THE EFFECTS OF GLOBAL AND LOCAL HETEROGENEITY ON COOPERATION IN MULTI-LEVEL PUBLIC GOODS: EXPERIMENTAL EVIDENCE

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ABSTRACT

Using an artefactual field experiment in a bilingual Swiss state with participants speaking different languages, this paper investigates how both heterogeneity and majority and minority statuses influence cooperation in a repeated multiple-level public good game in which participants can simultaneously contribute to a global good and local goods. Heterogeneity is based on language by using two native groups, German and French speakers, as our subject pool. We find that group heterogeneity has a negative effect on cooperation, which is mainly driven by a decrease in contributions to local public goods while contributions to the global good are not affected. The lower contributions to the local goods in the heterogeneous treatments are mainly due to lower contributions by majority members while the minority members contribute similar amounts to the reference group or even more. Finally, we observe that the impact of heterogeneity on contributions is magnified for individuals who are members of a linguistic minority in their real life. Our article has implications for managerial and public policy, highlighting the fact that global heterogeneity can affect cooperation behaviors in local groups, even when these are homogeneous. Furthermore, policy-makers should address majority members' concern to avoid lower levels of cooperation.

KEYWORDS

Multiple Public Goods, Artefactual Field Experiments, Social Identity, Switzerland, Heterogeneity.

JEL

C92, D02, D03, H41.

The Effects of Global and Local Heterogeneity on Cooperation in Multi-Level Public Goods: Experimental Evidence[1]

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Abstract:

Using an artefactual field experiment in a bilingual Swiss state with participants speaking different languages, this paper investigates how both heterogeneity and majority and minority statuses influence cooperation in a repeated multiple-level public good game in which participants can simultaneously contribute to a global good and local goods. Heterogeneity is based on language by using two native groups, German and French speakers, as our subject pool. We find that group heterogeneity has a negative effect on cooperation, which is mainly driven by a decrease in contributions to local public goods while contributions to the global good are not affected. The lower contributions to the local goods in the heterogeneous treatments are mainly due to lower contributions by majority members while the minority members contribute similar amounts to the reference group or even more. Finally, we observe that the impact of heterogeneity on contributions is magnified for individuals who are members of a linguistic minority in their real life. Our article has implications for managerial and public policy, highlighting the fact that global heterogeneity can affect cooperation behaviors in local groups, even when these are homogeneous. Furthermore, policy-makers should address majority members' concern to avoid lower levels of cooperation.

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1. Introduction

In many countries, people live in increasingly diverse, heterogeneous, but also polarized societies in terms of ethnicity, religion, culture, or language.[2] This diversity may stimulate productivity, economic growth and technological innovations by bringing new skills and perspectives (see, e.g., Ager and Brückner, 2013; Bove and Elia, 2017; Docquier et al., 2019). But at the same time, increased heterogeneity may affect economic development by undermining social cohesion and creating coordination costs (e.g., Alesina et al., 1999, Lazear, 1999; La Ferrara, 2003; Alesina and La Ferrara 2005).[3]

Several previous studies have also documented that ethnic diversity, and more broadly heterogeneity, can be detrimental to cooperation, inducing lower provision of public goods (e.g., Alesina and La Ferrara, 2005; Miguel and Gugerty, 2005; Drouvelis et al., 2021). This may be explained by the fact that individuals tend to favor their in-group (e.g., Tajfel et al., 1971; Bernhard et al. 2006; Charness et al., 2007; Drouvelis and Nosenzo, 2013, Balliet et al. 2014; see Hewstone et al., 2002 for a review). Other explanations rely on the fact that social groups may have taste for different public goods (Poterba, 1998), that group heterogeneity would reduce coordination (Greif, 1993), or that enforcement of social norms of cooperation through peer punishment may be more difficult in polarized societies, in which individuals do not share similar values and perspectives (e.g., Kandel and Lazear, 1992; La Ferrara, 2003; Alesia and La Ferrara 2003; Miguel and Gugerty, 2005; Herrmann et al., 2008; Gächter and Herrmann, 2011; Nikiforakis et al., 2012).[4]

Interestingly, however, other studies are more nuanced, showing that heterogeneity is not necessarily always detrimental to the public goods. Indeed, previous studies have shown that, in some cases, minimally fragmented groups may contribute more than fully homogeneous groups (Chakravarty and Fonseca, 2014; Chakravarty et al., 2016; Chakravarty and Fonseca, 2017). A possible reason behind this finding is that the presence of a single out-group minority

[2] Esteban and Ray (1994) develop the notion of polarization as an indicator for conflict based on the postulate that group "identification" and intergroup distances can be conflictual.

[3] Lazear (1999) discusses the trade-off between the gains of diversity (due to diverse skills within a production unit that may enhance overall productivity) and the potential costs that may arise from communication challenges among individuals with different languages, cultures, and backgrounds. This would suggest an optimal level of diversity.

[4] Some studies argue that, even in the absence of in-group favoritism, it can be efficient to transact preferentially with members of one's own group when market imperfections are present. The reason is that it would enlarge the set of cooperative strategies by supporting self-enforcing agreement (La Ferrara, 2003; Alesina and La Ferrara 2005).

member may make the in-group identity more salient, which in turn may lead majority members to contribute more in minimally fragmented groups (Chakravarty and Fonseca, 2014). Another possible explanation, consistent with the optimal distinctiveness theory, is that (single) minority members may feel a high desire of inclusiveness into the group and thus contribute more (e.g. Leonardelli, 2010; Chakravarty and Fonseca, 2014).[5]

In this paper, we attempt to contribute to the existing literature by providing new experimental evidence on how heterogeneity affects cooperation in the context of overlapping public goods.[6] The originality of our study is twofold. First, to the best of our knowledge, our paper is the first to investigate the role of both global and local heterogeneity in the context of a multi-level public good, where individuals can simultaneously contribute to both a local and a global good. Indeed, as underlined by Gisselquist, Leiderer, and Niño-Zarazúa (2016), most of the theories and empirical evidence pointing out to negative effects of social diversity on cooperation focus on a single level of public good and neglect the fact that decisions made by individuals at the global and local levels interact with each other.

In particular, relying on multi-level public good games allows us to test whether individuals facing two public goods engage in arbitrage in favor of the most homogeneous public good.[7] For instance, are individuals likely to prefer contributing to the local public good when the local group is homogeneous, but the global group is heterogeneous? Interestingly, little is known about the extent of inter-group cooperation in the context of multi-level public goods games. Moreover, in contrast with the existing literature, we assume that both local and global public groups can be heterogeneous. Investigating multi-level contexts constitutes a major issue as in their day-to-day life, individuals often interact with others within a multitude of sometimes overlapping groups, such as work teams in companies, or municipalities and states. At the same time, they often belong to a multitude of identity groups based on, for example, language, ethnicity, or gender. The superposition of these identity groups and interaction groups can

[5] The optimal distinctiveness theory in social psychology posits that minority members may express their willingness to cooperate due to their need for assimilation or inclusion in the groups (Brewer, 1993). Note that our current study does not seek to identify these different forces but rather to measure the net effect of heterogeneity. It is beyond the scope of this paper.

[6] The advantage of using an experiment is to circumvent the difficulty with observational data to clearly disentangle the role of the co-existence of minority and majority identities on public good provision from other factors (e.g., Gächter, 2007).

[7] We define a homogeneous public good as a good provided by individuals belonging to the same homogeneous linguistic group.

sometimes result in situations in which an individual might belong simultaneously to a minority identity group and to a majority identity group, depending on the perspective taken.

Our paper is related to Chakravarty and Fonseca (2017) who run an experiment where subjects can contribute to both a local good and a pure public good and vary group identity. However, the main difference between our study and that of Chakravarty and Fonseca is that their research focuses on a club good where participants decide on excluding others, whereas in our current paper, both goods are non-excludable. Our paper is also closely related to Gallier et al. (2019) who investigate how group favoritism impacts the efficiency of multi-level public goods provision through an inter-neighborhood experiment. Their findings show that participants tend to favor their own neighborhood, influencing their contributions to local versus global public goods. In their study, identity is induced by informing participants of their shared attachment to their neighborhood (the smaller group) and their region (the larger group). In contrast, our study induces identity through language as a proxy for cultural differences. Additionally, we do not aim to test for parochialism since the Marginal Per Capita Return (MPCR) for the local good is higher than for the global good.

A second originality of our paper is that it goes beyond the investigation of the impact of group fragmentation on cooperation by testing the role of minority and majority statuses. This allows us to test in more detail whether the effects of fragmentation result from a change in behavior by minorities, majorities, or both. Specifically, we investigate to what extent individuals belonging to the minority or to the majority are more likely to reduce their contribution compared to individuals in the homogeneous group. Surprisingly, the literature analyzing the effects of minority and majority status on cooperation is scarce. A few exceptions are Smith (2011) and Chakravarty and Fonseca (2014), who provide mixed evidence. Furthermore, to the best of our knowledge, there are no previous studies on the role of minority vs. majority status in the context of multi-level public goods in which individuals can have different majority and minority statuses in each group.

In our experiment, unlike previous experimental studies that have investigated in-group favoritism using the minimal paradigm (Tajfel et al. 1971)[8], group membership is based on

[8] There is a large existing literature in psychology on in-group favoritism mostly inspired by social identity theory and minimal group experiments (i.e. Tajfel, 1982). Social identity theory is presented in Tajfel et al. (1971) and was originally developed to understand the psychological basis of intergroup discrimination. According to social identity theory, social identity is the individual's self-concept derived from perceived membership in social groups.

language as a proxy for culture by using two native groups in the canton of Valais in Switzerland, French and German speakers, as our subject pools. Historically, around the world, language identity has been an important factor of sub-group identity formation, and a growing literature indicates that culture, generally approximated by language, plays an important role in economically relevant decisions (Alesina and La Ferrara, 2005; Desmet et al., 2009, 2012; Eugster et al., 2011, 2017; Guin, 2017; Brown et al., 2018; Erhardt and Haenni, 2018; Lapointe, 2018). At the cantonal level, German speakers are in the majority while French speakers are in the minority. These two linguistic groups exhibit different local customs and social norms. The German-speaking minority, originating from Upper-Valais, has a strong social identity but also share similar socio-economic characteristics. For that reason, we argue that the canton of Valais is an appropriate environment for studying social sub-group identity and the effect of group affiliation on cooperative behaviors. Furthermore, to reinforce the homogeneity in terms of socio-economic characteristics, we chose participants from among students attending the same applied science university. Most of the experimental literature on heterogeneity that use real identity groups do so in contexts where there is current conflict or a recent history of conflict. In contrast, our paper uses identity groups in Switzerland, where the two groups in the experiment have co-existed peacefully for a long time. One exception is the paper by Espinosa et al. (2019), which compares the role of heterogeneity in contexts with and without conflict in Spain (also using language as a marker of cultural diversity).

Our experimental design consists of four treatments. Our baseline treatment (called *French homogeneous* treatment) is based on a repeated multi-level public good game composed of a global group and two sub-groups (local groups). At each period, participants can allocate their initial endowment into three different accounts: *i*) a private account (i.e., not contributing to the group accounts); *ii*) a local public group account; and *iii*) a global public group account. In this treatment, the global group is composed of members belonging to the same group identity according to their mother tongue (i.e., French language). The *German homogeneous* treatment is similar to the previous treatment except that all group members are German speakers.

The experimental method designed to test the theory is driven by the search for the minimal group. Previous studies have examined how ingroup favoritism differs across natural or artificial identities. Using a meta-analysis and using different sets of games, Balliet et al. (2014) find no significant difference for in-group favoritism across natural and artificial identities. By contrast, Lane (2016) and Eckel et al. (2022) find that real groups can lead to stronger or weaker in-group favoritism than minimal groups, depending on the specific context. Precisely, Lane (2016) finds that, for ethnic or gender-based natural groups, favoritism is weaker than for minimal groups, while the opposite holds for social and geographical groupings where favoritism is stronger than for minimal groups.

In the remaining treatments, we exogenously introduce heterogeneity by varying the relative number of German and French speakers. Specifically, in the treatment called "*Low Heterogeneity*", one member of one local group is a German speaker and has a minority status at both the local and global level, while the remaining members are French speakers and thus have a majority status at both levels. Finally, in the treatment called "*High Heterogeneity*", we increase heterogeneity by increasing the number of German speakers at both the local and global levels, and thus have subjects with a conflicted majority status (i.e., they are in the global majority but local minority, or vice versa).

To anticipate our findings, we find that group heterogeneity has a negative effect on cooperation, which is mainly driven by a decrease in contributions to local public goods while contributions to the global good are not affected. Interestingly, a more detailed analysis shows that the decrease in contributions to heterogeneous local goods results from local majority members rather than minority members. More precisely, in the heterogeneous treatments, majority members contribute less to the local goods while the minority members contribute similar amounts compared to the reference group or even more. We also find that German speakers are much more cooperative than their French counterparts in homogeneous groups. However, they contribute on average the same as the French speakers when they interact in heterogeneous groups. Finally, we observe that the impact of heterogeneity on contributions is magnified for individuals who are members of a linguistic minority in their real life.

The paper is organized as follows. In the following section, we give an overview of the literature. In Section 3, we present the institutional background, our experimental design and our procedures. In Section 4, we discuss details on the hypotheses that we test in the paper. In Section 5, we present our main results. Finally, Section 6 concludes.

2. Related literature

Our paper lies at the crossroads of three different strands of the literature on the effects of group composition on public good provision: *i*) Social and ethnic fragmentation, *ii*) minority and majority status, and *iii*) multi-level public goods.

