. In order to further enhance the generalizability of results associated with dyadic health effects in entrepreneurship, we recommend future studies be conducted with international samples.

Practical Implications

The main practical implication is a simple, but also a powerful and important, one. Our findings suggest that entrepreneurs should find ways to maintain or improve their mental and physical health to foster both monetary success and well-being, even more so if they did not complete tertiary education or are solo self-employed, in addition to supporting their spouses' mental and physical health. Policy makers could provide entrepreneurs with information and

support in this endeavor; for instance, Warr (1987) suggests that the following nine conditions foster mental health: opportunity for control, opportunity for skill use, externally generated goals, variety, environmental clarity, availability of money, physical security, opportunity for interpersonal contact, and a valued social position. Entrepreneurs and policy makers should seek to provide environments characterized by those features (Gielnik et al., 2012).

As regards physical health improvements, policy makers could use our findings as a basis for implementing entrepreneurial health management programs, perhaps featuring sports facilities and training vouchers for the exclusive use of entrepreneurs, as a direct lever to enhance entrepreneurs' success. Such a scheme would clearly extend the traditional entrepreneurship education and venture support approaches. However, there are parallels with large firms that have since the 1980s increasingly offered a variety of initiatives (e.g., onsite fitness facilities and health education) to improve the physical health of employees and their families through lifestyle and behavior changes such as exercising, losing weight, and eating healthier diets (Danna & Griffin, 1999), with the aim of subsequently improving firm performance. Together with the support by policy makers, entrepreneurs may want to increasingly invest in their strength and endurance to achieve greater success in entrepreneurship.

To end with our initial example of a highly successful entrepreneur, Richard Branson makes sure he starts the day with some enlivening activity and also gets enough sleep (McGrath, 2018): "I rise early at 5.30am after seven hours' sleep (...) I generally spend from 6am until 9am doing fun things to benefit my body such as tennis and kite-surfing." Branson believes prioritizing physical activity makes him more productive (Branson, 2017a); a view supported by research indicating that physical activity is relevant to entrepreneurial success (Goldsby, Kuratko & Bishop, 2005), as further exemplified by Branson's case, "I'm not a fan of formal meetings and would much prefer (...) a walking meeting." (Branson, 2017b). In

addition, before getting down to business, Richard Branson shares a healthy breakfast with his wife and family (McGrath, 2018), putting him in a “great mind frame” (Branson, 2017b). By putting his family ahead of his business during a typical day, Branson actively nourishes his own mental health and invests in his spouse’s health capital. This is also obvious in the intent to spend quality time with his spouse (Clarkson, 2016), “I make it a priority to spend time with my wife Joan every single day,” Branson says. “It reminds me of why I do what I do.” The benefits of setting time aside for his spouse and devoting attention to his loved ones are clear to Richard Branson, “You’ll be more relaxed, and may even learn things from them that can help in your business” (Clarkson, 2016). The accounts of Richard Branson’s routine support the conclusion of this study that entrepreneurs should invest in both their own health and that of their spouse. Such boundary-spanning investments in health as human capital could lead not only to a reduction in health expenditure, but could also improve the long-term realization of economic potential such as innovation, wealth, and competitiveness through entrepreneurship.

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Table 1. Correlations and descriptives

	Min.	Max.	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. monetary entrepreneurial success (log)	0	14	10.09	1.88											
2. non-monetary entrepreneurial success	0	10	7.36	1.59	0.13**										
3. entrepreneurial mental health	10.91	76.64	51.88	8.77	0.08**	0.39**									
4. entrepreneurial physical health	15.61	69.57	52.14	8.09	0.05**	0.16**	-0.06**								
5. spousal mental health	12.44	77.77	51.14	9.13	0.05**	0.21**	0.35**	0.06**							
6. spousal physical health	9.21	69.01	51.42	8.61	0.06**	0.16**	0.06**	0.23**	-0.01						
7. entrepreneur's age	25	88	51	10	0.05**	0.05**	0.15**	-0.23**	0.09**	-0.25**					
8. entrepreneur's sex	0	1	0.33	0.47	-0.25**	0.01	-0.10**	0.03	0.07**	-0.00	-0.11**				
9. entrepreneur's education	0	1	0.45	0.50	0.12**	0.11**	0.09**	0.05**	0.09**	0.05**	0.18**	-0.02			
10. entrepreneur's weekly work hours	1	80	44	18	0.34**	-0.11**	-0.03	0.02	-0.06**	-0.00	-0.12**	-0.38**	-0.05**		
11. entrepreneur status	0	1	0.53	0.50	0.28**	0.03**	0.02	0.01	-0.02	0.03**	-0.08**	-0.23**	0.03	0.41**	
12. no. of children under 14	0	7	0.62	0.94	-0.04**	0.01**	-0.05**	0.16**	-0.04**	0.21**	-0.52**	-0.02	-0.03**	0.04**	-0.02

