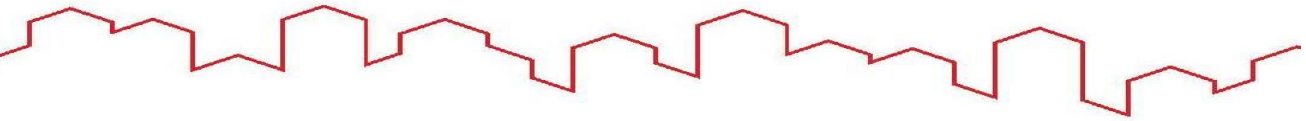

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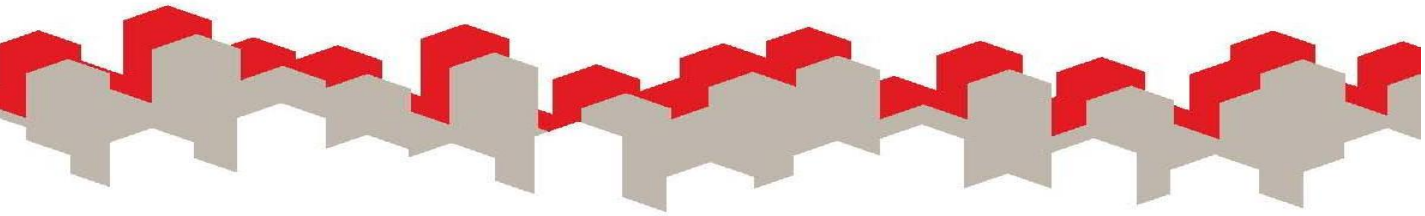

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Psychological Costs of Migration: Home Country Natural Disasters and Mental Health*

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Abstract

The psychological toll of leaving one's familiar environment is a dominant explanation for why some people do not migrate despite relatively high wage differentials and low monetary costs of moving. Yet there is little direct empirical evidence on the existence and the characteristics of psychic costs. Using linked administrative and survey data (the 45 and Up Study) from Australia, a country where one in four residents was born overseas, we show that migrant mental health is significantly affected by home country natural disasters. In the three months following a disaster, mental health related drug use and visits to mental health specialists increase by 5% and 33%, respectively. The effects persist for up to 12 months after the initial shock and increase with distance to the home country. In contrast, we do not find any effects of home country disasters on the physical health conditions of migrants. Given that individuals in our sample have lived in their destination country for an average of 40 years, our estimates suggest strong persistence in these costs.

Keywords: psychic costs of migration; natural disasters; mental health

1 Introduction

Larry Sjaastad's seminal paper in 1962 (Sjaastad 1962) laid the groundwork for thinking about the psychic costs of migration. A classic example of psychic costs of migration comes from Sjaastad himself: "Since people are often genuinely reluctant to leave familiar surroundings, family, and friends, migration involves a "psychic" cost."[1] Since then, psychic costs have been used to explain why migration does not take place even in the face of obvious wage differentials and relatively small monetary moving costs (Borjas 2014). Despite the wide use of psychic costs as an integral component of migration models, very few studies to date have made an attempt at empirically showing the existence of these costs. While it may be intuitive that people do not want to leave their home countries because of ties to family, networks, and other social arrangements, capturing this empirically is challenging.

Part of the challenge comes from the fact that who migrates is not random for multiple reasons, only one of which are psychic costs. An ideal experiment designed to examine the existence of these costs would involve randomly lowering psychic costs (say by forcibly eliminating social ties) for one set of people, and examining migration decisions while holding all other costs and returns to migration constant. Such an experiment is not only unfeasible, but also the removal of social ties would eliminate any informal financial ties (as is often found in informal credit arrangements) which are very common in the developing country context. Hence, obtaining a clear measure of *purely* psychic costs is conceptually and practically rather difficult.