2.1. Cooperation in multi-level public goods

Our paper contributes to the experimental literature on multi-level public goods.[9] It is closely related to Blackwell and McKee (2003), Cherry and Dickinson (2008), and Buchan et al. (2009, 2011). Blackwell and McKee (2003) run a series of experiments on public goods where the participants have to decide how much of their endowment to contribute to a global public good of twelve players or to a club good of four-players. The authors varied the MPCR to the global public good between four values (0.1, 0.15, 0.2 or 0.3) while the MPCR to the club good was always equal to 0.3. The authors find that the participants contribute more to the global good than to the club goods for most of the cases except when MPCR of the global good equals 0.1. In the context of a voluntary contribution mechanism, Fellner and Lunser (2008) experimentally investigate the tension that arises when subjects belong to a smaller local and a larger global group. Precisely, the authors compare two different conditions: one in which both goods are socially equally efficient and a second where the global good is socially more efficient than the local good. They find that when both the local and the global goods have the same efficiency, subjects contribute more to the local group. In contrast, when the global good is more efficient, individuals are more likely to contribute to the global good during the first periods. However, this tendency unravels over time and cooperation in the local public good tends to substitute to cooperation to the global good.

Chakravarty and Fonseca (2017) run an experiment where subjects can contribute to a local good in addition to a club good. In their experiment, the authors vary both the size of the MPCR and group identity.[10] They find that total contributions are higher when a local good is available

[9] Another strand of the literature deals with the so-called "unpacking effect." Cherry and Dickinson (2008) investigate multi-level public goods. The baseline is a standard treatment with a single public good. In the other treatments, subjects may contribute to three different public goods. In one treatment, all public goods have the same MPCR while in another treatment, all three public goods have different MPCRs. The authors find that total contributions are higher when participants can contribute to multiple public goods. In the same vein, Bernasconi (2009) shows that subjects' total contributions increase when a single public good is split into two identical public goods.

[10] Precisely their experiment consists of two parts. In the first part participants self-select into one of two social groups depending on their choices in a task (preference for painting) to form group membership, in the tradition of the minimal group paradigm (Tajfel *et al.* 1971). In the second part of the experiment, participants play a six-player cooperation game in which three subjects belong to one social group and the other three belong to the other group. At each period, participants must decide how to allocate their endowment either in the i) global public good, where returns are divided equally between the six players; ii) in the club good, whose returns are divided equally between the three players from their group or in iii) their private account. The authors vary two dimensions. The first dimension is the size of the MPCR of the club good. The second dimension is the composition of the groups in term of social identities that was either homogeneous (i.e., all six subjects belong to the same social identity group), or heterogeneous (i.e., three subjects were one identity type and the other three were another type). In a first treatment condition, the MPCR of both public and club goods is equal to 0.4. In *a second treatment* condition the MPCR of the club good is equal to 0.8, while the MPRC of the public good is equal to 0.4. In addition, the

than when subjects can only contribute to the global public good, and that individuals contribute more to the local club good even when returns to contributions to the global public good financially dominate those to the local good. In addition, the authors observe strong in-group effects (i.e., strong positive in-group reciprocity) and that subjects exploit the substitutability between the club good and the public good contributions, with subjects responding to lower out-group member contributions to the global public good by contributing more to their club good. Our paper is close to Chakravarty and Fonseca (2017) with the notable exception that in our current paper, both goods are non-excludable.

Kesternisch et al. (2016) run an online artefactual field experiment with participants of two municipal districts from two neighboring German cities. The experiment consists of a multiple level public good with a regional and a local public good. The treatment dimension of the experiment is the social efficiency of the local and regional public goods. The authors observe that participants are likely to substitute contributions away from the local to the regional public good if the latter is more efficient. When the common local affiliation is revealed through a label, participants perceiving a strong local identification adjust their contribution behavior and contribute more to the excludable local public good. Gallier et al. (2019) run another artefactual field experiment within the framework of a nested public good game. They find evidence of the existence of parochialism since participants contribute relatively more to the local public good although the upper-layer public good has a higher expected payoff. However, and surprisingly, individuals' behaviors and the extent to which they contribute more to their local group seem not to depend on whether local groups are composed of individuals belonging to the same neighborhood or of different neighborhoods.

Beekman et al. (2015) run a laboratory experiment and use a multi-level public good game for measuring cooperation within- and between-groups. More specifically, they study how cooperation is affected by the group members' experience of a prior phase of conflict. The authors find that within-group cooperation increases when groups have a shared history of conflict compared to when they play the multi-level public good without any prior history, while between-group cooperation diminishes when two groups have previously been in conflict. The authors do not find a significant response to an increase in the return to between-

authors ran two control treatments. The first control treatment is similar to the previous treatment except that there is no identity manipulation. The second control treatment introduces social identities with three subjects of each group, but subjects could only contribute to a single public good shared by all six subjects.

group cooperation when there has been a prior history of conflict between the groups, which is contrary to the results of previous studies that induce weaker forms of group identity.

Finally, in a slightly different perspective, Buchan et al. (2009) ran a public good experiment conducted in six different countries. Participants were affected to groups of 12 subjects and could contribute to either a global public good with an MPCR of 0.25 or to a local public good with an MPCR of 0.5, shared only by players in the same country. Interestingly the authors find that participants belonging to more globalized societies were more likely to contribute to the global public good. In a related paper, Buchan et al. (2011) find similar results, showing that participants are more likely to contribute to the global public good when they identify more closely with the global identity.

2.2. Social fragmentation and prosocial behaviors

The second literature our paper contributes to is the one on social fragmentation. Indeed, we compare cooperative behavior in groups of different configurations, ranging from perfect homogeneity to strong heterogeneity. For the last decades, economists have investigated how social identity related to ethnicity, religion or language can affect behaviors relevant for the process of economic decision-making (e.g., Akerlof and Kranton, 2000; Bowles and Gintis, 2004). There is previous empirical evidence showing that social and ethnic fragmentation may be detrimental to the contributions to public goods (e.g., Easterly and Levine, 1997; Alesina et al., 1999; Miguel and Gugerty, 2005; Habyarimana et al., 2007).

Using US data, Alesina et al. (1999) find a negative relationship between ethnic fragmentation and the provision of public goods.[11] In the same vein, Khwaja (2009) observes that social heterogeneity is detrimental to the maintenance of public projects in rural Pakistan. Miguel and Gugerty (2005) show that schools in communities in Kenya with high fragmentation benefit from lower funding levels than schools in more homogenous communities. There are also a number of experimental papers in the same vein. For example, using a series of experimental games run in Uganda, Habyarimana et al. (2007) observe that ethnic diversity undermines public goods.[12] Altogether, these studies shed light on the existence of a negative relationship

[11] Alesina et al. (1999) showed that in US cities the share of spending on productive public goods like education or roads is inversely related to the city's ethnic fragmentation.

[12] Additional experimental evidence show that group membership might affect subjects' behavior in various contexts, including public good games (Eckel and Grossman, 2005; Tan and Bolle, 2007), bargaining games (Hargreaves Heap and Varoufakis, 2002; Zizzo, 2003), trust games (Hargreaves Heap and Zizzo, 2009), coordination games, prisoner's dilemma (Charness et al., 2007; Goette et al., 2006), and two-person sequential games (Chen and Li, 2009). Overall, economic experiments show that group membership leads to more within-group cooperation.

between ethnic heterogeneity and public goods provision. A possible reason behind this finding is that different social groups may dislike sharing a public good with one another (Luttmer, 2001). This would imply that individuals in a social group composed of sub-groups of different identities might prefer contributing to public goods mostly accessible to the sub-group they identify with.

Interestingly, some studies find, however, that fragmentation is not always detrimental to cooperation and/or that the relationship between fragmentation and cooperation is non-linear (Chakravarty and Fonseca, 2014; Chakravarty et al., 2016). Chakravarty and Fonseca (2014) use a six-player public good game to study the effects of social fragmentation and social identity on public good provision. The authors vary both the degree of fragmentation and group identity.[13] The main treatment condition is the degree of social fragmentation, which varies from fully homogenous (all six members belonging to the same identity group) to fully fragmented (three members of each social group). More precisely, the authors consider four different treatments: homogeneous games with six players of the same type (6/0) and three treatments varying the degree of heterogeneity (5/1, 4/2, 3/3) In addition, the authors ran a control treatment where they did not induce identity. Chakravarty and Fonseca (2014) confirm that increasing fragmentation generally leads to lower contributions to the public good. However, the authors show that the relationship between contribution and the degree of fragmentation is non-linear. In particular, the authors find that participants contribute most when there is a single out-group member (i.e., a 5/1 configuration) constituting a small minority. They interpret this finding as having a minority member making more salient the existence of different social groups, consequently triggering a sense of belonging to a group, which in turn translates into an increase in the willingness to contribute to the public good. In other words, having a minority player made more salient the idea of belonging to the majority group. Consequently, as the positive in-group bias dominates the negative out-group bias in a low fragmentation case, the net effect is a higher public good provision.

Our paper is also related to Chakravarty et al. (2016) who ran an artefactual field experiment in India to investigate the effect of religious identity among Hindu and Muslim groups by varying the way participants are matched with each other's in a prisoner's dilemma and a stag hunt game. The treatments are the religious identity of the two individuals as well as the degree of

[13] In their experiment, there are two social identities constructed in the spirit of the minimal group paradigm (Tajfel et al., 1971). Precisely participants had to select their social group based on their preferences for paintings by two artists (Klee or Kandinsky).

village-level religious heterogeneity. Interestingly, the authors do not find that fragmentation lead to lower cooperation. They even find the opposite. More precisely, residents of religiously heterogeneous villages are more cooperative than those who reside in homogeneous villages. The increase in cooperation is due to higher cooperation rates between in-group members. Indeed, in fragmented villages, social identity is reflected through greater in-group favoritism rather than out group prejudice.

2.3. Minority versus Majority Status

Our paper goes beyond the effects of group fragmentation on cooperation by investigating the role of minority and majority statuses of individuals within a group. The literature analyzing the effects of minority and majority membership on cooperation is surprisingly very scarce. To the best of our knowledge, a few exceptions are Smith (2011) and Chakravarty and Fonseca (2014). Smith (2011) looks at the impact of diversity in a six-player public good game, ranging from low levels of diversity (five players from one social group and one of the other) to high (three players from each group). The author finds that in heterogeneous groups, players belonging to the majority contribute more than those in the minority.[14] Chakravarty and Fonseca (2014) do not find significant differences in individual contributions between minority and majority members but only when individual information over contributions is available. However, when only aggregate information is provided so that contributions cannot be singled out, minority members contribute significantly less than majority members.[15]

[14] Interestingly, minority members' contributions are positively correlated with their beliefs about majority members' contributions, but the opposite is not true.

[15] The literature in psychology has long laid emphasis on differences in behaviors between members of numerically minority and majority groups. This strand of research mainly focuses on discrimination issues (see Leonardelli and Brewer (2001) for a survey of this literature). What emerges from this line of research is that members of numerically smaller (minority) groups exhibit more in-group bias and discriminate more than members of numerically larger (majority) groups. One explanation is that discrimination by minority group members may reflect the insecurity associated with categorization in a relatively disadvantaged or vulnerable group; majority group members, by contrast, discriminate less because they find security in their group size and have less need to increase the level of in-group advantage. A second explanation is that discrimination by minority group members reflects the greater in-group salience associated with their smaller size: members who belong to these more salient minority groups will discriminate more than members of majority groups simply because minority members are more focused on the in-group than are majority group members. This later explanation is consistent with the theory of "optimal distinctiveness" (Brewer, 1991; 1993).

3. Institutional Background, Experimental Design and Procedures

3.1. Institutional Background

In this subsection, we briefly describe the context of our artefactual field experiment. Switzerland is characterized by a decentralized federal system with three layers of government: Federal, Cantonal, and Municipal (also called Communes). It includes 26 cantons of different cultures and languages, enjoying a relatively high level of independence from the federal government (Kriesi and Trechsel, 2008). Switzerland is a multilingual country with four national languages: 63% of Swiss citizens speak German (more precisely, German speakers in Switzerland speak a variant of the Swiss German dialect), 23% French, 8% Italian, and less than 1% speak Romansh (Swiss Federal Statistics Office, 2016). Historically, three bilingual (French-German) Cantons exist in Switzerland: Bern, Fribourg, and Valais. While German is the majority language at the national level, it is a minority language in some cantons. In the canton of Valais, for example, 68% of the population speak French and 25% speak (Swiss) German. In that canton, then, a German speaker would be part of the national majority, but in the linguistic minority at the cantonal level.[16] An important point to note is that the German-speaking population of Upper Valais has a very strong identity resulting both from their local dialect ("Walliser" German), which is older than most of the other Swiss dialects, and from the mountain geography of the Upper Valais.

Individuals living in a bilingual canton experience the same political and institutional environment while belonging to different language groups. This characteristic makes the Canton of Valais an interesting natural laboratory to study social interactions across different linguistic groups. Indeed, individuals in that region regularly interact in their daily lives with others in multiple overlapping groups, in which their own identities make them either part of the minority or the majority.

In our analysis, we focus on students at the University of Applied Sciences, located in Sierre (Sieders), a bilingual city in Valais. In Sierre, the population also predominantly speaks French (78% of the population speaks French while 12% speaks German).[17] Furthermore, the

[16] At the country level, aside from language, different sub-group identities might exist along religious, cultural, or, more broadly, ethnic identities. However, sub-group identities also exist in the everyday work life. Indeed, work teams are often heterogeneous and composed of individuals from different genders or cultures belonging to the same work team. In addition, in the business world, individuals interact with different teams, so that one might belong to the majority in one team, and in the minority in another team.

