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Do climate change and climate disasters at home shape return migration intentions? Evidence from a survey of West Africans in Germany

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Abstract

Do Climate Change and Climate Disasters at Home Shape Return Migration Intentions?
Evidence from a Survey of West Africans in Germany

by Daniel Meierrieks and Irene Pañeda-Fernández*

This study explores the role of climate conditions in shaping return migration intentions among international migrants. Using original survey data of over 1,000 first-generation migrants from West Africa living in Germany, we correlate observational data on temperature increases in the respondents' home regions in West Africa to their return migration intentions. Moreover, by means of a survey experiment, we investigate how informational cues about climate disasters in the migrants' origin countries might influence their desire to return home. We find that observed climate change in the form of warming does not affect return migration intentions, and neither do informational cues about climate risks that are provided in the survey experiment. Moreover, we find that differences in migrants' socioeconomic status, education or attachment to their home countries do not moderate the influence of climate change and disasters on return intentions. By contrast, in the survey experiment economic factors are found to play a decisive role: migrants are more inclined to return if job prospects in their home country improve, whereas favorable employment in Germany reduces return intentions. This latter finding provides some evidence that economic motivations rather than environmental concerns prominently shape return migration decisions.

Keywords: *return migration; climate change, climate disasters; survey experiment; Germany; West Africa*

JEL classification: F22; Q54

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Zusammenfassung

Diese Studie untersucht die Rolle klimatischer Bedingungen bei der Entstehung von Rückkehrabsichten internationaler Migrant*innen. Anhand originärer Umfragedaten von über 1.000 Migrant*innen der ersten Generation aus Westafrika, die in Deutschland leben, korrelieren wir Beobachtungsdaten zu Temperaturanstiegen in den Herkunftsregionen in Westafrika mit den Rückkehrabsichten der Befragten. Zudem untersuchen wir mittels eines Umfrageexperiments, wie Informationshinweise zu Klimakatastrophen in den Herkunftsländern der Migrant*innen deren Wunsch zur Rückkehr beeinflussen könnten. Unsere Ergebnisse zeigen, dass der beobachtete Klimawandel in Form von Erwärmung keinen Einfluss auf die Rückkehrabsichten hat – ebenso wenig wie die im Experiment gegebenen Hinweise auf Klimarisiken. Auch Unterschiede im sozioökonomischen Status, Bildungsniveau oder der Bindung an das Herkunftsland der Migrant*innen beeinflussen den Zusammenhang zwischen Klimawandel bzw. Katastrophen und Rückkehrabsichten nicht. Im Gegensatz dazu spielen im Umfrageexperiment ökonomische Faktoren eine entscheidende Rolle: Migrant*innen zeigen eine höhere Rückkehrbereitschaft, wenn sich die Berufsaussichten im Herkunftsland verbessern, während günstige Beschäftigungsmöglichkeiten in Deutschland die Rückkehrabsicht verringern. Letzteres deutet darauf hin, dass ökonomische Motive – und nicht Umweltaspekte – maßgeblich die Entscheidung zur Rückkehrmigration prägen.

Schlüsselwörter: *Rückwanderung; Klimawandel, Klimakatastrophen; Umfrage–experiment; Deutschland; Westafrika*

JEL Klassifikation: F22; Q5

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1. Introduction

International migration is not necessarily permanent. Rather, we can differentiate between permanent and temporary migration (e.g., Dustmann and Weiss, 2007). Temporary migration, in turn, includes, e.g., circulatory migration (i.e., a repetitive movement between home and host country, e.g., to engage in seasonal labor), transit and onward migration (where migrants move from one country to another to try to find a possible permanent destination) and *return migration* (e.g., Dustmann and Weiss, 2007) which is "when people return to their country or region of origin after a significant period abroad [...]" (King, 1986: 4).[1]

Return migration is not rare. Studying the patterns of global migration, Azose and Raftery (2019) estimate that 67 to 87 million people migrated internationally for each five-year period between 1990 and 2015, where approximately 25% of this global migration (i.e., approximately 17 to 21 million) is return migration from host to migrants' home countries. Such figures have motivated research interests in the determinants of return migration intentions and behavior. For example, existing research suggests that migrants may return to their origin countries after they have finished their education (e.g., Alves, 2022), earned enough money to invest back home (e.g., Mesnard, 2004) or after their retirement (e.g., Bolzman, 2022) and due to concerns about their children and families (e.g., Dustmann, 2003), socio-cultural and emotional ties to the origin country (e.g., De Haas et al., 2014), economic difficulties and discrimination in the host country as well as economic opportunities at home (e.g., Borjas and Bratsberg, 1996; Tezcan, 2019).[2]

[1] For alternative definitions of return migration, see King and Kuschminder (2022).

[2] For overviews of the literature on the determinants of return migration and return migration intentions, see, e.g., Mohamed and Abdul-Talib (2020), Wahba (2022), Weldemariam et al. (2023) and Oklikah et al. (2024).

In this study, we add to this evidence by examining how *climate conditions in the origin country* affect *return migration intentions*.[3] Indeed, while a number of studies have examined various structural, individual and policy drivers of return migration, there is almost no empirical evidence relating the return migration of international migrants to climate conditions in their origin countries (for an exception for the case of Nepalese return migration, see Epstein et al., 2022).[4] For instance, in their review of studies on return migration to Sub-Saharan Africa, Weldemariam et al. (2023: 7) come the conclusion that "none of the studies explicitly mentions environmental or climate drivers as determinants in the context of return migration." This lack of research on the relationship between climate conditions and return migration is surprising, as there is at the same time an extensive literature on whether and how climate change and climate disasters lead to international out-migration, relating climate conditions in the origin country to the formation of migration aspirations and the decision to migrate internally or leave the country (e.g., Gray and Mueller, 2012; Beine and Parsons, 2015; Coniglio and Pesce, 2015; Cattaneo and Peri, 2016;

[3] In our study, return migration intentions refer to the evaluative conclusion that migrating back (to the home country) would be preferable to staying (in the host country) and the will to pursue a course of action towards (eventually) migrating back to the home country (see also Mjelva and Carling, 2023). Focusing on intentions to return is sometimes criticized because many migrants who wish to return do not end up doing so (e.g., Gardner et al., 1985). For instance, social, political, or economic barriers blur the relationship between return intentions and actual remigration (e.g., Constant and Massey, 2002). Nevertheless, the literature on return intentions has convincingly established that their study is valuable for several reasons (see, e.g., Waldorf, 1995; de Haas and Fokkema, 2011; Carling and Pettersen, 2014). First, there is a lack of reliable quantitative datasets to study actual return migratory behavior (de Haas et al., 2015). Second, the wish to migrate can be viewed as a first step in the migration process, e.g., allowing to investigate the relationship between migration capabilities and intentions (Carling and Pettersen 2014; Carling and Schewel 2018). Third, intentions are arguably the best proxy for actual migratory behavior (e.g., van Dalen and Henkens, 2013; Tjaden et al., 2019). Finally, return intentions are relevant in their own right as they can affect decisions to invest in relationships, assets or skills (e.g., Dustmann, 1999; Carling and Pettersen, 2014; Diehl and Liebau, 2015).

[4] In addition to the case of return of international migrants, researchers may also examine the association between climate conditions and *internal* return migration, e.g., relating the return movements of rural-urban migrants to climate events in rural areas (e.g., Entwisle et al., 2020).

Koubi et al., 2016; Hoffmann et al., 2020; Sedova and Kalkuhl, 2020; Helbling and Meierrieks, 2021; Pañeda-Fernández and Meierrieks 2025).[5]

In this paper, we study how climate change in the form of temperature increases as well as the occurrence of climate disasters (such as droughts and floods) in the origin countries of potential returnees affect their return migration intentions. We first hypothesize that such changes adversely affect return migration intentions regardless of individual circumstances (unconditional effect). For instance, this may be the case because climate disasters are associated with the destruction of public and private infrastructure and the loss of human life as well as with economic and political instability in the migrant's origin country, discouraging return migration. Alternatively, we argue that the effect of climate change and disasters on return migration intentions may depend upon individual characteristics of potential returnees (conditional effect). In detail, we hypothesize that individual differences in the migrants' material conditions, their level of education or attachment to their home country moderates their responsiveness to the prospect of unfavorable climatic changes in their home countries. For example, more educated individuals may also be more knowledgeable about the adverse consequences of climate change and thus respond more strongly to the prospect of climate change and disasters.

We test these hypotheses by through an original and representative survey of over 1,000 first-generation West Africans living in Germany. In this survey, we asked the respondents about their return migration intentions in addition to a plethora of demographic, socio-economic, family and migration history factors. Consequently, in our empirical analysis we relate observational data on temperature increases (as a proxy for climate change) in the migrants' subnational region of origin to their

[5] Reviews of the literature on the migratory effects of climate disasters and climate change can be found in, e.g., Piguet et al. (2011), Obokata et al. (2014), Berlemann and Steinhardt (2017), Cattaneo et al. (2019), Kaczan and Orgill-Meyer (2020), and Mukherjee and Fransen (2024).

return migration intentions to test whether stronger increases in temperature are—unconditionally or conditionally—associated with lower return migration intentions. Moreover, we employ a preregistered survey experiment design, providing the West African migrants with informational cues about the prospect of climate disasters such as droughts and floods—as would be consistent with climate change—in their country of origin to test whether such cues affect return migration intentions.[6]

Our main empirical findings are as follows. First, while a considerable number of survey participants report interest in eventually returning to their home country (where they usually wish to divide their time between the origin country and Germany), we find no evidence that survey participants from regions within their respective origin countries more strongly affected by warming report lower return migration intentions. Second, there is also no convincing evidence that migrants who are in a better material or legal position, have a higher level of education or feel more attached to their home country respond differently to warming than those respondents who live more precarious lives, are less educated or feel less attached to their home country. That is, the relationship between our objective climate change measure and return migration intentions is not conditional on several individual socio-economic and psychological traits. Third, from our survey experiment we also do not detect an unconditional effect of informational cues about climate disasters on return migration intentions. Respondents that receive information that climate disasters will occur frequently in their home countries in the future do not report lower return migration intentions compared to those respondents that receive a cue promising that climate disasters will be rare. Fourth, we also find no evidence of conditional effects of the climate disaster cues on return migration intentions.

