Eva Vriens

MUTUALISM

in the 21st century

The why, when, and how behind successful risk-sharing institutions

MUTUALISM IN THE 21ST CENTURY

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Eva Vriens

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Mutualism in the 21st century: The why, when, and how behind successful risk-sharing institutions
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Mutualism in the 21st century

The why, when, and how behind successful risk-sharing institutions

Schenkkringen in de 21e eeuw

Waarom, wanneer en hoe instituties om risico's te delen succesvol zijn

(met een samenvatting in het Nederlands)

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CHAPTER 1

Synthesis

1.1 Background

1.1.1 The revival of collective action

Over the past 15 years, many European countries have witnessed a revival of bottom-up movements and organizations. This revival is in part a response to the neoliberal ideologies that influenced policy-making in most of Europe since the end of the 20th century (Natalier & Willis, 2008). While governments were decentralizing and transferring more services to the private sector, collective action was reinvented in many local communities (Ilcan & Basok, 2004). Citizens grew increasingly dissatisfied with the access to (and quality of) goods and services and started taking matters into their own hands to address local problems (De Moor, 2015). The development was modest at first, but since about five years the presence of new, cooperatively organized organizations has become impossible to ignore in most sectors.

All over Europe, energy cooperatives have been founded for the production of sustainable energy through joint investments in windmills or solar panels (Klagge & Meister, 2018; Yildiz et al., 2015). Many care cooperatives emerged, ranging from elderly care to cooperative daycare centers for children, particularly in less populated areas (where demand does not meet the criteria to be attractive to market parties; Boumans & Swinkels, 2015). New food and agriculture cooperatives aim to shorten the chain from farm to fork, to reduce the global ecological footprint, increase food quality, and ascertain better price control (Gómez Mestres & Lien, 2017). Finally, and the focus of this dissertation, new insurance organizations that reintroduce subdivision of policyholders in small risk-sharing groups have emerged out of dissatisfaction with the costs, organization, and accessibility of insurance and welfare benefits (Abdikerimova & Feng, 2019; Van Leeuwen, 2016).

These citizen collectives share a dissatisfaction with the system at large, be it from public or private provisions. The government no longer does what its citizens expect it to do (Tjeenk Willink, 2018) and the new collectives believe that a simpler, local solution could yield better results (Putters, 2018). In some cases, like in the health and the insurance sector, the organizations arise because (good) alternatives are lacking (i.e., out of direct need). A declining welfare state means for certain groups or in certain regions a lack of access to public services. Where the market does not meet local demand, bottom-up initiatives emerge to fill the gap. For others, such as the bottom-up organizations in the energy and the food sector, the emergence is more aptly explained as seizing opportunities that come with, for example, new technologies that allow to localize production (De Moor, 2015). The initiators saw room for improvement (a growing demand for clean energy or for farming with a lower carbon footprint) and decided to seize technological and often also financial opportunities. Despite this initial difference, however, the new institutions for collective action generally claim to have in common a focus on creating societal added

value (De Moor, forthcoming). Not mere energy production, but renewable energy; no profit-based retirement homes, but community-driven care; no intensive farming for international export, but local short-chain production for local consumers; and no anonymous insurance, but a fair, solidarity-based system.

Together, these institutions for collective action have become part of a societal movement of rethinking the provision of goods and services, not as one-off initiatives but as ambitious organizations that are here for the long haul. They formalized their institutional framework, legally organized in cooperatives or associations, while mostly maintaining a small, local character. To benefit from scale, like when lobbying for their common cause, they rather organize in bigger umbrella organizations[1] than they would make concessions on the benefits of their small-scale, local governance model. That is, mergers or fusions of collectives that span multiple communities or villages—often applied by institutions for collective action in the 19th and 20th century (see, e.g., Rabobank; De Moor, 2013; Groeneveld, 2016)—are (for now) less common in this recent revival of institutionalized collective action (Dedeurwaerdere, Polard, & Melindi-Ghidi, 2015; Monteiro & Stewart, 2015).

To benefit from their local or small-scale organization, many collectives ask active involvement in decision-making from their members (e.g., in board functions or by attending general assemblies) and often to some extent fulfill secondary (social) functions as well. Hence, the organizations prosper or fail depending on the commitment of their members. This, in turn, revives the importance of age-old scientific questions about how to organize successful cooperation, particularly related to questions of resilience and future member commitment (Ubels, 2020).

This dissertation focuses on participation in risk-sharing institutions, or more specifically mutual insurance associations (mutuals). Before discussing in more detail the what, why, and how of our own research, this chapter provides a more in-depth introduction to mutuals as risk-sharing groups. We situate the movement historically as well as within the current demographic, governmental, and insurance landscape. Subsequently, we present our research aims and questions, the theories and methods used, and the main results summarized per chapter. We end this first chapter with an overarching conclusion and a discussion of policy implications.

1.1.2 Building on historical patterns

The recent revival of institutions for collective action receives a lot of attention in the media. In Dutch newspapers, for instance, the number of articles mentioning citizen collectives (or rather: initiatives)[2] has increased rapidly over the last decade

[1] See, e.g., the Dutch network 'Nederland Zorgt Voor Elkaar' (https://www.nlzorgtvoorelkaar.nl) for care coops or the European ReSCOOP (https://www.rescoop.eu/) for energy coops.

[2] The overwhelming majority of media coverage describes these organizations as citizen initiatives. We prefer the term collectives because it implies a more established, less provisional structure that better fits the organizations' ambitions.

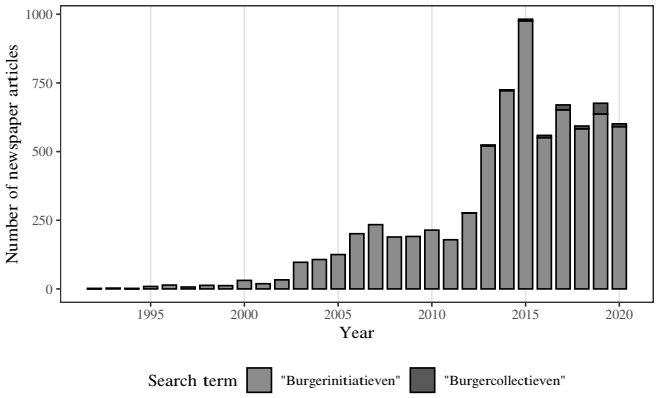


Figure 1.1. Number of Dutch newspaper articles about "burgerinitiatieven" and "burgercollectieven" per year as catalogued in the LexisNexis database, January 1992–September 2020

(Figure 1.1). While the media often describe these institutions as unique in this time, within the larger history this way of organizing goods and services is far from novel. Throughout history, developments often seem to reiterate and accelerate, and the emergence and decline of institutions for collective action are no exception. Over time, three broad waves can be distinguished in which bottom-up collective action and self-organization have been prevalent (De Moor, forthcoming). The earliest examples can often be attributed to early modern times (1500 – 1800). "Commons" (institutions for collective action primarily focusing on land use and management), for instance, provided cooperating farmers benefits of scale, allowing for a development towards more intensive agriculture (Hoppenbrouwers, 2002). In cities, a similar collective organization occurred in guilds, where craftsmen (generally of the same profession) helped each other professionally and set up a first mutual insurance system, where members of the guild would support each other in times of need, such as for fire or funerals (Epstein & Prak, 2008). Within these collective institutions, the members jointly decided on rules and organizational structures. This way, membership of a common or guild required active involvement and commitment, which decreased misuse of the collective benefits (De Moor, 2015).

These collective institutions formed the main way of organizing for several centuries until by the end of the 18th century, guilds were formally abolished. As liberalism became more entrenched in national policies, the cooperation among craftsmen in guilds was argued to lead to intolerably high wage costs and prices (Van Leeuwen, 2016). However, collective action did not leave the scene for long. Early in the 19th century, cooperatives and mutual insurance organizations were established to provide services that were not adequately provided otherwise. Because governmental poverty support remained limited, for instance, mutual insurance associations (mutu-

als) served to create a financial safety net, be it to cover life risks (e.g., health, funeral) or non-life risks (e.g., fire, agriculture; Van Leeuwen, 2000). The main difference with the guilds from the first wave of institutionalized collective action was the shift from multi-purpose to single-purpose organizations. The institutions were successful and grew in popularity quickly, until in the 20th century criticism grew that they were not inclusive enough (Downing, 2012; Harris, 2012). With respect to mutuals, in particular, the public debate favored the idea that financial support should be available for everyone, not only for the people that were invited to enter the mutuals.

As such, the 19th century mutuals laid the foundations for the welfare state currently in place in many European countries (Beito, 2000; De Swaan, 2004). During the second half of the 20th century, many mutuals (particularly those covering life risks) were dissolved as their tasks were taken over by national welfare states. Others seized operations in competition with rising private insurance companies. The minority that did manage to survive merged and professionalized into large mutual insurance companies in order to compete with the newly emerging private insurance companies (Emery & Emery, 1999; Van Leeuwen, 2016). This brought an end to the second wave of institutionalized collective action—for mutuals and for other cooperatives and collective action initiatives in general.[3]

1.1.3 The revival of mutualism

Risk-sharing has been around for so long (Platteau, 1997) and mutuals have had such key roles within the earlier collective action waves (De Moor, forthcoming) that it comes as no surprise that, along with the rise of cooperatives, mutualism and risk-sharing are likewise reviving. Examples are, for instance, Friendsurance in Germany, Axieme in Italy, or Broodfonds in the Netherlands.[4] These new organizations have emerged in reaction to increased privatization, declining welfare states, and exclusion from both public and private insurance benefits (Natalier & Willis, 2008).

In many countries, globalization and changing demographic profiles have resulted in new (or growing) population groups that are excluded from welfare benefits (Taylor-Gooby, 2006). When the access to benefits is restricted by citizenship, for instance, (labor) migrants may be excluded from, e.g., unemployment benefits (Baldini, Gallo, Reverberi, & Trapani, 2016; Lehtonen & Liukko, 2015). Alternatively, welfare states transferred the provision of certain benefits to private market parties. This is true in many countries for self-employed workers. Whereas salaried employees have access to retirement and disability benefits through taxes on incomes, self-employed workers

[3]Mutual-type solidarity networks have never disappeared in rural areas of many Asian, African, and Latin-American countries. In these areas, where formal insurance systems are often lacking, communities share risk in intergenerational support networks (Fafchamps, 1992). Given our focus on groups that respond particularly to failures of other insurance structures, these intergenerational support groups are not the focus of this dissertation.

[4]See, for more information, the websites of these organizations https://www.friendsurance.de, https://www.axieme.com, and https://www.broodfonds.nl.

either have to rely on their own savings or have to resort to (more expensive) private insurance companies (Van der Linden, 2008).

In many countries new organizations have been established (not always successful) that aim to fill this gap. This revival is so recent that many of them still seem to be experimenting with, and searching for, the best modes of operation. While most new organizations explicitly state taking their 19th century predecessors as inspiration (see Chapter 2 for examples), they prefer to not use the name mutuals or mutual insurance organizations. The main reason for not doing so may be that the connotation of mutual insurance today differs from its historic meaning. Nowadays, when we think of mutual insurance, it is usually the large not-for-profit insurance companies (such as the US-based Liberty Mutual Group or the Dutch Achmea) that come to mind (De Swaan & Van der Linden, 2006).

While most of these companies started out as small mutual insurance associations in the 19th century, the only aspect that survived years of marketing, professionalization, and competition is the formal ownership of members—meaning that any profit made should either be paid to them or put back into the company (Lehtonen & Liukko, 2015).[5] Even regarding ownership, however, the actual voice members have in organizational matters has decreased to such a degree that it has become largely void of meaning (Chaddad & Iliopoulos, 2013). Moreover, as price competition drove the companies to pool all members in a single, large risk-sharing group, the role of solidarity has gradually disappeared from the mutuals' collective memory.

The new insurance organizations are not inspired by present mutual insurance companies, but a comparison of their mission statements reveals that they are mainly interested in copying the ideas of solidarity, transparency, and fairness from their 19th century counterparts. They want their members (or policyholders) to join a risk-sharing (sub)group that does not only provide them an individual safety net, but where members actively and directly support each other; they want to operate the organization with a clear, minimum set of rules; and they believe that—when not all premiums were needed to pay out insurance claims—at least some of it should be returned to the members, rather than go to the profit of anonymous shareholders.[6]

Ownership, on the other hand, is no longer an explicit goal of the new insurance organizations. In fact, in conversations and interviews held with people of some of these new organizations not uncommonly formal ownership was said to be largely meaningless and mostly a hindrance to efficient organization. While they often do give members the freedom to set local rules within the risk-sharing group, they do not provide ownership of the organization as a whole. These differences make that

[5]This in contrast to stock insurance companies, which are co-owned by external shareholders who enjoy dividend income based on corporate profits.

[6]Some other (new) insurance companies have implemented similar reward systems. InShared, for instance, a non-life insurance organization that was established in 2009 and is part of the Dutch mutual insurance company Achmea, also rewards its policyholders by returning part of the premium if money is leftover at the end of the year.

the new insurance organizations do not consider themselves mutuals, but rather use terms like Peer-to-Peer (P2P) insurance or Crowdsurance.

Despite starting from the same principles, the organizations differ substantially in set-up. The German Friendsurance, for instance, is formally registered as an insurance broker,[7] whereas the Dutch Broodfonds groups are formally registered as associations,[8] where members help each other out with 'endowments' rather than 'insurances'. This translates into many variations related to the organization and rules, the type of coverage, and the type and number of members. However, in all organizations the interdependencies between members introduce alternative factors driving the decision to participate. The goal of this dissertation research has been to study which factors enhance successful participation in mutuals, or risk-sharing groups in general.

1.2 Research aim and focus

1.2.1 Participation in mutuals: A social dilemma

Participation in mutuals, or risk-sharing groups more generally, is often approached from the perspective of a social dilemma (Fafchamps, 1992). A social dilemma takes place in a situation with strategically interdependent actors where at least some actors are tempted by individual opportunities and incentives to abstain from cooperation (i.e., to defect), while compared to the cooperative outcome this makes all actors (including the defecting actors) worse off (Olson, 1965). In the most basic, abstract setting social dilemmas can be solved through repetition. That is, in repeated settings the short-term benefits of defection might no longer outweigh the long-term benefits of cooperation. While defecting may yield the best outcome now, not being able to cooperate in the future would make the overall outcome worse (Raub, Buskens, & Corten, 2014).

Within mutuals, the social dilemma concerns the strategically interdependent decision to share risks (Coate & Ravallion, 1993). In many ways (and despite repetition), this particular social dilemma situation may be more difficult to solve than that of a classic public good situation. Compare, for instance, self-organization in mutuals to self-organization in energy cooperatives. In energy cooperatives, the decision may concern whether or not to invest in windmills. A windmill is too costly for any individual alone, so people need to cooperate to obtain the collective good (i.e., the windmill and the clean energy it produces). While energy could be obtained individually through traditional energy providers elsewhere, after an initial—more costly and more uncertain—investment, participation in the energy cooperative yields the

[7] See https://www.friendsurance.de/erstinformationen.

[8] See https://www.broodfonds.nl/meest_gestelde_vragen?hoe_zit_een_broodfonds_juridisch_in_elkaar.

benefits of local and sustainable energy, often ultimately for a lower price and with (some extent of) personal control (Bauwens, 2019).

In the basic sense the same holds with respect to mutual insurance. Everyone could save individually to create a safety net for illness, or (in many cases) they could opt for an insurance with a private insurance company, but both solutions are more costly than saving collectively. So in terms of *expected* benefits, everyone is better of in the mutual than in another arrangement. The crucial difference, however, is that the *actual* benefit—obtained for everyone and almost immediately in energy cooperatives—is obtained individually in a risk-sharing group, namely only by the person(s) in need. When you decide to participate, you do not (yet) know whether you will ever receive the benefit. In fact, in the best-case scenario you never do (Platteau, 1997). Strictly speaking, that means that in the best-case scenario the *actual* costs do outweigh the benefits. Or, in other words, had you known in advance that you would not need to rely on the safety net, you would not have participated. Hence, risk-sharing groups are a type of social dilemma under uncertainty: Participants do not know if and when they will reap the benefits of participation.

This makes for a more fragile balance between the long-term benefit of cooperation (participation) and the short-term benefit of defection (withdrawal), particularly when one or several other members do need support in the short-term and you have to pay them (Fafchamps, 1992). After all, you never know in advance for how many people you'll have to pay the support (simultaneously) and whether they remain a member to pay the costs to support others (in case they end up depending on it). The longer the time window between contributing and receiving, the higher the uncertainty, and the more trust in other group members is needed for participation to succeed.

1.2.2 Moral hazard and adverse selection

Because of this added source of uncertainty, when it comes to risk-sharing the issues of 'defecting' (withdrawal) and 'free-riding' (making use of the contributions of others) are usually discussed as pertaining to moral hazard and adverse selection. Moral hazard is the phenomenon where insured people start to engage in more risky behavior or decrease loss prevention (*ex ante* moral hazard; Arrow, 1971) or file exaggerated or even fraudulent insurance claims (*ex post* moral hazard; Adams, Andersson, Jia, & Lindmark, 2011) in order to earn back their investment. In mutuals, it is essentially a way to free-ride on the contributions of others (Fehr & Schmidt, 1999).

However, compared to a regular insurance system, such fraudulent behavior is generally argued to be lower in mutuals, precisely because of the organization in smaller risk-sharing groups (Adams et al., 2011; Harris, 2012). Subdividing members in small risk-sharing groups is thought to bring about social control as well as norms of fairness and solidarity that prevent people from misusing the collective fund (Van

Leeuwen, 2016). Policyholders with a regular insurance company normally do not think about the fact that their premiums are pooled with those of others. They think of their premiums as a payment to the company rather than a payment to the insurance of other policyholders. In small risk-sharing groups, on the other hand, all members are informed when money is requested from the fund. Within small groups, solidarity motives not only make people willing to pay the costs to support others, but misuse also means directly taking money away from other persons. Hence, guilt will be more important in preventing moral hazard (Emery & Emery, 1999).

Subsequently, adverse selection is a tendency of attracting an above-average number of high-risk members (Akerlof, 1970). This is not just a problem for small risk-sharing groups or mutual insurance groups. With any insurance low-risk people are less likely to take out an insurance policy. However, despite the many benefits of using small risk-sharing groups, pooling all policyholders in one big group helps insurance companies to overcome the problems associated with adverse selection and spread potential risks. The bigger the risk-sharing group, the less problematic high-risk outliers will be. Insurance requests are smoothed, do not vary as much from one month to the next, and the big insurance fund is (mostly) sufficient to cover all requests.

As such, while there is broad agreement that mutuals can lower moral hazard concerns, their survival may be at risk in the face of adverse selection. Hence, throughout this dissertation, when we study factors that enhance success, the underlying mechanisms often relate to moral hazard, adverse selection, or both.

1.2.3 Defining success

Broadly speaking, the aim of this dissertation research is to understand success in mutuals. Then again, there are myriad ways to define success. The fact that mutuals are established means that people chose to participate, which could be considered a success. Yet, generally speaking, cooperation (or collective action) is considered successful when people continue to participate. In a way, this makes every phase in-between resemble current success only, without guarantee for the future. After all, where once membership of an association was part of one's religious or societal position and thus generally accepted as a lifelong engagement (De Moor, 2013), membership today is more like a trade arrangement. People join (and invest money, time or effort) because the association offers an interesting benefit. But this decision is not self-evident and is repeatedly reevaluated—other options exist that might become more attractive over time (Van den Berg & Hart, 2008). We will therefore focus on success as continued participation in two ways: participation over time up until the point of measurement and people's tendency to, *ceteris paribus*, continue to do so in the future.

In unravelling success factors, we recognize causal heterogeneity (Poteete, Janssen, & Ostrom, 2010), meaning there is more than one route to the same outcome. The

problem of participation is complex and diverse and there is a multitude of (combinations of) factors that explain the outcome. Our approach will be to take a multilevel perspective on success and consider strengths and potential pitfalls on three aspects: that of the institution, the (social) group, and the individuals.

As we narrow our definition of success, it is important to acknowledge which discussions of success fall beyond the scope of dissertation. Primarily, we focus only on participation *within* the risk-sharing groups. Hence, we do not discuss success in terms of benchmark comparisons to how many members there are in total, how big the movement is, how big it should be, or whether it properly serves the causes it was initially set up for. Moreover, while we discuss the emergence of the movement, our research does not serve investigations into whether it is the best solution to the insurance problem (compared to state or market insurance).

Hence, in the remainder of this dissertation, when we talk about micro-level factors we talk about the members, the individuals within the risk-sharing groups. When we talk about the macro-level factors, we refer to the macro-level *in this study*, i.e. the mutuals themselves: the (social) group of members and their institutional structure.

1.2.4 Central research questions

As previously indicated, we focus on factors that explain successful participation in mutuals on the institutional, social, and individual level. Here, we can build on a long research tradition where collective action scholars have aimed to disentangle factors that promote cooperation in all types of social dilemmas. Using experimental studies, these factors were manipulated and isolated to derive causal explanations. With respect to individual factors, experiments on collective goods have often shown that predictions of conventional theories on collective action, which assume rational, self-regarding behavior (Olson, 1965), are often not confirmed. More cooperation occurs than predicted (Chaudhuri, 2011; Ledyard, 1995), implying that not all participants act based on self-regarding motives (Bowles & Gintis, 2002; Bowles, 2008).

Socially, literature from various disciplines shows that communication enables participants to overcome distribution problems (Ahn, Ostrom, & Walker, 2007; Bochet, Page, & Putterman, 2006; Rand, Dreber, Ellingsen, Fudenberg, & Nowak, 2009; Sally, 1995). Moreover, several studies indicate that the more cohesive the group structure, the more successful the cooperative effort (Carpenter, 2007; Cavalcanti, Engel, & Leibbrandt, 2013). They are reinforced in their trust in the other participants' commitment, which strengthens their own belief in the project (Baggio, Rollins, Pérez, & Janssen, 2015; Kollock, 1994; Mulder, Van Dijk, De Cremer, & Wilke, 2006). Institutionally, norms (Fehr & Gächter, 2000; Ostrom, 2000), rules (Ostrom, Gardner, & Walker, 1994; Poteete & Ostrom, 2004), and sanctions (Van Miltenburg, 2015) have been found to promote cooperative behavior.

None of these factors ensure cooperation in all instances, though. Results from

field and laboratory experiments reveal that cooperative behavior strongly depends on small context-related cues (Keizer, Lindenberg, & Steg, 2008) and tendencies to cooperate differ substantially between settings (Liberman, Samuels, & Ross, 2004). In other words, to understand the success or failure of cooperative efforts, one cannot consider contextual factors in isolation, but should consider the interplay between individual, social, and institutional factors using an integrated approach. After all, if we are interested in understanding individual factors that motivate people to participate in mutuals, we need to consider individual behavior within a contextualized setting of rules and social relations—recognizing that this context may influence the type of motivations present. Likewise, characteristics of the individuals and the relations between them may drive the type of rules needed or implemented. Thus, we extend earlier research by studying several key individual, social, and institutional factors in combination.

Throughout this dissertation, each chapter takes one of these factors as starting point, albeit never in isolation. Every sub-study includes explanatory factors related to other aspects as well, thereby providing a test of participation in context. In general, the chapters focus specifically on one of the following questions: *1) What institutional frameworks are designed to make participation work in new mutuals and how likely is it (based on historical examples) that these will succeed? 2) How important are social components of membership in people's decision to continue to participate? And 3) which individual motivations drive people to continue participation despite risk heterogeneity?*

1.3 A deductive theoretical approach

To answer the research questions we rely on two main theoretical approaches. On the macro-level, we apply the three-dimensional framework of resilience in institutions for collective action (De Moor, 2015) to the setting of mutuals and compare organizations with respect to characteristics of the institution, resource, and members. On the micro-level and for the links between micro and macro, we rely on the analytical sociology framework (Coleman, 1990; Hedström, 2005). Building on a game-theoretically inspired micro model, we use computer simulations to derive and hypothesize on micro-to-macro links.

1.3.1 Macro model

On the macro-level, we need to categorize the main organizational features of the different new mutual groups to be able to hypothesize on their probable future trajectories. The three-dimensional framework of De Moor (2015) provides a way to categorize collective action organizations and aims to uncover and analyze the factors that determine resilience. It proposes that three dimensions should be taken into

account: the institution, the resource(s), and the members.

The institution is the set of rules that shapes the organization; the resource, in this case, refers to the common fund that is created to support group members; and the members are all those that chose to enter the risk-sharing group. The theory poses that long-term resilience can result only from a proper balance between institution, resource, and member-characteristics. This is due to the inherent links between the three categories. For instance, characteristics regarding the degree of member involvement in the drafting of rules (i.e., institution to member) affect how the institution and resource will be structured (member to institution and member to resource). And characteristics of the institution and resource determine what type of members are willing to join (institution and resource to member).

The three-dimensional model captures these and many other interrelations between the institution, resource, and members with reference to how the three aspects balance jointly in terms of efficiency (balance between institution and resource), utility (balance between resource and member), and equity (balance between member and institution). Based on this framework, we categorize various new mutuals and hypothesize on their future successes and limitations.

While the framework has been successfully applied to many historical commons, we enrich the theory in two ways: by extending its application to mutuals and by providing a method to structurally assess shifts in the balance between the three dimensions. The categorization of mutuals with respect to different balance shifts enables the derivation of hypotheses about their projected future development paths. However, it should be acknowledged that because these hypotheses are posed on the macro-level, they lack clear empirical testability. For these macro-level patterns, too many intertwined factors are at stake. Hence, the role of the theory should be seen rather as providing a way to identify, describe and categorize the main relevant factors.

1.3.2 Micro model and macro-to-micro links

On the micro-level, we need a theoretical framework to identify mechanisms underlying participation. For this purpose, we rely on a game-theoretically inspired micro model with "thick" rationality assumptions (Coleman, 1990). Rational choice theory is used to explain actions that are suitable for the realization of specific goals, given the limitations imposed by the situation. Strict neoclassical rational choice theory is highly criticized for putting too much emphasis on cost-benefit calculations, for imposing a too high cognitive burden on the actors, and for neglecting social structures. To counter these problems, thick sociological rational choice explanations pose different assumptions on the type of rationality, preferences, and context assumptions (Wittek, 2013).

Rather than assuming full rationality, thick rational choice imposes bounded rationality constraints. This means that actors do not take into account all actions

and all possible outcomes but base themselves on a smaller information set to reduce the cognitive burden. Given this information set, they make the choice that is most likely to help them reach their goal (Camerer, 2003). In terms of preferences, thick rational choice makes room for non-selfish motivations. Finally, instead of focusing on methodological individualism explanations, thick rationality explains behavior within wider social structures (Granovetter, 1985).

The notion of applying social structures and social preferences to social dilemmas in general is not new. However, within formal models of participation in risk-sharing groups such discussions are largely missing. We therefore introduce social structures and preferences to explain how participation can be sustained. First, we theorize how social structures—by embedding the participant as decision-maker within the risk-sharing group (Coleman, 1990; Downing, 2012)—increase not only their commitment to (honest) participation, but trust in the commitment of others as well (Kollock, 1994; Ostrom, 2010). As such, we include macro-to-micro links to the decision-making model (Hedström, 2005).

We introduce social preferences to get rid of the simplifying assumption of risk homogeneity that most (strict rational choice) risk-sharing models apply. Following strict rational choice assumptions, actors would never participate in a risk-sharing group knowing their personal risk to be below the group's average (Coate & Ravallion, 1993; Ligon, Thomas, & Worrall, 2002). They would pay more to support others than they receive help in return, which ultimately makes participation more costly (i.e., the problem of adverse selection). However, risk-sharing groups in practice are never fully homogeneous. Still there are numerous examples of successful risk-sharing institutions. How do they manage to generate stable, resilient participation patterns despite heterogeneity? We theorize on participation in heterogeneous risk-sharing groups based on micro-level motivations of risk aversion (Akerlof, 1970) and solidarity (Fehr & Schmidt, 1999).

While risk aversion is commonly applied to risk-sharing models, by including solidarity we extended existing micro-level theoretical models on risk-sharing such that participation can be explained under heterogeneity as well. It should be acknowledged, though, that while thick rationality assumptions broaden the application of rational choice theory to a wider set of contexts, the effects of social preferences are more difficult to quantify. The distinction between classical *homo economicus* explanations and social preferences remains largely qualitative.

1.3.3 Micro-to-macro links

The aggregate outcomes of micro-level behavior are far from evident due to the many interdependencies between people (Coleman, 1987; Hedström, 2005). While people might be willing to participate in one setting, if something changes (e.g., in the context of risk-sharing when suddenly more people request support from the common fund or

when other people decide to withdraw), the utility of participation might change and fall below the threshold for the focal actor as well. In other words, the global patterns of interest are more than the aggregation of individual attributes (Macy & Willer, 2002). Agent-based simulations provide a solution here. Through simulations, we can derive the micro-macro links and understand macro-level outcomes and the feedback processes that generate them (Bianchi & Squazzoni, 2015). That is, we study under which conditions risk-sharing arrangements are resilient and when are they subject to withdrawal cascades.

Simulations were used to simulate decision-making by agent populations in an interdependent setting. The aim was to increase our understanding of the dynamics underlying a formal theoretical model and to derive testable hypotheses about the interdependent circumstances of how people influence each other's decisions to continue membership of a mutual. That is, while formal analysis of the model yields insight into general effects, the simulations made it possible to see how behavior of agents changes over time as a result of new events (such as other agents dropping out). Moreover, the artificial agent-based setting makes it possible to test dynamics for very large populations and very large time periods—dynamics that are difficult (if not impossible) to mimic with real subjects. Clearly, the departure from general effects, while allowing increased complexity, is at the same time a pitfall as well. The resulting predictions are only valid within the tested parameter space, which, compared to an analytical model, makes the predictions less generalizable.

1.4 A multi-method empirical approach

Most field-based research on institutions for collective action still relies on case studies and small-N comparisons (Poteete et al., 2010). This is surprising given the broad, multidisciplinary interest in identifying conditions that influence collective action. If we want to get a better grip onto the combinations of these factors that are robust in explaining participation in various contexts, we need to use multiple methods. After all, each method has its strengths and weaknesses. By combining methods, they can complement each other by compensating for the other method's limitations. If comparable results are found through multiple methods this increases robustness, validity, and reliability (Buskens & Raub, 2008).

Moreover, given the goal of disentangling success from a multilevel perspective (i.e., from characteristics, of the institution, the social group, and the individual), we have to resort to different methods depending on the sub-question asked. Therefore, we opted for three different methods, of which one is exploratory and the other two are explanatory. The purpose of the exploratory method (a qualitative review) was to further develop macro-level regularities. Building onto an existing model, the exploratory techniques helped to categorize and isolate the main relevant factors and refine theoretical reasoning. The method was applied with the goal of generating

hypotheses rather than testing them. The explanatory methods (a survey and an experiment), on the other hand, served to put the derived theories and hypotheses to test.

Below each of the methods is introduced by reference to what purpose it served, how it was conducted, and what its main strengths and limitations were. With this wide combination of methods, both based on abstract models and context-specific experiences, on highlighting potentially relevant factors and deducing statistical relations, on maximizing external as well as internal validity, we can join the different pieces of evidence. If, through the various methods, we find complementing results, we can—with more certainty—uncover the mechanisms behind the success of mutuals (Buskens, 2014).

1.4.1 A qualitative review

A qualitative review was used to compare the institutional frameworks of various new mutual insurance or Peer-to-Peer insurance organizations, with the aim of highlighting their key focus and hypothesize on what certain institutional choices imply for their future development. Between October 2018 and January 2019, we made an inventory of new insurance initiatives worldwide that made use of risk-sharing groups by looking for mentions in blogs, news reports, and/or on social media (Twitter, Facebook, and LinkedIn). This resulted in a database of 57 active and inactive insurance initiatives founded between 2006–2018, of which the majority (39) was founded in 2015 or later. Of the 57 organizations we selected 11 for a more thorough review, mostly because these were the organizations with sufficient information available on their websites, in annual reports, and through contact with a representative of the organization.

Several key dimensions of the institution (e.g., legal structure, decision-making structure), the resource (e.g., whether or not risk differentiation was applied, whether the organization used reinsurance), and the members (e.g., if and how communication was organized, whether groups were formed endogenously) were selected to compare the 11 insurance organizations. This information was used to search for broader categories overarching these organizations based on key similarities and differences. That is, by comparing characteristics of the three different dimensions, we could disentangle which goals and developments were given priority, what that meant for their current strengths and weaknesses and, broadly speaking, for their probable future development paths.

While the method proved useful to gain broad insights into similarities and differences across groups, its exploratory nature meant we could only derive predictions about what the differences ultimately imply. Further empirical testing is needed to support the derived theory.

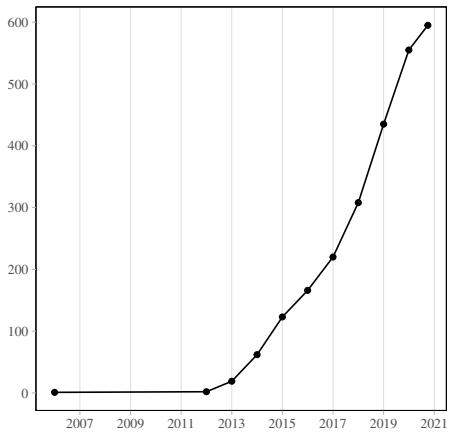


Figure 1.2. Number of Broodfonds groups over time (January 2006 – October 2020)

1.4.2 Field survey

The next step was to test determinants of success *within* new mutual groups. For this purpose, we studied participation dynamics in Dutch Broodfonds groups via surveys among their members. Broodfonds is an ideal case, because it allows us to study participation in mutuals for a much bigger sample than most case studies on collective action. After an informal start of the first group in 2006, its members developed a formal institutional model that could be applied by other groups as well. The number of Broodfonds groups has grown rapidly since (Figure 1.2), from 18 by the end of 2012, to 230 in the beginning of 2017 and 595 today (October 2020). With an average of 45 members per group this boils down to 26,900 members in total, active across the Netherlands. The different groups together represent a clear-cut setting of collective good provision, while at the same time there is substantial differentiation in how each group operates. As such, the Broodfonds groups form a sort of natural laboratory to study the potential of sharing risk in our current society. We therefore start with a general introduction to Broodfonds, followed by a description of the set-up of our survey.

1.4.2.1 About Broodfonds

Broodfonds is a collective insurance arrangement for self-employed workers. In 2004, the Dutch government abolished the law that ensured self-employed workers access to disability benefits.[9] Public provision of disability benefits for self-employed workers

[9]The Law Disability Insurance for Self-employed workers (In Dutch: Wet Arbeidsongeschiktheidsverzekering Zelfstandigen, WAZ) was a mandatory Dutch insurance until August 1, 2004. It gave self-employed workers access to disability benefits of up until 70% of the minimum wage.

Figure 1.3. Number of self-employed workers and number with disability insurance over time

Source: Data about the number of self-employed workers are from Statistics Netherlands (2020); data about the number of self-employed workers with disability insurance are from B. Janssen et al. (2015), Lautenbach et al. (2017), and Van der Torre et al. (2019).

was too expensive, and a private system—introducing competition between market partners—would make the insurance cheaper for both providers and recipients of the insurance (De Jong, Von Meyenfeldt, & Tsiachristas, 2009). The private market developed slowly, however, and premiums were expensive,[10] particularly for a large group of self-employed workers without staff that do not have a high, stable income from one month to the next. Moreover, contrary to the universal character of the public welfare system, private companies refused high-risk people (e.g., older people) access to insurance (Van der Torre et al., 2019). Consequently, as illustrated by Figure 1.3, while the number of self-employed workers has increased by 50%, from 1 million in 2003 to almost 1.5 million in 2019 (Statistics Netherlands, 2020), the share that has a disability insurance is low and, if anything, seems to be decreasing (Van der Torre et al., 2019).[11]

Several organizations have emerged to fill this gap, such as Broodfonds (2006), CommonEasy (2014), and SharePeople (2017). In these organizations, self-employed workers join risk-sharing groups or networks in which they support each other in case of illness. Broodfonds is the largest and most established organization in the Nether-

[10]For someone with an average income working in a heavy profession (e.g., in construction), the insurance premium lies around €432 per month (Corré, 2020).

[11]In 2019, 72% of self-employed workers reported not to have a disability insurance (76% of self-employed workers without staff). These are mostly young people, migrants, singles, and people with a low income (Berkhout & Euwals, 2016). When asked why they are not insured, many say the costs do not outweigh the benefits (47%) or that they cannot afford it (36%). A minority was declined by the insurer because of their age (5.5%) or health (4.9%; Van der Torre et al., 2019).

Table 1.1. The different contribution levels for participation in a Broodfonds group

Level	Monthly contribution	Monthly endowment	Maximum buffer
1	€33.75	€750.00	€1,215.00
2	€45.00	€1,000.00	€1,620.00
3	€56.25	€1,250.00	€2,025.00
4	€67.50	€1,500.00	€2,430.00
5	€75.75	€1,750.00	€2,835.00
6	€90.00	€2,000.00	€3,645.00
7	€101.25	€2,250.00	€3,645.00
8	€112.50	€2,500.00	€4,050.00

lands, and it continues to grow. Literally translated as Bread Fund, the organization serves to provide its sick members with an income replacement that covers basic expenses (i.e., allows them to put bread on the table). It is a bottom-up organization with some top-down control. That is, any group of self-employed workers can start a new Broodfonds group, but to carry the name Broodfonds this group has to adhere to the main institutional principles outlined by the umbrella cooperative BroodfondsMakers, which protects the Broodfonds name and helps and advises both new and existing Broodfonds groups.

The main institutional framework, drafted by the BroodfondsMakers, sets rules on the number of members, the contribution rates, the endowment eligibility, and the internal organization.[12] It specifies that a new group needs at least 20 members to get started and has room for at most 50. The rationale underlying these numbers was that this way at least one member can be supported for a couple of months, while at the same time the group can be collectively managed and all members know each other. Every member pays a monthly contribution to an individual Broodfonds bank account. This contribution can be chosen from a list of fixed contribution levels, where the more you pay, the more you would receive in case of sickness (see Table 1.1). The contribution levels are the same for everyone; in contrast to the private insurance alternative, a Broodfonds group does not differentiate contribution levels based on *ex ante* predicted risk.

The contributions of all members are saved on individual accounts. The combination of all individual accounts constitutes the group's common 'insurance' fund. If an individual account reaches the maximum buffer (because no or few group members have gotten sick), the excess contributions will be returned at the end of the calendar year. Hence, members never pay more than strictly necessary to support each other. If someone within the group does get sick, this person can request support from the group to cover loss of income. This support is based on trust: members do not need to provide proof of their illness through official doctor's notes or house visits, but they are asked to update the group on their progress towards recovery.

[12] See https://www.broodfonds.nl/hoe_het_werkt for the main rules and requirements (in Dutch).

The financial support received is called an endowment, because legally Broodfonds groups cannot call themselves insurance organizations—they do not provide the coverage levels and payout guarantees required to be one (e.g., members can get only support from their Broodfonds group for a period of at most two years). Each Broodfonds group has the legal structure of an association. Within the association endowments to sick members are paid in fractions by all members, making the total amount received from every individual member low enough to keep the recipient exempt from paying taxes over the endowment (even if the recipient needs endowments for a full year).

Every Broodfonds group is governed by three board members, who are chosen and elected from the member base for a period of three years. The board is responsible for the day-to-day organization, contact with sick members, and communication (e.g., about a sick member) to the rest of the group. In principle members should be willing to take up a board function at some point during their membership. In addition, members are expected to attend annual general assemblies in which they will vote on new rules or modes of organization.

While all Broodfonds groups are organized according to the same, fixed institutional framework, each group has the freedom to create additional rules tailored to their specific situation. Many groups have, for instance, introduced rules that specify criteria for membership. Common membership restrictions include requirements such as the necessity to work or live in the same municipality and for new members to be introduced by one or two existing group members. Other rules target the involvement and commitment of all group members, for instance by helping to organize additional (informal) activities, or by acting as buddy or support group for sick group members. As a result, there is substantial variation in the precise norms and rules on what is expected from members, meaning that the Broodfonds case allows us to study a variety of factors (pertaining to individual, social, and institutional levels) in combination.

1.4.2.2 About the data collection

We conducted a survey among members of Broodfonds groups to test hypotheses regarding the social structures and social preferences that are driving participation. For this survey, we collaborated with the BroodfondsMakers cooperative. In several meetings, we discussed what they perceived as main risk and success factors for Broodfonds groups and what they hoped to learn from our research, both about Broodfonds in particular and about sharing risk in general. As such, the formulation of our research questions is driven not just by scientific gaps and interests, but is meant to have direct social impact through this strong link with an interested societal partner as well.

The BroodfondsMakers cooperative gave input on drafts of the questionnaire and questions they liked to see answered. Moreover, they helped us gain access to all members by announcing the survey, sending out the invitation and reminder emails, and answering questions of participating members. Afterwards, we provided them

and all Broodfonds groups with a report (Vriens, Buskens, & De Moor, 2018) summarizing the findings of the study. These agreements have been formally registered in a cooperation contract signed by the BroodfondsMakers and the Faculty of Social and Behavioral Sciences of Utrecht University.

Between May 10 and June 14, 2017, all 10,331 members of the 230 Broodfonds groups that were officially established before February 2017 were invited to fill out an online self-completion survey. The survey inquired about personal characteristics, motivations, and social relations. The chairpersons of the 230 groups were asked to fill out a second survey, with questions about organizational properties. This approach yielded response of 5,192 members (50.7%) and, for the organization questionnaire, 196 of 230 chairpersons (85.2%). The survey data was used to gain insight into the trust and commitment of Broodfonds members, which we explained (in separate substudies) from descriptions of the social relations between group members and risk heterogeneity, insurance use, and individual motivations.

While the survey helped to gain insights into the main explanatory factors in a contextualized setting, the cross-sectional nature only enabled tests for correlations and not causations. And strictly speaking there is no variation in success per se: We only have data about members and cannot compare them to non-members, so instead of studying current participation (which all respondents do) we had to rely on participatory intentions to anticipate future behavior. On the other hand, the field setting did allow us to test a multiplicity of factors simultaneously. Many mechanisms do not work in isolation but are successful precisely because of their interconnectedness with other individual and contextual cues. Hence, while the method might suffer from limitations in internal validity, it scores high on external validity.

1.4.3 Online experiment

Finally, we used an online experiment to empirically test the hypotheses derived from the simulation study. The experiment allowed us to test participation dynamics over time, comparing members and non-members in a more abstract setting. We programmed a risk-sharing experiment in oTree (Chen, Schonger, & Wickens, 2016) that, using a between-subjects design, served to test differences in participation dynamics and participation rates for groups with high and low risk heterogeneity. The experiment was contextualized according to the example of Broodfonds, meaning that subjects were asked to imagine being self-employed workers and offered the possibility to share the risk of losing their income due to illness in groups of 10 people. For 20 rounds they could make a decision of whether or not to (continue to) be part of the risk-sharing group. Before the start of the experiment, all subjects participated in smaller tasks to measure their risk aversion and solidarity. The experiment was conducted with participants from the Prolific platform. 525 people participated in twelve sessions, conducted between June 5 and June 11, 2020. 430 of them could be

assigned to a 10-person risk-sharing group and completed the entire study.

The main advantage of using experiments is that they allow for control over the variation in important independent variables. The causal relation between manipulation and outcome differences is mostly obvious. At the same time, the method suffers from its artificial set-up. Despite efforts to contextualize the experiment (i.e., by providing a concrete scenario rather than an abstract game), the setting remains less natural and (most importantly) anonymous. Hence, while providing high internal validity, their external validity may be questioned (Buskens & Raub, 2008; Roe & Just, 2009).

1.5 Chapter summary

Throughout the dissertation, we apply the above-mentioned theories and methods by starting from a broad perspective and diving deeper and deeper into the precise underlying mechanisms. This means alternating theory and empirics as well as explorative and explanatory methods. Moreover, every chapter places one of the sub-questions central, and thus mainly focuses on either institutional, social, or individual aspects. Each chapter does embed the theory and results within the wider context, though.

Table 1.2 summarizes the main question, theory, and method for each chapter. We start with a discussion of the emergence of new mutuals and a study into their organizational characteristics in Chapter 2. This chapter relies on macro-level theory and uses the exploratory qualitative review to derive hypotheses regarding the main probable development paths. Subsequently, in Chapter 3, we consider the social structure of the risk-sharing groups. Using intuitive macro-to-micro-level theories and data from the survey among Broodfonds members, we study how network structures and social relations affect participation. In Chapters 4 and 5, finally, we focus on individual (micro-level) motivations of risk aversion and solidarity to explain the macro-level phenomenon of heterogeneous yet successful mutuals. In Chapter 4, we use agent-based simulations to develop a micro-to-macro theory and derive predictions regarding successful participation in risk-sharing groups. In Chapter 5, we test the predictions derived in Chapter 4 using micro-level data from the survey and the online experiment.

Finally, before discussing the main results of the different chapters, a small disclaimer is in order. The chapters were written as independent research papers and can be read independently as such. Cross-references between the chapters are provided as references to the corresponding articles or working papers. This also means that terminology and notation may vary slightly between the chapters. Moreover, some overlap between the different chapters could not be avoided.

Table 1.2. Structure of the dissertation

Chapter	Question	Theory	Method	Factors
2	What institutional frameworks are used by new mutuals?	Macro-level three-dimensional framework	Qualitative review	Institution, resource, and member characteristics
3	How important are social components of membership?	Macro-to-micro network theories	Survey data	Network structures and individual relations
4 & 5	Which individual motivations drive participation?	Micro-to-macro model (agent-based simulations)	Survey and experiment	Risk aversion and solidarity

1.5.1 Chapter 2: Mutuals on the move

Based on the three-dimensional model of De Moor (2015) and a qualitative review of 11 new mutuals we conclude that the new insurance organizations can roughly be divided into two categories: top-down and bottom-up organizations. The top-down organizations (e.g., the German Friendsurance) subdivide their members into smaller risk-sharing groups based on an idea of generalized solidarity, but in many other ways the structure resembles that of other insurance companies. Their members are policyholders who take out an insurance policy. They are often exogenously assigned to a risk-sharing group, are not in contact with other members of this group, and are not involved in decision-making processes. The bottom-up organizations (e.g., Broodfonds), on the other hand, often have members who create their own risk-sharing group within the larger umbrella organization. The group is formed endogenously, members decide (within the basic institutional framework) jointly on matters of day-to-day organization, and contact with group members is promoted.

Hence, while risk-sharing groups are installed by all organizations, this is based on a different ideology about solidarity. The top-down organizations treat solidarity as a generalized social preference (i.e., as altruism). By being part of a group (regardless of who else is part of this group), policyholders will behave differently, resulting in fewer claims. The bottom-up groups, on the other hand, are based on direct solidarity (i.e., within-group solidarity). Here, the idea is that people become motivated to help specific other members within the same group. While organizations of both types argue that their model helps to reduce moral hazard problems, the real questions are whether this is true and whether they are equally capable to do so. What drives solidarity? Further research is needed to empirically distinguish these groups, but based on accounts of historical mutuals as well as on literature about many other public good and common-pool resource settings one would think that solidarity requires constant investment.

Another difference between the two types of organizations is that the top-down organizations apply artificial intelligence and machine learning tools to create differ-

entiated risk profiles (and thus premium levels) that are further refined over time, while the bottom-up organizations apply fixed premium rates for all members. This signals a different tactic against adverse selection, where adverse selection could, in the future, be a risk particularly for the bottom-up organizations. Their strategy of being open to everyone and not distinguishing in premiums based on expected risk might make them particularly attractive for high-risk members, who are either excluded from regular insurance companies or are charged very high premiums. It remains to be seen whether the two types of organizations will indeed develop different aggregate risk profiles.

1.5.2 Chapter 3: Networks and new mutualism

We used theories of social embeddedness to hypothesize how group-level network structures (through cohesion and connectedness) and individual-level relations among members (both weak and strong ties) affect members' commitment and trust levels, two factors taken as proxies for future participation. The hypotheses were tested among members of Broodfonds groups using the survey data. The main idea tested was that within small groups social norms can be created that invoke trust that others will be honest and willing to help, which simultaneously enforces one's individual commitment to remain a member of the risk-sharing group. We categorize the many theories about the importance of social embeddedness in social dilemmas to disentangle the effects of group-level and individual-level embeddedness, which we hypothesize to matter in different ways. After all, someone with many connections within the group is not necessarily part of a cohesive group. Likewise, in a cohesive group there may be people at the margins of the network with few connections to others. These variations may affect members' willingness to participate, both between and within groups.