[17] Swiss Federal Statistics Office (2017): https://www.bfs.admin.ch/bfs/fr/home/statistiques/statistique-regions/portraits-regionaux-chiffres-cles/cantons/valais.html

composition of the students of the University of Applied Sciences is similar to the language composition of the population of Sierre with a great majority of French-speaking students. Finally, note that German-speaking and French-speaking students study in different buildings of the campus and do not interact much with each other.

An important point in our study is that we do not systematically position French speakers as the majority group at the local level and German speakers as the majority group at the global level. Instead, we intentionally place them in situations that sometimes contrast with their real-life experiences. It may be important to place individuals in situations contrary to what they experience in real life when testing the effect of being a majority or minority in an experiment for several reasons. First, by reversing the roles, we ensure that observed differences are due to the experimental condition (majority vs. minority) rather than preexisting factors while keeping natural identity. Second, placing individuals in roles opposite to their everyday experience helps to better understand how the status of being a majority or minority influences their decisions and behaviors. This helps isolate the psychological and behavioral effects associated with each status. Third, individuals who are always in the same role (majority or minority) may have biased responses due to their habits or social expectations. By placing them in an opposite role, we can observe more authentic behaviors and reduce biases associated with their usual role.

In the final section of the result section, we will examine whether real-world status (being a minority or majority in real life) affects decisions. Interestingly, our results suggest that the effects of heterogeneity are magnified for individuals who are minorities in real life.

3.2. Experimental design

3.2.1. The Baseline Treatment

In our experiment, subjects play an eight-player multi-level public good game. At the beginning of each session, the program randomly forms groups of eight subjects. Each group of eight subjects consists of two (also randomly formed) sub-groups of four subjects. We name a group of eight subjects a “global group” and a sub-group of four subjects a “local group”. Thus, each subject belongs both to a local group with three other subjects and to a global group that includes her or his local group members and the four members of the other local group. In other words, four subjects belong to one local public group and the other four participants belong to the other local public group, but all together form the global public group.

Each session consists of 10 periods. In every period, subjects receive an endowment of 20 ECU (Experimental Currency Units). They can allocate any portion of their endowment in any of three ways: *i*) the private account (participants can keep their endowment to themselves), *ii*) the global public group account, whose returns are divided equally between the eight players; *iii*) the local group-specific account, whose returns are divided equally between the four players from their local group. The marginal per capita return (MPCR) of the global public good is 0.2 and the MPCR of each local public good is 0.4, which allows us to keep the social return similar in both the local and the global public good (i.e., 0.2*8=1.16 in the global public good and 0.4*4=1.16 in the local public good).

The payoff of each individual *i* is given as follows:

$$\pi = y - c_i^{g,b} - c_i^l + a\sum_{j=1}^{8} c_j^g + b\sum_{j=1}^{4} c_j^l \qquad (1)$$

Where *y* is the initial endowment, *a* is the marginal per capita return (MPCR hereafter) from the global public good (with a=0.2 and $0<a<1<8a$) and *b* is the MPCR from the local public good (with b=0.4 and $0<b<4b$).

The main dimension of our study is social identity. Instead of using the minimal paradigm to create the experimental groups, we exploit real linguistic identities of participants (German-speakers and French-speakers) to form identity groups.

In the baseline treatment, both local groups, and thereby the global group, are composed of members belonging to the same identity group defined according to their mother tongue; all participants are French speakers. This baseline is shown in Figure 1a.

[Figure 1a: about here]

It is common knowledge that the composition of local and global groups remains unchanged throughout the session (i.e., *partner* matching). The participants are also informed of the composition of their groups.

3.2.2. All German Treatment

Our second treatment (called the "All German" treatment, hereafter *AllGerman*) is similar to the baseline except that both local and global groups are homogenous and composed of German speakers only. Comparing this treatment to the baseline allows us to check whether there exists a pure identity effect, independent of the minority-majority status dimension.

[Figure 1b: about here]

In the remaining treatments, we introduce heterogeneity in both the local and global groups by mixing language groups and varying the number of participants from one linguistic group. We compare contributions in these heterogeneous treatments to the French baseline, since French speakers always remain a majority in global groups. Therefore, these comparisons allow us to isolate the impact of the minority-majority status dimension, independent of the pure identity effect mentioned above.

3.2.3. Low Heterogeneity Treatment

In the treatment called "Low Heterogeneity" (hereafter *LowHet*), one member of one local group has a minority status at both the local and global level, implying that all other members have a majority status at both levels. Concretely, in our design, this translates to global groups of eight where seven members are French speakers and have a majority status, and one member is a German speaker and has a minority status. At the local level, one local group out of the two (called local group 2 in Figure 1c) is composed of three French speakers and one German speaker, while the other local group (local group 1) is composed of four French speakers. As such, French speakers in this treatment have a majority status in both local groups and the German speaker has a minority status in the local group he belongs to, as shown in Figure 1c.

[Figure 1c: about here]

3.2.4. High Heterogeneity Treatment

In the treatment named "High Heterogeneity" (hereafter *HighHet*), we increase the number of German speakers from one to three in one of the two local groups, keeping the other local group uniquely composed of French speakers. Concretely, this translates to global groups of eight where five members are French speakers, and three members are German speakers. As a result, at the global level, this treatment is similar to the first treatment: French speakers have a majority status and German speakers have a minority status. At the local level, however, one local group (local group 2) is now composed of one French speaker and three German speakers while the other local group is homogeneously composed of four French speakers (local group 1) . Consequently, at the local level, the French speaker has a minority status in the mixed local group, while the three German speakers have a majority status (see Figure 1d). The other local group is composed only of French speakers.

[Figure 1d: about here]

3.3. Procedures

The experiment consists of 11 sessions conduced at the University of Applied Sciences located in Sierre, Switzerland, where students were recruited using the ORSEE software (Greiner, 2015). In total, 184 students participated (48 for each of the treatment except for the Baseline in German where 40 participants took part in the study), and three sessions were conducted for each treatment. 58.15% of the participants are females and the mean age is 23.04 years (S.D. = 3.09) with no significant differences of demographics across treatments. The experiment was computerized using zTree (Fischbacher, 2007). Table 1 below presents characteristics of the experimental sessions. Upon arrival, subjects were randomly assigned to a computer after drawing a tag from an opaque bag. Instructions (see Appendix 1 for instructions translated in English)[18] were distributed at the beginning of each part and read aloud. [19] On average, a session lasted 90 minutes, including payment. Subjects were paid the sum of their earnings in each period, at the rate of 100 ECU = 5.00 CHF. In addition, they were paid a 10.00 CHF show-up fee. On average, they earned 23.95 CHF (S.D.=2.68). Payments were made in cash and privately in the back of the room.

[Table 1: about here]

4. Theoretical Predictions

Standard theoretical predictions are straightforward: if individuals are rational, selfish, and utility maximizers they should never contribute to any public goods and thus keep their endowment for themselves. Since the game is repeated a finite number of periods, the same predictions apply for all periods.

However, based on previous studies, we can reasonably expect that contribution levels will be strictly positive in both public goods and decline over time. Indeed, previous experimental studies have documented two strong empirical regularities in public goods experiments: (*i*) the fact that people contribute more than the standard theoretical predictions; and (*ii*) that average contribution declines over time when the game is repeated (see Ledyard, 1995; Andreoni, 1995;

[18] Instructions were first read completely by a bilingual organizer in one language, then in the other. The order of the languages was changed for every other session.

[19] Before playing the repeated public good game, players participated in a dictator game and a trust game (using the strategy method). These games are not used in this current paper. Participants were informed of their payoffs for each game only at the end of the experiment.

Croson, 1996; Gachter and Fehr 1999; Keser and van Winden, 2000; Herrmann, Thoni, and Gachter, 2008).[20]

More importantly, we conjecture that *ceteris paribus,* local public goods may be more attractive than global public goods. Indeed, although both local and global goods provide the same maximum social payoff, the private marginal per capita return (MPCR) is higher in the local good (0.4) than in the global good (0.2). As a result, subjects should contribute more to the local public good than to the global public good (Fellner and Lunser, 2014; Chakravarty and Fonseca, 2017). Furthermore, several previous studies have shown that cooperation in public goods game is higher in small groups because free riding is easier to detect (Isaac and Walker, 1988; Isaac, Walker, and Williams, 1994). Our first conjecture is reflected in Hypothesis 1.

Hypothesis 1 – *In all treatments, individuals contribute significantly more to the local public good than to the global public good.*

Our second set of hypotheses refers to comparisons across treatments and relates to the literature on the effects of group homogeneity and heterogeneity on cooperative behavior.

Several previous studies have shown that heterogeneity may be detrimental to cooperation to public goods (e.g., Alesina and La Ferrara, 2005; Miguel and Gugerty, 2005; Drouvelis et al., 2021). In line with this existing literature, we may reasonably conjecture that introducing heterogeneity will lead to lower overall contributions to public goods. One reason often mentioned for this is in-group favoritism (e.g., Tajfel et al., 1971; Charness et al., 2007; Drouvelis and Nosenzo, 2013, Balliet et al. 2014; see Hewstone et al., 2002 for a review). Heterogeneity may then reduce contribution levels because individuals refrain from cooperating when the group includes outgroup members.[21] Thus, an obvious possible conjecture to draw is that heterogeneity will reduce cooperation due to intra-group favoritism. However, some studies seem to partially contradict these findings by showing that fragmentation can generate more cooperation when it is minimal. (Chakravarty and Fonseca,

[20] The main explanation generally evoked in the literature to explain why contributions are positive and decline over time with repetition is rooted in social preferences, more precisely in conditional cooperation, i.e., the fact that people choose to cooperate, depending on previously observed decisions of others or on beliefs about their decisions (e.g., Keser and van Winden, 2000; Fischbacher, Gachter, and Fehr, 2001; Croson 2007, Fischbacher and Gachter, 2010). Contributing may also be explained by the desire of individuals to avoid feeling guilty – feeling guilt being the "flip-side of the warm glow" (Andreoni et al., 2017). Besides, by analogy with investment decision-making, contributors who are risk-averse over the expected social value of contributions, given the possible free-riding behavior of their partners, might choose to diversify the risk by contributing to several (here two) public goods.

[21] Alternatively, different social groups may also dislike sharing a public good with one another (Luttmer, 2001). Another possible reason is that different social or ethnic groups may prefer different public goods (Poterba, 1998)

2014; Chakravarty and Fonseca, 2016; Chakravarty et al., 2016). According to Chakravarty and Fonseca (2017), this may be because "an in-group affiliation is a powerful driver for cooperation, such that some diversity may be beneficial; however, such an affiliation only works in the presence of an out-group." In other words, the presence of a single out-group minority member may make the in-group identity more salient, which then may lead majority members to contribute more in situations with minimal fragmentation (Chakravarty and Fonseca, 2014). This may also stem from the fact that in weakly fragmented groups, minority members may express their desire for inclusion by cooperating more (e.g., Leonardelli, 2010; Chakravarty and Fonseca, 2014).[22]

Altogether, these previous findings suggest that the effect of heterogeneity may be nonlinear. Precisely, we conjecture that when the level of fragmentation is very high (as in our *Highhet* treatment), the level of cooperation may be lower than in the homogeneous treatment primarily due to a bias of favoritism. Conversely, we may reasonably suggest that a low level of fragmentation (as in the *Lowhet* treatment) may lead to higher levels of cooperation compared to the homogeneous treatment by making the identity of the majority group more salient.

While this non-linearity of the effect of heterogeneity has been observed in linear public goods games, less is known regarding this relationship in the context of multi-level public goods. Indeed, in the context of multi-level public goods, we must consider an additional complexity due to the possibility that individuals may engage in arbitrage and substitute their contribution towards the most homogeneous local public good in the presence of a heterogeneous global public good.

Our conjectures are summarized as follow:

Hypothesis 2 – *(a) Highly heterogeneous groups (HighHet) contribute less to public goods than fully homogeneous ones. (b) Minimally heterogeneous global groups (LowHet) contribute more to public goods than fully homogeneous ones. (c) Heterogeneity in the global group favors contributions to the homogenous local public good instead of the heterogeneous global good.*

[22] This is the idea developed by the optimal distinctiveness theory in social psychology. This theory asserts that individuals desire to attain an optimal balance of inclusion and distinctiveness within and between. We use the term Optimal Distinctiveness Hypothesis as a catch-all term to describe these potential effects. However, we acknowledge that our study does not allow us to isolate these different factors—the salience effect from the optimal distinctiveness effect.

We will test Hypothesis 2a and 2b by comparing contribution levels across our main treatments: *Baseline*, *LowHet*, and *HighHet*. Indeed, if our hypothesis is correct, we should find higher contributions in the baseline than in the *HighHet* treatment but also higher contributions in the *LowHet* treatment than in the *Baseline* treatment. Furthermore, we will test hypothesis 2c by checking whether global heterogeneity leads to a transfer of contributions toward the homogeneous local good in the *LowHet* and *HighHet* treatments (i.e., higher contributions in the local good and reduced contributions in the global good).

Our third hypothesis is more exploratory and investigates how the majority or minority status affects individual contributions in the heterogeneous treatments (i.e., *LowHet* or *HighHet*). It takes advantage of the fact that our experimental setup also allows one additional level of disaggregation. Indeed, within a local group, different individuals experience different minority statuses. For example, in the *LowHet* treatment, the heterogeneous local group includes one subject who is in the local and global minority, and three individuals who are part of both majorities.