[6] The anonymized preregistration documentation related to this experiment can be found here: https://osf.io/7m4ry/?view_only=c0a5146e41a5480f8b75f3fb94540b6f.

Finally, from the survey experiment we do find evidence that cues about beneficial economic circumstances (in the form of sound employment opportunities in Germany or the home country) affect return migration intentions in expected ways: survey participants are more likely (less likely) to report an intention to return home when they are ample job opportunities in their home country (when they have a good job in Germany). These latter findings may suggest that economic prospects are more relevant to individual return migration intentions than environmental concerns. Our findings thus contribute to our understanding of the relative impact of direct versus indirect effects of climate change on migration (Cottier et al., 2022).

The rest of this contribution is organized as follows. In Section 2, we develop several testable hypotheses concerning the unconditional and conditional effects of climate conditions on return migration. We introduce our data of a survey of first generation West African migrants in Germany in Section 3. In Section 4, we relate observational data on climate change in the survey respondents' country of origin to their return migration intentions. Then, in Section 5, we use our survey data to further test by means of a survey experiment our hypotheses concerning the nexus between country-of-origin climate conditions and return migration. Section 6 concludes.

2. Theoretical Considerations and Hypotheses

2.1 Theoretical Considerations

We can view return migration through different theoretical lenses such as economic approaches rooted in neoclassical economics (NE) or the new economics of labor migration (NELM), the structural approach or transnationalism (e.g., Cerase, 1974; Cassarino, 2004; Dustmann and Weiss, 2007; Bilgili, 2022; King and Kuschminder, 2022; Wahba, 2022).

Economic models of return migration emphasize that the decision to migrate back home is the consequence of a rational calculus that weighs the (opportunity) costs and benefits of staying and migrating back against each other. For instance, NE theory views migrants as primarily lifetime earnings maximizers and emphasize the role of wage differentials between home and host country, where change in this differential can induce return migration (Sjastaad 1962; Harris and Todaro 1970). NELM theory, by contrast, shifts the focus from the individual to the household and views migrants as target-earners who move abroad for a limited amount of time to spread household income risks and overcome market constraints in the sending country. Thus, they seek to earn an education and enhance their earnings potential back home or to accumulate or remit savings until a target has been achieved (Stark, 1991; Dustmann and Weiss, 2007). Prior studies have found evidence consistent with both theoretical propositions, suggesting there is no single process of return migration due to heterogeneity in the motivations and backgrounds of migrants (e.g. see de Haas et al., 2015; Yang 2006; Tiwari 2021). The benefit maximizing analysis of the economic perspective of NE and NELM can also be adapted so that non-monetary factors also matter to migrants' decision-making. Such an approach can explain that discrimination in the destination country can push migrants to leave by decreasing the benefits of staying (e.g., Di Sant Pierre et al., 2015; Tezcan, 2019).

Finally, transnationalist approaches emphasize that attachments and ties to the language, culture and kin of one's home and destination country are not mutually exclusive (Glick-Schiller et al., 1999; Cassarino 2004) and the structural approach highlights how structural conditions at home matter return intentions (e.g., Cerase 1974). These approaches are not necessarily in conflict with the economic perspectives discussed above. For instance, according to transnationalism, changes in economic or political conditions in origin or destination or in personal circumstances can spark a movement from migrants because they have networks, skills and knowledge that

are useful in both contexts. The structuralist proposition that sees return intentions as responsive to macroeconomic conditions in origin is also consistent with the income maximizing calculus at the individual and household level proposed by NE and NELM respectively.

With respect to the role of climate conditions in return migration, this theoretical discussion suggests that (potential) return migrants might be responsive to adverse climate events in their home country because they usually still have (transnational) ties to it (e.g., via the news, family members or other networks). It also suggests that potential returnees change their return migration intentions in predictable ways: the prospect of climate change and disasters affects the relative attractiveness of the home vis-à-vis the host country, e.g., by impacting macroeconomic conditions (such as unemployment and economic growth). At the same time, the theoretical discussion also points to the role of individual factors in potentially moderating the responsiveness to adverse climate events. For example, more educated migrants may have a different calculus with respect to return migration than their less educated counterparts (Dustmann and Weiss, 2007), which, in turn, may also result in differential migration responses to climate conditions in their home countries.

2.2 Unconditional Relationship between Climate Conditions and Return Migration

As our first hypothesis, we argue that adverse climate conditions in the migrants' home country (to which they could potentially migrate back to) make return migration less attractive:

H1: Unfavorable climate conditions in the migrants' home country negatively affect return migration intentions.

There are several reasons for this theoretical expectation. First, unfavorable climate conditions are expected to produce adverse *direct* effects. For instance, climate disasters such as droughts and floods are anticipated to result in the destruction of public and private infrastructure as well as the loss of human life. This arguably makes it less attractive to migrate back home. What is more, adverse climate events are also expected to produce further detrimental *indirect* effects. For example, unfavorable climate events (e.g., temperature shocks, heavy storms or droughts) may reduce economic activity and increase within-country income inequality, e.g., by hurting agricultural output and industrial productivity (e.g., Bergholt and Lujala, 2012; Dell et al., 2012, 2014; Klomp and Valckx, 2014; Carter et al., 2018; Letta and Tol, 2019; Emediegwu et al., 2022; Paglialunga et al., 2022; Ferreira, 2024). Climate extremes may also unfavorably affect human health as well as overall well-being and life satisfaction, e.g., by facilitating the spread of disease, inducing mental stress and constraining certain types of outdoor leisure activities (e.g., Bourque et al., 2007; Berry et al., 2010; Maddison and Rehdanz, 2011; Deschenes, 2014; Meierrieks, 2021). Finally, they may also contribute to the weakening of institutions and increases in political instability, e.g., by fueling conflict over scarce resources or weakening government control over territory affected by climate disasters (e.g., Omelicheva, 2011; Burke et al., 2015; Mach et al., 2019; Khurana et al., 2022).

In sum, the literature suggests that climate change and disasters may have detrimental direct and indirect ramifications. Due to these unfavorable effects, we expect the migrants' home country to become—ceteris paribus—a less attractive return migration destination. What is more, the literature suggests that these unfavorable ramifications ought to be felt more strongly in poorer countries. For instance, Klomp and Valckx (2014) find that climate disasters are particularly detrimental to economic growth in developing countries. This makes it even more plausible that

negative climate conditions could matter to the return migration intentions of West Africans, the subject of our investigation.

2.3 Conditional Relationship between Climate Conditions and Return Migration

Potentially, some individuals respond more strongly to adverse changes to climate conditions than others with respect to their return migration intentions. That is, there may be a conditional relationship between these conditions and return migration, i.e., a heterogeneous response of the latter to the former. In the following, we discuss how individual differences in (i) socio-economic and legal status, (ii) levels of education and (iii) connectedness to one's home country may shape one's return migration response in light of climate change and disasters.

Socio-Economic and Legal Status. First, we focus on the socio-economic and legal status of a migrant, i.e., whether their material and legal security in the host country affects the role of unfavorable climate conditions in their return migration intentions. Here, we expect socio-economic and legal security to make migrants less responsive to more unfavorable climate conditions in their home country. For instance, a secure legal status in the host country will allow a migrant who has returned to their home country to re-enter the host country to avoid adverse economic or political consequences of negative climate events at home. Similarly, more financial resources may make it possible for the returnee to weather adverse climate events (e.g., by buying an air-conditioning system or flood insurance in the home country), so that these adverse climate events are less likely to factor into their return migration intentions. Additionally, migrants of higher socio-economic status may have already too many investments (e.g., in terms of language acquisition, economic investments or the establishment of a social network) in the host country, making their

return intentions less malleable in the first place.[7] In sum, this leads to the following hypothesis:

H2: Climate conditions in origin are less likely to shape the return intentions of migrants with a better socio–economic and legal status than more precarious migrants.

Education. Furthermore, we consider heterogeneous effects in the response to climate events due to differences in education. Here, we expect more educated individuals to change their return migration intentions more strongly than their less educated counterparts. In detail, they ought to lower their return migration intentions in reaction to the prospect of worsening climate conditions:

H3: Unfavorable climate conditions are more likely to (negatively) shape the return intentions of those highly educated relative to those with low education.

In detail, we expect empirical support for this hypothesis because prior research shows that a basic understanding of climate change and its consequences is a determinant of the migratory responses to adverse climate conditions. For example, Helbling et al. (2021) study how climate change affects the migration intentions of 37,000 individuals across 30 African countries, finding that climate change only increases migration intentions among individuals who are climate literate, i.e., know about climate change and its adverse (future) consequences. Climate literacy and awareness, in turn, strongly correlates with individual levels of education (e.g., Lee et al., 2015).

[7] Alternatively, we might argue that individuals with more economic resources and a more secure legal status in the host country may be in a better position to freely decide on their return migration than their counterparts whose lives are more precarious. As the former are more likely to have the financial means to return home and the legal security to make this voyage, they may also be more likely to respond to negative climate events at home. This alternative hypothesis—that climate conditions are more likely to shape the return migration intentions of potential returnees with a good economic and legal status—is also discussed in our preregistration documentation.

Connectedness. Migrants who feel more attached to their country of origin are expected to experience heightening feelings of homesickness and nostalgia, making them more likely to want to return to their country of origin in the first place (e.g., Cassarino, 2004). At the same time, such migrants are also anticipated to be more interested in news about their home country, including developments concerning adverse climate events. Thus, the migrants' connectedness to the country of origin may serve as a precondition for the migrants' return intentions to be responsive to changing climate conditions at home. In other words, we argue that migrants who are attached to their home country will be more receptive to information about climate disasters in the home country, which, in turn, is expected to shape their return migration intentions accordingly. Consequently, as the prospect of negative climate events ought to reduce return migration intentions in the first place, those who feel attached to their home country are expected to respond to these events with lower return intentions than those who feel less attached:

H4: Unfavorable climate conditions are more likely to (negatively) shape the return intentions of those who are more closely connected to their country of origin.