For the 230 Broodfonds groups studied, we found group-level embeddedness to generate higher trust levels, while individual-level embeddedness is a more important driver for commitment. That is, we considered different network structures (dense, clustered, star-shaped, and sparse networks) and found that all network structures with some type of interconnectedness bring about higher trust levels than sparse networks, with dense networks most beneficial to create trust. This signals the importance of group-level agreements. Promises to pay for the support of each other could be exchanged one-on-one, but in the end trust must be conveyed that the whole group commits to this agreement. That dense networks outperform clustered networks further strengthens this line of reasoning, as trust within clusters provides no guarantees for the commitment of members in other clusters. Further in line with this idea is the notion that while individual-level strong ties generate higher trust as well, they do so particularly for young groups. Basically, as long as group-level social norms have not had the chance to develop, the best (or only) indicator that others

may also commit is reliance on their strong ties (people they know and trust). Over time, as the networks within mutual groups become more dense and social norms arise, this reliance on strong ties wavers off.

Compared to trust, commitment seems to be more of an individual trait. It does not depend on group-level network structures but relates only to individual embeddedness: the more (strong) ties people have to other members in the Broodfonds group, the more committed they are to remain part of the initiative. Interestingly, for commitment, strong ties actually increase in importance over time (in contrast to trust). While we did not foresee this, a possible explanation of this finding may be that commitment, given that it implies a willingness to pay the costs for the support of others, may mostly be directed at specific others. People are more willing to support others if they know these people personally, and particularly if they established stronger relations with them. This might reflect that commitment is also driven by solidarity motives. Such solidarity motives might grow with experience and time, and when people get a chance to pay to support one's strong ties, this would actually have a positive effect on commitment. Furthermore, it could reflect the support felt from strong ties if the member has received support in the past—which is simply more likely to have happened the more time has passed.

All in all, this means that social structures are very important for people's willingness to continue participation in the future—at least if this willingness is measured through proxies of commitment and trust. The higher the social embeddedness, the more members are willing to pay the costs for each other and also trust that others will do the same. Or rather: that they will not misuse the fund and that they will continue membership to support others if they need it in the future. Moral hazard, on the whole, does not seem to be much of a worry for Broodfonds groups.

1.5.3 Chapter 4: Sharing risk under heterogeneity

Based on the mismatch between formal models predicting that sharing risk is generally only possible in homogeneous groups and the observed reality of highly heterogeneous risk-sharing groups, we designed an alternative risk-sharing model: one where the risk distribution (and thus the extent of heterogeneity) is not public information. The model includes three parameters that could explain participation of people whose risk is lower than the group average: risk aversion, solidarity, and reinforcement learning. While risk aversion is often used as explanation for participation in 'unequal' risk-sharing relations, solidarity and reinforcement learning (an updating mechanism where people modify their estimate of the group's average risk based on fluctuations in support requests) were newly introduced.

In this alternative model, participation depends not just on static preferences, but on fluctuations in support requests (which increase and decrease the estimate of the group's average risk) and in changes in the number of participants (when other

group members, in response to these fluctuations, decide to drop out after all). To derive hypotheses regarding participation in this dynamic setting, we used agent-based simulations for a wide set of parameter combinations. These simulations gave insight into how agents react to each other's decisions and to support requests, and thus yielded hypotheses about when risk aversion or solidarity were able to explain participation despite higher costs.

The basic predictions underlying the model are that while participation is possible under heterogeneity, members are more likely to remain part of the risk-sharing group when heterogeneity is lower. The larger the heterogeneity, the more low-risk agents drop out (and thus the more the risk-sharing group suffers from adverse selection). Moreover, people who are more risk averse or are driven more by solidarity motives are more likely to participate in the risk-sharing group. On top of these general relations, we derived several predictions from the simulations that relate to reactions to the interdependencies between agents. First, since the agents adjust their estimate of the group's average risk based on observed support requests, participation dynamics are more extreme when they are more susceptible to fluctuations (i.e., stronger reinforcement learning). Or, in other words, the more people base their evaluation about participation on whether or not they had to pay for other people in the round before, the less likely it is that they continue to participate.

Finally, the simulations predict an interdependency between the degree of heterogeneity and risk aversion and solidarity in the sense that the positive effect of risk aversion and solidarity is smaller in less heterogeneous groups. While this might seem counterintuitive (after all, these motivations make people willing to participate despite heterogeneity), the effects of risk aversion and solidarity should be interpreted as fixed. They can compensate for heterogeneity, but only to this fixed degree. Any level of risk aversion (resp. solidarity) is more likely to be sufficient to compensate for increased costs if the heterogeneity is not too high.

1.5.4 Chapter 5: Managing risk heterogeneity in risk-sharing groups

In the final chapter, we conduct empirical tests to explain the observation that risk-sharing groups can emerge despite being heterogeneous in terms of their members' risk. We test the hypotheses from chapter 4 using two cases: the Broodfonds groups (using the survey data) and subjects in an online experiment. While the two cases are based on very different samples and methods, the results are broadly similar.

The main difference is that risk heterogeneity, the starting point for this study, did not induce significant differences in participation rates in the experiment, whereas for Broodfonds groups we did observe the predicted negative effect of heterogeneity on commitment. The higher the variance in the aggregate perceived risk of Broodfonds members of the same Broodfonds group, the lower each member's individual commitment. A possible explanation for this difference in results could be that while

half of the groups were objectively more heterogeneous in the experiment, in the survey the effect is based on perceived heterogeneity. Since subjects in the experiment were not aware of the true risk distribution, subjects of both treatments might have simply considered the distribution to be unequal, without learning how unequal it really was in practice. The finding that participation decisions in the experiment are strongly influenced by the amount of people requesting support (which would give the perception of higher risk of other group members) would support this idea.

Another surprising finding, at least in the light of theoretical models on this topic, is that risk aversion did not have a clear, linear effect on participation. For neither sample did we find the expected general positive effect. In the experiment, we found that risk aversion only starts to advance participation after the first round (i.e., after the initial decision of whether or not to join). In the Broodfonds groups, risk aversion only positively affected commitment for respondents whose risk was below the group's average. This may signal that the uncertainty of potentially losing your income is not solved by joining a risk-sharing group. Other than with a regular insurance, the risk-sharing solution is to some extent still uncertain. You do not know how many others participate, if they will continue to do so, how needy they are, how much participation will cost you, if the fund will be sufficient to support you, and so forth. Hence, the group might give financial support, but introduces so many new sources of uncertainty that a risk averse person might not find this option very attractive either. This would be in line with conclusions by Platteau et al. (2017), who conclude that participation rates are much lower than would be expected based on arguments of risk aversion. Only once (low-risk) members have cooperated for a while, do they start to trust the established risk-sharing arrangement and consider the risk-sharing group to be the less uncertain alternative.

We did find strong positive effects of solidarity in both samples. Both Broodfonds members with higher solidarity motives were more committed and experimental subjects that scored higher on solidarity were more likely to participate. This signals an important difference in the meaning of insurance in risk-sharing groups as opposed to regular insurance. People join not only to create individual security, but for the opportunity to help others in need as well. In none of the samples did this effect vary depending on the degree of heterogeneity, though. The differences in (perceived) heterogeneity may not have been large enough for such differences to become paramount.

Finally, we used the data from the experiment, which introduces variation in the outcome measure over time, to test the effect of group-level dynamics. Particularly, we tested to what extent subjects reacted to support requests and withdrawal decisions of other group members, and to what extent such reactions would result in withdrawal cascades. We found these variables to be the most important predictors for participation in the experiment: both support requests and people withdrawing strongly increased the probability of others also withdrawing from the risk-sharing group in the next round. It should be noted, though, that while this poses seri-

ous limits to the resilience of risk-sharing groups, the risk levels in the experiment were highly inflated compared to any real-life situation in order to observe enough events. Hence, for Broodfonds groups and other mutuals, which additionally benefit from higher social and institutional embeddedness than the subjects in the artificial experimental setting, this does not immediately raise ground for concern.

1.6 Conclusion and discussion

The aim of this dissertation was to understand success in mutuals and risk-sharing groups. Success, in this case, refers to long-term, continued participation of its members. We studied successful participation through three main questions: *1) What institutional frameworks are designed to make participation work in new mutuals and how likely is it (based on historical examples) that these will succeed? 2) How important are social components of membership in people's decision to continue to participate? And 3) which individual motivations drive people to continue participation despite risk heterogeneity?* This way, we recognized causal heterogeneity (Poteete et al., 2010) and tried to increase understanding into the combinations of factors that together make successful cooperative efforts more likely.

We started from a broad societal and institutional perspective, and first categorized the main ways chosen to set up the institutional frameworks of risk-sharing institutions. We assessed the effectiveness and consequences of these frameworks based on existing theories on how to organize institutions for collective action. Within the context of these institutions, we subsequently investigated the social embeddedness of participants within risk-sharing groups, given that about half of the institutions reviewed emphasized the importance of social embeddedness and direct member contact and involvement. Finally, because the institutional and social contexts suggested the importance of solidarity on top of (or in addition to) mere monetary concerns for membership, we studied individual motivations.

In discussing the main results and their implications, we take the reverse approach. Based on what we learned about individual motivations and behavior, we build up to the social and institutional level. This way, we can use the behavioral insights to distill the most important lessons for how to organize within and across risk-sharing groups.

1.6.1 Lessons learned

The first main finding of this dissertation is that solidarity is an important determinant for participation in risk-sharing groups, whereas risk aversion only seems to enter at a later stage. This is compelling, given that risk aversion is often by default included as behavioral assumption in risk-sharing models. Yet neither in the field (for members of Broodfonds groups) nor in the experiment did risk aversion unequivocally

drive the decision to (continue to) participate. In the Broodfonds sample, we only found an effect for the subsample of low-risk respondents (the ones more likely to drop out). In the experiment, only the decision to *continue* to participate could be explained from risk aversion, not the initial decision of whether or not to join. This could entail two things: either our measure is flawed (we used the same validated staircase method to measure risk aversion in both studies), or the causal relation is different.

We are inclined to believe the latter. After all, if a risk averse individual takes out an insurance to avoid uncertainty, it can be questioned whether a risk-sharing group solves uncertainty to the same extent as a regular insurance does. Any social dilemma introduces new sources of uncertainty. Hence, for participation in risk-sharing groups risk assessments might be made differently than theoretically assumed (Elabed & Carter, 2015). They have to decide, between two uncertain strategies, which one takes away most uncertainty. Only after people have learned that the risk-sharing arrangement is trustworthy do they start to assess not participating as the more uncertain alternative.

At the same time, the finding that solidarity plays such an important role both in the contextualized field setting as in the artificial experiment clearly distinguishes risk-sharing groups from other insurance solutions. Those that are willing to participate do so not only for individual security, but to help out others as well. To some extent, solidarity is a static personality trait (i.e., general altruism; Levine, 1998), and this is how we should interpret the finding in the experiment. The subjects did not know each other, nor were they able to communicate during the experiment. Hence, if solidarity motivated people to participate, these solidarity motives were targeted to strangers. Who the recipients of support were was irrelevant.

While we did not distinguish between group-specific solidarity and general solidarity for the Broodfonds members, it seems likely that the solidarity observed in the experiment is a baseline solidarity, whereas within Broodfonds groups it goes beyond general solidarity motives. It is fostered and strengthened because members know with whom they share risk and for whom they pay shares of the endowment. There are two reasons to assume this to be true. First, in the experiment, while solidarity had a positive effect, if group members got sick or withdrew from the risk-sharing group, this strongly decreased the probability that the subject would continue to participate in the next round. For the Broodfonds members, on the other hand, the number of sick group members over the past twelve months did not affect their commitment. This suggests that Broodfonds members do not care if more people request support, because—knowing these people—they are willing to support them and also see that their support truly benefits them.

The second reason to believe that solidarity is targeted to and fostered by the risk-sharing group comes from the finding that members with stronger social embeddedness are more committed to remain part of the Broodfonds group. Additional

(strong) ties increase commitment, and strong ties do so in particular the longer the group exists. This suggests that over time solidarity is strengthened, extending beyond general altruism and including direct solidarity towards the people of one's risk-sharing group. Therefore, risk-sharing groups are more likely to become resilient, favoring long-term, continued participation, if they invest in generating high levels of social embeddedness—not just for the group on average, but also to maintain commitment levels for each individual member.

Of course, the institutional structure of Broodfonds groups is designed to promote cohesive social networks as Broodfonds groups explicitly place solidarity at the core of their success. In part, the importance of group-specific solidarity might therefore also be a function of the institutional set-up in which the study was conducted. At the same time, it seems clear that some sort of social and/or institutional embeddedness is needed to interrupt the strong withdrawal dynamics observed after (several) support requests were made in the experiment. That is, if (as observed in the experiment) withdrawal by one (or several) members can so easily set in motion withdrawal cascades, group-level measures are needed to prevent this response.

From the institutional comparisons, it is clear that where some of the new collective insurance organizations actively invested in bottom-up involvement, communication among members, and solidarity, the other half relied on generalized solidarity or altruism and used risk-sharing groups instead to make the insurance process cheaper and more transparent. This seems beneficial to gain quick growth (the top-down organized Friendsurance, for instance, with exogenously composed risk-sharing groups, grew much faster than the number of Broodfonds groups has), and although we could not test this it potentially also attracts more low-risk policyholders. However, the results of our subsequent studies do suggest that without investing in some other form of embeddedness these organizations could be more fragile. Their success is based on the potential redistribution of premiums when no or few people need support from the risk-sharing group. Since it is precisely this redistribution they will miss when the number of support requests increases (be it by chance or because people start acting out of moral hazard motives), they are at higher risk for the withdrawal dynamics observed in the experiment. As such, despite their fast initial growth their long-term resilience might be smaller.

Finally, in addition to these content-related lessons, a reflection on our theoretical and methodological contributions is in order. All in all, we contributed to existing research about successful mutuals and institutions for collective action in general by starting from the perspective of theoretical pluralism. Following a multidisciplinary approach, we combined theories and hypotheses from analytical sociology, behavioral economics, and socioeconomic history. These various approaches, relying on different core factors and mechanisms, gave leeway to think about the participation problem from macro, macro-to-micro, micro, and micro-to-macro perspectives (Coleman, 1990). The combination of these theories allowed for more nuanced predictions about

the factors underlying successful (i.e., continued) participation in mutuals.

Methodologically, many conclusions drawn could be made precisely because we combined different methods and studied participation for different aspects of social and institutional embeddedness. For instance, even though we did not explicitly measure the difference between generalized and within-group solidarity (as done, for instance, by Baldassarri, 2015), we were able to draw these conclusions because of the differences observed from various methods. Or, more precisely, these conclusions followed from the anonymous experimental setting, the Broodfonds groups characterized (despite variation across groups) by high average levels of social embeddedness, and the observation that institutions that differ in their ideas about solidarity also see this translated into different types and numbers of policyholders. By using both abstract settings high in internal validity and field studies high in external validity, we could distinguish general mechanisms from context-specific findings. Hence, while each of the methods has its limitations, combined they give a more fine-grained, nuanced picture of participation dynamics in mutuals.

1.6.2 Limitations and future research

Despite the many insights obtained through our multi-perspective, multi-level, and multi-method endeavor, there are several limitations that should be addressed in future research on this topic. First and foremost, we only focused on success within mutuals and risk-sharing groups. However, any discussion about the potential of risk-sharing groups as an insurance solution within societies would also benefit from a comparison of those who do join such groups to those who chose not to. While we have gained a lot of insight on what works and does not work given this set-up, we can only speculate on whether this is the best set up. The results of this dissertation do not provide direct comparisons between the new mutuals and welfare states or existing insurance companies.

In particular, we could stand to gain insight into matters of in- and exclusion. While the new insurance organizations want to make insurance more accessible, it should be studied whether they succeed in doing so. Are the risk-sharing groups indeed open to everyone? And how attractive is the solution to the general population? Historical accounts of mutuals often describe how certain groups (e.g., women or elderly people) were structurally denied access (Harris, 2012; Van Leeuwen, 2016). While such structural exclusion is exactly what the new collective insurance groups oppose (they emerged precisely to tailor a group that is excluded from public and/or private insurance benefits), there is no way of knowing whether exclusion processes will not (start to) play a role informally within risk-sharing groups that are formed endogenously. One could wonder, for instance, whether the rule that new members can join existing groups only upon introduction by existing members—which is highly effective to maintain trust levels within the group—brings about equal access oppor-

tunities for everyone.

At the same time, while membership rates of organizations such as Broodfonds continue to grow rapidly, the organizations remain marginal players when put into contrast to the target population (e.g., there were 25,000 Broodfonds members compared to almost 1.5 million self-employed workers in 2019). Are the remaining self-employed workers not interested, or are there certain access barriers for specific subpopulations? Future research should investigate such questions of in- and exclusion, with special attention to the diversity of members and non-members.

In addition, to meet our aim of identifying a broad range of success factors, we had to give in on very precise, explicit, and indisputable measures of the underlying measures. That means, for instance, that while our study on social embeddedness strongly suggests that these group-level embeddedness effects are driven by the social norms, we did not explicitly measure those norms. Second, while the combination of methods suggests an important difference between generalized altruism and group-directed solidarity, these mechanisms have not been disentangled within the separate study samples. For such precise unraveling of mechanisms, the best approach would be to focus on one or two key mechanisms and study different settings in which these mechanisms were isolated as much as possible. The causal relations for most of these factors have been studied in isolation in various settings, though, which is why we could build on the existing literature and could confidently distinguish the same mechanisms even in more complex, interdependent settings.

Regardless, further exposing these mechanisms for this specific context would be an interesting avenue for future research. Several extensions could be thought of. With respect to participation dynamics, first, the risk-sharing model and the empirical results for the Broodfonds study and the experiment could be used to further develop an empirically calibrated risk-sharing simulation model, where dynamic, long-term participation patterns are derived from data of the Broodfonds members. Yielding predictions for realistic parameter settings (i.e., with lower risk levels and less events in total), this could help to assess to what extent the withdrawal dynamics observed in the simulation study and experiment are a result from a lack of social and institutional embeddedness or from the more extreme parameter combinations, and could increase insights into the circumstances under which Broodfonds groups are more at risk for future withdrawal cascades.

Second, the findings from the study about the role of network embeddedness in Broodfonds groups could be used to build a more refined model about the role of cohesion and connectedness. Particularly interesting here are clustered networks, the most common network structure across Broodfonds groups. Portraying high subgroup cohesion but low overall connectedness, they warrant insights in whether trust can transcend sub-clusters or actually inhibits trust in others outside of these clusters (Flache & Macy, 1996). Moreover, it is not obvious whether the development of generalized altruism towards direct solidarity necessarily advances commitment and

future participation for clustered networks. What if the people requesting support are people outside of one's sub-cluster? Is social embeddedness beneficial regardless of its precise structure or should some network structures be actively avoided?

Finally, while we distinguished two types of new collective risk-sharing institutions (bottom-up and top-down organizations), for the remainder of the dissertation we mostly focused on bottom-up organizations. The artificial experimental setting does not particularly address one organization type over the other as subjects did not have a say in the rules of the arrangement and were not able to communicate. Hence, an extension of the experiment that includes social aspects (e.g., by including communication options or an in-between step where members have to approve each other's support requests), would also test whether the bottom-up organization is more or less capable to promote continued participation.

1.6.3 Policy implications

The results of this dissertation highlight several important practical implications. The main implications relate to the organization of risk-sharing groups. On top of that, the results suggest several secondary implications for broader country-level policies. These secondary implications were not directly tested, but do arise from discussions of our results.

1.6.3.1 For risk-sharing groups

For the organization of (bottom-up) risk-sharing groups, even if they are formally institutionalized as cooperatives or associations, it seems important not to equate them one-on-one with insurance arrangements. Without denying that it would benefit the success of these institutions if they were formally recognized as legitimate *alternatives* to regular insurance, the bottom-up risk-sharing groups in their current form cannot be, and may not want to be, insurance providers. The uncertainties surrounding membership are too high for membership to resemble an insurance policy. To do so, they should, for instance, provide higher or longer coverage and certainty that the common fund will be sufficient for the payout to its members. There is a risk in doing so, though, because a movement towards more financial certainty, requiring external investments and reinsurance systems, decreases transparency and might negatively affect the degree of solidarity (see, for instance, the difference in solidarity perceptions between the bottom-up and top-down institutions).

Yet the large role of solidarity for the success of risk-sharing groups forms another reason why a direct equation with insurance seems out of place. While insurance is traditionally based on the notion of solidarity, its implementation in large insurance companies or public welfare systems in no way resembles the type of solidarity invoked by risk-sharing groups. The fact that even without social or institutional embeddedness solidarity was already such an important driver for participation at least

for the short time-window of the anonymous experiment signals that risk-sharing organizations should create an environment where solidarity is potentially strengthened and at the very least maintained over time. Promoting contact among members and organizing regular meetings seems a straightforward way to do so, but given that generalized altruism already goes a long way the same may perhaps also be reached through institutional embeddedness. As long as members place trust in and feel committed to the institution, an institution that carries the norm of operating based on explicit solidarity may already go a long way—as long as it presents itself as different from regular insurance companies.

Finally, despite not wanting to restrict access or differentiate contribution levels based on estimated risk profiles, risk-sharing groups would still benefit from (better) insights into their own levels of risk heterogeneity. Perceived heterogeneity did negatively affect commitment levels, so groups should at least be aware of these risks (and perceptions). Any actions to promote commitment (be it institutionally or socially) become more important the larger the group's heterogeneity.

1.6.3.2 For governments

Besides these direct implications of our research, the findings also raise several questions for policy makers. While we did not perform macro-level comparative analyses, and therefore cannot provide indisputable macro-level advise, this dissertation does raise several macro-level questions that should be addressed by policymakers.

This is particularly relevant in the Netherlands, where recently a new nationwide agreement was reached to reintroduce a mandatory disability insurance for self-employed workers (Wolzak, 2020). The new law, which is expected to be installed in 2024, should provide a public and affordable insurance for self-employed workers (with expected monthly premiums of €80–€130). While unions of self-employed workers are generally glad that some degree of flexibility remains (e.g., by offering the possibility to extend the waiting time from one to two years), there is widespread frustration about the limited voice self-employed had in the drafting of these arrangements and the lack of flexibility depending on sector-specific needs (Corré, 2020).

Thus, in finalizing these new arrangements, certain aspects of how the new insurance takes shape deserve more attention. And given the success of the new risk-sharing institutions, it seems only fair to at least take into consideration the possibility of using risk-sharing groups in this new insurance arrangement as well. Over the past ten years several risk-sharing institutions, among which Broodfonds, have demonstrated to possess a robust institutional structure, stable participation patterns, and—most importantly—generally low support requests. In other words, so far there seem to be quite a few successful examples of alternative insurance arrangements. It would not hurt to think more about how the advantages these mutuals provide can be incorporated in the new formal insurance regulation as well.

While reliance on Broodfonds is at least acknowledged through the option to

extend the waiting period to two years (which is the maximum coverage period offered by Broodfonds groups), a solution that deserves further thought, for instance, is to expand the general, publicly regulated mandatory disability insurance with a risk-sharing group option. The main reason that Broodfonds managed to keep contribution rates low is that they cover disability for at most two years. This is also why private insurance companies have been refusing the most high-risk individuals: the real costs lie in providing a disability insurance for someone who is declared 100% disabled. It takes a lot of money to support this person year after year. However, one option that could be considered, for instance, is to allow a Broodfonds group (or another risk-sharing group) to take out a collective insurance policy for the risk of long-term disability (i.e., after two years). The insurance premium of individual members would then be based partly on the group-level risk. Low-risk people would act as guarantee for their high-risk group members and pay part of the price if a group member indeed continues to rely on an insurance after the two-year period. This way, risk-sharing groups could be implemented within a regular insurance scheme as well, following the risk-sharing ideology applied by top-down institutions like the German Friendsurance.

At the same time, it is important to acknowledge that despite the fast growth of Broodfonds groups, their seemingly robust organization, and their increased media attention, they do not seem to move the private market much. The number of self-employed workers continues to grow as well, so despite their internal success there remains an important national health risk where a lot of uninsured self-employed workers would get into severe monetary trouble if they get disabled. A critical look is needed into this high-risk group, how they could be reached, and what type of insurance or risk-sharing solutions could support them.

2

CHAPTER 2

Mutuals on the move: Exclusion processes in the welfare state and the rediscovery of mutualism

A slightly different version of this chapter has been published as Vriens, E. & De Moor, T. (2020). Mutuals on the Move: Exclusion Processes in the Welfare State and the Rediscovery of Mutualism. *Social Inclusion, 8*(1): 225–237. De Moor developed the main theoretical framework applied in this paper. Vriens and De Moor jointly expanded this theory to the context of mutuals. Vriens made the inventory of mutuals, collected the data, and analyzed the results. The main part of this chapter was written by Vriens, and De Moor substantially contributed to this chapter by providing detailed feedback on several earlier versions.

Abstract

Declining welfare states and increasing privatization of the insurance sector are leaving an increasing number of (mostly European) people without insurance. In many countries, new organizations like Friendsurance (Germany) and Broodfonds (the Netherlands) have emerged to fill this gap. Referred to as peer-to-peer insurance, they strive to make insurance fair, transparent, and social again. Resembling 19^{th}-century mutuals, they pool premiums in (small) risk-sharing groups. We compare eleven new mutuals with respect to their institutional, resource, and member characteristics and find two broad typologies. The first bears the most resemblance to the 19^{th}-century mutuals: Members are (partly) responsible for governance, there is no risk differentiation, premiums are fixed and low, and insurance payouts cover basic expenses only and are not guaranteed. The second group, while also sharing risk and redistributing unused premiums, is organized more like the present-day commercial insurers it reacted against, e.g. with refined InsurTech methods for risk differentiation and a top-down organization. We thus pose that, while both groups of new insurers reinvent the meaning of solidarity by using direct risk-sharing groups (as is central to the concept of mutuals), they have different projected development paths—especially considering how, in case of further growth, they are likely to face and deal with problems of moral hazard and adverse selection.

2.1 Introduction

Be it in the fields of climate and energy, health care and welfare states, politics and governance, or banking and insurance, when it comes to solving collective problems, the shortcomings of market and state have increasingly come to light. Over the past two decades this has sparked a revival in collective action in many countries globally, displayed by the rapid increase in the number of cooperatives in agriculture, energy, and infrastructure. People are joining forces to establish and strengthen institutions for collective action (ICAs) to solve problems that have not been solved to their satisfaction by traditional suppliers (De Moor, 2015).

Parallel to this development in collective resource management, similar developments in the service sector can be noted. Particularly in insurance, where new initiatives such as Friendsurance (Germany) and Broodfonds (the Netherlands) emerged out of a mounting discontent with the way insurance is currently organized. These insurance organizations, many of which refer to themselves as peer-to-peer (P2P) insurance, aim to reinstate fair, transparent, and social insurance. Although their name suggests a one-on-one relationship between those involved, in practice they go back to mutual insurance principles as laid down centuries ago, pooling premiums in (small) risk-sharing groups that introduce many-to-many relationships between members.

Historically, the earliest mutual insurance associations (mutuals) can be traced

back to the guilds in the first wave of collective action in early modern times (1500 – 1800), but the current initiatives emulate the mutuals that emerged over the 19th century during the second wave of collective action, with its culmination in 1880 – 1920 (De Moor, 2015). Friendsurance (Germany), for instance, evokes villagers that established mutual risk-sharing arrangements in the event of fire, where neighbors would help build a new home, while Axieme (Italy) takes as example the fishermen and ship owners that helped each other by putting money in a common treasury for boat repairs. That they do not refer to the earlier guild insurance is probably because the 19th-century mutuals usually focused on insurance services only, whereas guilds formed multi-purpose organizations in which insurance was part of a larger package of collective services (Van Leeuwen, 2000).

Following their 19th-century counterparts, we observe that the new initiatives generally base their insurance model on four principles: solidarity, transparency, fairness, and innovation. Solidarity is invoked by relying on sharing risk in subgroups, with policyholders supporting each other with money from a common fund. Transparency is achieved by abandoning the large bureaucratic systems and making do with minimum sets of rules and clarity about insurance eligibility and payouts. Fairness is implemented by returning (some share of) unused premiums to the policyholder rather than to the insurer's profit. Innovation, finally, is where the new initiatives move beyond the historical model. Based on the assumption that 21st-century InsurTech (e.g., online exchange platforms, artificial intelligence, blockchain) has a primarily positive impact on collective action, they apply this to create large solidarity networks in our current societies.

In this chapter, we aim to provide a better understanding of why these new initiatives are emerging, and in so many different countries. What needs do they respond to? Do they represent a revival of mutualism or is this an entirely new institutional development? Can we expect these initiatives to play a role in the insurance sector of the future? With the 'oldest' initiative established in 2006, there is little experience to base such predictions on. However, we do have a wealth of knowledge on the development of mutuals in the past. By comparing characteristics of past and present mutuals as well as contextual developments leading to their rise (and demise), we aim to provide preliminary insights into the role these new initiatives play in our current societies, their future chances, and what factors appear crucial for their resilience.

A historical outlook is particularly helpful in reference to classic insurance problems of moral hazard and adverse selection. Moral hazard occurs when insured people increase risky behavior or decrease loss prevention (*ex ante* moral hazard; Arrow, 1971) or file exaggerated or even fraudulent insurance claims (*ex post* moral hazard; Adams et al., 2011). Adverse selection occurs when insurances attract an above-average number of high-risk members (Akerlof, 1970). The general consensus is that historically, mutuals were better able to deal with these problems than early market and government insurers (Emery & Emery, 1999; Harris, 2012). The ascribed rea-

sons (social control, fairness, solidarity) are what the new initiatives likewise use as arguments for their case. While it is too early to state whether they succeeded in this mission, it is possible to compare whether (and where) they are likely to get into trouble due to their institutional structure.

For this purpose, we compare eleven collective insurance initiatives (currently) active in twelve countries, established between 2006 – 2018, on the basis of their institutional, resource, and user properties, properties derived from De Moor's (2015) three-dimensional model of resilience in ICAs. First, however, we lay the contextual groundwork by sketching the relevant wider economic, societal, and institutional embeddedness of these initiatives. Why are they emerging now? What pressing issues in the insurance sector are they responding to? Similarly, we provide a general outline of the historical development of mutuals. Only in comparison can we start to understand which role the new initiatives, still in their infancy, may take in our future societies.

2.2 The wider insurance landscape

2.2.1 The crisis of the insurance system

When it comes to national insurance systems, countries have traditionally been categorized as utilizing private (US), public (Norway, Sweden, Finland, Denmark, UK, Italy, Canada), or mixed (Germany, France, Austria, Switzerland, Belgium, the Netherlands) models for organizing insurance (Lameire, Joffe, & Wiedemann, 1999). This classification marks how the majority of insurance is organized; all countries with established insurance systems at least offer some form of public insurance—particularly for unemployment, disability, and retirement—for some subgroups (e.g., Medicaid in the US). Private insurers, however, have quickly gained ground in all (particularly European) countries, as principles of neoliberalism have provided the economic justification for delegating the provision of social insurance (like health insurance) to private insurers (Natalier & Willis, 2008). While this process might seem more apparent in 'mixed insurance' countries, it is also taking place in countries (such as Sweden) that have traditionally been characterized as public (Sunesson et al., 1998).

At the same time, little has been done to accommodate new risks introduced by recent demographic transitions. Aging populations (longer retirement, elderly care), higher divorce rates (child support), and increasing unemployment put pressure on the capacity of the welfare state (De Vroom & Øverbye, 2017; Parkinson, 2011). Moreover, while universalist benefits are, in principle, at everyone's disposal, their implementation increasingly causes social exclusion. Eligibility is dependent on citizenship and salaried employment, which conflicts with changing demographic profiles of a globalized world (Taylor-Gooby, 2006). The condition of citizenship, for one,

excludes the growing number of (labor) migrants from social benefits in most European countries (Baldini et al., 2016; Lehtonen & Liukko, 2015).[1] The condition of salaried employment, secondly, deprives the growing number of self-employed workers of benefits, leaving them uninsured or at the mercy of private insurance companies (Van der Linden, 2008).

These private insurers introduce increasingly detailed forms of risk segmentation by unpooling risks. While based on principles of actuarial fairness (i.e., you pay according to your needs), this largely serves to increase profit (Ericson, Barry, & Doyle, 2000). The repercussions of such differentiation are that premiums have become increasingly expensive for high-risk groups, if they are accepted as clients at all. Hence, the groups of people that are excluded from insurance expand, and those who do have insurance report lower levels of trust in their insurer (Lehtonen & Liukko, 2015).

The new insurance initiatives, therefore, respond to problems with both state and private insurance arrangements. By borrowing aspects of historical mutualism, they believe they can reshape expectations of insurance and alleviate some of the financial pressures that make the benefits offered by existing parties so expensive (or unaffordable).

2.2.2 A historical mutual insurance framework

Risk-sharing through mutual insurance has been around for so long that to summarize it in a few paragraphs is impossible within the limits of this chapter. For excellent discussions of mutuals throughout history, we refer the interested reader to the book of Van Leeuwen (2016). For this chapter, which puts new mutuals central, a basic overview suffices.

The mutuals that emerged in the early 19$^{\text{th}}$ century were the product of age-old mutually dependent social relations that took shape in local guilds and credit economies (Ismay, 2015). These mutuals arose in many different countries, but scholarly discussions largely focus on mutuals in Europe (e.g., the UK, the Netherlands, Spain), the US, and Australia (Downing, 2012; Harris, 2012). In these discussions, scholars often distinguish between mutuals that covered life risks (e.g., health, funeral) and non-life risks (e.g., fire, agriculture). While membership figures tentatively suggest that risk-sharing groups in the latter were smaller (Van Leeuwen, 2000),[2] the general consensus is that all early mutuals had relatively small risk-sharing groups, which gave them a comparative advantage over early market or government insurers in dealing with problems of adverse selection and moral hazard (both *ex ante* and

[1] While there are large differences between European countries in the extent of exclusion, with exclusion in most Mediterranean countries double or triple the size of that in Scandinavian countries, exclusion is substantial everywhere (Baldini et al., 2016).

[2] At least for the Netherlands, membership figures suggest that often non-life mutuals had less than 100 members, while the majority of life mutuals had fewer than 500 members (Van Leeuwen, 2000).

ex post), as signaled by the lower number of claims (Adams et al., 2011; Emery & Emery, 1999; Harris, 2012; Van Leeuwen, 2016).

The risk-sharing groups were usually composed of people who lived in the same community, so they could vouch for each other and monitor each other's behavior (Van Leeuwen, 2000). This reduced problems of adverse selection, as they had a rough estimate of the type of risk admitted in the group. Once admitted, members were expected to take on some responsibility in governance and to participate in social events (Downing, 2012). Thus, traditional mutualism consisted not only of voluntary arrangements to contribute to a common fund (De Swaan & Van der Linden, 2006, p. 184), but served social needs as well (Harris, 2012, pp. 1-2). The social bonds and affinity that were created this way kept occurrences of moral hazard low, as it felt wrong to most people to take (excessive amounts of) money from their fellow group members. Moreover, informal monitoring and social punishments (e.g., loss of reputation) scared off those who might still have been inclined to do so.

As the 20th century approached, the membership figures of mutuals grew quickly. This increased organizational complexity, which in many cases meant that traditional ownership structures were modified to ease decision-making and minimize potential conflicts. Ultimately, this often entailed a transition towards managerial and corporate governance models, in which the management was in the hands of a managerial board consisting of external professionals. In most organizations, members only retained—to some degree—*ex post* decision control (Chaddad & Iliopoulos, 2013). Moreover, despite the fact that the large mutuals were initially often structured like umbrella organizations, with members subdivided within multiple, relatively small risk-sharing groups, conviviality within these groups quickly waned, which reduced their ability to monitor each other (Downing, 2012).

Essentially, this means that mutual insurance had a different definition in the early 1800s than it does today, and this is a consequence of the evolution mutuals have gone through over the past two centuries. Nowadays it is usually the large, private, not-for-profit insurance companies (such as the US-based Liberty Mutual Group) that come to mind (De Swaan & Van der Linden, 2006, p. 12). Many of these companies evolved from 19th-century small-scale mutuals (Van Leeuwen, 2016).[3]

Their defining characteristic still is that they are (partly) owned by their stakeholders and have—at least on paper—a responsibility to them for their operations (Lehtonen & Liukko, 2015). Members are, for instance, given the right to select management, and any profit should either go to them or into the company. This is in contrast to stock insurers, which are owned by shareholders and usually see the pro-

[3]This is not to say that all 19th-century mutuals grew into large mutual insurance corporations. In fact, only a minority (mainly those that merged and professionalized) survived (Schneiberg, 2002). Following intensifying public debates over what voluntary mutuals lacked (e.g., no coverage of prime risks like old age and industrial accidents), the vast majority were taken over by the welfare state (which would cover a broader variety of risks). Others, particularly in the non-life domain, ultimately had to cease operations in competition with commercial insurers (Van Leeuwen, 2016).

duction of wealth for shareholders as their primary function (Cummins, Weiss, & Zi, 1999). However, while ownership has always been central to mutual insurance, the actual voice members have in organizational matters has decreased to such a degree that nowadays it is largely void of meaning (Chaddad & Iliopoulos, 2013). Moreover, the meaning of solidarity gradually changed in the evolution of mutual insurance companies. Large-scale anonymous structures have come to replace the old systems, which were smaller and more focused on direct solidarity.

It is the traditional conception of mutual insurance that fits well with the new insurance initiatives. They, too, revert to subdividing the member base into smaller risk-sharing groups, thereby promoting solidarity and giving the policyholders, to varying degrees, a say in the design of their own risk-sharing group (albeit not necessarily through ownership). Hence, while they explicitly present themselves as different from mutual insurance companies, which they treat on a par with stock insurers, the term Peer-to-Peer might mainly be a modern rebranding of the age-old principle of mutualism.

Essentially, while for mutual insurance companies the defining feature that survived over time is formal ownership by immediate stakeholders (and by extension that profits are retained within the company), the new initiatives borrow solidarity-related aspects (risk-sharing groups, redistribution mechanisms) from the historical model; aspects they consider apt for reducing moral hazard. A cautionary note is in place here, for although these aspects indeed made many historical mutuals successful, the same reliance on small groups and informal social control also imposed fragility. If moral hazard did occur undetected, for small mutuals it more often led to financial problems or even bankruptcy (De Swaan & Van der Linden, 2006; Van Leeuwen, 2016). Historically, larger market insurers might have had more moral hazard occurrences, but also had the financial stability to cope with them.

2.3 Theory

The initiatives in different countries largely developed independently, so a common framework is needed to compare the initiatives and pinpoint differences and (particularly) similarities that may not be obvious at first. For this purpose, we apply the three-dimensional theoretical framework of De Moor (2015), originally developed for historical analysis of the functioning of commons and other ICAs, to mutuals. There are many structural similarities between mutuals and ICAs, so this framework can reveal where the institutions are more fragile. The framework poses that three dimensions should be considered when evaluating cooperation for the production, use, and management of a collective good: the resource, the users, and the institution. Applied to mutuals, these reflect the insurance fund, the policyholders, and the set of rules and regulations. These dimensions are tightly interrelated and resilient cooperation is the result of striking a proper balance between them.

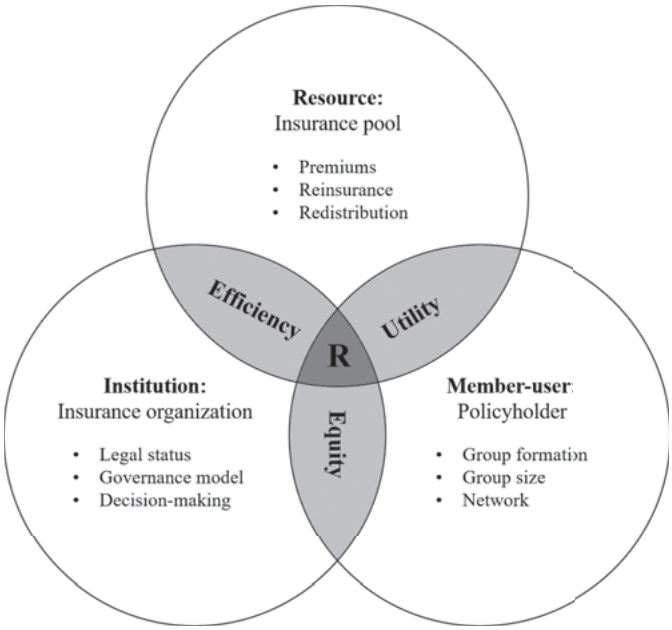


Figure 2.1. A three-factor framework for the functioning of mutuals, adapted from De Moor (2015)

Note: R stands for Resilience.

The institution entails the overarching organizational form as well as all rules and regulations regarding both user and resource. The resource dimension encompasses everything related to the construction and use of the resource, i.e. the premiums (that together form the insurance fund) and insurance payouts. Finally, the user dimension concerns who makes up the member base, i.e., whether the group is open or closed, small or large, homogeneous or heterogeneous. There are myriad interrelations between these dimensions: group characteristics follow from institutional rules of entrance; resource characteristics are the result of institutional rules and users' demands and needs; resource and institutional characteristics influence which users join, and so forth. These interrelations are captured by the balance in efficiency, utility, and equity (Figure 2.1).

Since insurance primarily serves to protect against financial loss, efficiency is often the main balance considered. Literature that disputes the premises of the seminal tragedy of the commons (Hardin, 1968) stresses that institutions, with properly defined rules and norms, are vital to avoid overuse and thus to not override the resource's carrying capacity. Efficiency then results from the interaction between institution and resource, as the institution sets the rules of access and use that largely determine resource availability (Ostrom, 2005). For mutuals, these rules arrange financial matters

of creating the fund (e.g., setting premium levels) and payout from the fund (e.g., determining coverage and eligibility). They should ensure that no more is claimed than is saved in the fund, but should simultaneously avoid underuse. When more is saved than is needed for payouts, premiums are too high and the balance is likewise inefficient. For historical mutuals, efficiency clearly improved over time. Initially there was little knowledge on how many claims should be expected, what contribution rates were necessary to cover those claims, and how eligibility should be judged. Over time the mutuals started to professionalize by applying basic risk differentiations on crude categories of, for instance, age (Van Leeuwen, 2016). Current mutual insurance companies maximize efficiency by using complex tools to calculate individual risk probabilities and adjusting premiums accordingly. Moreover, they reinsure part of the premiums with external insurance companies who pay the insurance if the local fund were still to be depleted.

In addition to financial performance, social aspects form important indicators for the functioning of mutuals and other ICAs. In the framework, this is captured in the evaluation of utility and equity. Utility represents the balance between users and resource. Rather than assessing resource management, utility asks whether the resource is sufficient for the users' needs. For the historical mutuals, utility was achieved by combining various types of support. While it is true that initially payout was usually limited (both in amount and duration), being able to receive some benefits did alleviate members' most urgent needs (Emery & Emery, 1999; Harris, 2012). Moreover, while coverage was not guaranteed (meaning no payout if the fund was already depleted), this was compensated for with additional services (e.g., social support). Over time, the financial utility improved as payouts got higher and more secure, but the utility derived from social functions decreased. Moreover, while the introduction of risk differentiation may have been positive for low-risk groups, for others it meant that insurance became more expensive. In other words, utility may be perceived in different ways and vary among members within a mutual group.

Lastly, equity is achieved when users feel heard. It has long been recognized that ICAs in which members participate in the decision-making process are more likely to survive because involvement enhances reciprocity and solidarity (Ostrom, 1990). It bestows feelings of responsibility in members and makes them committed to the institution's success. Moreover, institutions characterized by member involvement appear more resilient as they are better capable of change than those governed top down (De Moor, 2015), most likely because involved members better understand why, and which, changes are needed. For historical mutuals, equity was initially given a key role (through bottom-up organization and decision-making). Over time, it seems that improvements in efficiency have come at the expense of equity, as these changes were set in motion by professional board members or external managers.

In general, resilient institutions manage to balance equity, efficiency, and utility. In practice, however, balance is often achieved on two of these at the expense of the

third (De Moor, 2015). For the historical mutuals, for instance, equity and utility seemed to have come at the expense of efficiency in the early 19th century, while efficiency replaced equity throughout the 20th century. We assess such matters for the new initiatives as well. By comparing the new insurance alternatives on the use of risk differentiation, reinsurance methods, and strategies for profit (i.e., characteristics of the resource and the institution) we assess their balance regarding efficiency. Risk differentiation and redistribution policies (part of the fairness goal of all initiatives) will be used as indicators for how the initiatives work towards utility. Finally, how governance decisions are made and whether policyholders have a say in drafting their rules help us assess the role they give to equity.

2.4 Methods

The number of new mutual-like organizations is rapidly increasing, although most are (still) small in size. Moreover, while they use digital tools for their organization, most still focus on local (national) markets, communicating in their respective languages, which makes it difficult to get a count of the number of active initiatives internationally. Our inventory of new insurance initiatives was based on mentions in blogs and news reports as well as presence on social media (Twitter/Facebook). For this purpose, we used the search terms [Peer-to-Peer OR P2P OR crowdsurance OR new] AND [mutuals OR mutualism OR insurance].

We inventoried 57 initiatives (active and inactive, see Tables A.1-A.2 in the Appendix) that were established between 2006 – 2018, with the majority (39) founded in 2015 or later. With the exception of Latin America and most of Africa—where local micro-insurances are ubiquitous, but no accounts of new institutionalized and digitalized initiatives were found, possibly because their insurance sectors are less developed generally and internet penetration rates are low(er)—comparable initiatives are being established everywhere. The majority are European, although some of the pioneers started outside of Europe (e.g., TongJuBao in China, PeerCover in New Zealand) and several initiatives (e.g., Teambrella, VouchForMe, WorldCover) ignore national borders altogether.

Of the 57 initiatives, we selected 11 for a more thorough review (Table 2.1), simply because we could collect sufficient information about them. For the others, websites provided too little information, content was only available in foreign languages, and/or we could not get in touch with a representative of the organization. The selected initiatives cover different parts of the world as well as different insurance products. Still, we note that caution is warranted in contemplating these initiatives' success, as most new mutuals, with the exception of Friendsurance (150,000 policyholders) and Lemonade (425,000), have a relatively small member base (with Versicherix not even officially launched yet).

Table 2.1. Overview of new mutuals included in review, sorted by founding year

P2P insurer	Year (founded)[1] launched	Country	# Policyholders mid-2019	Type of insurance
Broodfonds	(2006) 2011	Netherlands	$> 20,000$	Life: Income protection for self-employed workers
Friendsurance	2010	Germany, Australia	$\approx 150,000$	Non-life: Deductibles of insurance offered by 175 insurance partners (e.g., household, liability, motor)
CommonEasy	(2014) 2016	Netherlands	$< 1,000$	Life: Income protection for self-employed workers
TongJuBao	2014	China[2]	$> 20,000$	Life: Divorce, child abduction; family migration
Lemonade	(2015) 2016	US	$\approx 425,000$	Non-life: Renters'; home
Teambrella	2015	International[3]	< 500	Non-life: Motor; bicycles; pets
Versicherix	(2015) –	Switzerland	0	Anything policyholders need insured
Axieme	2016	Italy	$> 2,000$	Anything policyholders need insured (e.g., professional risk; casualty & property)
Besure	2016	Canada	Not disclosed	Anything policyholders need insured
Tribe	2016	Norway	$> 2,500$	Non-life: House; furniture; motor; health; travel; pets
SharePeople	2017	Netherlands	$< 1,000$	Life: Income protection for self-employed workers

Notes: [1]Added only if the launch year differs from the founding year; [2]TongJuBao is looking for a market in Europe and the US under the name P2P connect; [3]Teambrella is currently active in Argentina, Germany, Peru, Russia, the Netherlands, and the US.

2.4.1 Measures

To compare the institution, resource, and user dimensions of the insurance organizations, we derive two or three characteristics per dimension. For the institution, we compare whether the initiatives use non-profit (e.g., cooperative, association) or for-profit (stock insurance) organizational forms and to what extent users are involved in decision-making. For the resource dimension, we outline whether the initiatives use risk-differentiation and reinsurance and what share of the premium they potentially redistribute over the users. The user dimension, finally, is characterized by outlining whether the initiatives set limits to group size and whether the initiatives devise and promote means of communication among members.

2.5 Results

2.5.1 Basic characteristics

Table 2.1 signals that the new initiatives offer a broad range of insurance, both in the life and non-life domain. Particularly noteworthy is that several explicitly state that they insure everything, including what is not insured by other insurers or the welfare state (e.g., pet or family insurance). Sometimes this alternative insurance offer is how they market themselves (e.g., the family insurance of TongJuBao). Others

merely create the platform and infrastructure and invite (groups of) people to use this platform for any insurance they have in mind (e.g., Besure).