Note: The control variables spousal occupation dummies, industry dummies and year dummies are excluded for parsimony. Pearson product-moment correlation coefficients ** p<0.05 (two-tailed). The two dependent variables as well as the entrepreneur's biological sex, age, education and status were measured in year $t+1$. The independent (health) variables as well as the actual weekly working hours and number of children under 14 were measured in year t . The share (%) of entrepreneurs (observations) living with at least one child under 14 in the same household is reported in the descriptive analysis.

Table 2. Entrepreneurial health and spousal health on entrepreneurial success using APIM

	(1) monetary entrepreneurial success (log)			(2) non-monetary entrepreneurial success		
	(1a) actor	(1b) partner	(1c) APIM	(2a) actor	(2b) partner	(2c) APIM
	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)
entrepreneur's sex	-0.320(0.074) ^{***}	-0.337(0.075) ^{***}	-0.314(0.075) ^{***}	0.144(0.062) ^{**}	0.031(0.066)	0.130(0.062) ^{**}
entrepreneur's age	0.011(0.004) ^{***}	0.011(0.004) ^{***}	0.012(0.004) ^{***}	-0.000(0.003)	0.004(0.003)	0.003(0.003)
entrepreneur's education	0.340(0.070) ^{***}	0.360(0.073) ^{***}	0.330(0.071) ^{***}	0.170(0.060) ^{***}	0.189(0.065) ^{***}	0.134(0.059) ^{**}
entrepreneur status	0.581(0.064) ^{***}	0.585(0.066) ^{***}	0.567(0.066) ^{***}	0.156(0.054) ^{***}	0.129(0.057) ^{**}	0.151(0.054) ^{***}
entrepreneur's weekly work hours	0.027(0.002) ^{***}	0.027(0.002) ^{***}	0.028(0.002) ^{***}	-0.007(0.002) ^{***}	-0.007(0.002) ^{***}	-0.007(0.002) ^{***}
entrepreneurial mental health	0.012(0.003) ^{***}		0.010(0.003) ^{***}	0.058(0.003) ^{***}		0.056(0.003) ^{***}
entrepreneurial physical health	0.012(0.004) ^{***}		0.011(0.004) ^{***}	0.031(0.003) ^{***}		0.028(0.003) ^{***}
spousal mental health		0.006(0.003) [*]	0.003(0.003)		0.019(0.003) ^{***}	0.006(0.003) ^{**}
spousal physical health		0.012(0.003) ^{***}	0.010(0.003) ^{***}		0.023(0.003) ^{***}	0.017(0.003) ^{***}
constant	6.530(0.491) ^{***}	6.803(0.092) ^{***}	5.903(0.537) ^{***}	2.551(0.407) ^{***}	4.564(0.424) ^{***}	1.340(0.443) ^{***}
spousal occupation	included	included	included	included	included	included
industry	included	included	included	included	included	included
year	included	included	included	included	included	included
dyad (obs)	1,541	1,545	1,534	1,541	1,545	1,534
individual (obs)	3,944	3,944	3,876	3,938	3,937	3,870
Wald chi2	639.25 ^{***}	625.33 ^{***}	639.01 ^{***}	629.90 ^{***}	196.68 ^{***}	685.30 ^{***}
log likelihood	-7509.28	-7518.02	-7370.28	-6670.27	-6868.40	-6545.58

Note: *** p<0.01; ** p<0.05; * p<0.1. We controlled for the entrepreneur's biological sex, age, education, status, spousal occupation dummies, industry dummies and year dummies in year $t+1$, i.e., the same year as the dependent variables were measured. We controlled for actual weekly working hours and the number of children under 14 in year t . As the number of children under 14 is a household-level variable, we controlled for it at the dyad level (Level 2 of the MLM) to estimate the covariance of the random effects parameters.