In this paper we take a novel approach to empirically showing the existence and persistence of psychic costs. Among a group of migrants who have already left their home countries, we investigate whether shocks to their home countries in the form of natural disasters affect their mental health, and whether this effect varies with characteristics associated with migration (distance to the home country, time since migration, strength of social networks in destination country, etc.). If migrants are indeed emotionally linked to their countries of origin (either through direct family ties, or through social networks, or simply a sense of longing or care), we expect their mental health to deteriorate in the aftermath of a natural disaster in the home country. In our sample, we look at established migrants (the average migrant in our sample has been away from their home country for almost 40 years) and use administrative health records linked to a dataset on global natural disasters to show that *unexpected* natural disasters in their home country lead migrants to seek mental health services in their country of residence. Note that our

[1] Another example comes from Massey (1990): "psychic costs [are the] the psychological toll of leaving a familiar environment and moving to a strange setting".

findings do not provide measures of the *magnitude* of psychic costs of migration per se but rather *changes* in these costs due to unexpected shocks in the home country.

In the three months following the disaster, mental health drug use and mental health specialist visits increase by 5% and 33%, respectively. The effects persist up to 12 months. Natural disasters in countries that are *not* their home country, do not lead to a deterioration of mental health, and neither does a home country natural disaster lead migrants to seek care for non-mental health related illnesses. Furthermore, the magnitude of the reaction in the migrant's mental health varies with the severity of the disaster with more serious shocks eliciting larger responses. And finally, these effects vary with distance to the home country – the farther away the home country, the larger is the magnitude of the effects of the home country natural disaster on mental health outcomes. We take the specific mental health related response of migrants to shocks in their home country as providing one of the clearest empirical documentations of the psychic costs of migration.

We use a unique and large Australian survey dataset (the 45 and Up Study), which is linked to the respondents' administrative medical records. Australia is an ideal setting to study the behavior of migrants as one in four Australian residents is born overseas. Mental health is measured by prescription drug use and mental health specialist visits, which is available at a monthly level for every individual. The frequency of the medical records allows for precise identification of the timing of the effects of natural disasters on mental health. These data allow us to know the exact timing of when visits are made, to whom, and also when prescription drugs are picked up by individuals. The information on natural disasters comes from a comprehensive worldwide disaster database (EM-DAT). After controlling for home-country and time fixed-effects, natural disasters are plausibly exogenous and unexpected. Home country fixed-effects are important since some countries may be prone to more natural disasters than others and the frequency of such events could pick up correlated and unobserved home country characteristics.

Much has been written about the mental health of migrants in psychiatry and psychology (Bhugra (2004) provides a thorough review of this literature). The broad conclusions reached therein support the intuitive idea that migration can be extremely traumatic and stressful for the migrant and those around him or her, but that there is heterogeneity in experiences and stress related outcomes. For example, migration due to conflict can be particularly stressful as is evidenced in recent refugee studies (Bogic et al. 2015), but social capital in destination countries can play a mediating role (Lecerof et al. 2015). The fact that migration is often accompanied by some form of psychological stress is strong evidence in support of real psychic costs; however, most of the literature in psychiatry and psychology does not account for selection into migration. Moreover, note that even if we were able to move people randomly and measure their mental well-being as in Stillman et al. (2009), it would not adequately capture psychic costs of migration. People who

agree to move (say by entering a visa lottery) do not necessarily experience a *change* in the psychic costs of migration – they have, presumably, formed expectations regarding the costs and benefits of migrating and have chosen to move based on these expectations. Hence, comparing mental health among a group of migration lottery winners and losers says something important about the effects of migration on mental health, but does not necessarily shed light on the presence and size of psychic costs as these were already incorporated in the migration decision.