In the non-life domain, there is an emphasis on insurance types that enable some form of standardized risk differentiation and have relatively stable, mostly one-off insurance payouts (e.g., motor, pet, or travel insurance). These insurance types may be particularly suitable for mutual insurance, because they lower the uncertainty with respect to how much insurance is needed when claims are filed and for how long (the product's maximum value is specified in advance).

In the life domain, most mutuals historically focused on burial insurance, because all members need it at some point and moral hazard will be limited. When health insurance was offered, this was made feasible through minimal coverage that was capped at a limited number of consecutive months (Van Leeuwen, 2016). We see this strategy in use again for the new insurance types that insure health or disability. These organizations are a direct response to the privatization of insurance that was previously offered by the welfare state.[4] The insurance provided is usually only a minimum income replacement and offered for a limited number of months (e.g., two years for the Dutch Broodfonds). This way, they make insuring more unpredictable risks manageable.

2.5.2 Institutional, resource, and user features

Before reflecting on overall balance, we outline the main institutional, resource, and user features, categorizing the initiatives based on two or three characteristics. For more detailed information per initiative, we refer the reader to Tables A.3–A.5 in the Appendix.

With regard to the institution, a dichotomy arises when we compare the initiatives based on their organizational form and decision-making structure (Table 2.2). All top-down-organized initiatives are start-ups by entrepreneurs wishing to disrupt the insurance sector with a model that, institutionally, maintains the standard, for-profit structure (albeit as social enterprise in the case of SharePeople), but introduces innovations mainly in user and resource characteristics. Initiatives with bottom-up structures, on the contrary, started as local solutions that later scaled to associations or cooperatives (Broodfonds, CommonEasy) or were designed within the platform-economy movement before looking for users that would shape the actual rules of governance (Besure, Teambrella). These initiatives make the users responsible by involving them in the design of operational rules.

Roughly the same categories apply for the resource characteristics. The top-down

[4]Broodfonds, for instance, started after the Dutch state abolished the Disability Act for self-employed workers in 2004. With this abolishment, the Netherlands no longer offered social security arrangements for self-employed workers to cover sickness and disability. Instead of taking out a disability insurance with a private insurance company (which for many self-employed workers is too expensive, Van der Torre et al., 2019), Broodfonds emerged as a cheaper and social alternative.

Table 2.2. Categorization based on organizational form and decision-making structure

		Organizational form	
		For-profit, stock	Social enterprise, association, (platform) cooperative
Decision-making	Provider	Axieme, Friendsurance, Lemonade, Tribe, Versciherix	SharePeople
	Both		Broodfonds, CommonEasy, TongJuBao
	User		Besure, Teambrella

Table 2.3. Categorization based on risk differentiation and reinsurance policies

		Risk differentiation	
		Yes	No
Reinsurance	External	Axieme,[1] Friendsurance, Lemonade,[2] Tribe, Versciherix	
	Internal	Lemonade[2]	Broodfonds, TongJuBao
	None		Besure, CommonEasy, SharePeople, Teambrella

Notes: [1]Axieme, Friendsurance, and Tribe act as brokers so reinsurance is arranged by the insurance carrier they connect the policyholder to; [2]Lemonade uses external reinsurance as backup for internal reinsurance.

Table 2.4. Categorization based on communication and group size configurations

		Communication among users	
		Yes	No
Group size restrictions	Yes	Besure, Broodfonds	Friendsurance, Tribe[2]
	No	CommonEasy, Teambrella	Axieme, Lemonade, SharePeople

Notes: [1]Information on Versicherix is missing; [2]Members of Tribe do group with members they already know, so they likely do communicate via other means, but this is not structured through (or stimulated by) the mutual.

insurers use InsurTech technologies to calculate individual risk profiles, which are refined over time and translate into highly differentiated premium levels. Moreover, they cooperate with established insurers to guarantee payout when the local insurance fund is exhausted (Table 2.3). This is how they claim to provide high utility for everyone, but for low-risk groups in particular (for whom extensive risk differentiation generates lower premiums than with regular insurers).

The bottom-up initiatives start instead from the premises of equality and inclusion and do not differentiate based on (in their opinion) subjective risk profiles. To keep premiums low, their payouts usually do not provide full coverage; instead, they primarily want to make minimal support available to everyone. Therefore, they do not cooperate with established insurers for external reinsurance either. The larger (and older) initiatives (Broodfonds and TongJuBao) do have internal reinsurance systems

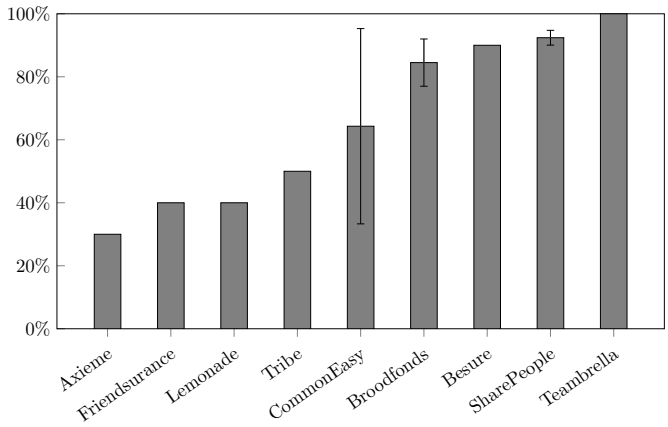


Figure 2.2. Maximum premium redistribution per organization

Notes: [1]Information is missing for TongJuBao and Versicherix; [2]The redistribution percentage for CommonEasy, Broodfonds, and SharePeople fluctuates because the amount unavailable for redistribution is a fixed (absolute) fee regardless of the premium level. See Table A.6 in the Appendix for calculations.

that operate across the risk-sharing groups, but initially all mutuals in this category pose the basic risk that payouts are not guaranteed: If the fund is depleted, losses are not covered.

A resource characteristic that distinguishes all new initiatives from regular insurers is the use of redistribution policies. Based on a fairness notion that premiums contributed to the fund are only meant for insurance payouts, all initiatives return at least some share of the unused premiums at the end of the term (usually one year). While we do observe that the maximum redistribution share is lower for the for-profit initiatives (which also invest part of the premium in external reinsurance), the share is substantial everywhere (Figure 2.2).

For member characteristics, finally, we find that communication within risk-sharing groups is possible (and stimulated) only in the bottom-up mutuals (Table 2.4), who base this on the idea that communication fosters commitment directly by creating agreement on rules and payouts, and indirectly by fostering cohesion and solidarity. However, when we divide the initiatives based on whether or not they pose restrictions on the maximum size of risk-sharing groups, the resulting division cannot be explained. The initiatives that pose such restrictions are Besure (which compels groups to set limits, but gives them freedom to decide on these limits), Broodfonds (20–50 members), Friendsurance (exactly 10), and Tribe (at most 10).

While the chosen limits vary per initiative, they are implemented out of a belief that the number of people to whom solidarity can be invoked is limited. When group members are anonymous or when groups exceed a boundary beyond which social

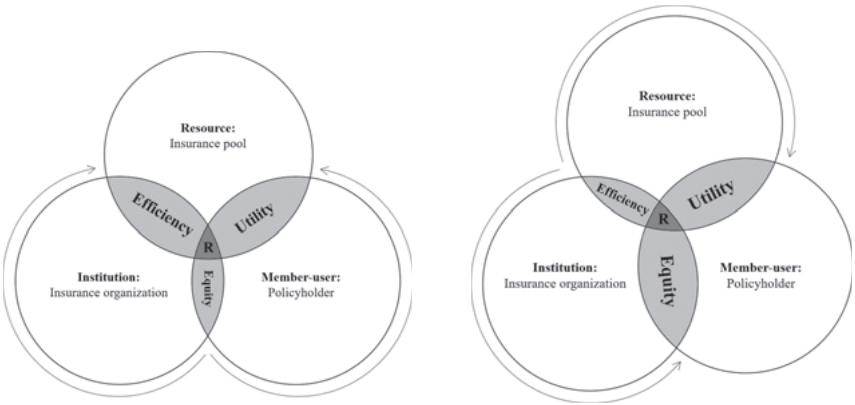
norms can no longer be maintained, the practice of sharing risk is no longer believed to reduce moral hazard. The other initiatives, contrarily, believe in the strength of large numbers and argue that solidarity is not directed towards specific others but generalized to the group as a whole. This is an interesting discord, as there is no agreement on optimal group size in research on ICAs either. Collective action is argued to benefit from larger groups, as it allows for a better spreading of risks, but larger groups are also considered detrimental for cohesion and therefore the willingness to cooperate (Olson, 1965; Poteete & Ostrom, 2004). We return to this issue in the discussion.

2.5.3 The balance on efficiency, utility, and equity

Apart from the ambiguity regarding group size, the new initiatives can be conceptualized as falling into two categories. The top-down organizations use risk sharing and redistribution as innovative tools, but institutionally resemble modern stock insurance companies, while the bottom-up organizations largely resemble their 19th-century counterparts—including the fact that they cannot promise the same degree of security as regular insurance companies do. Organizations of the latter type therefore unmistakably represent a revival of mutualism, operating between market and state, while the first category might be better classified as a new alternative within the private insurance sector.

The difference in how the two categories balance on efficiency, utility, and equity makes clear why. First, the dichotomy translates into a different vision of utility. While organizations in both groups emerged to better answer to policyholders' needs (i.e., the utility domain) than their state or market counterparts, they differ in how they perceive these needs. The top-down organizations envision optimal utility in an insurance policy that most accurately reflects actual needs (i.e., with premiums that most meticulously represent actual risk profiles). With this vision they aim particularly to improve utility for low-risk members. The bottom-up organizations consider utility to reflect a minimum security level for everyone, including high-risk individuals that may have difficulty taking out an insurance policy with private insurers. Whether this vision fits everyone's needs or ultimately results in problems of adverse selection (i.e., risk-sharing groups with mostly high-risk members; Akerlof, 1970) remains to be seen.

The implementation of utility is thus unevenly balanced towards different target users, but at least improving utility constitutes a core concern for all new insurance organizations. An assessment of the balance in efficiency and equity, however, signals the clear division between the two types of organizations. Typically, top-down organizations strive for utility and efficiency at the expense of equity, while the bottom-up organizations strive for utility and equity at the expense of efficiency (Figure 2.3). That is, the first group organizes the risk-sharing groups such that exactly the right



(a) Top-down organizations *(b)* Bottom-up organizations

Figure 2.3. Balance configurations for the two types of new insurance initiatives

Note: R stands for Resilience.

amount of premiums are paid, but can only do so by fixing the institutional setup and not giving members a say in how the group should organize itself. While this makes the decision-making process more efficient, the consequence of low member involvement might be that they perceive less procedural justice, e.g., on premium sizes or payout eligibility.

The second type of organization leaves much room for members to decide upon their internal structure and criteria for payout eligibility, which, although it enhances feelings of procedural justice, can result in a lengthier and more complex decision-making process and less efficient management. Although with time efficiency may increase when decision-making processes have consolidated and the formation of trust has rooted within the organization (De Moor, 2015), currently both types of organizations seem to balance two dimensions at the expense of the third. If the two types of organizations continue down this road, it stands to reason that, when they do grow up to be solid insurance alternatives, these initial differences will become more marked.

When we consider the number of members as a first indicator, for instance, it should be noted that some of the top-down organizations (Friendsurance, Lemonade) have larger member bases than the bottom-up mutuals. This is without doubt related to the fact that top-down structures make it easier for members to sign up. New members are exogenously assigned to a risk-sharing group and bear no responsibility for its creation with all corresponding institutional demands. In bottom-up organizations, contrarily, they first have to find sufficient interested others to form a group with, and subsequently have to reach agreement on how they want to organize cooperation. Even when new risk-sharing groups can start from some basic institu-

tional framework, this may imply a higher threshold for joining. Hence, the top-down organizations are more likely to grow, and to do so more quickly, in the coming years.

At the same time, this rapid growth and lack of member involvement raises the question of how the concept of solidarity will develop and whether the top-down organizations will manage to keep their role and meaning different from those of regular insurers. Simply forming a risk-sharing group by itself may not be sufficient; social identities have to be constructed to stimulate members' willingness to help others or prevent them from filing excessive or fraudulent insurance claims (i.e., moral hazard). Without active conveyance of solidarity and helping norms, the top-down organizations could develop in the direction of regular insurers, albeit with a different internal structuring of how insurance payouts are arranged.

With regard to the bottom-up organizations, it should be noted that so far, few have managed to secure a solid position as insurance alternatives. Some have had difficulties in getting off the ground (e.g., PeerCover in New Zealand), while others (like HeyGuevara in the UK and InsPeer in France) have stopped their operations after a few years. The uncertainty that comes with these organizations (no full coverage, no payout guarantee) might be too big of a step to take for people who have gotten accustomed to the availability of insurance in the welfare state. Hence, if the bottom-up mutuals want to become serious insurance alternatives, they have to reduce this uncertainty—for instance (like Broodfonds) by creating their own reinsurance system. The crucial task here is to do so in a way that does not jeopardize the established equity. A potential pitfall of further institutionalization (and bureaucratization) is that it may come at the expense of key values like responsibility and transparency.

2.6 Conclusion and discussion

So why, then, do we see new mutual-like organizations popping up in many different countries? What needs do they answer to and do they answer them sufficiently? How are they organized and what are the institutional parallels between these otherwise independently evolving initiatives? Can we expect these alternative organizational forms to proliferate and succeed in the long run? While the phenomenon is recent, the questions are not: They have been asked—and answered—with respect to historical mutuals as well. These mutuals emerged in the classical liberal era (early 19$^{\text{th}}$ century) due to inadequate public provisions with respect to, e.g., poor relief (Ilcan & Basok, 2004). They grew in popularity quickly, succeeded in alleviating their members' immediate needs, and ensured sufficiency by offering additional immaterial (social) support (Emery & Emery, 1999). At the same time, their voluntary organization and freedom to pose membership restrictions meant that large parts of the population were never covered by mutual insurance arrangements. In the 20$^{\text{th}}$ century, the mutuals' services were therefore increasingly incorporated by the state, making mutuals the founding fathers of the modern welfare state (Beito, 2000). Elsewhere, the mutuals

professionalized to compete with the growing number of market insurers, trying to find a niche between market and state in which they could offer the same levels of security while maintaining their member involvement and ownership advantage (Schneiberg, 2002).

Even though the new mutuals movement is still in its infancy, we have seen that the story of their rise is unmistakably similar: to answer to the inadequate insurance provisions of market and state, this time in the neoliberal era (De Moor, 2015; Natalier & Willis, 2008). Will the rest of the cycle repeat as well? Although it is too early to say (we would be comparing a development of two decades to one of two centuries), our review does indicate that, already in their foundation, the new insurance organizations seem to divide themselves into a group that aims to cater particularly to the needs of high-risk individuals, thereby rethinking the conceptions of solidarity and universalism as implemented by the welfare state in the life domain, and a group that targets particularly the needs of low-risk individuals, mostly in competition with the traditional market insurers in the non-life domain. It is therefore not unimaginable that, when the two insurance types manage to secure a solid position within the existing insurance landscape, they may likewise affect the organization of both the welfare state and market insurers.

This would, however, require that they learn from the 'mistakes' made by their historical counterparts. We have seen that while all new mutuals are attentive to ensuring utility, there is room for improvement in their balance on either equity or efficiency. If the organizations are to follow their current development path, the top-down organizations risk ending up similar to today's mutual insurance companies, having aspects of mutual insurance on paper (in this case, risk-sharing groups), without reaping the benefits in practice. Feelings of solidarity and trust—crucial to keeping moral hazard occurrences low—may gradually be forgotten as the risk-sharing group becomes more abstract and anonymous.

For the bottom-up organizations, on the other hand, neglecting the balance on efficiency might become problematic if mutuals encounter problems of adverse selection. Low premiums and zero-to-limited risk differentiation might, as we have also seen in the development of historical mutuals (Van Leeuwen, 2016), make the new mutuals particularly attractive to high-risk individuals. Risk-sharing groups with an above-average number of high-risk members may encounter difficulties when the number of claims exceed the resource's carrying capacity. For the new insurance initiatives to become resilient, it is therefore vital that they improve their balance regarding efficiency or equity, without harming the established balance on the other dimensions too much.

In light of these conclusions, a word of caution is in order. While we have stressed repeatedly that the initiatives are still in their infancy, it should also be noted that our inventory of new mutual-type insurance initiatives is by definition incomplete. We by no means claim to have a complete overview; after all, new mutualist organizations

may be set up as we speak. Since the initiatives develop largely independently of one another, it is difficult to get a grip on the available experience, and we cannot claim that a third organizational form is not being, or will not be, developed.

Frankly, this is a pioneering study and research into the role and development of new mutualism is only just beginning. While we can learn from historical experiences, many questions remain unanswered. First, as we have already touched upon, the historical mutuals—not just the 19th-century mutuals referred to in this chapter, but the older forms of guild insurance as well—have also known various different development paths. Some professionalized within the bottom-up framework and, similar to Broodfonds and TongJuBao, drafted overarching reinsurance systems to cater their insurance to more members without losing the small-group benefits of informal sanctioning and control mechanisms. Others, especially towards the 20th century, transformed into top-down organizations in order to compete with private insurers. It is to date unclear, however, why some mutuals survived while others did not. This signals that much more can be learned about institutional resilience from a direct comparison between some historical and current cases—to improve both the current institutions' resilience and the understanding of the historical mutuals' demise. Which institutional features are crucial for resilience? And which may potentially be harmful? More detailed case-by-case comparisons may yield insight into how the mutuals adjust over time and can restore their balance towards resilience.

Secondly, more insight into the role of group size and solidarity is warranted. While scholars have attempted to estimate optimal community sizes (Casari & Tagliapietra, 2018; Dunbar & Sosis, 2018), we know little about why certain community sizes seem to work well. What is the number of people to whom one can act on the basis of solidarity? Does solidarity even have to be directed at specific individuals or can it be generalized to a collective group identity? The mutuals that apply restrictions to group size base these restrictions on common-sense intuitions, but how accurate are these? Given that risk-sharing groups are the core of the new mutuals, but their limits range from 10 to 50 to (in theory) infinity, it is pertinent that we gain a better understanding of the relation between group size and solidarity. Do solidarity feelings increase or decrease depending on the size of the risk-sharing group? And is this relation even linear?

Finally, we know that differences in the institutional setup have important implications for individual and social factors that shape willingness to participate in mutuals. Institutions could, for instance, both enhance and crowd out solidarity motives (Bowles, 2008). To illustrate, whether or not the mutual provides an internal platform for communication matters a lot for how solidarity is perceived in practice, i.e., as generalized or the outcome of a direct interdependence between members. How do institutions shape social dynamics like a mutual sense of belonging or internal social norms? What role do such dynamics play for the willingness to participate (and more specifically, to support others)? And lastly, to what extent can digital

communication platforms invoke social dynamics similar to those that work in offline, localized communities?

Further research on the interplay between institutional, social, and individual factors will enhance our understanding of the functioning of the new mutuals (and by extension other ICAs) in our current societies, and ultimately increase insights into the role such initiatives are projected to play in the future.

3

CHAPTER 3

Networks and new mutualism: How embeddedness influences commitment and trust in small mutuals

A slightly different version of this chapter has been published as Vriens, E., Buskens, V., & De Moor, T. (2019). Networks and New Mutualism: How Embeddedness Influences Commitment and Trust in Small Mutuals. *Socioeconomic Review, 0*(0):1-22. Vriens developed the main idea of this manuscript. The survey for the data collection was drafted by all authors. The data collection was executed by Vriens with practical support of Schoenmaker and Jonkers of the BroodfondsMakers cooperative. Vriens wrote the main part of this manuscript and conducted the analyses. Buskens and De Moor contributed substantially by providing detailed feedback on earlier versions.

Abstract

Mutualism is reviving again in several countries, replying to state and market failure with an alternative, social insurance set-up. We study participation in these new mutuals with a focus on social embeddedness. We distinguish group-level embeddedness (network structure) and individual embeddedness (the type and quantity of ties to other group members) and study how these relate to members' commitment to mutuals and their trust in the commitment of others. We show that group-level embeddedness primarily affects trust, while individual embeddedness more strongly associates with commitment. These dynamics are revealed for mutuals of different ages using a unique multilevel dataset on the motivations, beliefs, and social relations of more than 5000 members of 230 small Dutch mutuals. Our results highlight the importance of thinking critically about the levels at which social embeddedness plays a role, as the dynamics are more subtle and not all means of embeddedness are equally fruitful in promoting cooperation

3.1 Introduction

Mutual insurance is the oldest, most basic, and cross-culturally applied means of risk-sharing worldwide.[1] In most of Europe, the US, and Australia, mutuals were the most widespread—and seemingly most successful—way of organizing insurance throughout the 19th century (Emery & Emery, 1999; Van Leeuwen, 2016). Nonetheless, the number of mutuals declined during the 20th century and their small-scale and local character disappeared. Many were dissolved as their tasks where taken over by national welfare states (Beito, 2000). Others seized operations in competition with rising private insurance companies, or, when they did manage to survive, merged and professionalized into large mutual insurance companies (Schneiberg, 2002).

Yet even with large insurance companies nowadays forming the status quo, the establishment of new mutuals over the past decade demonstrates that mutualism is by no means a phenomenon of the past (De Moor, 2015; Vriens & De Moor, 2020). Mutuals still form a key means to share risk among rural populations in sub-Saharan Africa (Lemay-Boucher, 2009), India (Ligon et al., 2002), and Southeast Asia (Fafchamps & Lund, 2003). Moreover, mutuals are reviving in western countries as well (examples are Friendsurance in Germany and Broodfonds in the Netherlands); particularly among the self-employed, migrants, or people working in the informal sector—subpopulations that are often poorly insured (or not at all) (ILO, 2001).

In this chapter, we focus on these recently established mutuals, which institutionally resemble their 19th century counterparts. Responding to failures in the insurance

[1] The oldest forms of mutual insurance can be found among the early modern guilds, where craftsmen came up with a pre-modern social security system for their members (see Epstein & Prak, 2008).

provisions of both market and state, they envision an insurance that is based on solidarity, fairness, transparency, and innovation (Vriens & De Moor, 2020). That is, members take out an insurance not only to help themselves, but others in their risk-sharing group as well; the premiums they pay to the insurance fund are (partly) returned if they were not needed for payouts to group members by the end of the term; they cooperate within an umbrella institution governed by a minimum set of rules as well as clarity on, e.g., payouts and eligibility; and (transcending the historical model) they organize their cooperation not (only) through real-life meetings, but with digital communication platforms and artificial intelligence tools.

This organizational form, which (partly) returns organizational responsibility to the members, categorizes the new mutuals as institutions for collective action (De Moor, 2015). Organized on an informal, voluntary basis, mutuals often cannot rely on binding legal agreements to enforce members' participation, but depend on principles of responsibility, reciprocity, and trust instead. This creates a classic cooperation problem (Ostrom, 1990) at the heart of mutuals, as members face uncertainty regarding, for instance, the genuineness of insurance claims or other members' willingness to pay the costs for insurance payouts. In addition, members do not know whether they will ever need an endowment from the fund or how many others (simultaneously) will.

Basically, while the decision to join a mutual implies a promise to insure others as well (and thus to incur costs to meet their needs), this initial decision gives no guarantee for the future. Members could at any time decide to revoke their membership if they no longer want to pay to help others (e.g., because others file more claims than expected), and if they do, they take back the share of their contributions that has not been spent on payouts. Alternatively, remaining a member, they might start to take more risks because they are insured, exaggerate losses, or even make them up entirely (i.e., various degrees of *ex ante* and *ex post* moral hazard; Arrow, 1971) to reap the benefits of their contributions.

Experiences from the past have taught us that mutuals generally faced fewer moral hazard problems than early market and government insurers (Van Leeuwen, 2016; Emery & Emery, 1999). Due to their small risk-sharing groups, cohesive structures, and strong social control, the number of claims was controlled over time. At the same time, we know that when moral hazard behavior did occur, it was often more detrimental. Trust could quickly deteriorate, particularly when many people needed the insurance, resulting in reduced willingness to cooperate (Coate & Ravallion, 1993). Moreover, the small groups often did not have the financial stability to cope with increases in claims, leading to depleted insurance funds or even bankruptcy (De Swaan & Van der Linden, 2006).

Learning from the past, it follows that if the new mutuals are to become lasting insurance alternatives, they have to create an environment that not only triggers motivation for voluntary cooperation, but sustains it as well. Therefore, this study

serves to gain insight into factors affecting members' individual commitment and trust levels. We use these performance indicators because low levels of commitment and trust pose a threat to the mutual's survival, while high levels signal the members' intent to, *ceteris paribus*, continue cooperation in the future and their beliefs that others will do the same (Gundlach, Achrol, & Mentzer, 1995; Kollock, 1994). Since sudden changes due to internal or external shocks can by nature not be foreseen, these indicators are our best proxies for future behavior.

Following the new mutuals' belief in social motives over complex institutional arrangements, we aim to disentangle how various aspects of social embeddedness (both in general and through individual relations) relate to commitment and trust. While in our modern societies institutions are given a key role in solving all types of cooperation problems (Bravo, 2010), a large body of literature suggests that social embeddedness—conceived through reciprocity (Bowles & Gintis, 2002), reputation (Raub & Weesie, 1990), norms (Poteete & Ostrom, 2004), cohesion (Coleman, 1990), or communication (Balliet, 2010)—may be equally, if not more important (Granovetter, 1985; Bowles, 2008).

To put these ideas to a test we compare 230 different risk-sharing groups, established between 2006 and 2017, of a Dutch mutual called Broodfonds[2]. In Broodfonds groups, self-employed workers jointly arrange an income protection insurance for sickness and disability in groups of at most 50 members. The interesting feature of this mutual is that the 230 groups are organized on the same basic principles, thus enabling us to compare many large, natural networks. Additionally, compared to other new mutuals—most of which are established after 2016 (Vriens & De Moor, 2020)—a considerable share of Broodfonds groups has several years of experience, enabling comparisons of the extent to which commitment and trust have consolidated within these groups.

We therefore measured trust and commitment levels, as well as several indicators for social embeddedness, among 5,192 members (51%) of the 230 different Broodfonds groups active at the beginning of 2017. And although our cross-sectional survey data obstructs causal analyses, they do enable us to explicate the generally kept implicit mechanisms underlying social aspects of participation. Moreover, it provides an integrated approach to test the combined effects for a set of hypotheses for which the isolated relevance is well-established.

3.2 Revival of mutualism

Before we proceed, a short characterization of the wider developments contributing to the emergence and organization of mutuals helps to grasp the framework within

[2]Broodfonds literally translates to Bread Fund (a fund that allows you to buy bread). The name signals the purpose of the insurance, which does not cover health expenses but serves as income replacement. It refers to the saying "to put bread on the table", which means to earn enough for a living.

which the hypothesized relations on individual and social factors take part.

3.2.1 Economic and societal embeddedness

The revival of new mutuals initiatives is a response to the decline of the welfare state, which, over the past few decades, has taken place in many (particularly European) countries, where principles of neoliberalism have provided the economic justification for delegating the provision of social insurances (such as health insurance) to the private sector (Natalier & Willis, 2008). Moreover, these countries increasingly place responsibility with citizens and consider it as governmental tasks to inspire and assist citizens to take responsibility for social problems in their community (Ilcan & Basok, 2004). This spurred an increase in (the popularity of) institutions for collective action that, as often observed simultaneously (Schneiberg, 2011), takes place not only in the service sector (where the new mutuals emerge), but in fields of agriculture, energy, and health care as well, in domains where adequate provisions are lacking (De Moor, 2015).

This trend has direct parallels to the 19th century, when mutuals and voluntary organizations also emerged side by side to create financial security and assist poor relief due to inadequate public provisions (Van Leeuwen, 2016). And although the new movement is still in its infancy, its development is promising. The initiatives all organize through umbrella structures (ranging from cooperatives and social enterprises to formal insurance entities), which they use to enable new members to relatively easy start their own risk-sharing group using the same basic organizational framework (Vriens & De Moor, 2020). As such, they act as legitimate operators between market and state, as their 19th century counterparts did before them (Ware, 1989).

3.2.2 Institutional embeddedness

Most small mutuals (past and present) have a stable, well-defined membership, clear procedures to accept new members, and rules on, e.g., schedules of payments, contribution levels, and sanctions in case of non-payment or misbehavior (ranging from warnings to monetary fines to removal from the collective). Moreover, the groups are democratically organized, have a chairman, secretary, and treasurer chosen from their members, and hold regular meetings for which attendance is largely compulsory. Finally, although some groups set particular restrictions to membership, such as by profession or location, the funds are generally open to everyone (Abdikerimova & Feng, 2019; Lemay-Boucher, 2009; Mariam, 2003; Murgai, Winters, Sadoulet, & De Janvry, 2002).

To illustrate, the regulations of Broodfonds specify the following general conditions: (1) groups should contain between 20 and 50 members; (2) each member pays a fixed monthly contribution (chosen from a fixed set of contribution levels); (3) members who fall ill receive a monthly endowment (proportional to their contribution) for

at most two years, the costs of which are shared by all group members; (4) members take alternating turns occupying board positions; and (5) the board has the right to terminate membership of members who misbehaved.[3]

This basic organizational framework was designed by the first Broodfonds group, which started in 2006 with approximately 50 members. These members self-organized because from 2004 onwards the welfare state left self-employed workers at the mercy of private insurance companies, who charged premiums that most self-employed workers cannot afford. From 2011 onwards, more Broodfonds groups were established. To carry the name Broodfonds, all adhere at least to the basic institutional principles outlined above. The number of Broodfonds groups grew rapidly afterwards, from 18 by the end of 2012 to 230 by February 2017 (reference date for our data collection) and 595 in October 2020 (see Figure 1.2 in Chapter 1).

Despite institutionally being largely similar there are also variations between the different Broodfonds groups. Each Broodfonds has the freedom to specify additional rules tailored to their local needs. This introduces variation between Broodfonds groups, for instance in restrictions posed on membership or on the annual number of meetings (Vriens et al., 2018). Additionally, and central to the current study, the groups differ in the extent of intra-group social contact and the type of membership motivations that dominate (monetary or social).

3.3 Theory

Literature on understanding participation in mutuals starts from the theory of social dilemma's (Coate & Ravallion, 1993; Fafchamps, 1992). Cooperation entails joining the mutual, investing resources to create a collective insurance fund, and paying the costs to help other members in times of need, while defection entails moral hazard behavior or withdrawal to avoid paying the endowments of others. Obviously, the collective benefit (i.e., security in times of need) is obtained only when all (or most) players cooperate. However, the uncertainties inherent to mutuals, such as not knowing whether one ever needs the insurance or whether those who currently do will reciprocate in the future, may tip the balance in favor of defection—especially when one or several members actually call upon using the insurance fund (Platteau, 1997).

On top of these internal dynamics, in most natural settings the dilemma is not merely whether or not to engage in one specific partnership. For example, there may be several solutions to solve the insurance problem: Aside from participation in a mutual, people could rely on own savings, borrow money, or take out an insurance with a private insurance company. In such settings, commitment to the current partnership has long been recognized as a crucial feature underlying long-term cooperation (Hauert, 2002; Kollock, 1994; Orbell, Schwartz-Shea, & Simmons, 1984).

[3]See https://www.broodfonds.nl/hoe_het_werkt for the main rules and requirements (in Dutch).

Commitment to mutuals is the result not only of individual needs and risk perceptions (Coate & Ravallion, 1993), but also of the belief that most others will behave similarly, i.e. are also committed (Kollock, 1994). Without trust in others' commitment, no individual member will commit, while one's own commitment is required for others to do so. Likewise, when members start calling other members' commitment into question or even suspect some of them to commit fraud and misuse the insurance, this might set in motion a shift to withdrawal or deceptive strategies, potentially even resulting in failure of the collective.

Commitment and trust are thus vital to sustain cooperation in a mutual type of collective action setting. The relation between the two is well-established (Ostrom, 2010; Sargeant & Lee, 2004) and their relevance in the collective action context is supported by evidence from field studies (Haapasaari, Michielsens, Karjalainen, Reinikainen, & Kuikka, 2007) and experiments (Baggio et al., 2015). We therefore start from the following assumption:

Assumption 3.1: *Commitment and trust are interlinked in a positive and mutually reinforcing relationship.*

3.3.1 The role of social embeddedness

The reinforcing relationship between commitment and trust implies interdependencies in members' behavior, hence introducing a natural role for social embeddedness as predictor of both. Through social embeddedness, commitment and trust of members of the same group can be aligned. Studies on historical mutualism, for instance, demonstrate that as the member base of mutuals grew vastly throughout the 20$^{\text{th}}$ century, the institutions professionalized and social embeddedness decreased (Ismay, 2015). While the large member base would still institutionally be subdivided in smaller risk-sharing subgroups, within these subgroups the sense of mutual responsibility, solidarity, and social control decreased. Members could or would no longer call each other out on their responsibilities, which translated in larger number of claims (hinting at increased moral hazard; Downing, 2012).

This suggests that in and of itself, the small size of the risk-sharing groups does not explain decades of mutuals' success in controlling moral hazard. Instead, it was the social structure within these groups that truly induced cooperative and prosocial behavior. This structure created the social bonds needed to establish helping norms and to control and monitor each other's behavior. We therefore argue that, even though cooperation is to some extent regulated within institutions, we should look at the social embeddedness within these institutions to understand commitment and trust. Moreover, when it comes to social embeddedness, we should not only consider group-level embeddedness, but individual relations as well (Lazega & Snijders, 2016). After all, a mutual group might have established strong helping norms overall, but there might be one or a few members located on the outskirts of the network, not in

contact with (many) others. It is not evident that they would be equally inclined to comply to these social norms.

3.3.2 Group-level embeddedness

On the group-level, embeddedness enhances participation through two main drivers: connectedness and cohesion. Connectedness enables the spreading of information about intentions and behavior of other group members and provides opportunities for control. Members who are tied can communicate their commitment, exchange promises (Orbell et al., 1984), monitor each other's behavior (Raub & Weesie, 1990), and establish trust relations (Buskens, 2002). The higher the embeddedness, the sooner information about potential misconduct would be common knowledge to all members (Raub & Weesie, 1990). Connections to other members (both directly and indirectly) can thus foster both trust and commitment. This is supported by the large amount of evidence that shows that cooperation is higher when members can communicate (Balliet, 2010; Ledyard, 1995).

Cohesion, secondly, creates a sense of belonging to a group which induces behavior matched to group interests rather than personal ones (Orbell et al., 1984). Particularly, it creates a cooperative norm that strengthens members' commitment by aligning personal values to that of the mutual as well as evoking a sense of obligation to remain a member. By fostering social norms and a sense of group identity, cohesion also increases trust in the intentions of other group members. After all, they relate to the same identity (Coleman, 1990). For mutuals, this positive effect of cohesion is found both in experiments (Attanasio, Barr, Cardenas, Genicot, & Meghir, 2012; Barr, Dekker, & Fafchamps, 2012) and in the field (Murgai et al., 2002) in settings where individuals endogenously form their own risk-sharing groups. By grouping with known others, such as people from the same community, they ensure a common identity.

As can be seen from Figure 3.1, the two drivers do not necessarily require the same network structures to yield optimal results. A network can be well-connected without being cohesive (e.g., star-shaped networks) or cohesive yet poorly connected (e.g., clustered networks, Bodin & Crona, 2009; M. A. Janssen et al., 2006). In general, then, dense networks are most likely to advance trust and commitment levels, as they benefit both from connectedness and cohesion.

Sparse networks, on the other hand, are poorly embedded in any way. Trust in the cooperative tendencies of other members will not be reinforced through communication, nor is there a basis on which to turn individual solidarity into general helping norms. Hence, it follows that any network structure is more likely to come with high trust and commitment levels than the sparse network. As there are no theoretical foundations on which to expect connectedness to be more important than cohesion or vice versa, we do not hypothesize on differences between the star and clustered

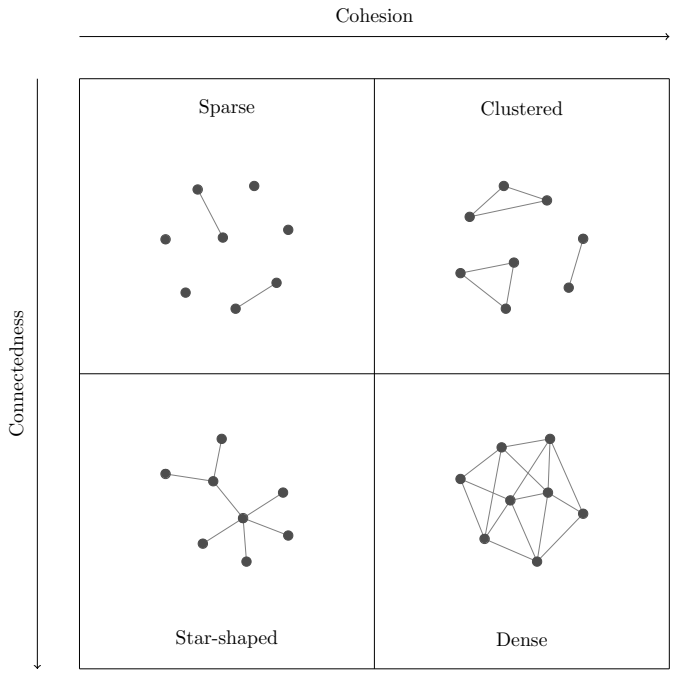


Figure 3.1. Typology of network structures

network, but will confine ourselves to hypothesizing on these networks in comparison to the two extremes (i.e., the sparse and dense network)

For the context of mutuals there is little research on the type of network structures fostering trust and commitment, largely because adequate data is lacking. A notable exception is the paper by Downing (2012), which compares referral networks of members bringing in new members for two Australian mutuals, one in the period 1855–1872 and one between 1903–1915. Downing shows that where the first had a dense connection pattern, the second was more star-shaped, because the majority of members did not feel responsible for bringing in new members. He tentatively took this as a sign that social embeddedness and commitment had waned.

Hypothesis 3.1: *Compared to mutuals with star and clustered networks, members who perceive their mutual as sparse (resp. dense) have lower (resp. higher) levels of* ***(a)*** *commitment to the mutual and* ***(b)*** *trust in the commitment of other group members.*

3.3.3 Individual embeddedness

While networks may on the group-level be well-connected, this need not be the case for each individual. We therefore also consider individual variation resulting from their

degree centrality (counting the number of ties per member of the network; Freeman, 1979). After all, studies repeatedly show that people are more likely to help people they are directly connected to (Baldassarri, 2015; Leider, Möbius, Rosenblat, & Do, 2009; Suri & Watts, 2011).

As these are the ties for which members are in control over the monitoring process and the exchange of promises, direct ties are the ones with whom members can coordinate on cooperative behavior. They can, therefore, add to overall network embeddedness when it comes to trust and commitment. The more central members are in terms of degree, the more other members there are with whom they can exchange commitments and build individual trust relationships. Conversely, members with lower degree centrality participate less in the communication process and cannot rely as much on direct agreements to foster commitment and trust.

Underlying this relation is the mechanism that having (more) ties to others members decreases uncertainty. Uncertainty is largest when one does not know any other members, as that gives no ground for believing others will cooperate apart from a general assumption that they will behave similarly. Knowing one or a few others with whom promises can be exchanged will strongly reduce uncertainty and reinforce this general belief that others behave similarly. This also follows, for instance, from studies on social learning that show that people are more likely to use information from their network when they are uncertain about the strategy to proceed with (Mason & Watts, 2012; Vriens & Corten, 2018). However, we hypothesize that as intentions align, each next tie has a lower impact on reducing uncertainty, until at some point a ceiling effect occurs where additional ties hardly decrease uncertainty; i.e., hardly contribute to commitment and trust levels.

Hypothesis 3.2: *There is a positive, marginally decreasing relation between members' total degree and their levels of* ***(a)*** *commitment to the mutual and* ***(b)*** *trust in the commitment of other group members.*

Although all ties can be expected to increase commitment and trust, strong ties likely offer something extra. They generally share the same social norms and beliefs and can therefore be trusted to behave similarly (Coleman, 1990). Moreover, communication tends to be more intensive among strong ties, which makes members more aware of each others considerations and commitment. Lastly, strong tie networks do not only encourage compliance with social norms and rules, but their strong informal control mechanisms also reduce the need for formal monitoring and sanctioning mechanisms (Buskens, 2002).

All of this means that members with strong ties more often want to cooperate and be given the chance to help each other. Thus, having strong ties within the mutual can be expected to increase levels of commitment and trust. Indeed, strong ties are often found to be associated with higher levels of trust, commitment, and cooperation in social dilemma situations (Ostrom, 1990; Quentin Grafton, 2005). For mutuals,

this feature is highlighted in case studies that reveal strong solidarity networks, often based on kin relations, underlying old networks of mutuals (Fafchamps, 1992).

In understanding the association between the number of strong ties and individual factors such as commitment and trust, note should be taken of the natural limit in the number of strong ties that can be maintained. Strong ties are mutually used to seek advice, support, or help in times of need, which also means that maintenance of these ties requires substantial time and effort (Vriens & van Ingen, 2018). This introduces a natural limit in the number of strong ties that can be maintained (Hill & Dunbar, 2003), implying that no individual needs strong ties to all members of the mutual to be willing to trust or commit. Hence, analogous to total degree, strong tie degree is expected to relate to commitment and trust in a marginally decreasing manner.

Hypothesis 3.3: *There is a positive, marginally decreasing relation between members' strong tie degree and their levels of* ***(a)*** *commitment to the mutual and* ***(b)*** *trust in the commitment of other group members.*

Summarizing, degree is expected to positively relate to commitment and trust, with strong ties providing an additive effect. The strength of this additive effect, however, may vary depending on the mutual's cooperation phase (Bodin & Crona, 2009). In mutuals that are established recently, there is no common history on which to base general trust in the functioning of the mutual, members might not know a lot of other members with whom they can exchange promises of commitment, and lastly, they might not be convinced yet whether the promises of those with whom they recently established a tie are actually trustworthy.

In general, uncertainty is highest in this stage, so it follows that if members were to have some strong ties (whom they know share the same norms and values), these ties probably play a large role in their decision-making process. In that regard, trust in strong tie connections can serve as a catalyst to initiate collective action (Krackhardt, 1992). In mutuals that have existed for some time, members know more other members, who in turn have proven their trustworthiness. Moreover, social norms on helping behavior have had the chance to develop. Finally, these mutuals have more likely experienced one or several occasions in which support was needed and indeed provided. This allows members to rely more on other aspects of social embeddedness, and therefore the relative importance attached to strong ties is likely to have wavered off. Without saying they are unimportant, it can be posited that they are less relied upon compared to the start-up phase.

The importance of strong ties to start cooperation is highlighted both in institutions for collective action (e.g., Ostrom, 1990; De Moor, 2015) and for social movements (e.g., Passy, 2002). Although we are not aware of any studies on this interaction in mutuals, we extrapolate the general mechanism to the current context for our final hypothesis:

Hypothesis 3.4: *The additional benefit of strong tie degree for* ***(a)*** *commitment and* ***(b)*** *trust in the commitment of others is smaller the longer the mutual exists.*

3.4 Data and measurement

The hypotheses are tested using survey data collected among members of Broodfonds. This data collection has been approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of Utrecht University in March 2017 (reference number 17-042). We invited all 10,331 members of the 230 Broodfonds groups that were officially established before February 2017 to fill out an online self-completion survey that inquired about personal characteristics, motivations, and social relations. The chairpersons of the 230 groups were asked to fill out a second survey, with questions about organizational properties. Data was collected between May 10 and June 14 2017. In preparation, two research announcements were sent a few months and a few weeks prior to the start of the data collection. All members were invited via personalized emails containing a unique access code to the survey. After one week, we sent personalized reminder emails to those who did not participate yet. Chairpersons received a second reminder after three weeks, reminding them in particular of the survey on organizational properties.

This approach was very effective: 5,192 respondents filled out the member questionnaire (50.7%). The organization questionnaire was filled out for 196 of 230 groups (85.2%). These response rates are exceptionally high. In the Netherlands, response rates for web-based surveys usually lie around 35% for cross-sectional household surveys. Without telephone or face-to-face follow-up (as for this study), the response is generally even lower (Bethlehem & Cobben, 2013).

3.4.1 Dependent variables

The survey contained a series of statements that together measure the constructs commitment and trust. An overview of the precise statements and, if applicable, the surveys from which they were obtained is included in Tables B.1–B.2 in the Appendix.

To measure commitment, firstly, we included seven items that covered both affective and normative aspects (i.e., both emotional attachment and perceived obligation towards the organization; Meyer, Allen, & Smith, 1993).[4] Example items are "*I tell others proudly that I am part of this Broodfonds*" (affective, Van der Lippe et al.,

[4]In organization research, continuance commitment is generally called upon as a third dimension of commitment. This dimension depends on external factors (i.e., the presence or absence of attractive alternatives), and does not measure individual efforts of making the organization successful. Because small mutuals require active involvement of their members (in terms of deciding on organizational structures, organizing and attending meetings, and helping each other) and generally arise when no (or few) alternatives are available, affective and normative commitment are most useful as proxies for success.

2016) and "*Even if it were to my advantage, I do not feel that it would be right to leave Broodfonds right now*" (normative, Jak & Evers, 2010).

For trust we used a total of six items that jointly capture both trust in other group members commitment and trust in their trust. Example items are "*All members of my Broodfonds are basically honest*" (Yamagishi & Yamagishi, 1994) and "*All members of my Broodfonds are trustful of each other*". Responses to all questions were measured on a 7-point scale ranging from (-3) "completely disagree" to (3) "completely agree". The items were measured so that higher scores reflect stronger commitment and trust.

Because the items form an adapted selection of their original scales, we used exploratory factor analysis to test their validity and Cronbach's alpha analysis to test reliability. All items were combined in a single EFA with Promax rotation. The EFA extracted two factors (based on the number of Eigenvalues > 1 and the levelling off of the scree plot); one factor for all trust items and one for all commitment items (detailed results are reported in Table B.3 in the Appendix). All items had factor loadings above .32, implying that at least 10% of their variance is captured by the factor, and none of the items had cross-loadings above .32 to other factors. The Cronbach's alpha reliability scores were also very high ($\alpha = .824$ and $\alpha = .936$ for commitment and trust, respectively), so we ran one-dimensional factor analyses for each construct and saved the factor scores as variables.

3.4.2 Network variables

To measure the network structures, we rely on the respondents' cognitive perceptions. Cognitive rather than actual network structures were used, for while this perception may be wrong, it is the mindset on which respondents base their ideas on social embeddedness and thus what influenced their commitment and trust levels (Krackhardt, 1987). The respondents could choose from the following descriptions: (1) *"In our Broodfonds most people know each other well"* (dense network); (2) *"Our Broodfonds has some groups of members who know each other well, while members of these different groups don't really know each other"* (clustered network); *"In our Broodfonds a small group of members knows most other members well, while the other members only know this small group but not each other"* (star network); and (4) *"Our Broodfonds consists of a bunch of individuals who don't really know each other"* (sparse network).

For each Broodfonds group, we created four aggregated group-level variables storing the percentage of respondents that chose this network structure. The larger the percentage for one network structure, the more reliably we can interpret this as resembling the actual network structure. Conversely, measurement error (indicated by high variety in individual responses) is captured by the low percentages for all network structures, and thus lower weight of this predictor variable in the analysis. In general, agreement levels were reasonable, with on average 54% of respondents within each mutual group choosing the same structure (SD = 14%, range [31%;100%]), compared

to a low 4% for the least applicable structure (SD = 4%, range [0%;19%]).

In addition to perceptions of the overall structure, respondents reported their own degree within the mutual group. For total degree, we followed DiPrete et al. (2011, p. 1242) and considered two members to be minimally tied when they would stop to talk at least for a moment if they run into each other. Hence, we asked "*With how many members would you have a chat if you would run into them on the street?*". Strong tie degree was measured by asking "*With how many members of your Broodfonds do you discuss personal matters?*". This question is adapted from the well-known name generator question "If you look back on the past six months, with whom did you discuss important matters?". This question is thought to measure the respondent's core discussion network: the network of (the most important) strong ties in a person's life (Marsden, 1987). Both degree variables are constructed relative to the potential number of ties (i.e., groupsize−1)

The various network measures, although related, tap into distinct aspects of individual and group-level social embeddedness. Correlations between the measures are modest. The highest correlation is between strong tie degree and total degree ($\rho = .30$), which makes sense given that strong ties are part of total degree. Remaining correlations lie between $\rho < .01$ for the clustered network with total degree and $\rho = .13$ between the dense network and strong tie degree (disregarding the meaningless correlations between the structure dummies; see Table B.4 in the Appendix for an overview of correlations between all variables).