3. Survey Data

3.1 Sampling Strategy

To test the hypotheses outlined above, we employ original survey data. In detail, we conducted a survey of first generation West African immigrants in Germany in November and December 2023 in cooperation with *Verian*, a private research and evaluation agency. Our target population was foreigners (aged 18 or older) registered in Germany who were born in one of the 15 countries that were member states of *ECOWAS* (*Economic Community of West African States*) at the time of the survey, i.e., Benin,

Burkina Faso, Cabo Verde, Côte d'Ivoire, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.[8]

In accordance with BAMF-Forschungsdatenzentrum (2021), we cooperated with the *Research Data Centre* (*Forschungsdatenzentrum*) of the *German Federal Office for Migration and Refugees* (*Bundesamt für Migration und Flüchtlinge, BAMF*) which provided us with personal addresses of our target population drawn from the *German Central Registry of Foreigners* (*Ausländerzentralregister*; *AZR*), which allowed us to contact potential survey participants.

We first conducted a pre-test to gauge response rates. Contacting 600 potential survey participants from the AZR address list (AZR, 2023), we received 58 responses. Based on this response rate of 9.7% and assuming a population of West Africans over 18 living in Germany of approximately 200,000 (estimate from the *Federal Statistical Office of Germany*), we decided to send our survey to 10,000 addresses to obtain a final target sample of *N*=1,000. While we received a total of 18,500 addresses (the selection population) from the AZR database, 10,000 addresses (the gross sample) were ultimately selected to contact potential survey participants (AZR, 2023). Here, the gross sample accounted for the features of the selection population with respect to country of origin, age, residence title etc. Concerning the 10,000 contacted West Africans, the first group comprised individuals with a resident permit (*N*=7,600).[9] The second group included individuals with a temporary suspension of deportation (*Duldung*; *N*=2,400). The oversampling of people with a *Duldung* was carried out due to the presumed lower response rate of this group. Originally, it was planned to also

[8] In 2024, Niger, Burkina Faso and Mali announced their withdrawal from ECOWAS.

[9] According to German law, there are six different reasons associated with permits, namely (1) unlimited residence permits (*Niederlassungserlaubnis*) as well as permits (2) for education and training, (3) for gainful employment, (4) on international law or on humanitarian or political grounds, (5) for family reasons and (6) due to special residence rights.

include people who were in the asylum process during the time of the survey. However, as obtaining the addresses of this group of people is subject to special data protection restrictions and thus very time-consuming, West Africans that were in the asylum process were ultimately not surveyed.

Our field procedure was as follows. First, every individual in our gross sample of 10,000 received a letter via the mail, inviting them to participate in our study. In the letter (in both German and English, French or Portuguese, depending on the home country of the potential survey participant), potential participants were informed about the goals of the survey and the associated procedure. Respondents received 5€ with the invitation. Furthermore, they received a link, username, password as well as personalized QR code as ways to access our online survey. In addition to German, the surveys were also provided in an English, French or Portuguese version, depending on the participants' respective home country.[10] Respondents who were willing to participate were sent an additional 10€ as well as a thank-you note on completion of the survey, which had already been announced in our initial letter as an incentive.

3.2 Overview of Survey Data

In our survey, inter alia, we asked respondents about their country of origin, certain demographic traits (e.g., age, gender, relationship status and number of children) as well as their socio-economic background (e.g., level of education, personal income and employment status), family background (e.g., number and whereabouts of siblings and other family members), migration history (e.g., concerning the timing and means of arriving in Germany), integration into German society (e.g., with respect to German skills and participation in German social life), feelings about Germany (e.g.,

[10] We relied on services of native speakers to ensure that all translations were correct and compatible across different languages.

concerning discrimination) and their future migration intentions, including return migration intentions.

Sending out 10,000 survey invitations, we received 1,020 valid and completed survey questionnaires. Most of these 1,020 participants were residing in one of the three most populous German states, Baden-Württemberg, Bavaria or North-Rhine Westphalia. Most respondents (ca. 80%) were between the ages of 18 and 39, while only 4% were older than 50. About 69% of respondents were men and 31% were women. Concerning their country of origin, about 42% of survey participants originated from Nigeria, 15% from Ghana, 11% from Guinea and 10% from the Gambia; other ECOWAS countries accounted for between less than 1% (Cabo Verde) and 7% (e.g., Togo).

3.3 Return Migration Intentions

The main objective of this paper is to understand how climate conditions in the respondents' home country shape their intentions to eventually return to their home country. However, how large are return migration intentions among West Africans living in Germany in the first place? To answer this question, we consider the following survey item: "*Five years from now, I would prefer to be living …*", where respondents could answer "*In Germany*", "*In my country of origin*", "*In another country*"; they could also refuse to answer. As shown in Figure 1, approximately 83% of respondents say that they prefer to live in Germany in the near future. Less than 4% of respondents say that they would like to return to their country of origin in the next five years.

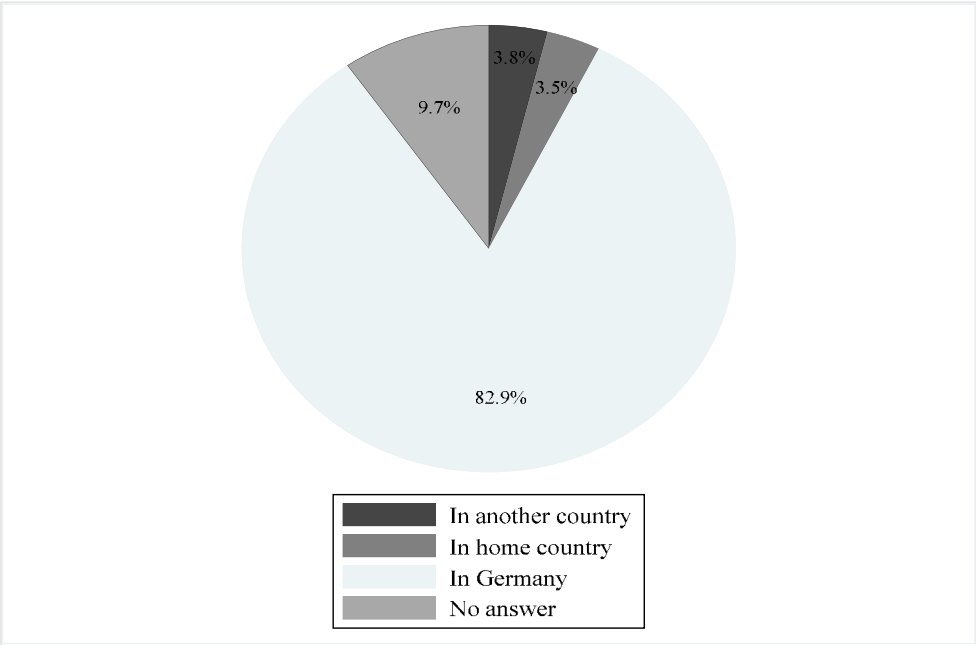

Figure 1: Leaving or Staying in Germany in the Near Future

However, as noted above, many West Africans in Germany are fairly young. They may not think about leaving Germany in the near future because they, e.g., have not finished their education or have not earned enough money to allow for a comfortable life back home. Thus, we also considered the survey participants' response to the following question: "*Do you want to stay in Germany for the rest of your life?*" This item was only given to respondents who answered in the previous question that they would prefer to live in Germany in the near future (*N*=846). In addition to not answering the question, respondent could answer "Yes", "*No, I would like to move to another country*", "*No, I would like to return to my country of origin*" or "*I would like to divide my time between Germany and my country of origin*".

As shown in Figure 2, in the long run return migration intentions are more pronounced. While a plurality of respondents (43%) say they want to stay in Germany for the rest of their life, a considerable number of respondents (31%) want to return to their country of origin for at least part of their future life, while another 4% intend to outright return to their home country.

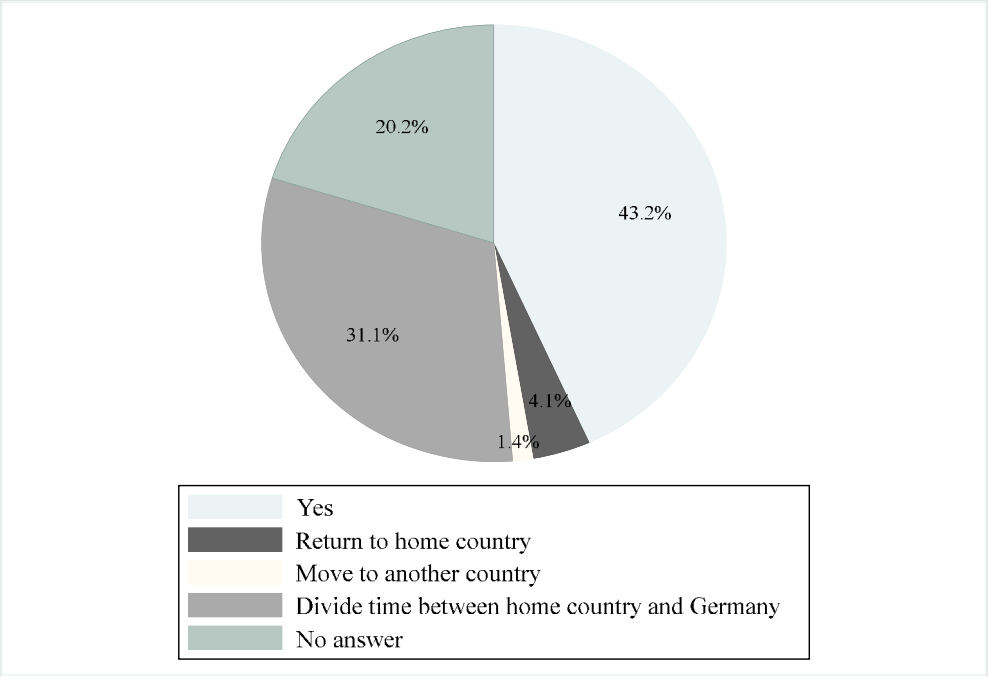

Figure 2: Staying in Germany for the Rest of One's Life

4. Climate Change in the Home Region and Return Migration Intentions

While the previous section has shown that there is considerable interest in eventually (voluntarily) returning to one's country of origin over the course of one's life, in this section, we investigate whether climate change that has occurred in the respondents' country of origin affects this interest. In line with our theoretical discussion, we test whether (i) climate change unconditionally reduces return migration intentions and (ii) the role of climate change in return migration intentions is conditional upon individual characteristics related to respondents' legal status, material conditions, level of education or attachment to their home country.