There is only a scarce empirical literature looking at majority and minority status and contributions to public goods. For example, Smith (2011) looks at the impact of diversity in a six-player public good games, ranging from low levels of diversity (five players from one social group and one of the other) to high (three players from each group). He finds that minority players contribute less than majority ones. Chakravarty and Fonseca (2014) find the same result but only when minority members' actions are not identifiable by the other participants in the public good game. In our experiment, however, individuals can have different majority and minority statuses in each group, which makes individuals' behavior more complicated to anticipate.

To analyze these questions, we will turn to individual-level regressions. These estimations will account for the type of local and global group experienced by each subject, and for the interaction with their minority status within each group. Given how our experimental setting differs from the previous literature, it is difficult to make precise predictions. We can however formulate the following exploratory hypothesis:

Hypothesis 3 (Majority versus minority) – *Majority members in heterogeneous groups contribute more than minority members.*

5. Results

We begin the data analysis with aggregate-level descriptive statistics on the average contributions in our different treatments. Then, we explore individual-level data to better understand the impact of (global and local) group heterogeneity on contributions to the nested public goods.

5.1. Aggregate-Level Results

Figure 2 shows the trends in average total contributions to both types of goods over the 10 periods for each treatment. Figures 3 and 4 show the same trends, but for the global and local goods, respectively. Table 2 displays the average contribution over the ten periods to the different goods by treatment. Consistent with previous findings, these figures and that table show that subjects contribute to both public goods and that contributions decrease over time.

[Table 2: about here]

Table 2 also indicates that, in all treatments, subjects contribute more to the local goods than they do to global goods, which confirms Hypothesis 1.[23] This is not surprising since the MPCR of the local good is higher than the global good and the social payoffs of both public goods are the same in our experiment (Blackwell and McKee, 2003; Fellner and Lünser, 2014). Furthermore, the literature in experimental economics suggests that cooperation in public goods games is higher in small groups because free riding is easier to detect (Isaac and Walker, 1988; Isaac, Walker, and Williams, 1994). These findings are summarized as follow:

Result 1 – *In all treatments, subjects contribute more to the local goods than they do to global goods.*

Next, we consider differences across treatments. First, Table 2 and Figure 2 show that on average, total contributions (i.e. the sum of the contributions to both local and global goods) are higher in the *AllGerman* treatment than in the French baseline, suggesting the existence of a pure identity effect. A Mann-Whitney test using global groups as independent observations

[23] Contributions to local public goods amount to 74%, 61%, 64% and 63% of total contributions to public goods in the French Baseline, the *AllGerman* treatment, the *LowHet* treatment, and the *HighHet* treatment, respectively. Simple *t*-tests comparing the 10-period averages confirm that differences in contributions to the global good and to the local good are statistically significant at the 1 per cent, 5 per cent, and 10 per cent level for the French baseline (p=0.001), *LowHet* treatment (p=0.012), and *HighHet* treatment (p=0.070), respectively. However, the contributions to the two types of goods are not statistically different in the *AllGerman* treatment (p=0.11).

indicates that this difference is borderline significant only (p=0.10; two-tailed).[24] Regarding the effect of heterogeneity on contributions, Table 2 and Figure 2 indicate that the average total contributions are lower in the *Lowhet* and *HighHet* treatments than in the baseline. However, these differences are not statistically significant (p=0.15 for LowHet vs baseline and p=0.26 for HighHet vs baseline; two-tailed).[25]

[Figure 2: about here]

After examining the levels of total contributions, we now look in more detail at contributions to the global public good and then to the local public good. Regarding contributions to the global public good, Table 2 and Figure 3 indicate that average contributions to the global good are significantly higher in the *AllGerman* treatment than in the French baseline (p=0.018). Our data also show that average contributions to the global good in the heterogeneous treatments are not significantly different from those in the French baseline (p=0.63 for *LowHet vs* baseline and p=0.42 for *HighHet vs* baseline). Moreover, we also do not find a significant difference between the *LowHet* and *HighHet* treatments (p=0.87).

[Figure 3: about here]

Finally, we consider differences in contributions to the local goods. Figure 4 and Table 2 show that no significant difference is found between the French baseline and the *AllGerman* treatment (p=0.86). They also reveal that average contributions to local goods are significantly higher in the French baseline than in the *LowHet* treatment (p=0.078). Average contributions to the local good are also higher in the French baseline compared to the *HighHet* treatment, although this difference is not statistically significant (p=0.15). Finally, no significant difference is found between the *LowHet* and *HighHet* treatments (p=0.75).

[Figure 4: about here]

To obtain more precise results, we turn to regression estimates on the individual determinants of contribution decisions to each public good. First, for each type of good *k*, we estimate the following equation, denoting individuals with subscript *i* and periods with *t:*

[24] All non-parametric tests shown in this paper are run at the group level (i.e., the level of independent observations).

[25] Our results are interpreted here in comparison to the French baseline. Indeed, comparisons between the two heterogeneous treatments and the French baseline are more relevant than comparisons with the *AllGerman* treatment in order to capture a pure fragmentation effect while keeping French speakers as the majority population. Comparisons using the German homogeneous treatment as a benchmark would result in lower p-values, at *p*=0.006 for the comparison with *LowHet* and *p*=0.068 with *HighHet*.

$$C_{itk} = \alpha_k + \sum_{j \in treatments} \beta_{jk} * Treatment_{ijt} + \rho_k * L_{it} + \Theta_k X_{it} + \varepsilon_{it} \quad (1)$$

We estimate this equation using random-effects GLS models with robust standard errors clustered at the global group level. The independent variables of interest are the binary variables indicating the treatment experienced by each individual. We control for the individual's mother tongue in L_{it}, which is equal to one for German speakers. Moreover, in X_{it}, we also control for a period variable and several demographic controls obtained through a post-experiment survey (family income level, education level, gender, and age).

Table 3 presents the estimation results for Equation 1 in Columns 1, 3, and 5. It confirms our previous findings. The *AllGerman* treatment variable captures a positive and significant coefficient in columns (1) and (3), indicating that both total and global contributions are significantly higher in the *AllGerman* treatment than in the French baseline. However, this coefficient is not significant for local contributions. Interestingly, the "German-speaking" variable is not statistically significant in any estimate. Altogether, these findings suggest that German speakers contribute more than the French speakers do, but only when they interact with each other in the homogeneous treatments.

We summarize these findings as follows:

Result 2 – *Both total contributions and contributions to the global good are higher in the homogeneous AllGerman treatment compared to the French baseline, while no difference in contributions is found between German and French speakers in the heterogeneous treatments.*

This result is not surprising for a number of reasons. Firstly, it is well documented that the people of Upper-Valais have a very strong identity. They are a minority and see themselves as such. Secondly, generally speaking, the many referenda that punctuate Swiss political life show that the Swiss German and the Swiss French differ on a number of issues, particularly the role of the State in the economic and social life (Büchi, 2015).[26] The French-speaking Swiss expect more from the State than the German-speaking Swiss. As a result, the latter are more used to cooperating with each other than the former, who see the State as a 'coordinating' agent. This is

[26] Leisibach and Schaltegger (2022) using a quasi-experiment show that Swiss German are more likely to adopt long-term behaviors (such as saving for retirement or pursuing continuing education) than Swiss French.

undoubtedly reinforced by the fact that the people of the Upper Valais live mainly in a mountainous region that is not very hospitable.[27,28]

Turning to the coefficients on the *LowHet* and *HighHet* variables, we find that they are not significant except in column (5), which uses contributions to the local good as the dependent variable. These findings indicate that the negative effect of heterogeneity on contributions is mainly driven by a decline of contributions to the local good while contributions to the global good remain unchanged. Moreover, *t*-tests on the coefficients found on the *LowHet* and *HighHe*t variables show that these coefficients are not statistically different from each other. In other words, the different levels of heterogeneity affect contributions similarly.

Finally, and consistent with previous studies, the trend variable captures a negative and significant coefficient in all estimates, indicating that contributions decline over time for all types of goods.

[Table 3: about here]

These findings are summarized in result 3:

Result 3 – *(a) Global group heterogeneity has a negative effect on local contributions but not on contributions to the global good. (b) For both types of public goods, contributions in the Low Heterogeneity (LowHet) and High Heterogeneity (HighHet) treatments are not statistically different.*

Notably, Result 3 holds after controlling for the subjects' mother tongues (i.e., the "German-speaking" control variable). Therefore, the different levels of contribution between treatments cannot be explained by a "pure" language effect. Result 3 partially validates Hypothesis 2a since heterogeneity induces lower contributions but only for local goods. However, the fact that there is no significant difference in contributions to public goods between the two heterogeneous treatments contradicts Hypothesis 2b. Indeed, Hypothesis 2b stated that we

[27] Furthermore, other studies have highlighted cultural differences between German-speaking and French-speaking cultures. For instance, the study by Willinger et al. (2003) showed that Germans cooperate more than the French. Even though this study pertains to Germany and France, we can reasonably draw a parallel with what happens in the Swiss cantons.

[28] One might argue that religion could also explain the difference of cooperation, since it has been shown that Protestants cooperate more (in a voluntary contribution mechanism) than Catholics (Benjamin, Fischer and Choi, 2010). However, while the German-speaking Swiss are generally Protestant, this is not the case in the Upper Valais, which is very strongly Catholic.

expected individuals to contribute more in the *LowHet* treatment than in the baseline, and to cooperate less in the *HighHet* treatment than in the baseline. This is not what we observed.

At first glance, it is surprising that global group heterogeneity has a negative effect in the local group only. Indeed, we might have reasonably expected subjects to contribute also less to the global public good. Our results instead show that subjects sought to maintain their level of contributions to the global public good.[29] In the following section, we will try to understand this seemingly counterintuitive result.

5.2 Individual-Level Results: Heterogeneity

Our results so far indicate that heterogeneity negatively impacts contributions to local goods only. In this sub-section, we attempt to understand this finding by going one step further in the data analysis and consider the different configurations of local groups within the heterogeneous treatments. Indeed, one possible explanation behind this finding is that the lower level of contribution in local public goods in the *LowHet* and *HighHet* treatments may be driven by the heterogeneous local group where the *relative* fragmentation is greater than in the global group.[30] For instance, the number of outgroup members is 1 out of 8 at the global level in the *LowHet* treatment, whereas it is 1 out of 4 in the heterogeneous local group within that treatment. Similarly, in the *HighHet* treatment, the number of outgroup members (specifically German speakers if we take *AllFrench* baseline as a reference) is 3 out of 8 in the global group compared to 3 out of 4 in the heterogeneous local group.[31] Another possible reason is that the presence of a heterogeneous global group may reduce the overall trust in others, and reduce the overall perceived effectiveness of contributing to any single local public good. Therefore, individuals

[29] Interestingly, this is confirmed by participants in the post experiment questionnaires who argue that contributing even modestly to the global good participates to some kind of global "solidarity".

[30] Indeed, in the heterogenous treatments, local groups may be either totally homogeneous or heterogeneous (see Figures 1c and 1d).

[31] More specifically, the proportion of German speakers in the *HighHe*t treatment is 3/8 at the global level. At the local level, that proportion is either 3/4 with a probability of 1/2 (i.e., the heterogeneous local group), or 0/4 with a probability of 1/2 (i.e., the homogeneous local public good). Overall, the fragmentation index in the local groups in the *HighHet* treatment is thus equal to: (1/2)(3/4) + (1/2)(0/4) = 3/8. Therefore, the same level of fragmentation is present on average at both the local and global levels. However, it is reasonable to imagine that the effect of fragmentation is driven by the heterogeneous local group. In the same way, the proportion of German speakers in the *LowHet* treatment is 1/8 at the global level. At the local level, it is either 1/4 with a probability of 1/2 or 0/4 with a probability of 1/2. Thus, in total, the fragmentation index is equal to (1/2)(1/4) + (1/2)(0/4) = 1/8, which is the same as in the global group. Again, although the same average level of fragmentation is observed at both the local and global levels, fragmentation may be perceived to be higher by the local heterogenous group, which may trigger a stronger reaction from this group.

may be less motivated to contribute, even to the homogeneous local public good, due to the diluted perceived impact on the overall welfare.

To check which of these two explanations is true, it is necessary to test whether the decline of contribution in the local good in the heterogeneous treatments result from lower contributions from both local groups (i.e. the local homogeneous and local heterogeneous good) or is only driven by the local heterogeneous group. To explore this, we estimate a second equation with a slight refinement. Instead of indicator variables for each treatment, this equation includes indicator variables that denote the whole experimental group configuration of the individual: both the treatment (i.e., *HighHet* or *LowHet*) and the composition of the local group (either homogenous or heterogenous). We denote these configurations by the $Config_{ijt}$ variable below:[32]

$$C_{itk} = \alpha_k + \sum_{j \in configs} \beta_{jk} * Config_{ijt} + \Theta_k X_{it} + \varepsilon_{it} \quad (2)$$

We estimate this equation using random-effects GLS models with robust standard errors clustered at the global group level. Results from Equation 2 are shown in Columns 2, 4, and 6 of Table 3. The table shows how instead of including one binary variable for each treatment, Equation 2 includes two binary variables. Each configuration binary variable corresponds to one local group within each treatment. For example, the "*LowHet* * Locally heterogeneous" variable is equal to 1 for individuals who took part in the *LowHet* treatment and were assigned to a heterogeneous local group.