Appendix A. Cross-lagged analysis on the causal effects of entrepreneurial health and spousal health on entrepreneurial success using SEM

	(1a) health → monetary success (log)	(1b) monetary success (log) → future entrepreneurial mental health	(1c) monetary success (log) → future entrepreneurial physical health	(2a) health → non- monetary success	(2b) non- monetary success → future entrepreneurial mental health	(2c) non-monetary success → future entrepreneurial physical health
	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)	Coef. (Std.)
monetary success (log)		0.377(0.099)**	0.291(0.088)**			
non-monetary success					2.059(0.100)***	1.029(0.094)**
entrepreneur's sex	-0.438(0.079)***	-1.733(0.415)***	0.526(0.371)	-0.019(0.066)	-1.626(0.386)***	0.523(0.362)
entrepreneur's age	0.009(0.004)**	0.115(0.033)***	-0.191(0.020)***	0.006(0.004)*	0.103(0.020)***	-0.197(0.019)***
entrepreneur's education	0.435(0.068)***	0.903(0.364)**	1.087(0.325)***	0.160(0.057)***	0.482(0.338)	0.942(0.317)***
entrepreneur's status	0.663(0.070)***	-0.057(0.376)	-0.274(0.336)	0.270(0.059)***	-0.421(0.348)	-0.386(0.327)
entrepreneur's weekly work hours	0.028(0.002)***	-0.037(0.012)***	-0.003(0.010)	-0.009(0.002)***	-0.003(0.011)	0.018(0.010)*
entrepreneurial mental health	0.012(0.004)***			0.034(0.003)***		
entrepreneurial physical health	0.015(0.004)***			0.066(0.003)***		
spousal mental health	0.009(0.004)**			0.011(0.003)***		
spousal physical health	0.015(0.004)***			0.018(0.003)***		
no. of children under 14	-0.064(0.042)	0.173(0.224)	0.819(0.200)***	0.002(0.036)	0.009(0.209)	0.735(0.196)***
constant	6.530(0.491)***	21.265(99.559)	235.017(89.007)***	-34.955(15.775)**	41.264(93.093)	243.616(87.262)***
spousal occupation	included	included	included	included	included	included
industry	included	included	included	included	included	included
year	included	included	included	included	included	included
individual (obs)	2,823			2,818		
Chi2	2362.08***			1973.44***		
log likelihood	-111748.63			-110812.71		

Note: *** p<0.01; ** p<0.05; * p<0.1. We controlled for the entrepreneur's biological sex, age, education, status, spousal occupation dummies, industry dummies and year dummies in year $t+1$, i.e., the same year as entrepreneurial success was measured. We controlled for actual weekly working hours in year t .

Appendix B. Entrepreneurial health and spousal health on entrepreneurial success: The role of entrepreneurs' biological sex (two-intercept approach)

	(1) monetary entrepreneurial success (log)	(2) non-monetary entrepreneurial success
	Coef. (Std.)	Coef. (Std.)
male entrepreneur (male)	6.255(0.569)***	1.095(0.471)**
female entrepreneur (female)	4.748(0.707)***	1.957(0.574)***
entrepreneur's age	0.012(0.004)***	0.002(0.003)
entrepreneur's education	0.329(0.071)**	0.131(0.059)**
entrepreneur status	0.574(0.066)***	0.153(0.054)***
entrepreneur's weekly work hours	0.028(0.002)***	-0.007(0.002)***
male*entrepreneurial mental health	0.011(0.004)***	0.063(0.004)***
male*entrepreneurial physical health	0.009(0.005)**	0.034(0.004)***
male*spousal mental health	0.002(0.004)	0.004(0.003)
male*spousal physical health	0.006(0.004)	0.013(0.004)***
female*entrepreneurial mental health	0.009(0.006)	0.046(0.005)***
female*entrepreneurial physical health	0.016(0.006)**	0.018(0.005)***
female*spousal mental health	0.007(0.006)	0.010(0.005)**
female*spousal physical health	0.020(0.006)***	0.025(0.005)***
spousal occupation	included	included
industry	included	included
year	included	included
dyad (obs)	1,534	1,534
individual (obs)	3,876	3,870
Wald chi2	76616.32***	59807.67***
log likelihood	-7367.44	-6538.34

Note: *** p<0.01; ** p<0.05; * p<0.1. We controlled for the entrepreneur's biological sex (two dummies representing men and women), age, education, status, spousal occupation dummies, industry dummies and year dummies in year $t+1$, i.e., the same year as the dependent variables were measured. We controlled for actual weekly working hours and the number of children under 14 in year t . As the number of children under 14 is a household-level variable, we controlled for it at the dyad level (Level 2 of the MLM) to estimate the covariance of the random effects parameters.