3.4.3 Control variables

On the level of the mutual, we controlled for the mutual's group size and the number of years the mutual exists (with 0 years for mutuals that started in 2017, the year of data collection). Because one mutual started 11 years prior to the data collection while all other mutuals started between 0 and 6 years earlier, we recoded this variable so that 6 represents 6 years or more. Variables pertaining to membership characteristics measure the difference between the starting date of the mutual and how much later the respondent joined the mutual (or, for the few respondents that switched from Broodfonds group, how much earlier), whether the respondent is a member of the mutual's board, and whether the respondent received an endowment in the twelve months preceding data collection.

As for basic socio-demographics, we included age, gender, and risk aversion. We measured risk aversion by asking the respondent five times to choose between a safe bet or a gamble, where the next question depended on the answer to the previous question (i.e., a riskier gamble if the respondent chose the gamble in the previous question and vice versa; Falk, Becker, Dohmen, Huffman, & Sunde, 2016). This determined respondents' position on a risk 'staircase' of 32 steps, which we recoded to a proportion variable where 0 represents most risk seeking and 1 most risk averse.

Table 3.1. Descriptive statistics ($N = 4294$)

Variable	Mean	SD	Min	Max
Commitment	0.01	0.92	−3.89	1.54
Trust	0.02	0.96	−4.54	1.38
Total Degree	0.43	0.35	0	1
Strong Tie Degree	0.08	0.11	0	1
Yrs Existence - Yrs Member	0.64	1.06	−5	5
Insurance Use	0.05		0	1
Boardmember	0.11		0	1
Female	0.47		0	1
Age	49.28	8.64	21	74
Risk	0.37	0.23	0	1
Dense network	0.13	0.14	0	1
Clustered network	0.46	0.18	0	0.95
Star network	0.25	0.13	0	0.67
Sparse network	0.16	0.16	0	0.80
Years Existence	2.69	1.32	0	6
Groupsize	46.13	5.64	21	53

Table 3.2. Fit statistics for relative and log-transformed degree models ($N = 4294$)

	SEM model 1		SEM model 2	
	Absolute	Log-transformed	Absolute	Log-transformed
AIC	21102.19	20955.09	21100.37	20948.79
BIC	21312.23	21165.13	21323.15	21171.56

3.5 Results

Descriptive statistics of all variables are displayed in Table 3.1. The items underlying the factor scores of commitment and trust are mean-centered. The low minimum compared to the maximum suggests that the two variables are negatively skewed with the mean (rescaled to 0) above average on the original measurement scale. In other words, for the majority of respondents average commitment and trust levels are high.

With respect to the indicators of network structure, we see that close to half of the respondents consider the network within their mutual to be clustered. A quarter of the respondents perceive a star-shaped network (most likely with the board members in central positions), while a minority considers the network as dense (13%) or sparse (16%). The average respondent has a relative total degree of approximately 43% and has strong ties to approximately 7% of the other members within the mutual. Both variables seem to be strongly positively skewed, which already suggests that a marginally decreasing function might better fit the data.

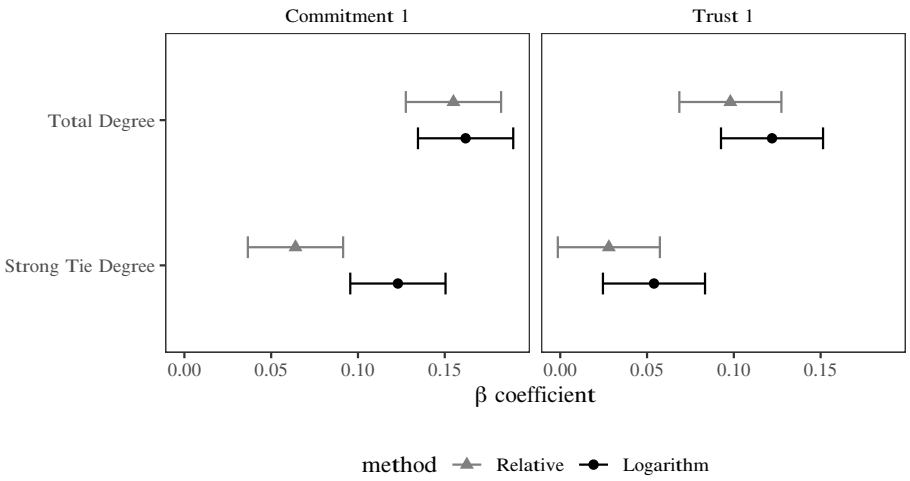


Figure 3.2. Standardized coefficients for relative and log-transformed degree variables

3.5.1 Model fitting

We estimated Multilevel Structural Equation Models (ML SEM) to estimate the effects on commitment and trust while controlling for their interdependencies. To identify the model, this recursive relationship was modelled not as a covariance, but as reflexive direct effects that were constrained to be equal. We took a stepwise approach and estimated first a model including al direct effects (Model 1) before including the interaction between strong tie degree and years since the mutual started (Model 2). Moreover, each model was estimated using relative and log-transformed variables for the two degree types. All models were fitted using Maximum Likelihood estimation.

First, we tested whether the relationship between degree and our dependent variables indeed follows a marginally decreasing function. For that, we evaluate both overall model fit (Table 3.2) and differences in the strength of standardized coefficients (Figure 3.2). Overall model fit was evaluated by comparing the AIC and BIC, as these allow for comparisons between non-nested models. For both models, the AIC and BIC statistics are lower when the degree variables were log-transformed, with differences far exceeding the threshold of 10 (Burnham & Anderson, 2003). Moreover, we see larger standardized coefficients after log-transformation, particularly for strong tie degree. All in all, this supports the hypotheses that the utilities of increasing total and strong tie degree are marginally decreasing.

We therefore proceed to interpret the results of the SEM models with log-transformations of the degree variables (Table 3.3) and report the alternative analyses in the Appendix (Table B.5). In general, we find that most variation in both commitment and trust is on the individual level, rather than across mutual groups. Intraclass correlations

Table 3.3. Multilevel SEM for commitment and trust (unstandardized coefficients, $N = 4294$)

	Model 1				Model 2			
	Commitment		**Trust**		**Commitment**		**Trust**	
Level 1								
Commitment			0.26^{***}	(0.01)			0.26^{***}	(0.01)
Trust	0.26^{***}	(0.01)			0.26^{***}	(0.01)		
Total Degree	0.33^{***}	(0.03)	0.25^{***}	(0.03)	0.33^{***}	(0.03)	0.25^{***}	(0.03)
Strong Tie Degree	0.26^{***}	(0.03)	0.12^{***}	(0.03)	0.26^{***}	(0.03)	0.11^{**}	(0.03)
Strong Deg × Yrs Mutual					0.04^{*}	(0.02)	-0.06^{*}	(0.02)
Yrs Mutual - Yrs Member	-0.02	(0.01)	-0.04^{**}	(0.01)	-0.02	(0.01)	-0.04^{**}	(0.01)
Insurance Use	0.22^{***}	(0.05)	0.12^{*}	(0.06)	0.22^{***}	(0.05)	0.12^{*}	(0.06)
Boardmember	0.20^{***}	(0.04)	0.02	(0.04)	0.20^{***}	(0.04)	0.02	(0.04)
Female	0.09^{***}	(0.02)	0.01	(0.03)	0.09^{***}	(0.02)	0.01	(0.03)
Age	0.02^{***}	(0.00)	0.00^{**}	(0.00)	0.02^{***}	(0.00)	0.00^{**}	(0.00)
Risk	-0.17^{**}	(0.05)	0.10	(0.06)	-0.17^{**}	(0.05)	0.10	(0.06)
Level 2								
Dense network	0.14	(0.12)	0.77^{***}	(0.14)	0.15	(0.12)	0.75^{***}	(0.14)
Clustered network	-0.03	(0.11)	0.49^{***}	(0.12)	-0.02	(0.11)	0.47^{***}	(0.12)
Star network	0.08	(0.14)	0.49^{**}	(0.17)	0.10	(0.14)	0.46^{**}	(0.17)
Years Mutual	-0.01	(0.01)	0.05^{**}	(0.02)	-0.01	(0.01)	0.05^{**}	(0.02)
Groupsize	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
Variance estimates								
Level 1								
σ	0.59^{***}		0.67^{***}		0.58^{***}		0.67^{***}	
R^2	0.31		0.23		0.31		0.23	
Level 2								
σ	0.01		0.02^{**}		0.01		0.02^{***}	
R^2	0.10		0.55		0.12		0.55	
Model fit								
AIC	20955.09				20948.79			
BIC	21165.13				21171.56			
LR χ^2 (1)	4.48				4.53			
RMSEA	0.03				0.03			
CFI	0.99				0.99			

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

were only $\rho = .03$ and $\rho = .06$ in the empty model. Moreover, for commitment the predictors do a poor job explaining the limited group-level variance there is: while they explain 31% of the variance on the individual level, they only explain 6% of the mutual-level variance. Interestingly, for trust the results are the reverse: The predictors explain 55% of the variance on the mutual level and 23% on the individual level. This signals that commitment seems to be more of an individual consideration that can vary among members of the same group, while trust depends more on group-level interdependencies and requires that other members and the group as a whole are taken into account.

3.5.2 Hypotheses tests

More differences between commitment and trust appear in relation to the network structure variables. No matter the reference category, there are no associations between any of the network structures and commitment. Network structures only play a role in relation to trust, with all structures outperforming the sparse network and the dense network outperforming the clustered ($b = -.28$) and sparse ($b = -.77$) net-

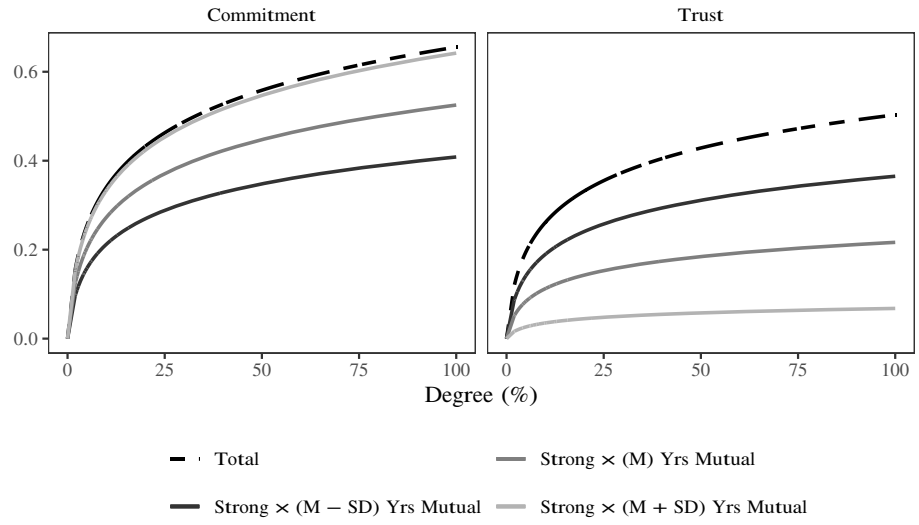


Figure 3.3. Marginal utility of increasing (strong) tie degree

work, but not the star-shaped network. While a lack of difference between dense and star-shaped networks in relation to trust might suggest that connectedness trumps cohesion in advancing trust, we find no significant difference between star-shaped and clustered networks. The data is thus inconclusive with regards to these mechanisms, but we do have partial support for Hypothesis 3.1 (i.e., only with respect to trust).

Moving to individual embeddedness, a logarithmic increase in total degree coincides with increases in both commitment and trust. This supports Hypothesis 3.2. For the relation to strong tie degree, we estimated both the direct effect (Models 1) and its interaction with the mutual's age (Models 2). Interestingly, the results in relation to trust are in line with our hypotheses, while the results for commitment show the reverse. A higher strong tie degree is associated both with higher commitment and higher trust (supporting Hypothesis 3.3), but in older groups the effect only becomes smaller in relation to trust. For commitment, the association with strong tie degree is actually stronger in older groups, signalling partial support for Hypothesis 3.4. It should be noted, though, that in comparison to Model 1 the R^2 does not change, the AIC only improves little and the BIC (which penalizes model complexity) decreases a little (although neither differences exceed the threshold of 10). This suggests that the substantial meaning of this effect might be modest and that significance may also be a result of the large sample size.

To better understand the log-effects of degree, we plotted the relation over the untransformed scale (Figure 3.3). The effects of strong tie degree are plotted for members of mutuals of average age (2.7 years) and members of mutuals 1 SD above

(4.1 years) and below average (1.3 years). As can be seen from Figure 3.3, the increase in commitment is strong for a relative total degree up to approximately 12% and strong tie degree adds substantially to the effect of total degree. Moreover, in older groups it is clearly more beneficial to invest in additional strong ties. In relation to trust, all effects are smaller, and they waver off faster. The effect of total degree is largest, but the figure also signals that especially in younger groups, trust levels can substantially increase if members also have a few strong ties. For older groups, however, it is more beneficial to increase total degree than to invest in strong ties, as the nearly horizontal line suggests that strong ties hardly add to the effect of total degree.

3.6 Conclusion and discussion

New mutuals, seeking to organize a more social, fair, and transparent insurance, are gradually emerging in several countries as an alternative within the existing insurance system. They consist of small risk-sharing groups in which members pool money to pay the costs for the insurance of others. While institutional arrangements can to some extent regulate individual behavior within these mutuals, we argue that network embeddedness is crucial for high levels of commitment and trust, two important factors underlying the willingness to participate. In substantiating this claim, we considered not only group-level embeddedness (here: in terms of perceived network structures), but individual embeddedness as well (operationalized through total and strong tie degree), thereby introducing within-group differences in embeddedness. Methodologically, we collected a unique multilevel dataset that comprises information about 5,192 members of 230 comparable small Dutch mutuals (called Broodfonds), which enabled us to compare many individuals and how they operate within large, natural networks.

We showed that both group-level and individual network embeddedness play a vital role, albeit in different ways. The only commonalities between commitment and trust are that larger total degree and larger strong tie degree are positively related to both, although, as expected, the utility of extra (strong) ties marginally decrease with each new tie. Other than that, commitment and trust seem to be affected by different dimensions of embeddedness—a finding we did not hypothesize on *a priori*. It seems that group-level embeddedness matters only for trust levels. That is, our results indicate that all network structures with some type of interconnectedness (i.e., dense, clustered, and star-shaped networks) outperform sparse networks when it comes to individual trust levels, with dense networks seemingly most favorable (outperforming clustered networks). Commitment, on the other hand, seems to be more of an individual trait, as it does not depend on group-level network structures but only relates to individual embeddedness.

The strong relationship between trust and group-level embeddedness signals the

importance of group-level agreements, e.g., through the establishment of social norms, that all members want to participate, share risks, and pay the costs to support each other. Members can exchange such promises with their own ties (which are also positively related to trust), but in the end they need to trust the whole group to commit to this agreement. This is signalled, for instance, by the finding that dense networks come with higher trust levels than clustered networks: In clustered networks, trust may be achieved within subgroups, yet this provides no guarantees for the commitment of members beyond these clusters.

Finally, commitment and trust again contrast in how the added benefit of strong ties changes over time. We hypothesized that strong ties would especially add to total degree in young groups, and indeed found this to be the case in relation to trust. This can be understood in line with the previous conclusion, namely because of the limited availability of shared helping norms in early cooperation stages. Group-level cohesion and social norms require time to develop, so in the early stages, when network structures are likely not as dense, members have to look for other indicators that others intend to commit. This makes them rely more on their strong ties: people they know well and trust. Over time, as mutuals become more dense and social norms arise, this reliance on strong ties wavers off.

However, for commitment we found the reverse: it is especially in older groups that having more strong ties advances commitment. While we did not foresee this, a possible explanation of this finding may be that commitment, given that it implies a willingness to pay the costs for the support of others, may mostly be directed at specific others. People are more willing to support others if they know these people personally, and particularly if they established stronger relations with them. This might reflect that commitment also involves solidarity motives (see also, for instance, Baldassarri, 2015): Committed individuals not only help others because they believe others will reciprocate in the future, but also because they want to help them—especially those to whom they have developed stronger ties. Such solidarity motives might grow with experience, and when they target particularly one's strong ties, these also influence commitment more.

Before stipulating on the wider implications of these findings, some limitations of the study design should be taken into account. First, although commitment and trust are widely acknowledged as determinants of (future) cooperative behavior, they remain correlates at best. Several internal and external factors might cause (sudden or unexpected) changes in behavior. Moreover, members might be highly committed and actively involved while not behaving honestly (e.g., pretend illness to reap the benefits). Although the study proved insightful in terms of the mechanisms underlying commitment and trust, further implications regarding mutuals' overall success remain speculative.

Second, our dimensions of network embeddedness were solely based on self-reports. With complete network data we would maybe understand better why certain networks

impact trust and commitment differently. In our study, for instance, we do not know which of the other members are trusted (more), meaning that our trust indicator could also be an average of very high within cluster trust levels and low to non-existing between cluster trust levels. With more detailed network data, we could explore whether trust can transcend lower level clusters or whether high trust within strong tie clusters inhibits trust in others outside of these clusters (Flache & Macy, 1996). Complete network data, combined with intra-organizational multilevel network analyses (Lazega & Snijders, 2016), are needed to disentangle the various intertwining and confounding mechanisms.

Third, the dataset used in this study, although rich, detailed, and innovative in many ways, poses some limits to the generalizability of the results. Most importantly, the member base of the mutuals studied consists entirely of self-employed people. Doubts may arise on whether the intentions and behavior of this subgroup can be translated one-on-one to other (sub)populations, given that self-employed workers are generally considered to be more entrepreneurial, less risk averse, and used to self-organization. However, although the last element goes undisputed, empirical evidence for the first two claims is often lacking (Koudstaal, Sloof, & van Praag, 2015; Holm, Opper, & Nee, 2013).

Therefore, if we keep these potential issues in mind, it still goes without doubt that this study adds important insights to existing literature on network embeddedness and mutuals (or institutions for collective action in general). For one, it sheds light on an up and coming phenomenon of new mutualism that seeks to fill the cracks that emerged in state and market dominated insurance systems. Moreover, in investigation participation it shows the importance of distinguishing between group and individual level network effects as well as different cooperation phases. Where group-level embeddedness is most important in relation to trust, for willingness to commit individual connections seem to be most important.

With an eye towards the future, this implies that if the new mutuals want to follow their vision of a fair and social insurance, they have to actively create opportunities for communication and social exchange. In case any (internal or external) crises that threaten the survival of the mutual groups do occur, groups high in social embeddedness are more likely to overcome them. Practically, this means that the new mutuals should, for instance, regularly organize meetings with all members, as such meetings enable the development of group norms (thereby promoting trust) and provide opportunities to form new ties to other group members (fostering commitment).

Future research could build on these insights by replicating and further investigating these different effects for different levels of network embeddedness, either in other comparative case studies or in controlled environments. Ideally, the study population would be followed over time. Since relations and networks are endogenously formed, it would then be possible to see how the formation of ties, rather than their existence, influences trust and commitment. Alternatively, other types of centrality could be

considered, or, on the network level, actual network structures. Finally, it would be interesting to disentangle trust in specific group members from trust in sub-clusters and the institution in general, preferably even separate for different levels of governance (i.e., the risk-sharing group as well as the overarching organization). Answers to each of these questions would further increase insight into the relations between individual and social factors, and especially their interaction with the wider context in which they take place.

4

CHAPTER 4

Sharing risk under heterogeneity: Exploring participation patterns in situations of incomplete information

This chapter is co-authored by Vincent Buskens and has been submitted to an international journal. The main theoretical model was developed jointly by Vriens and Buskens. Vriens conducted the simulations, analyzed the data, and wrote the main part of the manuscript. Buskens contributed significantly by providing detailed feedback on numerous accounts.

Abstract

Motivated by the emergence of new Peer-to-Peer insurance organizations in many countries globally (see, e.g., Friendsurance in Germany and Broodfonds in the Netherlands), we propose a model of individual decision-making in risk-sharing arrangements with risk heterogeneity and incomplete information about the risk distribution as core features. The model puts forward participation as a utility maximizing alternative for agents with higher risk levels, who are more risk averse, are driven more by solidarity motives, and less susceptible to cost fluctuations. We use this basic micro-level model to simulate decision-making by agent populations in an interdependent setting. The result is a dynamic behavioral model where one agent's decision to participate depends on the characteristics and decisions of other agents in the risk-sharing group. By varying parameter settings with respect to need heterogeneity and group size on the population level, and risk aversion, solidarity, and reinforcement learning on the agent level, we predict the resilience or decay of participation. Simulation results show that successful risk-sharing arrangements are less likely in more heterogeneous populations, as alternative factors (e.g., risk aversion) can less often make up for the larger cost deficiencies. At the same time, more heterogeneous groups deal better with uncertainty and temporary cost fluctuations than more homogeneous populations do.

4.1 Introduction

In recent years many new insurance initiatives such as Friendsurance (Germany) and Broodfonds (the Netherlands) were launched in countries that traditionally have strong insurance systems. These initiatives, which often refer to themselves as Peer-to-Peer (P2P) insurance, aim to rethink how insurance is organized (Abdikerimova & Feng, 2019). Inspired by mutual insurance associations (mutuals) from the 19th century, they go back to insurance in its most basic form: fair, transparent, and social (Vriens & De Moor, 2020). Rather than placing responsibility and trust with corporate insurers, they return responsibility and trust to the policyholders by having them arrange their own safety net within small risk-sharing groups.[1]

Other than regular insurance, which is paid in fixed premiums or through salary taxation, the participation costs in mutuals relying on risk-sharing groups fluctuate depending on how many or how often group members request support. When more is saved through contributions than needed for payouts to members in need of support, (a share of) the fund's reserves get redistributed among all members (Breer & Novikov, 2015). Thus, while participants pay a contribution fee to build the insur-

[1]The new insurance initiatives cover a variety of things, such as the deductable excess of, e.g., liability insurance (Friendsurance) or an income replacement for self-employed people in case of sickness (Broodfonds). They act as umbrella organizations, with their members (or policyholders) subdivided into smaller risk-sharing groups (of 10, 50, or up to a few hundred members).

ance fund, the actual participation costs are determined by the number of claims. The lower the number of claims, the lower the costs for all participants. This introduces an interdependency between group members in the sense that one person's actions (support requests) directly affect the costs of participation for others. Under the basic assumption that costs mainly drive willingness to participate, it follows that willingness to participate likewise varies over time, thereby making participation in this type of risk-sharing organizations more fragile. Members could at any time decide to revoke their membership if they no longer want to pay to help others (e.g., because more support is requested than expected; Platteau, 1997), and if they do, they take from the common fund the share of their contributions not spent on payouts.

With this in mind, it is important to deepen our understanding of why people participate in these new risk-sharing arrangements and when participation can be resilient to cost fluctuations. While many scholars have developed and refined risk-sharing models (Coate & Ravallion, 1993; Genicot & Ray, 2003; Kimball, 1988; Ligon et al., 2002), these models generally assume homogenous risk probabilities or—if the homogeneity assumption is relaxed—complete information on the distribution of risk in the population. In these models, a rational agent bases membership on the comparison between one's own risk probability and that of other participants, which is constant over time as long as risks do not change. However, a heterogeneous model assuming complete information is not only very constraining in terms of agents' cognitive abilities, it is also unrealistic that agents would have such detailed information about all other agents in the population beforehand. Finally, and perhaps most importantly, it comes with the hidden assumption that agents are not affected by realized outcomes (people requesting support), which is unlikely to hold in practice.

Relaxing the assumption of homogeneity is of utmost importance if we want to understand real-world risk-sharing dynamics. From data collected among 230 Dutch Broodfonds groups (Vriens, Buskens, & De Moor, 2017), for instance, we know that there is substantial risk heterogeneity within these groups. And these groups are no exception. Risk-sharing has been the most common method of creating security among (rural) populations worldwide—see, e.g., Lemay-Boucher (2009) for examples in sub-Saharan Africa; Ligon et al. (2002) on India; and Fafchamps and Lund (2003) on Southeast Asia. It is highly unlikely that in so many natural settings the created groups are (or have been) homogeneous in terms of risk. It is therefore of utmost importance that our theoretical ideas of when and why people engage in risk-sharing relations account for risk heterogeneity as well.

Luckily, complete information is not a necessary requirement for the realization of heterogeneous risk-sharing arrangements. As long as people assume risk levels to be approximately similar, or that the existing risk heterogeneity is somehow compensated for (e.g., because the low-risk participant is risk averse), risk-sharing arrangements can still arise (Skogh & Wu, 2005). We propose a model where agents know their own risk but not the true risk distribution. They base their decision-making on a personal

belief about the group-level average. Based on new experiences (i.e., group members requesting support), they update this belief over time. This alternative approach combines forward-looking decision-making with backward-looking learning as a tool to deal with decisions under uncertainty. The result is that as more support is requested in some rounds than in others, the estimate of the average risk, and therefore the expected utility of participating, also fluctuates over time. Hence, where a complete information model may soon land on an equilibrium, the alternative model continues to update, thus slowing down the stabilization process. On the plus side, it may lead to a larger number of people joining in the first place (and thus prevent failure from the start). On the downside, it may increase the possibility of withdrawal cascades, where agents follow each other in opting out of the risk-sharing arrangement while they may not have, had they known the true distribution.

What are the implications of this alternative approach for the effect of risk heterogeneity? The general consensus for any voluntary risk-sharing arrangement is that heterogeneity introduces adverse selection (Arrow, 1984): Those with the lowest risk profiles will opt out of the arrangement, followed by the second-lowest risk profiles, and so on—until either the entire risk-sharing arrangement fails or only high risks remain. This is, however, based on the assumption that the risk distribution is common knowledge. For our incomplete information model, the basic intuition is that participation patterns are more likely to be resilient when the agents that are part of the risk-sharing arrangement can cope with cost fluctuations. That is, when the difference in the utilities of participating and not participating is big enough that it holds even under temporary increases in the number of support requests. After all, an increase in support requests increases the estimate of the group's average risk, which decreases the utility of participation. Hence, on the one hand incomplete information may decrease the negative effect of heterogeneity (as long as people assume that others' risk levels will be similar; Skogh & Wu, 2005). On the other hand, the negative effect may also be strengthened when, if fluctuations in support requests are more extreme in more heterogeneous group, the estimate about the group's average risk exceeds the true probability level.

The aims of this chapter are thus to investigate theoretically the extent to which (1) risk-sharing groups are indeed less likely to succeed when agents do not have complete information; (2) the reliance on realized support requests increases the chances of generating withdrawal cascades particularly in more heterogeneous groups; and (3) what levels of alternative individual factors (risk aversion, solidarity, and reinforcement learning) are needed to obtain a safe bandwidth that realizes participation patterns even under larger fluctuations in group members' claims. We introduce these additional individual factors, for otherwise participation cannot be explained for everyone whose personal risk is smaller than the (estimated) group average.

Risk aversion, firstly, reflects a preference for certain outcomes over risky situations in which outcomes are uncertain. It is deemed crucial for understanding why people

take out insurances (Arrow, 1984), but also for participation in micro-insurance and helping arrangements (Platteau et al., 2017; Vogt & Weesie, 2004). Solidarity, secondly, implies prosocial behavior towards members of the same group (Baldassarri, 2015) from which personal utility (a good feeling) is derived as well (Gintis, Bowles, Boyd, & Fehr, 2005). The risk-sharing groups introduce many-to-many relationships that are argued to invoke solidarity, which makes people willing to (unconditionally) pay for the insurance of other group members.[2] As a final factor, we consider how people let current experiences influence (or override) their previous belief about the group's average risk. Based on reinforcement learning (Macy & Flache, 2002), those who do so to a larger extent are more susceptible to fluctuations in support requests and therefore more likely to withdraw when costs unexpectedly (temporarily) increase.

The assumption of incomplete information and model feature of agents updating their beliefs over time introduce new, dynamic interdependencies between agents. It means we cannot produce generalized, formally derived predictions of how agents behave under all circumstances (Bianchi & Squazzoni, 2015). After all, if (some) agents drop out because their estimate of the average risk increases, others—initially interested in participating—might follow because the total number of members decreased. Hence, the group-level outcome is more than the aggregation of individual attributes (Macy & Willer, 2002). We therefore rely on agent-based modelling techniques to derive predictions about agent behavior and group-level outcomes under irreducible heterogeneity for a variety of parameter combinations.

In the following sections, we take several steps to study the success of risk-sharing arrangements theoretically. Section 4.2 provides an overview of relevant literature on this topic as developed in different fields. In Section 4.3, we combine these insights in the construction of a static N-person Risk-Sharing Model (RSM). In Section 4.4, we build, through simulations, a dynamic, interdependent RSM to study how willingness to participate is affected by stochastic fluctuations in support requests and changes in other members' behavior. Section 4.5 presents the simulation results and Section 4.6 discusses the implications from this model in light of the new mutuals and derives testable hypotheses for future research. Section 4.7 summarizes and concludes.

4.2 Literature review

We focus on studies that approach participation in risk-sharing arrangements as a special type of social dilemma. Other than with regular public good provision, for sharing risk there is (potentially) a long delay between contributing and actually obtaining the benefit of cooperation (support in times of need). In fact, when talking about sharing risk, ideally one never actually needs the support from the group

[2] Another role of solidarity, albeit not the focus of the current chapter, is that it prevents excessive (fraudulent) insurance claims (i.e., it reduces moral hazard; Van Leeuwen, 2016), because the small risk-sharing groups make apparent that these payouts would be paid directly out of the pockets of the other group members.

(Platteau, 1997). This introduces the social dilemma, because the short-term benefit of withdrawing to avoid paying the costs to help others may easily outweigh the uncertainty surrounding the long-term benefit of perhaps needing and receiving the security oneself someday (Fafchamps, 1992). Moreover, one-time individually rational decisions to withdraw (e.g., because of a sudden increase in support requests by fellow group members) may translate into a collectively worse outcome where no one is insured (Coate & Ravallion, 1993).

This classifies risk-sharing arrangements as a cooperation problem under uncertainty. Participation is uncertain not only because it is unknown whether one, as an individual, ever needs a payout from the collective fund. It also derives from not knowing how many others (simultaneously) need support and whether they remain a member to pay the costs to support others (Vriens, Buskens, & De Moor, 2019). We will review the main modelling approaches that take this uncertainty into account, be it from the perspective of mutual insurance, risk-sharing networks, or support games, with a special interest in whether and how these models approach heterogeneity in risk. Our review includes both formal analytical (game-theoretic) models and agent-based simulations and uses findings from empirical studies (both lab and field-based) whenever they guided theoretical refinement.

Subsequently, we briefly address the status quo on modelling our key compensation factors of interest. While risk aversion has a central role in all models related to mutual insurance, solidarity (or prosocial motives generally) and reinforcement learning do not. For these, we base ourselves on other decision-making models.

4.2.1 Risk-sharing models

Theory development on risk sharing started after the seminal work of Posner (1980), who combined Scott's (1977) descriptions of mutual insurance based on solidarity networks and reciprocity with Popkin's (1979) counterexamples of opportunistic behavior. His argument, that an informal risk-sharing arrangement can be sustained over time when lasting relationships develop between self-interested members, was formalized by Kimball (1988) and Coate and Ravallion (1993). Their models form the starting point for subsequent model building of mutuals and risk-sharing agreements.

The central question in these first models was under what conditions self-interested agents will enter an informal risk-sharing arrangement voluntarily *ex ante* without defecting *ex post*. The set-up is one where agents do not pay an initial contribution, but only divide the available resources after someone indeed needs support. *Ex post* defection thus means that agents refuse to share their payoff if they end up with the higher one. The models start from a basic assumption that players are homogeneous in their risk probability: Each player is equally likely to end up with a high or low income. For an infinitely repeated game, the theoretical optimum entails full income pooling and equally sharing the aggregate available resources each period. This can,

as long as the gain from defection is small, be achieved regardless of group size.

Empirical tests refute this prediction, observing small groups, partial sharing of risk, and less than full insurance instead (Fafchamps & Lund, 2003; Murgai et al., 2002; Townsend, 1994; Udry, 1994). To accommodate these findings, alternative models predict cooperation rates when participation only requires limited commitment (Ligon et al., 2002), when cooperation should be robust not only to individual deviations but also to deviations by subgroups (Genicot & Ray, 2003), when arrangements are made in networked, rather than group settings (Bloch, Genicot, & Ray, 2008), or when participation can take place through threshold models (i.e., not all agents have to join in round 1; Breer & Novikov, 2015).

None of these models, however, start from an assumption of risk heterogeneity.[3] For predictions resulting explicitly from risk heterogeneity, we can borrow from the insights obtained from so-called support games and solidarity games. These games distil conditions under which players *ex ante* agree to help others if by some probability they might be the one who needs the other's help (Hegselmann, 1994; Vogt & Weesie, 2004). They predict an optimal support relation under homogeneity, but show that cooperation is likewise possible under heterogeneity in needing support, for instance when (low-risk) players are risk averse.

These dynamics have been corroborated in lab experiments. While Tausch et al. (2014) find support for adverse selection in experiments with heterogeneity in risk levels, Vogt and Weesie (2006) find that this can be compensated for by risk aversion. Simulation studies that extend this model to N-person settings predict that when players endogenously choose with whom to engage in (dyadic) support relations, stable support relations arise under heterogeneity in needing support as long as heterogeneity is modest and risk probabilities are average (Hegselmann & Flache, 1998). While these results emerge in N-person settings of multiple one-on-one support relations, it suggests that cooperation in N-person risk-sharing groups can, to a certain degree and under certain conditions, be successful in heterogeneous groups as well.

4.2.2 Risk aversion

Central to sharing risk is the assumption that agents are risk averse, operationalized using a concave utility function. Applied to an insurance context, it means agents are willing to incur larger insurance costs today to ascertain an income in the future (Arrow, 1984). For risk-sharing settings, however, some scholars have questioned the validity of the assumption, primarily due to the low participation rates that are observed in field studies (see Platteau et al., 2017, for a review). They argue that risk-sharing arrangements might not solve the uncertainty problem, because they

[3] While Breer and Novikov (2015) ultimately do relax the assumption of risk homogeneity, they only derive from it that participants whose risk is higher than the group average are more likely to join, not under which conditions those whose risk is lower than the group average still might.

introduce additional uncertainty with respect to how many other participants will need support, whether the fund is sufficient to meet these requests, and whether others remain a member after receiving support to reciprocate the favor in the future.

Several alternative assumptions are proposed, such as loss aversion (Kahneman & Tversky, 1979), hyperbolic discounting of future utility (Platteau et al., 2017), or ambiguity aversion (Elabed & Carter, 2015). Following this line of reasoning, some models (e.g. Dercon, Hill, Clarke, Outes-Leon, & Taffesse, 2014) have posed additional assumptions of prudence and temperance, which help selection of the most preferred alternative in situations when there is more than one source of uncertainty.

Despite these advances in the use of more sophisticated risk aversion measures in recent studies, we start from a plain concave utility function in which we assume players to be non-satiated and risk averse. Extra differentiation, such as loss aversion (Kahneman & Tversky, 1979) or ambiguity aversion (Elabed & Carter, 2015), could be introduced at a later stage, but given the substantial number of parameters to be modelled, we keep the model simple in this regard.

4.2.3 Solidarity

A plethora of evidence, both lab and field based (Andreoni & Miller, 2002; Camerer, 2003; Chaudhuri, 2011; Fehr & Gächter, 2002; Ledyard, 1995; Ostrom, 1990) signals that cooperation in social dilemmas extends far beyond basic self-interested, reciprocal, and reputation-based motivation. The number of alternative explanations that have been proposed is likewise towering, with other-regarding preferences interpreted, among others, as encompassing motives of altruism (Levine, 1998), solidarity (Baldassarri, 2015), strong reciprocity (Fehr & Fischbacher, 2003), guilt (Snijders, 1996), inequity aversion (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999), social welfare (Charness & Rabin, 2002), or fairness (Cox, Friedman, & Gjerstad, 2007; Rabin, 1993). Nonetheless, despite some notable exceptions (Charness & Genicot, 2009; Lin, Meng, & Weng, 2019), most theoretical models on risk-sharing arrangements revolve exclusively around the self-interest assumption.

For other social dilemma settings, the most applied models are models of inequity aversion (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999), which assume that an agent is altruistic towards others if their material payoff falls below an equitable benchmark, but feels envy when their payoffs exceed this benchmark. Subsequently, some studies make distinctions between altruism (directed to any other agent) or solidarity (directed to members of the same group; Baldassarri, 2015). While inequity aversion models do not accurately account for behavior in all social dilemma settings (Andreoni & Miller, 2002), nor adequately explain individual-level behavior (Blanco, Engelmann, & Normann, 2011), the common conception is that due to its simplicity, it is generally the preferable model in terms of broad applicability.

In our model, we label our social preferences ‘solidarity’, reflecting willingness to

help others within the same risk-sharing group. We assume that solidarity is triggered once agents are in need of support. In that sense, it resembles a simplified (one-sided) version of inequity aversion, disregarding envy and as such relating also to models of guilt aversion (Snijders, 1996; applied to risk sharing in Lin et al., 2019) and social welfare (Charness & Rabin, 2002). It is implemented such that players who perceive solidarity motives are willing to suffer some costs (i.e., have smaller shares of money redistributed from the common fund) to cover the loss of others.

4.2.4 Reinforcement learning

Standard analytical game theory uses forward-looking rationality, which assumes high cognitive capabilities of all actors involved. Its alternative, backward-looking rationality, not only makes it easier to derive predictions, but also poses fewer constraints on the agents' cognitive capabilities (Macy & Flache, 2002). In situations of incomplete information, it entails learning about the profitability of certain strategies over time. Many learning models have been developed (see Camerer, 2003 for a review), but most (e.g., belief learning; Fudenberg & Kreps, 1995) focus on agents adapting their strategies towards best-replies against beliefs about the strategies other agents have.

In our model, the main information deficiency of agents concerns the risk distribution within the risk-sharing group. This requires a learning model that focuses on outcomes, rather than strategy beliefs. For this purpose, reinforcement learning (Bush & Mosteller, 1955) and Bayesian learning (Jordan, 1991) can be considered: two models that differ in the cognitive abilities they impose on the agents. Reinforcement learning has agents following a simple updating rule (Macy & Flache, 2002). Every round, they update by some weight their estimate of the profitability of a certain strategy (here: of participating) based on realized payoffs in the previous rounds (here: driven by the number of support requests). Hence, when in a particular round more agents request support, the estimate of average risk is revised upwards.

With Bayesian learning, instead, agents are assumed to consider every possible collection of agent characteristics (here: of risk distributions). Each collection is given a certain weight, and over time these weights are updated based on realized outcomes (Jordan, 1991). Hence, the number of support requests are used to add more or less credibility to each potential risk distribution: the more support requests, the more weight is given to distributions that have larger group averages or more extreme distributions.

The general consensus is that while models of reinforcement learning are often too slow to match the pace of human learning, Bayesian learning models are too complex (Camerer, 2003). Especially in our case, since we focus not on a discrete set of strategy profiles, but on an (in theory) infinite number of possible risk distributions, Bayesian learning is too demanding (cf. a complete information model). We therefore start

from a simple model of reinforcement learning (cf. Macy & Flache, 2002) and assume that by some weight agents let current experiences (i.e., support requests) override their previous estimate. Essentially, by introducing learning we assume agents to be boundedly rational (Camerer, 1998) such that they maximize their utility based on an estimate of the average risk of other agents, but do not know or incorporate all individual risk profiles.

4.3 Model construction

We define an N-person Risk-Sharing Model (RSM) in which $N \geq 2$ agents indexed by $i \in \{1, \ldots, N\}$ choose simultaneously to become a member ($m = 1$) or not ($m = 0$) at time point $\tau = 1$. In each next time period $1 < \tau \leq T$, agents that opted to join decide whether or not to remain. If at any time point τ an agent decides to opt out, this decision is irrevocable. After each decision, a random draw by Nature determines realized events (i.e., which agents, if anyone, need support) and resulting payoffs. We use n to denote the number of agents that are part of the Risk-Sharing Group (RSG), with $0 \leq n \leq N$. A boundedly rational, utility maximizing agent joins the RSG as long as the short-term expected payoff under $m = 1$ exceeds that of $m = 0$.

Each agent receives an income Y_i with probability $(1 - p_i)$ and y_i with probability p_i, where $Y_i - y_i$ represents the loss that can be insured[4] and p_i is an independent and identically distributed (i.i.d.) risk probability. If agents join the RSG, they pay a contribution c_i for membership and receive a benefit b_i under p_i, where $c_i < b_i$ and $y_i + b_i \leq Y_i$. For simplicity, we assume homogeneous incomes, losses, contributions, and benefits ($Y_i = Y$, $y_i = y$, $c_i = c$, and $b_i = b$) and leave heterogeneity only with respect to p_i.

To make the RSG represent a collective non-profit fund, the pooled money that is not needed to pay benefits gets redistributed among all agents with an individual share δ. That is, the expected profit on the level of the mutual corresponds to[5]

$$P = \sum_{i=1}^{n} (c - p_i b - \delta) = 0. \tag{4.1}$$

The bounded rationality assumption implies that players cannot foresee the risk levels of other agents j. Instead, we assume that agents have an estimate $\hat{p}_i$ of the average risk probability of all other agents. $\hat{p}_i$ is based on an intuition about the risk probability of the population and is updated over time τ after observing the number of support requests by other group members in the previous round. We denote for

[4] In the broader context of risk-sharing applications, this loss could also reflect failed harvests, a broken product, stolen goods, poor health, etc.

[5] The basic set-up assumes there are no operation costs involved in the organization of the mutual insurance fund. For an institutionalized setting, the profit parameter could easily be extended to include some administration fee that is paid by all members and reflects a fixed cost (i.e. that is not redistributed at the end of the term).

each agent i the number of other group members $j \neq i$ that needed support in the previous round as $k_i^{\tau-1}$, where $k_i^{\tau-1}$ influences the agent's average risk estimate $\hat{p}_i$ with some weight as determined by the learning parameter $0 < \omega \leq 1$, i.e.

$$\hat{p}_i^{\tau} = (1-\omega)\hat{p}_i^{\tau-1} + \omega\frac{k_i^{\tau-1}}{n^{\tau-1}}. \tag{4.2}$$

Thus, the estimate of others' risk at time τ is a function of the previous estimate as well as the proportion of members that requested support k_i/n in the previous time point $\tau - 1$. Combining (4.1) and (4.2), the expected redistribution boils down to

$$\hat{\delta}_i = \frac{nc - p_i b - \hat{p}_i(n-1)b}{n} = c - \hat{p}_i b - \frac{(\hat{p}_i - p_i)b}{n}. \tag{4.3}$$

In this equation, c reflects the maximum available amount for redistribution (if no one needs support everyone simply gets their contribution to the common fund returned), $\hat{p}_i b$ reflects the estimated average loss on payments to other players, and the difference $(\hat{p}_i - p_i)$ either decreases or increases this share spent on payments depending on whether player i's risk is lower or higher than the estimated other players' average risk $\hat{p}_i$, respectively. If we include that each agent receives benefit b with probability p_i, we can rewrite this such that $p_i\left(b - \frac{b}{n}\right)$ represents the expected net benefit from participation, while $-\hat{p}_i\left(b - \frac{b}{n}\right)$ represents the expected net costs (see Section C.1 in the Appendix for detailed derivations).

Thus, without additional assumptions of solidarity and risk aversion, agents would participate only when $p_i > \hat{p}_i$. We rewrite $\beta = b - \frac{b}{n}$ and introduce solidarity α as the utility obtained by agent i from supporting any of agents $k_i > 0$. Hence, solidarity interacts with the net costs $\hat{p}_i\beta$ agents expect to pay to support group members, lowering by some factor $0 \leq \alpha \leq 1$ these subjective costs to $(1-\alpha)\hat{p}_i\beta$. Solidarity can then explain participation even if $p_i < \hat{p}_i$ as long as $\alpha \geq \frac{\hat{p}_i - p_i}{\hat{p}_i}$.

Finally, that players do participate even if $p_i < \hat{p}_i$ and $\alpha < \frac{\hat{p}_i - p_i}{\hat{p}_i}$ is explained by assuming that players are risk averse. We capture this by adding an exponent $(1-r)$ to the utility function: $EU = EV^{(1-r)}$ with $0 < r < 1$ for both strategies $m = 1$ and $m = 0$ to obtain

$$EU = \begin{cases} (1-p_i)Y^{(1-r)} + p_i y^{(1-r)}, & \text{if } m = 0 \\ (1-p_i)(Y - (1-\alpha)\hat{p}_i\beta)^{(1-r)} + p_i(y + \beta - (1-\alpha)\hat{p}_i\beta)^{(1-r)} & \text{if } m = 1. \end{cases} \tag{4.4}$$

Put differently, it follows that when player i would not need support, i.e. under $(1-p_i)$, we always have $Y^{(1-r)} \geq (Y - (1-\alpha)\hat{p}_i\beta)^{(1-r)}$. No benefits are obtained, so participation is costly only. Under p_i, contrarily, we always have $(y + \beta - (1-\alpha)\hat{p}_i\beta)^{(1-r)} > y^{(1-r)}$. Hence, the crucial evaluation lies in the difference between the

subjective values attached to the net benefits and net losses, which depend on the player's risk preferences. In essence, the model states that players will participate when the individual risk p_i, solidarity α, risk aversion r, and the size of the loss $Y - y$ are sufficiently large, while estimated others' risk $\hat{p}_i$ and the learning parameter ω are sufficiently small. What 'sufficiently large' and 'sufficiently small' mean, is analyzed using simulations to accommodate for the stochasticity in group-level support requests.

4.4 Simulations

The aggregate outcomes of the RSM are far from evident due to the interdependencies between agents. While the utility of participation might lie above the threshold for some agent i at time point τ, sudden peaks in k_i or changes in n and $\hat{p}_i$ due to the withdrawal of other agents j might move the utility below the threshold at time point $\tau + 1$. Thus, the global patterns of interest are more than the aggregation of individual attributes. Agent-based models (ABM) provide a solution here (Bianchi & Squazzoni, 2015; Macy & Willer, 2002).

We use ABM simulations not for individual behavior, but with the purpose of understanding group-level outcomes. That is, under which conditions are risk-sharing arrangements stable and when are they subject to withdrawal cascades? Through simulations, we can dynamically model the micro-level foundations of the RSM to compare the outcomes on the group-level. On the micro-level, the agents at risk are those with a negative $p_i - \hat{p}_i$ difference. While the RSM proposes several parameters that can compensate for this difference, in principle these are the agents whose utility may fall below the participation threshold.

On the group-level, the severity of this risk is captured by risk heterogeneity. The more heterogeneous agent groups are in terms of risk, the more likely it is that these groups have larger sets of agents with substantial negative $p_i - \hat{p}_i$ differences. In other words, the larger the number of agents that are at risk of falling below the participation threshold when other (low-risk) agents withdraw or fluctuations in k_i are more extreme. The simulation thus serves to compare different levels of risk heterogeneity, whether and how they lower group-level participation rates, and which (combinations of) individual factors (learning, solidarity, and risk aversion) may minimize or diminish this effect.

Below we discuss the set-up of our dynamic RSM roughly following the ODD (Overview, Design concepts, Details) protocol of Grimm et al. (2010). The simulation was programmed in NetLogo and analyzed in R. The NetLogo code is documented in Appendix C.2.

4.4.1 Parameter settings

The dynamic RSM consists of an agent population deciding whether or not to participate in the RSG. Agent variables modelled are individual risk p_i, risk aversion r, solidarity α, and reinforcement learning ω. Environmental variables are the size of the benefit b and the size of the population N. The model is run over a number of discrete consecutive time steps τ, which can be seen as representing months: Every month, agents evaluate whether or not to proceed in the RSG.

Table 4.1 presents an overview of all possible and tested model parameters. The risk probabilities are randomly drawn to increase group-level variation in fluctuations in k, the number of agents that need support. For all other parameters, we chose an expressive selection of fixed parameter values. Note that this implies that for each parameter combination the fixed parameter values apply to all agents in the agent population. While earlier models (e.g., Skogh & Wu, 2005; Vogt & Weesie, 2004) suggest that heterogeneity in a second factor, such as risk aversion, is necessary to compensate, what really matters is that low-risk individuals score higher on this factor. High-risk agents will participate regardless of whether they score high or low on this factor, making this factor irrelevant. Hence, there is no need to test this under balanced heterogeneity; we can test the effects of these parameters for a homogeneous population without loss of information. This setup has the advantage that we can separate the model dynamics with regards to parameter settings from the stochastic processes that result from the differences between expected risk and realized support.

