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A critical look at the methodology of quantitative studies on entrepreneurial competencies and business success

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PROBLEM DESCRIPTION

How do, if at all, methodological challenges identified in the entrepreneurship literature in general, manifest in studies on entrepreneurial competencies and business success? What are the consequences for the reliability and validity of these studies?

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Erik O'Donnell

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ABSTRACT

The entrepreneurial competencies of owner-managers of small or medium-sized enterprises (SMEs) are seen as causes for the survival and success of their SMEs. There is a research literature of quantitative studies providing evidence for such a causal link. Entrepreneurial competencies could therefore be a means to financial success for individuals and macroeconomic success for policymakers.

However, several methodological shortcomings have been pointed out to exist in the entrepreneurship literature. If these methodological shortcomings also exist in quantitative studies on entrepreneurial competencies and business success, caution is required when it comes to assuming a causal link between the entrepreneurial competencies of SME owner-managers and the success of their SMEs. This in turn means that caution is also required in using this research to inform policy and practical decisions.

To find out if caution is warranted or not, this thesis critically analyzes quantitative studies on entrepreneurial competencies and business success to assess whether there is evidence for a causal link between the two. The research questions of the thesis are how, if at all, methodological issues in these studies threaten their 1) reliability or 2) validity. The thesis relies on reliability and validity as the main concepts of critical analysis. In addition, the thesis makes use of a theoretical concept called ‘the research triad’; a holistic approach to logically analyzing the relationship between theory and methodology, and ‘directed acyclic graphs’ (DAGs), a formal, graphical language for modeling causal assumptions.

The research design of the thesis consists of two major parts. The first part is a structured literature search to gather as many quantitative studies on entrepreneurial competencies and business success as possible. The structured search provides the sample of the thesis. The second part is the critical analysis of this sample, which is done by applying the theoretical concepts to the studies of the sample.

The thesis analysis shows that the quantitative studies on entrepreneurial competencies and business success are reliable but that there are three major threats to validity:

- Nonresponse bias from not including failed or otherwise unsuccessful entrepreneurs in study samples.
- A type of selection bias called ascertainment bias arising for the same reason.
- Confounding common method bias caused by using the entrepreneur as the only source of information on entrepreneurial competencies in cross-sectional research designs.

The conclusion of the thesis is that, because of the discovered threats to validity, there is only inconclusive evidence for a causal link between the entrepreneurial competencies of SME owner-managers and the success of their SMEs. Consequently, the thesis concludes that caution is required in using quantitative studies on entrepreneurial competencies and business success to inform policy and practical decisions.

Furthermore, the analysis of the thesis implies that future research on SME owner-manager's entrepreneurial competencies and business success must include information on failed or otherwise unsuccessful entrepreneurs to be valid and unbiased. In cross-sectional research designs, researchers must use third parties to evaluate entrepreneurs' entrepreneurial competencies. Additionally, due to the high failure rates among entrepreneurs, researchers who study samples of only surviving entrepreneurs should consider the methodological challenges known from sociological research on elite populations. Moreover, methodological reviews of entrepreneurship literature who conceptualize validity as having to do with causality, cannot rely solely on the presence or absence of statistical methods to assess validity.

SAMMENDRAG

Entreprenørers entreprenørielle kompetansene har blitt foreslått å være årsaker til at entreprenørenes små og mellomstore bedrifter (SMBer) overlever og opplever suksess. Det finnes flere kvantitative studier som fremlegger bevis for at en slik årsakssammenheng eksisterer. Entreprenørielle kompetanser kan derfor være en måte å oppnå finansiell suksess for individer og makroøkonomisk suksess for et lands styringsmakter.

Det har blitt pekt ut metodologiske svakheter i entreprenørskapslitteraturen. Problemet er at hvis disse svakhetene også finnes i studiene på entreprenørielle kompetanser, er det ikke sikkert at man kan være trygg på at det faktisk er årsakssammenheng mellom entreprenørielle kompetanser og forretningssuksess. Da må man være forsiktig hvis man vil hen vise til disse studiene når man fatter politiske vedtak eller tar praktiske avgjørelser.

For å finne ut om det er nødvendig å utvise slik forsiktighet, gjør avhandlingen en kritisk analyse av de kvantitative studiene på entreprenørielle kompetanser og forretningssuksess for å finne ut om det faktisk er bevis for en årsakssammenheng mellom disse to tingene. Avhandlingens forskningsspørsmål er hvordan, hvis i heletatt, metodologiske problemer truer 1) påliteligheten og 2) validiteten til disse studiene. I tillegg til konseptene 'pålitelighet' og 'validitet' benytter avhandlingen seg av konsepter som 'forskningstriaden', som er en holistisk fremgangsmåte for å logisk analysere forholdet mellom teori og metodologi. Videre bruker avhandlingen 'rettede asykliske grafer' (RAGer), som er et formelt, grafisk språk for å modellere og analysere årsakssammenheng.

Avhandlingens forskningsdesign består av to hoveddeler. Den første delen er et strukturert litteratursøk med mål om å samle så mye så mulig av den kvantitative litteraturen på entreprenørielle kompetanser og forretningssuksess. Dette strukturerte søket er opphavet til utvalget av studier som blir analysert i avhandlingen. Den andre delen består av den kritiske analysen av disse studiene ved å anvende de teoretiske verktøyene beskrevet i over på utvalget av studier.

Avhandlingens kritiske analyse viser at de kvantitative studiene på entreprenørielle kompetanser og forretningssuksess er pålitelige, men at det finnes tre store trusler mot deres validitet:

- Skjevhet som følge av at entreprenører som ikke har opplevd suksess ikke blir tatt med i studiene (*nonresponse bias*).
- En annen type skjevhet som oppstår av samme årsak (*ascertainment bias*).
- Skjevhet i tverrsnittsundersøkelser som bare får informasjon om entreprenørielle kompetanser fra entreprenøren selv (*common method bias*).

Avhandlingen konkluderer med at det ikke er sterke bevis for en årsakssammenheng mellom entreprenørielle kompetanser og forretningssuksess på grunn av usikkerheten rundt studienes validitet, og at forsiktig må utvises dersom man vil henvise til disse studiene når man fatter politiske vedtak eller tar praktiske avgjørelser.

Videre følger det fra avhandlingens analyse at dersom fremtidig forskning på entreprenørielle kompetanser og forretningssuksess skal være valid og uten skjevhet, må informasjon om entreprenører hvis forretninger ikke har overlevd være en del av forskningsdesignet. I tverrsnittsundersøkelser må forskere bruke tredjeparter til å evaluere entreprenørens entreprenørielle kompetanser. I tillegg, siden de fleste entreprenører opplever at bedriften ikke overlever, må forskere som studerer utvalg av bare overlevende entreprenører ta stilling til de metodiske utfordringene som diskuteres i sosiologisk forskning på elitepopulasjoner.

I tillegg viser avhandlingens analyse at metodologiske litteraturstudier av entreprenørskapslitteratur ikke kan bruke kun tilstedeværelse eller fraværet av visse statiske mål for å bedømme studiers validitet, gitt at man ønsker å tenke på validitet som et konsept som har noe med årsakssammenheng å gjøre.

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1 Introduction

The search for entrepreneurial competencies to support business success and macroeconomic development has been compared to the search for the Holy Grail (Mitchelmore and Rowley, 2010). Competencies are sets of behavior an individual can use to reach certain goals (Boyatzis, 2008). Entrepreneurial competencies are the competencies that are relevant when the goal is successful entrepreneurship (Mitchelmore and Rowley, 2010). In other words, entrepreneurial competencies are the sets of behaviors entrepreneurs can use to succeed as entrepreneurs. Moreover, if it is true that the individual abilities of the entrepreneur as owner-manager is one of the major causes of business success (Markman and Baron, 2003), it follows that strengthening entrepreneurs' entrepreneurial competencies should lead to more business success. It is in this sense that entrepreneurial competencies have been compared to the Holy Grail.

If the 'Grail' hypothesis is true, entrepreneurial competencies would be a road to increased growth, sales and profit for individual entrepreneurs. For policymakers, entrepreneurial competencies would be a road to grow the economy on a regional or national level, through strengthening the entrepreneurial competencies of the small business sector (Thongpoon et al., 2012, Ng et al., 2016, Krishnan, 2017, Krishnan, 2013, Jamin et al., 2016, Bendary and El Minyaw, 2015). On the political level, it is near universally accepted that entrepreneurship is a positive economic force and a possible solution to unemployment, economic growth, regional development and innovation, which in turn leads to high levels of public support and government subsidies for entrepreneurs and their small and medium enterprises (Nightingale and Coad, 2014).

Research on entrepreneurial competencies is done mainly in two contexts, the first being education. Entrepreneurial competencies are a part of the national education strategies of many nations (Lilleväli and Täks, 2017) and are particularly relevant for entrepreneurship education (Schelfhout et al., 2016, Mindt and Rieckmann, 2017). The second context is the small and medium-sized enterprise (SME) context. In the SME context, entrepreneurial competencies can refer to the competencies of a firm or an individual. On the firm level, entrepreneurial competencies refer to the behavior, actions and strategies of the firm. Consequently, the line between organizational science, strategic management and entrepreneurship is often blurry, as researchers draw on concepts such as core competencies (Prahalad and Hamel, 1990), dynamic

capabilities (Teece et al., 1997) or entrepreneurial orientation (Lumpkin and Dess, 2001, Lumpkin and Dess, 1996).

On the individual level, entrepreneurial competencies refer to the entrepreneurial competencies of a person, who is usually the owner-manager of an SME. In this context, entrepreneurial competencies represent a shift from studying the supposedly stable personality traits that separates the entrepreneur from ordinary people – dubbed the ‘trait approach’ by (Gartner, 1988) – to more dynamic and learnable constructs (Lans et al., 2014). The entrepreneur is assumed to be a central cause of the success of his or her SME and entrepreneurial competencies represent the clusters of behaviors that the entrepreneur must master for the business success to materialize (Man et al., 2002, Man and Lau, 2000).

The idea that motivates interest in individual level entrepreneurial competencies is the hope that improving individuals’ entrepreneurial competencies can turn them into more powerful causes of business success. However, a precondition for this hope is that the entrepreneurial competencies of the owner-manager actually are major causes of the success of his or her SME. That is, there has to be good evidence for a causal link between owner-manager competencies and SME business success to justify thinking that increasing SME owner-manager’s entrepreneurial competencies will translate into more business success. The evidence regarding this supposed causal link is the focus of this thesis. In particular, this thesis focuses on the quantitative evidence for this supposed causal link, since policymakers and practitioners most frequently use quantitative research to inform their decisions (Sallee and Flood, 2012).

Several recent quantitative studies report evidence for a positive relationship between owner-manager entrepreneurial competencies and business success of owner-manager’s SME (e.g. Thongpoon et al., 2012, Sánchez, 2012, Ng et al., 2016, Radzi et al., 2017, Man et al., 2008, Lopa and Bose, 2014, Krishnan, 2013, Bendary and El Minyawawi, 2015, Ahmad et al., 2010). However, the conclusions drawn within any research area are only as sound as the methodological practices that underlie the research (Ketchen et al., 2008). According to Crook et al. (2010), the methodological quality of entrepreneurship research – while having greatly improved in recent times – has not yet reached an ideal state, there is still a significant gap between what entrepreneurship researchers are doing and what they should be doing. Reliability, validity and whether there is nonresponse bias in the sample are areas that need focus (ibid.). According to Short et al. (2010), some of the largest methodological gaps in the entrepreneurship literature are fit between design and method, reliability and validity, common method bias and nonresponse bias. Problems may also arise from low data quality,

unrepresentative samples and the definitional flexibility of key terms (Nightingale and Coad, 2014) and lack of explicit and critical treatment of how method and methodology are deployed in individual studies (McDonald et al., 2015).

Since the entrepreneurial competencies literature is a subfield of the entrepreneurship literature, it could be the case that the methodological issues outlined for the entrepreneurship literature in general also exist in quantitative studies on entrepreneurial competencies and business success. If this is the case, there are reasons to doubt the evidence supporting the central assertion; that entrepreneurial competencies cause business success. This in turn creates doubt as to whether these quantitative studies should be used to inform policy or practical decisions. This is especially true if the methodological issues are serious enough to threaten the reliability or validity of the studies. In other words, entrepreneurial competencies should only be seen as a road to business success and economic growth, i.e. should only be seen as a ‘Holy Grail’, to the extent that the studies providing evidence for entrepreneurial competencies as a cause for business success are methodologically sound.

Despite much debate in the entrepreneurship literature about the best methods and methodologies, there is still little evidence on how this is practiced in individual studies (McDonald et al., 2015). Therefore, a critical analysis of the quantitative studies on entrepreneurial competencies and business success would be useful. A critical analysis focuses on research methods and methodological flaws (Randolph, 2009) and can be used to evaluate how well research literature represents the issues at hand (Torraco, 2005). It follows that a critical analysis could address doubts about the evidence and clarify to what extent the research can serve as a basis for real-life decisions by critically analyzing the methodological practices of the quantitative studies of the on entrepreneurial competencies and business success.

1.1 Purpose of the thesis

The purpose of this thesis is to critically analyze quantitative studies on entrepreneurial competencies and business success to assess whether there is evidence for a causal link between the two.

Quantitative studies are studies that attempt to explain phenomena by collecting numerical data which are then analyzed using mathematical methods, usually statistics (Aliaga and Gunderson, 2002, Muijs, 2010). Entrepreneurial competencies refer to the entrepreneurial competencies of individual owner-managers of SMEs. Business success refers to the business success of an owner-manager’s SME. The relationship of interest is between the entrepreneurial

competencies of the owner-manager and the business success of his or her SME. For the sake of brevity, this thesis will refer to ‘quantitative studies’, ‘entrepreneurial competencies’ and ‘business success’ with these definitions in mind.

1.2 Research questions

Critical analysis of research literature focuses on research methods and methodological flaws related to the research methods (Randolph, 2009). Methodology is understood to cover concepts such as research design, method, sample choice, construct choice etc. In other words, methodology in the sense of all the concrete choices a researcher can make about how to design and conduct a study, that has some bearing on what can be inferred from the study. Discussions of epistemology and ontology fall outside of this understanding. A methodological issue is anything that threatens a study’s reliability or validity. Reliability and validity is how a study shows that its research process is rigorous and trustworthy (Roberts et al., 2006) and are therefore necessary conditions for inferring causality.

However, generic concerns about methodological issues do not reveal what has actually happened in a given study (Shahar and Shahar, 2013). For example, a generic concern is the fact that cross-sectional research designs can’t determine the direction of causality, but this alone cannot be used to infer that any given study is unreliable or invalid. Therefore, a critical analysis should provide an account of *how* methodological issues arise to threaten reliability and validity, at the level of specific studies. In other words, a critical analysis should show how the methodology – i.e. choice the research design, method, sample choice, construct choice etc. – comes together in such a way that it creates doubt about the reliability and validity of specific studies. This leads to the following research questions:

Research question 1: How, if at all, do methodological issues threaten the reliability of quantitative studies on entrepreneurial competencies and business success?

Research question 2: How, if at all, do methodological issues threaten the validity of quantitative studies on entrepreneurial competencies and business success?

1.3 Contribution

This thesis contributes in two ways. Firstly, it contributes to the discussion about research design and methodological approach in entrepreneurship research, which McDonald et al. (2015) suggest is a critical step in improving the quality of entrepreneurship research. Secondly, by showing the ramifications of methodological issues on the reliability and validity of quantitative studies on entrepreneurial competencies and business success, this thesis shows the

extent to which there is empirical proof for a causal relationship between entrepreneurial competencies and business success, which potentially has large implication for policymakers and practitioners.

1.4 Structure of the thesis

Section 1 makes up the introduction and explains the context, purpose, research questions and contribution of the thesis. Section 2 describes the theoretical concepts that together make up the theoretical framework of the thesis. These concepts are the tools used to structure the critical analysis and act as the lens through which the sampled studies are analyzed. Section 3 describes the methodology of the thesis, i.e. how the sample of studies analyzed in this thesis was found, how the theoretical framework was applied to these studies, and the methodological challenges of this process. Section 4 describes the critical analysis of the studies, i.e. the result of applying the theoretical framework (section 2) to the found studies (section 3). Section 5 discusses the findings of the critical analysis and draws out the ramifications for the validity and reliability of the analyzed studies. Section 6 contains the conclusion of the thesis. The implications that follow are described in chapter 7. Limitations are discussed together with opportunities for further research in section 8. Section 9 is the final section and contains the references of the thesis.

2 Theoretical framework

The section presents the concepts that are used critically analyze the quantitative studies on entrepreneurial competencies and business success. Section 2.1 presents a holistic account of how various methodological concepts hang together, conceptualized as a research triad consisting of logic, theory and methodology. Section 2.2 defines the key terms ‘reliability’ and ‘validity’ and shows how they are understood in this thesis. Section 2.3 presents the formal language used to analyze causality in the analysis of the studies. Section 2.4 presents methodological issues that are already known from the entrepreneurship literature to be used as a starting point for the analysis.

2.1 The research triad – logic, theory and methodology

Most and Starr (2015) present a holistic approach to analyzing research from a methodological standpoint. This is conceptualized as a research triad consisting of logic, theory and methodology. Most and Starr (2015, p. 29) use the metaphor of a juggler to explain the research process in terms of the triad:

... we can think of the researcher (and the research community as a whole) as a juggler. The image is now one where each element of the triad needs to be held in the air at the same time in a complex set of interrelationships, indicating that for the juggler to be successful, all the balls (elements of the triad) must be kept going simultaneously. If any fall the enterprise fails. In this sense no element is more important than any other.

Theory explains the connection between concepts and how ideas are related, the development of theory depends a great deal on logic and requires logical analysis (Most and Starr, 2015). Logic ties together theory and methodology, both of which in turn shapes the application of that logic (ibid.). The implication is therefore that one must consider that logic, theory and methodology are interdependent and support each other when analyzing research from a methodological standpoint (ibid.). Another implication is that errors in one or more members of the triad are likely to spill into the others.

2.2 Reliability and validity

Reliability and validity are ways of showing rigor and trustworthiness of research processes (Roberts et al., 2006). Reliability is demonstrating that the operations of a study can be repeated with the same results (Rowley, 2002). In survey research, reliability also refers to the ability of the survey instruments to consistently produce the same results (Reznick, 1993). Validity

consists of two concepts: internal validity and external validity (Smith, 2013). Internal validity refers to the degree to which we can infer that a causal relationship exists between the variables being studied, given the methodology and research design being used (Mullen et al., 2009). External validity is the degree to which a causal relationship can be generalized beyond the particulars of the study; i.e. beyond the particular measurements, persons, settings and time of the study (ibid).

Construct validity is the degree to which measurements of a study actually reflect the theoretical constructs they are supposed to measure (ibid.). Construct validity can be seen as a special case of internal validity; for example, if a study isn't actually measuring variables A and B, we cannot infer anything about the causal relationship between A and B based on that study. However, if it turns out the study was mistakenly measuring A and C accurately, the study could still be internally valid for the causal relationship between A and C, and it could even be externally valid for other settings of A and C. However, if it's unclear what is being measured, for example because the measurements are unreliable, we cannot say anything about A and B nor generalize, making the study both internally and externally invalid. Internally invalid studies cannot be generalized either, of course.