For total contributions, the configuration variables are not significant (Column 2) except the "*LowHet* * Locally homogeneous" variable, which has a negative and significant coefficient. That being said, while they are not significant, the coefficients for both *HighHet* configurations are negative. For global goods, Column 4 shows that there are no significant differences between the homogenous baseline and the various configurations for contributions to global goods (with all coefficients relatively close to zero). Finally, looking at local goods (Column 6), we observe that contributions are significantly lower than in the baseline for those in locally homogeneous groups within the *LowHet* treatments (with a coefficient of -3.23). The disaggregation of the treatment variables thus suggests at first glance that within the *LowHet* treatment, lower contributions mostly stem from those in locally homogeneous groups, since

[32] In these estimates, we do not control for the individual's mother tongue, due to collinearity between that variable and the more detailed group configuration variables.

the coefficient for individuals in the locally heterogeneous groups is -1.17, smaller and not statistically significant. However, a *t*-test indicates that the two coefficients are not statistically different from each other (p=0.13). Turning to the *HighHet* treatment, we also find significantly lower contributions from individuals in the *HighHet* treatment (for both heterogeneous and homogeneous local groups, with coefficients of -2.60 and -2.49, respectively) compared to the baseline (only at the 10% level of statistical significance). These lower contributions stem from individuals in both types of local groups. Indeed, these two coefficients are not statistically different, thus indicating that individuals contribute the same to local goods regardless of whether they belong to a homogeneous or a heterogeneous local group.

Altogether, these findings suggest that the lower contributions observed in the heterogeneous treatments are not solely driven by the local heterogeneous groups. Both homogeneous and heterogeneous local groups reduce their contributions. This finding invalidates our hypothesis 2c, which posited that global heterogeneity would lead individuals in locally homogeneous local groups to contribute more to the local public good. It suggests that heterogeneity reduces the overall perceived impact or effectiveness of contributing to any single local public good, including in homogeneous local groups. Our results are summarized as follows:

Result 4 – *In low and high heterogeneity treatments, both homogeneous and heterogeneous local groups contribute significantly less to local goods compared to the fully homogeneous reference group.*

5.3 Individual-Level Results: Minority Status

The previous results indicate that disaggregating results can uncover some interesting dynamics that are hidden in a more high-level analysis. Interestingly, our previous results have shown that in cases of global heterogeneity, both homogeneous and heterogeneous local groups reduce their level of contribution. To better understand these results, we refine the analysis and investigate whether this decline in contributions is due to the majority or the minority members within each group. We can analyze whether subjects within the same local group but experiencing either a majority or minority status also diverge in their contributions. This should help determine whether, in fragmented contexts, it is the majority, the minority, or both who reduce their contributions.

We can do so by refining the configuration variable introduced in Equation 2, including not only the treatment and type of local group, but also whether the individual is a majority member

or not. We represent this with interaction terms between the experimental configuration experienced by the individual and his or her minority or majority status:

$$C_{itk} = \alpha_k + \sum_{j \in configs} \beta_{jk} * Config_{ijt} * Maj_{it} + \Theta_k X_{it} + \varepsilon_{it} \quad (3)$$

Estimation results from Equation 3 are provided in Table 4. The independent variables include several possible configurations. For example, the "*LowHet* * Locally heterogeneous * Global Min. * Local Min" variable is a dummy variable that takes 1 if the individual is subject to the *LowHet* treatment, belongs to a heterogeneous local group, and has a minority status in both groups. The other interactions variables are created similarly.

[Table 4: about here]

Looking at global goods first, Column 2 of Table 4 shows that for almost all configurations, there is no statistical difference between contributions of individuals in heterogeneous situations and the reference group (with most coefficients between about -0.6 and 1). This observation is in line with Results 1 and 2. The only exception is for individuals who are globally in the majority but locally in the minority (with a coefficient of 3.12). Interestingly, these individuals contribute significantly more to the global good than the reference group. Thus, contrary to our hypothesis, fragmentation does not lead to a transfer from the global towards the local public good, but rather the opposite. This finding is nevertheless consistent with Gallier et al. (2019) who found that participants exhibit a tendency to favor their own group at the expense of efficiency by contributing to the public good with the lowest MPCR. Indeed, it is also the case here as the MPCR was higher for local groups than for global groups. This finding shows the importance of in-group favoritism.

Result 5 – *Looking at contributions to global goods, individuals in the HighHet treatment who are part of the local minority and the global majority contribute more to global goods than in the baseline. No significant differences in contributions to global goods are found between minority and majority members of global groups for other configurations.*

Regarding local goods, we find statistically significant and negative coefficients for several configurations (Column 3 of Table 4). Interestingly, our results suggest that the impact of majority statuses depends on the overall heterogeneity profile of the group. First, we find negative and significant coefficients in both configurations in which subjects are in locally

homogeneous groups (and thus in the local and global majorities). More specifically, we find a coefficient of -3.21 (significant at the 1% level) for individuals in the *LowHet* treatment within homogenous local groups, and of -2.49 (also significant at the 1% level) for those in the *HighHet* treatment within homogenous local groups. Second, we also find a negative and significant coefficient for subjects who find themselves in the global minority, but the local majority, at -3.49 (significant at the 5% level).

Finally, in contrast, for the subjects who find themselves in both majorities, but who are in a locally heterogeneous group, we do not find a significant coefficient, although it is negative at -1.17. We summarize our results for local goods as follows:

Result 6 – *For local goods, our results suggest that the impact of majority statuses depend on the overall heterogeneity configuration of the group. In particular, lower contributions are driven by two types of participants: those in homogenous local groups in the heterogeneous treatments (and thus in both majorities), and those in local majorities and global minorities within heterogenous local groups, but only in the HighHet treatment.*

Interestingly and somewhat surprisingly, Result 6 indicates that when there is fragmentation, it is primarily the local majority contributors to the local public good who reduce their contribution to this public good, not the minorities. Consistent with the distinctiveness theory, a potential explanation may be that local minority members do not want to reduce their contribution levels in order to signal to others their willingness to cooperate despite their status of local minority members.

5.4. Impact of Real-World Minority and Majority Status

In this sub-section, we investigate whether real-world status (i.e., minority or majority status in real life) affects decisions in the experiment. Indeed, as mentioned earlier, an advantage of our experimental design is that we recruited subjects in the field, in a country and region characterized by multiple languages. Therefore, some of our subjects are members of a minority language group in the real world. In particular, the region of Valais is bilingual, with some municipalities with a majority of German speakers and others with a majority of French speakers. However, our experimental setup does not necessarily reflect systematically the reality of minority vs majority groups at the global (national) and local (canton) levels in Switzerland. For example, some participants may be assigned the role of a minority (majority) in the laboratory while they are part of a majority (minority) group in their day-to-day life. Indeed, in some experimental configurations, the French were a majority at the global level (the

country) but a minority at the local level (the canton), whereas in reality it is the opposite in the canton of Valais.

We can therefore investigate how real-life minority status interacts with social identity implemented in the laboratory. We may reasonably argue that being part of a minority in one's real life may exacerbate the impact of being a minority in the experiment. Consequently, participants belonging to a minority group both in the experiment and in real life may contribute less to public goods in the laboratory than individuals who are also in the minority group in the laboratory but belong to the majority in real life.

To conduct this analysis, we add an interaction term to Equation 2 between the group configuration and the real-world minority status. We define real-life minority status in three ways. Specifically, to determine whether our subjects are part of a local linguistic minority locally, we compare their mother tongue to three different definitions of the official language: *i*) the language they used in compulsory school prior to enrolling in college, *ii*) the official language of their birth municipality and *iii*) the official language of their current home municipality of residence. For each definition, if their mother tongue differs from the official language, we consider them as members of a real-world linguistic minority according to that definition.

Table 5 reports estimates using the three different definitions of real-life minority status. The independent variables in Table 4 include variables reported in previous tables. In addition, we also include a dummy variable called "Real-World Minority Status" that takes 1 if an individual is part of a local minority status in her/his real life. We interact this variable with our treatment variables of interest.

[Table 5: about here]

The interaction coefficients in Table 5 show that the contributions of real-life minority members are significantly more reduced compared to the reference group than for individuals who are not part of a linguistic minority in real life. However, these coefficients are only significant when defining real-life minority using the difference between the mother tongue and the language of the current home municipality (Column 1). In that model, we see that in 3 of the 4 heterogeneous group configurations (i.e., within the *LowHet* and *HighHet* treatments), the interaction terms are negative and statistically significant. These coefficients indicate that when experiencing a fragmented group configuration, members of real-world minorities participating

in our experiment reduce their contributions more than subjects who are not part of real-world minorities. We also see a positive coefficient for the variable indicating that the subject is part of a real-world minority, indicating that for subjects in the French baseline, being part of a real-world minority tends to increase experimental contributions. Overall, our results depend on the definition and configuration but point to a general take-away summarized in the following result.

Result 6 – *The impact of heterogeneity on contributions is stronger for individuals who are members of a linguistic minority in their real life, compared to subjects who are members of a real-world linguistic majority.*

6. Conclusion

In this paper, we study experimentally how individuals cooperate and contribute to overlapping public goods when they belong to two different heterogeneous groups in which they can be in the majority or the minority. To do so, we ran an original artefactual field experiment based on a multi-level public good experiment conducted in a bilingual university in the canton of Valais, in Switzerland. We vary the composition of the groups across our different treatments by using two distinct and cohesive linguistic groups in Switzerland (German and French speakers) as our subject pools. In our baseline treatments, both local and global groups are homogenous. In the remaining treatments, we introduce heterogeneity in term of social identity by varying the number of French and German speakers. We have five main findings.

First, we observe that contributions to the local public goods in heterogeneous treatments are lower than in homogeneous treatments while contributions to the global goods remain unchanged.

Second, a more detailed data analysis indicates that within heterogeneous global groups, both homogeneous and heterogeneous local groups contribute less to local goods compared to the fully homogeneous reference group. This indicates that in heterogeneous treatments, individuals who face two public goods do not engage in arbitration in favor of the local homogeneous public good. This finding may be interpreted as suggesting that heterogeneity induces some kind of negative externality by reducing the overall perceived impact or effectiveness of contributing to any single local public good including the homogeneous local public good.

Third, a disaggregated data analysis indicates that lower contributions in the high heterogeneity treatments compared to homogeneous treatments are mainly driven by the fact that local majority members reduce their contributions while minority members' contributions are unchanged. A possible explanation based on the optimal distinctiveness theory is that minority members may feel a high desire of inclusiveness into the group (e.g., Leonardelli, 2010; Chakravarty and Fonseca, 2014).

Fourth, we find that German-speaking Swiss contribute on average significantly more than the French-speaking Swiss. Interestingly, this is the case only in the homogenous treatments while in the heterogeneous treatments, we observe no significant difference between German- and French-speaking Swiss. These findings seem to suggest the existence of a higher intra-group favoritism among the German-speakers.

Finally, our data reveal that subjects who are members of a linguistic minority in their real life are significantly more affected by heterogeneity in the experiment. In other words, when faced with heterogeneity in the experiment, their contributions are significantly more reduced compared to the baseline than for individuals who are not part of a linguistic minority in real life.

Altogether, our results indicate that heterogeneity tends to decrease contributions, especially to public goods at the local level. However, the main take-away from our results is that trends at the aggregate level can hide various effects and that an individual's situation is an important predictor of that individual's contributions to public goods. Consistent with previous findings (Gallier et al., 2019), our results indicate that individuals prioritize contributing to a public good where they are in the majority over considerations of efficiency (in terms of MPCR). Despite the local public good having a higher MPCR than the global public good, we observe that heterogeneity has a more pronounced effect on local public goods. Additionally, we do not observe a shift in contributions towards the global public good. On the contrary, we observe the opposite trend, where minority individuals in the local public good contribute more to the global public good where they are in the majority.

One limitation of this study is that it does not consider all the possible configurations of heterogeneity. For example, our experiment does not include local groups with an equal amount of French and German speakers (i.e., 2 of each). Moreover, our experimental design does not consider the situation with a majority of German speakers at the global group. We deliberately chose to limit the configurations under study to avoid the multiplication of treatments. A natural

extension of this work may consist in running new sessions with a majority of German speakers and to further vary the degree of heterogeneity across groups. This is left for further research.

Another possible extension of this study may consist in varying the marginal per capita return (MPCR) of both local and global goods. Indeed, in this current study, the MPCR of the global public good was lower than the MPCR of each local public good, which allowed us to keep the social return similar in both the local and the global public good. There are pros and cons in setting the same social efficiency for local and global public goods. This gives a strong incentive to contribute locally. This may explain why we found higher contributions to the local groups. An avenue for new research may consist in running additional treatments with similar MPCR in both local and global groups to check how this would influence contributions and interact with heterogeneity (see, e.g., Weimann et al. (2019) for a discussion).

The sensitivity of our results to elements such as these mentioned above are ultimately empirical questions that can be explored in future research. Nevertheless, we feel that our evidence for the role of heterogeneity and social identity on contribution levels, even in a stylized laboratory environment, highlights their importance in understanding the full impact of in-group favoritism in different contexts. It also highlights an important argument for why heterogeneity is not necessarily always undesirable for society, as we found many situations where heterogeneity is not detrimental to overall contributions and could even increase cooperation.

Our results have public policy implications. The issue of fragmentation is closely related to the problem of ethnic segregation. Our study sheds light on the fact that although diversity has several important economic benefits (i.e., Galinsky et al., 2015), without effective management, diverse groups run the risk of under provision of public goods (Alesina et al., 1999).[33] The key is to find ways to maximize the gains and minimize the pains of diversity—to harness innovation and economic growth without inducing under-provision of public good.

An important policy implication that emerges from this study relates to the evidence that public policies aiming at promoting cooperation within heterogeneous groups should target the majority members rather than the minority group. Indeed, as shown by our data, the lower levels

[33] Several studies have shown that promoting diversity has numerous benefits for societies and organizations that were beyond the scope of this current study (Herring, 2009). Diversity facilitates creativity and innovation, promotes higher quality decisions, and enhances economic growth (Loyd et al., 2013; Sommers et al., 2008; Antonio et al., 2004; see also Galinsky et al. (2015) for a discussion on the gains associated to diversity). For instance, experimental evidence shows that ethnically diverse juries consider more perspectives and make fewer inaccurate statements than homogeneous juries (Sommers, 2006).

of contributions in the heterogeneous treatments result from the majority members who contribute significantly less compared to their counterparts in the homogeneous treatments while minority members' contributions are unaffected.