We used two stopping rules for our simulation runs. First, the simulation ended as soon as the risk-sharing group was empty (i.e., all members dropped out). Second, the simulation ended when (after at least 120 rounds) membership rates were stable for 60 rounds. While this meant that in our results the longest simulation runs took 559 rounds (before reaching stability) and 674 rounds (before ending in failure), we only stored detailed per-round data up until round $T = 180$. This practical limit was chosen because, if rounds are months, this generates a dataset with simulated dynamics for what represents a 15-year period.[6]

In total, we performed $\sigma = 50$ simulation runs of all parameter combinations to test within parameter combinations what share of the outcome is driven by the stochasticity resulting from the discrepancy between p_i and k_i. Since Y and y merely represent the bandwidth within which the dynamics of benefits and losses take place and are not of substantial interest otherwise, we fixed these values to $Y = 100$ and $y = 0$.

To model risk heterogeneity, we draw p_i from three uniform distributions with ranges [0,0.3], [0.05,0.25], and [0.1,0.2]. Hence, at the starting point ($\tau = 0$), the average risk probability per agent population is $\bar{p} = 0.15$ for each heterogeneity condition.

[6]For any real-life situation it is unlikely that long-term cooperation patterns would be characterized by fixed characteristics (e.g., no changes in the risk probability over time), so we should not use this basic model to interpret cooperation dynamics on very long time scales.

Table 4.1. Overview of model and simulation parameters

Parameter	Possible values	Values simulation
Constants		
Number of rounds	$T > 0$	$T = 180$[1]
Number of simulations	$\sigma > 0$	$\sigma = 50$
Maximum income	$Y > 0$	$Y = 100$
Income after loss	$0 \leq y < Y$	$y = 0$
Varying parameters, random		
Risk probability	$0 \leq p_i \leq 1$	$p_i \sim \begin{cases} U([0.1, 0.2]) \\ U([0.05, 0.25]) \\ U([0, 0.3]) \end{cases}$
Estimated average risk probability at $\tau = 1$	$0 \leq \hat{p}_i \leq 1$	$\hat{p}_i = p_i$
Varying parameters, fixed		
Size subject population	$N \geq 2$	$N \in \{10, 50, 90\}$
Benefit	$0 < b \leq (Y - y)$	$b \in \{40, 80\}$
Reinforcement learning	$0 \leq \omega \leq 1$	$\omega \in \{0.2, 0.4\}$
Risk aversion	$0 \leq r \leq 1$	$r \in \{0, 0.2, 0.4\}$
Solidarity	$0 \leq a \leq 1$	$\alpha \in \{0, 0.2, 0.4\}$
Parameter combinations:		324
Total observations:		2,916,000[2]

Notes: [1] Simulations could take more rounds, but per-round information was stored for up to $T = 180$ rounds; [2] Total observations = parameter combinations × rounds × simulations.

We chose this average risk level, because it is low enough to enable fund building and payouts in small groups, whilst simultaneously high enough to ascertain sufficient translations into actual support events (and thereby fluctuations). For the estimated average risk, we take $\hat{p}_i = p_i$ as starting value, assuming that agents initially believe that other agents face a similar risk as they do themselves (cf. Skogh & Wu, 2005).

For the remaining parameters we implement two or three fixed values. For the subject population, we chose values of 10, 50, and 90 to compare substantially different group sizes, as that might affect the severity by which fluctuations impact the estimated risk and how costly participation is. With respect to the benefit parameter, we chose 40 and 80 to compare a situation in which almost the entire loss is covered versus the situation in which participation is cheaper yet with a smaller loss coverage. For risk aversion and solidarity we use parameter values 0, 0.2, and 0.4. Since values $> .5$ guarantee participation, this allows us to compare the interesting in-between cases. Finally, we use 0.2 and 0.4 as weights for reinforcement learning (excluding 0 as that inhibits learning).

4.4.2 Process overview and scheduling

Figure 4.1 presents a flowchart describing the different stages of the simulation. We systematically compare all $3 \times 3 \times 2 \times 2 \times 3 \times 3 = 324$ parameter combinations from

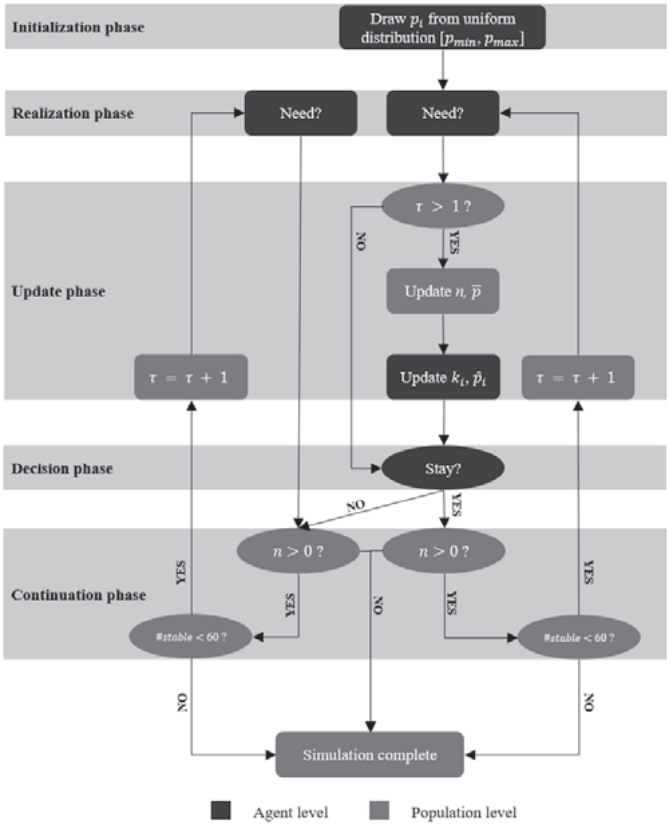


Figure 4.1. Simulation process flowchart

matrix P, that contains the unique parameter combinations on the rows, with input parameters Y, y, T, p_{min}, p_{max}, N, b, ω, r, and α on the columns, i.e.

$$P = \begin{bmatrix} 100 & 0 & 180 & 0 & 0.3 & 10 & 40 & 0.2 & 0 & 0 \\ 100 & 0 & 180 & 0 & 0.3 & 10 & 40 & 0.2 & 0 & 0.2 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 100 & 0 & 180 & 0.1 & 0.2 & 90 & 80 & 0.4 & 0.4 & 0.4 \end{bmatrix}$$

All stages of the simulation are run 50 times for each row of matrix P. In the first phase, the initialization phase ($\tau = 0$), individual risk probabilities p_i are randomly drawn from the range $[p_{min}, p_{max}]$ for each agent in the population. After this phase, the simulation starts at round $\tau = 1$, using synchronous updating. All agents move through the flowchart simultaneously and wait for other agents to arrive before proceeding to the next phase. In the realization phase, a random draw translates the

individual risk probabilities to realized support events. The update phase is skipped in the first round and agents move immediately to the decision phase. In the decision phase all agents decide, by calculating and comparing the expected utilities of participating ($m = 1$) and not participating ($m = 0$), whether or not to join the RSG.

Regardless of the decision, all agents move back to the realization phase. However, only agents that chose to stay move to the update phase, which involves updating population-level parameters n (the total number of agents that chose to stay) and $\bar{p}$ (the average risk probability of the RSG) as well as agent-level parameters k_i (the number of group members other than i that need support) and $\hat{p}_i$ (the estimated average risk probability). Subsequently, the agents that are part of the RSG are brought to the decision phase, while the agents that dropped out are moved to another realization phase. Agents loop over these phases until one of the two stopping conditions ($n = 0$ or # stable rounds $= 60$) is met.

Note that agents only choose to join in the first round; afterwards they choose (if they joined) whether to stay or not. Likewise, since only RSG members move through the update phase, any realization k_i is common knowledge for members only. Given this model set-up, agents cannot wait a few rounds to see how the RSG develops and decide whether or not to join, nor can they, if they chose to leave, revoke this decision at a later time point. Without new information about k_i, they do not update $\hat{p}_i$, and therefore have no incentive to participate in later rounds if they did not in round $\tau = 1$ or in the round they decided to leave. This is a strict modelling choice, but one justified by the substantive argument that leaving (which is essentially a way of defecting) will not be rewarded by other group members by allowing the defected members to return whenever it suits them better. At the same time, it does imply that as long as we do not introduce new members to the population in later rounds, the RSG can only remain stable or decrease in size. In the discussion we discuss implications of this design feature as well as several (simple and more complex) solutions.

At each round, we also calculate whether agents would have decided to participate in the risk-sharing group if they had known the true risk distribution (i.e., under complete information). In this benchmark Complete Information Model (CIM), agents know the distribution of p of all other members in their RSG, which means they update based on $\bar{p}$ rather than their estimate $\hat{p}_i$. Hence, while they update by recalculating expected benefits after other agents drop out, there is no learning involved based on ω and k_i. The CIM thus shows the baseline withdrawal pattern that can be expected from the initial distribution and input parameters, recognizing that for some agents the RSG is not interesting to begin with. Deviations between the RSM and the CIM are the result of agents' responses to fluctuations and thus reflect 'erroneous' dropouts. This way, we can compare the results of the simulation model based on reinforcement learning (the RSM) to that of earlier, static modelling approaches to understand how this alternative interpretation affects predictions about risk-sharing behavior.

4.4.3 Data and analysis

We logged data on the population level for each time point × parameter combination for 50 simulations and, while storing the final round number, only kept observations up until round $T = 180$. This brings the total number of observations to 2,916,000.

Our variable of interest is the membership rate: the percentage of agents that decides to remain a member. The main predictor is risk heterogeneity, a categorical comparison of the three conditions under which the risk distribution of an agent population was drawn. First, we explored the average stability of the agent populations of different heterogeneity conditions visually by comparing differences in membership rates between the RSM and CIM. Here, we also include visualizations of the average risk $\bar{p}$ for the three heterogeneity conditions over time, to assess whether dropout follows adverse selection mechanisms (i.e., low-risk agents are more likely to drop out, increasing the average risk within the risk-sharing groups).

Subsequently, we used multilevel OLS regression models with simulation runs nested in parameter combinations to predict membership rates for each agent population. The multilevel specification was used to separate the effects of the different model parameters from the effects of which particular distribution is drawn and how risks were translated to support requests. Hence, the variance on level 1 represents stochasticity resulting from the translation of probabilities to events within parameter combinations[7], whereas the variance on level 2 represents variation in outcomes depending on specific parameter combinations.

The goal of this analysis was not to statistically draw conclusions about a sample, but to give a qualitative description of the results of the simulation runs; i.e., to numerically infer under which conditions more agents remain part of the RSG. Primarily, we were interested in the extent to which population size N and individual factors risk aversion r, solidarity α, and learning ω compensate or strengthen the effect of fluctuations for different risk heterogeneity conditions. In other words, we tested for interactions between these variables and risk heterogeneity. The size of the benefit b, the dropout in the previous round (relative to the population size N), the average estimated risk $\hat{p}$, and the time period τ were included as control variables. We centered and standardized all continuous variables (i.e., all but the heterogeneity conditions) to be able to compare effect sizes. The analyses were conducted on all observations of $\tau > 1$ (as interdependencies in decision-making only start from round 2 onwards) and $\tau \leq 60$ (as we found most groups to be stable by that time point, with occasional dropouts not influencing other agents to follow).

Finally, as a sensitivity check, we analyzed the stability of the results by running additional simulations in which we relaxed the core assumption of i.i.d. risks and in-

[7] After all, for each population a risk distribution is randomly drawn and risks are randomly translated into support requests, meaning that for the same parameter combination the risk distribution looks different every simulation run and two agents with the same risk may not have needed support equally often.

troduced external correlated shocks. Shocks are inherently present in the simulation model due to the difference between expected risk and realized support as well as the misconception between true risk and estimated risk. In our analyses on the aggregate level, however, the effects of these shocks are not clearly visible. By running multiple simulations over many parameter combinations we have smoothed this process. Moreover, as the shocks remain based on the average risk probability, they will rarely be truly out of bound. To see whether extreme shocks can set in motion new withdrawal cascades, we tested a variation of the model where we include correlated risks. Correlated risk refers to the simultaneous occurrence of many losses from a single event. We compared three variations where we introduce an external shock of $p_s = 0.5$ (i.e., making 50% of the RSG members reliant on support) in one, two, or three consecutive time periods starting from round $\tau = 50$. Since we were primarily interested in what happens in the rounds following the shock(s) we implemented a new stopping rule ending all simulations after 80 runs. We repeated each parameter combination for 30 simulations, resulting in a new dataset with another $3 \times 324 \times 80 \times 30 = 2.332.800$ observations.

4.5 Results

Figure 4.2 plots the decay in membership rates (left panel) and the increase in the average risk probability $\bar{p}$ (right panel) for the three risk heterogeneity conditions. The two panels show patterns that are generally in line with adverse selection arguments: while the membership rate decreases, $\bar{p}$ increases, so the decrease in membership is the result of low-risk agents dropping out. Strikingly, adverse selection is much more severe for the RSM than for the CIM. Under the static complete information model, the decision whether or not to participate is made in the first round. While membership rates are indeed lower when heterogeneity increases—indicating that cooperation is more difficult to establish—stable participation patterns are still predicted for a substantial share of the population (i.e., 84% for the low heterogeneity condition, 69% for the intermediate heterogeneity condition, and 56% for the highest heterogeneity condition under our chosen parameter settings).

When comparing these participation patterns to the results we obtain with the RSM, we see that despite agents' starting assumption that the group's average risk resembles their own, support requests rapidly increase the average estimated risk probability $\hat{p}$ (dotted line in right panel) for all but the low heterogeneity condition, which causes membership rates to drop below that of the CIM within 10 rounds already (left panel). Hence, while roughly speaking the decay patterns observed for the RSM in the first 10 rounds can be attributed to the fact that the negative $p_i - \bar{p}$ difference is too big to compensate for by any of the other parameters, the fact that the relative number of members continues to drop afterwards in the RSM is explained by the uncertainty surrounding the true risk distribution $\bar{p}$ and the temporary peaks

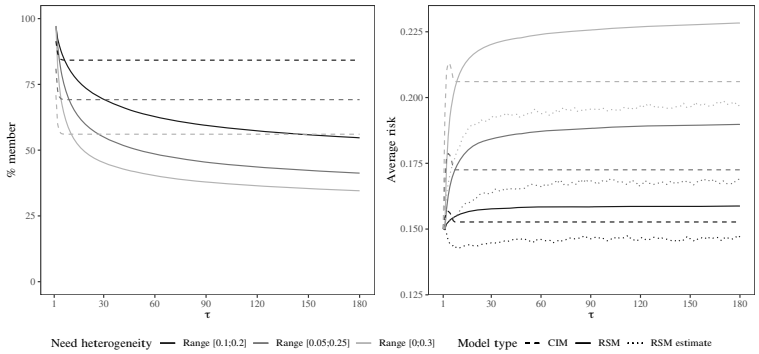


Figure 4.2. Membership rates and risk probability over time for the three risk conditions

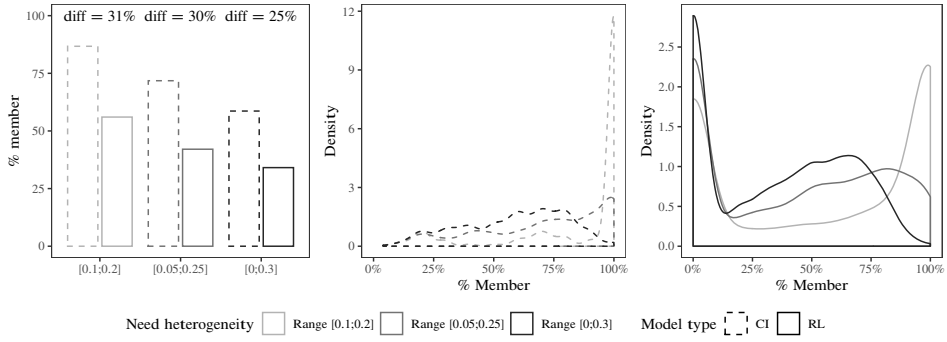


Figure 4.3. Average percentage and distribution of expected and realized members (in round $\tau = 60$) for three risk heterogeneity conditions

in the number of support requests k and the resulting cost fluctuations.

At the same time, the right panel of Figure 4.2 also shows that, because agents start from a similarity assumption, agents tend to underestimate the average risk. The estimate only starts to catch up to the true average risk when participation decay starts to slow down (after approximately $\tau = 60$). The slower decrease after $\tau = 60$ suggests that a temporary increase in k might drive an occasional agent to drop out every now and then, but that this no longer takes place through cascading effects where agents follow each other in opting out—a pattern we do observe for the first rounds. In other words, the steep decrease up until round $\tau = 60$ represents overall success versus failure; for any changes after these rounds, it should be relatively easy to draft countermeasures.

Figure 4.3 plots the average and distribution of membership rates for time point $\tau = 60$, chosen because it represents a period where most major changes have occurred (see Figure C.1 in Appendix C.3 for an overview of the distribution in different time

points). It signals the importance of not only considering the average membership rates, but also the variation between groups. Lower average membership rates are largely driven by RSGs that failed.

The right panel of Figure 4.3 shows that for each heterogeneity condition, there are roughly two peaks. For the low heterogeneity condition, the highest peak remains around full membership, but when members start to withdraw this nearly always sets in motion a cascade that ends in complete failure. The other two heterogeneity conditions both have moved their main peak from full membership to group failure, but also seem to have stabilized more often on alternative, in-between membership rates. This signals not only that high heterogeneity is less attractive for low-risk agents, but also that withdrawal does not automatically lead to cascades as long as some degree of heterogeneity exists. A substantial number of groups continues to exist and seems to have found more or less stable participation rates. Hence, while low-heterogeneity RSGs are more successful in terms of average membership rates, some degree of heterogeneity might be beneficial for the group as a whole, for dropout of a few members is less likely to result in complete failure.

Apart from showing that RSGs either fail or retain quite large membership rates, zooming in on the distribution also shows that failure is much higher than it would have been under complete information. With complete information, total failure would only be expected for 1805 (11%) of 16200 groups (approximately 600 per heterogeneity condition). In the RSM, contrarily, 3625 groups (22%) failed—1297, 1228, and 1100, in the low, intermediate, and high heterogeneity condition, respectively. This means about half the groups that failed did so due to cost fluctuations and incomplete information, and more in low-heterogeneity RSGs than in high-heterogeneity RSGs.

4.5.1 Predicting membership rates from individual motivations

Table 4.2 shows the results of the multilevel OLS regression analyses. Model 1 estimates the main effects and Model 2 includes the interaction terms for r, α, ω, and N with risk heterogeneity (taking the lowest heterogeneity condition as reference category). First of all, the results indicate that most variance lies on the second level: The null model has an intraclass correlation of $\rho = 0.73$. This means that most variance is explained from the model parameters, but at the same time that 27% of the results are driven by stochasticity in p_i and k_i. This is an important finding: despite favorable starting conditions, RSGs can still be at risk for failure. Depending on the realization of support requests RSGs may lose a lot of members regardless of the parameter combination.

The main effects follow the expected pattern from the model input: More risk heterogeneity generates lower membership rates; risk aversion and solidarity increase membership rates; and membership rates are smaller the larger the reinforcement

Table 4.2. Multilevel OLS regressions on membership rate for 813,845 simulation run × round combinations.

	M0		M1		M2	
Intercept	64.902^{***}	(1.388)	75.625^{***}	(0.924)	75.624^{***}	(0.909)
Range [0.05,0.25]			-13.887^{***}	(1.307)	-13.887^{***}	(1.286)
Range [0,0.3]			-23.038^{***}	(1.307)	-23.035^{***}	(1.286)
Risk aversion r			17.718^{***}	(0.534)	18.630^{***}	(0.909)
r * Range [0.05,0.25]					0.537	(1.286)
r * Range [0,0.3]					-3.271^{**}	(1.286)
Solidarity α			13.431^{***}	(0.534)	14.546^{***}	(0.909)
α * Range [0.05,0.25]					-0.380	(1.286)
α * Range [0,0.3]					-2.965^{**}	(1.286)
Reinforcement learning ω			-3.892^{***}	(0.534)	-3.874^{***}	(0.909)
ω * Range [0.05,0.25]					-0.226	(1.286)
ω * Range [0,0.3]					0.171	(1.286)
Population size N			1.567^{***}	(0.534)	2.483^{***}	(0.909)
N * Range [0.05,0.25]					-0.970	(1.286)
N * Range [0,0.3]					-1.777	(1.286)
Benefit b			-2.846^{***}	(0.534)	-2.846^{***}	(0.525)
% of members that left			-0.030^{*}	(0.016)	-0.030^{*}	(0.016)
Estimated average risk $\hat{p}_i$			-2.239^{***}	(0.018)	-2.239^{***}	(0.018)
Time point τ			-7.463^{***}	(0.015)	-7.463^{***}	(0.015)
Residual variance	232.24		172.68		172.68	
Random intercept	624.19		100.14		97.37	
Intraclass correlation	0.73		0.35		0.34	
Log Likelihood	$-3,373,026$		$-3,252,181$		$-3,252,163$	
Akaike Inf. Crit.	6,746,059		6,504,389		6,504,369	
Bayesian Inf. Crit.	6,746,094		6,504,540		6,504,612	

Notes: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; Range [0.1,0.2] used as reference category.

learning weight. Population size has a positive influence, which means that (the effects of) fluctuations are more modest in larger groups. The effect of the benefit parameter is negative, implying that in general monetary participation costs are higher than the benefits (due to low-risk agents that remain part of the RSG anyway). There is a small negative effect of the percentage of members that left at round $\tau - 1$, but the main driver of the cascades observed in Figure 4.2 is the average estimated risk. Finally, member rates are smaller the more time has passed. The main effects drastically reduce the variance on the parameter combination level, sharply decreasing the random intercept and leaving most unexplained variance the result of stochasticity on level 1.

Model 2 adds the interactions with the heterogeneity conditions. These effects do not improve the explained variance much (residual variance drops from 100 to 97), for the only dynamics we find are those related to risk aversion and solidarity. For both, the effects are about 3% points smaller in the highest heterogeneity condition compared to the lowest heterogeneity condition, thus strengthening the negative effect of high heterogeneity. This can be understood if we realize how these factors compensate for increases in cost. Say that an agent has a risk probability of $p_i = 0.14$ and solidarity $\alpha = 0.2$ (assuming no risk aversion). In that case, this agent is willing to accept every $\hat{p}_i > 0.14$ up until $\hat{p}_i = 0.175$ (Figure 4.4). Since higher risk het-

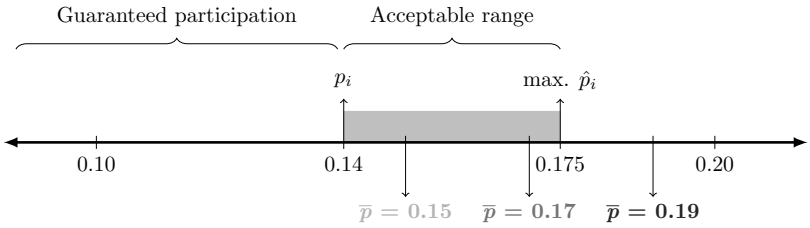


Figure 4.4. Illustration of extent to which solidarity can compensate for larger costs

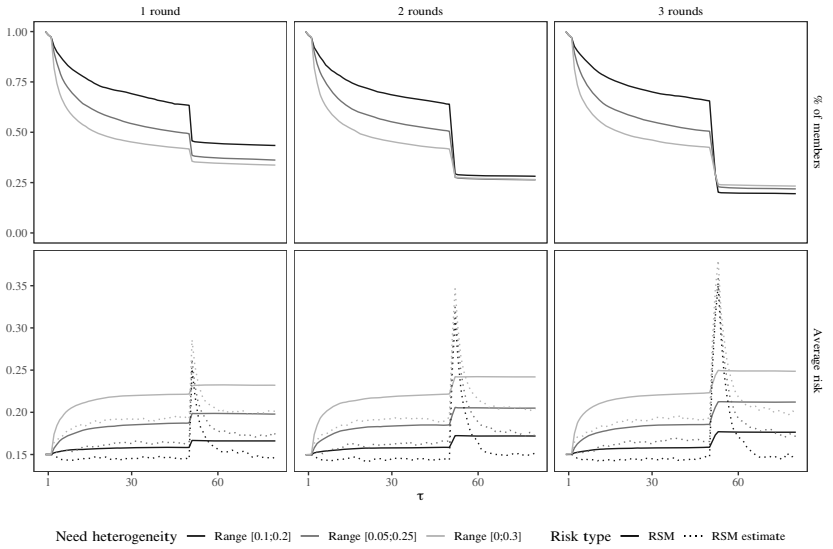


Figure 4.5. Membership rates and average risk over time after one, two, or three rounds of high correlated shocks

erogeneity conditions have higher maximum risk probabilities, solidarity is less likely to compensate for the increasing costs in more heterogeneous groups—the costs may more easily exceed the acceptable range. For more homogeneous groups, contrarily, limited solidarity (or risk aversion) is already sufficient to be willing to participate even if $\hat{p}_i > p_i$.

4.5.2 Sensitivity check

Figure 4.5 plots the decay in membership (top row) and increase in average risk (bottom row) for the three correlated shock conditions, tested with the same parameter combination matrix P over thirty simulations. It shows that such a shock has a strong effect in next round, but does not have a long aftermath in terms of starting

Table 4.3. Percentage of agents that remains member at $\tau = 60$ after high correlated shocks

	Range [0.1,0.2]	Range [0.05,0.25]	Range [0,0.3]
No shock	63%	49%	40%
1 shock at $\tau = 50$	44%	37%	35%
2 shocks at $\tau = [50, 51)$	28%	27%	27%
3 shocks at $\tau = [50, 52)$	20%	22%	24%

new cascades. The learning mechanism, which updates based on the number of support requests, causes the estimated risk to increase rapidly, but to decrease just as fast once the correlated shock(s) passed. However, the effects of such large shocks are still detrimental, for they lead to large decreases in membership rates. The more consecutive rounds the shock lasts (and thus the more it impacts the average estimated risk), the steeper the total dropout. This holds particularly for the low heterogeneity condition, whose average membership rates after three shock rounds even end up below those of the other heterogeneity conditions (Table 4.3).

That particularly RSGs low in heterogeneity are affected by such sudden and temporary shocks can be explained both from differences in the average risk and differences in the variation. Since mostly low-risk agents drop out initially, the average risk of the most heterogenous groups has increased more (approaching $\bar{p} = 0.22$). Hence, the difference between the average risk and the temporary shock is smaller for the high heterogeneity groups, thereby increasing the probability that other factors can compensate for this gap (i.e., the scores on risk aversion and solidarity now also matter for the high-risk agents). Second, since in low-heterogeneity groups most agents have approximately the same risk, once the utility drops below the threshold for one, it mostly likely also does for most others, because the costs and benefits are largely the same for all members.

4.6 Implications and hypotheses

From the simulation results we can derive a set of testable hypotheses. We start by comparing our model to the classic risk-sharing models that assume complete information about the risk distribution. Skogh and Wu (2005) proved theoretically that under incomplete information participation can still arise, based on the assumption that agents believe the risk probabilities of other agents will be more or less similar to their own. If we instead assume that agents update their ideas about the risk probabilities of other group members based on realized support requests, we found participation rates to be significantly lower and much less stable. As long as the weight attached to these new realizations is small enough, however, decisions remain largely based on the similarity assumption, resulting in the high participation levels

predicted by Skogh and Wu. Hence, the following basic hypotheses can be derived:

Hypothesis 4.1: *Incomplete information about the risk distribution in the population decreases the likelihood that members stay in the risk-sharing group.*

Hypothesis 4.2: *The more susceptible members are to support requests, the smaller the likelihood that members stay in the risk-sharing group.*

Incomplete information was primarily introduced to explore what this meant for the effect of heterogeneity. Classic risk-sharing models (Coate & Ravallion, 1993; Kimball, 1988) assume homogeneous risk distributions. Risk heterogeneity hinders participation, for members who know their risk to be lower than the group's average will opt out. We focus on perceived rather than true risk and compare variations in heterogeneity rather than homogeneity versus heterogeneity, but the same mechanism applies. Members whose risk is lower than the estimated group's risk are at risk of dropping out. Hence, these hypotheses are in line with earlier models (albeit stronger because estimated risk increases rapidly) and show the general adverse selection tendency.

Hypothesis 4.3: *The lower the risk heterogeneity, the larger the likelihood that members stay in the risk-sharing group.*

It is important to realize that continued membership is a decision that depends not only on (changes in) the number of support requests, but on (changes in) the total number of members as well. Hence, if a sudden increase in support requests means that for some members the utility of participating no longer outweighs that of not participating, in the next round other members—who did not have a problem with the increase in the group's average risk—might also prefer not participating over participating. Not only because of new support requests, but also because of the decreased number of members. After all, the risk estimate is updated based on the number of support requests relative to the number of members. If the costs of supporting group members have to be carried by fewer people, the costs of participation likewise increase. This sets in motion withdrawal cascades, where both earlier dropouts and continued support requests cause members to drop out round after round.

Hypothesis 4.4: *The larger the number of support requests, the higher the probability that withdrawal cascades arise where members follow each other in deciding to leave the risk-sharing group.*

With regards to these fluctuations in support requests, subsequently, our sensitivity checks indicate that while more heterogeneous groups are less successful overall, they are better equipped to deal with sudden, exceptional increases in support requests. In more homogeneous groups, the high similarity between agents means that if something happens that make participation less attractive for one agent, this

is probably true for most others as well. Hence, under extreme fluctuations, more agents 'erroneously' drop out in more homogeneous groups.

Hypothesis 4.5: *The more homogeneous the risk-sharing group, the more membership rates are effected by sudden, exceptional increases in support requests.*

Finally, as in other models that study the effect of risk heterogeneity (Attanasio et al., 2012; Skogh & Wu, 2005; Vogt & Weesie, 2004), we included individual factors that can compensate for risk heterogeneity. While risk aversion is often used as compensatory factor, we also proposed to include solidarity in the risk-sharing utility function. The simulations pointed out that while these factors could indeed compensate for heterogeneity, they can only do so to some extent. Hence, in comparing homogeneous versus heterogeneous groups, it is true that a heterogeneous group in general is more likely to succeed if its members are driven by solidarity and risk aversion motives. However, once we start to compare degrees of heterogeneity, it becomes clear that less heterogeneous groups are still more successful. Or rather, the more heterogeneous the risk distribution of a risk-sharing group, the higher the demands posed on the extent of risk aversion and solidarity of its members. This results in the following hypotheses:

Hypothesis 4.6: *The lower the risk heterogeneity, the stronger the positive effect of* ***(a)*** *risk aversion and* ***(b)*** *solidarity on the likelihood that members stay in the risk-sharing group.*

Altogether, these hypotheses make for an interesting theory on the role of risk heterogeneity. More homogeneous groups are, on many accounts, more likely to be established, to succeed, and to maintain high membership rates. Heterogeneous groups, on the other hand, are less likely to succeed overall and suffer a bigger loss in terms of adverse selection. Yet when they do manage to succeed, they are more resilient to extreme fluctuations in support requests.

This difference is the result of assuming incomplete (as opposed to complete) information about the distribution of risk in the group. It signals that the real threat for the success of risk-sharing groups is not high risk, but a perception of high risks. Every time a sudden increase in support requests results in a spike in estimated risk, more agents are at risk of dropping out. Therefore, many more agents dropped out than they would have under complete information. The low-heterogeneity condition had fewer of these peaks, but if they do occur, the results are more detrimental.

This has important implications for the new mutuals initiatives. In general, communication and information are key. To prevent members reacting to sudden and temporary increases in support requests, the organizations need to be clear about the long-term perspectives of the risk-sharing group. Only then can the weight of one-time realizations be decreased. Another solution is to boost solidarity by stimulating dense and cohesive RSGs. However, these measures may be easier to implement if the

group size is smaller, while larger groups were better able to smooth support requests and deal with the occasional drop-out.

Hence, in the end it might be more important to try to keep heterogeneity within reasonable bounds, precisely because this type of RSG is generally quite small. To avoid the risk of withdrawal cascades, heterogeneity should be controlled as much as possible, even if that means separate RSGs will be formed for high- and low-risk subgroups. Alternatively, despite many new mutuals initiatives starting from the premise that the insurance should be available to everyone, and therefore refrain from applying risk differentiation in contribution levels based on (in their opinion) subjective risk profiles (Vriens & De Moor, 2020), it may help to follow regular insurance companies in asking different premium levels to different people. Such differentiation might help to counter the tendency of low-risk members to drop out.

4.7 Conclusion and discussion

Engaging in risk-sharing (or mutual insurance) arrangements can be uncertain, fragile, and unstable—but so is its uninsured alternative. So what, then, explains long-term successful participation? What allows stable participation patterns to emerge even under more heterogeneous distributions of risk? We modelled participation in risk-sharing arrangements such as informal mutual insurance organizations. The interest for this endeavor is derived from the recent revival of mutualism, that takes shape through initiatives that experiment with alternative ways of organizing insurance (Vriens & De Moor, 2020). Under the label of Peer-to-Peer insurance, these organizations set up insurance in risk-sharing groups (RSGs). Given the large uncertainty in such initiatives, as well as the emphasis these initiatives themselves place on motives of solidarity, it seems vital to better understand the mechanisms underlying cooperation in such settings.

We constructed a dynamic Risk-Sharing Model (RSM) that is based on the idea that members have incomplete information about the risk distribution. Through agent-based simulations we compared several degrees of risk heterogeneity to see how that affects agents' willingness to be part of the mutual. We included several individual motivations (risk aversion, solidarity, and lower reinforcement learning weights) that may compensate for the cost increases that come with higher heterogeneity. Our model showed that more heterogeneous populations are less likely to realize successful, stable RSGs, which may be explained from the fact that in more homogeneous groups individual motivations such as solidarity and risk aversion can better compensate for cost fluctuations, for these fluctuations will be less extreme. At the same time, the model predicts that more homogeneous populations—precisely because of their similarity—are less capable of dealing with sudden, exceptionally large increases in support requests, making them fragile to sudden internal or external shocks.

These results provide potentially important clarifications on the role of hetero-

geneity in risk-sharing arrangements. A logical next step would be to test these mechanisms in an empirical setting. Lab experiments are arguably most relevant, because they enable isolated tests of the core mechanisms. Moreover, lab experiments make it possible to not only analyze the basic behavior (e.g., by manipulating risk heterogeneity and comparing participation levels), but also to study the role of endogenous motivations, and how they change over the course of the experiment.

At the same time, it should be noted that with an eye on tractability the model introduced several severe simplifications, particularly with respect to individual motivations and preferences. We therefore end with a discussion of possible extensions, in increasing order of how much they change the basic RSM, that would further fine-tune insights in the dynamics of participation.

4.7.1 Stabilizing participation patterns

The current model set-up is such that member rates can never increase. One solution to this problem would be to extend the model by introducing a random new batch of agents at several time points. These new agents get the choice whether or not to join the RSG, knowing only their own risk and the number of agents that are currently part of the RSG. While this allows for membership rates to increase as well, it likely would not solve the heterogeneity problem. As long as agents do not know the risk distribution beforehand, low-risk agents might join initially, but would eventually drop out again, just like the other low-risk agents did before them. The high-risk agents do remain, meaning that if the simulation is continued infinitely, ultimately we would end up with completely homogeneous groups of high-risk agents.

The alternative would be to change the learning parameter in a way that moves reinforcement learning more in the direction of Bayesian learning. Plain reinforcement learning assumes naive agents (Camerer, 2003), and it would make sense to model learning in such a way that over time agents are less susceptible to support requests, because they get a better idea of what the true group-level risk is. At that point, they should no longer be much affected by sudden peaks in support requests, thus stabilizing participation rates.

4.7.2 Endogenous group formation

Several studies, both theoretically and empirically, have shown that endogenous preferences play an important role in the formation of RSGs. The simulation results of Hegselmann and Flache (1998), for instance, signal that agents are more likely to engage in risk-sharing relations when their risk probabilities lie closer together, and that this effect is stronger for agents with more extreme risk probabilities (both high and low). Attanasio et al. (2012) find experimentally that close friends and relatives group assortatively on risk attitudes and are more likely to join the same risk-sharing group, while unfamiliar participants group less. This might be due to a lack of trust

in a group of strangers, which relates to the social dilemma aspect of risk-sharing arrangements. Players do not trust that they can reap the benefits of cooperation if the other group members (and their risk attitudes) are not known.

In the current setup, agents who drop out are treated as uninterested in such risk-sharing arrangements. However, they might have participated had the group composition been different (e.g., when homogeneity is larger). Rather than providing a single risk-sharing setting as an all-or-nothing decision, another possibility would therefore be to let agents choose between different RSGs. However, this does introduce the possibility that agents who currently reside in RSGs even though it is relatively costly would decide to leave these groups for another, more homogeneous RSG. Introducing endogeneity in group formation increases the number of alternative strategies and could therefore drastically alter the results with respect to how parameters like risk aversion and solidarity affect participation in RSGs.

4.7.3 Dynamic solidarity

In the current model, solidarity is treated as a personal characteristic that is independent of earlier experiences. There is, however, no reason to assume beforehand that solidarity is constant. Solidarity motivations can compensate for cost fluctuations, as in the current RSM, but may in turn also be affected by them. It might feel good to help one or two others, but what if one has to support multiple group members without needing the help in return? Or what if one group member repeatedly needs support? Does this only affect one's participation costs or do such different degrees of helping intensity also affect one's degree of solidarity?

The model could be extended with solidarity implemented as following a Markov chain process in the sense that current solidarity depends in part on earlier experiences. Solidarity motives could grow as members cooperate for longer time periods, for instance because of increased social embeddedness: The better agent i gets to know their fellow group members, the more willing they might be to help them, as social norms regarding helping behavior are established among them. Alternatively, when the same agent repeatedly needs support, it is also conceivable that other agents' willingness to provide it has an expiration date. Is the level of solidarity towards the same agent equal after 1, 5, or 20 support requests? An interesting next step would be to model how such dynamics affect solidarity motives over time.

4.7.4 Moral hazard

In the current model set-up, to participate in the RSG is the cooperative strategy, while not participating is the strategy of defection. Another means to defect, however, is not to (no longer) participate in the RSG, but to make fraudulent use of the money saved in the common fund. As in most risk-sharing models, this strategy is not accounted for in the basic model. A model extension that includes this possibility

involves the implementation of parameters reflecting the probability that such misuse is caught, e.g. through random institutional checks or because of informal social control mechanisms. Moreover, the social preferences parameter would have to be extended. For agents with high solidarity motives, individual opportunistic strategies might be less attractive because of an additional guilt parameter (Fehr & Schmidt, 1999; Snijders, 1996).

5

CHAPTER 5

Managing risk heterogeneity in risk-sharing groups: A multi-method study on risk aversion and solidarity

This chapter is co-authored by Vincent Buskens and has been submitted to an international journal. The theory for this paper was developed jointly by Vriens and Buskens, the survey was designed by Vriens, Buskens, and Tine de Moor, and the experiment was designed by Vriens and Buskens. Vriens programmed and conducted the experiment and analyzed the two datasets. Vriens is responsible for writing the main part of the manuscript, and Buskens has provided substantial feedback.

Abstract

A recent revival of organizations that provide insurance in risk-sharing groups (e.g., Broodfonds in the Netherlands, Friendsurance in Germany) brings us back to the age-old question of how risk-sharing groups can survive despite their risk heterogeneity. Data tells us that members within these groups vary substantially in their risk of needing support, essentially meaning that low-risk members pay more to support others than they receive support in return. How can heterogeneous risk-sharing groups realize stable participation rates? In a multi-method study, we examine the potential of risk aversion and solidarity as compensators for heterogeneity by comparing the results of a survey conducted among 5,192 members of 230 Broodfonds groups to an online experiment with 430 British subjects of the Prolific platform. While we find that risk heterogeneity has a negative effect on participation in Broodfonds groups, our experimental manipulation of heterogeneity has no significant effect. Moreover, risk aversion does not predict participation in the field study nor in the initial decision to join in the experiment. In the first, it only predicts participation for low-risk members and in the latter, it only explains continued participation. Solidarity motives, finally, are a strong predictor in both settings. These results have important implications for theories on sharing risk (in which traditionally risk aversion is a crucial factor) and for understanding what may make risk-sharing groups successful in practice.

5.1 Introduction

Over the past two decades, new mutual insurance organizations have been launched in many countries globally (see Vriens & De Moor, 2020 for an overview). In the Netherlands, for example, many self-employed workers have joined so-called Broodfonds groups (lit.: "bread funds") in which up to 50 members support each other in case long-term illness makes generating an income impossible. Other than regular insurance, which is paid in fixed premiums, the new organizations use risk-sharing arrangements: Contribution fees are used to build a common insurance fund of which the reserves not used to support members in need get redistributed at the end of the term. Thus, participants directly help each other, yet are all better off the lower the number of claims (redistribution then lowers the costs for all participants). This introduces an interdependency between members that could make participation particularly fragile the larger the heterogeneity in members' insurance risk (Platteau, 1997; Vogt & Weesie, 2004).

Risk heterogeneity implies an inequality where some group members have an above-average reliance on support from the risk-sharing group (Hegselmann & Flache, 1998). Others (the low-risk people) pay more to support these high-risk people than they receive support in return. Hence, participation is less attractive for low-risk people (the returns from redistribution are lower than they could be in a more homo-

geneous group), which is thought to hinder success (Breer & Novikov, 2015; Coate & Ravallion, 1993). While insurance companies solve this dilemma by decreasing premium rates for low-risk policyholders, many risk-sharing groups do not. Broodfonds groups, for instance, do not apply *ex ante* risk differentiation based on the premise that risk cannot be perfectly assessed and everyone should have access to support (Vriens & De Moor, 2020). From data collected among 230 Broodfonds groups (Vriens et al., 2017), we know that there is substantial risk heterogeneity within these groups. What makes (low-risk) people willing to participate in heterogeneous risk-sharing groups? In this chapter, we study empirically to what extent risk aversion and solidarity can explain this pattern using a multi-method approach.

After all, Broodfonds groups are not exceptional. Although the new collective insurance organizations are covered with great curiosity and certain disbelief in European media (see, e.g., Curvers, 2019), sharing risk is the oldest means of creating security worldwide (Platteau, 1997). The earliest written accounts were found among the early modern guilds, where craftsmen came up with a pre-modern social security system for their members (see Epstein & Prak, 2008). Later, in the 19th century, mutuals were the most widespread—and arguably most successful—way of organizing insurance in most of Europe, the US, and Australia (Emery & Emery, 1999; Van Leeuwen, 2016). While small-scale mutuals have slowly faded from the collective memory in these countries (as their tasks have largely been taken over by welfare states and large private insurance companies; Beito, 2000), they still form a key means to share risk among rural populations in sub-Saharan Africa (Lemay-Boucher, 2009), India (Ligon et al., 2002), and Southeast Asia (Fafchamps & Lund, 2003).

This brings us to the gap between theory and practice, because while theoretical accounts often make the simplifying assumption of risk homogeneity (Coate & Ravallion, 1993; Ligon et al., 2002), in doing so they get rid of a crucial characteristic of real-world risk-sharing groups. Models that do relax the homogeneity assumption generally use risk aversion to explain why people may decide to share risk despite heterogeneity (Attanasio et al., 2012; Breer & Novikov, 2015; Vogt & Weesie, 2004). Risk averse people prefer certain outcomes over uncertain gambles even if the expected value of the gamble is more profitable (Arrow, 1984). Applied to the context of sharing risk, it is hypothesized that this makes them willing to pay more to support others today to ascertain an income in the future (Platteau, 1997). While experiments corroborated that risk averse people were willing to share risk despite heterogeneity (Vogt & Weesie, 2006), many field studies show lower participation rates than would be expected from a risk aversion assumption (Platteau et al., 2017). Hence, further empirical research is needed to shed light on the role of risk aversion—or more specifically, on whether risk-sharing groups are or are not considered an attractive, uncertainty-reducing alternative for risk averse people.

In small risk-sharing groups, participants do not only create financial security for themselves, but for others as well. This introduces a social aspect that could

either strengthen resilience (when participants get motivated by solidarity from helping each other) or weaken it (when participants perceive the distribution of costs and benefits as unequal). Hence, the second aspect included in this study is solidarity, operationalized as pro-social motives directed towards members within the same risk-sharing group, i.e., beyond general motives of altruism (Baldassarri, 2015), from which personal utility (a good feeling) is derived as well (Gintis et al., 2005). We highlight this aspect particularly because it aligns with the vision of the new risk-sharing groups themselves. While their revival can mostly be attributed to a new and growing societal need—changing demographic structures, decreasing welfare states and increasing privatization of the insurance system have led to an increase in the number of people excluded from social insurances—the new organizations see a chance as well. Their mission statements describe a desire to go back to insurance as it was historically perceived: simpler, fairer, and kinder (Vriens & De Moor, 2020). In other words, solidarity has been given a central role, and empirical research is needed to find out whether that is justified.

In this chapter, we aim to gain insight into the dynamics of risk-sharing processes, particularly into mechanisms that drive people to participate or drop out, using two case studies. The first is a study among members of Broodfonds groups. Using survey data we study cross-sectionally how commitment (taken as predictor for future participation) relates to risk and insurance use (of both the individual and the group), risk aversion, and solidarity. While yielding insights in the role of risk aversion and solidarity for people embedded in real-world risk-sharing groups, the data only includes members and therefore lacks a counterfactual comparison. Therefore, we also conducted an online experiment among Prolific users. In a contextualized experiment we mimicked the structure of Broodfonds groups and studied under which circumstances people were willing to join and remain part of the group. This enabled us to truly test dynamics in participation processes, albeit tested in an abstract, artificial, and anonymized setting. Combined, the two case studies make up for each other's limitations (Buskens & Raub, 2008) and help to gain insight in how risks are shared, what the role of risk aversion and solidarity is, and more generally what characteristics allow for stable participation patterns in risk-sharing groups. If complementary results are found through both methods, we can—with more certainty—uncover the mechanisms behind the success of risk-sharing arrangements (Buskens, 2014).

5.2 Theory

The main theoretical framework to explain sharing risk and organizing mutual insurance is structured around the premise that the decision to participate represents a social dilemma (Fafchamps, 1992). While everyone could decide to save individually, this is more costly than saving collectively. However, saving collectively is surrounded by uncertainty. The main source of uncertainty—one absent in general public good

dilemmas—is that people never know whether they, at some point, actually need support from the common fund. In fact, in the best case scenario they never do (Platteau, 1997). This makes participation in mutuals or risk-sharing groups particularly tricky, for the benefit (insurance in times of need) may never be obtained. Additional sources of uncertainty are not knowing how many others will decide to participate (common to all types of social dilemmas), how often they need support from the common fund (simultaneously), and whether they will remain members to reciprocate the favor in the future (Vriens et al., 2019).

The classic risk-sharing model starts from a situation of symmetry. By assuming homogeneous risks (generally operationalized as equal opportunities of ending up with a high or a low payoff), they explain how long-term stable risk-sharing arrangements can emerge among rational, self-interested people (Coate & Ravallion, 1993; Fafchamps, 1992). Without such assumptions, adverse selection comes into play. Adverse selection describes the phenomenon that risk-sharing groups (or insurances in general) attract an above-average number of high-risk members (Akerlof, 1970). It implies that any rational actor, who decides whether or not to participate in a risk-sharing arrangement based on cost-benefit calculations, opts out of arrangements in which their risk is lower than the group average (Genicot & Ray, 2003; Ligon et al., 2002). When risk-sharing groups attract in particular high-risk people, participation becomes more expensive for everyone involved and the common fund may be insufficient to support everyone (i.e., relatively speaking, payouts from the common fund are needed more often).

This does not mean, however, that any risk heterogeneity inherently means the risk-sharing arrangement will fail. Hence, let us rephrase the theoretical argument from a comparison between homogeneous and heterogeneous risk-sharing groups (where heterogeneous risk-sharing groups are always worse off) to one that explores what extent of heterogeneity is acceptable. An early simulation model of Hegselmann and Flache (1998) studied how networks of mutual support can evolve in a world inhabited by rational egoists that need help with different probabilities (i.e., risk heterogeneity) and choose their risk-sharing partners endogenously in opportunistic ways. The model predicts that while people are, to some extent, willing to engage in unequal risk-sharing relations, they prefer partnerships that are as equal in risk as possible. In a different simulation study we predicted, for partnerships of $N > 2$ people and populations that vary in the degree of risk heterogeneity, whether utility-maximizing agents are willing to participate given specific risk aversion and solidarity traits (Vriens & Buskens, 2020). Our simulation results likewise showed that while stable participation patterns can emerge under various degrees of heterogeneity, in general group-level participation rates are lower the more heterogeneous the group. This effect was even stronger when agents did not know the actual risk distribution but based their estimate of the group-level risk on inferences from earlier support requests.