2.2.1 Validity – association vs. causation

In this thesis validity is understood as a causal concept. According to Pearl (2009) there is a crisp distinction between concepts of causality and concepts of association. An associational concept is 'any relationship that can be defined in terms of a joint distribution of observed variables' (ibid., p. 99). A causal concept is 'any relationship that cannot be defined from the distribution alone' (ibid., p. 99). In other words, statistics and the language of statistics and probability, on its own, is not enough to support inferences about causality. Researchers who want to talk about causal relationships must therefore supplement the language of probability with a language of causality (ibid.). Therefore, for this thesis to be able to analyze and make claims about validity, it must necessarily make use of a language of causality.

2.3 Directed acyclic graphs (DAGs)

The 'language of causality' used in this thesis is the DAG. DAGs have been adopted in epidemiology (VanderWeele and Robins, 2007) and social science (Knight and Winship, 2013) to model causal relationships and to detect and avoid bias. DAGs are made from dots and arrows (Elwert, 2013) and make intuitive and flexible tools for modeling causal relationships and understanding the statistical consequences of causal assumptions (Glymour, 2006). Since

DAGs are also grounded in mathematics, they ‘... allow non-mathematicians to draw rigorous, mathematically based conclusions about certain types of statistical relationships’ (Glymour, 2006, p. 388). However, mathematical formality also comes with formal rules for how to use DAGs to make causal diagrams. In addition, there are rules for how to interpret causal diagrams made from DAGs.

2.3.1 Making causal diagrams with DAGs

In a causal diagram, letters visualize variables and arrows visualize the causal relationships between variables. A causal diagram made from DAGs is a DAG with letters instead of dots. All DAGs are made up of chains, forks and inverted forks (Elwert and Winship, 2014), see Figure 1 below.

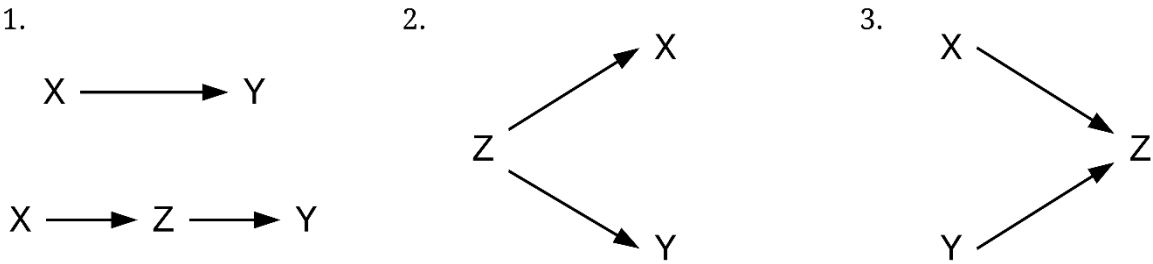


Figure 1: Chains, forks and inverted forks make up DAGs.

- 1. A chain going from X to Y. Below a chain going from X to Z to Y.
- 2. A fork; a chain goes from Z to X and from Z to Y.
- 3. An inverted fork, both chains from X and Y converge to Z.

Chains, forks and inverted forks can be combined to create DAGs of arbitrary complexity (ibid.).

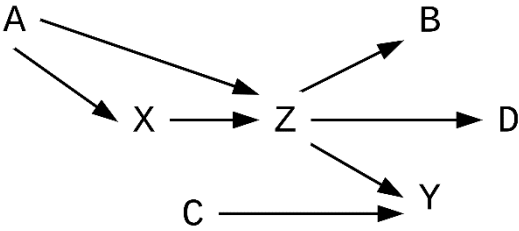


Figure 2: A more complex DAG made up of chains, forks and inverted forks.

2.3.2 Interpreting causal diagrams made from DAGs

Chains, forks and inverted forks represent assumptions about causal relationships (Glymour, 2006). In Figure 1, the chain $X \rightarrow Y$ represents the idea that X causes Y. The chain $X \rightarrow Z \rightarrow Y$ represents the idea that X causes Z, and Z in turn causes Y. The fork $X \leftarrow Z \rightarrow Y$ represents the idea that Z causes both X and Y. The inverted fork $X \rightarrow Z \leftarrow Y$ represents the idea that both Y and X cause Z; i.e. that Z is a common effect of X and Y.

A path is a sequence of arrows between two variables, regardless of the direction of the arrows (Glymour, 2006, Elwert and Winship, 2014). For example, in Figure 2 above, $A \rightarrow X$ is a path and $A \rightarrow X \rightarrow Z \rightarrow D$ is a path. Since the arrow directions don't matter for paths, $B \leftarrow Z \rightarrow Y \leftarrow C$ is a path, $A \rightarrow Z \leftarrow X$ is a path, and so on. However, paths can only traverse a variable once (Elwert and Winship, 2014); therefore $A \rightarrow X \rightarrow Z \rightarrow A$ in Figure 2 is not a valid path.

Variables that are connected by a path will be statistically dependent unless the path is blocked (Glymour, 2006, Elwert and Winship, 2014). A path is blocked if 1) there is a collider variable on the path or 2) a variable on the path has been conditioned (Elwert and Winship, 2014). A collider variable is a common effect. In Figure 2, $Z \rightarrow Y \leftarrow C$ is blocked by Y, which means there will be no statistical dependence between Z and C. In this case, Y is a collider or a common effect of Z and C. Note that a path like $B \leftarrow Z \rightarrow D$, without conditioning, is unblocked since it contains no colliders. Therefore, B and D are statistically dependent even though neither causes the other.

Conditioning (for example controlling, stratifying or selecting) a variable will also block a path so that there is no statistical dependence transmitted through the path (Elwert and Winship, 2014). Conditioning on a variable is visualized by placing a box around the variable. For example, if one controls for Z in $A \rightarrow X \rightarrow Z \rightarrow D$, i.e. $A \rightarrow X \rightarrow \boxed{Z} \rightarrow D$, there will be no statistical dependence between A and D, or X and D.

2.3.3 Using causal diagrams to detect bias

Sources of spurious association (i.e. bias) in research are closely related to the causal structures (chains, forks and inverted forks) seen in Figure 1. Bias that arises structurally comes from the causal model and research design and does not diminish with increased sample sizes. For example, since a fork $X \leftarrow Z \rightarrow Y$ is an unblocked path, there will be a statistical association between X and Y. It's called confounding bias when a researcher thinks that the association between X and Y is due to $X \rightarrow Y$, when it is actually due to a fork $X \leftarrow Z \rightarrow Y$ (Elwert and Winship, 2014), see Figure 3 below.

For example, let X be ‘carrying matches’, Y be ‘lung cancer’ and Z be ‘smoking’ in Figure 3 below. Even though X doesn’t cause Y, a correlation will be found between them because they are both caused by Z (Hernán et al., 2004). This correlation does not reflect any causal link between carrying matches and lung cancer, it reflects the fact that both carrying matches and lung cancer is caused by smoking. The appropriate response is to control for Z, which will remove any statistical association between X and Y (Elwert and Winship, 2014). In other words, $X \leftarrow \boxed{Z} \rightarrow Y$ makes X and Y statistically independent.



Figure 3: Controlling for a variable. A fork like the one shown on the left side can be a source of confounding bias if the researcher is not aware of it. On the right, controlling for Z is indicated by the box around Z, in which case X and Y are statistically independent.

Conditioning on a common effect Z of X and Y, i.e. $X \rightarrow \boxed{Z} \leftarrow Y$, creates a spurious association between X and Y (Elwert and Winship, 2014), see Figure 6, iii., below. It is called ‘endogenous selection bias’ when a researcher reports statistical association in his or her research as if all of it comes from $X \rightarrow Y$, when actually some or all of it comes from $X \rightarrow \boxed{Z} \leftarrow Y$ instead (ibid.). Endogenous selection bias covers a large number of biases usually called different names, such as selective nonresponse bias, ascertainment bias, attrition bias, Heckman selection bias, sample selection bias, homophily bias and more (ibid.). Elwert and Winship (2014, p. 36) give the following intuition for endogenous selection bias:

Consider the relationships between talent, A, beauty, B, and Hollywood success, C. Suppose, for argument’s sake, that beauty and talent are unassociated in the general population (i.e., beauty does not cause talent, talent does not cause beauty, and beauty and talent do not share a common cause). Suppose further that beauty and talent are separately sufficient for becoming a successful Hollywood actor. Given these assumptions, success clearly is a collider variable. Now condition on the collider, for example, by looking at the relationship between beauty and talent only among successful Hollywood actors. Under our model of success, knowing that a talentless person is a successful actor implies that the person must be beautiful. Conversely,

knowing that a less than beautiful person is a successful actor implies that the person must be talented. Either way, conditioning on the collider (success) has created a spurious association between beauty and talent among the successful. This spurious association is endogenous selection bias.

See Figure 4 below for this intuition in DAG form.

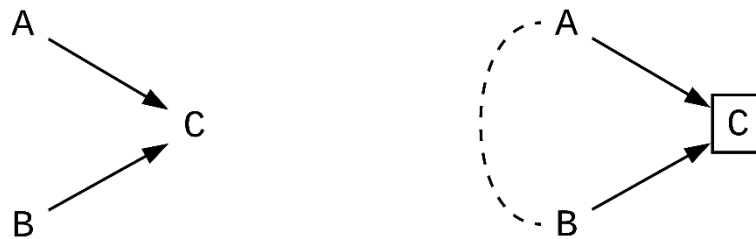


Figure 4: The relationship between talent, beauty and Hollywood success. On the left side, talent (A) and beauty (B) are both causes of Hollywood success (C). On the right side, only looking at successful Hollywood actors constitutes conditioning on the variable C, which induces spurious statistical dependence between A and B. Conditioning on C is indicated by a box around C, the spurious association between A and B is indicated by the dashed line between A and B.

It is also possible to condition on Z in chain $X \rightarrow Z \rightarrow Y$, i.e. $X \rightarrow \boxed{Z} \rightarrow Y$. This will remove any statistical dependence between X and Y. When a researcher mistakenly conditions on Z because he or she thinks Z is a confounder, i.e. the researcher thinks he or she is doing $X \leftarrow \boxed{Z} \rightarrow Y$, it is called overcontrol bias (Elwert and Winship, 2014). Jager et al. (2008, p. 73) give an example of a situation that could produce overcontrol bias:

Hsu et al.³ investigated the relationship between BMI and the risk for ESRD using data of more than 320 000 members of Kaiser Permanente. They were able to show that, adjusted for a number of confounders like age, sex, and race (but not for blood pressure), increased BMI was strongly associated with an increased risk for ESRD.

The problem was whether to control for blood pressure when estimating the effect of body mass index (BMI) on end-stage renal disease (ESRD). If blood pressure is a confounder, not controlling for it would mean not seeing the true effect of BMI on ESRD. However, if blood pressure is part of the causal pathway that leads to the development of ESRD, controlling for it would mean underestimating the effect of BMI on ESRD, see Figure 5 below.

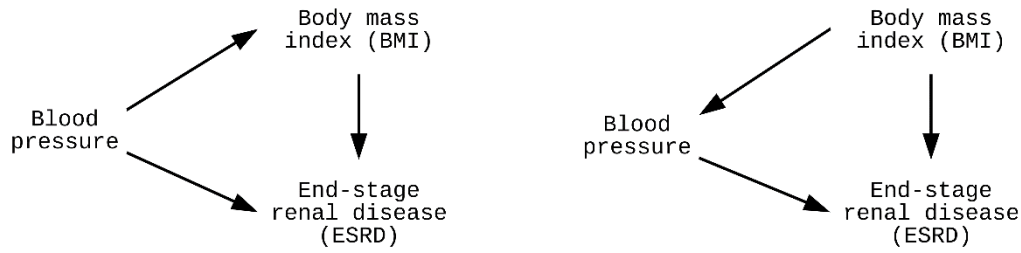


Figure 5: Two different scenarios with different implications for controlling a variable. On the left blood pressure acts as a confounder and should be controlled for to get a correct estimate of the effect of BMI on ESRD. On the right, blood pressure is part of the causal pathway through which BMI effects ESRD. Controlling for blood pressure in the latter case would produce a wrong estimate. The data alone will not show what is the right thing to do, only a considerable knowledge of medical literature can provide the answer (Jager et al., 2008).

In this case, not controlling for blood pressure was correctly chosen based on the existing knowledge in the medical literature (Jager et al., 2008). Jager et al. (2008) point out that the data alone will not indicate whether blood pressure is a confounder or not, it is the researcher who needs a considerable amount of knowledge about what the medical literature says about potential causal pathways between BMI and ESRD.

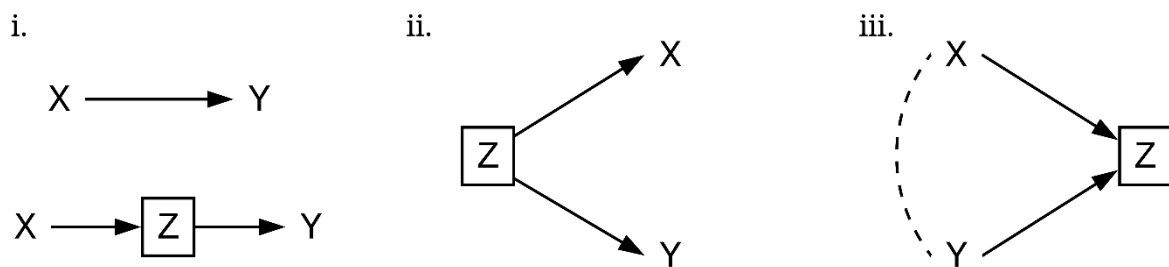


Figure 6: The effects of conditioning on chains, forks and inverted forks. A box surrounding Z visualizes conditioning on Z in a chain, a fork and an inverted fork.

i. Conditioning on Z results in over-adjustment bias (Jager et al., 2008) since Z is a mediator between X and Y. Over-adjustment bias removes an association that shouldn't be removed, making an association weaker than it really is.

ii. Conditioning on Z removes the spurious association between X and Y (Elwert and Winship, 2014). Statistical association between X and Y won't show up because controlling for Z removes the confounding effect of Z.

iii. Conditioning on Z creates a spurious association between X and Y (Elwert and Winship, 2014), as indicated by the dashed line between X and Y.

2.4 Known methodological challenges

According to Short et al. (2010), some of the largest challenges within the entrepreneurship literature relate to fit between design and method, reliability and validity, common method bias

and nonresponse bias. There are also methodological and statistical challenges particular to research on entrepreneurial SMEs (Nightingale and Coad, 2013). Fit between design and method, and reliability and validity, are covered in broad terms in section 2.1. However, it is useful to have some specific examples to serve as a starting point for analysis. The aim of this section is to present a non-exhaustive list of ‘usual suspects’ already pointed out by the entrepreneurship literature.

2.4.1 Sample issues

A consistent theme among method experts in entrepreneurship research is challenges relating to sampling issues (Short et al., 2010 p. 9); ‘The base rate of ‘successful’ entrepreneurship is probably quite low. If this assertion holds, there are substantial numbers of would-be entrepreneurs who fail to reach a recognizable level of achievement that would lead to their inclusion in a study.’ The underrepresentation of unsuccessful small firms in researchers’ samples can lead to bias (Nightingale and Coad, 2013).

A related issue is the degree of representation in samples (ibid., p. 120):

The uncertainty principle¹ means that to get good data, researchers often have to use unrepresentative samples. For example, Eesley and Roberts (2010) investigate entrepreneurial learning in a sample of Massachusetts Institute of Technology (MIT) alumni, 44% of whom had postgraduate degrees; Sanandaji (2010) constructs an entrepreneurship index based on a list of billionaires; Shane’s (2000) seminal study on entrepreneurial opportunities focuses on entrepreneurs taking advantage of MIT patented technology; and Audretsch (2007) explores innovation from appropriation of knowledge spillovers and university patents. Like lottery winners, these atypical subsamples are a tiny minority of the most successful cases, and, although highly visible, give a misleading picture of entrepreneurship in general.

Unrepresentative samples can lead to ascertainment bias (Elwert and Winship, 2014). The DAG structure of ascertainment bias is the following (ibid., p. 40):

¹ The data sets with detailed information are unlikely to include unsuccessful firms due to high exit rates for young firms, causing a tradeoff between representability (data on both successes and failures) and data quality (good data on successes, but little or none on failures) (Nightingale and Coad, 2013)

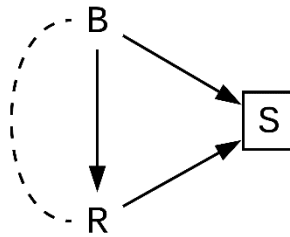


Figure 7: The DAG structure of ascertainment bias.

Elwert and Winship (2014) use the example of a study wanting to find the effect of a music album’s commercial success on the chance of being included in the Rolling Stone magazine’s list of 500 Greatest Albums of all time. Would topping the Billboard charts be associated with inclusion in the Rolling Stone 500?

The study only sampled albums that had earned some elite distinction, effectively excluding less successful albums. i.e. conditioning on elite distinction. However, elite distinction is a common effect of both topping the Billboard charts and inclusion in the Rolling Stone 500.

B represents topping the Billboard charts; R represents inclusion in the Rolling Stone 500; S is the sample selection; the box around S indicates conditioning. The dashed line indicates spurious association induced by conditioning on a collider variable (a common effect of B and R).

In sum, sample practices – i.e. who is included in the sample, what population is the sample drawn from – is something to consider when analyzing methodology.

2.4.2 Common method bias

Common method bias (or common method variance) is variance that comes not from the constructs the measures represent, but rather the method used to take the measurements (Podsakoff et al., 2003). In other words, common method bias is an alternate explanation for the observed association between constructs (ibid.). Common method bias is a serious concern for researchers using survey-based data, especially if the dependent and independent variables are from the same source and are perceptual in nature (Chang et al., 2010). In sum, methodological analysis should consider whether the method of study can be an alternate explanation for its reported association.

2.4.3 Non-response bias

According to Berg (2005, p. 865) ‘non-response bias refers to the mistake one expects to make in estimating a population characteristic based on a sample of survey data in which, due to non-response, certain types of survey respondents are under-represented’. In the context of entrepreneurial literature, this is related to the sampling issues described above, where low-

performance or unsuccessful entrepreneurs could be excluded. However, there could be other groups or people that are under-represented in samples.

3 Methodology

This section presents the methodology of this thesis. Section 3.1 presents the research design and the thought process behind its choice. Section 3.2 presents the literature search which is the method that was used to obtain the sample of this thesis. Section 3.3 presents how the theoretical framework – the concepts described in section 2 – have been applied to the sample. Section 3.4 presents reflections on methodological challenges of the research design; i.e. reflections on potential threats to reliability and validity stemming from the methodological choices described in this section.

3.1 Research design

The research questions are the following:

Research question 1: How, if at all, do methodological issues threaten the reliability of quantitative studies on entrepreneurial competencies and business success?

