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2018

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MPRA Paper No. 88389, posted 09 Aug 2018 15:45 UTC

Krieger, A., Block, J. & Stuetzer, M. (2018). Skill variety in entrepreneurship: A literature review and research directions. *International Review of Entrepreneurship*, 16(1), 29-62.

Link to published version of the article: <https://www.senatehall.com/entrepreneurship?article=588>

Skill variety in entrepreneurship: A literature review and research directions

Alexander Krieger¹, Jörn Block², Michael Stuetzer^{1,3}

¹ Baden-Wuerttemberg Cooperative State University, Coblitzallee 1-9, D-68193 Mannheim, Germany

² Trier University, Universitätsring 15, DM-Gebäude, D-54296 Trier, Germany

³ Ilmenau University of Technology, Faculty of Economic Sciences and Media, Ehrenbergstr. 29, D-98684 Ilmenau, Germany

Abstract

Lazear's concept of skill variety has been established in entrepreneurship research and is considered an important extension to human capital theory. The literature on skill variety, its determinants and its effects on entrepreneurial outcomes is growing. But especially the literature on determinants of skill variety as well as the relation between gender and skill variety is still in its infancy. Thus, this article takes stock of the academic knowledge collected about skill variety, its outcomes and determinants, its measurement alternatives as well as the role of gender. Overall, it can be summarized that skill variety is an important driver of entrepreneurship - above all for the entry-decision into entrepreneurship. The literature on skill variety and entrepreneurial success shows mixed evidence. Looking at the determinants of skill variety, extant literature is scarce. The debate whether the acquisition of skill variety is driven by a purposeful investment strategy or by the possession of certain endowment factors (such as risk aversion or a taste for variety) has not come to a conclusion. Regarding the topic of gender and skill variety, the studies under investigation report negative correlations between being female and skill variety. Measurement alternatives of skill variety used in academic research are diversely and sometimes inconsistently used. This makes it difficult to compare the results of different studies.

Keywords

Skill variety, balanced skills, literature review

JEL Classifications: J24, L26, M13

1 Introduction and motivation

Human capital is an evergreen in entrepreneurship research (Block et al., 2013; Marvel et al., 2016). Human capital measures have been employed to explain entrepreneurial choice (e.g. Obschonka et al., 2017), endurance (e.g. Bruce, 2002) and success (e.g. Davidsson and Honig, 2003; Stuetzer et al., 2013a). Following Becker (1964), human capital is defined by knowledge and skills that are acquired through educational and work experiences. This definition implies that education and work are investments into human capital while knowledge and skills are the outcomes of these investments. Most existing studies use measures based on education or work experience as proxies for entrepreneurial human capital (Reuber and Fischer, 1994). Arguably, there is a relationship between human capital investments (educational or work experience) and outcomes of human capital investments (knowledge, skills), but the correlation is sometimes weak. For example, experience gained through working in a specific field, does not necessarily lead to an increase in knowledge or skills about that field (Sonntag, 1998). Another example is that scholars often use years of schooling as a proxy for human capital. But what has been learned obviously depends both on the type of school (content orientation, instructional quality) as well as individual characteristics, such as motivation or cognitive abilities (Unger et al., 2011). Nevertheless, Marvel et al. (2016) find that 80% of the conducted studies in entrepreneurship use measure of human capital investment rather than measure of human capital outcomes.

The magnitude of the relation between human capital and entrepreneurship varies considerably across different studies (Unger et al., 2011). For example, looking at the relation between human capital and entrepreneurial success, some report a strong correlation (e.g. Duchesneau and Gartner, 1990; $r = 0.4$) while others report only weak correlations (Davidsson and Honig, 2003; $r = 0.06$). One reason for these mixed results might be the use of different investment- and outcome-based human capital measures. Besides the differentiation of outcome-based and investment-based human capital measures, one should also look at the transferability

of human capital to specific situations. The transferability of human capital is also referred to as task-relatedness (of human capital). There exists no singular entrepreneurial task. Instead entrepreneurs face a variety of tasks in order to set up a venture and keep it running (Davidsson, 2006; Lazear, 2005). Entrepreneurial tasks are, among others, the discovery and exploitation of business opportunities, marketing and selling products, and negotiating with suppliers.

To tackle the issue of task-relatedness of human capital, it is necessary to take a closer look at knowledge and skills as the main constituting elements of human capital. First is knowledge which is defined as “the possession and understanding of principles, facts, processes, and the interactions among them” (Marvel et al., 2016, p. 616). Naturally knowledge is of higher value for entrepreneurship if it is related to specific entrepreneurial activities. An entrepreneur should have knowledge of the market, of relevant technologies or of how to run a firm. Knowledge is usually clustered in particular domains (such as accounting, marketing, manufacturing and production, human resources or general management). Yet, only few studies (e.g. Dimov, 2007; Shane, 2000) have investigated the effects of task-related knowledge on entrepreneurship. So far, we know little about which exact task-related knowledge matters most for entrepreneurship.

Second, skills “refer to observable applications or know-how” (Marvel et al., 2016, p. 617) and are thus related to specific tasks. One distinguishes between general skills, such as mathematics or public speaking and cross-functional skills, such as social skills or problem-solving skills. Similarly to knowledge, skills that are related to entrepreneurial tasks are more important for entrepreneurship than general human capital (e.g. Bosma et al., 2004; Lerner and Almor, 2002). For example, to negotiate with a supplier, an entrepreneur must have relevant knowledge about the product and its specifications, the supply chain as well as different skills, such as social skills, language skills and business skills to be able to evaluate an offer.

As argued above, there is not one single entrepreneurial task but rather a variety of tasks an entrepreneur has to conduct. Consequently, Lazear (2005) came up with the concept of skill variety (also referred to as concept of balanced skills) to cover the nature of entrepreneurship and to provide human capital measures that are at the core of task-relatedness. Lazear (2005) argues that skill variety increases both the probability of becoming an entrepreneur as well the entrepreneurial performance. Empirical results indicate that the concept of skill variety is an enrichment to the field of entrepreneurship, reflected in high correlations with various entrepreneurship variables (e.g. Chen and Thompson, 2016; Stuetzer et al., 2013b).

The purpose of this paper is to provide an overview of the research on skill variety in entrepreneurship. This literature review is structured according to the main foci of the articles under investigation: Effects of skill variety (e.g. entrepreneurial choice or success), determinants of skill variety (e.g. an entrepreneurial personality or entrepreneurial parents) and female skill variety (are there gender differences in skill variety?). Furthermore, the existing research is analyzed with regard to the operationalization of skill variety. As discussed above, coming from a human capital perspective, skill variety might be operationalized from a knowledge, skill or task perspective. In addition, skill variety can be measured directly (outcomes of human capital investments) or indirectly (investments in human capital).

2 The concept of skill variety in entrepreneurship

In the following, an overview of Lazear's skill variety approach is given, including possible routes through which skill variety can be acquired.

An entrepreneur is somebody who is "usually responsible for the conception of the basic product, hiring the initial team and obtaining at least some early financing" (Lazear, 2003, p. 3). Thereby, an entrepreneur brings together a number of different resources. This requires knowledge of and skills in a large number of business areas (Lazear, 2005). Lazear (2003)

further argues that individuals can choose between two commercial activities – paid employment and entrepreneurship. Through these commercial activities individuals earn their livings. Thus, individuals that opt for paid employment try to maximize their income by investing in one skill in particular (other skills are irrelevant for paid employment). In turn, individuals that opt for entrepreneurship try to achieve balance in skills, as they are limited by their weakest skills. In sum, the skill variety approach can be seen as a model of vocational choice and success. Note that although the literature uses the term skill variety or skill balance, Lazear's concept is not only about skills but also includes knowledge. In order to avoid the lengthy and cumbersome term skill and knowledge variety, we use the shortened form skill variety.