4.1 Measuring Climate Change in the Home Region

In our survey, we also asked the respondents about their *home region*, i.e., the specific part of the country of origin where they were born. The respective home region corresponds to a first-level administrative division of the origin country, e.g., one of the 36 federal states of Nigeria or one of the 14 autonomous districts of Cote d'Ivoire. In our sample, respondents came from 109 regions within the 15 ECOWAS countries, meaning there were about 9.3 respondents per region on average. Approximately 90 respondents did not specify their home region; these respondents are dropped from the subsequent analysis.

We assume that return migrants will eventually migrate back to their respective home region within their country of origin. To study how climate change affects the respondents' intentions to migrate back, we collect climate data from the *Geospatial Database* of the *Global Data Lab*.[11] This dataset builds on climate reanalysis data from Hersbach et al. (2023) and makes this data available at the level of the first-level administrative unit of the respective country of interest. We define climate change as the difference between the regional mean surface temperature over the 2018-2022 period and the 1990-2000 period.

Figure 3 shows that almost all regions experienced warming when comparing the 1990-2020 period to the 2018-2022 period. While only 1% of regions experienced minimal cooling, the mean temperature increase was 0.72°C, where there was also substantial between-region variation in warming. This warming is expected to have a number of unfavorable ecological effects; as discussed in Arias et al. (2021) as part of a recent report by the *Intergovernmental Panel on Climate Change*, climate change leads to changes in the frequencies and intensity of extreme climate events such as

[11] The data is available here: https://globaldatalab.org/geos. We use version V0.2 of this dataset.

droughts, heavy storms (e.g., hurricanes), heavy rainfall and flooding. At the same time, warming and its ecological concomitants are anticipated to adversely impact the economies and societies of affected regions, e.g., by impairing public health, labor productivity and economic growth as well as increasing violence and political instability (e.g., Maddison and Rehdanz, 2011; Dell et al., 2012; Klomp and Valckx, 2014; Burke et al., 2015). The ecological and broader socio-economic and politico-institutional consequences of climate change in the home region may thus, in turn, reduce return migration intentions.

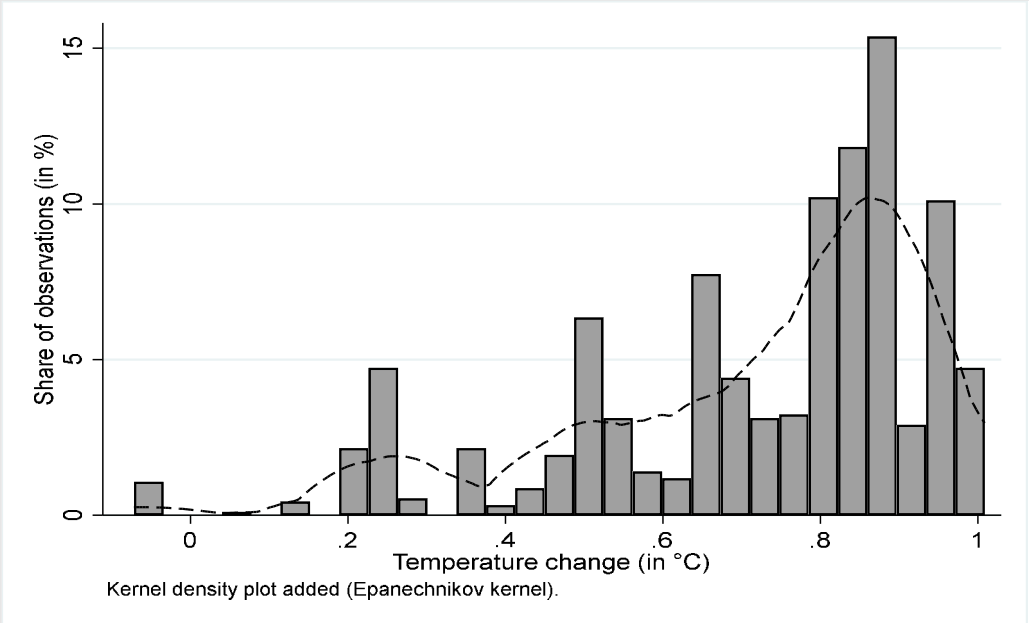

Figure 3: Distribution of Temperature Changes in Home Regions

4.2 Empirical Approach

To examine the influence of regional warming on return migration intentions, we consider the following regression model:

$$intent_i = \beta_0 + \beta_1 \times temperature_{h,i} + \beta_2 \times legal_i + \beta_3 \times material_i + \beta_4 \times educ_i + \beta_5 \times attach_i + \beta, \times X' + \varepsilon_i \quad (1)$$

Our dependent variable, *intent*, is a binary variable that is equal to unity when a survey respondent *i* says that they want to (i) eventually want to migrate back to their home country or (ii) eventually want to divide their time between their home country and Germany. In these cases, the respondents voice their intention to migrate back at least for some time, making it plausible that they may also be affected by climate change in their home regions. The dependent variable is equal to zero when respondents do not state that they want to return, instead (i) wishing to stay in Germany forever, (ii) wanting to migrate to a country other than their home country or (iii) being undecided.

As discussed above, our main variable of interest, *temperature*, measures local climate change as the difference between mean surface temperatures over the 2018–2022 period and the 1990–2000 period in the respective home region *h* of respondent *i*.

We also control for the respondents' legal (*legal*) and material (*material*) status, their level of education (*educ*) and the degree to which they feel attached to their home country (*attach*). In detail, to assess the respondents' legal status, we use their answer to the following survey item: "*What type of residence permit do you have now in Germany?*" Respondents could answer that they either have a permanent residence permit (*Niederlassungserlaubnis*), permits for work, study or family reasons, a refugee status, humanitarian or subsidiary protection or another form of special permit. We construct a binary variable that is equal to unity for individuals who have a permanent residence permit or a permit due to family reasons (i.e., marriage and/or children); the variable is equal to zero when the respondent's legal status is less secure (e.g., due to having only a temporary work permit or enjoying only subsidiary protection). Approximately 34% of respondents enjoy a low level of legal precarity according to this definition.

To indicate a respondent's material status, we use two survey items asking a respondent (i) whether they are currently unemployed and (ii) whether they have received any social benefits or income support from the state in the month before the survey, respectively. If the respondent gives an affirmative answer to one or both questions, their level of material precarity is considered to be high. 19% of respondents say that they are currently unemployed and 14% say that they received government benefits in the past month.

Our variable indicating respondents' level of education is straightforward. We consider their answer to the question "*What is the highest level of education you have obtained?*" and create a variable that is equal to unity when a respondent has at least completed their secondary education and zero otherwise (this corresponds to respondents who have no formal education, only informal schooling, only primary education or who have not completed their secondary education). In our sample, approximately 71% of respondents are coded as having at least secondary education.

Finally, to measure how strongly a respondent feels connected to their home country, we consider their answer to the following question: "*Let us suppose that you had to choose between being a German and being a [person from your country of origin]. Which of these two groups do you feel more strongly attached to?*" The answer could range from a respondent saying that they only feel as a national from their home country to them saying that they only feel German. We code this variable in a way that higher levels of the connectedness variable correspond to the respondent feeling more attached to their home county (i.e., less attached to Germany). In our sample, approximately 37% of respondents feel more or only attached to their home country, approximately 43% feel equally attached to their home country and Germany and approximately 20% feel more or only attached to Germany.

Finally, we include a vector of additional controls, *X*. Here, we account for a set of *demographic variables* for respondents' gender and age as well as the respondents having children and being in a serious relationship with a German or a person with permanent residence in Germany. These demographic factors may also shape return intentions. For instance, respondents who are older may be more likely to wish to return to live in their home country for their retirement. Furthermore, we include a set of *geographic controls* in the form of country-of-origin dummies and dummies for the respondents' respective German federal state of residence. This is to account for cross-country differences (e.g., in terms of political circumstances) and differences in economic and socio-political conditions between different parts of Germany. Finally, we include *interview controls*, i.e., dummy variables to account for the week in which the online survey was conducted and the language in which the interview was conducted. This is to account for any disruptions between weeks that may matter (e.g., important political developments in the home country) and for differences in languages that may systematically affect survey responses.

While Equation (1) allows us to assess the unconditional effect of home region temperature increases on return migration intentions, to investigate conditional effects we amend Equation (1) with an interaction term of the following form:

$$intent_i = \beta_0 + \beta_1 \times temperature_i + \beta_2 \times moderator_{ij} + \beta_3 \times (temperature_i \times moderator_{ij}) + \beta, \times X' + \varepsilon_i \quad (2)$$

Here, *moderator* refers to one of the four moderating variables for respondents' legal status, material conditions, level of education or attachment to their home country, i.e., the variables *legal*, *material*, *educ* and *attach*. We consider four different interaction models, where we consider each moderator separately; the remaining three respective moderator variables are included (in non-interacted form) in the vector X. When estimating Equation (2), the coefficient β_1 gives the effect of climate change

when the moderator is zero, e.g., the impact of rising temperatures when respondents do not have at least secondary education. When the moderator is equal to unity (e.g., when respondents do have at least secondary education), the effect of regional warming on return migration intentions is given by ($\beta_1 + \beta_3$). Accordingly, when the coefficient associated with the interaction term is not statistically significant, this suggests that there is no convincing evidence of an interaction effect.