Research question 2: How, if at all, do methodological issues threaten the validity of quantitative on studies entrepreneurial competencies and business success?

To answer the research questions, it is necessary to find some quantitative studies on entrepreneurial competencies and business success. This sample of quantitative studies must be in some way representative of the ‘population’ of quantitative studies. Only then can the answers to the research questions be said to hold for the population. In other words, the answers to the research questions are interesting to the extent they are generalizable to the population of quantitative studies. It follows that it would be optimal find all the quantitative research on entrepreneurial competencies and business success, i.e. to study the whole population. In any case, the closer the sample is to the population, the better. Therefore, to find as many studies as possible on entrepreneurial competencies and business success, a structured search method for finding literature has been chosen. The method used to find the relevant literature is described in detail below.

3.2 Literature search

To find literature, a search strategy recommended by (Denney and Tewksbury, 2013) was used. The strategy consists of iteratively ‘outlining’ and then ‘narrowing’ the search. The outlining step consists of choosing a broad topic for investigation, adding evidence to the topic and then breaking it down into themes (ibid.). The narrowing step consist of using the themes as “signposts” to direct the search into a narrower and more specific focus (ibid.). A literature

search should have explicit criteria for inclusion (Randolph, 2009). The criteria for inclusion was that a study is a 1) quantitative peer-reviewed journal article, and that 2) the relationship under study is between some individual level construct of entrepreneurial competencies and some firm level construct of business success.

3.2.1 The first outlining

The broad topic is entrepreneurial competencies. To gather evidence for the topic, ABI\Inform was searched with the following search string:

ti(entrepreneur* AND competenc*) OR
 ab(entrepreneur* AND competenc*)

This search string filters search results from the ABI\Inform database such that the query returns all material with entrepreneur* competenc* in the title or abstract. The search terms entrepreneur* competenc* include all the following variations of entrepreneur and competence (Table 1):

entrepreneur*	competenc*
entrepreneur	competence
entrepreneurial	competences
entrepreneurialism	competencies
entrepreneurially	competency
entrepreneurism	
entrepreneurs	
entrepreneurship	
entrepreneurships	

Table 1: The different versions of the words entrepreneur and competence that was included in first search on entrepreneurial competencies.

However, this yielded 981 results in the ABI\Inform database. This was deemed too broad for the purpose of outlining. Therefore, the following search string was used instead:

ti(entrepreneur* NEAR/1 competenc*) OR
 ab(entrepreneur* NEAR/1 competenc*)

The *NEAR/1* operator ensures that the search result only includes the different versions of entrepreneur and competence (listed in Table 1) when they appear next to each other.

The search string including the *NEAR/1* operator yielded 261 results. These were filtered by peer reviewed articles only. The articles were then filtered in the following way:

- If the article title indicated that entrepreneurial competencies was the main topic of the article, it was included.
- If this could not be determined by the title, the abstract was read. Articles whose main topic was not entrepreneurial competencies were then filtered out.

This resulted in 115 articles. The abstracts of these 115 articles were read. Three central themes emerged:

1. Entrepreneurial competencies and education (52 articles).
2. Entrepreneurial competencies and small and medium-sized enterprises (SMEs) (39 articles).
3. Entrepreneurial competencies and women entrepreneurs (24 articles).

See Figure 8 below.



Figure 8: From left to right, how the results of the preliminary search were sorted and partitioned into themes. The numbers show how many articles make up each theme, the relative sizes of the boxes reflect the relative number of articles in within each theme.

3.2.2 Narrowing the focus

After the first step of outlining and breaking into themes, the next step was to narrow the focus. The focus was narrowed to entrepreneurial competences and SMEs, i.e. entrepreneurial competencies and small to medium business in general.

3.2.3 Outlining entrepreneurial competencies and SMEs

At this point, it was unlikely that the first search had captured all articles relevant to this theme. In order to cast a wide net, SCOPUS and Web of Science were used as search engines. SCOPUS was searched with the following search string:

entrepreneur* W/1 competenc*

The “W/1” operator is equivalent to the “NEAR/1” operator. Web of Science was searched with the following search string:

entrepreneur* NEAR/1 competenc*

This yielded 339 articles from SCOPUS and 272 from Web of Science. The searches were restricted to peer reviewed articles. The article references from SCOPUS, Web of Science and ABI\Inform (261) were imported into EndNote. Duplicates were then removed. This resulted in 426 articles in total.

SME is only one of several terms used for small to medium business. Therefore, the 426 articles were then sorted in EndNote by searching for abstracts or titles containing any of the following words: SME*, SMB*², venture*, firm*, business*, small, medium. This resulted in 66 articles.

² Small and medium-sized business (SMB)

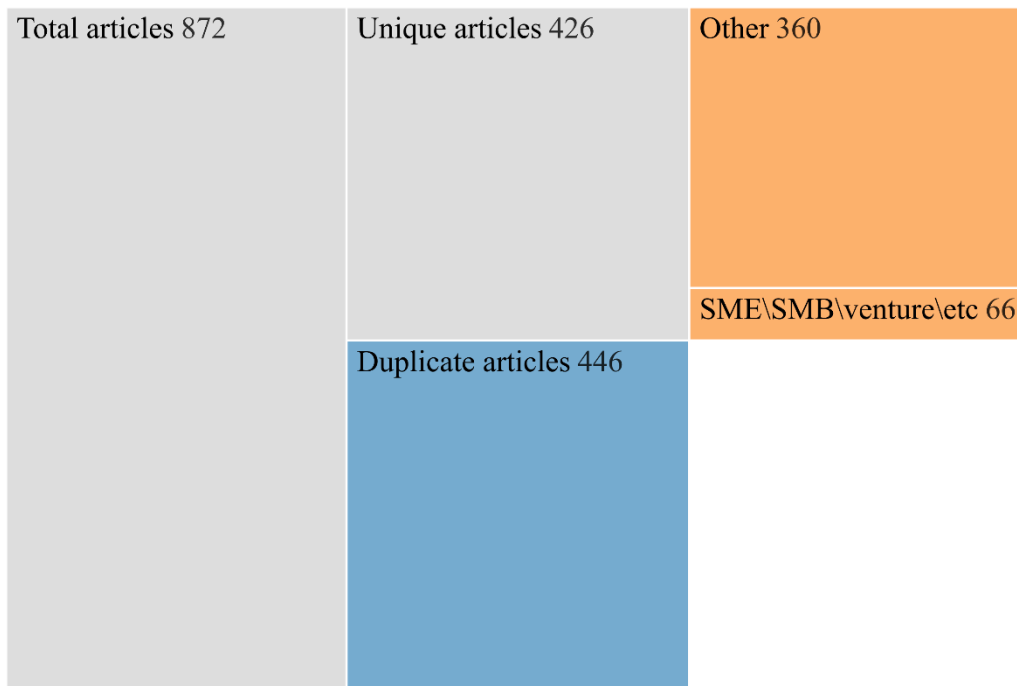


Figure 9: The relative sizes of the number of articles at different points in the sorting process.

The leftmost rectangle represents the total amount of peer reviewed articles found (852) on ABI\Inform, SCOPUS and Web of Science in total, using the search string “entrepreneur* NEAR/1 competenc*”. Roughly half of the found articles were unique, roughly one-sixth of unique articles had any of the words SME*, SMB*, venture*, firm*, business*, small, medium in their title or abstract.

For the sake of brevity, SME is from here on used as a catch-all term for SME, SMB, venture, firm, etc. After having outlined entrepreneurial competencies (ECs) and SMEs, the next step was breaking it down into themes. The 66 papers found were sorted by reading abstracts. The general themes found were the following:

- 17 papers were conceptual, theorizing about the relationship between ECs and various aspects of the SME.
- 16 studies looked at the effects of ECs on business success.
- Eight studies focused on uncovering what ECs exist at some place and/or what ECs some person in some industry has.
- Six studies looked at the antecedents of ECs, i.e. what situations lead to ECs in the people involved in an SME.
- Six studies focused on the relationship between EC and other concepts.
- Five studies looked exclusively on social competence.
- Five studies were on women SME owner-managers.
- Three studies presented tools for evaluating the ECs someone has.

See Figure 10 for a visualization of the themes.

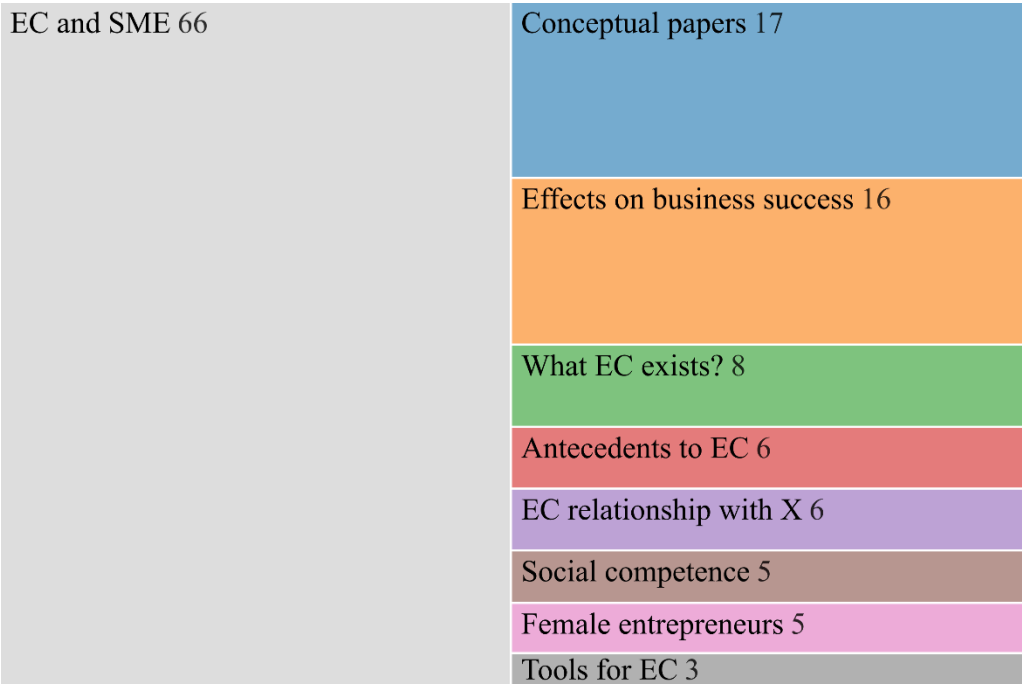


Figure 10: The breakdown of the main themes of the collected articles on entrepreneurial competencies (ECs) and SMEs (here used as a catch-all term for SME, SMB, venture, firm, etc.).

The colored boxes on the right represents the themes found during the outlining process in the same order as described on the previous page. The size of each box visualizes the relative size of each theme in terms of how many articles are in the theme, relative to the total amount of articles show in grey on the right.

In order to gain a deeper understanding of the theme of entrepreneurial competences and SMEs, abstracts were re-read and sample articles of different sub-themes were read. This led to the following understanding of the relationship between the themes:

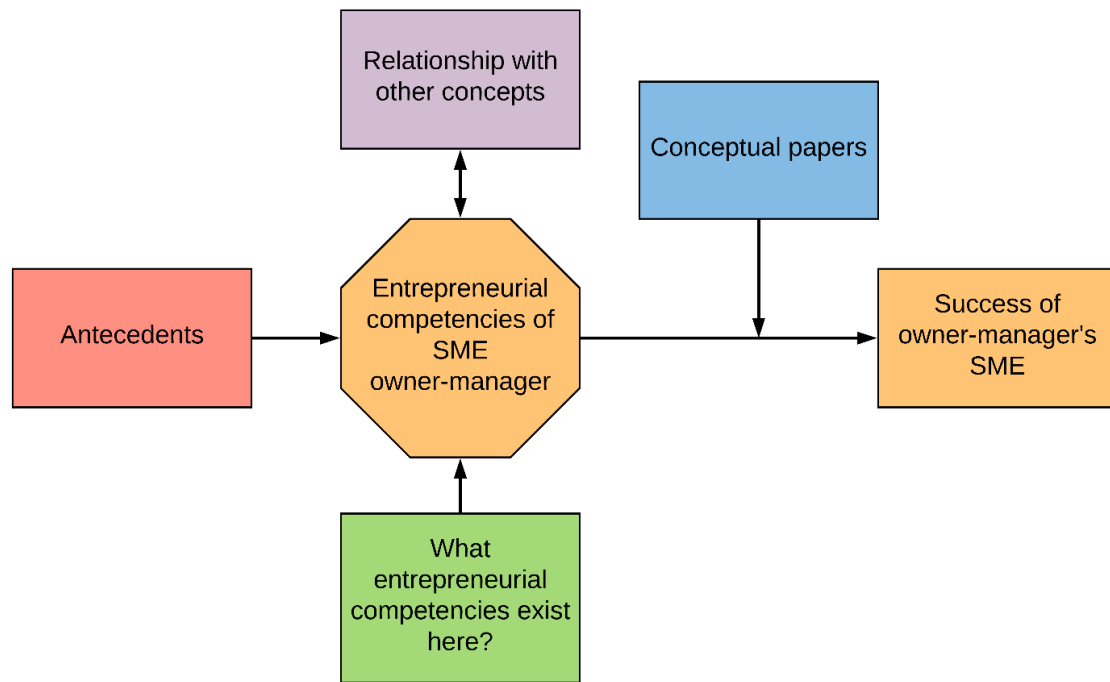


Figure 11: How the different themes relate to each other (not a DAG).

The main bulk of studies try to quantitatively assess the relationship between the entrepreneurial competencies and the success of the SME, visualized in Figure 11 by an arrow going from the orange octagon to the orange square. The entrepreneur is typically an owner-manager of an SME, and the research questions are about the relationship between the owner-manager’s entrepreneurial competencies (on an individual level) and the business success of his or her SME (on the firm level).

Most of the conceptual papers are concerned with explaining how entrepreneurial competencies could lead to the success of the SME. This is visualized in Figure 11 by the arrow from the box labeled ‘Conceptual papers’ to the arrow going from the orange octagon to the orange box. A smaller bulk investigates the relationship of entrepreneurial competencies with other concepts (e.g. between entrepreneurial competence and financing choices (Mei and Long, 2012) or psychological capital (Ismael and Muhamed, 2013) within the context of the SME. This is visualized by an arrow going to and from the top purple square to the octagon in Figure 11.

Another bulk investigates antecedents to entrepreneurial competencies, i.e. what situations and contexts lead to entrepreneurial competences, visualized by an arrow from the leftmost red square to the orange octagon in Figure 11. The last bulk attempts to find out what entrepreneurial competencies already exist at a workplace (an SME) or what types of

competencies can be found among SME owner-managers in different industries. This is visualized by an arrow going from the bottom green square to the orange octagon in Figure 11. Social competence is a type of entrepreneurial competence, and its research is therefore included in the main entrepreneurial competencies-success relationship depicted on Figure 11. Women entrepreneurs are a specific subset of SME owner-managers and therefore also included in the main entrepreneurial competencies-success relationship. The tools for evaluation entrepreneurial competence are included in the “what type of entrepreneurial competencies exist here?” theme.

3.2.4 Narrowing the focus

From the literature read so far, the most fundamental questions in the research on entrepreneurial competencies and SMEs seemed to be the following:

- What are the effects of entrepreneurial competencies on business success?
- How do entrepreneurial competencies lead to business success?
- What brings about entrepreneurial competencies for the owner-manager(s) of the SME?

The focus was narrowed to the studies focusing on these three questions. This meant discarding the two themes of ‘relationship with other concepts’ and ‘what entrepreneurial competencies exist here?’. See Figure 12 below for a visualization of the remaining themes and how they relate.

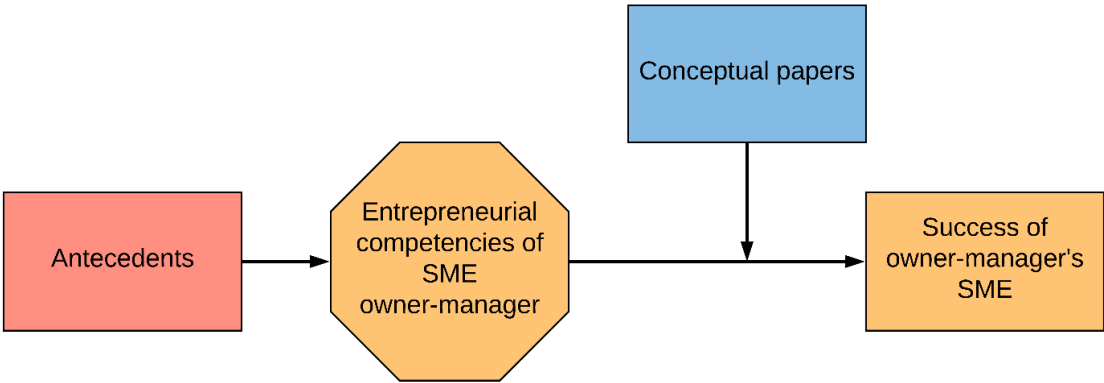


Figure 12: The main research questions after narrowing the focus and how they are related (not a DAG). Questions about antecedents seek to explain how entrepreneurial competencies arise and/or improve. Questions of entrepreneurial competencies and success try to find out what effects the entrepreneurial competencies of the SME owner-manager have on the success of the business. Conceptual papers try to explain the mechanisms of how individual entrepreneurial competencies affect business success. Cf. fig 11.

3.2.5 The final outlining

Now that the focus had been sufficiently narrowed, a final round of outlining remained. The goal was at this point to gather all the existing research on 1) the effects of entrepreneurial competencies on SME success, 2) how these entrepreneurial competencies lead to SME success, and 3) what causes entrepreneurial competencies in individuals in SMEs. To do this, ABI\Inform was searched with the following search string:

(entrepreneur* AND competenc*) AND
(sme* OR smb* OR venture* OR firm* OR business*)

This query returns all sources containing all combinations of entrepreneur and competence found in Table 1 (p. 18) and any occurrence of SME, SMB, venture, firm or business occurring anywhere in the title, abstract or keyword. However, this returned 41611 document results, so it was deemed necessary to narrow the search. Therefore, the following search string was used:

ti(entrepreneur* AND competenc*) AND
ab(SME* OR SMB* OR venture* OR firm* OR business*) AND
NOT (educat* OR universit* OR student*)

This query requires a combination of entrepreneur and competence as found in Table 1 (p. 18) in the title, while the abstract must contain at least one occurrence of SME, SMB, etc. The query also attempts to filter out documents focusing on education by excluding documents containing versions of education, university or student in the title, abstract or keywords. This resulted in 138 documents, which was reduced to 75 by removing duplicates and further reduced to 47 by removing irrelevant material.