How can individuals acquire skill variety? In the following, an overview of possible routes through which individuals might theoretically acquire skill variety is given. Please note that studies that investigate determinants of skill variety empirically are discussed in Section 3.4. First, one mechanism to acquire skill variety can be seen in prior entrepreneurial experience. Starting a new venture offers opportunities to learn as the entrepreneur faces challenges on an everyday basis. Learning theories suggest that prior experience facilitates the understanding of new challenges. Experiential learning requires the transformation of experience into knowledge or skills (Kolb, 1984). Previous self-employment can thus be seen as “the best training to gain specific knowledge and skills in various fields, which are then most productively applied in later entrepreneurship” (Stuetzer et al., 2013b, p. 98). This is both reflected in a high proportion of prior self-employed individuals among nascent entrepreneurs (Evans and Leighton, 1989; Davidsson and Honig, 2003) as well as higher success rates for individuals with entrepreneurial experience.

Second, managerial experience is a path to acquire skill variety. Management roles provide entrepreneurs with relevant skills in making decisions, solving problems, planning or negotiating (Romanelli and Schoonhoven, 2001; Shane, 2003). Overall, managers are exposed to

diverse tasks (Parker, 2009). These tasks allow individuals to build up experience that can be transformed into skill variety. Research shows mixed evidence on the relevance of managerial experience for entrepreneurship. While Gimeno et al. (1997) report a positive relation between prior managerial experience and entrepreneurial performance, Davidson and Honig (2003) found no effect on entrepreneurial opportunity discovery and exploitation.

Third, work experience in small and young companies might lead to the accumulation of skill variety. In small and young companies there are usually no complex hierarchical structures. Work places and conditions are laid out to be rather generalist than specialized, demanding each employee to fulfill a variety of tasks (Elfenbein et al. 2010; Parker 2009). Empirical evidence is provided by Wagner (2004), who reports a higher probability to enter entrepreneurship for individuals with prior experience in small and young companies.

Fourth, formal education can also be a route to acquire skill variety. Studying a varied university curriculum, students acquire knowledge in different domains. A student aspiring a career in paid employment might rather choose a more specialized university curriculum. Beyond that, a broader theoretical curriculum enables students to work in different jobs and industries after finishing their studies (Lazear, 2005). Lazear (2005) and Backes-Gellner et al. (2010) provide empirical evidence for the relevance of variety in educational backgrounds for the entrepreneurial choice.

3 Review of the scientific literature on skill variety

There are three recent literature reviews on human capital in entrepreneurship. First, Unger et al. (2011) bring together the results of 70 independent samples in their meta-analytical study about human capital and entrepreneurial success. Overall, human capital measures are correlated to entrepreneurial success by $r = 0.098$. Furthermore, higher correlations to entrepreneurial success are reported for more task-related measures of human capital. Second, Marvel et al. (2016) discuss the results of 109 articles on human capital and entrepreneurship. They

stress the importance of human capital throughout the venturing process and also highlight task-related human capital measures. Third, Martin et al. (2013) review the literature on the relationship between entrepreneurship education and human capital assets, behaviors and performance. They report a significant relationship between entrepreneurship education and human capital assets, especially for academic programs.

All three reviews provide compelling evidence that especially task-related human capital is an important driver and influence factor of entrepreneurship. As argue above, skill variety, is strongly connected to the entrepreneurial task. However, skill variety as a concept has been neglected in previous reviews, probably due to the small body of literature on skill variety back then. The literature, however, has grown and our review aims to close this research gap.

3.1 Literature search and selection criteria

The scholarly articles on skill variety in entrepreneurship were identified in a Google Scholar title and keyword search for the term ‘Entrepreneurship’ and one of the terms ‘skill variety’, ‘balanced skills’, ‘skill balance’, ‘balanced skill set’, ‘Jack-of-all-trades’. Studies that cover the concept of skill variety and empirically investigate skill variety, its antecedents and outcomes are subject of this review. Few studies without a direct connection to Lazear’s concept of skill variety are considered, because the conceptualizations and variables used are similar to Lazear’s approach (example search terms are ‘labor diversity’, ‘functional experience’, ‘functional expertise’, ‘generalists’, ‘experience diversity’). In a next step, the search was expanded based on the references cited in these articles. To confirm the results, further searches were conducted in EBSCO, SSCI, EconLit and ERIC, among others. Finally, experienced research scholars in the field of human capital and entrepreneurship were asked to suggest further important studies. The search returned 255 hits (as of April 2017).

Despite the high theoretical relevance of skill variety for entrepreneurship, there are only few studies published on the subject. Hence, (unpublished) working papers are included

in this review. Working papers were only included if no published article (from the same author, on the same topic) is available. An exception to this rule is made for Lazear's (2003) working paper that was published later on in the *Journal of Labor Economics* (Lazear, 2005), because Lazear (2003) is the first source on the concept of skill variety. The working papers and articles were selected based on the following criteria:

- Scholarly articles and working papers are included. Reports and notes for practitioners as well as bachelor and master theses were excluded.
- Only papers that were relevant for the field of entrepreneurship were taken into account.
- Articles must be written in English or German to be included.

Using these criteria, 68 articles and working papers are selected for the literature review.

3.2 Development of scientific research on skill variety and structure of the review

The concept of skill variety has experienced a notable rise in entrepreneurship research since the first theory development and empirical evidence by Lazear (2003, 2005). At this point it should be noted that Lazear's theory has quite some similarity with the O-ring theory of production, which was championed by Kremer (1993). He argues that different tasks of production should be executed competently together. If one task is poorly executed the whole production will suffer. Looking at entrepreneurship, which demands several tasks that need to be performed in parallel, the concept of skill variety can be viewed as a specific example of the O-ring theory of production (Bublitz et al., 2017). In this specific example, the single founder's skills and the requirements resulting from his enterprise are the object of investigation. For this reason, studies with a focus on team skill variety are excluded. Another argument why studies investigating team skill variety are excluded is that it is difficult to decide whether there are solely positive effects of team skill variety or if these positive effects interfere with negative effects such as communication problems, conflicts or disagreement within the entrepreneurial team (Harrison and Klein, 2007). Please also note that there is another strand of literature looking at the related

concept of task variety. In general, it is found that task variety is a relevant factor for work satisfaction, which is especially true for entrepreneurs that conduct a wider variety of tasks than employees (e.g. Hundley, 2001; Schjoedt, 2009). Although work satisfaction could be considered an outcome of skill or task variety, it is not accounted for in this review. The body of literature is constrained to entrepreneurship outcome variables only (e.g. entrepreneurial choice or success).

Our review paper analyzes the content of the identified articles. The structure of the review was chosen according to the emergence of the literature following Lazear's (2003) idea of skill variety in entrepreneurship. First, the effects of skill variety are investigated (entrepreneurial intentions, entrepreneurial choice and entrepreneurial success). Second, different determinants of skill variety are shown. Third, an overview of the relationship between gender and skill variety is given. This includes several studies that have a main focus on gender issues and skill variety as well as information (on gender and skill variety) from the articles of the other two categories (if available). Last, the articles under investigation are analyzed in regard to the operationalization of skill variety. For an overview on the different categories and articles within these categories see Table 1.

Table 1: Categories and empirical studies within each category

Category of <u>main</u> focus	Description	Final sample
Effects of skill variety (Section 3.3)	Investigates the entrepreneurial outcomes of skill variety at an individual level.	56
Determinants of skill variety (Section 3.4)	Investigates the sources and areas which skill variety in entrepreneurship comes from.	5
Gender and skill variety (Section 3.5)	Investigates the topic of skill variety differences between the sexes and its relation to different entrepreneurial outcome variables.	6

3.3 Literature with a focus on effects of skill variety

Literature focusing on the effects of skill variety is predominantly concerned with entrepreneurial intentions, entrepreneurial choice and entrepreneurial success (see Table 2).