Experimentally, Vogt and Weesie (2006) found that risk heterogeneity decreases

willingness to engage in dyadic risk-sharing relations, but that risk-sharing relations emerge nonetheless. Finally, Tausch et al. (2014), found that when risk profiles are common knowledge, high-risk people were more likely to participate in 3-person risk-sharing groups than low-risk people and sharing risk was more likely to succeed in homogeneous rather than heterogeneous groups. Hence, driven by an interest to compare different degrees of heterogeneity, our baseline hypothesis is the following:

Hypothesis 5.1: *The lower the risk heterogeneity of a risk-sharing group, the larger the likelihood that members remain part of the risk-sharing group.*

The most popular explanation for why low-risk people participate in risk-sharing groups (or take out an insurance) is that people do not mind the extra costs if that guarantees them a safety net in the future. Called risk aversion (Arrow, 1971), the main idea is that not joining the risk-sharing arrangement introduces a gamble where with some probability you end up with nothing. The aversion towards this probability makes low-risk people willing to join such an arrangement even with high-risk people. Several theoretical variations on risk aversion exist, such as loss aversion (Kahneman & Tversky, 1979) or ambiguity aversion (Elabed & Carter, 2015), but we follow the majority of risk-sharing theories (Breer & Novikov, 2015; Coate & Ravallion, 1993; Delpierre, Verheyden, & Weynants, 2016; Laczó, 2014; Vogt & Weesie, 2004) and stick to the notion of plain risk aversion.

The positive effect of risk aversion to counter risk heterogeneity is corroborated experimentally (Vogt & Weesie, 2006). In field studies, risk aversion is rarely measured explicitly, but there is some evidence that participating in risk-sharing arrangements is lower than would be expected under risk aversion (Platteau et al., 2017), suggesting that risk-sharing arrangements may not always be an uncertainty-reducing alternative. To assess whether the theoretical role assigned to risk aversion holds in practice, we therefore test the following individual-level hypothesis:

Hypothesis 5.2: *The higher members' risk aversion, the larger the likelihood that they remain part of the risk-sharing group.*

The second individual-level explanation we put to a test is the role of solidarity motives. This requires a bit more clarification, as solidarity is used to describe different mechanisms in different studies. In the seminal work of Fafchamps (1992), for instance, solidarity networks are used to describe the age-old risk-sharing networks in place in preindustrial societies. Fafchamps refers to solidarity as a form of mutual insurance, where the person receiving assistence is expected to help others in return—without specifying how much help is warranted. In other words, solidarity is used to describe self-regarding direct or indirect reciprocity. In this case, however, we refer to solidarity as a type of pro-social motive that extends cooperation beyond basic reciprocal and reputation-based cooperation (Chaudhuri, 2011; Ostrom, 1990). It involves (to some extent) utility derived from helping others without expecting help

in return (Fehr & Schmidt, 1999), and as such may invoke willingness to participate in risk-sharing groups when self-interested people would not.

While often discussed as a general personality trait (e.g., altruism, Levine, 1998), we believe that in the context of risk-sharing groups the distinction by Baldassarri (2015) is more applicable. In the experiment of Baldassari, solidarity (pro-social motives towards members of one's group) is found to lead to higher cooperation rates than altruism (pro-social motives in general). Given that risk-sharing groups do not necessarily need people to be pro-social in general, but rather willing to pay the costs to support others within the group (Vriens & Buskens, 2020), this particular notion of pro-social motives seems most applicable, and also best in line with the ideology of the new mutuals themselves. Experimentally, solidarity—or rather social preferences in general—are found to increase participation in informal risk-sharing arrangements when contrasted to the introduction of formal insurances (Lin, Liu, & Meng, 2014; Lin et al., 2019). Finally, studies about historical mutuals of the 19th century often place solidarity motives central to explanations of their success (Harris, 2012).[1] Hence, our third hypothesis reads:

Hypothesis 5.3: *The higher members' solidarity, the larger the likelihood that they remain part of the risk-sharing group.*

The above hypotheses all concern generalized predictions. There are, however, good reasons to believe that the effects of risk aversion and solidarity may depend on the group context—and thus on risk heterogeneity. That is, when risk averse people are looking for the solution that provides them more security, it may be questioned whether all risk-sharing groups are equally capable of providing this (Platteau et al., 2017). After all, risk-sharing groups introduce many uncertainties as well (e.g., how many people need support and how often, and whether the fund will be sufficient to help everyone). These uncertainties increase with heterogeneity. Likewise, if we hypothesize on the role of solidarity as pro-social behavior towards the members of the risk-sharing group (rather than pro-social behavior in general), it may matter who these people are (Vriens et al., 2019).

Through simulations, we showed that while risk aversion and solidarity can advance participation despite risk heterogeneity, they are more effective in doing so when heterogeneity is lower (Vriens & Buskens, 2020). While this may seem contradictory at first—after all, these two factors generally enable participation under inequality—this result should be interpreted with an eye on how these factors were operationalized to increase the motivation to participate. Taking solidarity as example, any member with at least some degree of solidarity motives is willing to pay higher costs to help

[1] It should be noted that while case studies of historical mutuals often mention solidarity (and social norms, social control) as an important reason for success, this is discussed more in relation to reducing moral hazard than for countering adverse selection. Moral hazard (when insured people increase risky behave or exaggerate insurance needs, Arrow, 1971) falls beyond the scope of the current investigation.

other group members (solidarity compensates for these costs). However, it will only compensate up to some degree. If, in more heterogeneous groups, the cost fluctuations of supporting others are larger and higher over time, the probability increases that the degree of solidarity (or risk aversion) is insufficient. Hence, to assess the dynamics of risk aversion and solidarity we derive the following hypothesis:

Hypothesis 5.4: *The higher the risk heterogeneity, the weaker the positive effect of* ***(a)*** *risk aversion and* ***(b)*** *solidarity on the likelihood that members remain part of the risk-sharing group.*

Finally, to further investigate the dynamics and interdependencies between the decision-making of different group members, we study how the behavior of other group members affects individual decision-making. Collective action theories state that people are willing to participate only as long as a sufficient number of others also participate (i.e., when the number of participants is above a certain threshold, Granovetter, 1978). This goes for the willingness to start to cooperate in the first place, but remains just as true in deciding whether or not to continue to cooperate. Any collectively established cooperation arrangement is fragile to small (or rare) disturbances, which can cause a downward cascade of cooperation (Ostrom, 2005).

In the context of risk-sharing groups, fluctuations in the number of group members requesting support could be such disturbances. When suddenly several group members need support, the costs of participation go up. This could mean that for one or a few members, participation may no longer be interesting. If they then choose to opt out of the risk-sharing arrangement, this drives the remaining members to reevaluate whether the risk-sharing arrangement is worthwhile given a smaller number of people with whom risk is shared. Especially assuming that low-risk members are more likely to opt out after sudden or temporary cost increases, a decrease in the total number of members also means an increase in the average participation costs per round. Our earlier simulation study also showed that dropout by one (or several) members could easily set in motion withdrawal cascades (Vriens & Buskens, 2020). Our final hypothesis thus reads:[2]

Hypothesis 5.5: *Sudden increases in support requests and dropouts by one (or several) member(s) set in motion cascades such that other members are less likely to remain part of the risk-sharing group either.*

[2]This hypothesis cannot be tested with the cross-sectional data of the Broodfonds groups (Study 1) and will therefore be tested with the experimental data only (Study 2).

5.3 Study 1: Broodfonds survey

5.3.1 About Broodfonds

Broodfonds is a collective in which self-employed workers in the Netherlands (who are excluded from welfare benefits regarding retirement and disability) organize their own financial safety net. Everyone pays a monthly contribution that is used to create a common fund from which members suffering from long-term illness can be supported. At the time of writing (October 2020), there are 595 Broodfonds groups in the Netherlands with an average of 45 members per group (26,900 in total). Each group, while based on the same organizational framework, is registered as an independent association (i.e., not formally recognized as an insurance). Governed by board members that are sequentially chosen and appointed from their own member base, they share the risk of income loss due to illness on the basis of trust. Sick members do not need to prove illness through official doctor's notes or house visits, but are asked to update the group on their progress towards recovery.

The first Broodfonds group started in 2006. Subsequently, three members of this group started a new cooperative called BroodfondsMakers that, as an umbrella organization, supports other self-employed workers to start their own Broodfonds group. These new groups have to adhere to the basic organizational framework to carry the name Broodfonds. The number of Broodfonds groups grew rapidly afterwards, from 18 by the end of 2012 to 230 by February 2017 (reference date for the data collection) to 595 by October 2020.

Common membership restrictions include requirements such as the necessity to work or live in the same municipality and to be introduced by one or two existing group members. Risk is never a restriction: as a policy, Broodfonds groups do not differentiate based on (predicted) risk. In their opinion risk cannot be estimated precisely and everyone deserves basic support levels. Yet since groups are formed endogenously, it could be that risk does factor in implicitly when people decide with whom to join a group (e.g., there are a few groups that consist entirely of people working in the same sector). As such, substantial variation may exist between the different groups in terms of risk heterogeneity.

5.3.2 Data

We rely on an online survey conducted among all 10,331 members of the 230 Broodfonds groups that were established before February 2017 (Vriens et al., 2017). This survey, administered between May 10 and June 14, 2017, asked about personal characteristics, membership motivations, and use of the mutual fund. The chairpersons of the 230 groups were asked to fill in a second survey with questions about organizational properties and support. 5,192 respondents filled in the member questionnaire (50.7%). The organization questionnaire was filled in for 196 of 230 groups (85.2%).

The data collection has been approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of Utrecht University (reference number 17-042).

5.3.3 Methods

An obvious drawback of using a cross-sectional survey among members of existing risk-sharing groups to test theories about participation is, of course, that all respondents participate, meaning that strictly speaking there is no variation on the outcome variable. We can, however, look at people's intentions to continue membership in the future. One often-used factor to measure such intentions is commitment (Hauert, 2002; Kollock, 1994; Orbell et al., 1984; Vriens et al., 2019). Low levels of commitment signal a potential threat, as members are more likely to leave in the future; high levels make it more likely that members will continue to participate regardless of potential (internal or external) changes.

Commitment was measured through seven items (obtained from Meyer et al., 1993) that covered both affective aspects (emotional attachment) and normative aspects (perceived obligations).[3] Example items are "*I tell others proudly that I am part of this Broodfonds"* (affective, Van der Lippe et al., 2016) and "*Even if it were to my advantage, I do not feel that it would be right to leave Broodfonds right now*" (normative, Jak & Evers, 2010). Responses to all questions were measured on a 7-point scale ranging from (0) "completely disagree" to (6) "completely agree", where higher scores reflect more commitment. Because the items form an adapted selection of the original scales we used Exploratory Factor Analyses to test their validity and construct a scale based on the factor loadings (which were above the 0.32 threshold for all items). The scale has a Cronbach's alpha reliability of $\alpha = 0.82$.

To predict commitment, we take proxies for risk aversion, solidarity, risk, benefit size, and time on the individual level, as well as risk heterogeneity, the number of support requests, and group size on the level of the mutual group.

Risk aversion was measured using the "staircase" method: a validated method of inferring risk preferences through iterative multiple price lists (Andersen, Harrison, Lau, & Rutström, 2006; Falk et al., 2016). It presents respondents with five choices between a lottery and a sure payoff, where the lottery is constant (always a 50/50 gamble of 300 versus 0 points) and the size of the sure payoff varies conditional on the previous decision (i.e., a higher sure payoff if the subject chose the lottery and vice versa). For the survey, a 1:1 translation was used so that 300 points were presented as a hypothetical €300. The safe counteroffer ranged between €10 and €310 depending on the position on the staircase. After five questions, respondents ended up on position

[3] In organization research, continuance commitment is generally called upon as a third dimension of commitment. This dimension depends on external factors (i.e., the presence or absence of attractive alternatives), and does not measure individual efforts of making the organization successful. Because small mutuals generally arise when no (or few) alternatives are available, affective and normative commitment are most useful as proxies for success.

0 to 31 on the staircase, where 31 is the most risk averse position and 0 the most risk seeking.

Respondents were also asked about their motivation for joining a Broodfonds group (with options ranging from financial, to organizational and social motives). We used three motives that capture social aspects ("*To be able to do something for other people*", "*Solidarity towards each other*", and "*Being part of a group*") to create a factor scale of solidarity. All items had factor loadings above the 0.32 threshold and the scale has a Cronbach's alpha reliability of $\alpha = 0.75$.

As proxies for individual risk we used two indicators: A self-rated health status (perceived risk) and whether or not the respondent received a benefit from the group in the twelve months preceding the survey. Perceived risk was measured by asking respondents to rate their current (mental and physical) health on a 7-point scale ranging from (0) "very bad" to (6) "very good".

Broodfonds groups use fixed combinations of contributions and corresponding threshold sizes, so we also used information about the size of the benefit in case they would need support. Options ranged from €500 to €3000 in steps from €250. The resulting variable was scaled by dividing the answer by 100.

Time, finally, was included as the number of years that the Broodfonds group exists before 2017 (the year the survey was conducted). In addition, we included a 'deviation' variable indicating for every member of the group whether they joined Broodfonds earlier or later than this group's starting date. This deviation is positive if a group member joined an existing group and negative in case a group member switched to a different group. The latter occurred, for instance, when a group got bigger and decided to split into two separate groups.

For the risk of the Broodfonds group we again used two indicators. We calculated, for each Broodfonds group, the standard deviation of the self-rated perceived risk question as an indicator of risk heterogeneity. Moreover, we used the sum of the number of respondents who indicated that they received a benefit divided by the total number of members as an indicator of realized risk. Finally, we included the number of members of each Broodfonds group.

To compare our analyses to earlier analyses on the same data (Vriens et al., 2019) and to prevent that effects can be attributed to other relevant factors used before, we added several additional variables as controls. These include age, gender, trust in other group members, the number of (strong) ties to other group members, and the network structure of the different Broodfonds groups (dense, clustered, star-shaped or sparse). The latter were measured as cognitive social network structures (Krackhardt, 1987) and depict the proportion of members of each group that considered that network structure to be the best description for the relations within their group.

Table 5.1 shows the descriptive statistics of all variables. There are slightly more men than women in the sample (54%) and members are on average 49 years old. Most respondents feel relatively healthy and the average realized risk (in terms of

Table 5.1. Descriptive statistics for member- ($N = 3570$) and group-level ($N = 230$)

Variable	M	SD	Min	Max
Members				
Commitment	3.90	0.93	0.00	5.43
Risk aversion	19.70	6.98	0.00	31.00
Solidarity	3.44	0.88	0.00	4.70
Perceived risk	0.94	1.02	0.00	6.00
Received benefit	1.05	0.23	1.00	2.00
Benefit size	17.13	5.74	5.00	30.00
# Years Broodfonds − # Years member	0.65	1.10	-5.00	10.00
Gender: Female	1.47	0.50	1.00	2.00
Age	49.20	8.70	21.00	74.00
Trust	0.03	0.97	-4.54	1.38
Total degree	7.07	9.53	0.00	100.00
Strong tie degree	41.95	34.69	0.00	100.00
Groups				
Risk heterogeneity	0.98	0.28	0.44	1.83
Relative number of benefits	0.05	0.05	0.00	0.25
Total number of members	44.83	6.75	21.00	53.00
# Years Broodfonds group	2.59	1.43	0.00	11.00
Dense network	0.14	0.16	0.00	1.00
Clustered network	0.46	0.19	0.00	0.95
Star network	0.24	0.13	0.00	0.67
Sparse network	0.16	0.17	0.00	0.80

who received a benefit in the last twelve months) in the group was 5%.

We used multilevel OLS regression analyses to predict commitment using a two-step approach: First a model (M1) with all direct effects, followed by a model (M2) that included interactions of risk aversion and solidarity with risk heterogeneity. The models were compared with reference to the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), which consider one model superior over the other once the difference exceeds the threshold of 10 (Burnham & Anderson, 2003).

5.3.4 Results

The starting point for this study was the risk heterogeneity in Broodfonds groups. Using self-assessed risk perceptions aggregated to the group-level, the average risk per Broodfonds group was 0.94 (almost 1 point above the 7-point scale minimum of 0), indicating that on average Broodfonds members of all groups consider themselves to be healthy. However, the standard deviation ranges from (0.44−1.83), with an average of 0.98 (SD = 0.28). This indicates that there is substantial variation both between and within groups in the individual risk perceptions. The correlation with member commitment rates is $\rho(228) = -.214$ ($p = .001$) on the group level and $\rho(4939) = -.053$ ($p < .001$) on the member level. That is, in groups were heterogeneity is higher, commitment of members seems to be lower.

Table 5.2 reports the results of the multilevel regression analyses, to test which

relations hold significantly while controlling for group-level clustering and the relevant individual and group-level covariates. In general, most variance occurs on the member level. Only 2.7% of the variance in the empty Model M0 is shared on the group level. Compared to the empty model, Model M1 explains 47% of the variance on the member level and 67% of the variance on the group level.

Table 5.2. Multilevel OLS regression analyses on commitment ($N = 3570$)

	(M0)		(M1)		(M2)	
Members						
Intercept	3.894***	(0.017)	1.662***	(0.143)	3.049***	(0.131)
Risk aversion			0.003	(0.002)	0.003	(0.002)
Risk aversion × Risk heterogeneity					0.001	(0.006)
Solidarity			0.427***	(0.014)	0.427***	(0.014)
Solidarity × Risk heterogeneity					0.080	(0.049)
Perceived risk			−0.002	(0.012)	−0.001	(0.012)
Received benefit			0.175**	(0.056)	0.169**	(0.056)
Benefit size			0.003	(0.002)	0.003	(0.002)
# Years Broodfonds − # years member			−0.021	(0.012)	−0.021	(0.012)
Gender: Female			0.007	(0.024)	0.008	(0.024)
Age			0.015***	(0.001)	0.015***	(0.001)
Board member			0.135**	(0.042)	0.135**	(0.042)
Trust			0.327***	(0.013)	0.327***	(0.013)
Strong tie degree			0.005***	(0.001)	0.005***	(0.001)
Total degree			0.002***	(0.000)	0.002***	(0.000)
Groups						
Risk heterogeneity			−0.147**	(0.054)	−0.148**	(0.054)
Relative number of benefits			0.303	(0.303)	0.304	(0.303)
Total number of members			−0.001	(0.002)	−0.001	(0.002)
# Years Broodfonds			−0.034**	(0.012)	−0.034**	(0.012)
Dense network			0.134**	(0.045)	0.135**	(0.045)
Clustered network			0.026	(0.034)	0.026	(0.034)
Star network			0.034	(0.037)	0.034	(0.037)
Random intercept group		0.024		0.008		0.008
Residual variance		0.843		0.444		0.444
Intraclass correlation		0.027		0.019		0.018
Log Likelihood		−6,645.275		−3,707.143		−3,712.055
Akaike Inf. Crit.		13,296.550		7,458.285		7,472.110
Bayesian Inf. Crit.		13,316.070		7,594.252		7,620.437

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

As already expected from the bivariate correlation, Model M1 shows a negative effect of risk heterogeneity on commitment. In groups where the standard deviation of average perceived risk is 1, commitment is 0.147 points lower. This supports Hypothesis 5.1. The effect of risk aversion is not significant, which implies no support for Hypothesis 5.2. Solidarity, on the other hand, has a strong positive effect on commitment, with 1 additional point on the solidarity scale equating 0.427 points extra on the commitment scale. This provides support for Hypothesis 5.3. Finally, Model M2 adds the interaction effects between risk heterogeneity and risk aversion and solidarity. It does not explain additional variance, nor does it improve the model fit (the AIC and BIC scores are worse). Neither one of the interaction effects is significant, which means that the effects of risk aversion and solidarity do not depend on group-level heterogeneity. Hypothesis 5.4 is not supported.

Hypothesis 5.5 (about cascades in participation decisions) cannot be tested with the survey data, because all respondents in the cross-sectional sample are participating. However, commitment does not seem to be affected by factors that could be indicators for member interdependencies: Neither the relative number of benefits nor group size are significantly related to commitment. Interestingly, individual perceived risk does not affect commitment either. One would expect people with higher risk to be more committed (since they are more likely to need support from the risk-sharing group in the future), but this does not follow from the data. It could be that this effect is captured partly by the variable indicating whether or not the member received a benefit. We do find members that received a benefit in the last twelve months to be more committed than those who did not. Since there is a moderately strong correlation between perceived risk and whether a benefit was obtained ($\rho_s = 0.266, p < .001$), it could be that perceived risk is captured in this variable as well. Those who received a benefit might perceive their risk to be higher, thinking they might need support again in the future. At the same time, it could be a sign against moral hazard or free riding: there is no incentive for people to drop out once they obtained their benefit. Instead, they might feel like it is up to them to reciprocate the favor in the future.

Finally, commitment is lower in older groups than in younger groups. There is no way to disentangle whether this is a cohort effect (i.e., older groups where less committed to begin with) or an age effect (i.e., commitment decreases over time), which makes it important to keep monitoring commitment levels of members over time. The remaining variables affect commitment in the expected directions. Like in Vriens et al. (2019), women, elderly people, people with higher trust levels, and people with more (strong) ties to other group members are more committed. Moreover, commitment is higher in dense networks than in networks with few to no relations among members.

Since high-risk members have immediate individual incentives to be members of the risk-sharing group, for them risk-aversion or solidarity should hardly play a role. Therefore, these effects might be perceived more clearly if we repeat the analyses for low-risk members only (the ones most likely to withdraw). The low-risk subgroup was defined by selecting within each Broodfonds group those respondents whose individual perceived risk was lower than or equal to the group's average (resulting in a total of $N = 1973$ respondents). In general, most results remain stable. There are, however, two important differences. The negative effect of risk heterogeneity is stronger for the low-risk subgroup ($b = -0.224$, $p = 0.002$) compared to the full sample ($b = -0.147$, $p = 0.007$), indicating, as the theory would predict, that the effect of heterogeneity is mainly detrimental for low-risk members. Secondly, for the low-risk subgroup we do find a positive effect of risk aversion ($b = 0.004$, $p = 0.038$), which indicates that the mechanism underlying risk aversion (reducing uncertainty) is relevant only when perceived risk is low(er). High-risk members may be more certain to at some point need support in the future (or perceive their risk to be high because they are already

receiving support), so they are committed regardless of their general risk aversion. Detailed results of the subgroup regression analyses are displayed in Table D.1 in Appendix D.1.

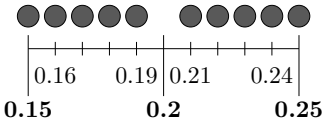
5.4 Study 2: Online experiment

5.4.1 Experimental design

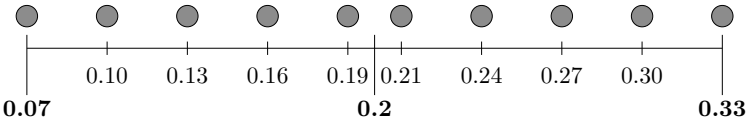
Because the survey data of the members of Broodfonds groups only yielded intentions to continue membership and cross-sectional correlations, we also designed and conducted an online experiment. The experiment was contextualized and largely followed the set-up of Broodfonds groups. Subjects were asked to imagine working as freelancers for 20 rounds (which were explained to reflect months). Every month they worked on an assignment that earned them a steady income of 900 points (£6). When they got sick, they could not finish the assignment and would have no income. In the first round, they were invited to share the risk of getting sick and earning nothing with up to nine others. If they accepted, they would pay a contribution of 300 points (£2) that would be used to pay sick members of the risk-sharing group. A sick member would receive a benefit of 750 points (£5)—unless the sum of sick members × 750 points exceeded the sum of contributions. In that case the sum of contributions would be equally divided over the sick members.

At the end of every round, the share of contributions that was not needed to pay benefits got redistributed across all members. As such, subjects that did not join the risk-sharing group earned 900 or 0 points depending on their health status. Healthy members of the risk-sharing group earned between 900 points (when no one got sick and the entire contribution fee could be returned) or 600 points (when the entire contribution fee was needed to pay sick members). Sick members, lastly, earned between 675 points (750 - 300 + 225) if they were the only sick member in a group of 10 and 0 points (-300 + 300) if all members would be sick simultaneously (the latter being very unlikely).

At the end of the experiment, one of the 20 rounds would be randomly drawn and added to the subject's earnings. Therefore, we opted for a higher contribution fee of which the remainder would be returned every round, instead of saving contribution fees in a common fund over time (as is done by Broodfonds groups). We chose this approach following earlier risk-sharing experiments (Charness & Genicot, 2009; Lin et al., 2014). Paying subjects the sum of all earnings in all rounds would imply that they saved their entire income and subjects would be incentivized to care about the final sum. In practice, however, most of one's income goes to paying rent and utilities, which is why illness (and the resulting lack of income) poses a serious threat. By randomly drawing one period for payout, subjects were incentivized to smooth consumption over periods.



(a) Condition 1: HG-L



(b) Condition 2: HG-H

Figure 5.1. Probability distributions for the two risk heterogeneity treatments

Subjects were told that other members in their risk-sharing group might not have the same risk of getting sick. Yet while they knew their own risk, they did not know the risk of other members nor whether it was higher or lower than theirs. This they had to infer from the realizations of illnesses over time. Using a between-subjects design, we systematically compared two treatment conditions in which the subject population has the same average risk ($\bar{p} = 0.2$), but varies in the internal degree of risk heterogeneity. Participants play either the low (HG-L) or the high (HG-H) heterogeneity condition, with risks ranging between $0.15 - 0.25$ and $0.07 - 0.33$, respectively. The probability distributions in these conditions are displayed in Figure 5.1, where each circle represents the risk probability for one experimental subject.

For each low risk heterogeneity treatment, we ran a high heterogeneity treatment twin in another session that uses the same realization of sickness events over the treatment's round, albeit divided over different players. That is, while the risks are assigned randomly and it is also random which player gets sick in each round, we made sure that in all groups the same number of total sickness events occurred (i.e., $N\bar{p}T = 10 \times 0.2 \times 20 = 40$ events). These 40 events were randomly divided over 20 rounds and for each division we ran an HG-L and an HG-H session, in which the sickness events were randomly assigned to the participants based on their risk weight. This way of systematically controlling the total number of events reduces the noise that is introduced by translating probabilities to realizations and provides a cleaner test of the differences between the heterogeneity conditions given our small sample size.

In the first round, participants were asked whether they wanted to join the risk-sharing group. If they joined, in all subsequent rounds they would be asked whether they wanted to *continue* to be part of the risk-sharing group. If they would not join (round 1) or would decide to opt out (all later rounds) they did not get a chance to

return at a later stage. Subjects who do not participate only saw their own realization of every round (i.e., whether they got sick or not), but no longer had a choice to make.

Subjects who did join were informed about the realizations in their risk-sharing group every round: whether or not they themselves got sick, how many members the risk-sharing group has, what the health status of the other members is, how much money was needed to pay sick group members, how much of the contribution was returned, and how much they would earn if that round were drawn for payment. Before the start of the experiment, subjects had to read the instructions (which were the same for all subjects regardless of the treatment), were presented with example screenshots of what the decision situation could look like in different rounds, and had to answer a series of questions to verify that they had read and understood the instructions correctly. The instructions, example screenshots, and questions are included in Appendix D.2.

5.4.1.1 Risk preferences and solidarity

Before the risk-sharing game we present the subjects with several other decision scenarios to measure risk preferences and solidarity. For risk preferences we use the same "staircase" method (Andersen et al., 2006; Falk et al., 2016) that we used in the survey among Broodfonds members. In five decision situations, they had to choose whether they would prefer a lottery (always a 50/50 gamble of 300 versus 300 points) or a fixed amount (ranging from 10 to 310 points).

As an indicator for solidarity we used the Social Value Orientation Slider Measure (SVOSM; Murphy, Ackermann, & Handgraaf, 2011), which is found to outperform its competitors (the Triple-Dominance Measure and the Ring Measure) in most respects (Bakker, 2019). The SVOSM presents the subject with 15 dictator games that vary in the conversion rates of points allocated to the decision maker (between 50 and 100 points) and the recipient (between 15 and 100 points). The subjects knew that the recipient is a real person. Choices are made in real time and they have to wait for the other person to make a decision before they continue. They do not know, nor were they informed afterwards, who this other person is. The average score of all points assigned to oneself can be translated into an overall score, the SVO angle, that indicates the degree of prosociality.

We randomly choose the outcome of one lottery and dictator game to add to the payoff of participants, to avoid wealth effects where choices to the current decision are influenced by the outcome of the previous decision (Azrieli, Chambers, & Healy, 2018; Harrison & Elisabet Rutström, 2008).

5.4.2 Data and procedure

The experiment has been approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of Utrecht University (reference number 20-229). The

experiment was programmed using o-Tree (Chen et al., 2016) and conducted with UK-based participants recruited from Prolific. Participants signed up for a session a day in advance. When they started the session, they first had to read and agree to a consent form, which informed them about the confidentiality and anonymity of their data, the data storage term (10 years), the ethical approval, and the open access of the anonymized data. They were instructed that the study consisted of four parts, of which parts two and three were played interactively (with 1 and 9 other persons, respectively). In the instructions we stressed that these were real people and not simulated bots and that they should keep their attention to the screen to not keep other people waiting.

The study consisted of the staircase method (Part 1), the SVOSM (Part 2), the risk-sharing game (Part 3) and a survey (Part 4). As soon as people had given consent they could start with Part 1. Parts 2 and 3 started when enough people arrived at these stages. If not enough people showed up to form a group, after 15 minutes the waiting participants were redirected back to Prolific and received a show-up fee of £5.

For Part 1, we used an oTree implementation of the staircase method that was programmed by Holzmeister (2017). The implementation presents five sequential lottery questions, where the subject is asked to choose between option A (the lottery) or option B (the sure payoff) and keeps track of the progress by means of a progress bar. For Part 2, we programmed a continuous version of the SVOSM in oTree, where the subjects can choose a division of points between themselves and the receiver using a slider. For Part 3, we programmed the formation of groups *after* the subjects had finished reading the instructions and answering questions, so that people would not be stuck waiting for others. Part 4, finally, consisted of a survey. For all subjects that participated in the risk-sharing group for at least one round, the survey started some questions about their motivation for joining the risk-sharing group. All subjects were asked about several demographics.

At the end of Part 4, subjects were informed about their earnings. For each of Parts 1, 2, and 3, one round was randomly chosen and added to the subject's earnings. The exchange rate for all points earned during the experiment was 150 points = £1. Combined with a show-up fee of £2, this meant that subjects could earn between £5 and £11.40 for their participation in the experiment.

The data was collected in twelve sessions conducted between June 5 and June 11, 2020. In total, 525 people showed up for these sessions (68% of those who signed up), of which 430 people could be assigned to a group for Part 3 of the experiment. Of those 430 people, 424 completed the entire study. They needed between 35 and 95 minutes to complete the experiment and earned between £5 and £10.63 (M = £9.04, SD = £1.69).[4]

[4]For 31 subjects, the final earnings ended up below £5, but their earnings were raised to the base fee of £5.

5.4.3 Methods

As dependent variable, we store for all participants in all groups and all rounds whether or not they participated in the risk-sharing group. As main predictor variables, we take the treatment condition (HG-L versus HG-H) and the subject's score on risk aversion and solidarity (the SVO angle). Risk aversion is measured the same as in Study 1. The SVO angle is computed as $\text{SVO}^\circ = \arctan(\frac{\overline{A}_o - 50}{\overline{A}_s - 50})$, where $\overline{A}_o$ is the average amount the subject assigned to the recipient and $\overline{A}_s$ is the average amount kept. A prosocial subject with inequality aversion would yield an angle of 37.38°; a perfectly consistent individualist yields an angle between −7.82° and 7.82° (Murphy et al., 2011).

Other predictors included are the risk probability assigned to each subject and, about the round before, whether they were sick, the total number of members, the number of members who dropped out, and the number of sick members in the risk-sharing group. As control variables, we include the subject's gender and age (divided by 10) and whether the subject indicated to have knowledge about game theory.

Table 5.3 shows the descriptive statistics of all variables. The majority of participants in the experiment was female (75%), the average age of subjects was 39. Only 32 respondents indicated to have any knowledge of game theory. The average subject was considerably risk averse (M = 19.88) and prosocial (M = 33.34).

To analyze the data, we started by comparing—on the level of the groups—how many subjects participated per round. Each HG-L group was matched to its HG-H twin (based on the total number of sickness events per round). We have data for 21 HG-L groups and 22 HG-H groups. Because the 22$^{\text{nd}}$ HG-H group does not have a twin, we excluded this group from the group-level analysis. Note that while the other 21 groups are paired, within the risk-sharing groups there might still be differences in the number of sick members, because the subject that got sick in a round may not be part of the risk-sharing arrangement. Still, the starting characteristics of these groups are comparable, so we used a paired samples t-test to compare each group × round combination of the two treatments.

Subsequently, we used Event History Analyses (EHA) on the subject × round level to predict withdrawal (the event) from risk heterogeneity, risk aversion, solidarity, and all other model parameters. EHA is commonly used to analyse time-to-event data. The focus is on the modelling of event transition (i.e., from participating to not participating) and the time it takes for the event to occur. The benefits of EHA are that it allows both time-fixed and time-varying factors into the same model and that it takes care of right-censoring in the data. Right censoring means that for some people the event (withdrawal) may not have occurred yet by the end of measurement (i.e., after 20 rounds). EHA enables estimating transition times despite this information being 'missing' in the dataset (Allison, 2010).

The model estimates the hazard ratio $h_{i,t}$, which is the conditional probability

Table 5.3. Descriptive statistics per treatment

Treatment	Variables	M	SD	Min	Max	N
Subjects						
HG-L	Risk	0.20	0.03	0.15	0.25	207
HG-H		0.20	0.08	0.07	0.33	216
HG-L	Risk aversion	20.05	6.07	0.00	31.00	207
HG-H		19.66	6.65	0.00	31.00	216
HG-L	Solidarity	32.73	9.09	11.62	46.60	207
HG-H		34.07	8.04	11.62	49.81	216
HG-L	Gender: Female	0.75		0	1	207
HG-H		0.75		0	1	216
HG-L	Gender: Other (not disclosed)	0.01		0	1	207
HG-H		0.00		0	1	216
HG-L	Age	3.83	1.47	1.80	7.60	207
HG-H		4.08	1.49	1.80	7.60	216
HG-L	Game theory	0.09		0	1	207
HG-H		0.06		0	1	216
Groups × Rounds						
HG-L	Total members $t-1$	6.60	2.02	2	10	420
HG-H		6.56	2.20	0	10	440
HG-L	New withdrawals $t-1$	0.93	0.44	0	3	420
HG-H		0.95	0.46	0	4	440
HG-L	# sick members RSG $t-1$	1.26	1.23	0	6	420
HG-H		1.26	1.28	0	6	440
Groups × Subjects × Rounds						
HG-L	Participate	0.64		0	1	4140
HG-H		0.64		0	1	4320
HG-L	Sick $t-1$	0.19		0	1	4140
HG-H		0.19		0	1	4320

that individual i will drop out at time point t given that they did not do so prior to time point t, i.e. $h_{i,t} = P(T_i = t \mid T_i \geq t)$. For the 20 discrete decision rounds in our study, the hazard ratio is a function of the number of withdrawals relative to the number of subjects at risk of withdrawal. The goal of the analyses is to disentangle what motivates people to participate in the risk-sharing group or to opt out. Subjects of all 43 groups were included if they answered all survey questions included in the analyses (which was true for 423 of 430 subjects). For 216 of them an event was observed (meaning they dropped out at some point during the 20 rounds of the experiment) and because EHA excludes all observations for any round after this decision this brings the total number of observations on the subjects × rounds level to 5625.

5.4.4 Results

Figure 5.2 shows for each of the 21 treatment pairs the number of members of the risk-sharing group (Y-axis) per round (X-axis). The grey bars indicate the predefined random determination of sick people per round. A comparison of the different graphs shows that there is no clear pattern between the treatment conditions. While the

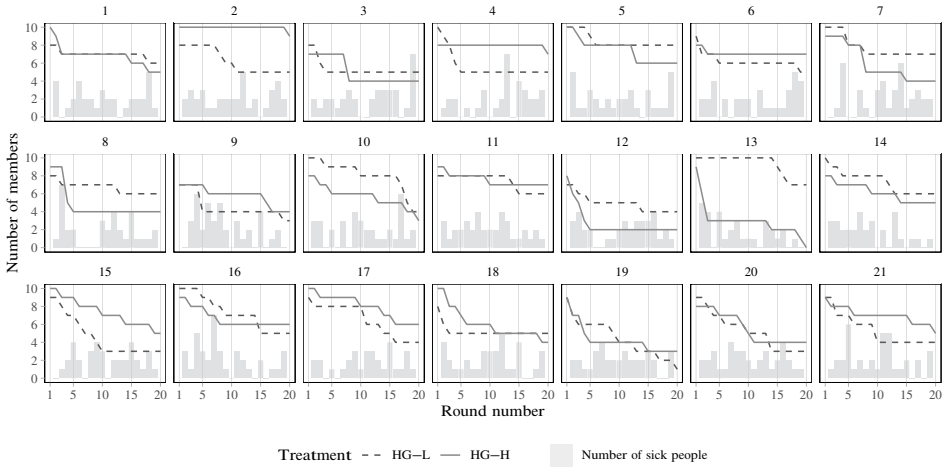


Figure 5.2. Number of members per treatment per round over all 21 group classifications

theory predicts the HG-L line to end above the HG-H line, this is only the case in about half of the graphs. Moreover, for many pairs we see the lines crossing each other once or even two or three times. There is no clear trend where one treatment has more members than the other in all rounds. A paired samples t-test for every group $\times$ round combination confirms this. The average number of members in treatment HG-L is $M = 6.35$ ($SD = 1.93$), the average for HG-H is $M = 6.23$ ($SD = 2.12$). The mean difference ($M_d = 0.12$) is not significant ($t(df = 419) = 1.028, p = 0.304$).

What does seem to be apparent from the graphs is that a member who opts out of the risk-sharing group is usually followed by one or several others in the next few rounds. This signals that people seem to react to each other and one opt-out decision could set in motion a cascading event. With the exception of some end-game effects towards round 20, it also seems that when such a withdrawal chain comes to an end, the risk-sharing group remains stable afterwards.

Table 5.4 reports the results of the Event History Analyses. As can be seen from the left panel of Figure 5.3, the survival probability is 0.88 for the first round, meaning that 12% of the participants are predicted to never participate at all. After 20 rounds, the survival probability is 0.48. In other words, about half of the subjects have dropped out after 20 rounds (corresponding to 216 events). The second panel of Figure 5.3 shows the predicted survival plot after all main effects of the predictor variables are included (Model M1a in Table 5.4). The huge decrease after round 1 suggests that the effects of the variables may not be constant for all rounds, which also treatens the validity of the proportional hazard assumption underlying EHA models (i.e., that ratio of the hazards for any two individuals is constant over time; Allison,

Table 5.4. EHA on the likelihood of withdrawal (216 events, $N = 5625$)

	(M1a)		(M1b)		(M2)	
Received benefit	0.246	(0.184)	0.249	(0.184)	0.249	(0.184)
Risk aversion	−0.015	(0.011)	0.006	(0.015)	0.005	(0.019)
Risk aversion × t			−0.003*	(0.002)	−0.003*	(0.002)
Risk aversion × HG-H					0.001	(0.021)
Solidarity	−0.031***	(0.008)	−0.031***	(0.008)	−0.028*	(0.011)
Solidarity × HG-H					−0.007	(0.016)
Risk	−2.264*	(1.111)	−2.301*	(1.113)	−2.307*	(1.114)
Gender: Female	−0.390*	(0.154)	−0.369*	(0.155)	−0.381*	(0.157)
Gender: Other (not disclosed)	−0.958	(1.014)	−0.929	(1.014)	−0.915	(1.015)
Age	−0.055	(0.048)	−0.055	(0.048)	−0.055	(0.048)
Game theory	−0.495	(0.285)	−0.500	(0.285)	−0.495	(0.286)
Treatment: HG-H	−0.017	(0.140)	−0.025	(0.140)	−0.039	(0.144)
Total members $t-1$	−0.101	(0.067)	−0.105	(0.067)	−0.103	(0.067)
Total left $t-1$	0.452**	(0.162)	0.448**	(0.162)	0.449**	(0.162)
Num. sick members RSG $t-1$	0.392***	(0.060)	0.394***	(0.060)	0.393***	(0.060)
LR χ^2 Test	89.993***	(df = 12)	94.092***	(df = 13)	94.296***	(df = 15)
LR χ^2 Difference Test			4.099*	(df = 1)	0.204	(df = 2)

Note: $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

2010). A test of this assumption indicates that while the overall model does meet this assumption ($\chi^2(13) = 11.8352$, $p = 0.541$) it is violated for the covariate risk aversion ($\chi^2(1) = 5.2161$, $p = 0.022$). We therefore acknowledge this time dependency by adding the interaction between round 1 and risk aversion to the model (Model M1b).

In Model M1b, like in the group-level t-test, the treatment condition does not significantly affect withdrawal rates. Hence, other than for the Broodfonds sample, Hypothesis 5.1 is not supported. Interestingly, the main effect of risk aversion (which is the effect of risk aversion in round 1) is not significant, but we do find a significant effect of risk aversion × t. This means that risk averse subjects were indifferent with respect to the decision to join initially, but those risk averse individuals who did join were more likely to remain a member. Hence, we find partial support for Hypothesis 5.2.

The results do resemble those for the Broodfonds sample with respect to solidarity (Hypothesis 5.3, supported). The hazard rate for solidarity is significant and negative, which means that people with higher solidarity motives are at lower risk for dropping out. One degree increase on the SVO angle decreases the withdrawal hazard rate by 3%. However, and similar to the Broodfonds sample, the effect of solidarity does not vary depending on the treatment group. Model M2 reports the results of the interactions between the risk heterogeneity treatments and risk aversion and solidarity. The χ^2 difference between Models M1b and M2 did not improve significantly, nor do any of the interaction terms significantly predict withdrawal. Hypothesis 5.4 is not supported.

With respect to Hypothesis 5.5, we take as indicators for interdependencies in decision-making whether subjects respond to other group members getting sick and other group members withdrawing. Both significantly and strongly influence the

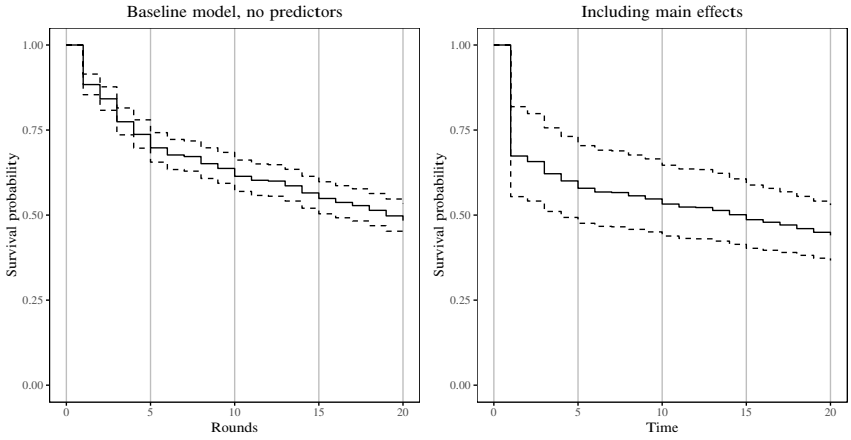


Figure 5.3. Average survival probability for baseline model and model with predictors

withdrawal hazard rates. That is, the hazard ratio of withdrawal increases by 48% if one group member was sick and by 56% if one person leaves. Interestingly, the total number of members does not matter. As long as the number stays stable, it does not matter how many people participate. All in all, this supports Hypothesis 5.5.

Finally, we find that subjects with higher risks are less likely to withdraw. Whether or not the subject received a benefit had, other than for Broodfonds members, no effect on their decision to continue participation. As for our controls, women are less likely to withdraw than men. Age and whether the subject had experience with game theory do not affect withdrawal.

Like for Study 1, we also performed the analyses for the subsample of low-risk subjects in the experiment. As low-risk subjects we selected all subjects with a risk probability below the initial population-level average of $\bar{p} = 0.2$. The results of these analyses are broadly similar to that of the full sample, apart from some effects failing to reach significance under the smaller sample size (i.e., that of risk, gender, and the number of members that left). As a second robustness check, we repeated the analyses in a multilevel model with subjects nested in risk-sharing groups. The reason that we did not report the multilevel event history analyses to begin with is that these do not allow for a test of the proportional hazard assumption. Since the random intercept on the group level is small ($\sigma^2 = 0.088$), we could report the unclustered EHA results without much loss of information. All results were found to be robust across the two methods. Detailed results for these two robustness analyses are listed in Tables D.2 and D.3 of Appendix D.1.

Table 5.5 summarizes the results of the different hypotheses for the two studies. The negative effect of risk heterogeneity was found only for the Broodfonds sample. Risk aversion did not directly affect participation in either study, but we found a

Table 5.5. Overview of hypotheses and results

Hypothesis	Exp. direction	Study 1: Broodfonds	Study 2: experiment
H1: Risk heterogeneity	−	−	0
H2: Risk aversion	+	+/0	+/0
H3: Solidarity	+	+	+
H4a: Interaction risk aversion	−	0	0
H4b: Interaction solidarity	−	0	0
H5: Cascades	−		−

partial effect for low-risk members in the Broodfonds sample and for all decisions after round 1 in the experiment. Solidarity was positively related to participation in both studies. There are no interactions between heterogeneity and risk aversion or solidarity, but we did find very strong cascade effects in the experiment.

5.5 Conclusion and discussion

In this chapter, we aimed to increase our understanding of the motivations and dynamics underlying participation in risk-sharing groups. Driven by the discrepancy between the substantial risk heterogeneity observed in risk-sharing groups in practice and the focus on risk homogeneity in many theoretical discussions, we aimed to further advance theoretical and empirical understanding of risk heterogeneity. How much risk heterogeneity is accepted by the low-risk members before deciding to drop out? How do people deal with the uncertainty introduced by unknown risk differences? To what extent can risk aversion and solidarity explain individual behavior? We hypothesized on the relation between heterogeneity, risk aversion, and solidarity in a dynamic, interdependent setting. These hypotheses were tested with two data sources: a survey among 5,192 members of 230 Dutch Broodfonds groups (in which self-employed people share the risk of long-term illness) and an online experiment with 430 British subjects of the Prolific platform. After all, only by combining different methods can we get a better grip onto the (combinations of) factors that are robust in explaining participation in various contexts (Poteete et al., 2010).

The two data sources rely on vastly different samples and methods. We compared socially and institutionally embedded risk-sharing groups in the real world to general risk-sharing motivations in an artificial setting, and cross-sectional data about participatory intentions to repeated decisions in a controlled environment. Still, the results of the two studies are similar in many regards. The main difference relates to risk heterogeneity, which we found (as hypothesized) to negatively affect commitment in Broodfonds groups, while the experimental manipulation did not result in differences in participation rates in between high and low heterogeneity groups.

This may partly be the result of differences in measurement. In the experiment, risk levels were exogenously determined, but subjects were not informed about the

distribution of risk. While we expected them to infer this inequality from observed differences in support requests over time, this may have been too complex. We do see, for instance, a strong reaction to the number of sick group members in the previous round, which could reflect the subject's perception of other group members' risk. Alternatively, while the Broodfonds survey data represents a cross-sectional snapshot, it does capture the effect of risk heterogeneity after a longer time period (ranging from 0 to 11 years), which means the perceptions of group-level risk have had more time to develop, leading to more marked group differences.

With respect to our motivations for participation, we found that the role of risk aversion (central in all risk-sharing literature) is not that clear-cut. Neither for the Broodfonds members nor for the subjects in the experiment did we find a general positive effect of risk aversion such that risk averse members are in general more likely to participate and continue to participate in risk-sharing groups. For the Broodfonds groups, we did find a positive effect if we restricted our sample to only those members whose risk was below the group's average—that is, those members who, strictly speaking, likely pay more to help others than they will receive support in return. For the subjects of the experiment, we found that risk aversion only affected this decision to participate for all rounds after round 1. That is, it increased the likelihood to *continue* to participate, but not the likelihood to join in the first place.

The lack of a general effect for risk aversion could mean several things. Perhaps we did not measure what we intended to measure. This seems unlikely, though, as the instrument has been validated (Falk et al., 2016). Alternatively, it is possible that motivation to share risk is driven not by risk but by loss aversion (Kahneman & Tversky, 1979). However, Vogt (2007) did not find any evidence for loss aversion in a risk-sharing set-up. Hence, we are more inclined to believe that for risk-sharing contexts the evaluation of uncertainty works differently. Particularly in the beginning, without prior knowledge about the other group members or the risk-sharing institution, the risk-sharing group may not successfully reduce uncertainty. For instance, people do not know how many others will participate, whether they continue to participate, how much support they will need, how much participation will cost them, whether the fund will be sufficient to support them, or if they even need support at all.