The same broad searched returned too many documents on SCOPUS and Web of Science as well (respectively 1086 and 1031 results). Therefore, the following search string was used for SCOPUS:

TITLE (entrepreneur* AND competenc*) AND
TITLE-ABS-KEY (sme* OR smb* OR venture* OR firm* OR business*) AND
NOT TITLE-ABS-KEY (student* OR universit* OR educat*)

This search string returns documents with any combination of entrepreneur and competence as found in Table 1 (p. 18) in the title, any version of SME, SMB, etc. in the title, abstract or

keywords, but attempts to filter out studies on education as seen in the “NOT TITLE-ABS-KEY” term. This yielded 87 documents, which was reduced to 31 by removing duplicates. For Web of Science, the following search string was used:

TITLE: (entrepreneur* AND competenc*) AND

TOPIC: (SME* OR SMB* OR venture* OR firm* OR business*)

NOT TOPIC: (student* OR universit* OR educat*)

The principles are the same as in the two previous searches, however all three databases have implemented their search filtering functionality using slightly different terms. This search returned 66 documents, which was reduced to 36 after removing duplicates. In total, searching all three databases lead to 114 references. These references include all types of documents (journal articles, conference papers, etc.) except books, newspaper articles and training materials. Abstract and titles were read to extract the documents whose focus was one or more of the three core questions described in section 3.2.4., which resulted in a total of eight new articles which combined with the previously found articles resulted in 53 articles in total.

To find studies on social competence the following search string was used for ABI\Inform:

ti(entrepreneur* AND (social NEAR/1 competenc*)) OR

ab(entrepreneur* AND (social NEAR/1 competenc*))

which resulted in 40 documents that were reduced to eight journal articles by reading abstracts. The following search string was used for SCOPUS:

TITLE (entrepreneur* AND (social W/1 competenc*))

OR ABS (entrepreneur* AND (social W/1 competenc*))

which resulted in 46 documents that were reduced to two journal articles and one conference paper by reading abstracts. Both queries for ABI\Inform and SCOPUS filter results by requiring the title or abstract to contain some combination of entrepreneur and social and competence (the latter within one word of each other). The forms of entrepreneur and competence can vary according to Table 1 (p. 18). The following search string was used for Web of Science:

TITLE: (entrepreneur* AND (social NEAR/1 competenc*))

OR TOPIC: (entrepreneur* AND (social NEAR/1 competenc*))

This resulted in 37 documents that were reduced to two journal articles after reading abstracts. This query is similar to the two before it, except the variations on entrepreneur and social competence are restricted to title or topic instead of title and abstract.

To find more studies on antecedents of entrepreneurial competencies in the context of the SME, ABI\Inform was searched using the following search string:

ti(entrepreneur* AND competenc* AND
(learn* OR antecedent* OR cause* OR origin*)) AND

ab(entrepreneur* AND competenc* AND (learn* OR antecedent* OR cause* OR origin*))

This query allows documents containing variations on entrepreneurial competence as seen in Table 1 (p. 18), in addition to one or more variations of learn, antecedent, cause or origin, as seen in Table 2.

learn*	antecedent*	cause*	origin*
learn	antecedent	cause	origin
learnability	antecedents	caused	originable
learnable		causeless	original
learned		causer	originalism
learnedly		causes	originalisms
learnedness		causeway	originalist
learner		causeways	originalists
learners			originalities
learning			originality
learnings			originally
learns			originalness
learnt			originals
			originant
			originants
			originarily
			originary
			originate

originated

originates

originating

Table 2: The variations of learn, antecedent, cause or origin that are included by using the ‘’ operator.*

The search resulted in 14 documents, which was reduced to five journal articles by reading abstracts. SCOPUS was searched with the following search string:

```
TITLE ( entrepreneur* AND competenc* AND  
( learn* OR antecedent* OR cause* OR origin* ) ) AND  
ABS ( entrepreneur* AND competenc* AND  
( learn* OR antecedent* OR cause* OR origin* ) )
```

This search is equivalent to the ABI\Inform search string, except that SCOPUS uses “TITLE” to filter by title instead of “ti” and “ABS” to filter by abstract instead of “ab”. This resulted in 11 documents, which was reduced to four after removing duplicates, and finally to zero documents by reading abstracts. Web of Science was searched with the following search string:

```
TITLE: ( entrepreneur* AND competenc* AND ( learn* OR antecedent* OR cause* OR origin* ) )  
AND TOPIC: ( entrepreneur* AND competenc* AND ( learn* OR antecedent* OR cause* OR origin* ) )
```

This filter works like mentioned above except filtering by title and topic instead of title and abstract. This resulted in 15 articles which were reduced to 12 by removing duplicates, and further reduced to one journal article and one book section by reading abstracts. In total, eight journal articles, two conference papers and one book section were found.

The total number of documents from all the searches described in this section amounted to 72. Of the 72 documents, 68 were journal articles, three were conference papers and one was a book section. The conference papers and book section were filtered out, leaving the 68 journal articles. Of these 21 were on entrepreneurial competencies and their effect on SME success, 20 papers were conceptual, 18 focused on social competence, and 13 on antecedents, see Figure 13.

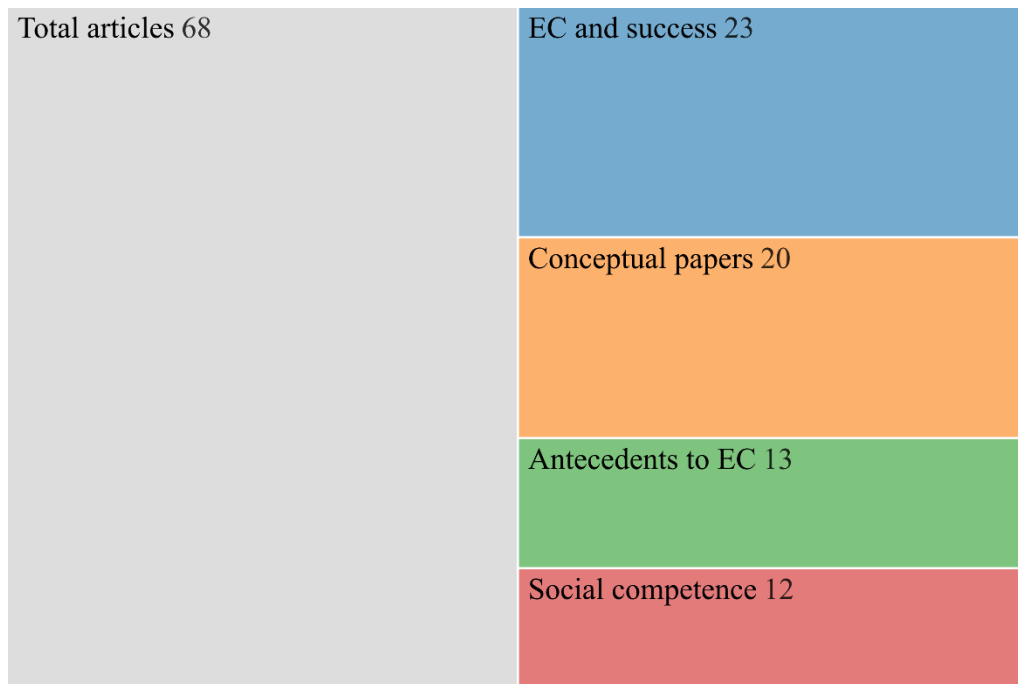


Figure 13: A visualization of the amounts of articles in each theme of the final outlining. The number of articles in each theme is represented by the relative size of each box, in comparison to the total amount of articles shown in grey on the left side of the figure. See Figure 12 for the relationship between these themes.

3.2.6 Examining the citation network

The last step of the literature acquisition process was to go through the references of the 72 documents to find any relevant material not yet discovered by the database searches. Documents citing the already gathered material were also checked when available. References were sorted by title; the abstract was read if the title indicated relevancy. This resulted in six new journal articles and one new conference paper. The author was not able to obtain six of the references found by examining the citation network. The author was unable to find Boam and Sparrow (1992) using ABI\Inform, SCOPUS, Web of Science, Google scholar or Google. Of these articles, Bird (2002) and Omrane and Fayolle (2011) was found but the author was not able to access them. The author was also unable to find English versions of da Silva and Klein (2016) and Willerding et al. (2012).

3.2.7 The final narrowing to the sample

After reading the literature relevant to the three fundamental questions

- 1) What are the effects of entrepreneurial competencies on business success?
- 2) How do entrepreneurial competencies lead to business success?
- 3) What brings about entrepreneurial competencies for the owner-manager(s) of the SME?

the focus was narrowed to the quantitative research on the relationship between the entrepreneurial competencies and SME success, see Figure 14. The articles that make up this set of literature will be the sample for analysis for this thesis. The set consists of 27 articles in total, with 19 articles on entrepreneurial competencies and SME success and 8 articles on the social competence of entrepreneurs (a subset of entrepreneurial competencies) and SME success.



Figure 14: The final focus was narrowed to the quantitative literature on the relationship between entrepreneurial competencies and SME success (not a DAG). Cf. Figure 12 and Figure 11.

3.3 Using the theoretical framework

To lay the foundation for a critical analysis, it was necessary to understand the main ideas and relationships of the literature, the research methods and how these have been applied (Torraco, 2005). Therefore, the main activity in applying the research triad was carefully reading of the literature. During and after this careful reading process, the theory, logic and methodology was assessed in terms of reliability and validity. Typical reflections were ‘could another researcher replicate this study? Would they get the same results? (reliability), ‘is it possible to infer a causal relationship based on this study?’ (internal validity), ‘would this result be valid for a different group of entrepreneurs?’ (external validity), ‘does this construct accurately represent the theory?’ (construct validity). The known methodological challenges (section 3.4) were kept in mind as these questions were asked.

Applying the DAGs consisted of a straightforward procedure:

1. Take the hypothesized causal relationships that the study is testing and draw them in DAG form
2. Look at the sampling selection of the study, is there anything about how the samples are selected or the sampling process that is causally related to the study’s hypothesized causal relationships? If so, draw them into the DAG.

3. Look at the other known methodological issues in the entrepreneurship literature (section 3.4). Is there anything that is causally related to the study's hypothesized causal relationships? If so, draw them into the DAG
4. Are there any theoretically relevant factors from the entrepreneurship literature that is causally relevant to the study's sampling methodology or hypothesized causal relationships? If so, draw them into the DAG.
5. Inspect the DAG for any of the structures shown in section 2.3.3.

The first step was done by looking at the variables being tested for statistical association in the study. For example, if U was the independent variable and W was the dependent variable in a linear regression, this implies $U \rightarrow W$ in the DAG. However, a model that describes how the variables are thought to be related was usually found in the previous chapters of the study. This model sometimes described other causally relevant variables in addition to those being regressed or modelled. These variables were included in the DAG.

The second and third step was done by carefully reading the methodology section of the study. Typical reflective questions were 'Who is in the sample? How was the sample selected? What were the criteria for being in the sample?' The next question was usually if there was anything about being in the sample that is causally related to one or more variables in the DAG from step 1, since this is a known to be potentially problematic (Elwert and Winship, 2014). If so, these new relationships were included into the DAG.

The fourth step was done by supplementing the DAG with causally relevant variables known from the entrepreneurship literature. A typical reflection was 'Considering the design of the study, are there variables that should have been taking into consideration that are missing?' If found, these were included in the DAG. In this step the known methodological issues from the literature (section 3.4) were frequently referenced.

The fifth step was done by inspecting the DAG created from the previous steps. If the DAG contained structures like the ones described in section 2.3.3 there could be spurious association in the study. Typical reflections were 'Are there any inverted forks in the DAG from the independent and dependent variable(s) under study? Is there any conditioning on the common effect? Are there any forks in the DAG leading to the independent and dependent variable(s)?' as these are potential sources of bias.

3.4 Reflections on methodological challenges

This thesis does not test empirical observations against hypothesis developed from theory. The aim of this thesis is not to find evidence for some causal relationship between different variables or constructs. Rather, this thesis analyzes already existing research literature, and tries to say something about the fit between methodology and the hypothesis in this examined research literature. Since the thesis does not aim to test causal relationship between constructs and since there is no attempt to generalize any causal relationships, it is difficult to apply validity as it is defined in section 2.2 to this thesis. This does not mean that this thesis is exempt from considering validity, but rather that it may be more appropriate to use a different idea of validity. Since the thesis is similar to a review in many ways, validity will be discussed in a similar manner as for reviews (see e.g. Randolph, 2009).

3.4.1 Reliability

The first methodological challenge is reliability. For this thesis reliability refers to whether someone else replicating this thesis, using the same methodology, would arrive at the same results and conclusions. According to Randolph (2009), when an entire thesis or dissertation is a review, it is common for researchers to recruit other individuals to test the reliability of the literature inclusion/exclusion system. While this thesis is not a review per se, the literature search still plays a major role in the thesis. Therefore, the fact that the literature inclusion/exclusion system has not been tested by anyone else could be a threat to reliability. I.e. it is possible that another person could end up with a different set of studies than the one in this thesis.

However, since the goal of the search method was to find as many articles as possible, and not some smaller representative set, this threat is less likely, unless a large part of the relevant literature has been missed entirely by the search. It is possible that some literature has been missed, since the literature search has relied on only three databases, ABI\Inform, SCOPUS and Web of Science. More databases and more specialized databases could have been included. However, these databases are comprehensive and include a wide variety of journals, it is likely that a high degree of the relevant literature should be able to be found through them. Therefore, while there might be individual studies missing, it is unlikely that large chunks of literature are missing.

Another issue is that academic books have not been considered. The non-inclusion of academic books might limit the understanding of central theoretical concepts, as academic books

sometimes provide more detailed and developed theory. A better approach might be to read relevant academic books before the literature search, as this might improve the author's ability to spot what is relevant and what is not. In addition, five articles were not included due to not being found, not being able to access, and not being available in English. This might have caused the exclusion of some relevant articles.

The method of narrowing the focus made it necessary to exclude studies that mainly look at the relationship between entrepreneurial competencies and other concepts. Studies that try to discover new types of entrepreneurial competencies or what competencies are associated with a particular industry have also been excluded. Optimally, these types of studies should be included to understand all facets of entrepreneurial competencies. This may limit the author's ability to understand the complete picture of the context surrounding entrepreneurial competencies.

Examining the citation network turned out fewer articles than expected. However, many of the relevant citations were of articles that had already been found through the database searches. The citations were sorted by title for relevancy, and then abstract. For a more thorough search, sorting by abstract from the outset would have been possible. Consequently, there is a possibility that relevant articles from the citation network were missed.

3.4.2 Validity

According to Cooper (1986), the procedures used to make inferences about the literature can be a methodological challenge for validity in the context of a literature review. The research triad (section 2.1) is a holistic concept, so there is necessarily a degree of subjectivity in applying it. Other researchers might have different ideas about what it means for logic, theory and methodology to be interdependent, and what that means in an analysis of methodology. This can affect the validity of this thesis.

However, this is supplemented by DAGs (section 2.3) whose application and interpretation are guided by formal rules independent of the author. Their implications are not subjective, and it should be easy for other researches to spot potential mistakes of application. The known methodological challenges (section 2.4) are also drawn from other researchers in the entrepreneurship field. The use of a formal language such as DAGs and the work of other entrepreneurship researchers' account of methodological challenges will hopefully balance the holistic nature of the research triad and therefore support the validity of the thesis.

3.4.3 The author's pre-understanding

The author is a student at the NTNU School of Entrepreneurship and has worked in two different start-ups over the last two years. The theoretical and practical courses at the NTNU School of Entrepreneurship in combination with the experience of real-life entrepreneurship have undoubtedly affected and contributed to the author's perceptions and understanding of entrepreneurship, and consequently had a role in shaping what articles have appeared relevant to the author. Hopefully, using a transparent method to find literature has prevented any negative consequences of the author's pre-understanding.

4 Analysis

This section presents the critical analysis of the sample of studies that was obtained using the methodology described in section 3. Section 4.1 focuses on the interplay between entrepreneurial competencies theory, research design and sampling practices of the sampled studies and how this can give rise to nonresponse bias and selection bias. Section 4.2 focuses on the interplay between entrepreneurial competencies theory, research designs and the methods employed by the sampled studies and shows how using survey methods in cross-sectional research designs can give rise to a confounding type of common method bias. Section 4.3 presents a summary of the analysis.

4.1 The interplay between theory, research design and sampling

In a study on entrepreneurs' entrepreneurial competencies in adolescence and habitual entrepreneurship in adulthood, Obschonka et al., (2011, p. 129) describe bias towards surviving ventures as a 'central shortcoming of many entrepreneurship studies'. Obschonka et al. (2011) is in fact the only study in the sample to include any data on failed ventures. As visualized in Figure 15, of the sample only 1 of 27 studies include failures as part of their study design. In the sample, no studies on social competencies included data on failures. In total, about 4% of the sample includes information on failed entrepreneurs as part of the research design.

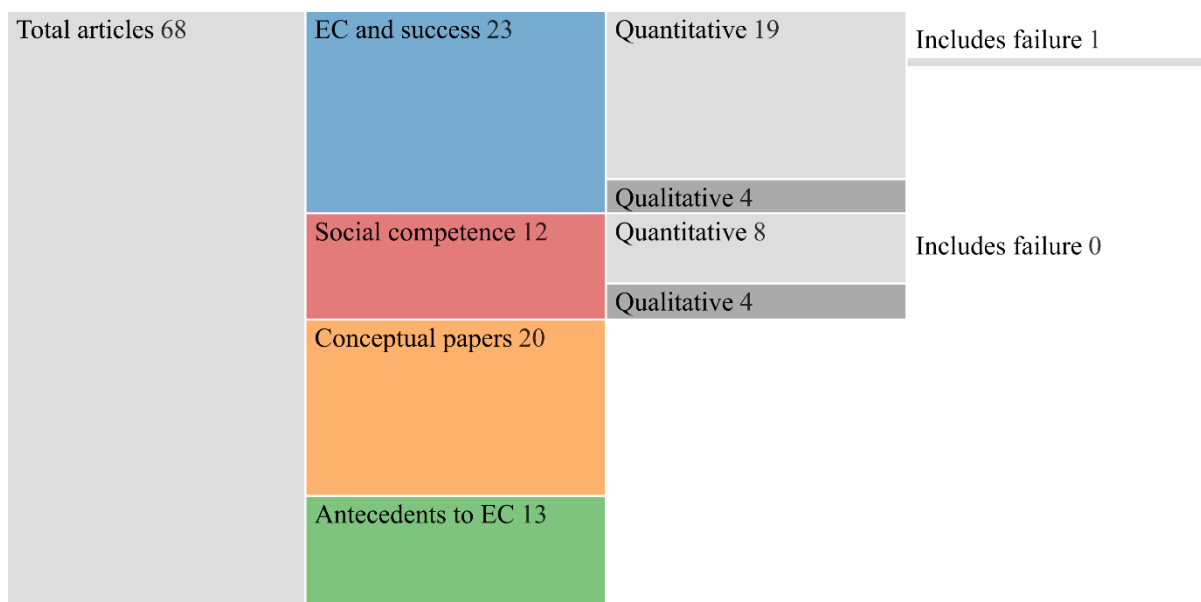


Figure 15: The proportion of studies including data on failures as part of the research design. Cf. Figure 13.

The 26 articles who do not include information on failed ventures all report some form of positive association between their entrepreneurial competencies construct and business success

construct. However, a sample of only surviving entrepreneurs poses a big problem, which is the possibility that the failed entrepreneurs could be just as competent. In other words, the entrepreneurs who have failed, and therefore are not included in the sample, could be doing the same things as the entrepreneurs who are succeeding.