Please note that most studies focusing on the determinants of skill variety or gender and skill variety also investigate effects of skill variety. Therefore, the studies are assigned to the three different tables/sections according to their main foci. This means, studies with a main focus on determinants of skill variety or gender and skill variety are not shown in Table 2. In the following, the contents of Table 2 are discussed. Here, the most prominent studies and a general tendency of other studies are presented. For more details see Table 2, which contains a summary of the contents, methods, sources and further information on the measurement of skill variety as well as gender and skill variety. This information will also be referred to in Sections 3.5 and 3.6.

Entrepreneurial choice and intentions

Lazear (2003, 2005) started the discussion on skill variety in entrepreneurship by developing a theoretical model (as described in Section 2). Beyond that, with a dataset of 5,000 Stanford alumni, he also presented first empirical evidence on the importance of skill variety for entrepreneurial choice in the US. Lazear (2003, 2004 and 2005) used both an educational (varied university curriculum) as well as a work perspective of skill variety (number of prior jobs and employers). Interestingly, the central premise of Lazear's arguments, that entrepreneurs perform more tasks compared to paid employees, was only investigated in the study of Lechmann and Schnabel (2014). They showed that entrepreneurs indeed perform more different tasks than employees.

Overall, 42 studies were found that followed Lazear's initial approach and studied skill variety and entrepreneurial choice in different country and measurement settings. For Germany, Wagner (2003) brought up first evidence that work-related skill variety predicts self-employment entry. Later, Wagner expanded his analysis on nascent and infant entrepreneurs as well as necessity- and opportunity-driven entrepreneurship (Wagner 2005a, Wagner 2006). He confirmed the high relevance of skill variety for entrepreneurial choice in all cases. Lechmann and

Schnabel (2014) only found partial support for Lazear's concept. They found that expert skills also play a major role for the entry into self-employment.

Most studies following Lazear have been carried out in the US (N studies=11). Most prominently, Chen and Thompson (2016), who analyzed data from the largest professional social networking websites, confirmed the importance of skill variety, but also acknowledged the importance of single factors, such as management experience. Hartog et al. (2010) found no relation between skill variety and entrepreneurial choice. Lazear's concept has been originally developed for single founders, rather than teams. Even so, Spiegel et al. (2013) revealed that there are no major differences between single and co-founders with regard to skill variety. Furthermore, it has been shown that skill variety is important for profit and non-profit entrepreneurs (Cho and Orazem, 2014) as well as for inventors with science and engineering degrees (Elfenbein et al., 2010). Skill variety has also been shown to be a mediator between educational mismatch and the propensity to become an entrepreneur (Stenard and Sauermann, 2016). Here, an educational mismatch is a person that does not work in a job according to his or her formal qualification. Skill variety also mediated the relation between risk aversion and entrepreneurial choice, surprisingly turning the negative effect of risk aversion around (Hsieh et al., 2017). Besides the US and Germany, the relation between skill variety and entrepreneurial choice has also been investigated in Scandinavia (e.g. Marino et al., 2012) and other European countries such as Italy (Silva, 2007) and the Netherlands (Hsieh et al., 2017). Overall, studies report a high importance of skill variety for the entrepreneurial choice. Only in a few studies this importance could not be confirmed. This is at least in part due to the different operationalizations of skill variety and will be discussed in Section 3.6.

Skill variety has also been studied in regard to entrepreneurial intentions or aspirations, as a precursor of entrepreneurial behavior (N studies=5). It depends on the sample, if it is appropriate to study entrepreneurial intentions. Studying a sample of employees or a sample of

students that have not completed the transition to working life leaves no other choices than using an intention based outcome variable. There are two studies examining the relationship between skill variety and entrepreneurial intentions of students. First, Obschonka et al. (2017) show that a variety of age-appropriate competencies mediates the relationship between an entrepreneurial personality and entrepreneurial intentions/alertness. Second, Backes-Gellner and Moog (2013) emphasize that variety in academic and work-related skills foster entrepreneurial intentions. Studies analyzing employee samples also report the high relevance of skill variety for entrepreneurial intentions (Hyytinen and Ilmakunna 2007a, 2007b). Moog et al. (2015) only find skill variety to be relevant for entrepreneurial intentions of scientists, if their peers have entrepreneurial ideas and their working time is balanced.

Lazear's (2005) results also hold true for intrapreneurship. On average, the upper management shows more skill variety than employees. This also applies to principal investigators of research collaborations (Boehm and Hogan, 2014) and managers in open source projects (Giuri et al., 2008). The relation between intrapreneurship and skill variety was expanded by Li and Zhang (2007), who showed that Chinese high technology companies lead by managers with more skill variety are more successful.

Entrepreneurial success

The concept of skill variety was not only investigated with regard to entrepreneurial choice, but also to entrepreneurial success (as intended by the original model of Lazear). Entrepreneurial success can be accounted for in various ways (e.g. income, firm survival). In the following, the main results of the 24 identified articles will be presented, ordered by the measurement of entrepreneurial success.

First, there are studies looking at the relationship between skill variety and income as a proxy for entrepreneurial success (N studies=12). The results are mixed. Some studies report

a positive effect of skill variety on income. With German data, Bublitz and Noseleit (2014) show that skill variety has a positive effect on income both for entrepreneurs as well as employees in small businesses. Åstebro et al. (2011) with Korean data and Hartog et al. (2010) with US data report higher incomes for entrepreneurs with skill variety, but not so for employees with skill variety. Spanjer and Van Witteloostuijn (2017) find a U-shaped relation between skill variety and income for US entrepreneurs. Until a certain threshold, skill variety has a positive impact on income, before it begins to lower the performance of entrepreneurs. Åstebro and Thompson (2011) as well as Åstebro and Yong (2016) find that skill variety has a negative impact on income for both entrepreneurs (800 Canadian inventors) and employees. Lechmann and Schnabel (2012) report also a negative correlation with data from the German BIBB 2006. Dencker et al. (2009) use job creation as a success indicator. They find negative implications of founder skill variety on job creation by start-ups. At the same time, entrepreneurs with skill variety are able to operate their firms with less employees (probably due to their own capabilities).

Second, there are studies looking at the relationship between skill variety and firm survival (N studies=5). Again, the results are mixed. For example, Oberschachtsiek (2012) shows (with German regional data) that skill variety is positively associated with firm survival. Hessels et al. (2014) also find entrepreneurs with more skill variety to persist longer in the market. Interestingly, this relation is mediated by innovations within the firms. On the other side, both Brixy and Hessels (2010) and Faila (2015) report a negative impact of skill variety on firm survival.

Third, there are studies analyzing the relation between skill variety and the progress of a (nascent) venture (N studies=3). Building on data from the Thuringian Founder Study, Stuetzer et al. (2012, 2013b) find skill variety to be important for the process of venture creation.

The process of venture creation is measured by the number of gestation activities (such as talking to customers or product development) undertaken by the founders. Furthermore, entrepreneurs with more skill variety tend to need less time to complete innovative projects (Bublitz et al., 2015). On the other hand, having less skill variety can be compensated for by locating a business in an agglomeration, probably because it is easier to find employees that complement the skill set of the founder.

Fourth, there are studies associating skill variety with different entrepreneurial competencies (N studies=3). Stuetzer et al. (2013a) find skill variety to be a predictor of entrepreneurial competencies, such as the discovery of business opportunities or resource allocation. Interestingly, Lazear (2012) expands his model of skill variety on leadership both theoretically and with the Stanford alumni data. Skill variety indeed predicts subsequent leadership roles in working life. Further, Åstebro and Yong (2016) report a positive relationship between skill variety of founders and invention quality. Fleming et al. (2007) highlight the importance of skill variety of inventors for generative creativity.