Finally, our study also has important implications for the management of enterprises and not-for-profit organizations. Indeed, in many cases, employees have to cooperate simultaneously in several groups on different projects at different scales. In each group, they may find themselves either in the majority or minority with respect to gender, race, language, or their nationality. Because we show that diversity at the global level may affect outcomes within groups at a lower level, managers need to foster cooperation at all levels.

References

Ager, P. & M. Brückner (2013). Cultural diversity and economic growth: Evidence from the US during the age of mass migration. *European Economic Review*, Vol. 64, November 2013, 76-97.

Akerlof, G. A., & Kranton, R. E. (2000). Economics and identity. *The quarterly journal of economics*, *115*(3), 715-753.

Alesina, A., Baqir, R., & Easterly, W. (1999). Public goods and ethnic divisions. *The Quarterly Journal of Economics*, 114 (4), 1243-1284.

Alesina, A., & Ferrara, E. L. (2005). Ethnic diversity and economic performance. *Journal of economic literature*, *43*(3), 762-800.

Allport (1954). The Nature of Prejudice. Addison-Wesley.

Andersson, H. and S. H. Dehdari (2021). Workplace Contact and Support for Anti-Immigration Parties. *American Political Science Review*, 115(4), 1159-1174.

Andreoni, J. (1995). Cooperation in public-goods experiments: kindness or confusion?. *The American Economic Review*, 891-904.

Andreoni, J., Rao, J., & Trachtman, H. (2017). Avoiding the Ask: A Field Experiment on Altruism, Empathy, and Charitable Giving. *Journal of Political Economy*, 125(3), 625-653.

Antonio, A. L., Chang, M. J., Hakuta, K., Kenny, D. A., Levin, S., & Milem, J. F. (2004). Effects of racial diversity on complex thinking in college students. *Psychological Scien*ce, 15, 507–510.

Balliet, D., Wu, J., & De Dreu, C. K. (2014). Ingroup favoritism in cooperation: a meta-analysis. *Psychological bulletin*, 140(6), 1556.

Beekman, G., Cheung, S. L., & Levely, I. (2015). The effect of conflict history on cooperation within and between groups: evidence from a laboratory experiment. *Journal of Economic Psychology*, 63, 168-183.

Bernhard, H., Fischbacher, U., Fehr, E., 2006. Parochial altruism in humans. *Nature* 442: 912-915.

Bernasconi, M., Corazzini, L., Kube, S. and Maréchal, M. (2009) Two are better than one!: Individuals' contributions to "unpacked" public goods. *Economics Letters*, 104(1), 31-33.

Blackwell, C., & McKee, M. (2003). Only for my own neighborhood?: Preferences and voluntary provision of local and global public goods. *Journal of Economic Behavior & Organization*, *52*(1), 115-131.

Bove, V. and L. Elia (2017). Migration, Diversity, and Economic Growth. *World Development*, Vol. 89, 227-239.

Bowles, S., & Gintis, H. (2004). Persistent parochialism: trust and exclusion in ethnic networks. *Journal of Economic Behavior & Organization*, *55*(1), 1-23.

Brewer, M. B. (1991). The social self: On being the same and different at the same time. *Personality and social psychology bulletin*, *17*(5), 475-482.

Brewer, M. B. (1993). Social identity, distinctiveness, and in-group homogeneity. *Social cognition*, *11*(1), 150.

Brown, M., Henchoz, C., & Spycher, T. (2018). Culture and financial literacy: Evidence from a within-country language border. *Journal of Economic Behavior & Organization*, Vol. 150, June 2018, 62-85.

Buchan, N., Gianluca, G., Wilson, R., Brewer, M., Fatas, E., & Foddy, M. (2009). Globalization and human cooperation. *Proceedings of the National Academy of Sciences of the United States of America*, 106, 4138-4142.

Buchan, N. R., Brewer, M. B., Grimalda, G., Wilson, R. K., Fatas, E., & Foddy, M. (2011). Global social identity and global cooperation. *Psychological science*, *22*(6), 821-828.

Chakravarty, C., & Fonseca, M. A. (2014). The effect of social fragmentation on public good provision: an experimental study. *Journal of Behavioral and Experimental Economics*, 53, 1-9.

Chakravarty, C., & Fonseca, M. A. (2017). Discrimination via exclusion: an experiment on group identity and club goods. *Journal of Public Economic Theory*, 19(1), 244-263.

Chakravarty, S., Fonseca, M.A., Gosh, S., & Marjit, S. (2016). Religious fragmentation, social identity and cooperation: evidence from an artefactual field experiment in India. *European Economic Review*, 90 I, 265-279.

Charness, G., Rigotti, L., & Rustichini, A. (2007). Individual behavior and group membership. *American Economic Review*, *97*(4), 1340-1352.

Chen, Y., & Li, S. X. (2009). Group identity and social preferences. *American Economic Review*, *99*(1), 431-57.

Cherry, T. L. Dickinson. 2008. Voluntary contributions with multiple public goods. *Environmental Economics, Experimental Methods: Routledge*, 184-193.

Croson, R. T. (1996). Partners and strangers revisited. *Economics Letters*, *53*(1), 25-32.

Desmet, K., Weber, S., & Ortuño-Ortín, I. (2009). Linguistic diversity and redistribution. *Journal of the European Economic Association*, 7(6), 1291-1318.

Docquier, F., R. Turati, J. Valette, and C. Vasilakis. Birthplace diversity and economic growth: evidence from the US states in the Post-World War II period. *Journal of Economic Geography*, 20(2), 321–354.

Drouvelis, M., Malaeb, B., Vlassopoulos, M., & Wahba, J. (2021). Cooperation in a fragmented society: Experimental evidence on Syrian refugees and natives in Lebanon. *Journal of Economic Behavior & Organization*, *187*, 176-191.

Drouvelis, M., & Nosenzo, D. (2013). Group identity and leading-by-example. *Journal of Economic Psychology*, *39*, 414-425.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy: policies and ethnic divisions. *The quarterly journal of economics*, *112*(4), 1203-1250.

Eckel, C. C., & Grossman, P. J. (2005). Managing diversity by creating team identity. *Journal of Economic Behavior & Organization*, *58*(3), 371-392.

Eckel, C. C., Wilson, R. K., & Youn, S. (2022). In-group favoritism in natural and minimal groups. *Economics Letters*, *219*, 110794.

Erhardt, K. and Haenni, S. (2018) Born to be an Entrepreneur? How Cultural Origin Affects Entrepreneurship. University of Zurich, Department of Economics, Working Paper No. 309.

Espinosa, M. P., E. Fatas, and P. Ubeda (2019). Linguistic diversity and out-group discrimination in bilingual societies. *Journal of Behavioral and Experimental Economics*, vol. 81.

Esteban, J. M., & Ray, D. (1994). On the measurement of polarization. *Econometrica: Journal of the Econometric Society*, 819-851.

Eugster, B., Lalive, R., Steinhauer, A. and Zweimüller, J. (2011), The Demand for Social Insurance: Does Culture Matter?. *The Economic Journal*, 121:F413-F448.

Fellner-Röhling, G., & Lünser, G. K. (2014). Cooperation in local and global groups. *Journal of Economic Behavior & Organization*, 108, I, 364-373.

Fellner, G., & Lünser, G. K. (2008). Cooperation in local and global groups. ELSE Working Papers 311. ESRC Centre for Economic Learning and Social Evolution: London, UK.

Fischbacher, U. & Gächter, S., & Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. Economics Letters, 71, 397-404.

Fischbacher, Urs, and Simon Gächter. 2010. Social Preferences, Beliefs, and the Dynamics of Free Riding in Public Goods Experiments. *American Economic Review*, 100 (1): 541-56.

Fischbacher, U. (2007). Z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental economics*, *10*(2), 171-178.

Gächter, S. (2007). "Conditional cooperation: Behavioral regularities from the lab and the field and their policy implications". In B. S. Frey & A. Stutzer (Eds.), *Economics and psychology: A promising new cross-disciplinary field* (pp. 19–50). MIT Press.

Gächter, S., & Fehr, E. (1999). Collective action as a social exchange. *Journal of economic behavior & organization*, *39*(4), 341-369.

Gächter, S., & Herrmann, B. (2011). The limits of self-governance when cooperators get punished: Experimental evidence from urban and rural Russia. *European Economic Review*, 55(2), 193-210.

Galinsky, A. D., Todd, A. R., Homan, A. C., Phillips, K. W., Apfelbaum, E. P., Sasaki, S. J., ... & Maddux, W. W. (2015). Maximizing the gains and minimizing the pains of diversity: A policy perspective. *Perspectives on Psychological Science*, 10(6), 742-748.

Gallier, C., Goeschl, T., Kesternich, M., Lohse, J., Reif, C. & Römer, D. (2019). Leveling up? An inter-neighborhood experiment on parochialism and the efficiency of multi-level public goods provision. *Journal of Economic Behavior & Organization*, 164, 500-517.

Goette, L., Huffman, D., & Meier, S. (2006). The impact of group membership on cooperation and norm enforcement: Evidence using random assignment to real social groups. *American Economic Review*, *96*(2), 212-216.

Greif, A. (1993). Contract enforceability and economic institutions in early trade: The Maghribi traders' coalition. *The American Economic Review*, 525-548.

Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with ORSEE. *Journal of the Economic Science Association*, 1, 114–125.

Guin, B. (2017). Culture and Household Saving. ECB Working Paper 2069.

Habyarimana, J., Humphreys, M., Posner, D. N., & Weinstein, J. M. (2007). Why does ethnic diversity undermine public goods provision?. *American Political Science Review*, *101*(4), 709-725.

Hargreaves-Heap, S., & Varoufakis, Y. (2002). Some Experimental Evidence on the Evolution of Discrimination, Co-Operation and Perceptions of Fairness. *The Economc Journal*, *112*(481), 679-703.

Hargreaves Heap, S. P., & Zizzo, D. J. (2009). The value of groups. *American Economic Review*, *99*(1), 295-323.

Herring, C. (2009). Does diversity pay? Race, gender, and the business case for diversity. *American Sociological Review*, 74, 208–224.

Herrmann, B., Thöni, C., & Gächter, S. (2008). Antisocial punishment across societies. *Science*, *319* (5868), 1362-1367.

Hewstone, M., M. Rubin, and H. Willis. 2002. Intergroup Bias. *Annual Review of Psychology* 53(1), 575-604.

Isaac, R. M., & Walker, J. M. (1988). Group size effects in public goods provision: The voluntary contributions mechanism. *The Quarterly Journal of Economics*, *103*(1), 179-199.

Isaac, R. M., Walker, J. M., & Williams, A. W. (1994). Group size and the voluntary provision of public goods: Experimental evidence utilizing large groups. *Journal of public Economics*, *54*(1), 1-36.

Kandel, E., & Lazear, E. P. (1992). Peer pressure and partnerships. *Journal of political Economy*, *100*(4), 801-817.

Keser, C., & Van Winden, F. (2000). Conditional cooperation and voluntary contributions to public goods. *Scandinavian Journal of Economics*, *102*(1), 23-39.

Kesternich, M., Goeschl, T., Lohse, J., Römer, D., & Reif, C. (2016). An online experiment on cooperation and groupishness across urban districts. VfS Annual Conference 2016 (Augsburg): Demographic Change 145848, *Verein für Socialpolitik / German Economic Association*. Conference Paper.

Kriesi, H., & Trechsel, A. H. (2008). *The politics of Switzerland: Continuity and change in a consensus democracy.*

Khwaja, A. I. (2009). Can good projects succeed in bad communities? *Journal of public Economics*, *93*(7-8), 899-916.

La Ferrara, E. (2003). Kin groups and reciprocity: A model of credit transactions in Ghana. *American economic review*, *93*(5), 1730-1751.

Lane, T. (2016). Discrimination in the laboratory: A meta-analysis of economics experiments. *European Economic Review*, 90, 375-402.

Lapointe, S. (2018). 'Love thy neighbour'? The effect of income and language differences on votes for municipal secessions. *Regional Science and Urban Economics*, 70, 229-245.

Lazear, E. P. (1999). Globalisation and the market for team-mates. *The Economic Journal*, *109*(454), 15-40.

Ledyard, J. O. (1995). Is there a problem with public goods provision. *The handbook of experimental economics*, 111-194.

Leonardelli, G. J, & Brewer, M.B. (2001). Minority and majority discrimination: when and why. *Journal of Experimental Social Psychology*, 37, 468-485.

Leonardelli, G. J., Pickett, C. L., & Brewer, M. B. (2010). Optimal distinctiveness theory: A framework for social identity, social cognition, and intergroup relations. In M. P. Zanna & J. M. Olson (Eds.), Advances in experimental social psychology, Vol. 43, pp. 63–113). Academic Press.

Luttmer, E. F. (2001). Group loyalty and the taste for redistribution. *Journal of political Economy*, *109*(3), 500-528.

Miguel, E., & Gugerty, M. K. (2005). Ethnic diversity, social sanctions, and public goods in Kenya. *Journal of public Economics*, *89*(11-12), 2325-2368.

Nikiforakis, N., Noussair, C. N., & Wilkening, T. (2012). Normative conflict and feuds: The limits of self-enforcement. *Journal of Public Economics*, 96(9-10), 797-807.