The intuition behind this problem is illustrated by Figure 16 and Figure 17 below. Figure 16 visualizes a hypothetical linear correlation between entrepreneurial competencies and business success. However, data points below the dotted line are excluded from the sample, these are the entrepreneurs who were in the process of shutting down their business or were completely shut down and therefore did not make it into the sample. In other words, the ‘... would-be entrepreneurs who fail to reach a recognizable level of achievement that would lead to their inclusion in a study.’ (Short et al., 2010 p. 9).

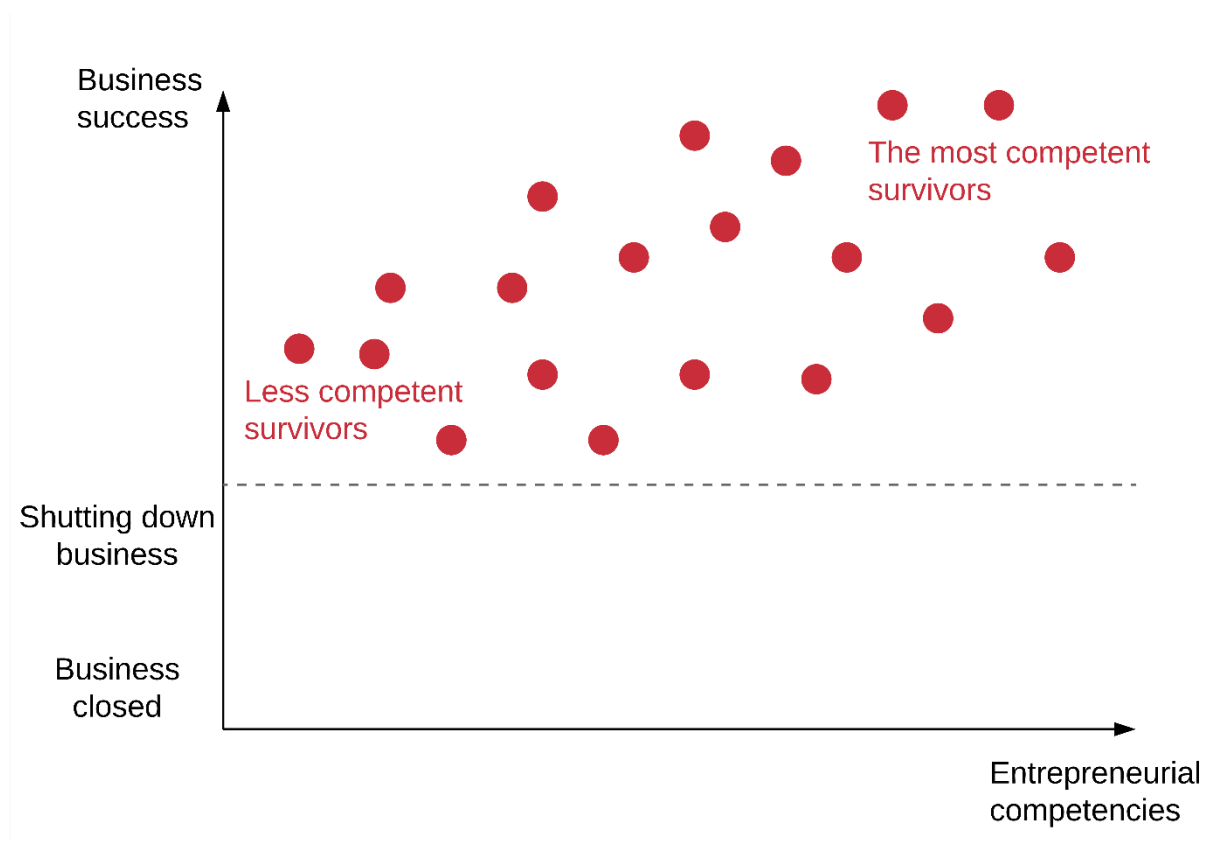


Figure 16: A hypothetical linear correlation between entrepreneurial competencies and business success.

From a theoretical standpoint, there are good reasons to think that the area below the dashed line in Figure 16 could be populated. Failure rates for new ventures are high (Aerts et al., 2007, Lasch et al., 2007, Lee et al., 2011, Pinfold, 2000). Casas and Hilb (2016) suggest 50% five years after incorporation. In some industries have rates up to 66% failure after the first three

years (Lasch et al., 2007). In addition to high failure rates, venture failure can be a source of learning for entrepreneurs (Rae and Carswell, 2001, Deakins and Freel, 1998, Cope, 2011). In addition, entrepreneurial learning is thought of as a competency that supports the development of entrepreneurial competencies (Man et al., 2008, Man, 2007).

In other words, the logical consequence of failure rates, entrepreneurial learning theory and entrepreneurial competencies theory is that that the area below dotted line in Figure 16 could be populated as shown in Figure 17. Figure 17 shows a hypothetical result of including failures in a study on entrepreneurial competencies and business success. It is easy to see how the inclusion of these hypothetical failures would neutralize any correlation between entrepreneurial competencies and business success. Consequently, failure rates, entrepreneurial learning theory, and entrepreneurial competencies theory come together logically in a way that makes including failures in study samples completely necessary. Not including failures in the sample can potentially make the entire statistical analysis of a study invalid, see Figure 17, and can be seen as a type of nonresponse bias, i.e. arising from the under-representation of unsuccessful entrepreneurs in the sample.

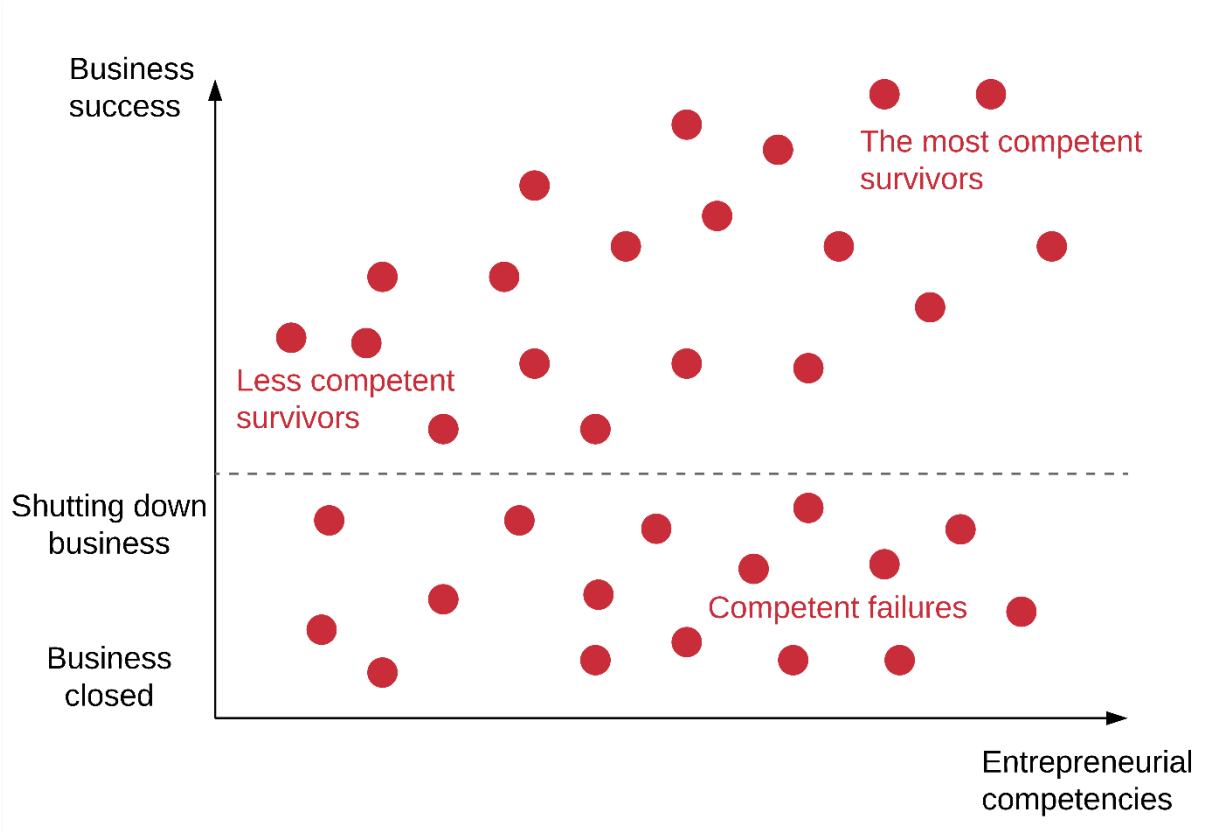


Figure 17: A hypothetical scenario where the association between entrepreneurial competencies and business success is neutralized by including entrepreneurial failure in the sample.

4.1.1 Ascertainment bias and sampling practices

The failure rate of ventures is high (Lee et al., 2011; Aerts et al., 2007; Pinfeld, 2000; Lasch et al., 2007). For example, on average one can expect that about 50% of the ventures have failed five years after incorporation (Casas and Hilb, 2016). In some industry sectors 66% might have failed after the first three years (Lasch et al., 2007). Consider a sample used by Ng et al. (2016) where 87.6% of sampled firms were over 6 years of age or Chandler and Hanks (1994) where the median age of the firms is 5 years. Or consider Man et al. (2008) where sample firms are all older than 3 years. In these samples, many firms will not have made it into the samples due to having failed. Given the failure rates reported in the entrepreneurship literature, as a rule of thumb, one can reason that at least half the sample is missing for a sample of firms five years old or older.

This has two consequences. The first is that this amounts to conditioning on firm survival; one could produce the same sample by sampling both survivors and failures over a period and then deleting the failures. The second is that high failure rates indicates that surviving firms are an elite population that might not be representative of SMEs in general. This is problematic because it can lead to selection bias. In the words of Elwert and Winship (2014, p. 39) ‘The problem is that studying the causes of success in a sample selected for success invites endogenous selection bias’.

These two consequences lead to endogenous selection bias in the studies that don’t include failures in their samples. As shown in Figure 18 below, not including failures in samples introduces the type of endogenous selection bias called ascertainment bias (see section 2.4.1) described by Elwert and Winship (2014, p. 40). The ascertainment bias is a logical consequence of the entrepreneurial competencies theory and the practice of not including failures in samples.

Entrepreneurial competencies are causally related to firm survival (Shepherd et al., 2000, Radzi et al., 2017, Ng et al., 2016) and so is business success. However, since not including failure amounts to conditioning on survival, this results in conditioning on a collider (a common effect) of the dependent and independent variable of the study, see Figure 18. Consequently, some amount of the statistical association reported in all the 26 studies who don’t include failures or information on failures in their research designs is spurious due to ascertainment bias.

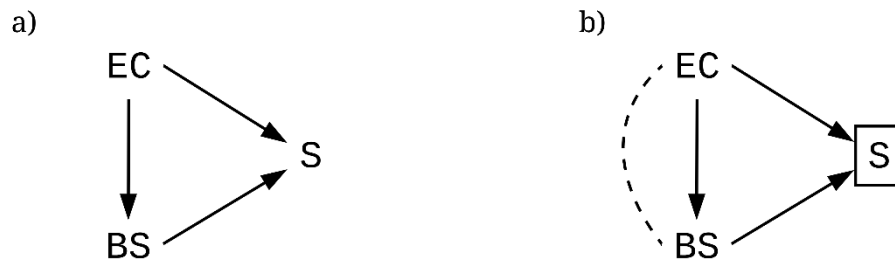


Figure 18: Endogenous selection bias when the sample only includes surviving firms.

As shown in a) entrepreneurial competencies (EC) cause business success (BS), but entrepreneurial competencies and business success also cause firms to not fail.

As shown in b), conditioning on S by sampling only surviving firms creates a spurious association between entrepreneurial competencies and business success, on top of the causal connection.

4.1.1.1 Studies with unknown sample origin

Ahmad et al. (2010), Thongpoon et al. (2012), Musthofa (2017) and Lopa and Bose (2014) do not mention how or from where they obtained their samples, see Figure 21 for an overview. In addition to posing some challenges to reliability, the non-inclusion of failures still guarantees ascertainment bias since survival is a common effect of the independent and dependent variables under study.

4.1.1.2 Sampling from databases

A majority of the studies sampled in this thesis get their samples from various premade lists, directories or databases, see Figure 21. For example, Krishnan (2017) gets samples from various local industrial associations, Kyndt and Baert (2015) use the databases of three information and coaching organizations for entrepreneurs. Chandler and Jansen (1992) use the state of Utah records of business incorporations. Tocher et al. (2012) recruited study participants from business incubators and clients of Small Business Development Centers through the USA. Sánchez (2012) uses the Spanish Chamber of Commerce directories to get their sample.

There are at least two ways in which drawing a sample from a database or a premade list causes ascertainment bias. The first is that the database lacks information on failed or unsuccessful ventures. For example, ventures that have gone out of business might be removed from local industrial associations and business registers. Ventures that never had much success might not have made it into the lists and databases in the first place.

An illustrative example Sambasivan et al. (2010), who drew most of their sample³ from the list of winners of the Enterprise-50 award (an award for entrepreneurs based on management and financial performance) between 1997 and 2003, a sample unlikely to contain any laggards. Of course, even though a data on failures are available in a database, list or register, the researcher might still exclude them as an intentional part of the research design, leading to the ascertainment bias situation described above.

The second way is when the database (or list, register, etc.) has its own criteria for who is included and who is not. For example, a database of firms might also have criteria for inclusion; it might only list firms of a certain age, size or financial status. For example, in the case of the Enterprise-50 award, only certain firms would meet their requirements for managerial and financial performance. This can be a source of bias if the independent and dependent variables of the study (in this case entrepreneurial competencies and business success) are causally related to those inclusion criteria. Figure 19 below illustrates these situations with DAGs.

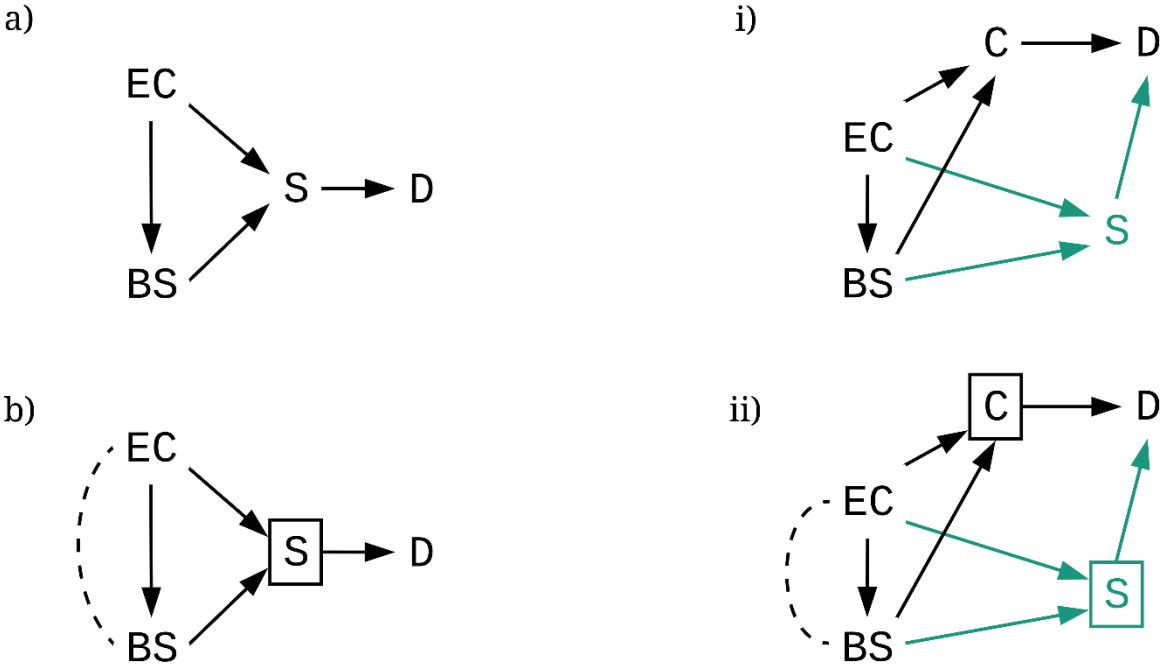


Figure 19: Ascertainment bias when the sample is drawn from a database, list or register.

Sampling from a database of only survivors constitutes conditioning on survival (a) and b)), but there might be additional bias due to the criteria needed to be met to be in the database, list or register in the first place (i) and ii)).

³ Sambasivan et al. (2010) intended to study less successful entrepreneurs as well, but the less successful entrepreneurs refused to participate in the study; Sambasivan et al. (2010) note that this might introduce bias into the study and that future studies should include both successes and failures.

EC = entrepreneurial competencies; BS = business success; S = survival; C = Meeting criteria for inclusion; D = being listed in the database, list or register

The leftmost part of Figure 19 shows how drawing a sample from a database creates endogenous selection bias. It doesn't matter whether it is the researcher who excludes failed firms or if the database does it beforehand for unrelated reasons. When survival is a cause for being on the database in the first place (a), sampling from the database constitutes conditioning on firm survival (b) and creates spurious association between the independent and dependent variables.

The rightmost part of Figure 19 shows how things get more complicated when taking any inclusion criteria of the database into account. Conditioning on survival is problematic because both entrepreneurial competencies and business success are causally related to firm survival. If a database has certain inclusion criteria, and both entrepreneurial competencies and business success are causally related to those inclusion criteria (i), sampling from that database constitutes conditioning on the inclusion criteria (ii) and is therefore a source of bias.

Take for example the list of winners of the Enterprise-50 award sampled by Sambisavan et al. (2010). Being highly competent and having a high amount of business success should increase the odds of winning the Enterprise-50 award, as the criteria for winning are managerial and financial performance. Business success is of course directly related to financial performance, entrepreneurial competencies are related to managerial performance (Man et al., 2002). This structure is visualized in Figure 19, ii) and is an additional source of ascertainment bias. It's worth noting that, in this case, conditioning on specific criteria would introduce ascertainment bias even if the database included information of failures.

4.1.1.3 Sampling from MBA programs

Gerli et al. (2011) and Camuffo et al. (2012) both draw their samples from participants in the 'Master for Entrepreneurs of SMEs', an MBA for entrepreneurs at the Italian business school Fondazione CUOA. Gerli et al. (2011) intentionally excluded the firms that failed during the MBA from their analysis as part of their research design, ending up with the ascertainment bias described in section 2.4.1.

For Camuffo et al. (2012), the argument is much the same as in the section above. Ascertainment bias arises from drawing samples from MBA programs when that constitutes conditioning on survival, and possibly if the entrepreneurial competencies and business success are related to the criteria of participating in the MBA program. For example, if there are criteria

related to managerial experience and profitability it could create an unrepresentative sample population like the Enterprise-50 award example described in the previous section, see Figure 20.