Table 2: Literature on effects of skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Aldén et al. (2014)	Respondents with more skill variety are more likely to be self-employed.	Quantitative (OLS)	Swedish Military general ability test	Sweden	-low variance of scores attained in different areas of ability tests, e.g. logical thinking, verbal skills, emotional stability	not reported
Åstebro et al. (2011)	Individuals with a history of changing occupations and employers are more likely to enter self-employment. This history is associated with higher earnings for entrepreneurs, but not for employees.	Quantitative (different regression techniques)	Korean Labor and Income Panel Study	Korea	-number of prior job roles held -number of prior employers	not reported
Åstebro and Yong (2016)	Both occupational and industry variety have positive relationships with invention quality. Further, industry variety has a negative relationship with entrepreneurial earnings while occupational variety has no relationship.	Quantitative (OLS)	Canadian Innovation Centre	Canada	-number of different occupational fields of experience -number of different distinct industries worked in	not reported
Backes-Gellner and Lazear (2003)	Confirms Lazear's results. Was not available from the authors on request.					
Backes-Gellner and Moog (2013)	Skill variety and variety in social capital foster entrepreneurial intentions among students.	Quantitative (different regression techniques)	Cologne Founder Study	Germany	-academic skill variety (analytical, practical, financial and marketing skills) -work skill variety (worked as a freelancer, intern, full-time or part-time employee, apprentice or as self-employed)	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Backes-Gellner et al. (2010)	Individuals that have not had a straight educational path, but switch between different educational possibilities, have a higher probability to end up in entrepreneurship.	Quantitative (different regression techniques)	Swiss Labor Force Survey	Switzerland	-educational skill variety (apprenticeship, vocational training, academic education)	not reported
Boehm and Hogan (2014)	Principal investigators in research collaboration projects have skill variety.	Qualitative	Case study in research collaboration projects	Germany, Ireland	-different roles (project manager, negotiator, resource acquirer, ...)	not reported
Brixy and Hessels (2010)	Nascent entrepreneurs are less likely to succeed (firm survival), if they have skill variety.	Quantitative (multinomial probit regression)	Survey of the Global Entrepreneurship Monitor (GEM)	Germany, Netherlands	-number of fields of experience (i.e. R&D/design/engineering, production, marketing, finance/accounting, law, human resources, general management, consulting)	not reported
Bublitz and Noseleit (2014)	Skill variety is significantly larger for entrepreneurs than it is for employees. Further, skill variety of employees is negatively related to firm size. Skill variety at higher levels is correlated with income, especially for entrepreneurs but also for employees in small businesses.	Quantitative (different regression techniques)	BIBB/BAuA Employment Survey of the Working Population 2006	Germany	-count over different general skills (e.g. law, math, handcraft, ...) and self-assessment to judge the balance in skills	women have less skill variety
Bublitz et al. (2015)	Entrepreneurs with more skill variety need less time to finish projects. Further, entrepreneurs with less skill variety benefit more from the positive relationship between agglomeration economies and completion time.	Quantitative (negative binomial regression)	Establishment History Panel	Germany	-number of different occupational fields of experience	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Chen and Thompson (2016)	Both employer and job variety are positively associated with entrepreneurship. The number of functional job experiences is more important. Specific types of experience (“business administration experience” and “senior management experience”) eliminate the positive effects of both employer and functional experience counts.	Quantitative (logistic regression)	Data from largest professional social network websites	USA, Canada	-functional job experience: accounting and finance, business administration, marketing and sales, R&D and engineering, personnel, production -number of prior employers	no differences
Cho and Orazem (2014)	Skill variety (number of job roles and industries) is both important for nonprofit as well as profit entrepreneurial choice.	Quantitative (probit regression)	Iowa State University Bachelor’s degree alumni survey data	USA	-number of prior job roles held -number of prior industries -academic skill variety (courses taken in the major and the average number of courses taken in other departments)	not reported
Colombatto and Melnik (2007)	Prior work experience as an employee positively correlates with expected entrepreneurial success, measured in income and firm size of startups.	Quantitative (different regression techniques)	Sample of newly founded firms, 2005	Italy	-years of working in paid employment prior to becoming entrepreneur (proxy for number of roles worked in)	not reported
Cumming et al. (2016)	Having skill variety is more important for serial entrepreneurship than the experience in venture capital.	Quantitative (probit regression)	Venture-backed startups in the CrunchBase online database	USA	-management education as proxy for skill variety	no differences
Daghbashyan and Hårsman (2012)	Arts graduates having switched industries (proxy for skill variety) are more likely to become entrepreneurs.	Quantitative (multinomial probit regression)	Individual time series data on all Swedish employees, firms and establishments	Sweden	-number of different industries worked in during the last four years	women have more skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Dencker et al. (2009)	Skill variety is negatively associated with job creation in firms. But skill variety makes it possible to operate firms with less employees. Firm failure is not predicted by skill variety.	Quantitative (different regression techniques)	German FEA	Germany	-self-assessment in breadth of knowledge (market and industry, marketing and sales and computer/hardware/software)	women have less skill variety
Douhan (2009)	Lazear's JAT theory holds, students with skill variety tend to become entrepreneurs.	Quantitative (different regression techniques)	Educational survey 1961/1966	Sweden	-narrow set: IQ dimensions (inductive, linguistic, spatial) -additional broad set: interest in sociability, general knowledge, mechanical activities -variance across all score values is skill variety	not reported
Dutta et al. (2011)	Individuals that have an education highly specialized on entrepreneurship are more likely to become entrepreneurs and are more successful (income and personal wealth). This relation is stronger for individuals with educational skill variety (moderation).	Quantitative (OLS regression)	Alumni of University of Arizona's Berger Entrepreneurship Program 1985-1999	USA	-count variable over different educational experiences (such as language courses or studying abroad)	women are more specialized and have less educational skill variety
Elfenbein et al. (2010)	Individuals with science and engineering degrees are more likely to enter entrepreneurship if they work in small firms. This is in part because they perform a broader range of commercial tasks in small firms.	Quantitative (different regression techniques)	National Survey of recent college graduates	USA	-count of commercial activities -count of research activities	not reported
Failla (2015)	Different measures of skill variety are set into relationship to firm failure. Both the number of previous employers and industries positively predict firm failure. But both measures positively predict entry into entrepreneurship.	Quantitative (different regression techniques)	Integrated Database for Labor Market Research	Denmark	-number of previous employers -number of previous industries	women have less skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Fleming et al. (2007)	Inventors demonstrate more generative creativity in patents when they have more skill variety.	Quantitative (different regression techniques)	U.S. utility patents	USA	-number of different occupational fields of experience	not reported
Fritsch et al. (2012)	Business specialists and engineers have the highest levels of skill variety. Entrepreneurs have more skill variety than employees. Employees in small businesses have higher levels of skill variety than those in larger businesses.	Quantitative (multinomial probit regression)	BIBB/BAuA Erwerbstätigenbefragung 2006	Germany	-count over different general skills (e.g. law, math, handcraft, ...) and self-assessment to judge the balance in skills	not reported
Giuri et al. (2008)	In OSS projects, managers tend to have balanced skills, in contrast to other team members.	Quantitative (ordered logit estimations)	SourceForge.net 1999-2003	Worldwide	-self-assessment of skills in programming, application-specific skills and spoken languages -experience: average level of time invested in each skill - number of skills named	not reported
Hartog et al. (2010)	Skill variety generates higher incomes, but only for entrepreneurs. Skill variety has no influence on the entry decision in entrepreneurship.	Quantitative (different regression techniques)	National Longitudinal Survey of Youth	USA	-coefficient of variation of abilities (verbal, math, technical, clerical, social)	not reported
Hessels et al. (2014)	Nascent entrepreneurs with more skill variety are more likely to succeed (innovation is a mediator from variety to success). Skill balance has no comparable effect.	Quantitative (multinomial logit model)	GEM 06/07	Germany, Netherlands	-years of experience in different fields (e.g. design/engineering, production, marketing/sales) -self-assessment to judge the balance in skills	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Hsieh (2016)	Learning multiple skills together is more important for entrepreneurial choice than skill variety itself.	Quantitative (different regression techniques)	SESTAT panel database	USA	-count of parallel domains of work experience (accounting, applied research, basic research, computer applications, design, development, employee relations, management and administration)	women have less (in parallel acquired) skill variety
Huber et al. (2014)	Teams (of students participating in entrepreneurship education) consisting of members with high skill variety show higher performance than teams with specialized members, even if a variety of specialized skills is combined.	Quantitative (different regression techniques)	Field experiment with 179 teams	Netherlands	-equal mathematical and verbal abilities as indication of skill variety	not reported
Hyytinen and Ilmakunnas (2007a)	Employees that have skill variety are more likely to do job switching as well as entrepreneurial aspirations.	Quantitative (probit regression)	Quality of Work Life Survey	Finland	-number of different fields of occupation (1, if number is greater than 3; 0 otherwise)	not reported
Hyytinen and Ilmakunnas (2007b)	Paid employees with varied work experience as well as those having worked as an entrepreneur in the past are more likely to have entrepreneurial aspirations.	Quantitative (probit regression)	Quality of Work Life Survey	Finland	- dummy: 1, if worked in more than three clearly different occupations	not reported
Kucel and Teodoro (2017)	Having a larger number of skills is positively associated with being self-employed. The number of previous jobs is not significantly associated with being-self-employed. Skill variety is shown to be dependent from entrepreneurial education, but also from higher education.	Quantitative (logit regression)	Reflex database	Spain	-count over 19 different skills that are self-rated above average (e.g. negotiating, foreign language or computer skills) -number of previous jobs"	women have less skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Kucel and Vilalta-Bufi (2016)	Skill variety does not significantly influence the probability to become an entrepreneur.	Quantitative (Heckman selection model)	Survey of tertiary graduates	Spain	-number of skills in which individual excels, e.g. analytical thinking, ability to perform well under pressure	not reported
Lazear (2003)	First theory development on skill balance. Number of job roles are decisive for being an entrepreneur, the number of prior employers plays no role. Prior job roles reflect skill variety and the willingness to acquire skill variety. Results also hold true for intrapreneurs (upper management).	Quantitative (logistic regression)	Stanford alumni data	USA	-number of prior job roles held -number of prior employers	not reported
Lazear (2004)	It is found that those who end up being entrepreneurs study a more varied curriculum than do those who end up working for others. CPS data show that entrepreneurs are rather generalists and do not have technical backgrounds on average.	Quantitative (logistic regression)	2002 CPS data and Stanford alumni data	USA, Germany	-difference between the number of courses taken in the student's field of specialty and the average number of courses taken in other fields. "Field of specialty" is defined simply as the field in which the student took the largest number of courses.	not reported
Lazear (2005)	As in Lazear (2003).	Quantitative (logistic regression)	Stanford alumni data	USA	-number of prior job roles held -number of prior employers	not reported
Lazear (2012)	Skill variety (wide range of job experiences) is associated with later leadership roles, not necessarily higher income.	Quantitative (logistic regression)	Stanford alumni data	USA	-number of prior job roles held	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Lechmann and Schnabel (2014)	First, entrepreneurs really have more tasks to fulfill (test of Lazear's premises). Second, entrepreneurs only partially have more skill variety. Besides broad skill variety, expert skills are important, too.	Quantitative (different regression techniques)	BIBB/BAuA Employment Survey of the Working Population	Germany	-changes of profession -number of different kinds of professional training	not reported
Li and Zhang (2007)	China's high technology ventures that have managers with skill variety are more successful.	Quantitative (OLS)	Randomly selected 300 new technology ventures	China	-functional job experience five functional areas: marketing, sales and promotion, accounting, controlling and finance, R&D and engineering, production, personnel	not reported
Mahé (2016)	Return migrants are likely to opt for self-employment. This is due to skill variety (occupation and jobs). Variety in sectors is not helpful, here, industry specialization is more important.	Quantitative (SEM)	Egyptian Labour Market Panel Survey	Egypt	-number of jobs held -number of sectors worked in -number of occupations worked in	not reported
Marino et al. (2012)	Workforce educational skill variety (over a company) promotes entrepreneurial behavior of employees as well as the formation of new firms.	Quantitative (OLS)	Integrated Database for Labor Market Research	Denmark	-index on the highest degrees of employees (on a company level)	not reported
Moog et al. (2015)	Skill variety positively affects the intention to become an entrepreneur, in cases where organizational peers have entrepreneurial ideas and where the working time is balanced between different academic activities.	Quantitative (ordered probit regression)	Data from 480 Swiss and German life sciences researchers	Switzerland	-number of job roles held (e.g. patenting, publication, teaching, ...) -working time balance (e.g. teaching, academic administration, research, ...)	women have more skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Oberschachtsiek (2012)	Having skill variety is an important factor for the longevity of self-employment.	Quantitative (different regression techniques)	Bridging allowances Lüneburg	Germany	-number of different fields of occupation (purchase, services, production, trade/installation, marketing/sales and administration)	no differences
Oberschachtsiek (2013)	Skill variety increases the probability of becoming a nascent entrepreneur.	Quantitative (different regression techniques)	Telephone-based survey, representative of overall population	Germany	-number of tasks performed in different professional fields	not reported
Obschonka et al. (2017)	Age appropriate skill variety (competencies) mediate the relation between an entrepreneurial personality and intentions as well as alertness. The variety approach yields significant results, but not better results than the single indicators together.	Quantitative (SEM)	Mind the gap (data from schools)	Finland	-count index over early entrepreneurial competencies (leadership, self-esteem, creativity, proactive motivation)	women have less skill variety
Orazem et al. (2010)	Students with more diverse academic programs are more likely to enter entrepreneurship. Along the individual career, the importance of academic diversity declines, while the diversity of work experiences become more important.	Quantitative (different regression techniques)	Iowa State University Graduates Survey	USA	-difference between the number of courses taken in the student's major and the average number of courses taken in other fields -number of different occupational experiences since graduation -number of different industries since graduation	women have less educational and work skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Peltonen and Arenius (2016)	Skill variety in terms of work experience diversity is important for the first entry into entrepreneurship. High cognitive ability is negatively associated with the entry in entrepreneurship, not so for people with skill variety.	Quantitative (different regression techniques)	FLEED	Finland	-employer diversity -industry diversity	not reported
Baba and Motohashi (2013)	Broad job categories (within few companies) are important for entrepreneurial success.	Quantitative (multinomial probit regression)	RIETI 2012	Japan	-number of companies -number of job categories	not reported
Spanjer and Van Witteloostuijn (2017)	Skill and knowledge variety is found to be positively associated with performance up to a certain threshold. After this threshold, an increase in an entrepreneur's experiential diversity lowers performance (inverted U-shape).	Quantitative (different regression techniques)	US National Labor Survey Youth 1979 and O-net	USA	-number of skills linked to an entrepreneur's past jobs -number of knowledge fields associated with the entrepreneur's past jobs	women have less skill variety
Spiegel et al. (2013)	Single founders do not have more skill variety than co-founders, but co-founders have complimentary skills within their teams.	Quantitative (Chi-2)	CrunchBase and LinkedIn	USA	-number of prior jobs held	not reported
Stenard and Sauer-mann (2016)	People, who are voluntarily mismatched (from an education perspective) in their jobs, have a higher probability to become entrepreneurs. This effect is partially mediated by skill variety.	Quantitative (logistic regression)	SESTAT	USA	-diversity of work activities (e.g. accounting and finance, employee relations, management, production and operations, ...)	women have less skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Stuetzer et al. (2012)	Entrepreneurs who exhibit skill variety undertake more gestation activities towards a new venture.	Quantitative (different regression techniques)	Thuringian Founder Study	Germany	-functional job experience five functional areas: marketing, sales and promotion, accounting, controlling and finance, R&D and engineering, production, personnel	not reported
Stuetzer et al. (2013a)	Active founders are investigated. Work skill variety is shown to be more important for entrepreneurial skills than traditional human capital variables.	Quantitative (OLS)	Thuringian Founder Study	Germany	-functional job experience five functional areas: marketing, sales and promotion, accounting, controlling and finance, R&D and engineering, production, personnel	not reported
Taylor and Greve (2006)	Skill variety of creators has positive influence on collector value of comic books, especially for single creators.	Quantitative (OLS)	Comic books published from 1972 through 1999	Worldwide	-number of genres a creator has worked in	not reported
Wagner (2003)	Both number of changes in profession and number of different professional trainings predict being self-employed. The number of different trainings is more important though.	Quantitative (probit regression)	BIBB/IAB, Strukturerhebung 1998/1999	Germany	-number of changes in profession -number of different kinds of professional training (after completing school)	not reported
Wagner (2005a)	For nascent entrepreneurs, both the number of professional fields as well as the number of professional degrees have a significant positive effect. For infant entrepreneurs, only the number of professional degrees matter.	Quantitative (rare event logistic regression)	Regional Entrepreneurship Monitor Germany	Germany	-number of professional fields of experience -number of professional degrees	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Wagner (2005b)	Both necessity and opportunity entrepreneurs differ from employees with respect to the number of professional fields of experience as well as number of professional degrees.	Quantitative (rare event logistic regression)	Regional Entrepreneurship Monitor Germany	Germany	-number of professional fields of experience -number of professional degrees	not reported
Wagner (2006)	The probability of being a nascent entrepreneur is dependent on the number of fields of experience and the number of professional degrees.	Quantitative (rare event logistic regression)	Regional Entrepreneurship Monitor Germany	Germany	-number of professional fields of experience -number of professional degrees	not reported