Paluck, E. L., Green, S. A., & Green, D. P. (2019). The contact hypothesis re-evaluated. *Behavioural Public Policy*, 3(2), 129-158.

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology*, 90(5), 751–783.

Poterba, J. M. (1998). Demographic change, intergenerational linkages, and public education. *The American Economic Review*, 88(2), 315-320.

Smith, A. (2011). Group composition and conditional cooperation. *The Journal of Socio-Economics*, 40, 616-622.

Sommers, S. R. (2006). On racial diversity and group decision making: Identifying multiple effects of racial composition on jury deliberations. *Journal of Personality and Social Psychology*, 90, 597–612.

Sommers, S. R., Warp, L. S., & Mahoney, C. C. (2008). Cognitive effects of racial diversity: White individuals' information processing in heterogeneous groups. *Journal of Experimental Social Psychology*, 44, 1129–1136.

Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social categorization and intergroup behaviour. *European journal of social psychology, 1*(2), 149-178.

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual review of psychology*, *33*(1), 1-39.

Tan, J. H., & Bolle, F. (2007). Team competition and the public goods game. *Economics letters*, *96*(1), 133-139.

Willinger, Marc & Keser, Claudia & Lohmann, Christopher & Usunier, Jean-Claude, 2003. "A comparison of trust and reciprocity between France and Germany: Experimental investigation based on the investment game," *Journal of Economic Psychology*, vol. 24(4), pages 447-466.

Weimann, J., Brosig-Koch, J., Heinrich, T., Hennig-Schmidt, H., & Keser, C. (2019). Public good provision by large groups–the logic of collective action revisited. *European Economic Review*, *118*, 348-363.

Zizzo D. (2003) "You Are Not in My Boat: Common Fate and Similarity Attractors in Bargaining Settings," working paper University of Oxford, Department of Economics.

Table 1: Experimental Sessions

Session	Treatment	Number of French Subjects	Number of German Subjects	Total Subjects
1	All German	0	16	16
2	Baseline French	16	0	16
3	Baseline French	16	0	16
4	Baseline French	16	0	16
5	LowHet	14	2	16
6	LowHet	14	2	16
7	LowHet	14	2	16
8	HighHet	10	6	16
9	HighHet	10	6	16
10	HighHet	10	6	16
11	All German	0	24	24
Total		**120**	**64**	**184**

Notes: Baseline French is a baseline ran with French-speakers only, "All German" is a homogeneous treatment with German-speakers only, LowHet is the treatment "Low Heterogeneity", HighHet is the treatment "High Heterogeneity." All subjects experienced 10 periods.

Table 2: Average Contributions by Treatment

Average contribution	Baseline French	All German	LowHet	HighHet
Total contribution	10.53 (7.86)	12.95 (6.95)	8.67 (7.55)	8.56 (6.91)
Global Good	2.71 (3.83)	5.00 (5.38)	3.06 (4.08)	3.10 (3.61)
Local Good	7.82 (6.79)	7.95 (6.00)	5.61 (5.88)	5.47 (5.47)
Sample Size	480	400	480	480

Notes: Standard deviations in parentheses.

Table 3: Determinants of individual-level contributions by experimental group configuration

	Total Contributions to Both Goods		Contributions to Global Goods		Contributions to Local Goods	
	(1)	(2)	(3)	(4)	(5)	(6)
French Baseline	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
AllGerman	3.98***	2.36**	3.20***	2.22***	0.78	0.14
	(1.49)	(1.05)	(0.92)	(0.64)	(1.33)	(1.1)
LowHet	-1.62		0.47		-2.09**	
	(1.32)		(0.51)		(1.04)	
LowHet * Locally heterogeneous		-0.30		0.87		-1.17
		(1.99)		(0.68)		(1.49)
LowHet * Locally homogeneous		-3.44***		-0.21		-3.23***
		(1.15)		(0.62)		(0.93)
HighHet	-1.46		0.86		-2.32*	
	(1.75)		(0.77)		(1.29)	
HighHet * Locally heterogeneous		-2.31		0.29		-2.60*
		(1.61)		(0.51)		(1.39)
HighHet * Locally homogeneous		-1.79		0.71		-2.49*
		(1.84)		(0.79)		(1.32)
Period	-0.65***	-0.65***	-0.35***	-0.35***	-0.29***	-0.29***
	(0.051)	(0.051)	(0.03)	(0.03)	(0.045)	(0.045)
German-speaking	-1.63		-0.98		-0.65	
	(1.06)		(0.63)		(0.76)	
Constant	12.1***	11.4***	0.82	0.55	11.3***	10.9***
	(3.84)	(4.12)	(2.75)	(2.86)	(2.25)	(2.34)
Equation	1	2	1	2	1	2
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	1840	1840	1840	1840	1840	1840
R-squared	0.12	0.13	0.12	0.12	0.068	0.073

Notes: Robust standard errors in parentheses, clustered at the global group level. Significance levels: *** 0.01 ** 0.05 * 0.1. Other controls include family income level, education level, gender, and age

Table 4: Determinants of individual-level contributions by complete group configuration and minority/majority status

	(1)	(2)	(3)
	Total Contributions	Contributions to Global Goods	Contributions to Local Goods
French Baseline	Ref.	Ref.	Ref.
AllGerman	2.37**	2.23***	0.15
	(1.04)	(0.64)	(1.09)
LowHet * Locally heterogeneous * Global Min. * Local Min.	-0.057	1.05	-1.10
	(2.41)	(1.09)	(1.82)
LowHet * Locally heterogeneous * Global Maj. * Local Maj.	-0.33	0.83	-1.17
	(2.08)	(0.77)	(1.49)
LowHet * Locally homogeneous * Global Maj. * Local Maj.	-3.39***	-0.18	-3.21***
	(1.14)	(0.61)	(0.93)
HighHet * Locally heterogeneous * Global Min. * Local Maj.	-4.12**	-0.62	-3.49**
	(1.78)	(0.42)	(1.60)
HighHet * Locally heterogeneous * Global Maj. * Local Min.	3.27	3.12***	0.15
	(2.10)	(1.11)	(1.67)
HighHet * Locally homogeneous * Global Maj. * Local Maj.	-1.77	0.71	-2.49*
	(1.83)	(0.80)	(1.31)
Period	-0.65***	-0.35***	-0.29***
	(0.051)	(0.030)	(0.045)
Constant	11.9***	0.77	11.1***
	(3.71)	(2.78)	(2.10)
Controls	Yes	Yes	Yes
N	1840	1840	1840
R-squared	0.15	0.14	0.082

Notes: Robust standard errors in parentheses, clustered at the global group level.
Significance levels: *** 0.01 ** 0.05 * 0.1.
These regressions show the difference in contributions between local groups of different configurations compared to the French baseline. Since they are homogeneous, *AllGerman* groups are always locally homogeneous, and members are always part of the global and local majorities. Each column uses a different dependent variable, representing contributions to different types of goods or to all goods. Other controls include family income level, education level, gender, and age.

Table 5: Determinants of individual-level contributions according real-world minority status

	(1)	(2)	(3)
	Mother tongue is different from language in:		
	Current Home Municipality	Compulsory school	Birth Municipality
French Baseline	Ref.	Ref.	Ref.
AllGerman	2.84***	2.65***	2.55**
	(0.98)	(1.00)	(1.12)
LowHet * Locally heterogeneous	0.42	0.49	1.06
	(1.85)	(1.79)	(1.88)
LowHet * Locally homogeneous	-2.88***	-2.84**	-3.05**
	(1.11)	(1.15)	(1.21)
HighHet * Locally heterogeneous	-0.61	-1.63	-1.79
	(1.92)	(1.70)	(1.42)
HighHet * Locally homogeneous	-1.53	-1.67	-0.66
	(2.09)	(2.02)	(1.98)
Real-World Minority Status	4.72**	3.18	2.69
	(1.85)	(2.62)	(4.28)
Real-World Minority Status interacted with:			
AllGerman	-5.85*	-1.81	0.23
	(3.52)	(2.75)	(4.23)
LowHet * Locally heterogeneous	-13.2***	-5.82	-7.68
	(2.63)	(4.62)	(4.72)
LowHet * Locally homogeneous	-7.74***	-6.16**	n.a.
	(1.88)	(2.78)	n.a.
HighHet * Locally heterogeneous	-9.77***	-4.20	-3.57
	(2.18)	(4.62)	(5.23)
HighHet * Locally homogeneous	-4.05	-0.95	-5.85
	(2.53)	(3.13)	(4.60)
Period	-0.65***	-0.65***	-0.65***
	(0.051)	(0.051)	(0.051)
Constant	10.9**	10.4**	11.5***
	(4.37)	(4.43)	(4.43)
Controls	Yes	Yes	Yes
N	1840	1840	1840
R-squared	0.15	0.14	0.15

Notes: Robust standard errors in parentheses, clustered at the global group level. Significance levels: *** 0.01 ** 0.05 * 0.1 Each column uses a different definition for the real-world minority status, as described at the top of the column. Other controls include family income level, education level, gender, and age.

Figure 1a: Illustration of the Baseline Treatment (All French)