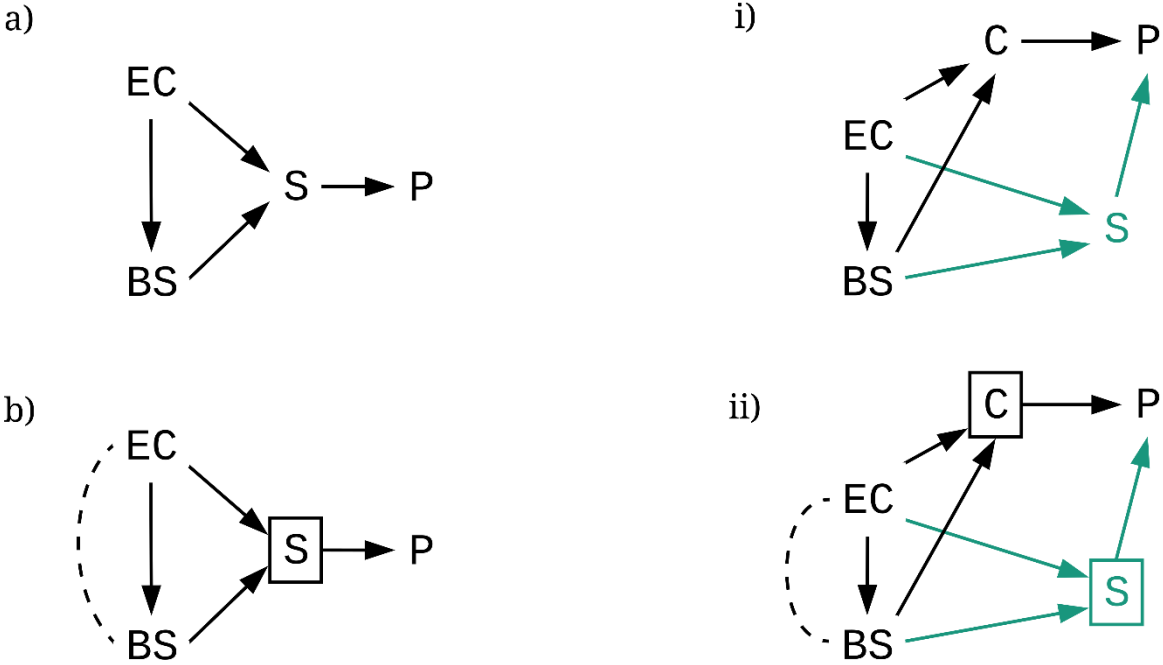


Figure 20: Ascertainment bias when the sample is drawn from an MBA program. Sampling from only survivors constitutes conditioning on survival (a) and b)), but there might be additional bias due to the criteria needed to be met to participate in the MBA program in the first place (i) and ii)).

EC = entrepreneurial competencies

BS = business success; S = survival

C = Meeting criteria for participation

P = Participating in an MBA

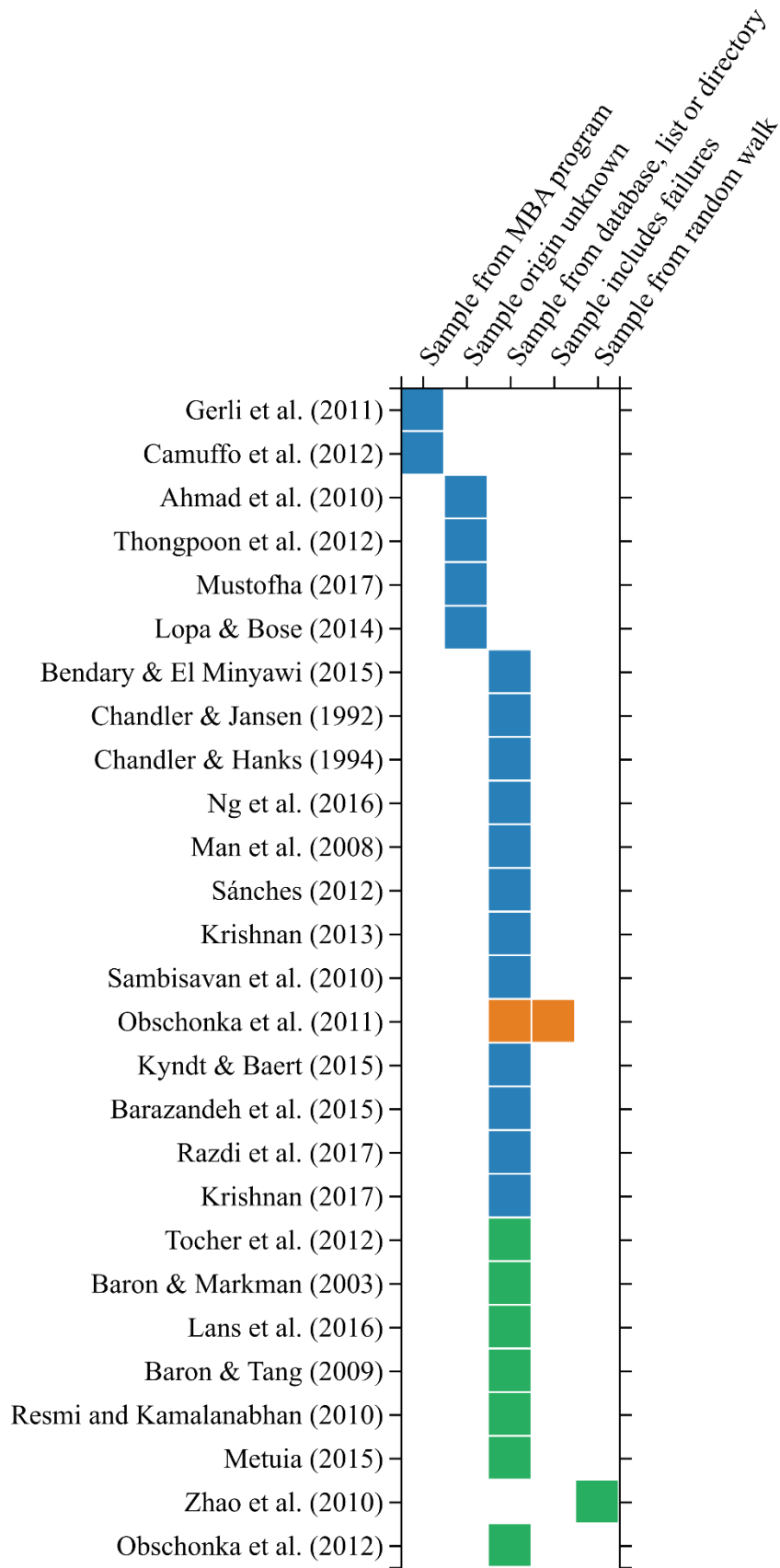


Figure 21: The sources entrepreneurs were sampled from. The figure also shows which studies include entrepreneurs who experienced failure, shown in orange. Research on social competence in green.

4.2 Interplay between theory and survey methods

It is a significant challenge to measure new venture performance (Chandler and Hanks, 1993). Data can be hard to find since new ventures usually have no obligations to share information on their performance (ibid.). Therefore, researchers must often rely on entrepreneurs' self-reported perceptions of both their competence and business success. As shown in Figure 23, 22 of 27 studies use cross-sectional survey design methods. Of all 27 studies, only Lopa and Bose (2014), Resmi and Kamalanabhan (2010), and Camuffo et al. (2012) report no measures of internal consistency; 89% of the studies sampled in this thesis reported some measure of internal consistency of the measures. 81% report Cronbach's alpha for their measures. Of these, 50% report alphas over 0.7 for all measures used, 36% report alphas over 0.6 for all measures used. The average Cronbach's alpha value for all measures was greater than 0.7 for 50% of the studies reporting alphas over 0.6 for all measures.

In the cross-sectional studies, data on entrepreneurial competencies and business success are gathered from one point in time through surveys. The data on business success might be entirely subjective or self-reported measures of performance indicators such as return on investment and sales numbers. Some studies also adjust their measures of business success using archival data (e.g. Baron and Tang, 2009). However, the use of subjective measures in itself is not necessarily a problem, as there is evidence that subjective measures business success can be highly correlated to objective measures of business success (Chandler and Hanks, 1993).

Nonetheless, a problem arises if one considers where entrepreneurs' perceptions of own competence might come from. That is, if one considers the cues in the environment an entrepreneur would likely use to assess his or her own competence. Take, for example, 'opportunity competencies' which are 'competencies related to recognizing and developing market opportunities through various means' (Man et al., 2002, p. 132) used by 36% of the cross-sectional studies. The obvious way for the entrepreneur to self-assess this competency would be to call upon the experiences related to their own venture; this is (by definition) the context in which one recognizes and develops market opportunities. To put it in crude terms, there is no way for the entrepreneur avoid reasoning like this: 'Well, my firm is doing well, this means I must be good at seeing market opportunities' or 'My firm isn't doing so well, so I can't be that good at seeing market opportunities.'. The same logic applies whenever the measured entrepreneurial competency is defined directly or indirectly by its effects on business success; the entrepreneurs are forced to self-assess the independent variable of the study by using the

dependent variable of the study as a cue. Sixty-eight percent the cross-sectional studies sampled in this thesis use at least one competency measure that is defined in this way.

The problem arises because firm success might come from other causes than the individual characteristics of the entrepreneur, but the entrepreneur might not be aware of this. There are several reasons to think this can happen. For example, start-up firms are more open to influence from external environmental factors due to their small size and limited resources (Chandler and Hanks, 1994), so it can be expected that factors outside the control of the owner-manager affects business success. Entrepreneurs are also more likely to think they have control in uncontrollable situations where chance plays a large part (Simon et al., 2000, Keh et al., 2002, Kannadhasan et al., 2014, De Carolis et al., 2009) so they might be more likely to assume responsibility for presence or lack of business success even though it was caused by something they couldn't control. Rogoff et al. (2004) suggest caution when it comes to owner-managers perceptions of the causes of venture success. This makes sense in the light of the fact that the start-up firm is an 'extension of the founder (Chandler & Jansen, 1992; Dyke, Fischer, & Reuber, 1992; Mintzberg, 1988)' (Chandler and Hanks, 1994, p. 77) and that firm performance is 'a yardstick by which the founder measures success' (Chandler and Hanks, 1994, p. 78).

4.2.1 Confounding bias

If the entrepreneurs are self-assessing the independent variable (entrepreneurial competencies) of the study by using the dependent variable (business success) as a cue, this automatically creates a positive association between the variables. In other words, if the entrepreneur is reasoning like this: 'Well, my firm is doing well, this means I must be good at seeing market opportunities' or 'My firm isn't doing so well, so I can't be that good at seeing market opportunities.', or likewise for other competencies, this creates a positive association that arises from the research design and not from a causal connection between the independent and dependent variable.

This is a type of common method bias that acts as a confounder as shown in Figure 22. This holds for any competency where the entrepreneur might use his or her own business success as a part of the self-assessment of the levels of that competency.

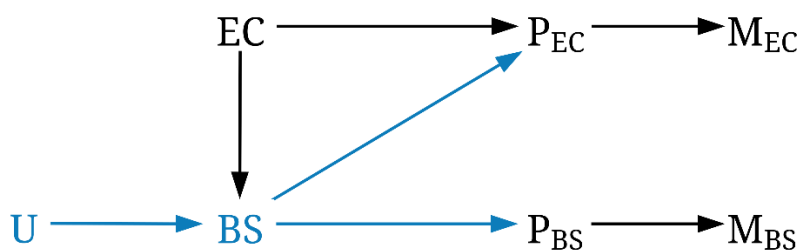


Figure 22: How business success (BS) confounds the relationship between entrepreneurial competencies (EC) and business success, through influencing the entrepreneur's perceptions of own entrepreneurial competencies (P_{EC}).

U represents causes of business success that do not come from any individual characteristic of the entrepreneur. P_{BS} represents the entrepreneur's perception of own SME business success. M_{EC} and M_{BS} represent the measurements of the entrepreneur's self-assessed entrepreneurial competencies and business success.

Unlike entrepreneurial competencies such as opportunity competence, social competence (effectiveness in interacting with others) is definitionally separated from business success. In addition, Baron and Markman (2003) cross-validated their measure of social competence with people close to the sampled entrepreneurs (e.g., spouses, other family members, close business associates) and found a high correlation between the measures. Six studies (numbered 17 to 22 in Figure 23) used or borrowed from Baron and Markman's cross-validated construct. Therefore, confounding bias may be less of a problem in the studies on social competence. However, Baron and Markman (2003) hold that the cross-validation should be interpreted with caution due to small sample size. Gerli et al. (2011) and Camuffo et al. (2012) used independent raters to assess the entrepreneurial competencies of entrepreneurs and found significant differences between entrepreneurs' self-ratings and independent raters.

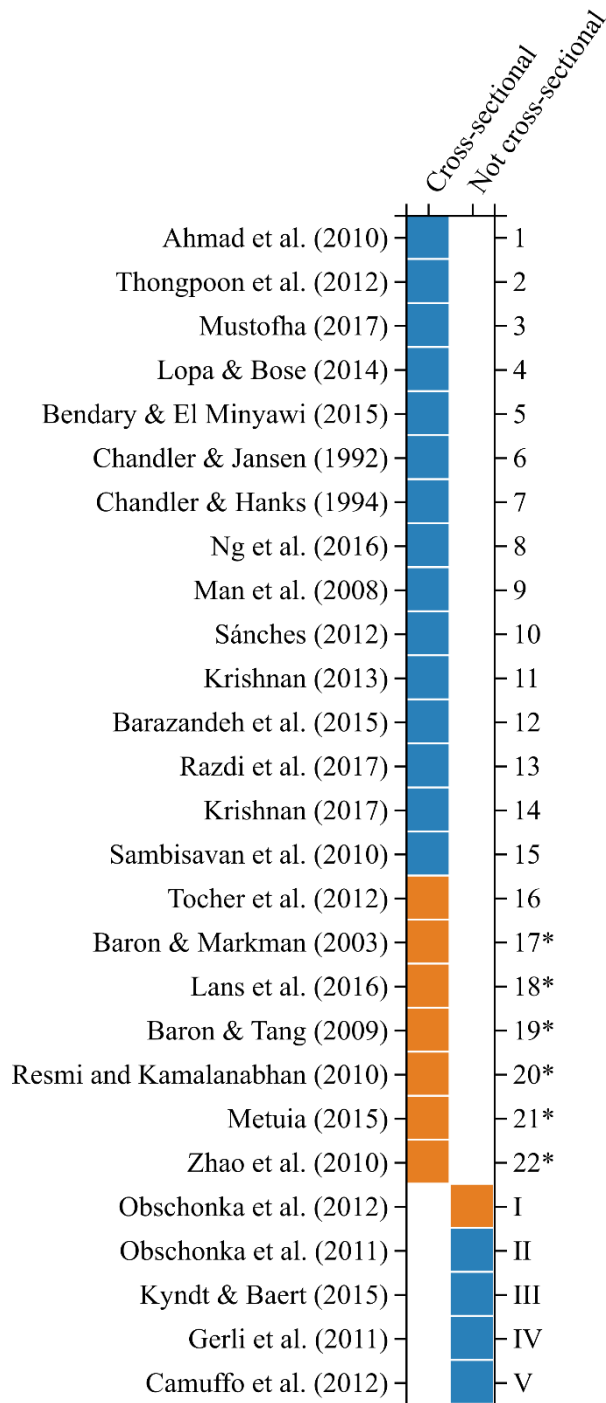


Figure 23: Studies using cross-sectional and non-cross-sectional design. Studies 1-22 use a cross-sectional design. Studies 17*-22* use a measure of social competence with some cross-validation. Studies I to V use different longitudinal research designs. Blue color indicates research on entrepreneurial competencies, orange color indicates research on social competence.

4.3 Summary

The analysis shows some minor threats to reliability. Four studies (15% of the sample) did not report how or from where they obtained their samples, making them hard to replicate. The reliability of measures is shown to be high, with 89% of the studies reported some measure of internal consistency. 81% report Cronbach's alpha for their measures, where 50% report alphas over 0.7 for all measures used, 36% report alphas over 0.6 for all measures used. Of the studies reporting Cronbach's alphas over 0.6 for all measures, the average Cronbach's alpha value was greater than 0.7 for 50% of the studies. The research designs and methods used are fairly standard and the analysis revealed no other threats to reliability.

The analysis has found three major threats to validity. The first threat is the lack of failed or otherwise unsuccessful ventures in study samples. This threat arises because due to the theory of entrepreneurial competencies, entrepreneurial learning and knowledge of high failure rates for new ventures, which comes together in a way that necessitates the inclusion of failed or unsuccessful ventures in study samples. Without including failures, the statistical association reported in a study is uncertain. This is the case for 96% of the sampled studies.

The second threat is selection bias. The analysis has shown that the studies that do not include failures in their samples (i.e. 96% of the sample) have a type of selection bias called ascertainment bias, which results in spurious association. This arises because the independent variables (entrepreneurial competencies) and dependent variables (business success) are causally related to survival, i.e. survival is a common effect of the independent and dependent variable in the vast majority (94%) of the sampled studies. Not including failures amounts to conditioning on survival, i.e. the common effect of the independent and dependent variable, which induces ascertainment bias. Sampling from a premade database, directory, list or MBA program induces the same problem, where the criteria for a firm being in the database, directory, list or MBA program can be a source of ascertainment bias in addition to firm survival.

The third threat is the entrepreneurs' self-assessment of entrepreneurial competencies in cross-sectional survey design methods. If entrepreneurs use experiences from their own ventures to inform the self-assessment of their entrepreneurial competencies, this leads to form of common method bias that causes confounding. This confounding provides an alternate explanation for the reported positive association between entrepreneurial competencies and business success in the sampled studies. This arises in part because of how entrepreneurial competencies are defined, and in part because the causal origin of business success is unknown while at the same

time, entrepreneurs are known to be unreliable sources for the causes of business success. See Figure 24 below for a visual summary of the threats to validity.