Appendix C. Entrepreneurial health and spousal health on entrepreneurial success: The role of entrepreneurs' education (two-intercept approach)

	(1) monetary entrepreneurial success (log)	(2) non-monetary entrepreneurial success
	Coef. (Std.)	Coef. (Std.)
entrepreneur's tertiary education (tertiary education)	6.424(0.668)***	1.773(0.555)***
entrepreneur's non-tertiary education (non-tertiary education)	5.803(0.600)***	1.095(0.495)**
entrepreneur's sex	-0.315(0.075)***	0.130(0.062)**
entrepreneur's age	0.012(0.004)***	0.003(0.003)
entrepreneur status	0.567(0.066)***	0.148(0.054)***
entrepreneur's weekly work hours	0.028(0.002)***	-0.007(0.002)***
tertiary education*entrepreneurial mental health	0.009(0.005)	0.058(0.004)***
tertiary education*entrepreneurial physical health	0.006(0.005)	0.031(0.005)***
tertiary education*spousal mental health	0.004(0.005)	0.000(0.004)
tertiary education*spousal physical health	0.012(0.005)**	0.012(0.004)***
non-tertiary education*entrepreneurial mental health	0.011(0.005)**	0.055(0.004)***
non-tertiary education*entrepreneurial physical health	0.014(0.005)***	0.026(0.004)***
non-tertiary education*spousal mental health	0.003(0.004)	0.010(0.004)***
non-tertiary education*spousal physical health	0.009(0.005)*	0.022(0.004)***
spousal occupation	included	included
industry	included	included
year	included	included
dyad (obs)	1,534	1,534
individual (obs)	3,876	3,870
Wald chi2	76636.47**	59154.68***
log likelihood	-7369.81	-6542.60

Note: *** p<0.01; ** p<0.05; * p<0.1. We controlled for the entrepreneur's education (two dummies representing tertiary education or not), biological sex, age, status, spousal occupation dummies, industry dummies and year dummies in year $t+1$, i.e., the same year as the dependent variables were measured. We controlled for actual weekly working hours and the number of children under 14 in year t . As the number of children under 14 is a household-level variable, we controlled for it at the dyad level (Level 2 of the MLM) to estimate the covariance of the random effects parameters.

Appendix D. Entrepreneurial health and spousal health on entrepreneurial success: The role of entrepreneur status (two-intercept approach)

	(1) monetary entrepreneurial success (log)	(2) non-monetary entrepreneurial success
	Coef. (Std.)	Coef. (Std.)
employer entrepreneur (employer)	6.379(0.609) ^{***}	1.154(0.503) ^{**}
solo self-employed (solo)	6.027(0.615) ^{***}	1.608(0.507) ^{***}
entrepreneur's sex	-0.307(0.075) ^{***}	0.138(0.062) ^{**}
entrepreneur's age	0.012(0.004) ^{***}	0.003(0.003)
entrepreneur's education	0.332(0.071) ^{***}	0.131(0.060) ^{**}
entrepreneur's weekly work hours	0.028(0.002) ^{***}	-0.007(0.002) ^{***}
employer*entrepreneurial mental health	0.007(0.005)	0.052(0.004) ^{***}
employer*entrepreneurial physical health	0.008(0.005) [*]	0.033(0.004) ^{***}
employer*spousal mental health	0.009(0.004) ^{**}	0.007(0.004) [*]
employer*spousal physical health	0.012(0.005) ^{***}	0.023(0.004) ^{***}
solo*entrepreneurial mental health	0.013(0.005) ^{***}	0.061(0.004) ^{***}
solo*entrepreneurial physical health	0.014(0.005) ^{***}	0.023(0.004) ^{***}
solo*spousal mental health	-0.003(0.005)	0.006(0.004)
solo*spousal physical health	0.008(0.005) [*]	0.012(0.004) ^{***}
spousal occupation	included	included
industry	included	included
year	included	included
dyad (obs)	1,534	1,534
individual (obs)	3,876	3,870
Wald chi2	76307.82 ^{**}	59037.58 ^{***}
log likelihood	-7368.22	-6539.45

Note: ^{***} p<0.01; ^{**} p<0.05; ^{*} p<0.1. We controlled for the entrepreneur's status (two dummies representing employer entrepreneurs and solo self-employed), biological sex, age, education, spousal occupation dummies, industry dummies and year dummies in year $t+1$, i.e., the same year as the dependent variables were measured. We controlled for actual weekly working hours and the number of children under 14 in year t . As the number of children under 14 is a household-level variable, we controlled for it at the dyad level (Level 2 of the MLM) to estimate the covariance of the random effects parameters.