Table 3: Literature on determinants of skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Åstebro and Thompson (2011)	Skill variety is associated with being an entrepreneur in a sample of 800 Canadian Inventors and 300 employees. But skill variety has a negative effect on income for both entrepreneurs and employees. Further examinations show that skill variety might result from a taste for variety rather than a human capital investment strategy.	Quantitative (different regression techniques)	Canadian Innovation Centre	Canada	-different occupational fields of experience (e.g. accounting, farming, marketing and plumbing)	not reported
Hsieh et al. (2017)	Risk aversion might lead individuals to acquire skill variety. There is a positive indirect effect of risk aversion on entrepreneurship. This indirect effect turns the negative direct effect of risk aversion on entrepreneurship into a positive effect overall.	Quantitative (OLS and probit regression)	Dutch research institute SEO	Netherlands	-variety of industries that a given degree major is observed to be used in -spread of grades that individuals achieve across three different secondary school courses	women have less skill variety
Oberschachtsiek (2009)	Taste for variety (desire for entrepreneurial career) and investments in abilities are important for skill variety.	Quantitative (different regression techniques)	Regional Entrepreneurship Monitor Germany	Germany	-number of prior job roles held	women have less skill variety
Silva (2007)	Skill variety matters for becoming an entrepreneur. Using fixed effect panel techniques, to control for individual unobserved characteristics, reveals that skill variety might be important for the entrepreneurial choice, but more as an innate ability.	Quantitative (Fixed effect panel techniques in logistic regression)	ILFI Survey (Longitudinal Survey of Italian Families)	Italy	-number of prior job roles held	not reported