Our paper relates to, and builds on some recent work trying to pin down evidence on the psychic costs of migration. Barrett & Mosca (2013) use a sample of migrants and non-migrants from Ireland (the migrants in the sample are return migrants), and correlate migration history with alcohol use as an indicator for psychic costs that someone may have incurred during their migratory episode. They account for selection into migration by using a propensity score matching technique. A couple of closely related papers (at least in terms of methodology) examine subjective well being and mental health of migrants in response to home country macroeconomic shocks (Akay et al. 2017, Nguyen & Connelly 2018). Akay et al. (2017) find that migrants in Germany whose home countries have positive economic shocks report having *worse* subjective well being. They interpret their results within the context of reference dependent behavior; hence, they provide evidence that for migrants, the home country is the relevant and natural comparator for economic outcomes. Nguyen & Connelly (2018) find the opposite result: good macroeconomic conditions in the home country have positive impacts on mental health among migrants in Australia. Our paper differs in a few critical ways: (a) while both papers could be interpreted as evidence of the psychic costs of migration, they are complicated by the fact that macroeconomic shocks in home countries directly affect the returns to migration; hence, those papers are not merely looking at changes in the psychic costs of migration,[2] (b) we observe direct mental health outcomes as opposed to self reported outcomes which could be under reported (Bharadwaj et al. 2017), and (c) the high frequency of medical outcomes observed allows for a precise matching of timing of natural disasters and mental health outcomes.

Although there are few economic studies dealing with psychic costs of migration, there is a large literature on remittances from migrants to their home countries. We do not have information on remittances by migrants in our sample, but our findings do shed some light on the results in this area of work. Theoretical and empirical papers have identified several motives for remittances such as insurance, loan repayment, inheritance

[2]The fact that our sample of migrants have been in their destination country for an average of 40 years mitigates concerns about direct economic comparisons between destination and home countries. Also as both Akay et al. (2017) and Nguyen & Connelly (2018) note, the longer migrants live in their host country, the less relevance there is for macroeconomic conditions in the home country for their subjective well-being and mental health.

and exchange, but altruism by migrants towards those left behind in the home country is always considered as one of the major reasons behind remittances (for a survey, see Rapoport & Docquier 2006).[3] Altruism towards the home country is clearly related to psychic costs and hence in this sense our results support the presence of altruistic behavior as a motive for remittances. Our results are more relevant to the dynamics of remittances. A puzzling result in the empirical work on dynamics of remittances is the finding of a large amount of persistence even after a long period of absence from the host country (Bettin & Lucchetti 2016). In some cases, remittances have not changed significantly over periods of 10 to 20 years (Brown 1998) while in other cases, a decline in remittances is followed by an upturn after 25 years in the home country (Czaika & Spray 2013). These results do not sit easily with theories of remittances based on financial contracts such as loan repayments or even on the traditional treatment of altruism (Stark 1978) that predicts "remittance decay" unless the migrant is considering a return to the home country.[4] Our finding that migrants experience a significant negative mental health shock following a home country disaster even 40 years after migration suggests that psychic attachment to the home country can in fact persist over very long periods of time.

2 Data and methods

For the empirical analysis, we use a unique data set from Australia constructed by linking the Sax Institute's 45 and Up Study data to individual medical records. The 45 and Up Study is a survey of more than 250,000 individuals 45 years of age or older residing in New South Wales (NSW), the most populous state of Australia (45 and Up Study Collaborators 2008). The sample was drawn from the Department of Human Services (formerly Medicare) enrolment database, which covers all citizens and permanent residents of Australia. People 80 years of age or older and residents of rural and remote areas were oversampled to increase their numbers. Information from the 45 and Up Study participants was collected via mail questionnaires in stages from 2006 to 2009. Most of the questionnaires (78%) were completed in 2008. Close to 18% of the sent-out questionnaires were returned, resulting in a sample of 267,153 individuals (about 11% of the NSW population aged 45 years and over). The 45 and Up Study sample is broadly representative of the populations of NSW and Australia in terms of most demographic and socioeconomic characteristics (age, gender, marital status, and employment), but there is positive selection on household income (Johar et al. 2012).

[3]For results related to natural disasters see Yang (2004) who shows that the level and composition of international financial flows to developing countries including net migrant remittances are significantly affected by exposure to hurricanes in the receiving country.

[4]For an alternative treatment of altruism in the context of social capital and migrant networks see Grieco (2004).