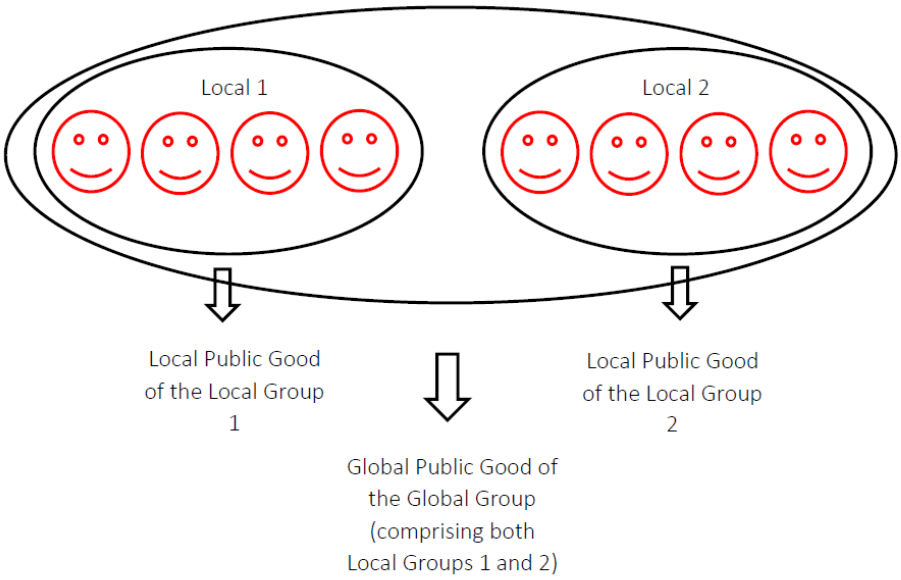


Figure 2b: Illustration of the *AllGerman* Treatment

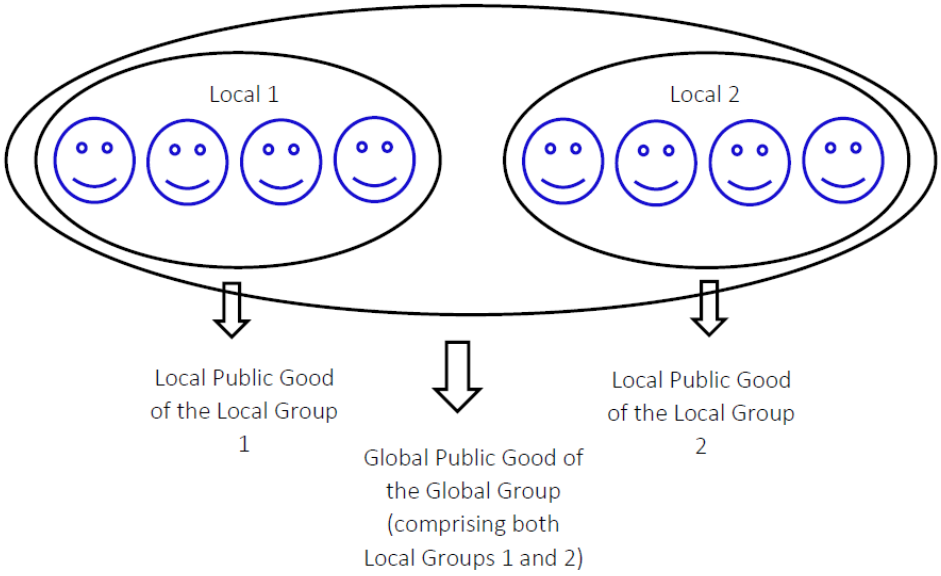


Figure 1c: Illustration of the LowHet treatment

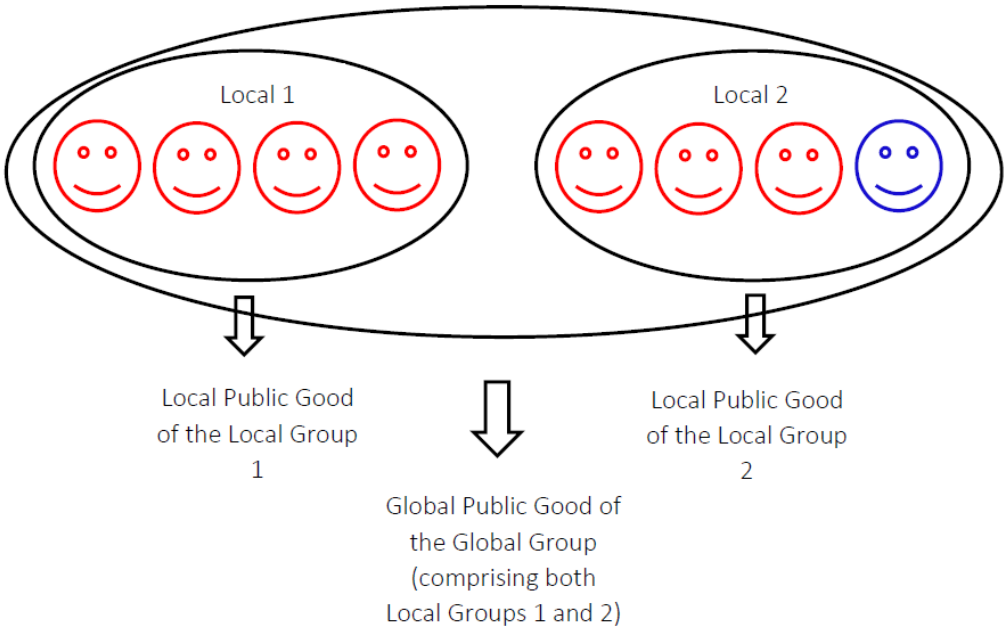


Figure 1d: Illustration of the HighHet treatment

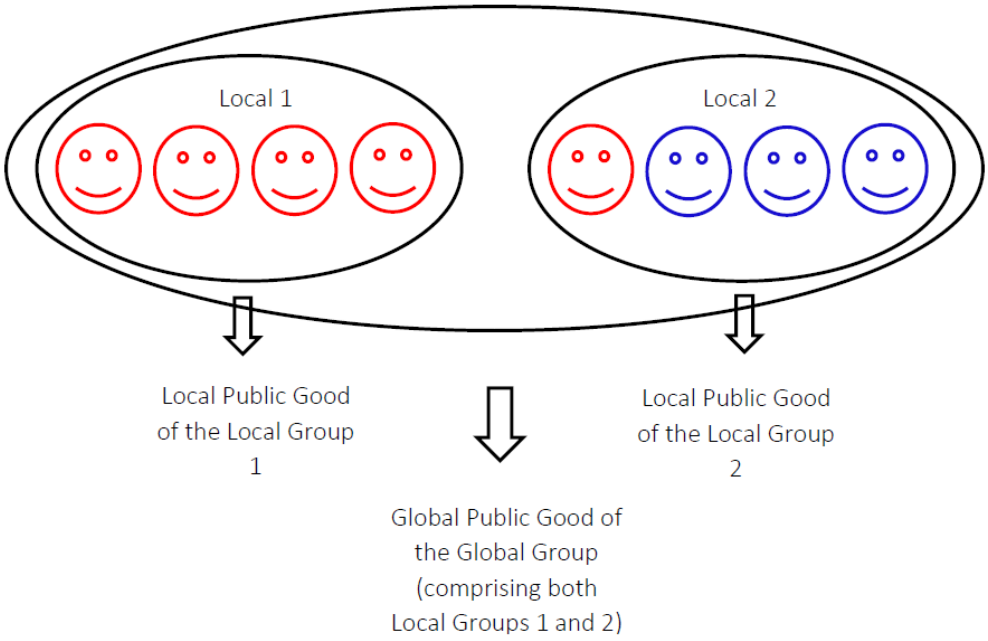


Figure 2: Average Total Contributions by Treatment

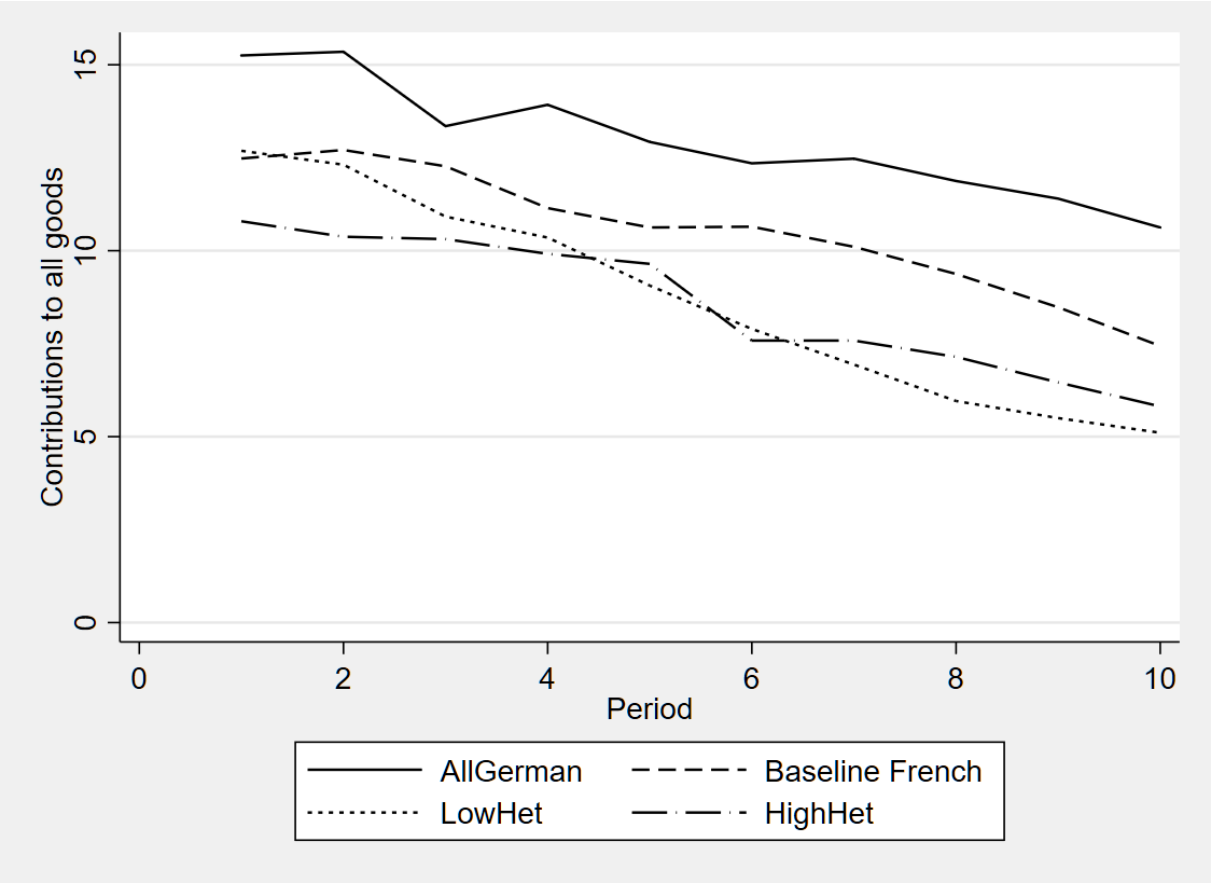


Figure 3: Average Contributions to Global Goods by Treatment

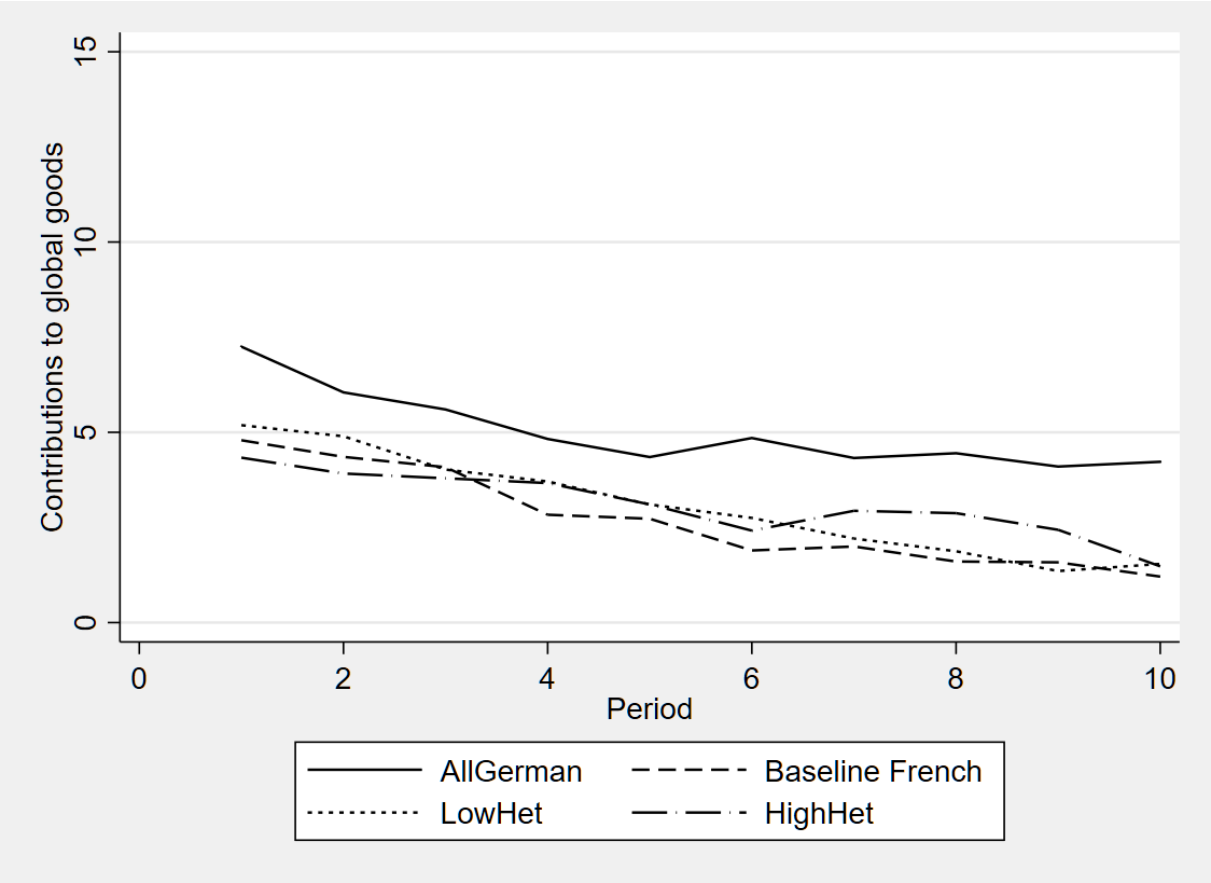
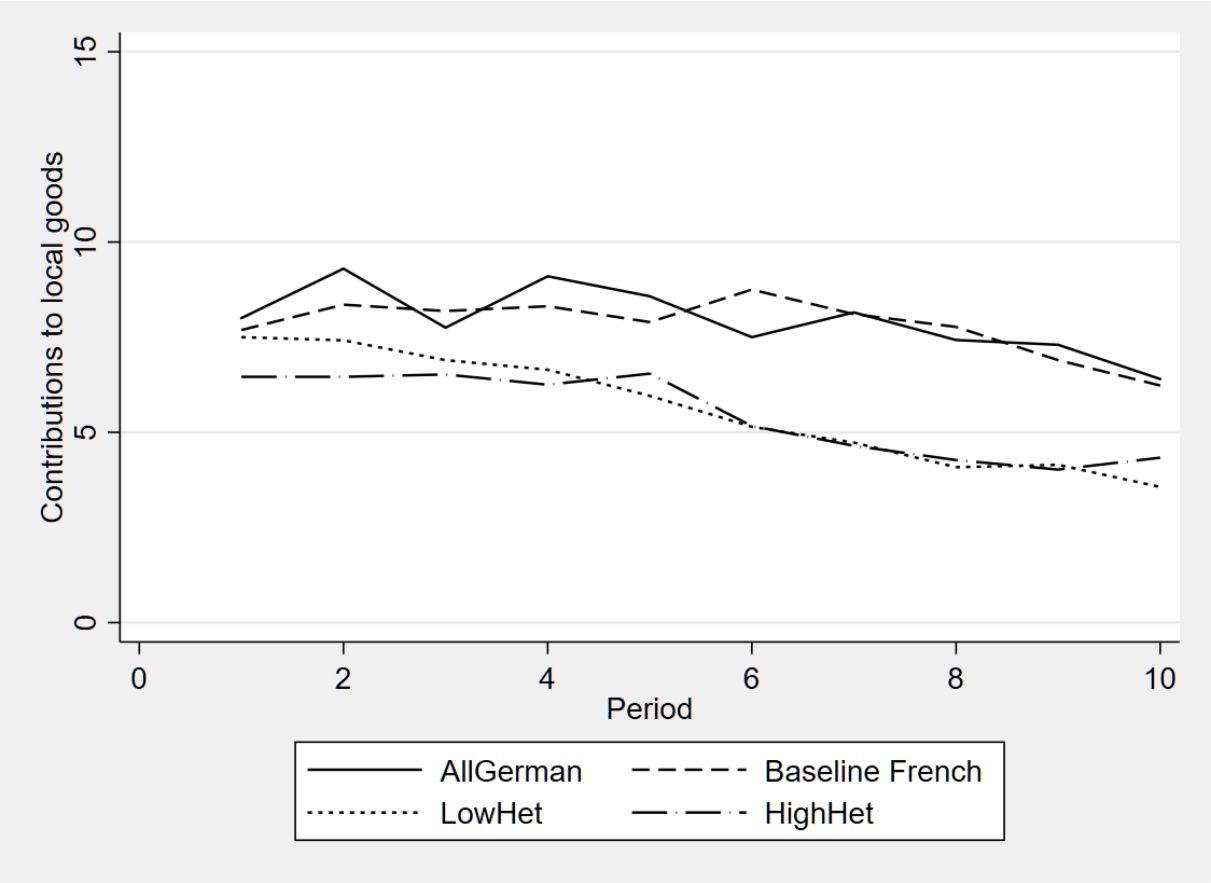


Figure 4: Average Contributions to Local Goods by Treatment



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