With so many additional sources of uncertainty, it is not evident which scenario (participating or not participating) is more attractive to a risk averse person. This has been suggested by other scholars observing the low participation rates in mutual insurance groups in low-income countries as well (Platteau et al., 2017) and would require models of ambiguity aversion instead (Elabed & Carter, 2015). Subsequently, for the (low-risk) people who did take the risk to join and built trust in the established cooperation, it becomes possible to disentangle the effect of risk aversion. They experienced that the risk-sharing group can take away a significant share of uncertainty—making it the preferred alternative for risk averse people. In the Brood-

fonds groups, then, the fact that we only found an effect for low-risk members might be because risk was measured as a self-perception. Those who had to rely on support in the past probably perceive their risk as high(er), so regardless of their (low) risk aversion in general they will be committed to remain a member in the future.

Solidarity was a strong predictor of participation both in Broodfonds groups and for the experimental subjects, albeit only as a main effect, not in interaction with heterogeneity. The strong effect of solidarity is interesting, because it was observed both in the Broodfonds groups, where members know each other, talk to each other, and are embedded within a trusted organizational framework, and in the experiment, where members shared risk with anonymous strangers. Hence, for the experiment, at least, what we measured were altruistic motives in general. For the Broodfonds groups, while we cannot distinguish between general altruism and in-group solidarity (cf. Baldassarri, 2015), it seems safe to say that both are likely to play a role. One indicator, for instance, is that while the number of people requesting support negatively affected participation rates in the experiment, it did not matter for Broodfonds members. This suggests that Broodfonds members, knowing the people who request support, do not mind paying these costs, because they also see how it benefits the recipients. On the other hand, the effect of solidarity in the Broodfonds analyses probably mostly reflects general altruism, because we also controlled for various aspects of social embeddedness (i.e., the number of strong ties and network structures) that probably capture the in-group solidarity aspects.

Finally, we found strong support for cascade effects in the experiment. The more group members got sick, the more likely the subject was to withdraw in the next round. And the more group members withdrew, the higher the chance that others would do so as well. Hence, a sudden increase in the number of sick group members is dangerous, for it often led to withdrawal cascades that could easily lead to overall group-level failure. Does that mean Broodfonds groups and other risk-sharing groups should fear for their resilience? Not necessarily. The effects found in the experiment are magnified compared to a real-world setting. First of all, it was very easy—and even sensible—for participants in the experiment to try out the arrangement for a couple of rounds to get to know the group members and their behavior before deciding to stay. Normally, such considerations are made before joining the group. Most people who dropped out in the first few rounds would probably have hesitated to participate in a real-life risk-sharing group and would have ultimately decided against it before the group even started.

Second, the cascades emerged in response to the number of people needing the insurance. This number was inflated to make sure that enough events could be observed to disentangle mechanisms for participation. The average risk of all group members in the experiment was 20% meaning that, while it varied per round, on average two members were expected to be sick in every 10-person population each round. In the Broodfonds group, the average number of benefits was 5% among the respondents,

but we know from communication with the organization that the real number is lower. This means that the reflection on whether or not to continue in this group when some people keep reporting ill will be much much slower in real risk-sharing groups. Not only because a 'round' lasts a month rather than a minute, but also because there will be many rounds in which not much happens. Still, despite being inflated in the experiment, risk-sharing groups should actively invest in measures that counter this potential instability.

Before discussing wider implications of our findings, however, some limitations should be taken into account. In the survey among Broodfonds members, first, we relied on a proxy for future cooperation. While commitment is generally considered a proper predictor for future participation (Hauert, 2002; Kollock, 1994), it can only be insofar as future circumstances resemble the present. There is no guarantee that current commitment can be extended to other, more extreme circumstances not part of the current measurement (e.g., a sudden, extreme increase in the number of support requests). Hence, in terms of validity, while the results help to understand the dynamics of risk-sharing under stable risk probabilities, any speculations regarding the effects of changes in risks (and, as a result, risk heterogeneity) remain speculative.

For the experiment, it is important to acknowledge that while experiments generally benefit from greater control, this is more difficult to establish in an online setting. Two possible problems are subjects that carelessly make decisions without properly reading the instructions or assessing the specific decision-making situations, and subjects dropping out before the end of the experiment (Arechar, Gächter, & Molleman, 2018). We took several measures to minimize these problems (such as making sure that unmotivated or impatient subjects had already dropped out before the actual risk-sharing treatment began and warning subjects that low-quality responses were a reason to withhold payment), but some disinterest or dropout could not be avoided.

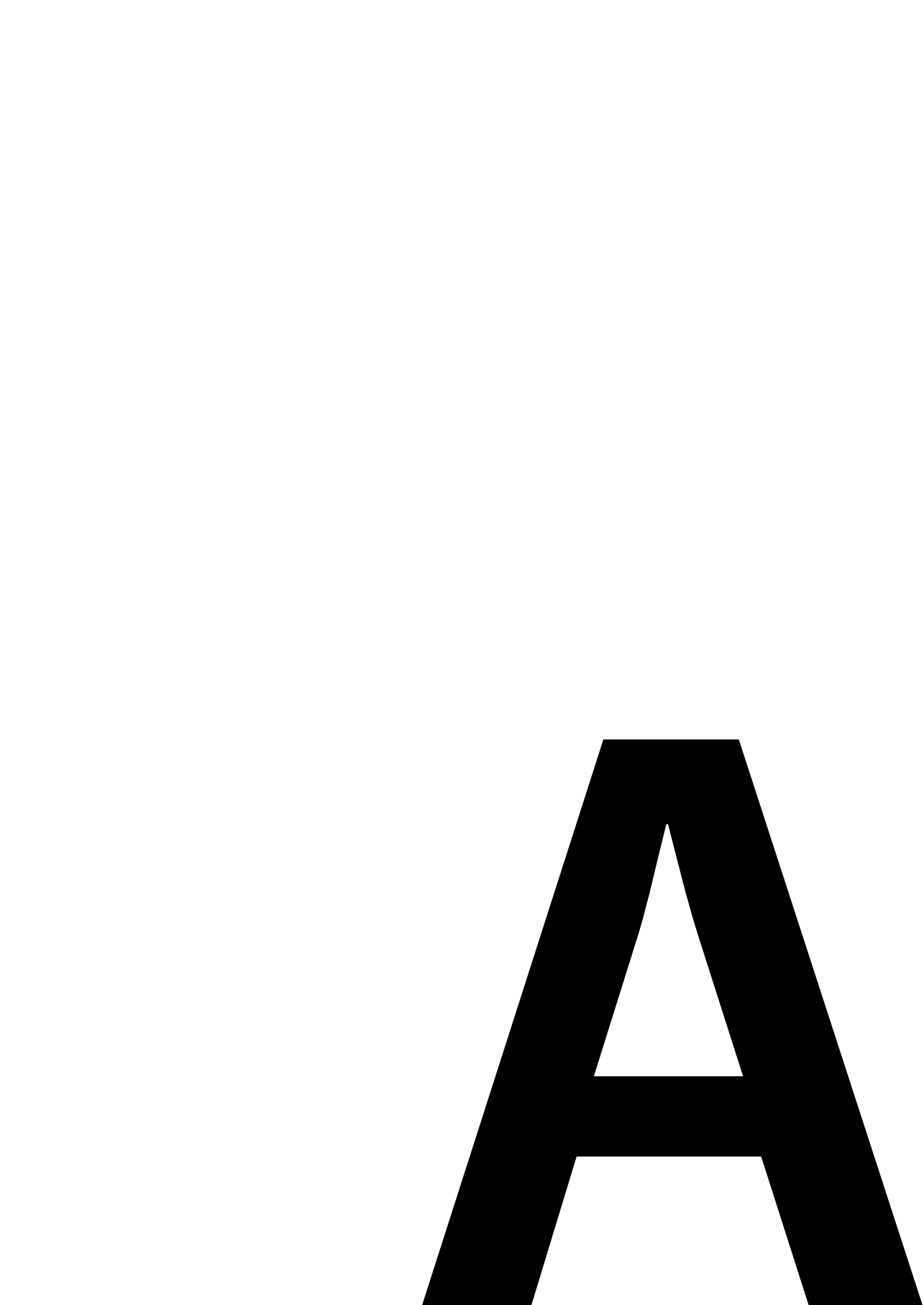
Yet while each method suffers from some other limitations, the benefit of our multi-method approach is that limitations of one study are mostly not a limitation for the other. For instance, the experiment introduces variation in participation rates and the Broodfonds survey allowed to test risk-sharing dynamics in an applied context. By using two different methods and subject populations, our consistent findings can be considered more robust (Buskens, 2014). There are, however, some aspects missing in both designs that could be addressed in future studies. For instance, while we studied several motivations for participation, we did not take into account issues relating to moral hazard. There is no information available about potential misuse of the common fund in Broodfonds groups, and misuse was not an option for the experimental subjects. This is, however, an important determinant for people's willingness to participate (Van Leeuwen, 2016; Vriens et al., 2019).

Moreover, we lack insights into the role of endogenous group formation. For Broodfonds groups we only know who are currently members of the group. We know nothing about the people who may have considered it but did not join in the end. For

the experiment people did not have a choice to form a group endogenously. They could share risk within the assigned population of 10 people, or they could not. People who did not participate in this specific group might have done so in another group, but in our experiment it cannot be disentangled whether people were not interested anyway or were not interested in this specific group. Earlier studies do show that endogenous group formation increases the motivation to share risk for those who manage to create a group (Attanasio et al., 2012; Hegselmann & Flache, 1998). Future research should look at the effects of endogenous group formation both within groups and across groups (for it does introduce a danger of social exclusion) and how this influences the group's risk heterogeneity.

Finally, future research should build on our mixed findings for the role of risk aversion in decision situations characterized by more than one source of uncertainty. In a way, our experiment measured a highly extreme scenario of uncertainty, as people were invited to join an anonymous risk-sharing group. They had to start cooperation from scratch and could not trust in an existing institution. It would be interesting to study emerging risk-sharing groups in the field (e.g., newly established Broodfonds groups) to study whether the perceived risks of participation change over time—or whether the new groups could even build on trust in the general institutional framework. Experimentally, studies should investigate whether collective action in such scenarios with two sources of uncertainty are more likely to be successful—and to attract risk averse people—if the social uncertainty can be taken away (Wit & Wilke, 1998).

Notwithstanding these limitations and open questions for future research, our in-depth approach to studying participation dynamics has generated some important insights. Risk heterogeneity and fluctuations in support requests can be dangerous for future participation levels, so risk-sharing groups should invest to increase commitment levels to such a degree that they can cope with sudden, temporary increases in support requests. Since solidarity proved to be such an important individual driver for participation, risk-sharing groups should actively invest in increasing (or at least maintaining) solidarity levels such that they can be consolidated into general group-level norms about unconditional helping behavior. Moreover, providing information about the general success and the temporary, exceptional nature of cost fluctuations might help to smooth ideas about the group's average risk levels.



APPENDIX A

Supplements to Chapter 2

Appendix A includes: (A.1) an overview of new mutuals initiatives (active and inactive); and (A.2) the summarized data with respect to institutional, resource, and member-user characteristics as obtained from websites, reports, and phone calls with the eleven organizations included in the review.

A.1 An inventory of mutuals initiatives

Table A.1. Authors' inventory of 36 active new mutuals initiatives with reference to their location, founding date, and website

P2P insurer	Country	Founded	Website
Africa			
Pineapple (previously Amyti)	South Africa	2017	https://www.pineapple.co.za/
Riovic	South Africa	2015	https://riovic.com/
Asia			
TongJuBao / P2P Protect	*China*	*2014*	*https://www.tongjubao.com/en*
Zhongtuobang	China	2016	https://www.zhongtuobang.com/
Bitpark	Japan	2016	https://bitpark.net/
Bandboo	Singapore	2016	https://www.bandboo.co/
Vouch Insurtech (previously insbee)	Singapore	2016	https://www.vouchinsurance.sg/
Intercare (part of SHAcom)	Taiwan	2009	https://www.shacom.com/
FairDee	Thailand	2018	https://www.fairdee.co.th/
Europe			
První Klubová First Club Insurance	Czech Republic	2013	https://www.prvniklubova.cz/en/
Otherwise	France	2016	https://otherwise.fr/
Wecover	France	2015	https://www.wecover.fr/
Friendsurance	*Germany*	*2010*	*https://www.friendsurance.com/*
Axieme	*Italy*	*2016*	*https://www.axieme.com/*
Turtleneck	Liechtenstein	2015	https://www.turtleneck.com/
Tribe	*Norway*	*2016*	*https://tribe.no/*
Craolo Clansurance	Switzerland	2014	https://www.clansurance.ch/
Versicherix	*Switzerland*	*2015*	*https://versicherix.ch/*
Broodfonds	*The Netherlands*	*2006*	*https://www.broodfonds.nl/*
CommonEasy	*The Netherlands*	*2014*	*https://www.commoneasy.nl/*
SharePeople	*The Netherlands*	*2017*	*https://www.sharepeople.nl/*
Gaggel	UK	2014	https://www.gaggel.com/
Inspool	UK	2015	https://www.inspool.com
Laka (previously Insure A Thing)	UK	2016	https://www.laka.co.uk/
So-sure	UK	2014	https://wearesosure.com/
North America			
Besure	*Canada*	*2015*	*https://besure.com/*
Glow First	Canada	2013	https://glowing.com/
Insureapeer	USA	2016	https://www.insureapeer.com/
Ledger investing	USA	2016	https://www.ledgerinvesting.com/about
Lemonade	*USA*	*2015*	*https://www.lemonade.com/*
Oceania			
Huddle	Australia	2016	https://huddle.com.au/
International			
Rega	International	2016	https://rega.life
Teambrella	*International*	*2015*	*https://teambrella.com*
VouchForMe (previously InsurePal)	International	2015	https://vouchforme.co/
InsChain	International	2015	https://www.inschain.io/
WorldCover	International	2015	https://www.worldcovr.com/

Note: Mutuals in italics are included in review.

Table A.2. Authors' inventory of 21 failed mutuals initiatives with reference to their location, founding and end date (if known)

P2P insurer	Country	Start date	End date
Africa			
Fo-Sho	South Africa	2016	-
PeerSure	South Africa	2015	-
Asia			
PeersMutual Protection	China	2015	-
Quark Alliance	China	2016	-
Europe			
goBundl	Denmark	2016	2018
Amalfi	France	2015	-
InsPeer	France	2014	2018
WeKeep	France	2015	2017
Tribe Cover	Ireland	2016	2016
Darwinsurance	Italy	2016	-
Allied Peers	UK	2015	-
Cycle Syndicate	UK	2014	-
Guevara	UK	2013	2017
North America			
DeductibleShield	USA	2013	2014
Dynamis	USA	2015	2018
Gather	USA	2014	2017
Jointly	USA	2013	2017
Uvamo	USA	2014	2016
Oceania			
Prince	Australia	2016	-
PeerCover	New Zealand	2013	2019
International			
Vernam	International	2017	2019

A.2 Institution, resource, and member-user characteristics

Table A.3. Characteristics of the new mutuals' institutions

P2P insurer	**Governance model**	**Rule configurations**	**Decision-making (in case of user involvement)**	**Legal status**
Broodfonds	Carrier	Provider & users	Small decisions by risk-sharing groups board; big decisions through majority voting; overarching decisions by provider	Provider as cooperative; risk-sharing groups as non-profit associations
Friendsurance	Broker	Provider	–	Insurance broker
TongJuBao	Carrier	Provider & users	Majority voting?	Civil law contract?
CommonEasy	Carrier	Provider & users	Primarily the provider, but members are regularly queried in surveys and focus groups and can veto payout requests	Limited liability company working for a foundation with the same name
Lemonade	Carrier	Provider	-	Insurance carrier
Besure	Infrastructure	Users	Voting by elected team	?
Teambrella	Infrastructure	Users	Decided per group, mostly median & majority voting	?
Versicherix	Carrier	Provider	-	Technological Insurance Stock Corporation
Tribe	Broker	Provider	?	Sub-agent of insurance carrier
Axieme	Broker	Provider	-	Insurance broker
SharePeople	Carrier	Provider	-	Social enterprise

Table A.4. Characteristics of the new mutuals' resources

P2P insurer	**Risk differentiation in premiums**	**Giveback policy**	**Use of reinsurance**	**Virtual currency**	**Insurer's earnings**
Broodfonds	No, contribution levels proportionally fixed to endowment	Yes, up to all but administration fee (€120/year)	Yes, internally	No	Flat registration (€225) + admin. fee (€10/month)
Friendsurance	Set by underlying insurer	Yes, up to 40%	Arranged by the insurance company	No	Brokerage commissions of insurance companies
TongJuBao	No	Yes, up to 75%	Yes, internally	No	Flat administration fee
CommonEasy	No, contribution levels proportionally fixed to endowment	Yes, up to all but administration fee once target savings (160% of cover) are reached	No	No	Flat administration fee of €10/month
Lemonade	Yes, based on InsurTech algorithms	Yes, up to 40% (to charity)	Yes, internally & externally	No	Flat administration fee (appr. 20%)
Besure	No, fixed price for all group members	Yes, up to 90%	No	Yes, 'credit'	10% of fund if group is launched
Teambrella	No	Everything not claimed (with approval of 3 randomly chosen teammates)	No	Yes, bitcoin	None
Versicherix	Yes, based on InsurTech algorithms	?	Yes, externally?	No	?
Tribe	Yes, you get a 5% reduction on premium at previous insurer	Up to 50%, 20 % points less if you or friend files a claim	Yes, externally	?	?
Axieme	Start with fixed premium, machine learning adjusts reputation over time	Yes, up to 25-30%	Arranged by the insurance company	No	Small (but not fixed) % of premium
SharePeople	No, contribution levels proportionally fixed to endowment	Everything above target savings (up to 90%)	No	No	Flat registration (€180) + admin. fee (€120/year)

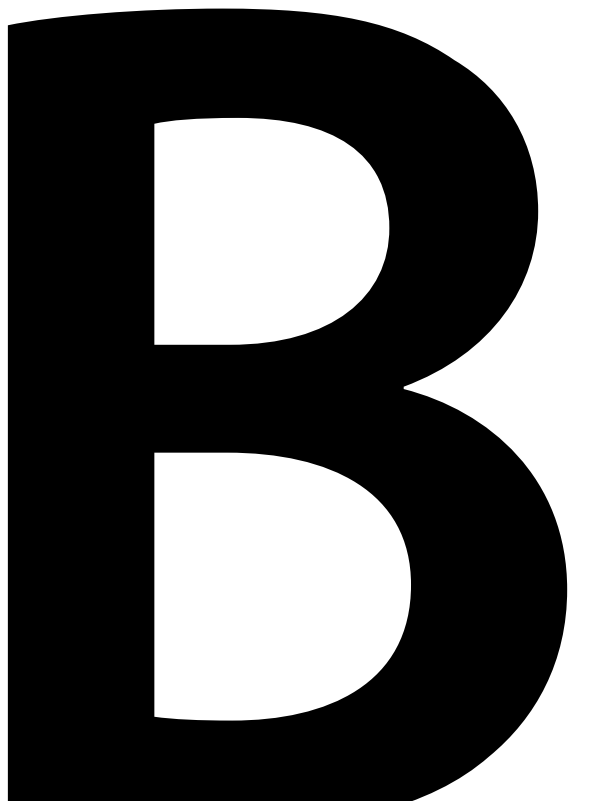
Table A.5. Characteristics of the new mutuals' member-users

P2P insurer	Size risk-sharing groups	Group formation	Communication between members
Broodfonds	Minimum: 20; maximum: 50	Endogenously	Communication via online platform + one or several face-to-face meetings annually
Friendsurance	Exactly 10	Exogenously or (for a minority) endogenously	No requirements or recommendations
TongJuBao	?	Endogenously	?
CommonEasy	Minimum of 2; no maximum; network of 1st, 2nd, and 3rd degree contacts.	Endogenously	Communication mainly with 1st degree contacts (mainly in case of illness); less with 2nd and 3rd degree contacts
Lemonade	No restrictions	Endogenously, by choice of charity	No contact, members anonymous in risk-sharing group
Besure	Restrictions set per group	Endogenously	Communication via online platform about rules, claims, and payments
Teambrella	Restrictions set per group	Endogenously	Communication via online platform about rules, claims, and payments
Versicherix	?	?	?
Tribe	Maximum: 10, network rather than group	Endogenously	No requirements or recommendations
Axieme	Minimum: 5, no maximum	Endogenously (based on existing group-s/associations)	No, only informed about number of claims by provider
SharePeople	No restrictions	Endogenously	Communication via online platform

Table A.6. Minimum and maximum percentage of contribution available for redistribution

	Broodfonds	CommonEasy	SharePeople
Monthly premium			
Minimum	33.75 + 10 = 43.75	5 + 10 = 15	0.06 × 1500 + 10 = 100
Maximum	112.5 + 10 = 122.5	200 + 10 = 210	0.06 × 3000 + 10 = 190
Amount not returned	10	10	10
Potential redistribution			
If minimum premium	33.75 / 43.75 × 100 = 77.1%	5 / 15 × 100 = 33.3%	90 / 100 × 100 = 90%
If maximum premium	112.5 / 122.5 × 100 = 91.8%	200 / 210 × 100 = 95.2%	180 / 190 × 100 = 94.9%
Average	(77 + 92) / 2 = 84.5%	(33 + 95) / 2 = 64.3%	(90 + 95) × 100 = 92.4%

Note: [1]The actual redistribution of these three initiatives is the same (i.e., everything except €10 administration fee). The resulting average percentage depends entirely on the range of premium levels offered, so a lower percentage is the result of a lower minimum insurance premium. It does not represent the actual average over policyholders per organization, as that would require information on the distribution of premium levels across policyholders.



APPENDIX B

Supplements to Chapter 3

This appendix includes: (B.1) an overview of all items used to measure commitment and trust as well as references to the surveys from which these items were obtained; and (B.2) the results of additinal descriptive and predictive analyses. That is, we report the output of the two-dimensional exploratory factor analysis of the commitment and trust items, a correlation table of all variables included in the analyses, and the results of the Multilevel SEM analyses using untransformed (relative) degree variables.

B.1 Overview of variables

Table B.1. Items in the commitment scale

Name	**Label**	**Reference**
Commitment1	I feel like I owe it to the other broodfonds members to remain member	(Jak & Evers, 2010)
Commitment2	Even if it were in my advantage I would not think it right to leave this broodfonds now	(Jak & Evers, 2010)
Commitment3	This broodfonds deserves my loyalty	(Jak & Evers, 2010)
Commitment4	I really care about the future of my broodfonds	(Van der Lippe et al., 2016)
Commitment5	I tell others proudly that I am part of this broodfonds	(Van der Lippe et al., 2016)
Commitment6	I really feel like I am part of this broodfonds	(Jak & Evers, 2010)
Commitment7	I feel emotionally attached to my broodfonds	(Jak & Evers, 2010)

Notes: The first 3 items measure normative commitment, the last four affective commitment.

Table B.2. Items in the trust scale

Name	**Label**	**Reference**
Trust1	All members of my broodfonds are basically honest	(Yamagishi & Yamagishi, 1994)
Trust2	All members of my broodfonds are trustworthy	(Yamagishi & Yamagishi, 1994)
Trust3	All members of my broodfonds stick to the agreements	
Trust4	All members of my broodfonds would do their best to help me	
Trust5	All members of my broodfonds have faith in each other	
Trust6	All members of my broodfonds see a future in broodfonds	

B.2 Descriptives and analyses

Table B.3. Exploratory Factor Analysis and Cronbach's alpha reliability

	Trust	**Commitment**	***Uniqueness***
Commitment1		.656	.502
Commitment2		.494	.819
Commitment3		.725	.443
Commitment4		.772	.356
Commitment5		.535	.785
Commitment6		.691	.572
Commitment7		.733	.477
Trust1	.963		.145
Trust2	.987		.095
Trust3	.793		.370
Trust4	.674		.383
Trust5	.734		.323
Trust6	.607		.412
Cronbach's alpha	.936	.824	

Note: Factor loadings < .32 not displayed.

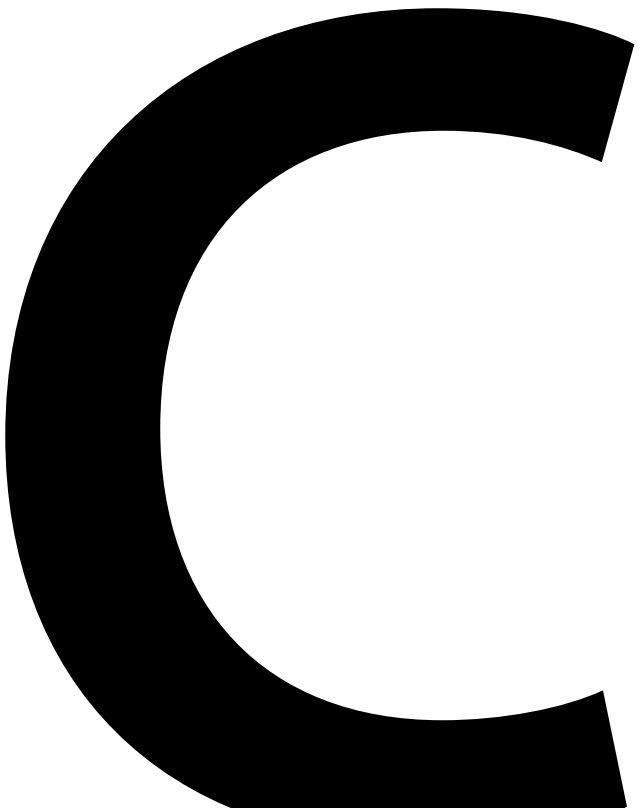
Table B.4. Correlation table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Commitment															
2 Trust	0.51														
3 Total Degree	0.25	0.19													
4 Strong Tie Degree	0.15	0.12	0.30												
5 Yrs Existence - Yrs Member	−0.11	−0.06	−0.16	−0.10											
6 Insurance Use	0.09	0.05	0.00	0.02	−0.01										
7 Boardmember	0.15	0.08	0.25	0.11	−0.12	−0.04									
8 Female	0.03	0.01	−0.10	−0.02	0.01	0.08	−0.02								
9 Age	0.16	0.00	0.05	−0.02	−0.05	0.04	0.02	−0.07							
10 Risk	−0.03	0.02	0.02	0.00	0.02	−0.03	0.03	−0.05	−0.02						
11 Dense network	0.05	0.12	0.09	0.13	0.09	−0.02	−0.01	−0.05	−0.04	0.01					
12 Clustered network	0.00	0.06	0.00	0.03	0.01	−0.03	−0.01	0.08	−0.06	0.02	−0.24				
12 Star network	0.00	−0.01	−0.02	−0.04	0.06	0.07	0.00	−0.03	0.05	−0.01	−0.18	−0.51			
14 Isolated network	−0.05	−0.16	−0.07	−0.11	−0.14	0.00	0.02	−0.03	0.06	−0.03	−0.46	−0.50	−0.07		
15 Years Existence	0.02	0.10	−0.01	0.01	0.38	0.07	−0.01	0.05	0.12	0.01	0.16	0.14	0.12	−0.38	
16 Groupsize	−0.02	0.03	−0.02	−0.06	0.10	0.06	−0.02	0.01	0.03	−0.01	0.05	0.04	0.00	−0.09	0.34

Table B.5. Multilevel SEM for commitment and trust (relative degree, $N = 4294$)

	Model 1				Model 2			
	Commitment		**Trust**		**Commitment**		**Trust**	
Level 1								
Commitment			0.26***	(0.01)			0.26***	(0.01)
Trust	0.26***	(0.01)			0.26***	(0.01)		
Total Degree	0.40***	(0.04)	0.26***	(0.04)	0.40***	(0.04)	0.26***	(0.04)
Strong Tie Degree	0.53***	(0.11)	0.24	(0.12)	0.54***	(0.12)	0.20	(0.12)
Strong Deg × Yrs Mutual					0.00	(0.00)	0.00*	(0.00)
Yrs Mutual - Yrs Member	−0.04**	(0.01)	−0.05***	(0.01)	−0.03**	(0.01)	−0.05***	(0.01)
Insurance Use	0.25***	(0.05)	0.13*	(0.06)	0.25***	(0.05)	0.13*	(0.06)
Board member	0.24***	(0.04)	0.05	(0.04)	0.24***	(0.04)	0.05	(0.04)
Female	0.10***	(0.02)	0.01	(0.03)	0.10***	(0.02)	0.01	(0.03)
Age	0.02***	(0.00)	−0.01***	(0.00)	0.02***	(0.00)	−0.01***	(0.00)
Risk	−0.15**	(0.05)	0.11	(0.06)	−0.15**	(0.05)	0.11*	(0.06)
Level 2								
Dense network	0.35**	(0.12)	0.93***	(0.14)	0.35**	(0.12)	0.92***	(0.14)
Clustered network	0.18	(0.11)	0.64***	(0.12)	0.18	(0.11)	0.63***	(0.12)
Star network	0.17	(0.15)	0.55**	(0.17)	0.16	(0.15)	0.54**	(0.17)
Years Mutual	0.00	(0.01)	0.06***	(0.02)	0.00	(0.01)	0.06***	(0.02)
Groupsize	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
Variance estimates								
Level 1								
σ	0.60***		0.68***		0.60***		0.68***	
R^2	0.29		0.22		0.29		0.23	
Level 2								
σ	0.01		0.02**		0.01		0.02**	
R^2	0.28		0.63		0.28		0.63	
Model fit								
AIC	21102.19				21100.37			
BIC	21312.23				21323.15			
LR χ^2 (1)	4.80				5.00			
RMSEA	0.03				0.03			
CFI	0.99				0.99			

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$



APPENDIX C

Supplements to Chapter 4

This appendix includes (C.1) further details about the formal modal construction; C.2 the NetLogo simulation code; and (C.3) figures detailing the distribution of the proportion of members and average risk for several rounds of the simulation runs.

C.1 Model construction

In the basic RSM, the expected utilities of participating ($m = 1$) and not participating ($m = 0$) are:

$$EU = \begin{cases} (1 - p_i)Y + p_i y & \text{if } m = 0 \\ (1 - p_i)(Y - c + \hat{\delta}_i) + p_i(y + b - c + \hat{\delta}_i) & \text{if } m = 1. \end{cases}$$

Agents will participate if:

$$\begin{aligned} EU(m = 1) &\geq EU(m = 0) \\ (1 - p_i)(Y - c + \hat{\delta}_i) + p_i(y + b - c + \hat{\delta}_i) &\geq (1 - p_i)Y + p_i y \\ -c + p_i b + \hat{\delta}_i &\geq 0. \end{aligned}$$

If we then rewrite $\hat{\delta}_i = c - \hat{p}_i b - \frac{(\hat{p}_i - p_i)b}{n}$ we obtain

$$\begin{aligned} -c + p_i b + c - \hat{p}_i b - \frac{(\hat{p}_i - p_i)b}{n} &\geq 0 \\ p_i(b - \frac{b}{n}) &\geq \hat{p}_i(b - \frac{b}{n}). \end{aligned}$$

Solidarity is included as parameter α compensating for the costs of supporting other group members. Rewriting $\beta = b - \frac{b}{n}$ this means

$$\begin{aligned} p_i\beta &\geq (1 - \alpha)\hat{p}_i\beta \\ \alpha\hat{p}_i &\geq \hat{p}_i - p_i \\ \alpha &\geq \frac{\hat{p}_i - p_i}{p_i}. \end{aligned}$$

Finally, if we include all revised terms in the original equation and add risk aversion, the utility functions read:

$$EU = \begin{cases} (1 - p_i)Y^{(1-r)} + p_i y^{(1-r)}, & \text{if } m = 0 \\ (1 - p_i)(Y - (1 - \alpha)\hat{p}_i\beta)^{(1-r)} + p_i(y + \beta - (1 - \alpha)\hat{p}_i\beta)^{(1-r)} & \text{if } m = 1 \end{cases}$$

C.2 NetLogo simulation code

```
breed [ agents an-agent ]

agents-own [
participate?
risk
needs-support?
estimated-risk
estimated-risk-previous
ci-participate?
ci-average-risk
ci-average-risk-previous
]

globals [
num-support
number-of-members
number-of-members-previous
ci-number-of-members
number-of-stable-rounds
]

to setup
  clear-all
  set-default-shape turtles ''face happy''

  if fix-seed? [ random-seed behaviorspace-run-number ]

  create-agents number-of-agents [
    set color green
    move-to one-of patches with [not any? agents-here]

    set risk (random-float (0.3 - 2 * minimum-risk) + minimum-risk)
    if debug? [ print risk ]
  ]

  ; Base first decision on hypothetical number of members:
  ; entire agent population
  set number-of-members count agents
  set ci-number-of-members count agents

  reset-ticks
end

to go
  if all? agents [ member? color [ white ] ] [
    ; Condition 1: stop if all agents are white
    ;stop
  ]
  if number-of-stable-rounds = 60 [
```

```
    ; Condition 2: after 120 rounds: stop if 60 ticks without change
    ; in number of members
    stop
  ]

  ask agents with [ color != white ] [
    ; Only if agents are participating (color != white)

    ; Step 1: Realization of who needs support -> start from round > 1
    ifelse ticks > 1 [
      set needs-support random-float 1 <= risk
    ] [
      set needs-support false
    ]

    ifelse needs-support = true [
      set color red
      set shape ``face sad''
    ] [
      set color green
      set shape ``face happy''
    ]
  ]

  ; Robustness check: what if 50% needs support in round 50?
  if shock? and member? ticks ( range 50 (50 + number-of-shocks) ) [
    if debug? [ print (word ``External correlated shock for ''
      number-of-shocks `` rounds.'') ]
    ask n-of ( count agents with [ color != white ] / 2 ) agents with [
      color != white
    ] [
      set needs-support? true
      set color red
      set shape ``face sad''
    ]
  ]

  ; Go back to observer level to count total number of agents that need
  ; support
  set num-support count agents with [ color = red ]
  if debug? [ print word ``Total support = '' num-support ]

  ask agents with [ color != white ] [
    ; Step 2: Decide whether or not to (continue to) participate
    decide-to-participate
    if participate? = false [
      set color white
      set shape ``face neutral''
    ]
  ]
  set number-of-members count agents with [ color != white ]
  if debug? [ print (word ``Number of members = '' count agents with
```

```
  [ color != white ]) ]

  ; Comparison: participation decisions if full information
  if ticks = 0 [ ask agents [
    set ci-participate? true
  ] ]
  ask agents with [ ci-participate? ] [ ci-decide-to-participate ]
  set ci-number-of-members count agents with [ ci-participate? ]

  ; After 120 rounds (10 years) -> check if decision-making is stable.
  ; As soon as 60 stable rounds: stop (For stable groups >= 180 rounds)
  if ticks >= 120 [
    check-if-members-changed
  ]
  set number-of-members-previous number-of-members

  tick
end

to decide-to-participate
  ifelse number-of-members > 1 [
    ifelse ticks = 1 [
      set estimated-risk risk
    ] [
      ifelse needs-support? [
        set estimated-risk ( 1 - learning ) * estimated-risk-previous +
          learning * ( ( num-support - 1 ) / number-of-members )
        if debug? [ print word ``For red agents ki ='' (num-support - 1) ]
      ] [
        set estimated-risk ( 1 - learning ) * estimated-risk-previous +
          learning * ( num-support / number-of-members )
        if debug? [ print word ``For green agents ki = '' num-support ]
      ]
    ]
    set estimated-risk-previous estimated-risk
    ; already assign value to this variable to be used in next round

    let eu-participation ( risk * ( beta - ( 1 - solidarity ) *
    estimated-risk * beta ) ^ ( 1 - risk-aversion ) + (1 - risk) *
    (income - (1 - solidarity) * estimated-risk * beta) ^ ( 1 -
    risk-aversion ) )
    let eu-noparticipation ( risk * 0 ^ ( 1 - risk-aversion ) +
    ( 1 - risk ) * income ^ ( 1 - risk-aversion ) )

    if debug? [ print word ``expected utility participation = ''
      eu-participation ]
    if debug? [ print word ``expected utility no participation = ''
      eu-noparticipation ]

    ifelse eu-participation >= eu-noparticipation [
      set participate? true
    ] [
```

```
      set participate? false
    ]
    if debug? [ print word ``participate = '' participate? ]
  ] [
    ; if one member left -> RSG failed, participate = 0
    set participate? false
  ]

end

to-report %-of-members
  report number-of-members / number-of-agents * 100
end

to check-if-members-changed
  ifelse number-of-members = number-of-members-previous [
    set number-of-stable-rounds number-of-stable-rounds + 1
  ] [
    set number-of-stable-rounds 0
  ]
  if debug? [ print (word ``Number of stable rounds at tick ''
    ticks `` = '' number-of-stable-rounds) ]
end

to-report average-estimated-risk
  ifelse number-of-members >= 1 [
    report mean [ estimated-risk ] of turtle-set agents with
      [ color != white ]
  ] [
    report 0
  ]
end

to-report average-risk
  ifelse number-of-members >= 1 [
    report mean [ risk ] of turtle-set agents with [ color != white ]
  ] [
    report 0
  ]
end

to ci-decide-to-participate
  let beta (benefit - benefit / ci-number-of-members )
  let ci-participation ( risk * (beta - (1 - solidarity) * ci-risk
    * beta) ^ ( 1 - risk-aversion ) + (1 - risk) * (income - (1 -
    solidarity) * ci-risk * beta) ^ ( 1 - risk-aversion ) )
  let ci-noparticipation ( risk * 0 ^ ( 1 - risk-aversion ) + (1 - risk)
    * income ^ ( 1 - risk-aversion ) )
  ifelse ci-participation >= ci-noparticipation [
    set ci-participate? true
  ] [
    set ci-participate? false
```

```
  ]
end

to-report ci-%-of-members
  report ci-number-of-members / number-of-agents * 100
end

to-report ci-risk
  ifelse ticks <= 1 [
    report mean [ risk ] of turtle-set agents
  ] [
    ifelse ci-number-of-members >= 1 [
      report mean [ risk ] of turtle-set agents with [ ci-participate? ]
    ] [
      report 0
    ]
  ]
end
```

C.3 Distributions obtained from the simulation runs

Figure C.1 shows the distribution of the proportion of members of all $324 \times 50 = 16,200$ agent populations for time points $\tau \in \{2, 6, 12, 24, 60, 180\}$. Most observations are clustered either at the far left (empty RSGs) or at the far right (complete RSGs). The general pattern is a rapid decrease of the number of complete groups in the first round, resulting in a variety of in-between categories. While the middle and high heterogeneity conditions end up with the highest peak around an empty mutual group, there are also groups that find stability with a proportion of members around 70% (high heterogeneity) and 85% (intermediate heterogeneity). For the most homogeneous need category the highest peak continues to lie around complete mutual groups even towards round $T = 180$.

Figure C.2 shows the distribution of average need for all groups of $n \geq 2$ agents (i.e., existing groups) at time points $\tau \in \{2, 6, 12, 24, 60, 180\}$. It shows that the three heterogeneity conditions start from three neat random distributions with an average of $p = 0.15$, but develop a rightly skewed tail from round 6 onwards already. For the intermediate and highest heterogeneity conditions the distribution flattens out and no longer has a clear peak. The most homogeneous group remains almost normally distributed across the original mean.

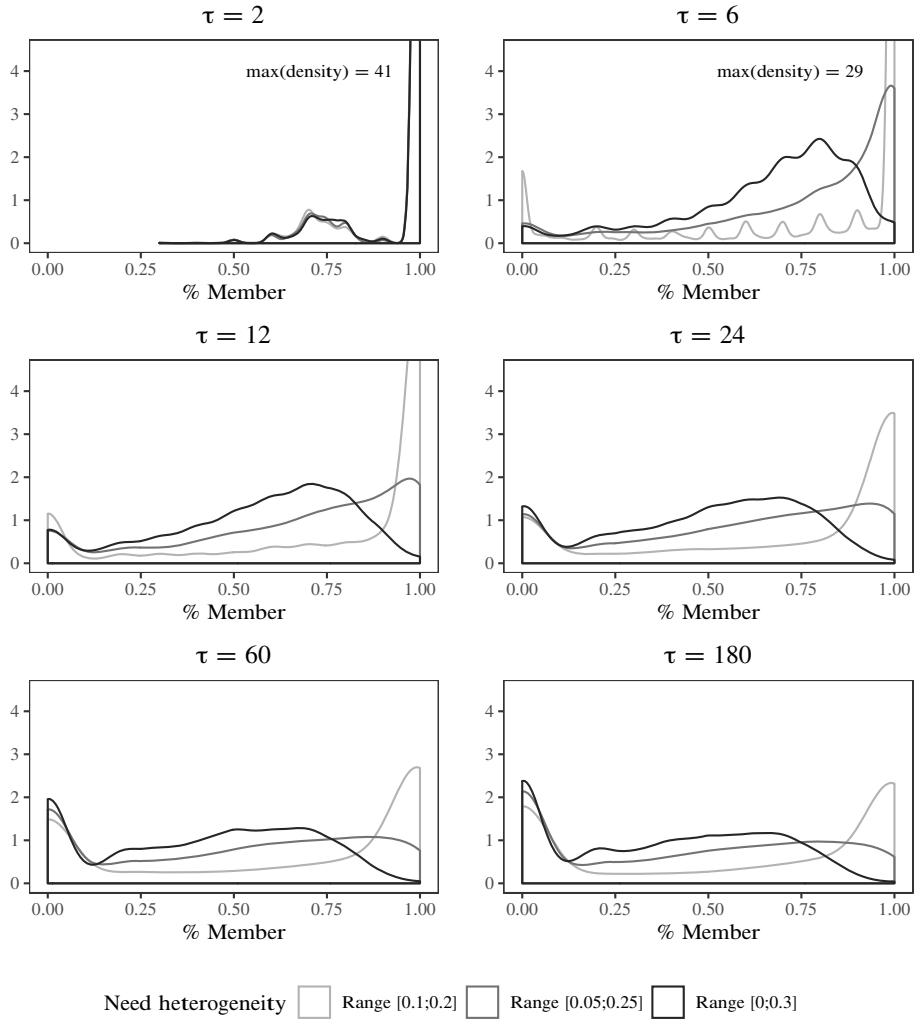


Figure C.1. Distribution of proportion of members n/N at time points $\tau \in \{2, 6, 12, 24, 60, 180\}$

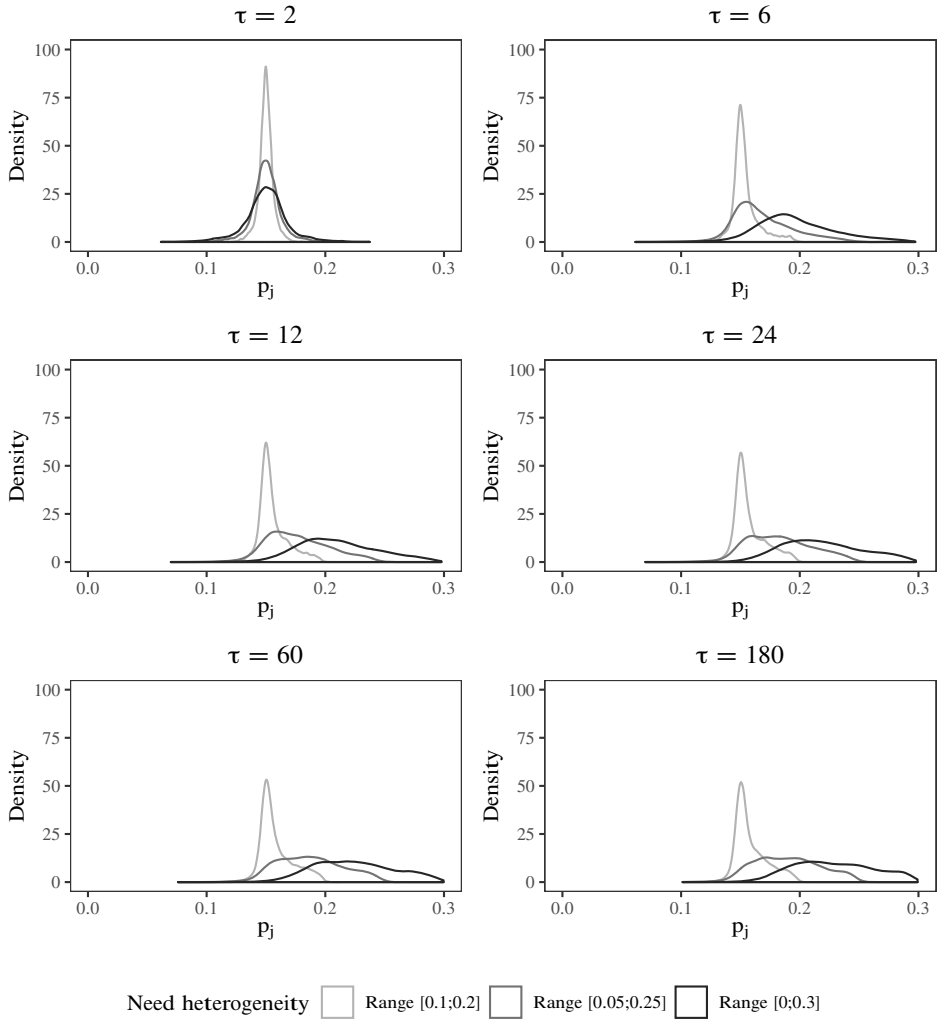
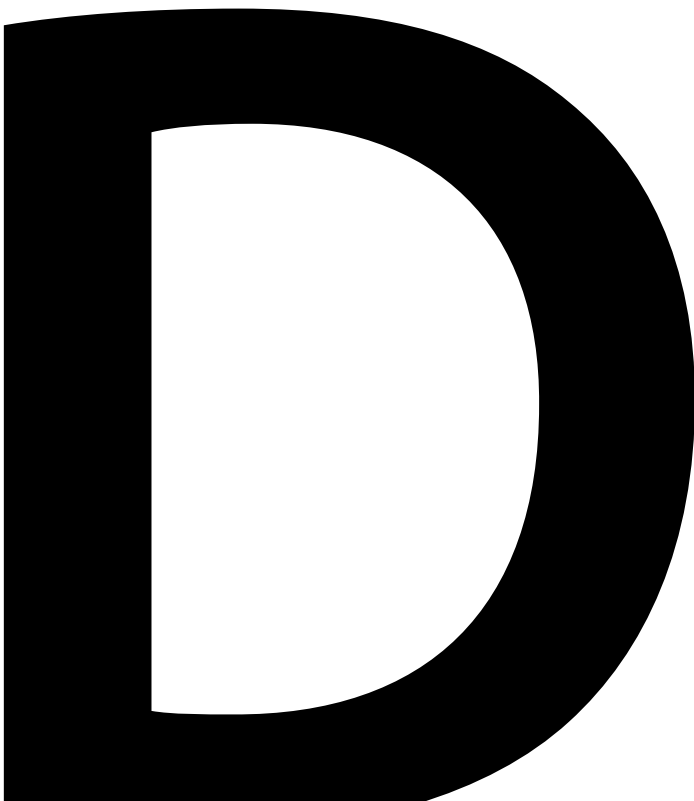


Figure C.2. Distribution of average need probability $\bar{p}$ at time points $\tau \in \{2, 6, 12, 24, 60, 180\}$



APPENDIX D

Supplements to Chapter 5

This appendix includes (D.1) the results of the robustness checks for both studies; and (D.2) the instructions for the experiment.