After excluding a small number (1,701) of invalid observations (volunteers and individuals younger than 45) and observations with missing information on the country-of-birth (3,197), the sample contains 262,355 individuals. Almost a quarter of them (63,474) are first generation migrants, that is, born outside Australia.[5] The migrants in the sample arrived to Australia on average 37 years ago (in 1970) at the average age of 26 years. Only a small proportion (5%) migrated to Australia in the past 10 years. There are migrants from 153 different countries in the 45 and Up Study sample. Most migrants (38.6%) came from the United Kingdom, followed by New Zealand (7.92%), Germany (4.37%), the Netherlands (4.13%), and Italy (3.34%).

The 45 and Up Study, with the consent of all the participants, is linked to the individuals' administrative health records, including the Pharmaceutical Benefits Scheme (PBS) and the Medicare Benefits Schedule (MBS) databases. The PBS and MBS data are supplied by the Commonwealth Department of Human Services (DHS) and linked to the 45 and Up Study by the Sax Institute using a unique identifier provided by the DHS. More than nine years of administrative records are available for all individuals in the sample, starting September 2005 and ending October 2014 for PBS and December 2014 for MBS.

The PBS database includes all filled prescriptions for the drugs covered by PBS except for those that cost less than the co-payment. For the general public, the co-payment varies from A$28.60 in 2005 to A$36.90 in 2014. For the individuals who hold a health care concession card (HCCC)[6], the co-payment is substantially lower (A$4.60 and A$6.00 in 2005 and 2014, respectively). Once the total amount spent on prescription drugs reaches a set amount, the Safety Net threshold[7], individuals without a concession card are also eligible for the lower co-payment for the rest of the calendar year. Most of the drug purchases recorded in the PBS data are made using a HCCC (87% of all drugs and 86% of depression and anxiety drugs).

We restrict the sample to the individuals who hold a HCCC because, as described in the previous paragraph, we can observe their complete history of prescription drug use. To identify concessional individuals we use information from both the survey and the administrative records. Concessional individuals are defined as (1) those who self-report that they have a HCCC in the survey or (2) those who fill in a prescription using a HCCC as per the administrative records. The analysis sample consists of monthly observations of filled prescriptions by these concessional individuals in the year they complete the

[5] In the survey, respondents are asked "In which country you were born?" with a list of the main source countries provided and "Other" to be specified option, which is later coded.

[6] We are referring to these individuals as concessional.

[7] The Safety Net threshold was A$874 and A$1,421 in 2005 and 2014, respectively.

survey or fill a script using a HCCC and all the following years.[8] There are 15,703,184 individual-month-year observations of concessional individuals (54% of the full sample). The eligibility for a health care concession card is linked to welfare benefit receipt, veteran status, low income, and/or pension age. This is reflected in the differences in the characteristics between concessional and non-concessional individuals as shown in Table 1. Concessional individuals are older, less likely to have a university degree, more likely to be at the bottom of the distribution of household income and live in lower socioeconomic status areas, as measured by the SEIFA Index of Relative Socioeconomic Advantage and Disadvantage (SEIFA). Thus, if there is heterogeneity in migrant psychic costs, our results are more informative of these effects in the sub-population that is older and less socioeconomically advantaged. There are no differences, however, in migrant status and gender between the two sub-samples.

Our main measure of mental health is a binary variable that takes the value one if an individual fills a prescription for depression and/or anxiety drugs in a given month, and the value zero otherwise. Drugs for these mental conditions (as well as other health conditions that we use in placebo tests) are identified in the administrative data using the Anatomical Therapeutic Chemical (ATC) Classification System codes[9], provided in Appendix Table A.1.

As an alternative definition of mental health, we use an indicator for whether or not an individual visited a mental health specialist (psychiatrist or psychologist) in a given month. The information on the visits to a mental health specialist comes from the MBS data. All medical services covered by Medicare are recorded in the MBS data, including general practitioner (GP) and specialist visits and diagnostic tests. Medicare covers all visits to psychiatrists; patients with depression and/or anxiety symptoms (as determined by their GP) are also eligible to receive compensation for a limited number of psychologist visits (starting 1 November 2006).