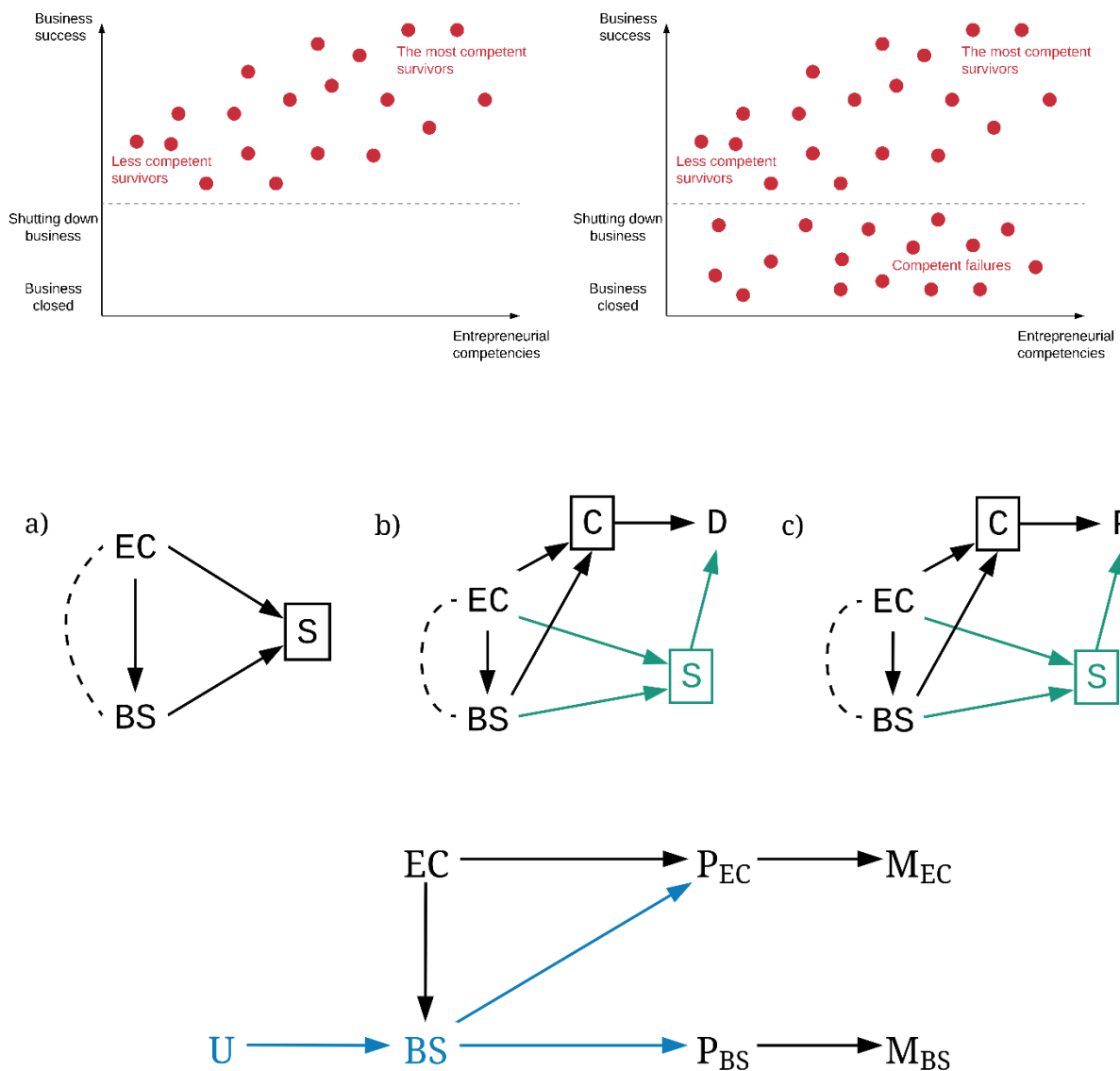


Figure 24: A visual summary of the threats to validity found by the analysis.

The top of the figure shows the hypothetical linear regression scenario that gives an intuitive account of the consequences of not including failed entrepreneurs in samples. Cf. Figure 16 and Figure 17.

The middle part of the figure, a), b) and c), show the DAGs who illustrate how ascertainment bias arises from conditioning on survival and the criteria of databases, lists and directories, and rightmost the criteria for participating in an MBA program. Cf. Figures 18, 19 and 20.

The bottom part of the figure shows the possible confounding common method bias from using the entrepreneur as the only source of data for the entrepreneur's entrepreneurial competencies in cross-sectional research designs. Cf. Figure 22.

5 Discussion

The purpose of this thesis has been to critically analyze quantitative studies on entrepreneurial competencies and business success to assess whether there is evidence for a causal link between the two. The strength of the evidence for causality rests on the reliability and validity of the studies that produced the evidence, hence the two research questions how, if at all, methodological issues threaten the 1) reliability, or 2) validity of quantitative studies on entrepreneurial competencies and business success. The purpose was motivated by the tension between, on one hand, the potential of entrepreneurial competencies to serve as a means to economic growth and, on the other hand, the methodological challenges found in the entrepreneurship literature in general, that potentially stand in the way of full confidence in the evidence for entrepreneurial competencies as a cause of business success.

The methodological challenges that exists in the entrepreneurship literature have been identified by previous research (e.g. Short et al., 2010, Nightingale and Coad, 2014, Mullen et al., 2009, McDonald et al., 2015, Crook et al., 2010). However, this research has focused on the level of the entrepreneurship field as a whole. When it comes to reliability, Mullen et al. (2009) build on Chandler and Lyon's (2001) report that 40 percent of the reviewed studies provide some measure of internal consistency and reliability, such as Cronbach's alpha or interrater reliability. Mullen et al. (2009) report 49 percent of their sample support such measures, a nine percent increase over time. In contrast, the analysis of this thesis shows that 89 percent of the studies sampled reported some measure of internal consistency of the measures, 40% more than Mullen et al. (2009). Crook et al. (2010) also build on Chandler and Lyon (2001) and find that 75% of their sample of studies ranging from 2005 and 2007 included some measure of internal consistency and reliability; an increase of 13 percent their sample of studies published between 2000 and 2002. The thesis analysis shows a 14 percent increase in the sampled studies in comparison to Crook et al. (2010). These results are consistent with the idea that the measurement reliability of the entrepreneurship field is increasing over time.

Furthermore, the thesis analysis shows that unsuccessful entrepreneurs are not being sampled in quantitative studies on entrepreneurial competencies and business success, the only exception being Obschonka et al. (2011), and it shows how this sampling practice threatens validity, by causing nonresponse bias and a type of selection bias called ascertainment bias in 96% of the sampled studies. Regarding validity in the entrepreneurship literature, Short et al. (2010) sampled the perceptions of entrepreneurship methodology experts to assess the

entrepreneurship literature and reported a consistent concern among the experts about the consequence of unsuccessful entrepreneurs not being included in samples. The thesis analysis provides evidence that these experts' concerns are valid by outlining the methodological consequences of not including unsuccessful entrepreneurs in samples, at the level of specific studies.

In fact, the thesis analysis shows that all the studies in the sample, with the exception of Obschonka et al. (2011), suffer from some degree of ascertainment bias. While it is a consequence of not including failures in the sample, it can also be understood in the broader context of sociological studies on elite achievement. Studies on elite achievement sometimes employ non-random samples of the population, where they compare one sample of outstandingly successful people to another group of somewhat less outstandingly successful people (e.g. Fortune 500 companies vs companies with revenues around a 100 million USD) (Elwert and Winship, 2014). According to Elwert and Winship (2014), this situation invites endogenous selection bias. As shown in the thesis analysis, a comparable situation arises when sampling only surviving entrepreneurs; the most successful survivors are comparable to the 'outstandingly successful people', and the least successful *survivors* are comparable to the 'only somewhat less outstandingly successful people' when considering the high rates of failures for new ventures.

However, it should also be noted that it is in general difficult to predict the size and sign of the spurious association induced by ascertainment bias (Elwert and Winship, 2014). Consequently, it is possible that the spurious association induced by ascertainment bias in the sampled studies is small. In fact, when spurious association induced by bias is quite small, it can be safely ignored (Shahar and Shahar, 2013). While there are rules of thumb for estimating the direction and magnitude of endogenous selection bias, Elwert and Winship (2014) suggest that more research on endogenous selection bias is needed before we can be confident about estimating its direction and magnitude.

Additionally, the thesis analysis shows how the mismatch between research design and methods arises from relying on the entrepreneur as the only data source for entrepreneurial competencies, which potentially acts as confounding type of common method bias in cross-sectional designs, posing a major threat to validity in 15 of the 27 studies sampled in this study. The thesis analysis therefore provides supporting evidence for another general concern among entrepreneurship methodology experts; the fit between the research design and methods (Crook et al., 2009). The exceptions to this are five studies using a longitudinal design and seven studies on social

competence. The latter due to cross-validation of the measures and the fact that entrepreneurs must not necessarily rely on their business experiences to evaluate their own social competence.

The thesis analysis also shows that unrepresentative samples are to date still a problem for the subset of the SME literature sampled in this thesis. This is in line with Nightingale and Coad (2013), who take an historical approach to the SME literature and identify low data quality, unrepresentative samples and the definitional flexibility of key terms as issues that have posed methodological challenges from the fields inception.

For the subset of entrepreneurship literature sampled in this thesis, the thesis analysis shows that the samples biased for survivors, i.e. samples with nonresponse bias, occur because of the research design rather than self-selection on the part of the entrepreneurs, since the unsuccessful entrepreneurs likely never receive a survey to reject in the first place. This is contrary to what Mullen et al. (2009) point out as a source of nonresponse bias; data collection constraints leading to self-selection among the entrepreneurs. The suggestion by Mullen et al. (2009) to account for nonresponse bias by comparing respondents from the first wave of surveys with late respondents (Armstrong and Overton, 1977) make sense for the self-selection scenario, however, it will not work when nonresponse bias arises due to the research design as shown by the thesis analysis. This is because the test proposed by Armstrong and Overton (1977) rests on the assumption that late responders are non-responders are similar. This assumption does not hold for the studies sampled in this thesis.

In more general terms, the thesis analysis points out several specific situations where the research design is not able to solve the problems at hand. This supports the sentiment of McDonald et al. (2015) that more critical debate about methodology and research design is needed, at the very least in the subset of entrepreneurship literature examined in this thesis. Indeed, McDonald et al. (2015) identified lack of explicit and critical treatment of how method and methodology are deployed in individual studies and note that (p. 307) ‘...it is of paramount importance to increase discussion about research design and methodological approach to a point where a critical and open debate about the usefulness of particular approaches for solving particular problems can be supported.’ The findings of the thesis analysis overall support the idea that a critical and open debate is needed.

Another point worth noting is that methodological reviews of the entrepreneurship literature such as Crook et al. (2009) and Short et al. (2010), stress the continuing methodological improvement of the entrepreneurship literature despite challenges. While the thesis analysis

shows support for this narrative in terms of reliability, the fact that it shows nonresponse bias and ascertainment bias for 96% of the sampled studies and possible confounding bias for 55.6% of the sampled studies, and the fact that studies that were sampled in this thesis were relatively new – 78% of the sample published over the last 8 years – does not fit the narrative of continual improvement for validity.

This is not to say that the findings of the thesis analysis are applicable to the entrepreneurship field as a whole, but rather that there could be a great deal of variability in methodological challenges and quality from sub-field to sub-field within the entrepreneurship literature. Another explanation could be the content analysis methodology employed by the entrepreneurship methodology reviews. For example, both Crook et al. (2009) and Mullen et al. (2009) build on Chandler and Lyon's 2001 review, where reliability and validity are assessed based on whether studies report certain measures or not. Crook et al. (2009) estimate validity by whether sampled studies report full correlation matrices, factor analysis or whether the articles assessed nonresponse bias. However, as can be seen from this thesis' analysis, the discovered threats to validity arise independently of whether studies report these measures or not. For example, a typical test for nonresponse bias – comparing respondents from the first wave with the late respondents (Armstrong and Overton, 1977) – is not effective in this case, because the assumption that late responders and non-responders are similar does not hold.

Mullen et al (2009) base their analysis of validity in part on whether studies assess convergent and discriminant validity, using such like common factor analysis or principal component analysis. However, it can be seen from the thesis analysis that the uncovered threats to validity arise independently of whether such techniques are used. If validity is, as suggested by Mullen et al. (2009), a causal concept, then validity cannot be determined by statistical measures alone (Pearl, 2009). This is consistent with McDonald et al. (2015) suggestion that *how* methods are deployed in the entrepreneurship literature is much more important than *which* type of methods are deployed.

6 Conclusion

This thesis has investigated how methodological issues threaten the reliability and validity of quantitative studies on entrepreneurial competencies and business success. Previous studies have identified methodological challenges at the level of the entrepreneurship literature in general, which if also present in the quantitative studies on entrepreneurial competencies and business success, could affect the present evidence for a causal link between entrepreneurial competencies and business success. The analysis of the thesis has shown how these general concerns have manifested in a subset of the entrepreneurship literature. Moreover, the analysis has shown the extent to which these manifestations threaten the reliability and validity of the studies. In other words, the analysis has connected the dots between the general concerns and perceptions of entrepreneurship methodology experts and threats to validity and reliability in specific studies.

Taken together, the findings of the thesis analysis show that there are significant threats to the validity of the quantitative studies that support a causal link between entrepreneurial competencies and business success. Therefore, it cannot be said that to date there is strong evidence for a causal link between entrepreneurial competencies and business success. In other words, it will remain inconclusive whether entrepreneurial competencies are a Holy Grail for business success and macroeconomic development until the threats to validity uncovered by the analysis are addressed.

On one hand, this thesis can be seen as providing compelling evidence that the concerns of entrepreneurship methodology experts over validity are justified. On the other hand, this thesis can be seen as supporting the idea that the reliability of entrepreneurship studies is improving over time.

The thesis analysis also casts doubt on the effectiveness of the content-analysis methodology of entrepreneurship methodology reviews to assess the general state of validity of a research field. If validity is a causal concept, the presence and usage of statistical procedures in a study cannot in itself be enough to assess validity (Pearl, 2009). The thesis analysis provides evidence that serious threats to validity can be present in entrepreneurship literature regardless of the statistical procedures used and regardless of the reliability of the studies. Moreover, the findings of the thesis analysis are not consistent with the narrative of the entrepreneurship literature as being in a state of continual methodological improvement in terms of validity. However, the findings support the narrative of continual methodological improvement when it comes to

reliability. In sum, the evidence provided by this thesis supports the idea that the entrepreneurship literature is becoming more reliable but not that it is becoming more valid.

7 Implications

The analysis conducted by this thesis has important implications for research design in quantitative studies on entrepreneurial competencies and business success. Firstly, given the standard statistical modeling practices of the field (multiple regression, SEM, etc.), quantitative research on entrepreneurial competencies and business success must incorporate information on failed entrepreneurs as part of the research design if it is to be valid and unbiased. Secondly, to avoid confounding from common method bias, cross-sectional quantitative research on entrepreneurial competencies and business success, with the exception of social competence research, must get their data on the entrepreneurial competencies of the entrepreneur from somewhere else than the self-assessment of the entrepreneur, for example by using third parties to rate the entrepreneurs' entrepreneurial competencies as done by Gerli et al. (2011) and Camuffo et al. (2012).

For policymakers and practitioners, the implication is uncertainty about whether entrepreneurial competencies can be used to deliver increased profits and economic growth. As long as the threats to validity remain unaddressed, the evidence for entrepreneurial competencies as a cause of business success will remain inconclusive. That is not to say there are no worthwhile reasons to provide training for entrepreneurs in the small business sector, but rather that there are to date no evidence to suggest that training in entrepreneurial competencies will produce effects on a macroeconomic scale. Of course, in this case the inconclusiveness of the evidence does not imply that there is no causal relationship between entrepreneurial competencies and business success, rather, there is no way to judge either way. Consequently, policymakers and practitioners should be cautious in using the quantitative studies on entrepreneurial competencies and business success to inform policy or practical decisions.

The analysis also has implications for more general entrepreneurship research. Since survivorship bias from high failure rates is a problem in SME research in general (Nightingale and Coad, 2013), this means that anyone studying a sample of only surviving entrepreneurs are likely studying an elite population. This in turn necessitates being familiar with the literature on the methodological challenges particular to studying elite populations. This is an important finding of the analysis that has consequences outside the entrepreneurial competencies literature; anyone who is studying variables that have some impact on a firm's survival chance, using a sample of surviving entrepreneurs, risks introducing some degree of ascertainment bias into their research.

In addition, this analysis also has implications for methodology reviews of entrepreneurship literature. Methodology reviews who wish to conceptualize validity as a causal concept cannot assess validity by relying solely on whether a certain statistical technique or measure is used in a study or not. Assessing ‘causal validity’ requires assessing the causal assumptions that underlies or motivates a specific study together with the employed methodology and research design. Importantly, assessing the causal assumptions of any given study does not mean trying to determine whether they are true or not, as they cannot be verified outside of experimental control (Pearl, 2009). However, as shown by the analysis of this thesis, it is still possible to analyze the interplay between the causal assumptions of the theory, methodology and research design to discover threats to validity.

8 Limitations and further research

The thesis has only sampled quantitative literature relevant to a specific relationship, i.e. between entrepreneurial competencies of SME owner-managers and the business success of their SMEs. The methodological challenges uncovered by the analysis may not be generalizable beyond the sample, i.e. the methodological challenges may be local to the sample or the subfield of entrepreneurial competencies. This is a clear limitation and the only way to assess it is for further research to do a similar type of analysis on other samples of entrepreneurs, e.g. different subfields or different causal relationships described in the entrepreneurship literature. Another limitation is that qualitative literature has not been assessed in this thesis. There could be compelling qualitative evidence for entrepreneurial competencies as a cause of business success that would have affected the conclusion of the thesis.

An additional limitation is that the methodology of this thesis does not produce an exhaustive account of the methodological challenges in any given study. This means that there could be methodological issues in the literature sampled by this thesis that the analysis has not uncovered. Consequently, addressing the methodological challenges uncovered by the analysis does not guarantee the validity of the sampled studies, because there could still be undiscovered methodological issues. It also means that the methodology employed in this thesis might not be equally relevant for all samples of literature. For example, it might be necessary to adapt or choose other concepts than the ones described in section 2 of this thesis, as one goes from subfield to subfield or to different literatures.

This thesis has also not made any attempts to investigate the competency levels of failed or otherwise unsuccessful entrepreneurs. This is a limitation of the thesis, as the nonresponse bias outlined in the analysis depends on the fact that failed entrepreneurs could be just as competent. However, it could be the case that the entrepreneurs who fail are in fact less competent, i.e. occupying only the low left corner in Figure 17. It could even be the case that low competence was a cause for having failed or being unsuccessful in the first place. In this case, the nonresponse bias described in the analysis would no longer be present. Consequently, the threat to validity would no longer be present as well. If the thesis had investigated the competency levels of failed or unsuccessful entrepreneurs, the findings of the analysis and conclusion could have been different. The thesis has not attempted to estimate the size of the ascertainment bias uncovered by the analysis, which could potentially be so small that it poses no threat to validity.

However, more research is needed before such estimation is possible (Elwert and Winship, 2014).

In sum, new knowledge about the entrepreneurial competencies of failed or otherwise unsuccessful entrepreneurs and new techniques to estimate endogenous selection bias, could ‘overturn’ the conclusion of this thesis. Therefore, further research should replicate existing studies on entrepreneurial competencies and business success, including failed or unsuccessful entrepreneurs in the sample. In cross-sectional designs, new research should use third party to evaluate the entrepreneurs’ entrepreneurial competencies. The findings could then be compared to the old studies, which would help determine the size and direction of nonresponse bias and ascertainment bias. This would also help determine the validity of the studies sampled in this thesis.

If the studies sampled in this thesis are found to be invalid, new theory and methodologies are needed. For example, researchers might benefit from methodologies that are better suited for populations selected with the independent variable in mind, e.g. necessary condition analysis (Most and Starr, 2003, Dul, 2016). In all cases, it could be useful to employ a tool for causal modeling such as the DAGs used in this thesis. Causal modeling can help in selecting the right research design and avoiding bias (Elwert & Winship, 2014, Glymour, 2006).