4.3 Empirical Results

Our empirical findings are reported in Table 1. In short, we find no evidence that climate change (measured in terms of temperature increases) in the respondents' home region is associated with individual return migration intentions. That is, there is no support for hypothesis *H1*. Rather, we find that these intentions increase with one's level of education and attachment to one's home country. For instance, these latter findings could imply that West African migrants in Germany want to return to their home country after they have received an education or completed their training or in response to feelings of homesickness and nostalgia. Moreover, some demographic variables are found to matter. Return migration intentions tend to be lower when respondents are female and younger, have no children and are in a serious relationship with a person that has close ties to Germany.

Table 1: Unconditional Effect of Climate Change on Return Migration Intentions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Home Region Temperature	-0.085	-0.072	-0.084	-0.092	-0.119	-0.071	-0.380
Change	(0.138)	(0.129)	(0.128)	(0.155)	(0.073)	(0.140)	(0.622)
Secure Legal Status		-0.042	-0.040	-0.042	0.029	-0.069	-0.215
		(0.037)	(0.036)	(0.037)	(0.020)	(0.044)	(0.178)
Material Precarity		-0.021	-0.018	-0.021	0.013	-0.065	-0.111
		(0.038)	(0.038)	(0.038)	(0.021)	(0.046)	(0.193)
At Least Secondary		0.069*	0.063*	0.069*	0.036**	0.125***	0.368*
Education		(0.036)	(0.036)	(0.036)	(0.017)	(0.043)	(0.188)
Attached to		0.115***	0.111***	0.115***	0.058***	0.163***	0.570***
Home Country		(0.016)	(0.016)	(0.016)	(0.010)	(0.018)	(0.083)
Feels Welcome in			-0.018				
Germany			(0.034)				
Family Important			0.148***				
			(0.039)				
Home Region Precipitation				-0.002			
Change				(0.006)			
Estimation Method	OLS	OLS	OLS	OLS	OLS	OLS	Logit
Observations	930	930	930	930	930	687	926
R^2 or Pseudo-R^2	0.053	0.112	0.122	0.112	0.103	0.183	0.087
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interview Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable is equal to unity when respondent says they want to (i) migrate home in the next five years, (ii) eventually migrate home or (iii) eventually divide their time between home country and Germany. In specification (5), the dependent variable is equal to unity when respondent says they want to (i) migrate home in the next five years or (ii) eventually migrate home. In specification (6), respondents that gave no clear answer about their return migration intentions are dropped. Demographic controls are for gender, age, having children and being in a relationship with a German or person with permanent residence in Germany. Geographical controls are for respondents' West Africa country of origin and location of residence (federal state) in Germany. Interview controls are for interview data and language. Constant not reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Table 1, we also report a series of robustness checks. First, we also control for respondents' feeling welcome in Germany to proxy discrimination in Germany and the importance of family in the respondents' life, both of which may motivate return migrations.[12] Here, we find evidence that people who are close to their families are

[12] Feeling welcome is measured by considering the following survey question: "Do you feel welcome in Germany?" Answers could range from "Totally" to "Not at all". Higher values of this variable mean that respondents feel less welcome. The importance of family is evaluated via the following question:

more likely to report return migration intentions, while climate change in the survey participants' home region again does not affect return migration intentions (Model 3 of Table 1). Second, using data from the *Geospatial Database* we also construct the mean difference in regional rainfall between the 2018–2022 period and the 1990–2000 period. Changes in rainfall are also reflective of climate change, given that temperature and precipitation tend to be strongly correlated (Auffhammer et al., 2013). Yet, as with regional temperature increases, we find no evidence that regional changes in rainfall patterns correlate with return migration intentions (Model 4).[13] Third, we construct an alternative dichotomous dependent variable that is equal to unity when respondents say that they want to eventually migrate home, so that respondents who want to divide their time between their home country and Germany are no longer considered. Here, we also do not find that regional temperatures increases are associated with individual return migration intentions in statistically significant ways (Model 5). Fourth, the same is true when we use a different sample for our estimations, dropping all respondents who provide no clear answer on whether they want to migrate back to their home country or stay in Germany (Model 6).[14] Finally, using a logit instead of an OLS estimation approach, we also detect no statistically significant association between warming and return migration intentions (Model 7).

"How important is family in your life?" From the responses, we create a binary variable that is equal to unity when respondents say that family is very important to them; it is equal to zero otherwise.

[13] In contrast to regional temperatures, there is no uniform change in regional rainfall, with some regions becoming wetter and others becoming drier. As a robustness check, we also test whether increases in wetness and dryness differently affect return migration intentions. We find no evidence that this is the case, supporting the notion that climatic factors are not important determinants of return intentions.

[14] That is, we exclude respondents who said that they did not know whether they would eventually migrate back or stay in Germany.

While the findings of Table 1 do not suggest that there is an unconditional relationship between climate change in the respondents' home region and their return migration intentions, we also hypothesized about possible conditional effects, where respondents may react different react differently to climate change at home due to differences in (i) legal status, (ii) material conditions, (iii) education or (iv) attachment to their home country. We report the corresponding interaction model estimates in Table 2.

Table 2: Conditional Effect of Climate Change on Return Migration Intentions

	(1)	(2)	(3)	(4)
Home Region Temperature Change	-0.302*	-0.031	-0.172	-0.175
	(0.165)	(0.136)	(0.159)	(0.244)
Secure Legal Status	-0.296***	-0.045	-0.042	-0.042
	(0.112)	(0.037)	(0.036)	(0.037)
Temperature * Status	0.352**			
	(0.145)			
Material Precarity	-0.014	0.112	-0.021	-0.021
	(0.038)	(0.142)	(0.038)	(0.038)
Temperature * Precarity		-0.178		
		(0.179)		
At Least Secondary Education	0.066*	0.070*	-0.030	0.069*
	(0.036)	(0.036)	(0.108)	(0.036)
Temperature * Education			0.145	
			(0.144)	
Attached to Home Country	0.115***	0.115***	0.115***	0.093*
	(0.016)	(0.016)	(0.016)	(0.052)
Temperature * Attachment				0.032
				(0.068)
Observations	930	930	930	930
R^2	0.118	0.112	0.112	0.112
Demographic Controls	Yes	Yes	Yes	Yes
Geographical Controls	Yes	Yes	Yes	Yes
Interview Controls	Yes	Yes	Yes	Yes

Notes: OLS-estimates reported. Dependent variable is equal to unity when respondent says they want to (i) migrate home in the next five years, (ii) eventually migrate home or (iii) eventually divide their time between home country and Germany. Demographic controls are for gender, age, having children and being in a relationship with a German or person with permanent residence in Germany. Geographical controls are for respondents' West Africa country of origin and location of residence (federal state) in Germany. Interview controls are for interview data and language. Constant not reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In short, we find little evidence of interaction effects. Individual differences in material conditions, education and attachment to the country of origin do not affect the likelihood of respondents reporting affirmative return migration intentions. That is, there is no evidence in support of hypotheses *H3* and *H4*. With respect to the role of legal status, we find that individuals with insecure legal status do have lower return migration intentions, though this effect is only statistically significant at the 10% level, while the effect of temperature increases on return migration intentions for individuals with secure status is insignificant.[15] These latter findings lend only very weak support to hypothesis *H2*.

Potentially, the definition of the moderator variables for legal and material status, education and attachment affect our interaction model estimates. To add to the robustness of our findings, we thus also operationalize each moderator variable in a different manner. First, we now measure legal precarity by differentiating between respondents that only have a refugee or unclear legal status and those respondents that have a permanent resident permit or a temporary permit for education, work or family reasons. Second, we alternatively measure socio-economic precarity via a binary variable that is equal to unity when the respondent earned less than approximately 1,565€ in the last month; this latter amount is equal to the mean-level of reported earnings.[16] Third, as an alternative measure of education, we create a dichotomous variable that is equal to unity when the respondent has a level of education beyond secondary education (i.e., respondents with university studies, completed university degrees or some other form of postsecondary education) and zero otherwise. Finally, we consider the following survey question to construct an

[15] Adding together the regression coefficient for the temperature variable (-0.302) and the interaction term (0.352) gives 0.050 (p=0.72).

[16] Note that only 737 respondents provided an estimate of their income in the last month.

alternative attachment measure: "*How often do you follow the news on the happenings in your home country?*" Higher values to this question mean that the respondent follows the news in their home country more frequently; we argue that respondents who are interested in such news are also more attached to their home country.

We report our estimates using the alternative moderator variables in the appendix (Supplementary Table 1). These results are consistent with those shown in Table 2 in that we again find no evidence of any interaction effect for differences in material status, education and attachment to the origin country. What is more, we find respondents with an insecure status (defined as respondents with a refugee or otherwise uncertain residence status) do not react differently to climate change at home with respect to their return migration intentions compared to respondents that have a more permanent legal status. In other words, the evidence that difference in legal status matters to return migration intentions—which was already weak in Table 2—does not receive further support from our robustness checks. Consequently, combining the results from Tables 1 and 2 suggests that there is no convincing statistical evidence in favor of any conditional effect related to individual differences legal status, material conditions, education and education to the country of origin.

5. Survey Experiment: Empirical Approach and Findings

In the previous section, we showed that there is no statistically convincing relationship—be it unconditional or conditional—between climate change in the home regions of West African migrants living in Germany and their return migration intentions. In this section, we add to this evidence by providing additional results from a survey experiment, where we study how informational cues about the prospect of climate disasters in the country of origin matter to return intentions. Here,

investigating the climate-return migration nexus by means of an additional empirical approach ought to strengthen the robustness of our empirical conclusions.