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Stuetzer et al. (2013b)	The performance of nascent entrepreneurs is associated with skill variety (even controlling for other human capital measures). Determinants of skill variety come both from endowments as well as investments. Early career interests, prior work engagement, as well as an entrepreneurial personality are decisive for skill variety.	Quantitative (different regression techniques)	Thuringian Founder Study	Germany	-functional job experience five functional areas: marketing, sales and promotion, accounting, controlling and finance, R&D and engineering, production, personnel	women have less skill variety

3.4 Literature with a focus on determinants of skill variety

Literature focusing on the determinants of skill variety is summarized in Table 3. There are in total only 5 papers exploring determinants of skill variety. Table 3 also contains methods, sources and further information on the measurement of skill variety as well as gender and skill variety. This information will be referred to in Sections 3.5 and 3.6.

Human capital theory (Becker, 1964) argues that individuals purposely invest in their knowledge and skills to obtain financial rewards in terms of wages and salaries. Lazear (2005) adopts these arguments to entrepreneurship, stating that investments in entrepreneurial skill variety should pay off in terms of firm profitability and survival. The purposeful and intentional investment in skill variety to run and succeed as an entrepreneur has been termed the investment hypothesis (Stuetzer et al., 2013b). Silva (2007), however, questioned this intentionality of skill accumulation. In a fixed effects panel analysis, using longitudinal data on Italian households, he finds that skill variety “only matters as an innate attribute” (Silva, 2007, p. 122). In a sample of Canadian inventors and employees, Åstebro and Thompson (2011) find that both skill variety and entrepreneurship are the expression of a taste for variety. Taste for variety is a label for several personality traits, such as preference for risk and adversity resilience. They argue that the acquisition of skill variety is driven by such innate attributes. This non-intentional acquisition of skill variety has been termed the endowment hypothesis (Stuetzer et al., 2013b). Kucel and Teodoro (2017), using a sample of Spanish university graduates, do not find support for this endowment hypothesis.

Stuetzer et al. (2013b) investigate different determinants of skill variety from both the investment and the endowment view. First, they find evidence that the age of an early entrepreneurial career interest (as an indicator for purposeful investment strategies) is negatively associated with skill variety. Second, they find entrepreneurial and management experience to be particularly important for skill variety. Moreover, they employ a holistic approach from personality research in associating an entrepreneurial personality profile, based on a Big Five

measure, with the development of skill variety. In their view, an entrepreneurial personality profile can be regarded as entrepreneurial talent. They find that an entrepreneurial personality profile is an important factor for the development of skill variety. Hsieh et al. (2017) expand the endowment view by using the personality factor of risk aversion. Interestingly, risk aversion leads to more skill variety (probably as a protection against labor market insecurities).

Overall, it can be argued that individuals with a taste for variety or an entrepreneurial talent choose broad educational curriculums or choose professions that allow the accumulation of skill variety, such as work in small and young companies, management or self-employment. As Lazear (2003) states, “Going into any job, individuals with a broader range of skills, acquired either through investment or through endowments, are more likely to be entrepreneurs”. It will remain an ongoing challenge to include more potential endowment factors in models explaining the development of skill variety.

3.5 Literature with a focus on gender and skill variety

Tables 2 and 3 and 5 contain information on gender (0 = male, 1 = female) and skill variety (besides their main foci). First, an overview over the main tendency in regard to gender and skill variety is given (see Table 4). The information on the relation between gender and skill variety is drawn from correlation tables or regressions with skill variety as dependent variable. Note that many studies reported these results without having a clear focus on gender but used gender only as a control variable in their analysis. Most studies that included the relevant information report a negative relation (N studies=18) between gender and skill variety.