Further research should also engage in critical analysis of other subfields of the entrepreneurship literature, to determine how the general concerns of methodology experts manifest on the level of specific studies. If there are large differences from subfield to subfield, or journal to journal, it would be interesting to understand how and why that happens.

9 References

- AERTS, K., MATTHYSSENS, P. & VANDENBEMPT, K. 2007. Critical role and screening practices of European business incubators. *Technovation*, 27, 254-267.
- AHMAD, N. H., RAMAYAH, T., WILSON, C. & KUMMEROW, L. 2010. Is entrepreneurial competency and business success relationship contingent upon business environment? *International Journal of Entrepreneurial Behaviour & Research*, 16, 182-203.
- ALIAGA, M. & GUNDERSON, B. 2002. Interactive statistics. Virginia. America: Pearson Education.
- ARMSTRONG, J. S. & OVERTON, T. S. 1977. Estimating nonresponse bias in mail surveys. *Journal of marketing research*, 396-402.
- BARAZANDEH, M., PARVIZIAN, K., ALIZADEH, M. & KHOSRAVI, S. 2015. Investigating the effect of entrepreneurial competencies on business performance among early stage entrepreneurs Global Entrepreneurship Monitor (GEM 2010 survey data). *Journal of Global Entrepreneurship Research*, 5, 1-12.
- BARON, R. A. & MARKMAN, G. D. 2003. Beyond social capital: The role of entrepreneurs' social competence in their financial success. *Journal of Business Venturing*, 18, 41-60.
- BARON, R. A. & TANG, J. 2009. Entrepreneurs' Social Skills and New Venture Performance: Mediating Mechanisms and Cultural Generality. *Journal of Management*, 35, 282.
- BENDARY, N. A. & EL MINYAWI, A. 2015. Entrepreneurial competencies effect on Small and Medium Enterprises performance through the mediation effect of psychological contracting of outsourcing. *International Journal of Business and Economic Development (IJBED)*, 3.
- BERG, N. 2005. Non-Response Bias. In: KEMPF-LEONARD, K. (ed.) *Encyclopedia of Social Measurement*. New York: Elsevier.
- BIRD, B. 2002. Learning entrepreneurship competencies: the self-directed learning approach. *International Journal of Entrepreneurship Education*, 1, 203-227.
- BOAM, R. & SPARROW, P. 1992. The rise and rationale of competency-based approaches. *Designing and achieving competency*, 3-15.
- BOYATZIS, R. E. 2008. Competencies in the 21st century. *The Journal of Management Development*, 27, 5-12.
- CAMUFFO, A., GERLI, F. & GUBITTA, P. 2012. Competencies matter: modeling effective entrepreneurship in northeast of Italy small firms. *Cross Cultural Management*, 19, 48-66.
- CASAS, T. & HILB, M. 2016. Founders in the living-dead trap: A theoretical exploration at entrepreneurship's dark core. *Entrepreneurship Research Journal*, 6, 401-423.
- CHANDLER, G. N. & HANKS, S. H. 1993. Measuring the performance of emerging businesses: A validation study. *Journal of Business venturing*, 8, 391-408.
- CHANDLER, G. N. & HANKS, S. H. 1994. Founder competence, the environment and venture performance. *Entrepreneurship*, 18, 77-90.
- CHANDLER, G. N. & JANSEN, E. 1992. The founder's self-assessed competence and venture performance. *Journal of Business venturing*, 7, 223-236.
- CHANDLER, G. N. & LYON, D. W. 2001. Issues of research design and construct measurement in entrepreneurship research: The past decade. *Entrepreneurship Theory and Practice*, 25, 101-113.
- CHANG, S.-J., VAN WITTELOOSTUIJN, A. & EDEN, L. 2010. From the Editors: Common method variance in international business research. *Journal of International Business Studies*, 41, 178-184.
- COOPER, H. 1986. *The Integrative Research Review: A Systematic Approach* Sage Publications: Beverly Hills, 1984, 143 pp. *Educational Researcher*, 15, 17-18.

- COPE, J. 2011. Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing*, 26, 604-623.
- CROOK, T. R., SHOOK, C. L., MORRIS, M. L. & MADDEN, T. M. 2010. Are we there yet? An assessment of research design and construct measurement practices in entrepreneurship research. *Organizational Research Methods*, 13, 192-206.
- DA SILVA, J. & KLEIN, A. Z. 2016. Possibilities and challenges of M-learning for the development of entrepreneurial competence. *Revista Ciencias Administrativas*, 22, 451-482.
- DE CAROLIS, D. M., LITZKY, B. E. & EDDLESTON, K. A. 2009. Why networks enhance the progress of new venture creation: The influence of social capital and cognition. *Entrepreneurship theory and practice*, 33, 527-545.
- DEAKINS, D. & FREEL, M. 1998. Entrepreneurial learning and the growth process in SMEs. *The Learning Organization*, 5, 144-155.
- DENNEY, A. S. & TEWKSBURY, R. 2013. How to write a literature review. *Journal of criminal justice education*, 24, 218-234.
- DUL, J. 2016. Necessary Condition Analysis (NCA): Logic and Methodology of “Necessary but Not Sufficient” Causality. *Organizational Research Methods*, 19, 10-52.
- ELWERT, F. 2013. Graphical causal models. *Handbook of causal analysis for social research*. Springer.
- ELWERT, F. & WINSHIP, C. 2014. Endogenous selection bias: The problem of conditioning on a collider variable. *Annual Review of Sociology*, 40, 31-53.
- GARTNER, W. B. 1988. “Who Is an Entrepreneur?” Is the Wrong Question. *American Journal of Small Business*, 12, 11-32.
- GERLI, F., GUBITTA, P. & TOGNAZZO, A. Entrepreneurial competencies and firm performance: an empirical study. VIII International Workshop on Human Resource Management Conference Proceedings, Seville, 2011.
- GLYMOUR, M. M. 2006. Using causal diagrams to understand common problems in social epidemiology. *Methods in social epidemiology*, 393-428.
- HERNÁN, M. A., HERNÁNDEZ-DÍAZ, S. & ROBINS, J. M. 2004. A structural approach to selection bias. *Epidemiology*, 615-625.
- ISMAEL, B. & MUHAMED, A. 2013. Entrepreneurial competencies, psychological capital, working capital management and perceived market share. A case study of small and medium enterprises in Dar-Es Salaam, Tanzania. *Journal of Business and Retail Management Research*, 7.
- JAGER, K., ZOCCALI, C., MACLEOD, A. & DEKKER, F. 2008. Confounding: what it is and how to deal with it. *Kidney international*, 73, 256-260.
- JAMIN, A., AKHUAN, N. M. & ZAMRI, M. T. The roles of entrepreneurial competencies and organizational innovation on business performance in service sectors SMEs. 2016. 191-196.
- KANNADHASAN, M., ARAMVALARTHAN, S. & KUMAR, B. P. 2014. Relationship among cognitive biases, risk perceptions and individual’s decision to start a venture. *Decision*, 41, 87-98.
- KEH, H. T., DER FOO, M. & LIM, B. C. 2002. Opportunity evaluation under risky conditions: The cognitive processes of entrepreneurs. *Entrepreneurship theory and practice*, 27, 125-148.
- KETCHEN, D. J., BOYD, B. K. & BERGH, D. D. 2008. Research methodology in strategic management: Past accomplishments and future challenges. *Organizational Research Methods*, 11, 643-658.

- KNIGHT, C. R. & WINSHIP, C. 2013. The causal implications of mechanistic thinking: Identification using directed acyclic graphs (DAGs). *Handbook of causal analysis for social research*. Springer.
- KRISHNAN, L. 2013. The role of competencies and personality in determining success of entrepreneurs in SMEs in Karnataka, India. *International Business Management*, 7, 258-266.
- KRISHNAN, L. 2017. Entrepreneurial Competencies and Contextual Determinants of Successful SME Business Startups in Bangalore, India. *IJEMR*, 7.
- KYNDT, E. & BAERT, H. 2015. Entrepreneurial competencies: Assessment and predictive value for entrepreneurship. *Journal of Vocational Behavior*, 90, 13.
- LANS, T., BLOK, V. & WESSELINK, R. 2014. Learning apart and together: towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of Cleaner Production*, 62, 37-47.
- LANS, T., VERHEES, F. & VERSTEGEN, J. 2016. Social Competence in Small Firms - Fostering Workplace Learning and Performance. *Human Resource Development Quarterly*, 27, 321.
- LASCH, F., LE ROY, F. & YAMI, S. 2007. Critical growth factors of ICT start-ups. *Management Decision*, 45, 62-75.
- LEE, S.-H., YAMAKAWA, Y., PENG, M. W. & BARNEY, J. B. 2011. How do bankruptcy laws affect entrepreneurship development around the world? *Journal of Business Venturing*, 26, 505-520.
- LILLEVÄLI, U. & TÄKS, M. 2017. Competence Models as a Tool for Conceptualizing the Systematic Process of Entrepreneurship Competence Development. *Education Research International*, 16.
- LOPA, N. Z. & BOSE, T. K. 2014. Relationship between Entrepreneurial Competencies of SME Owners/Managers and Firm Performance: A Study on Manufacturing SMEs in Khulna City. *Journal of Entrepreneurship and Management*, 3.
- LUMPKIN, G. T. & DESS, G. G. 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of management Review*, 21, 135-172.
- LUMPKIN, G. T. & DESS, G. G. 2001. Linking two dimensions of entrepreneurial orientation to firm performance: The moderating role of environment and industry life cycle. *Journal of business venturing*, 16, 429-451.
- MAN, T. W. & LAU, T. 2000. Entrepreneurial competencies of SME owner/managers in the Hong Kong services sector: A qualitative analysis. *Journal of Enterprising Culture*, 8, 235-254.
- MAN, T. W. Y. 2007. Understanding entrepreneurial learning: a competency approach. *International journal of entrepreneurship and innovation*, 8, 189-198.
- MAN, T. W. Y., LAU, T. & CHAN, K. F. 2002. The competitiveness of small and medium enterprises - A conceptualization with focus on entrepreneurial competencies. *Journal of Business Venturing*, 17, 123-142.
- MAN, T. W. Y., LAU, T. & SNAPE, E. 2008. Entrepreneurial Competencies and the Performance of Small and Medium Enterprises: An Investigation through a Framework of Competitiveness. *Journal of Small Business and Entrepreneurship*, 21, 257-265, 267-271, 273-276, 377.
- MARKMAN, G. D. & BARON, R. A. 2003. Person-entrepreneurship fit: why some people are more successful as entrepreneurs than others. *Human Resource Management Review*, 13, 281-301.
- MCDONALD, S., GAN, B. C., FRASER, S. S., OKE, A. & ANDERSON, A. R. 2015. A review of research methods in entrepreneurship 1985-2013. *International Journal of Entrepreneurial Behavior & Research*, 21, 291-315.

- MEI, D. Q. & LONG, Y. 2012. The Relationship between Entrepreneurial Competence and Financing Choices. *Proceedings of the 2012 International Conference on Management Innovation and Public Policy (Icmipp 2012), Vols 1-6*, 212-216.
- MEUTIA 2015. The relationship between entrepreneurship social competence and marketing performance in Indonesian smes: The role of business networking and product innovation. *International Journal of Applied Business and Economic Research*, 13, 5357-5373.
- MINDT, L. & RIECKMANN, M. 2017. DEVELOPING COMPETENCIES FOR SUSTAINABILITY-DRIVEN ENTREPRENEURSHIP IN HIGHER EDUCATION: A LITERATURE REVIEW OF TEACHING AND LEARNING METHODS. *Teoria De La Educacion*, 29, 129-159.
- MITCHELMORE, S. & ROWLEY, J. 2010. Entrepreneurial competencies: a literature review and development agenda. *International Journal of Entrepreneurial Behaviour & Research*, 16, 92-111.
- MOST, B. A. & STARR, H. 2003. Basic logic and research design: conceptualization, case selection, and the form of relationships. *Necessary conditions: Theory, methodology, and applications*, 24-46.
- MOST, B. A. & STARR, H. 2015. *Inquiry, Logic, and International Politics: With a New Preface by Harvey Starr*, Univ of South Carolina Press.
- MUIJS, D. 2010. *Doing quantitative research in education with SPSS*, Sage.
- MULLEN, M. R., BUDEVA, D. G. & DONEY, P. M. 2009. Research methods in the leading small business–entrepreneurship journals: A critical review with recommendations for future research. *Journal of Small Business Management*, 47, 287-307.
- MUSTHOFA 2017. THE EFFECT OF ENTREPRENEURIAL COMPETENCY ON PRODUCT INNOVATION AND BUSINESS PERFORMANCE: EMPIRICAL CASES OF FASHION BUSINESS IN CENTRAL JAVA, INDONESIA. *Researchers World*, 8, 13-21.
- NG, H. S., KEE, D. M. H. & RAMAYAH, T. 2016. The role of transformational leadership, entrepreneurial competence and technical competence on enterprise success of owner-managed SMEs. *Journal of General Management*, 42, 23-43.
- NIGHTINGALE, P. & COAD, A. 2014. Muppets and gazelles: political and methodological biases in entrepreneurship research. *Industrial and Corporate Change*, 23, 113-143.
- OBSCHONKA, M., DUCKWORTH, K., SILBEREISEN, R. K. & SCHOON, I. 2012. Social Competencies in Childhood and Adolescence and Entrepreneurship in Young Adulthood: A Two-Study Analysis. *International Journal of Developmental Science*, 6, 14.
- OBSCHONKA, M., SILBEREISEN, R. K., SCHMITT-RODERMUND, E. & STUETZER, M. 2011. Nascent entrepreneurship and the developing individual: Early entrepreneurial competence in adolescence and venture creation success during the career. *Journal of Vocational Behavior*, 79, 121.
- OMRANE, A. & FAYOLLE, A. 2011. Entrepreneurial competencies and entrepreneurial process: A dynamic approach. *International Journal of Business and Globalisation*, 6, 136-153.
- PEARL, J. 2009. Causal inference in statistics: An overview. *Statistics surveys*, 3, 96-146.
- PINFOLD, J. F. 2000. Examining New Venture Failure Rates: A New Zealand Study. *Small Enterprise Research*, 8, 56-72.
- PODSAKOFF, P. M., MACKENZIE, S. B., LEE, J.-Y. & PODSAKOFF, N. P. 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of applied psychology*, 88, 879.

- PRAHALAD, C. K. & HAMEL, G. 1990. The core competence of the corporation. *Boston (Ma)*, 1990, 235-256.
- RADZI, K. M., MOHD NOR, M. N. & MOHEZAR ALI, S. 2017. The impact of internal factors on small business success: A case of small enterprises under the felda scheme. *Asian Academy of Management Journal*, 22, 27-55.
- RAE, D. & CARSWELL, M. 2001. Towards a conceptual understanding of entrepreneurial learning. *Journal of small business and enterprise development*, 8, 150-158.
- RANDOLPH, J. J. 2009. A guide to writing the dissertation literature review. *Practical Assessment, Research & Evaluation*, 14, 1-13.
- RESMI, A. T. & KAMALANABHAN, T. J. 2010. A hierarchical regression analysis to understand the antecedents of entrepreneurial success. *International Journal of Electronic Customer Relationship Management*, 4, 377-394.
- REZNICK, R. K. 1993. Teaching and testing technical skills. *The American Journal of Surgery*, 165, 358-361.
- ROBERTS, P., PRIEST, H. & TRAYNOR, M. 2006. Reliability and validity in research. *Nursing Standard (through 2013)*, 20, 41-5.
- ROGOFF, E. G., LEE, M. S. & SUH, D. C. 2004. "Who done it?" Attributions by entrepreneurs and experts of the factors that cause and impede small business success. *Journal of Small Business Management*, 42, 364-376.
- ROWLEY, J. 2002. Using case studies in research. *Management research news*, 25, 16-27.
- SALLEE, M. W. & FLOOD, J. T. 2012. Using Qualitative Research to Bridge Research, Policy, and Practice. *Theory Into Practice*, 51, 137-144.
- SAMBASIVAN, M., LI-YEN, L., CHE-ROSE, R. & ABDUL, M. 2010. Venture Performance in Malaysia: Personal Initiative, Human Capital, and Competency Areas of Founding Entrepreneurs as Critical Success Factors. *Journal of Small Business and Entrepreneurship*, 23, 315-332,481-482.
- SÁNCHEZ, J. 2012. The influence of entrepreneurial competencies on small firm performance. *Revista Latinoamericana De Psicología*, 44, 165-177.
- SCHELFHOUT, W., BRUGGEMAN, K. & DE MAYER, S. 2016. Evaluation of entrepreneurial competence through scaled behavioural indicators: Validation of an instrument. *Studies in Educational Evaluation*, 51, 29-41.
- SHAHAR, E. & SHAHAR, D. J. 2013. Causal diagrams and the cross-sectional study. *Clinical epidemiology*, 5, 57.
- SHEPHERD, D. A., DOUGLAS, E. J. & SHANLEY, M. 2000. New venture survival: Ignorance, external shocks, and risk reduction strategies. *Journal of Business Venturing*, 15, 393-410.
- SHORT, J. C., KETCHEN JR, D. J., COMBS, J. G. & IRELAND, R. D. 2010. Research methods in entrepreneurship: Opportunities and challenges. *Organizational Research Methods*, 13, 6-15.
- SIMON, M., HOUGHTON, S. M. & AQUINO, K. 2000. Cognitive biases, risk perception, and venture formation: How individuals decide to start companies. *Journal of business venturing*, 15, 113-134.
- SMITH, H. L. 2013. Research design: Toward a realistic role for causal analysis. *Handbook of causal analysis for social research*. Springer.
- TEECE, D. J., PISANO, G. & SHUEN, A. 1997. Dynamic capabilities and strategic management. *Strategic management journal*, 509-533.
- THONGPOON, S., AHMAD, N. H. A. P. D. & YAHYA, S. A. P. D. 2012. Sustainable Performance of Thai SMEs: Investigating the Entrepreneurial Competencies and Sufficiency Economy Philosophy. *Asia Pacific Journal of Management & Entrepreneurship Research*, 1, 5-20.

- TOCHER, N., OSWALD, S. L., SHOOK, C. L. & ADAMS, G. 2012. Entrepreneur political skill and new venture performance: Extending the social competence perspective. *Entrepreneurship and Regional Development*, 24, 283.
- TORRACO, R. J. 2005. Writing integrative literature reviews: Guidelines and examples. *Human resource development review*, 4, 356-367.
- VANDERWEELE, T. J. & ROBINS, J. M. 2007. Directed acyclic graphs, sufficient causes, and the properties of conditioning on a common effect. *American journal of epidemiology*, 166, 1096-1104.
- WILLERDING, I. A. V., PRADO, M. L. & LAPOLLI, E. M. 2012. A Trilogy of Entrepreneurship: Performance, Capacity and Competence as a Factor of Success For Micro and Small Enterprises. *Ieee Latin America Transactions*, 10, 2017-2024.
- ZHAO, X. Y., FRESE, M. & GIARDINI, A. 2010. Business owners' network size and business growth in China: The role of comprehensive social competency. *Entrepreneurship and Regional Development*, 22, 675-705.