5.1 Design of Survey Experiment

To examine how susceptible survey respondents are to climate conditions in their home country with respect to their return migration intentions, we consider a factorial survey experiment with four randomized dimensions (for a discussion of this method, see, e.g., Auspurg and Hinz, 2015). In detail, each survey participant receives the following cue: *Imagine that five years from now, it appears that in [COUNTRY OF ORIGIN], [INSERT FROM (1)] and [INSERT FROM (4)]. In Germany, [INSERT FROM (2)]. Finally, regarding your friends and relatives, [INSERT FROM (3)].* The associated dimensions are as follows:

(1): (a) there are many job opportunities or (b) there are few job opportunities

(2): (a) you have a good job or (b) you do not have a good job

(3): (a) most of them live in Germany or in Europe or (b) most of them live in [country of origin]

(4): (a) climate disasters such as droughts, floods and coastal erosion occur regularly or (b) climate disasters such as droughts, floods and coastal erosion rarely occur

For instance, an individual from Nigeria could receive the following sentence: *Imagine that five years from now, it appears that in Nigeria, there are many job opportunities and climate disasters such as droughts, floods and coastal erosion rarely occur. In Germany, you have a good job. Finally, regarding your friends and relatives, most of them live in Germany or in Europe.*

Concerning the factorial survey experiment, our main dimension of interest refers to climate conditions in the West Africans' country of origin. Along with this

dimension, we also randomize other factors that could shape return migration intentions, namely (i) economic prospects in the home country, (ii) economic prospects in Germany and (iii) one's network in Germany/Europe or home country. Including these additional dimensions allows us to compare the effect size of our main dimension of interest to that of other factors and also helps avoid that respondents guess what the factorial survey experiment is about, thus lowering the risk of social desirability bias.

Directly after the respondent has received their (fully randomized) cues about climate conditions at home as well as other economic and social determinants of return migration, they are asked the following question: *Under these conditions, would you return to [country of origin]?* The answer can either be *Yes* or *No*. The respondents' answer to this question is our outcome of interest (dependent variable).

5.2 Empirical Approach

To test our first hypothesis (*H1*) of an unconditional effect of climate change on return migration intentions, we estimate the following model:

$$return_i = \beta_0 + \beta_1 \times climate_i + \beta_2 \times econorigin_i + \beta_3 \times jobGermany_i + \beta_4 \times network_i + \beta_i \times X' + \varepsilon_i \quad (3)$$

Here, for survey respondent *i*, *return* refers to their answer (negative or affirmative) to the question on their return migration intentions. Furthermore, *climate* is a dichotomous variable that is equal to unity when the respondent is exposed to the version of the vignette that says, "*climate disasters such as droughts, floods and coastal erosion occur regularly*" and zero otherwise. Concerning the other dimensions of the experiment, (i) *econorigin* is equal to unity when the respondent receives the vignette version that says "*there are many job opportunities*" in their home country, (ii) *jobGermany* is equal to unity when the respective vignette version says "*you have a good*

job" in Germany, while (iii) *network* is equal to unity when the respondent is exposed to the version of the vignette that says that most of the respondents' friends and family live in Germany or in Europe. While not strictly necessary in a survey experiment setting, in some specifications we include the vector *X* that includes some demographic controls (gender, age, having children and being in a relationship) as well as a set of country-of-origin dummies that we include to augment statistical precision.

To test our additional hypotheses (*H2*, *H3* and *H4*) that postulate a conditional effect of climate disasters on return migration intentions, we consider the following model:

$$return_i = \beta_0 + \beta_1 \times climate_i + \beta_2 \times moderator_{ij} + \beta_3 \times (climate_i \times moderator_{ij}) + \beta_4 \times econorigin_i + \beta_5 \times jobGermany_i + \beta_6 \times network_i + \beta_i \times X' + \varepsilon_i \quad (4)$$

In addition to the variables already introduced above, this model includes a variable *moderator* in its *j*-th form as well as an interaction term between the *moderator* and *climate* variables. This allows us to examine whether the effect of climate disaster information on return migration intentions is conditional upon certain individual traits. As hypothesized above, these traits are associated with individual socio-economic and legal status, level of education or connectedness to one's home country, respectively. We use the same variables as introduced in the previous section to operationalize these traits, i.e., *legal* (legal status), *material* (material status), *educ* (education) and *attach* (attachment to the country of origin).

5.3 Empirical Findings

We first report our findings concerning an unconditional association between the regular occurrence of climate disasters—as it would be expected under climate change—and individual return migration intentions, as estimated in Equation (3). While we present our full regression results in the appendix (Supplementary Table

2), we report an associated coefficient plot to summarize our main findings in Figure 4.

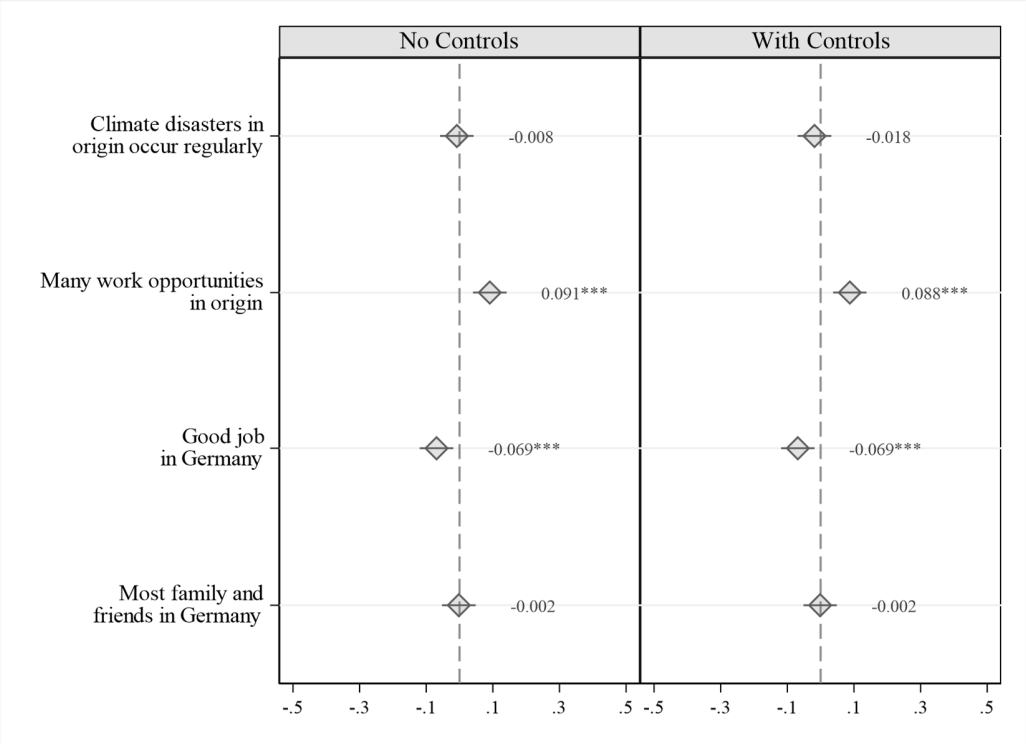

Figure 4: Unconditional Relationship between Climate Change and Return Migration

We find no evidence that respondents receiving a cue that climate disasters will occur regularly respond with lower return migration intentions than those receiving a cue promising that such disasters will occur only rarely. This finding is not affected by the inclusion of further controls, which also indicates that randomization was successful. That is, we do not find evidence in favor of *H1* which posits an unconditional (negative) effect of unfavorable climate conditions in home countries on return migration intentions.

In Figure 4, we also show that respondents are more likely to adjust their return migration intentions in response to economic cues. Here, the results are as expected, which also speaks to the overall soundness of our experimental design. First, the

prospect of many employment opportunities in the home country leads to higher return migration intentions. Second, having a good job in Germany lowers return migration intentions. By contrast, as also shown in Figure 4, there is no evidence that cues about the whereabouts of one's family and friends (whether they live in Germany/Europe or in the home country) affects return migration intentions.

Our other hypotheses postulate a relationship between climate conditions and return migration intentions that is conditional upon individual characteristics. We aim to uncover such response heterogeneity by estimating variants of Equation (4) that account for material and legal precarity (*H2*), education (*H3*) and connectedness (*H4*).

Socio-Economic and Legal Status. In Figure 5, we report the associated coefficient plots when focusing on material precarity (i.e., unemployment and dependence on government benefits) and legal precarity (i.e., temporary or insecure residence permit), respectively. Again, we report the full regression results, including a specification without further controls, in the appendix (Supplementary Table 3). We do not find that respondents affected by legal and/or material precarity respond differently to informational cues about climate disasters with respect to their return migration intentions than respondents not affected by precarity. Thus, these findings do not speak to *H2*. Even though socio-economic or legal precarity are arguably adversely related to individual agency or investment, this does not appear to translate into differences in responsiveness to the prospect of regular climate disasters at home.

As in the previous section, we are aware that the definition of the moderator variables for legal and material status (as well as for education and attachment) may affect model estimates. As a robustness check, we thus use the same alternative measures of socio-economic precarity(comparing respondents who earn more or less than the mean-level of earnings within the sample) and legal precarity (differentiating between respondents that only have a refugee or unclear legal status and those

respondents who have a more secure status) as introduced in the previous section. Reassuringly, as shown in Supplementary Table 3, using these alternative moderator operationalization yields the same empirical conclusion: respondents affected by legal and/or material precarity do not respond differently to informational cues about climate disasters.