D.1 Robustness checks

Table D.1. Multilevel OLS regression analyses on commitment for low-risk subgroup of each Broodfonds group ($N = 1973$)

	(M0)		(M1)		(M2)	
Members						
Intercept	3.922^{***}	(0.023)	2.987^{***}	(0.175)	2.992^{***}	(0.175)
Risk aversion			0.004^{*}	(0.002)	0.004^{*}	(0.002)
Risk aversion × Risk heterogeneity					0.007	(0.008)
Solidarity			0.428^{***}	(0.019)	0.428^{***}	(0.019)
Solidarity × Risk heterogeneity					0.077	(0.062)
Perceived risk			0.002	(0.035)	0.004	(0.035)
Received benefit			0.116	(0.111)	0.109	(0.111)
Benefit size			0.001	(0.003)	0.001	(0.003)
# Years Broodfonds − # years member			−0.012	(0.016)	−0.012	(0.016)
Gender: Female			−0.017	(0.032)	−0.016	(0.032)
Age			0.017^{***}	(0.002)	0.017^{***}	(0.002)
Board member			0.179^{**}	(0.056)	0.178^{**}	(0.056)
Trust			0.338^{***}	(0.017)	0.338^{***}	(0.017)
Strong tie degree			0.004^{*}	(0.002)	0.004^{*}	(0.002)
Total degree			0.002^{***}	(0.000)	0.002^{***}	(0.000)
Groups						
Risk heterogeneity			-0.224^{**}	(0.072)	-0.226^{**}	(0.072)
Relative number of benefits			0.547	(0.390)	0.550	(0.390)
Total number of members			0.000	(0.003)	0.000	(0.003)
# Years Broodfonds			-0.053^{***}	(0.015)	-0.054^{***}	(0.015)
Dense network			0.113	(0.059)	0.115	(0.059)
Clustered network			0.040	(0.045)	0.040	(0.045)
Star network			0.058	(0.049)	0.059	(0.049)
Random intercept group		0.044		0.012		0.012
Residual variance		0.835		0.433		0.433
Intraclass correlation		0.050		0.028		0.028
Log Likelihood		−3,636.586		−2,055.376		−2,059.998
Akaike Inf. Crit.		7,279.172		4,154.751		4,167.995
Bayesian Inf. Crit.		7,296.868		4,277.672		4,302.091

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Table D.2. EHA on the likelihood of withdrawal for low-risk subjects of each experimental risk-sharing group (113 events, $N = 2710$)

	(M1a)		(M1b)		(M2)	
Received benefit	0.273	(0.266)	0.270	(0.266)	0.255	(0.266)
Risk aversion	−0.019	(0.014)	0.010	(0.020)	0.003	(0.027)
Risk aversion × t			−0.005*	(0.002)	−0.005*	(0.002)
Risk aversion × HG-H					0.008	(0.029)
Solidarity	−0.028*	(0.011)	−0.029**	(0.011)	−0.015	(0.016)
Solidarity × HG-H					−0.030	(0.023)
Risk	−1.826	(3.053)	−2.002	(3.056)	−1.941	(3.082)
Gender: Female	−0.381	(0.224)	−0.340	(0.225)	−0.389	(0.229)
Age	−0.070	(0.069)	−0.066	(0.069)	−0.071	(0.069)
Game theory	−0.671	(0.427)	−0.668	(0.426)	−0.674	(0.428)
Treatment: HG-H	0.020	(0.228)	−0.002	(0.228)	−0.039	(0.236)
Total members $t-1$	−0.074	(0.092)	−0.071	(0.091)	−0.063	(0.092)
Total left $t-1$	0.402	(0.223)	0.414	(0.222)	0.427	(0.221)
Num. sick members RSG $t-1$	0.409***	(0.082)	0.409***	(0.083)	0.413***	(0.083)
LR χ^2 Test	47.894***	(df = 11)	52.338***	(df = 12)	54.249***	(df = 14)
LR χ^2 Difference Test			4.444*	(df = 1)	1.911	(df = 2)

Note: $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Table D.3. Multilevel EHA on the likelihood of withdrawal (216 events, $N = 5625$)

	(M1a)		(M1b)		(M2)	
Rounds						
Received benefit	1.275	(0.184)	1.278	(0.184)	1.279	(0.184)
Subjects						
Risk aversion	0.986	(0.011)	1.007	(0.015)	1.006	(0.019)
Risk aversion × t			0.996*	(0.002)	0.996*	(0.002)
Risk aversion × HG-H					1.002	(0.021)
Solidarity	0.967***	(0.008)	0.967***	(0.008)	0.969**	(0.011)
Solidarity × HG-H					0.996	(0.017)
Risk	0.106*	(1.12)	0.102*	(1.123)	0.102*	(1.124)
Gender: Female	0.676*	(0.157)	0.691*	(0.158)	0.686*	(0.16)
Gender: Other (not disclosed)	0.387	(1.025)	0.394	(1.026)	0.397	(1.026)
Age	0.948	(0.049)	0.95	(0.049)	0.95	(0.05)
Game theory	0.597	(0.29)	0.591	(0.292)	0.592	(0.293)
Groups						
Treatment: HG-H	0.978	(0.162)	0.967	(0.167)	0.961	(0.169)
Total members $t-1$	0.959	(0.07)	0.969	(0.07)	0.967	(0.07)
# sick members RSG $t-1$	1.481***	(0.061)	1.483***	(0.061)	1.483***	(0.061)
Total left $t-1$	1.581**	(0.166)	1.578**	(0.166)	1.578**	(0.166)
Random intercept group		0.070		0.088		0.084
(df) χ^2	(13)	90.62***	(14)	95.05***	(16)	95.11***
(df) χ^2 difference			(13)	4.43*	(2)	0.06

Note: $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

D.2 Instructions for the experiment

Instructions I

Please imagine the following situation: You **work as a freelancer**. Every round (which you could see as a month) you work on an assignment. With the assignments you do, you earn a steady **income of 900 points** per round (month). However, there is always a possibility that you get sick. When you get sick, you cannot work during that round. Your client does not pay you as long as you do not finish your task, which means you **do not earn anything** in that round.

In Part 3 of the study you will experience for **20 rounds** (months) that you either earn 900 points or, when you are sick, 0 points. At the end of the study, one of the 20 rounds is randomly selected for payout. So depending on your health status in the selected round, you either earn another 900 points or 0 points for part 3 of this study.

Your risk stays the same over all rounds of Part 3. With a risk of getting sick of 0.2, for instance, you would be sick and thus earning nothing approximately **once every 5 rounds**. A risk of 0.1 would mean earning nothing approximately once every 10 rounds; a risk of 0.33 on average once every 3 rounds.

A way to reduce the effect of illness is to **share the risk** of losing your income. You will be offered to start a risk-sharing group with up to 9 other people. Each one of you would pay **300 points** every round. From these contributions, a group member that is sick receives **750 points**. If not all points are needed to pay sick group member(s), the remaining points **are given back** to you. Hence, points are not saved across rounds and membership of the risk-sharing group never costs more than 300 points. Do note that a sick member also paid the contribution fee.

To start with, a couple of scenarios where you are part of a risk-sharing group and you yourself are healthy.

10 members, 1 sick group member
If all ten people join the risk-sharing group and one person (not you) gets sick, the costs of this benefit are shared over ten persons. Everyone pays 75 points, so of the 300 points you paid as a contribution you get 225 points returned. You would **end up with $900 - 300 + 225 = 825$ points** (£5.5) that round.

10 members, 4 sick group members
If four other persons get sick ($4 \times 750 = 3000$), the full sum of contributions ($10 \times 300 = 3000$) is needed to pay the benefits for these people. You would lose your entire contribution and **end up with 600 points** (£4) that round.

5 members, 1 sick group member
The fewer people that join, the fewer people you can support and the costlier sup-

port becomes. With **5 members**, for instance, the sum of contributions is 5 × 300 = 1500 points. If one person gets sick, each person would pay 150 points of the Constants.benefit — c and only get 150 points returned (**ending up with 900 − 300 + 150 = 750 points** that round).

This means a group of 5 members can only support up to two sick members per round. See Appendix D.2 for an overview of how many members can receive maximum support for varying group sizes.

Table D.4. Overview of size common fund and members that can be supported

Number of group members	Sum of contributions	Max. members full support
10	3000	4
9	2700	3
8	2400	3
7	2100	2
6	1800	2
5	1500	2
4	1200	1
3	900	1
2	600	0

7 members, 3 sick group members

If a risk-sharing group has more sick members than the maximum number the group can fully support, the sick members do not receive the full 750 points but instead **divide the sum of contributions**. For instance, if in a group of 7 members 3 members get sick, they each receive 700 points (2100/3) instead of 750 points.

Hence, membership of the risk-sharing group never costs more than 300 points. As long as you are healthy, your earnings vary **between 900 and 600 points**. On the other hand, if you get sick there is a higher variation in your earnings, also in the risk-sharing group. Let's look at two more examples.

10 members, only you sick

You receive most if you are the only sick member in a risk-sharing group of 10 people. You would pay a contribution of 300 points, receive the benefit of 750 points, and get 225 points of your contribution returned. Your earnings would be **750 - 300 + 225= 675 points** (£4.5).

7 members, you and two others sick

If you are one of three sick members in the earlier mentioned group of 7, you would pay 300 points and receive 700 points and therefore **end up with 400 points** (£2.67).

Thus, your earnings depend on the total number of group members and the number of sick members. All in all, if you are sick they could vary **between 675 points and 0 points** (the latter can only occur if all members are sick at the same time,

which is extremely unlikely).

You can only choose to join the risk-sharing group in the first round. If you do not join in round 1, you **will not get the chance** to do so in a later round either. When you do not join the risk-sharing group, in every round your earnings depend only on your own risk (you receive either 900 points or 0 points). If you do join in round 1, in all next rounds you will be asked if you want to **remain a member** of the risk-sharing group. In every round, you can choose to leave the group. However, if you do so you **cannot return in later rounds**.

After each round you will be **informed about the outcomes**: Whether or not you were sick and how many points you would earn if this round were drawn for the payment of Part 3. If you joined the risk-sharing group, you will also be informed about the total number of members, what the health status of the other members is (i.e., who got sick), how much money was needed to pay sick group members, and how much of the contribution will be returned to you. Before we start Part 3 we will show two examples of what the screen of the decision situation might look like and how this information is presented.

You and the people you can share risk with might not run the same chance of getting sick. Each one of you gets a risk assigned **randomly**. Other participants' risks may be lower or higher than yours, but this information is **not known**. You will only be informed about your **personal risk of falling ill**, but you do not know the risk levels of other participants, nor whether these are lower or higher than yours. If your risk is higher than that of others, you benefit most from their help. If your risk is lower, you will more often pay to help others than you will receive help in return.

Questions I

We will ask you a couple of questions about the instructions. Please note that this is **not a test**: If you don't know the answer, you can look back into the instructions on the left. You don't earn or lose points with right or wrong answers. The purpose is merely to know if you understand the instructions. If after reading the instructions and answering the questions you're left with any question or doubt, you can contact the researcher (Eva Vriens, e.vriens@uu.nl).

1. How many rounds will you play in Part 3 of this study?
a) 20
b) 25
c) 30

2. What is your income from work each round?
a) 800 points
b) 850 points

c) 900 points

3. How much do you have to pay if you decide to share risk?
a) 150 points
b) 250 points
c) 300 points

4. With how many others can you potentially share risk?
a) 8 people
b) 9 people
c) 10 people

5. What can you earn in this part of the experiment?
a) The sum of all points earned in all rounds
b) The points earned in one randomly selected round

6. What happens with your contribution if no one gets sick?
a) You get it back
b) You lose your contribution

7. What do you know about the other group members?
a) Nothing
b) Only whether they also joined
c) Whether they joined and how big their risk of getting sick is

8. Can you choose to join the risk-sharing group in every round?
a) Yes, you can always join
b) No, you can only join in round 1

9. Can you return to the risk-sharing group in later rounds?
a) Yes, you can always return
b) No, once you left you cannot return

Instructions II

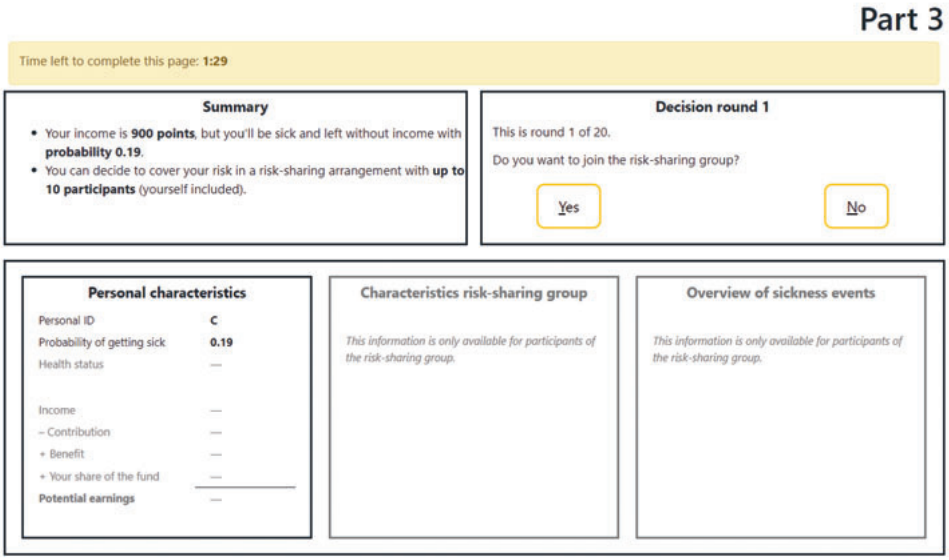


Figure D.1. Example of a decision round

Above you see a screenshot of a possible decision page in the first round. The top left box gives a summary of the decision situation. The top right box is the decision box, where you can choose to join the risk-sharing group using the buttons Yes or No. The boxes in the bottom row give information about the previous round(s) of the game. For the first round, this is only your personal ID and sickness probability.

Questions II

1. What is the participant ID for the decision-screen?
a) C
b) D
c) F

2. What is the probability that this participant gets sick?
a) 0.16
b) 0.19
c) 0.24

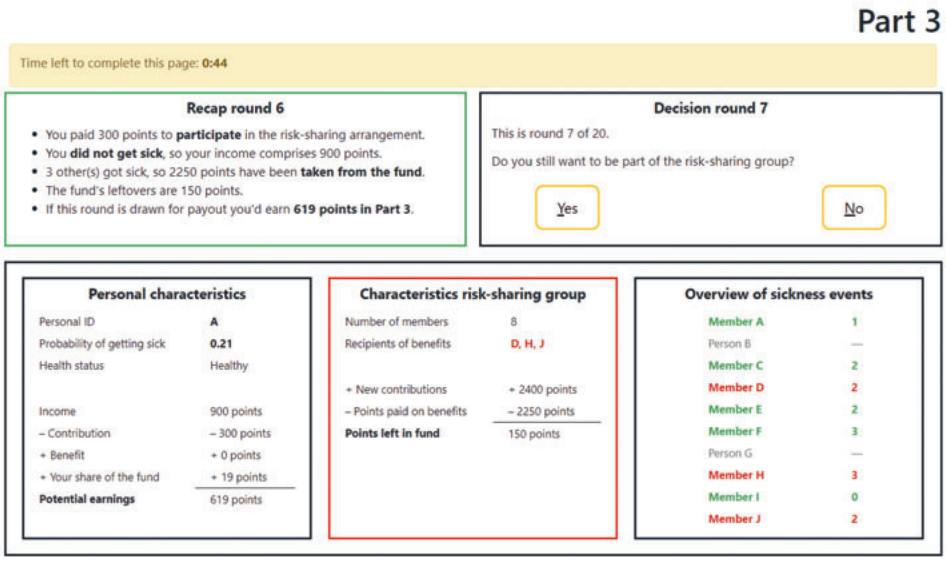


Figure D.2. Example of a decision round

Instructions III

The image shows a screenshot of the decision page in round 7 for someone who is a member of the risk-sharing group. The decision box in the top right is almost similar to that in round 1, except that it asks if you '**still want to be part of the risk-sharing group**' instead of whether you want to 'join the risk-sharing group'. The other boxes give more information compared to round 1.

In rounds 2 and higher, the top left box gives a **recap of the outcome** of the previous round. The color of the outline tells you whether you were sick in the previous round (**red outline**) or healthy (**green outline**). The recap further summarizes your income, and (in case you joined the risk-sharing group) the size of your benefit (if sick), how many others got sick, how many points were taken from the fund, the size of the fund, and your earnings if the previous round would be drawn for the payment of part 3.

The three boxes in the bottom half give information about you and other participants in the previous round (in this case round 6). The box on the left outlines **personal characteristics**: Your ID and sickness probability (as in round 1), your health status, and the various points leading to your potential earnings if at the end of the experiment that round is drawn for payout.

The box in the middle gives information **about the risk-sharing group**. A **red outline** means at least one member in the group was sick in the previous round. A **green outline** means that all members were healthy. If the outline is red, the box

also tells you which members were sick, how many points were taken from the fund to pay them, and how many points are left.

Finally, the box on the right gives an **overview of all sickness events** of all members in all rounds before the current round (in this case: 1-6). In the example, it states that member A was sick once in all six rounds, whereas member F was sick three out of six rounds. **Green** and **red** colors refer to the health status of all members in the previous round, meaning that members in red were sick the previous round (in this case: 6). If members drop out of the risk-sharing group, their information is no longer available. Their IDs are listed in grey.

The two tables with information about the risk-sharing group are available for **members only**. If you drop out, you are no longer informed about the number of people that are part of the risk-sharing group, the people who got sick, etc.

Questions III

1. How much would member A earn if round 6 were drawn for payoff?
a) 900 points
b) 19 points
c) 619 points

2. How many people are a member of the risk-sharing group (including A)?
a) 6
b) 7
c) 8

3. Which people are not part of the risk-sharing group?
a) A
b) B and G
c) D, H and J

4. Which members were sick in round 6?
a) A
b) B and G
c) D, H and J

5. What would happen if A had also been sick in round 6?
a) All sick members would receive 600 points instead of 750
b) A would only receive the 150 points that are left in the fund

Nederlandse samenvatting

Achtergrond

De afgelopen 15 jaar is sprake geweest van een heropleving van burgercollectieven en collectieve actie. Zo zijn in heel Europa honderden energiecoöperaties opgericht waarin door gezamenlijke investeringen in windmolens of zonnepanelen duurzame energie wordt opgewekt (Klagge & Meister, 2018). Nieuwe zorgcoöperaties voorzien in ouderenzorg of kinderopvang, met name in dunner bevolkte regio's (Boumans & Swinkels, 2015). Voedsel- en landbouwcoöperaties verkorten de route van boer tot bord in een poging de ecologische voetafdruk te verkleinen, de voedselkwaliteit te vergroten en de voedselprijs beter te controleren (Gómez Mestres & Lien, 2017). In de verzekeringswereld, tenslotte, hebben zich nieuwe organisaties aangediend die de prijs en toegankelijkheid van verzekeringen willen verbeteren door polishouders op te delen in kleine schenkkringen (zogenaamde 'risico-deelgroepen'; Abdikerimova & Feng, 2019; Van Leeuwen, 2016).

Volgens de initiatiefnemers van deze collectieven konden bestaande voorzieningen (zowel geleverd door de overheid als door marktpartijen) niet langer de vraag van burgers beantwoorden (Tjeenk Willink, 2018) en ligt de oplossing in een simpelere, lokale organisatie (Putters, 2018). Zo hebben bezuinigingen en versoberingen van de verzorgingsstaat ertoe geleid dat bepaalde groepen of bepaalde regio's geen (of onvoldoende) toegang hadden tot zorg of verzekeringen. Ook als er geen direct tekort was (bijvoorbeeld in de energie- en voedselsector) zien de nieuwe collectieven kansen. Het gaat ze niet om het produceren van energie, maar van duurzame energie; niet om winst maken op verzorgingstehuizen, maar om zorg vanuit de gemeenschap; niet om intensieve landbouw voor internationale export, maar om een korte keten van product naar consument; en niet om grote, anonieme verzekeringen maar om een eerlijk, solidair systeem (De Moor, in press).

In dit proefschrift staan de nieuwe onderlinge verzekeringen centraal. De opkomst en organisatie van deze collectieven vertonen veel parallellen met eerdere 'golven' van geïnstitutionaliseerde collectieve actie (De Moor, in press). De oudste toepassing van onderlinge verzekeringen wordt vaak toegeschreven aan de gilden in de vroegmoderne tijd (1500–1800). In gilden maakten ambachtslieden prijs- en kwaliteitsafspraken en ontwikkelden zij een eerste onderling verzekeringssysteem (Epstein & Prak, 2008).

Toen gilden aan het eind van de 18e eeuw werden verboden, werden de onderlinge verzekeringen veelal als op zichzelf staande organisaties voortgezet, bijvoorbeeld om gezamenlijk risico's van gezondheid, begrafenis, brand of landbouw af te dekken (Van Leeuwen, 2000). Deze onderlingen (*mutuals* in het Engels) waren enorm populair, maar vaak slechts voor specifieke bevolkings- of beroepsgroepen toegankelijk. Gedurende de 20^{e} eeuw ontwikkelden de meeste landen dan ook een verzorgingsstelsel dat de taken van de onderlingen overnam (Beito, 2000; De Swaan, 2004). Ook de meeste onderlingen met een focus op schadeverzekeringen verdwenen, omdat zij de concurrentiestrijd met private bedrijven verloren (Emery & Emery, 1999). Slechts

enkelen hebben deze professionaliseringsslag overleefd (denk bijvoorbeeld aan Achmea in Nederland), hoewel bij deze organisaties de coöperatieve grondslag vaak slechts nog op papier zichtbaar is.

Zodoende is het idee van onderling verzekeren geleidelijk uit ons geheugen verdwenen (Van Leeuwen, 2016). Tegelijkertijd is het concept van risico's delen zo oud en wijdverspreid (Platteau, 1997) dat het geen verrassing is dat nu het collectief gedachtengoed in andere sectoren heropleeft, ook onderlingen binnen de verzekeringswereld hun herintrede doen. Enkele voorbeelden zijn Friendsurance in Duitsland, Axieme in Italië en Broodfonds in Nederland. Deze nieuwe organisaties zijn ontstaan in reactie op de versobering van de verzorgingsstaat en een toenemende mate van exclusiviteit in zowel private als publieke verzekeringen (Natalier & Willis, 2008; Taylor-Gooby, 2006).[1] In hun organisatie kopiëren ze het model van de 19e-eeuwse onderlingen, maar toch verkiezen de meeste organisaties ervoor niet dezelfde soortnaam te hanteren. Zo kunnen ze zich onderscheiden van de grote onderlinge verzekeraars (zoals Achmea) die vandaag de dag nog bestaan.

Bij een onderlinge verzekeraar als Achmea hebben leden formeel zeggenschap over de organisatie, waardoor winst opnieuw in het bedrijf geïnvesteerd moet worden of aan de leden moet worden uitgekeerd (Lehtonen & Liukko, 2015). Deze zeggenschap betekent in de praktijk echter weinig tot niets (Chaddad & Iliopoulos, 2013). Bovendien zijn polishouders bij onderlinge verzekeraars vandaag de dag niet meer opgedeeld in kleinere schenkkringen, waardoor solidariteit niet langer een rol van betekenis speelt.

De nieuwe organisaties gebruiken daarom liever termen als *peer-to-peer* verzekeren of *crowdsurance*, om de nadruk te leggen op het solidair, transparant en eerlijk uitbetalen van verzekeringen. Leden sluiten zich aan bij een zogenaamde 'schenkkring' om niet alleen hun eigen financieel vangnet te regelen, maar ook dat van hun groepsgenoten. Wanneer het ingelegde geld niet nodig blijkt te zijn om groepsgenoten te ondersteunen, ontvangt ieder een deel retour.

Tegelijkertijd zijn er veel verschillen tussen de nieuwe organisaties. Het Duitse Friendsurance is bijvoorbeeld formeel geregistreerd als een verzekeraar, terwijl de Nederlandse Broodfondsgroepen geregistreerd zijn als verenigingen, waarin de leden elkaar helpen met schenkingen in plaats van uitkeringen. Dit leidt tot allerlei variaties in de organisatie en regels, de dekkingsgraad en het aantal leden. Het doel van dit promotieonderzoek was te achterhalen welke factoren succesvolle samenwerking in schenkkringen kunnen vergroten of juist verhinderen.

[1] In veel landen hebben arbeidsmigranten (een snelgroeiende groep) bijvoorbeeld geen toegang tot werkloosheidsuitkeringen (Baldini et al., 2016; Lehtonen & Liukko, 2015). Ook zelfstandigen zijn vaak op private verzekeraars aangewezen voor hun pensioen of arbeidsongeschiktheid, omdat deze uitkeringen normaliter worden betaald uit belastingen op salaris van werkenden in loondienst (Van der Linden, 2008).

Broodfonds als Nederlands voorbeeld

Broodfonds is het bekendste Nederlandse voorbeeld van een schenkkring. In Broodfondsgroepen van maximaal 50 leden organiseren ZZP'ers hun eigen arbeidsongeschiktheidsregeling door maandelijks een contributie te storten op een Broodfondsrekening. Wanneer groepsleden ziek worden, kunnen zij (na een eigen risicoperiode van één maand) aanspraak doen op steun van hun Broodfonds. De zieke ontvangt dan, op basis van vertrouwen, gedurende 1–24 maanden een schenking van de groep.

De eerste Broodfondsgroep is in 2006 opgericht als reactie op het afschaffen van de Wet Arbeidsongeschiktheidsverzekering Zelfstandigen (WAZ) in 2004. Na een aantal succesvolle jaren hebben drie leden van de eerste groep het organisatiemodel formeel uitgewerkt opdat het ook door andere ZZP'ers gebruikt kon worden. Deze drie leden, formeel georganiseerd in de BroodfondsMakers coöperatie, begeleiden en adviseren Broodfondsgroepen. De tweede Broodfondsgroep startte in januari 2011 en vervolgens is in tien jaar tijd het aantal Broodfondsen snel gegroeid. In oktober 2020, bij het afronden van dit promotieonderzoek, waren er 595 groepen. Met gemiddeld 45 leden per groep betekent dit dat destijds 26.900 ZZP'ers via een Broodfonds een arbeidsongeschiktheidsregeling getroffen hadden.

Om de naam Broodfonds te dragen, moet de groep aan enkele voorwaarden voldoen: 1) een groep moet bestaan uit minimaal 20 en maximaal 50 leden; 2) ieder lid maakt een maandelijkse contributie over naar een persoonlijke Broodfonds bankrekening; 3) er wordt geen onderscheid gemaakt in geschatte individuele risico's bij het vaststellen van de contributieniveaus; 4) als er meer gespaard is dan nodig om ziekte te kunnen dekken, krijgen leden een deel van de contributie terug; en 5) iedere Broodfondsgroep wordt geleid door een bestuur bestaande uit drie gekozen Broodfondsleden die iedere drie jaar rouleren.

Los van deze vaste regels hebben Broodfondsgroepen de mogelijkheid extra regels in te stellen, zoals bijvoorbeeld restricties in het toelaten van nieuwe leden. Vanuit wetenschappelijk oogpunt vormen Broodfondsgroepen dus een ideale onderzoekspopulatie. De verschillende groepen zijn grotendeels hetzelfde georganiseerd, maar kennen een grote variatie op individueel niveau (het type leden) en in de sociale dynamiek tussen leden. De Broodfondsgroepen vormen zo als het ware een natuurlijk laboratorium om de potentie van risico delen te onderzoeken in onze huidige samenleving.

Afbakening en doel van het onderzoek

Deelname aan een schenkkring wordt in wetenschappelijke literatuur vaak beschreven als een sociaal dilemma (Fafchamps, 1992). Een sociaal dilemma beschrijft een situatie waarin de betrokkenen in het maken van hun keuzes strategisch afhankelijk van elkaar zijn en waarin ten minste enkele van hen in de verleiding komen om zich niet coöperatief op te stellen en/of misbruik te maken van het collectieve goed. Wanneer

zij daar naar handelen zijn alle betrokkenen (inclusief degene die zich niet coöperatief opstelden) op lange termijn slechter af dan wanneer iedereen zou samenwerken (Olson, 1965).

Voor een schenkkring is het collectieve goed de verzekeringspot en het dilemma dat van wel of niet gezamenlijk risico's delen. In zeker opzicht is het dilemma binnen schenkkringen lastiger op te lossen dan voor een standaard publiek goed. Vergelijk het bijvoorbeeld met samenwerking in een energiecoöperatie. Binnen een energiecoöperatie hebben leden ervoor gekozen gezamenlijk te investeren in een windmolen (een investering die voor ieder individueel lid afzonderlijk te duur is en dus alleen door samenwerking bereikt kan worden). Hoewel ieder lid individueel energie kan kopen van private aanbieders, genieten zij na een initiële investering allemaal het voordeel van lokale en duurzame energie, vaak ook nog eens voor een lagere prijs (Bauwens, 2019).

Ook voor schenkkringen geldt dat leden ervoor kunnen kiezen om afzonderlijk spaargeld opzij te zetten of een verzekering kunnen afsluiten bij een private verzekering, maar dat samenwerking binnen een schenkkring een goedkopere oplossing is. Als het gaat om het *verwachte* voordeel is iedereen dus beter af door deel te nemen aan de schenkkring. In de praktijk is er echter een groot verschil in het *daadwerkelijk* verkregen voordeel. Anders dan bij een energiecoöperatie, ontvangen de deelnemers het voordeel immers individueel, en alleen wanneer zij de verzekering daadwerkelijk nodig hebben. Bij de beslissing om deel te nemen weet niemand of zij het voordeel ook daadwerkelijk zullen genieten. Sterker nog, in het beste geval hoeft men er nooit gebruik van te maken (Platteau, 1997). Dit betekent echter dat in het beste geval de *daadwerkelijke* kosten groter zijn dan de baten. Oftewel, achteraf gezien had men liever niet meegedaan. Schenkkringen zijn dus een voorbeeld van een sociaal dilemma onder onzekerheid: deelnemers weten niet of en wanneer zij ooit de vruchten plukken van de samenwerking.

Het gevolg is dat samenwerking in schenkkringen een stuk fragieler is dan dat in bijvoorbeeld een energiecoöperatie. Het is minder duidelijk of het langetermijnvoordeel van samenwerking opweegt tegen het kortetermijnvoordeel van lidmaatschap opzeggen, met name wanneer één of meerdere groepsgenoten aanspraak doen op de gezamenlijke verzekeringspot en zodoende de kosten voor lidmaatschap opdrijven (Fafchamps, 1992). Het is immers vooraf onbekend voor hoeveel groepsgenoten je (tegelijkertijd) zult moeten betalen en of zij vervolgens lid zullen blijven om anderen te steunen in de toekomst. Hoe langer de tijd tussen het afdragen van de maandelijkse premies en het daadwerkelijk ontvangen van de verzekering, hoe groter de onzekerheid, en hoe meer vertrouwen nodig is in andere groepsgenoten om langdurige samenwerking te realiseren.

Met dit promotieonderzoek is beoogd factoren te destilleren die schenkkringen succesvol (kunnen) maken. Daarbij beschouwden we een schenkkring als succesvol wanneer voldoende leden deelnemen en de intentie hebben dat ook in de toekomst

te blijven doen. In de zoektocht naar factoren die succes verklaren is uitgegaan van *causale heterogeniteit* (Poteete et al., 2010), oftewel de erkenning dat er meer dan één route tot een succesvolle uitkomst leidt. Samenwerking is het gevolg van een veelvoud van factoren. Er is dan ook gekozen om te zoeken naar succesfactoren op drie niveaus: de institutie, de (sociale) groep en het individu. Dit is vertaald in de volgende onderzoeksvragen: *1) Welke institutionele kaders zijn ontworpen om samenwerking in schenkkringen te organiseren en hoe groot is de kans (gekeken naar historische voorbeelden) dat deze kaders succesvol zullen zijn? 2) Hoe belangrijk zijn sociale componenten van schenkkringen in de beslissing om lidmaatschap voort te zetten?* En 3) *welke individuele motivaties maken deelname mogelijk ondanks onderlinge heterogeniteit in risico's?*

Een deductief-theoretische benadering

Twee theoretische benaderingen staan centraal in dit onderzoek. Op macroniveau is gebruik gemaakt van het driedimensionale schema van De Moor (2015) om weerbaarheid van instituties van collectieve actie te analyseren. Analytische sociologie (Coleman, 1990; Hedström, 2005) is gebruikt om processen op het microniveau te duiden evenals de relaties tussen het macro- en microniveau.

Het doel van de studie op macroniveau was het categoriseren van de institutionele kenmerken van de nieuwe organisaties om inzicht te krijgen in de meest waarschijnlijke toekomstige ontwikkeling. Daarvoor is onderscheid gemaakt in de institutie (de set van belangrijkste regels), het product (de *resource*, ofwel de verzekeringspot), en de gebruikers (de leden van de schenkkring). Volgens het driedimensionale model kan een organisatie alleen weerbaar zijn als alle drie de onderdelen in balans zijn (De Moor, 2015). De efficiëntie van de organisatie geeft aan in hoeverre de institutie en het product in balans zijn (de verzekeringspot moet voldoende zijn, maar ook niet groter dan nodig). Het nut (*utility*) van de organisatie betreft of het product afdoende is voor de leden. Rechtvaardigheid (*equity*) beslaat tenslotte de balans tussen de institutie en de leden en vraagt of leden voldoende gehoord worden binnen de organisatie. Een weerbare organisatie heeft in gelijke mate aandacht voor efficiëntie, nut en rechtvaardigheid.

Op microniveau is gebruik gemaakt van speltheorie, waarbij standaard rationele-keuzemodellen zijn uitgebreid met assumpties over beperkte rationaliteit, sociale voorkeuren en contextafhankelijkheid. Op basis van netwerktheorieën zijn voorspellingen afgeleid over hoe de sociale structuur waar de leden zich in bevinden van invloed is op hun bereidheid in de toekomst lid te blijven en hun vertrouwen in de bereidheid en betrokkenheid van anderen (Kollock, 1994; Ostrom, 2010). Sociale voorkeuren verklaren waarom mensen bereid zijn deel te nemen aan schenkkringen terwijl hun eigen risico lager is dan het gemiddelde van de groep. Mensen met een lager risico betalen immers vaker voor de steun aan groepsgenoten dan dat zij zelf hulp ontvangen (Coate

& Ravallion, 1993; Ligon et al., 2002).

Tenslotte is gebruik gemaakt van computersimulaties (*agent-based simulations*) om de stap van microniveau naar macroniveau te kunnen maken, omdat de geaggregeerde uitkomsten complexer zijn dan de som van individuele beslissingen (Macy & Willer, 2002). Hoewel af te leiden valt dat iemand bereid kan zijn om deel te nemen onder bepaalde omstandigheden, kan de situatie veranderen als meer mensen steun vragen of wanneer anderen besluiten hun lidmaatschap op te zeggen. Simulaties maakten het mogelijk om hypothesen af te leiden over het gedrag van mensen onder veranderde omstandigheden en onderlinge afhankelijkheid en de uitkomsten op groepsniveau over langere tijd—dynamieken die lastig (zo niet onmogelijk) na te bootsen zijn met echte mensen.

Een combinatie van empirische methoden

Om inzicht te krijgen in de combinaties van factoren die gezamenlijk bepalen of een schenkkring wel of niet succesvol is, zijn meerdere methoden nodig. Enerzijds omdat macro- en microvraagstukken ieder een andere benadering nodig hebben, anderzijds omdat de betrouwbaarheid en validiteit van de resultaten groter worden wanneer ze door meerdere methoden bevestigd zijn (Buskens & Raub, 2008). Zodoende is gebruik gemaakt van een (exploratieve) kwalitatieve vergelijking van organisaties, een vragenlijst onder leden van Broodfondsgroepen, en een online experiment.

De kwalitatieve vergelijking is uitgevoerd in het najaar van 2018 door middel van een inventarisatie van nieuwsartikelen, blogs en websites van nieuwe verzekeringen. Dit resulteerde in een overzicht van 57 organisaties (deels actief, deels inactief) opgericht tussen 2006 en 2018. Elf van deze organisaties zijn geselecteerd voor een uitgebreide vergelijking, omdat er voor deze organisaties voldoende informatie beschikbaar was op hun website en/of omdat er iemand van deze organisatie beschikbaar was om vragen te beantwoorden.

In mei en juni 2017 zijn alle 10.230 leden die zich voor februari 2017 bij een Broodfonds hadden aangesloten uitgenodigd om een vragenlijst in te vullen over hun motivatie, risico, vertrouwen en relaties met andere Broodfondsleden. Dit onderzoek is uitgevoerd in samenwerking met de BroodfondsMakers. Van deze Broodfondsleden hebben 5.192 (50%) de vragenlijst ingevuld, wat het mogelijk maakte om zowel binnen als tussen Broodfondsgroepen de betrokkenheid en het vertrouwen van leden te vergelijken.

Tenslotte is in juni 2020 een online experiment afgenomen met Britse gebruikers van het Prolific platform om te onderzoeken hoe de beslissing tot deelname verandert over de tijd. Anders dan voor de Broodfondsgroepen (waar alleen informatie beschikbaar was van leden), maakte het experiment het mogelijk om deelnemers met niet-deelnemers te vergelijken. Naar het voorbeeld van Broodfonds werden participanten gevraagd zich in te beelden te werken als zelfstandige en uitgenodigd om zich

te verenigen in een schenkkring. Gedurende 20 ronden hadden zij iedere ronde kans om hun volledige inkomen kwijt te raken als gevolg van ziekte en konden ze kiezen of ze dit risico wilden delen in de schenkkring. In het experiment werd de heterogeniteit in risiconiveaus van de deelnemers exogeen gemanipuleerd, zodat onderzocht kon worden wat de invloed is van heterogeniteit op de bereidheid tot deelname.

Overzicht van de resultaten

Op basis van het driedimensionale model van weerbaarheid in instituties voor collectieve actie (De Moor, 2015) en de kwalitatieve vergelijking, zijn de nieuwe schenkkringen ingedeeld in twee typen organisaties: *top-down* en *bottom-up* organisaties. De organisaties die tot de eerste categorie behoren (zoals het Duitse Friendsurance) verdelen hun polishouders in kleine schenkkringen volgens een idee van algemene solidariteit (of altruïsme). De polishouders hoeven elkaar niet te kennen en staan niet met elkaar in contact, maar de aanname is dat de wetenschap dat ze hun risico delen met anderen voldoende is om zich aan de regels te houden en geen misbruik te maken van de gedeelde verzekeringspot.

De *bottom-up* organisaties (zoals Broodfonds) laten het vormen van een groep aan de leden zelf over met het doel directe solidariteitsrelaties te creëren. Daarnaast geven ze hun leden tot op zekere hoogte verantwoordelijkheden in besluitvorming. Een tweede verschil is dat organisaties van de eerste categorie de contributieniveaus afhankelijk maken van individuele risico's, terwijl organisaties van de tweede categorie voor ieder lid hetzelfde contributieniveau hanteren. Zo kent iedere categorie haar eigen (potentiële) valkuilen: de eerste kan wellicht op termijn lastiger onderlinge solidariteit vasthouden, terwijl de tweede misschien overwegend leden met hogere risico's aantrekt.

Voor schenkkringen van de *bottom-up* categorie is, middels vragenlijsten onder Broodfondsleden, gekeken naar het belang van onderlinge relaties voor betrokkenheid en vertrouwen. Gegevens van 230 Broodfondsen zijn met elkaar vergeleken en daaruit bleek dat wanneer Broodfondsgroepen hechter zijn, leden meer vertrouwen hebben in elkaar. Het gaat daarbij om vertrouwen dat andere leden eerlijk zijn, bereid zijn elkaar te helpen, en ook in de toekomst lid blijven van het Broodfonds. Het belangrijkst om vertrouwen te genereren bleek het besef dat alle leden nauw met elkaar in contact staan—of dat nou direct is (in een hecht netwerk) of indirect (met een aantal centrale leden, vaak het bestuur, dat iedereen goed kent). Een hecht, maar geclusterd netwerk, waarin leden verschillende subgroepen vormen met weinig contact tussen subgroepen, werkt niet (of weinig) bevorderend voor vertrouwen. Beloftes om elkaar te steunen kunnen dan wel onderling worden uitgewisseld, maar dat vertaalt zich nog niet in vertrouwen dat de gehele Broodfondsgroep daartoe bereid is.

Los van de relaties op groepsniveau zijn ook individuele relaties belangrijk. Een aantal hechte relaties met andere Broodfondsleden kan vertrouwen in de groep sterk

vergroten—met name in nieuwe Broodfondsgroepen, waarin de meeste leden elkaar nog niet goed kennen en sociale normen nog niet ontwikkeld zijn. Voor de eigen betrokkenheid naar het Broodfonds toe, opgevat als de intentie om ook in de toekomst lid te blijven en andere leden te helpen in geval van nood, zagen we juist dat met name in oudere Broodfondsgroepen leden met hechtere relaties zich meer betrokken toonden. Dit wijst erop dat leden meer bereid zijn een ander lid te steunen (iets wat vaker is voorgekomen als een groep langer bestaat), wanneer zij dit lid ook goed kennen.

Tenslotte is middels simulaties, een online experiment en de Broodfondsdata onderzocht in hoeverre onderlinge heterogeniteit in het risico om (langdurig) ziek te worden van invloed is op deelname. De basisaanname was dat deelname aantrekkelijker is voor mensen met een hoger risico en dat een grote heterogeniteit in risico de kans vergroot dat leden met een laag risico hun lidmaatschap opzeggen. Zij betalen immers netto meer om anderen te steunen dan ze zelf aan steun ontvangen. Voor Broodfondsgroepen vonden we inderdaad dat dat de betrokkenheid van leden lager was in meer heterogene groepen, maar in het experiment werd dit niet bevestigd. In het experiment was heterogeniteit echter zo geïmplementeerd dat participanten wel wisten dat de risico's niet hetzelfde waren, maar niet hoe ongelijk het precies verdeeld was. Wellicht was het op basis van daadwerkelijke steunaanvragen te moeilijk de verdeling van risico's te achterhalen.

Een opvallend resultaat was dat risico-aversie—de gangbare verklaring voor het gegeven dat mensen bereid zijn meer te betalen voor de zekerheid die een verzekering biedt—zowel voor de Broodfondsgroepen als in het experiment geen eenduidige rol speelde. Voor de Broodfondsgroepen leek het alleen de motivatie tot deelname te vergroten voor leden met een risico lager dan het groepsgemiddelde. In het experiment bepaalde het niet de initiële keuze om wel of niet deel te nemen. Wel vergrootte het de kans dat, als eenmaal gekozen was voor deelname, participanten dit tot het einde deden. Dit wijst erop dat anders dan bij een reguliere verzekering de onzekerheid van het potentieel verliezen van je inkomen niet (volledig of voldoende) weggenomen kan worden door deelname aan een schenkkring. Een schenkkring kent zelf immers ook onzekerheid: het is onduidelijk hoeveel anderen meedoen of mee blijven doen, hoe groot hun risico is (en dus hoeveel het kost om hen te steunen), of de verzekeringspot voldoende is om jou te steunen als je zelf steun nodig hebt, enzovoorts. Pas na enige tijd deelgenomen te hebben, krijgen leden vertrouwen in de schenkkring en gaan ze deze beschouwen als het minder onzekere alternatief.

Solidariteit was wel een belangrijke voorspeller voor deelname zowel in Broodfondsgroepen als in het experiment. Dat toont aan dat schenkkringen een beduidend andere rol vervullen dan reguliere verzekeraars. Er wordt niet alleen aan deelgenomen om een eigen vangnet te creëren, maar ook om anderen te kunnen helpen in geval van nood. Daarbij is een belangrijk onderscheid dat solidariteit in het experiment, waarin participanten elkaar niet kenden, algemeen altruïsme weergeeft, terwijl het in

de Broodfondsgroepen directe solidariteit betreft.

Echter was de belangrijkste voorspeller voor deelname in het experiment niet solidariteit of individueel risico, maar het aantal steunaanvragen en veranderingen in het aantal leden. Als veel groepsgenoten (tegelijkertijd) aanspraak deden op de verzekeringspot, zette dit veelal een kettingreactie in gang waarin leden elkaar opvolgden in de beslissing om zich uit de groep terug te trekken. Zodoende leidde het terugtrekken van één of enkele leden regelmatig tot het mislukken van de schenkkring. Dit toont aan hoe kwetsbaar schenkkringen kunnen zijn bij tijdelijke schommelingen in het aantal steunaanvragen. Als er plots veel mensen beroep doen op de verzekeringspot, brengt dat het voortbestaan van de groep in gevaar. Al toont het experiment een extreme situatie (met hogere risico's en minder onderlinge verbondenheid dan in echte groepen), dient het wel als waarschuwing.

Conclusie

De focus op institutionele, sociale en individuele factoren en het gebruik van verschillende theoretische en empirische methoden hebben geleid tot een veelzijdig inzicht in de succes- en risicofactoren voor het onderling delen en afdekken van risico's in schenkkringen. Hoewel zonder twijfel geconcludeerd kan worden dat schenkkringen zoals Broodfonds een succesvol *alternatief* zijn voor een traditionele verzekering, blijkt eveneens uit de bevindingen dat de schenkkringen niet één-op-één met verzekeringen te vergelijken zijn en dat ze niet als zodanig beschouwd kunnen worden. Met name de *bottom-up* organisaties worden vaak (nog) gekenmerkt door veel onzekerheid en kunnen eenvoudigweg niet dezelfde garanties bieden als een reguliere verzekeraar (bijvoorbeeld vanwege de lagere dekkingsgraad).

Het is bovendien zeer de vraag of het schenkkringen ten goede zou komen als zij als verzekering zouden worden erkend. De grote rol van solidariteit wijst erop dat het succes van schenkkringen grotendeels komt omdat zij zich kunnen profileren als tegenhanger van de anonieme verzekeraar. De belangrijkste taak voor schenkkringen lijkt dan ook om solidariteit—of dat nou algemene of directe solidariteit is—vast te houden. Dit promotieonderzoek wijst op het faciliteren en stimuleren van onderling contact en het organiseren van bijeenkomsten als belangrijke maatregelen om solidariteit te bevorderen. Echter zou ook het vergroten van institutionele verbondenheid een manier kunnen zijn om de meer algemene solidariteit vast te houden. Zolang leden vertrouwen hebben in en zich betrokken voelen bij de organisatie, kan een organisatie die expliciet de norm uitdraagt van onderlinge solidariteit wellicht het beoogde effect al bereiken.

Tenslotte wijzen de resultaten van dit promotieonderzoek op het belang beter inzicht te krijgen in de (geschatte) risicoprofielen. Ook wanneer schenkkringen geen onderscheid willen maken in contributieniveaus op basis van verschillen in risico is dit van belang, aangezien zowel de perceptie van risicoheterogeniteit als schommelingen

in het aantal steunaanvragen een negatieve invloed bleken te hebben op de bereidheid tot (toekomstige) deelname. Hoe groter de heterogeniteit, hoe belangrijker het wordt om enerzijds andere voordelen van lidmaatschap te bieden en anderzijds goed te communiceren over langetermijnperspectieven, de tijdelijke aard van een plots groeiend aantal steunaanvragen, en het belang van collectieve samenwerking.

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About the author

Eva Vriens was born in Tilburg, the Netherlands, on October 21, 1991. In 2014, she obtained her bachelor's degree in Sociology combined with the Von Humboldt honours program at Utrecht University. In 2016, she completed the research master Sociology and Social Research (*with distinction*) and got awarded the competitive Talent Grant of the Dutch Research Council (NWO) for a PhD project. With this grant she started working as a Ph.D. candidate at the Interuniversity Centre for Social Science Theory and Methodology (ICS), the department of Sociology, and the research group Institutions for Collective Action at Utrecht University. She wrote her dissertation under supervision of prof. dr. ir. Vincent Buskens (Department of Sociology, Utrecht University) and prof. dr. Tine De Moor (Rotterdam School of Management, Erasmus University).

She currently works as a postdoctoral fellow at the Institute of Cognitive Sciences and Technologies of the National Research Council in Rome, Italy. Her research revolves around long-term cooperation, collective action, and trust relations, with a particular interest in cooperation under individual and collective risk and the emergence and evolution of social norms. She has experience with a wide variety of theoretical and methodological tools, such as formal analytical models, agent-based simulations, lab and online experiments, survey research, and network analysis.

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During the last 15 years, the number of institutions for collective action has risen significantly in Europe, and especially in the Netherlands. Where market- or government arrangements are deemed insufficient, goods and services are provided locally in energy, care, and food coops. Of particular interest is the revival of self-organized insurance in mutual insurance associations (mutuals), which require cooperation and trust under uncertainty. Members share risk and pay monthly contributions to support each other without knowing whether they ever need support, how many others need support, and whether these others repay the favor in the future.

Uncertainty complicates collective action and makes cooperation more fragile. At any moment members can decide to withdraw when support requests are too high. Why do some risk-sharing initiatives succeed, while others don't? To what extent does success depend on the individuals involved or the initiative's social and institutional properties? This dissertation answers these questions using a multidisciplinary approach. The results of agent-based simulations, abstract experiments and surveys among members of a Dutch risk-sharing organization are integrated to derive multi-faceted evidence on success factors for collective action and uncover institutional opportunities for optimizing success of mutuals.

Eva Vriens obtained her master's degree in Sociology and Social Research at Utrecht University. She conducted the present study as part of her Ph.D. research at the Interuniversity Center for Social Science Theory and Methodology (ICS), the department of Sociology, and the research group Institutions for Collective Action of Utrecht University.