Table 4: Overview of relation between gender and skill variety

Relation between gender (0=male, 1=female) and skill variety	Number of studies
Negative relation	18
Positive relation	2
Neutral relation	3
No information available	44

Table 5: Literature on gender and skill variety

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Lechmann and Schnabel (2012)	Skill variety has a negative impact on self-employment earnings, which is insignificant for women. Female employees have less skill variety, this is not true for entrepreneurs.	Quantitative (different regression techniques)	BIBB/IAB, Struktur-erhebung 2006	Germany	-number of changes of profession	women have less skill variety
Lin (2016)	Skill variety does not predict entry in entrepreneurship and does thus not explain the gender gap in entrepreneurship.	Quantitative (different regression techniques)	Wharton School of Business Alumni	USA	-number of previous employers	women have less skill variety
Strohmeier et al. (2017)	Ventures headed by men tend to exhibit a greater scope of innovation. This is partially due to less female skill variety.	Quantitative (hierarchical poisson regression)	Data from 300 male and 600 female highly-educated entrepreneurs	Germany	-number of professional degrees completed after school -number of occupational and job changes -number of professional trainings	women have less skill variety
Tegtmeier et al. (2016)	Theoretical adjustment of Lazear's theory (other motives than income maximization). Skill variety is important for women's entry decisions, only the number of occupational fields is not significantly related to entrepreneurial choice.	Quantitative (logit regression)	Sample of 1384 women graduates	Germany	-additional professional trainings -confidence in 19 distinct entrepreneurial tasks (e.g. identifying the need for a new product) -number of industries worked in -number of different occupational fields of experience (e.g. accounting, marketing)	only females in database

Reference	Main Content/Results	Method	Data source	Country	Measure of skill variety	Female
Tonoyan et al. (2009)	Women have less skill variety over all four operationalizations. Interaction effects show that skill variety is more important for men than for women concerning the transition into entrepreneurship. Overall, skill variety explains substantial part of the gender gap in entrepreneurship.	Quantitative (rare event logistic regression)	BIBB/IAB data (1998-1999)	Germany	-number of professional degrees completed -number of occupational and job changes -number of professional trainings	women have less skill variety
Wagner (2007)	Fields of experience are important for the entrepreneurial choice of both sexes. For men, especially the number of professional degrees is more important than for women. Overall, women score lower on both skill variety measures.	Quantitative (rare event logistic regression)	Regional Entrepreneurship Monitor Germany	Germany	-number of professional degrees -number of different occupational fields of experience	women have less skill variety

Literature with a clear focus on gender and skill variety is summarized in Table 5. There are in total only 6 papers with a clear focus on gender and skill variety. Table 5 also contains methods, sources and further information on the measurement of skill variety. This information will be referred to in Section 3.6.

The relationship between gender and skill variety can be approached from two points of view. First, it is an interesting question, whether skill variety is also important for women entrepreneurship. As shown above, skill variety is important for both entrepreneurial choice and success. However, most studies investigating skill variety use datasets that mainly consist of male entrepreneurs which reflects the general distribution of the gender of entrepreneurs. Less is known whether skill variety matters for female entrepreneurs too. Wagner (2007) was the first to address this particular research question. He found that skill variety is important for the entrepreneurial choice of both sexes (even though females have less skill variety). Tegtmeier et al. (2016) use a sample of female entrepreneurs and employees to show that skill variety is important for the female entrepreneurial choice. They also make some theoretical adjustments of Lazear's (2005) theory. Lazear's main argument for the occupational choice is lifetime income maximization. For women other factors (that are associated with entrepreneurship), e.g. self-fulfillment, family flexibility or social impact, are theorized to lead to skill variety.

The second question is, whether women have less skill variety than men and if this difference can explain entrepreneurial choice, success or other outcomes, such as innovativeness (skill variety as mediator). Here, most studies focus on the gender gap in entrepreneurship, which is the observed tendency that men are more likely to show entrepreneurship intentions, are more likely become an entrepreneur, to persist as an entrepreneur and to earn more in entrepreneurship than women. As explained above, Wagner (2007) found (1) women to have less skill variety than men and (2) skill variety to explain a rather small part of the gender gap in entrepreneurship. He finds fear of failure to be a stronger and more powerful mediator. With a

sample of Warton Business School alumni, Lin (2016) also reports no significant mediation of the gender gap over skill variety. In contrast, Tonoyan et al. (2009) find skill variety to be a strong explanation of the gender gap in entrepreneurship. About 30% of the gender gap is explained by different skill variety measures (German BIBB data are employed). Lechmann and Schnabel (2012) address the question if skill variety might be an explanation of the gender earnings gap in entrepreneurship. Findings from German BIBB data suggest that skill variety has a negative impact on self-employment earnings (this result is against Lazear's (2005) theoretical model but in line with the findings from Åstebro and Thompson (2011)). This effect is insignificant for women, though, which means that there seem to be other more decisive factors for women self-employment earnings. Here, working time differences between the sexes are found to explain about 25% of the gender earnings gap in entrepreneurship. In contrast, Strohmeyer et al. (2017) report skill variety to explain a substantial part of the gender innovativeness gap in entrepreneurship.

3.6 Overview of measures of skill variety

Next, we review the operationalization of skill variety. Please note that several studies of the 67 studies under investigation use different measures of skill variety at the same time (see Table 6 for an overview). Overall, 94 different measures are employed.

Human capital (also skill variety as a special form of human capital) consists of knowledge and skills that might be acquired through education or on the job. As argued in the introduction, a direct measure of human capital (outcome-based) is preferable over an investment-based measure that can only serve as a proxy for human capital, here skill variety. In this review, 15 out of 67 studies were identified that used direct measures of skill variety. There are a number of studies that use count variables on different general skills or abilities (e.g. law, math or handcraft) as measures for skill variety (e.g. Bublitz and Noseleit, 2014; Huber et al.,

2014). Other studies use count variables on skills more specific to entrepreneurship. Tegtmeier et al. (2016) use a confidence measure in 19 entrepreneurship specific tasks (e.g. identifying the need for a new product). Further, Obschonka et al. (2017) employ a count index on different early entrepreneurial competencies (e.g. leadership, self-esteem or creativity). Even though a direct (outcome-related) measure of skill and knowledge is preferable, it is not easy to decide which skills are relevant for entrepreneurship. Not all forms of variety might be conducive to entrepreneurial behavior or success.

Most studies (N studies=58) under investigation use investment-related skill variety measures. Lazear (2003, 2004 and 2005), who brought up the concept of skill variety in entrepreneurship, uses the number of different job roles as a proxy for skill variety. A related measure is functional job experience, which is for example used by Stuetzer et al. (2013b). Here, different functional areas (e.g., marketing, production, accounting and personnel) are set and the respondents have to decide in which areas they have work experiences. One major difference to the number of job roles is that one can have different functional experiences within one job role. For example, a tax manager (one specific job role) has experiences in leadership (personnel) and at least in accounting. Other frequently used skill variety proxies are the number of employers or industries as well as professional degrees and trainings.

The majority of skill variety measures is work-related. There are only three studies that employ an academic skill variety measure (Cho and Orazem, 2014; Lazear, 2004; Orazem and Jolly, 2010). Here, the differences between the courses taken in a college major and courses taken in other fields is used. Hsieh et al. (2017) use the spread of grades and the number of industries a degree can be used in. Overall, many different proxy variables are used in the literature to measure skill variety, which creates difficulties when comparing the results of the studies. In particular, proxy measures have the common problem that the measures might capture

part of the concept under investigation but also other aspects of variables not under investigation. For instance, the number of job roles might influence entrepreneurial choice as it reflects experience in diverse tasks in different positions, as needed in entrepreneurship. Yet, one cannot rule out other explanations as the number of employers not only reflects variety in tasks and experiences but also individual occupational preferences and occupational or job performance.

Table 6: Measurement of skill variety

Different measures of skill variety	Number of studies using measure
Number of prior job roles/professions	28
Count over specific skills/knowledge	15
Functional job experience	11
Number of prior industries	9
Number of prior employers	8
Number of professional degrees	6
Number of professional trainings	5
Difference between college major and other courses	3
Number of different work statuses	2
Spread of college grades	1
Number of industries a degree can be used in	1
Number of commercial activities	1
Number of research activities	1
Number of different parallel work experiences	1
Years in paid employment	1
Management education	1

Note: We review 67 papers, but some papers use multiple proxies for skill variety. Thus, papers using multiple different measures of skill variety are counted multiple times.