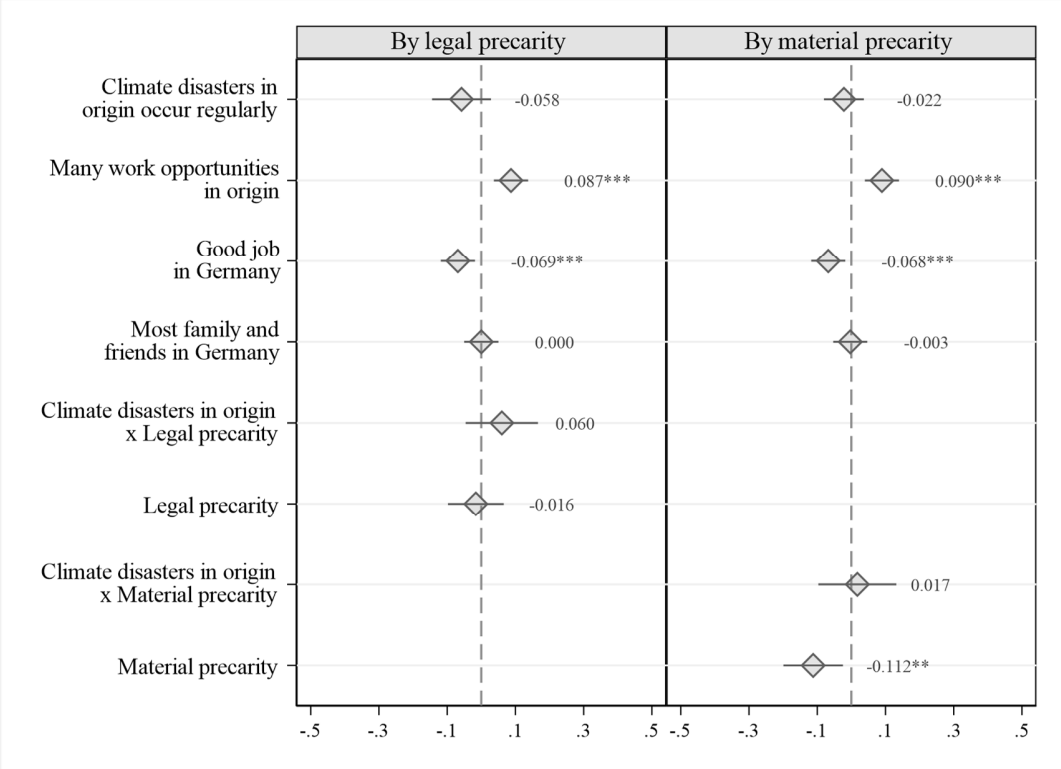

Figure 5: Role of Socio-Economic and Legal Status

Education. As hypothesized above, more educated respondents may react more strongly to climate cues due to having higher levels of climate literacy, meaning that, e.g., they have a better understanding of what the economic, political and health consequences of regularly occurring climate disasters may be.

As indicated in the coefficient plots in Figure 6, however, we do not find support for *H3* (regression results shown in Supplementary Table 4 in the appendix). That is, survey participants with secondary education do not respond markedly differently to

unfavorable climate disaster cues than their less educated counterparts. By contrast, cues about economic prospects in Germany or the home country continue to affect return migration intentions in expected ways. As a robustness check reported in Supplementary Table 4, we use an alternative education moderator (differentiating between respondents with postsecondary education and those with lower levels of education) and again find that survey participants with higher levels of education do not have a different response to unfavorable climate disaster cues.

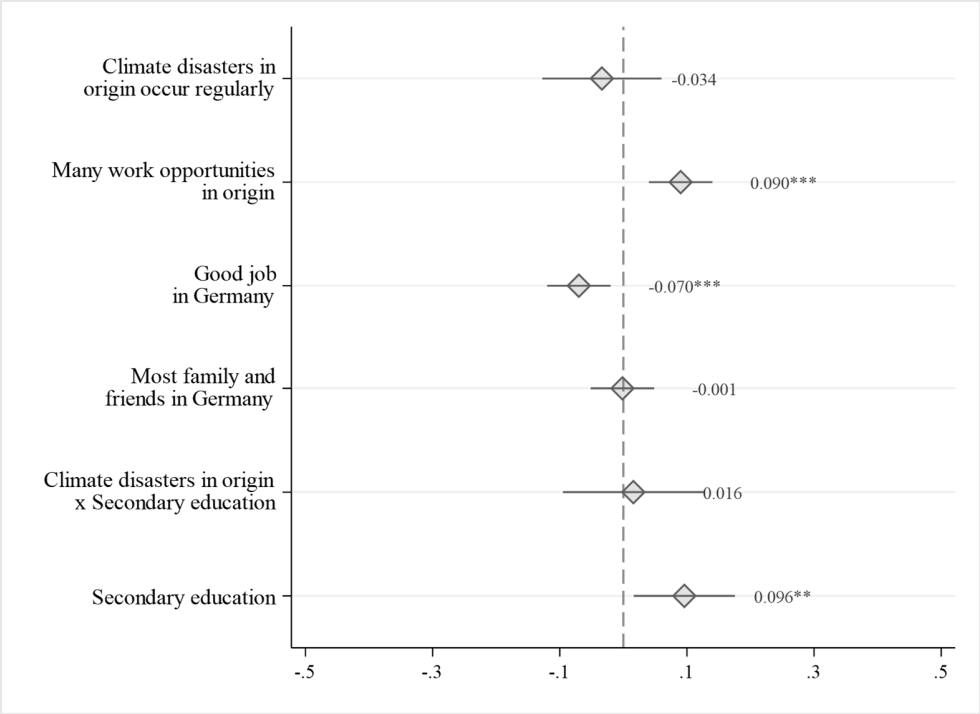

Figure 6: Role of Education

Connectedness. Finally, we argue that differences in individual attachment to their home country may moderate how survey participants respond to cues about climate disasters. For example, having a strong attachment to one's country of origin (in contrast to Germany) may correlate with a greater interest in one's home country and thus a greater likelihood of responding to "bad news" (e.g., concerning climate disasters) by changing one's intentions of migrating back home.

Yet, as shown by the coefficient plots of Figure 7, we find no evidence for this proposition outlined in *H4* (regression results reported in Supplementary Table 5 in the appendix). Those respondents who feel more attached to their home country do not respond differently to informational cues about the regular occurrence of climate disasters than those who feel more attached to Germany. As an alternative measure of attachment, we consider—as in the previous section—how often respondents follow the news on their home country and reassuringly again find that attachment does not moderate how survey participants react to informational cues about the frequency of climate events at home (see Supplementary Table 5).

Ultimately, those migrants that feel attached to their home country may not only be responsive to "bad news" about climate change but also to "good news" concerning the state of economy of their country of origin. To test this proposition, we consider a model where we include an additional interaction term accounting for the possibility that respondents who have a strong attachment to their home country respond more favorably to cues about a sound economic outlook in their home country. Indeed, as shown in Figure 7, we find evidence for this notion. At the same time, accounting for this additional heterogeneity does not matter to our empirical conclusion concerning the relationship between connectedness and climate disasters. In sum, the finding that survey participants who have a strong attachment react particularly favorably to cues about sound economic prospects in their home country is highly intuitive. What is more, this result underlines our finding—consistently shown in Figures 4 to 7—that cues about favorable economic prospects (both in the host and home country) rather than unfavorable climate events shape return migration intentions.

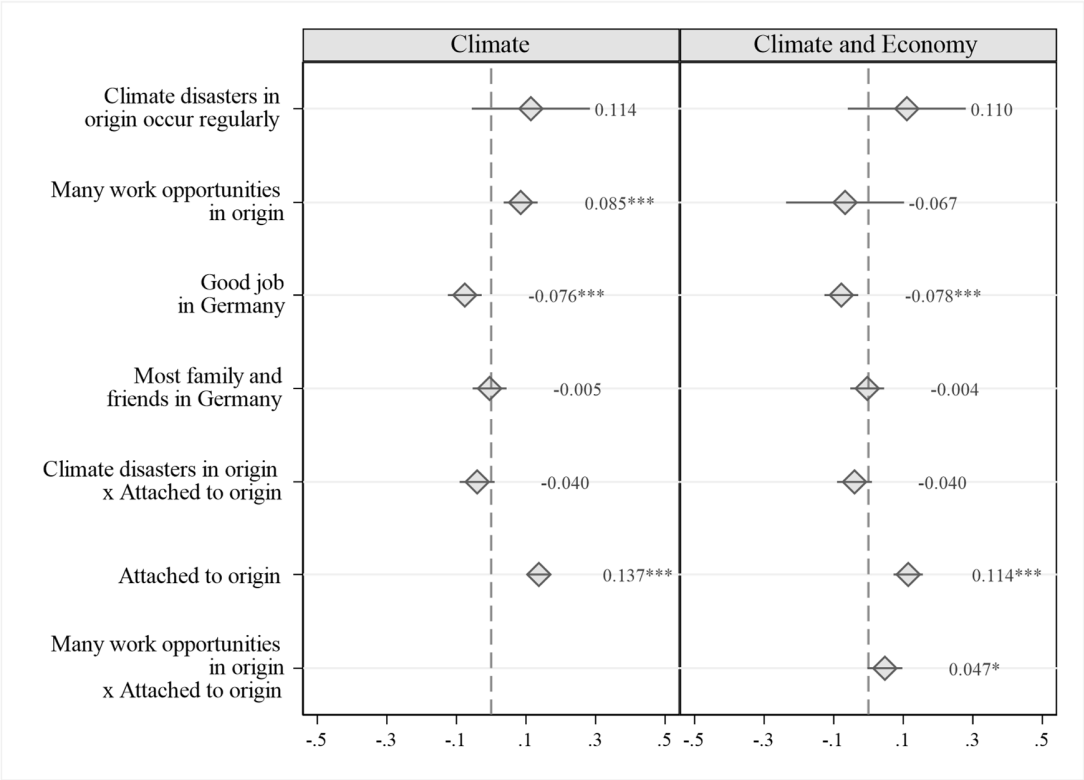

Figure 7: Role of Connectedness

6. Conclusion

The role of climate conditions in return migration is largely unappreciated in the broader climate-migration literature. In this paper, we contribute to the better understanding of return migration by assessing its relationship with the prospect of climate change and climate disasters in migrants' home countries.

We analyze original survey data of over 1,000 first-generation migrants from West Africa living in Germany. A considerable number of migrants want to eventually return to their home country at least for some time in the future, suggesting that many respondents do not see their migration experience as finished. Correlating observational data on temperature increases in the respondents' subnational regions of origin in West Africa to their return migration intentions, we find that the latter are

not affected by warming in the respondents' home regions. Neither do we find evidence that differences in migrants' socioeconomic status, education or attachment to their home countries moderate the influence of climate change in the form of regional warming on return intentions. Rather, we find that return intentions increase with migrants' level of education and attachment to their home country. These findings could imply that West African migrants in Germany want to return to their home country after they have received an education or in response to feelings of homesickness.

To delve into the direct influence of climate conditions in home countries vis-à-vis indirect effects operating via economic conditions, we run a survey experiment where we confront survey participants with different scenarios concerning economic prospects in Germany and their country of origin as well as the frequency of climate disasters in their West African country of origin. We find no evidence of an unconditional effect of climate disasters cues on return migration intentions. Similarly, there is no evidence of an effect conditional on respondent characteristics. For instance, we do not find that more educated survey participants respond differently to informational cues about climate disasters with respect to their return migration intentions than their less educated counterparts. Rather, we find that economic cues concerning sound economic prospects both in Germany and the home country consistently shape return migration intentions. For instance, survey participants are more likely to report that they would want to migrate home when there are ample job opportunities in their home country. These results open the door for many opportunities for future research to consider alternative sources of heterogeneity, e.g., as a consequence of differences in climate literacy rather than education.

In sum, our survey experiment findings suggest that economic prospects are more salient and influential than environmental concerns with respect to return migration intentions, providing rare evidence that disentangles direct from indirect effects of climate change on migration (Cottier at al., 2022). Indeed, these results do not necessarily imply that climate conditions do not matter to return migration intentions and behavior at all. For instance, negative climate events have been shown to hurt economic activity and employment prospects in the migrants' home country, thus indirectly making return migration less attractive. Investigating such linkages—also via experimental approaches—may be another fruitful area of future research.

The issue of return migration is important for both host and home countries. For instance, while host countries may want to retain migrant talent, home countries may be interested in luring the same talent back home. For the time being, our empirical results suggest that when designing related policy initiatives, policymakers are well advised to consider the influence of socio-economic prospects (i.e., education and employment opportunities) more strongly in host and home countries rather than to focus on climate concerns.

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Appendix

	(1)	(2)	(3)	(4)
Home Region Temperature Change	-0.114	-0.040	-0.126	0.148
	(0.139)	(0.169)	(0.141)	(0.256)
Refuge or Unclear Legal Status	-0.124			
	(0.117)			
Temperature * Status	0.121			
	(0.155)			
Below Median Net Income		-0.041		
		(0.122)		
Temperature * Net Income		0.131		
		(0.161)		
University Education			-0.085	
			(0.142)	
Temperature * University Education			0.144	
			(0.177)	
Home Country News Consumption				0.121***
				(0.046)
Temperature * News Consumption				-0.060
				(0.061)
Observations	930	682	930	930
R^2	0.112	0.119	0.109	0.099
Other Moderators	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Geographical Controls	Yes	Yes	Yes	Yes
Interview Controls	Yes	Yes	Yes	Yes

Notes: OLS-estimates reported. Dependent variable is equal to unity when respondent says they want to (i) migrate home in the next five years, (ii) eventually migrate home or (iii) eventually divide their time between home country and Germany. Other moderators are the variables used as moderators for secure legal status, material precarity, secondary education and attachment to the home country as used in the main text; one moderator is replaced by the respective alternative moderator in each specification. Demographic controls are for gender, age, having children and being in a relationship with a German or person with permanent residence in Germany. Geographical controls are for respondents' West Africa country of origin and location of residence (federal state) in Germany. Interview controls are for interview data and language. Constant not reported. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Supplementary Table 1: Alternative Estimation of Interaction Effects

	(1)	(2)
Climate Disasters in Origin Country Occur Regularly	-0.008	-0.017
	(0.026)	(0.026)
Many Job Opportunities in Origin Country	0.091***	0.092***
	(0.026)	(0.026)
Good Job in Germany	-0.069***	-0.067***
	(0.026)	(0.026)
Most Family and Friends in Germany	-0.002	-0.002
	(0.026)	(0.026)
Observations	1,020	1,020
R^2	0.019	0.053
Demographic Controls	No	Yes
Country of Origin Dummies	No	Yes

Notes: OLS estimates reported. Constant not reported. Demographic controls for age, gender, having children and being in a relationship. *** p<0.01, ** p<0.05, * p<0.1.

Supplementary Table 2: Estimates of Unconditional Relationship between Climate Disasters and Return Migration Intentions

	(1)	(2)	(3)	(4)	(5)	(6)
Precarity Variable →	Non-Permanent	Benefits	Non-Permanent	Benefits	Refugee Status	Mean Income
Climate Disasters in Origin Country Occur Regularly	-0.048	-0.009	-0.058	-0.022	-0.035	-0.032
	(0.044)	(0.030)	(0.044)	(0.030)	(0.030)	(0.047)
Many Job Opportunities in Origin Country	0.090***	0.094***	0.087***	0.090***	0.086***	0.082***
	(0.026)	(0.026)	(0.026)	(0.025)	(0.026)	(0.032)
Good Job in Germany	-0.070***	-0.068***	-0.069***	-0.068***	-0.069***	-0.087***
	(0.026)	(0.026)	(0.026)	(0.025)	(0.026)	(0.031)
Most Family and Friends in Germany	0.001	-0.004	0.000	-0.003	0.001	-0.008
	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)	(0.032)
Legal Precarity	0.026		-0.016		-0.115***	
	(0.040)		(0.042)		(0.043)	
Climate Disasters * Legal Precarity	0.062		0.060		0.062	
	(0.054)		(0.054)		(0.057)	
Material Precarity		-0.121***		-0.112**		0.002
		(0.043)		(0.044)		(0.048)
Climate Disasters * Material Precarity		0.013		0.017		-0.003
		(0.059)		(0.058)		(0.063)
Observations	1,020	1,020	1,020	1,020	1,020	737
R^2	0.025	0.034	0.066	0.075	0.073	0.066
Demographic Controls	No	No	Yes	Yes	Yes	Yes
Country of Origin Dummies	No	No	Yes	Yes	Yes	Yes

Notes: OLS estimates reported. Constant not reported. Demographic controls for age, gender, having children and being in a relationship. Precarity Variables: Non-Permanent=Individuals with permit for education and work permit or refugee or unclear status. Refugee Status=Individuals with refugee or unclear status. Benefits=Individuals that are currently unemployed or have received any social benefits or income support from the state in the month before the survey. Mean Income=Individuals who earned less than the sample-mean in the month before the survey. *** p<0.01, ** p<0.05, * p<0.1.

Supplementary Table 3: Estimates of Relationship between Climate Disasters and Return Migration Intentions Conditional on Socio-Economic and Legal Status

	(1)	(2)	(3)
Climate Disasters in Origin Country Occur Regularly	-0.025	-0.034	-0.016
	(0.048)	(0.048)	(0.031)
Many Job Opportunities in Origin Country	0.093***	0.090***	0.087***
	(0.026)	(0.025)	(0.025)
Good Job in Germany	-0.071***	-0.070***	-0.065***
	(0.026)	(0.025)	(0.025)
Most Family and Friends in Germany	-0.002	-0.001	0.001
	(0.026)	(0.025)	(0.025)
Secondary Education	0.105***	0.096**	
	(0.040)	(0.041)	
Climate Disasters * Secondary Education	0.017	0.016	
	(0.057)	(0.056)	
Postsecondary Education			0.187***
			(0.041)
Climate Disasters * Postsecondary Education			-0.030
			(0.054)
Observations	1,020	1,020	1,020
R^2	0.035	0.077	0.097
Demographic Controls	No	Yes	Yes
Country of Origin Dummies	No	Yes	Yes

Notes: OLS estimates reported. Constant not reported. Demographic controls for age, gender, having children and being in a relationship. *** p<0.01, ** p<0.05, * p<0.1.

Supplementary Table 4: Estimates of Relationship between Climate Disasters and Return Migration Intentions Conditional on Education Intentions

	(1)	(2)	(3)	(4)	(5)	(6)
Connectedness Variable →	Home	Home	Home	Home	News	News
Climate Disasters in Origin Country Occur Regularly	0.098	0.094	0.114	0.110	0.074	0.071
	(0.086)	(0.086)	(0.087)	(0.086)	(0.080)	(0.080)
Many Job Opportunities in Origin Country	0.084***	-0.089	0.085***	-0.067	0.086***	0.017
	(0.025)	(0.086)	(0.025)	(0.086)	(0.025)	(0.080)
Good Job in Germany	-0.074***	-0.077***	-0.076***	-0.078***	-0.073***	-0.074***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Most Family and Friends in Germany	-0.006	-0.004	-0.005	-0.004	-0.002	-0.002
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Attachment to Origin Country	0.139***	0.113***	0.137***	0.114***	0.056***	0.047***
	(0.017)	(0.021)	(0.018)	(0.021)	(0.015)	(0.018)
Climate Disasters * Attachment	-0.033	-0.032	-0.040	-0.040	-0.026	-0.025
	(0.026)	(0.026)	(0.026)	(0.026)	(0.021)	(0.021)
Job Opportunities in Origin Country * Attachment		0.053**		0.047*		0.019
		(0.026)		(0.026)		(0.021)
Observations	999	999	999	999	1,020	1,020
R^2	0.107	0.111	0.141	0.144	0.082	0.083
Demographic Controls	No	No	Yes	Yes	Yes	Yes
Country of Origin Dummies	No	No	Yes	Yes	Yes	Yes

Notes: OLS estimates reported. Constant not reported. Demographic controls for age, gender, having children and being in a relationship. Attachment Variables: Home=Individuals who feel more strongly attached to their home country rather than Germany (higher values mean higher attachment to home country). News=Individuals who consume news about their home country (higher values mean more frequent news consumption, i.e., connectedness to home country). *** p<0.01, ** p<0.05, * p<0.1.

Supplementary Table 5: Estimates of Relationship between Climate Disasters and Return Migration Intentions Conditional on Connectedness to Origin Country