4 Summary and open research questions

This paper provides an overview of the existing research on skill variety in entrepreneurship. The concept of skill variety has first been brought up by Lazear in 2003. The focus of most of the studies since Lazear's pivotal study lies on the outcomes of skill variety. It is understandable that studies seek to investigate the outcomes of a new concept first, followed by an analysis of the determinants afterwards. Research on skill variety is still in its infancy. Even though skill variety is a promising concept in entrepreneurship research, especially with regard to entrepreneurial choice, few studies have focused on determinants of skill variety. In the following, the central results of this review are summarized and a number of open research questions are derived (based on the structure of this review: outcomes of skill variety, determinants of skill variety, gender and skill variety and measurement of skill variety).

Entrepreneurial choice was identified to be a central outcome of skill variety. Most studies under review find skill variety to be an important driver of the entrepreneurial choice over different countries. This is true for profit and non-profit entrepreneurship (Cho and Orazem, 2014) as well as single and co-founders (Spiegel et al., 2013). Further, skill variety is important for entrepreneurial intentions, often a precursor of the entrepreneurial choice. Entrepreneurial intentions of both students and employees are predicted by skill variety (e.g. Obschonka et al., 2017; Hyttinen and Ilmakunna, 2007a, 2007b).

Entrepreneurial success has been identified as another outcome of skill variety. Entrepreneurial success can be accounted for in different ways (e.g. firm growth, income, firm survival or innovativeness). Results on the impact of skill variety on entrepreneurial success are mixed. Skill variety seems to play a negative role for success factors, such as income or firm survival (e.g. Åstebro and Thompson, 2011), or the relationship could be U-shaped (Spanjer and Van Witteloostuijn, 2017). This means skill variety is only conducive to entrepreneurial success from a certain threshold onwards. Other success measures, such as innovativeness (Åstebro and Yong, 2016), progress within a venture (Stuetzer et al., 2012) or entrepreneurial

competencies (Stuetzer et al., 2013a) are strongly positively correlated with skill variety. Given the mixed effects of skill variety on entrepreneurial success in terms of income and growth, the question naturally arises whether the effects of skill variety differ between different types of entrepreneurship. For example, the effect might be stronger for high-tech versus low-tech or innovative versus non-innovative entrepreneurship (Block et al., 2017). The effect might also be stronger for opportunity- versus necessity-driven entrepreneurship (Block et al., 2015). This is because one arguably needs more skills for more complex and more ambitious entrepreneurial projects. There is only very scant evidence on these topics. Wagner (2005a) found that skill variety matters for both, opportunity- and necessity-driven entrepreneurship, but clearly more research is warranted here.

The results on skill variety and its relation to success measures should also be considered with a look on potential determinants. As theorized by Lazear (2003), skill variety can be acquired intentionally for the purpose of income maximization. This obviously clashes with the results discussed above on skill variety and success measures. But research conducted by Silva (2007) or Åstebro and Thompson (2011) questions this intentionality and presents evidence that the acquisition of skill variety might be more dependent on endowments, such as an entrepreneurial talent or a taste for variety. If indeed, individuals acquire skill variety for the sake of satisfying their taste for variety and subsequently choose entrepreneurship as a profession for the same reason, it is understandable that such individuals are less successful entrepreneurs on average. This is especially true for financial success measures. In other words, if someone pursues entrepreneurship or other jobs with high skill variety because of a taste for variety, this person might accept lower earnings in exchange for non-financial gains such as fulfillment of his or her life plan.

It thus seems to be of the highest priority to understand how and why individuals acquire skill variety. Equipped with knowledge on the determinants of skill variety and the underlying intentions to acquire skill variety, entrepreneurship research can gain a better understanding of the appropriateness of using specific indicators of entrepreneurial success. A word of caution, though; it might prove difficult to truly disentangle the investment and the endowment driven acquisition of skill variety. Any investment-driven decision to acquire skills to start a venture might be based on certain endowments that gives the individual an initial edge or makes this investment behavior more likely. For example, assume an individual who switches jobs a couple of times in order to prepare for starting a business. This investment decision might be traced back to some endowed personality characteristics such as the Big Five trait openness. Openness is a general appreciation for variety of experience which makes it more likely an individual switches jobs. In sum, behind any investment decision might stand an endowment. Twin studies might be the method of choice to disentangle investment and endowment or at least control away endowment to focus on investment.

Related to the argument above, another important research area might be to explore at what point in time individuals start to acquire skill variety. Most studies measure skill variety at some point in adult life, which is reasonable because task-related human capital, especially skill variety, can be best acquired at work. However, a few studies showed that a varied university curriculum also predicts entrepreneurship (e.g. Lazear, 2005). Even fewer studies find that factors in adolescence (e.g., Obschonka et al., 2017 and Stuetzer et al., 2013b) either are correlated with subsequent skill variety or entrepreneurial outcomes. Correlations with early factors in adolescence should however be expected, if one accepts that certain endowments, as argued for example by Åstebro and Thompson (2011) and Silva (2007), are important drivers of the acquisitions of skill variety. Given these scant findings, there is a research gap on when the skill accumulation process starts and which factors influence early precursors of later skill variety. This research gap is surprising because it is well-known that skill acquisition is a cumulative

process, building on knowledge acquired in earlier stages of life (Cunha and Heckman, 2007). For this reason and for the reason of understanding how policy-makers and entrepreneurship educators can foster skill variety, it is necessary to explore the role of endowments (e.g. personality factors or entrepreneurial peers) in the process of skill acquisition in adolescence.

A substantial gender gap in entrepreneurship can be observed both in regard to entrepreneurial choice (Kelley et al., 2015) and success (e.g. Wagner, 2007). Scholars have investigated different potential explanations or mediators for the gender gap in entrepreneurship. Disadvantages in raising financial capital (e.g. Verheul and Thurik, 2001), personality differences (e.g. Obschonka et al., 2014) and differences in social networks (e.g. Klyver, 2011) have been analyzed recently. So far, there is no clear evidence from a human capital perspective on the gender gap (Cowling and Taylor, 2001). Studies analyzing the outcomes and determinants of skill variety report negative correlations of being female with different skill variety measures. Still, the effect of skill variety on entrepreneurial outcomes seems to be robust for both sexes (e.g. Tegtmeier et al., 2016). Beyond that, there are a few studies investigating skill variety as a mediator for the gender gap in German entrepreneurship (e.g. Tonoyan et al., 2009; Wagner, 2007). The studies conducted so far show mixed evidence. Thus, further studies should be carried out to explore the mediating role of skill variety in entrepreneurship in different country settings. A related research question should be raised on differences in skill variety measures over the educational trajectory. It is theoretically plausible that women have less work-related skill variety (e.g. due to discrimination in the labor market). But, as mentioned above, skill acquisition is a cumulative process, building on knowledge acquired early in life (Cunha and Heckman, 2007). Thus, it should be also explored, if there are gender differences in (early) educational skill variety measures.

Regarding the operationalization of skill variety, most studies conducted so far use work-related proxies as a measurement for skill variety (e.g. number of job roles held, number

of industries worked in and number of professional degrees). Some studies use variety measures over different (entrepreneurship-) specific skills (e.g. Tegtmeier et al., 2016). This makes it difficult to compare the results of the different studies. Further, human capital consists of skill and knowledge acquired through schooling or on the job training (Becker, 1964). It thus seems to be important to expand the current work focus of this literature stream to an education view. More education-related measures of skill variety should be combined with work-related measures. If studies use outcomes of human capital (direct measurement), there is no consensus on which skills should be taken into account. Some studies use entrepreneurial competencies (e.g. Obschonka et al., 2017; Tegtmeier et al., 2016) while others use general abilities (e.g. Bublitz and Noseleit, 2014).

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