Table 2 presents the means of the demographic and socioeconomic characteristics and mental health measures for native Australians (column 1), all migrants (column 2), and the 30 largest migrant groups[10] (column 3). To avoid the influence of outliers in small migrant groups, our main analysis sample consists of the concessional individuals from these 30 largest migrant groups and includes 3,464,024 person-month-year observations. Migrants in this sample come from various European, Asian, African, and North and South American countries, listed in Appendix Table B.1. Average time since arrival

[8]We do not include the years prior to the survey/first HCCC use in the analysis sample, as some individuals become eligible to a HCCC once they reach pension age; thus doing so, may over-estimate their concessional status.

[9]ATC classfication system is controlled by the World Health Organization Collaborating Centre for Drug Statistics Methodology (WHOCC)http://www.whocc.no/atc_ddd_index/

[10]With at least 200 individuals in the concessional individual sample.

is 44 years, and average age at arrival is 28 years. In column 4, we also present the descriptive statistics for an expanded list of 47 migrant groups[11]. Table 2 shows that the largest migrant groups (irrespective of the definition) are comparable to all migrants in terms of demographic and socioeconomic characteristics and mental health measures. There are, however, differences between Australian natives and migrants. Migrants are more likely to be male, are more educated, but have substantially lower (self-reported) household income than natives. On the other hand, there are no large differences in age and socioeconomic status of the local area by migrant status.

Table 2 shows that mental health drug use[12] is lower among migrants: 11.4% of migrants take depression or anxiety drugs in a given month compared to 13.6% of natives. This difference is driven by antidepressant use. The lower mental health drug incidence among migrants does not necessarily mean that migrants are less prone to mental disorders. As suggested by Bharadwaj et al. (2017), migrants are more affected by mental health stigma and in turn are less likely to seek mental health care. Note that due to migrant unwillingness to seek care, we may be underestimating the impact of home country natural disasters on migrant mental health in our analysis. On the other hand, the incidence of mental health specialist (both psychiatrist and psychologist) visits is comparable among natives and migrants. Close to a 1% of individuals visit a mental health specialist in a given month.

Information on natural disasters comes from EM-DAT, The International Disaster Database, maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health of the Université Catholique de Louvain, Brussels, Belgium (CRED 2015). Information for the database is collected from various sources, including United Nation agencies, governments, non-governmental organizations (the International Federation of Red Cross and Red Crescent Societies), insurance companies, research institutes, and press agencies with the priority given to the first three sources. CRED constantly reviews entries for inconsistencies, redundancy, and incompleteness, and revises them. Currently, EM-DAT contains information on 21,000 natural and technological disasters in the world, from 1900 to present. We have been granted access to the raw EM-DAT data.

In order for a disaster to be included in EM-DAT, at least one of the following criteria must be met:

1. At least 10 people are reported dead,
2. At least 100 people are reported affected,

[11] With at least 100 concessional individuals in the concessional individual sample.

[12] Depression and anxiety drugs constitute the vast majority of all prescription mental health drugs (97% for both natives and migrants).

3. A state of emergency is declared, or

4. International assistance is called for.

The following information is available about each disaster: date; country; type of disaster; the numbers of dead, injured, homeless, and in need of immediate assistance; and estimated value of damage (not always available).

We use EM-DAT data to create an indicator for whether or not one of the following disasters occurred in a migrant's home country in a given month-year:

- Geophysical: earthquake (ground movement or tsunami), mass movement (avalanche, landslide, or rockfall), or volcanic activity;
- Climatological: wildfire;
- Hydrological: flood or landslide; or
- Meteorological: storm (convective or extra-tropical storm or tropical cyclone) or extreme temperature (heatwave or coldwave).

We do not include biological disasters into our definition, as they are less likely to be exogenous to other factors that may affect migrant mental health. For example, poor economic conditions can directly affect migrants, as well as contribute to a disease outbreak. As explained above, these are not necessarily shocks and may influence the perceived return to migration. We also exclude droughts from our definition as droughts often do not have a clear onset date.

Our main focus is on severe natural disasters. Migrants may only be aware of severe natural disasters in their countries; moreover, less severe disasters may be local to specific areas. Our main measure of severity is death and injury rate per 100,000 population. We define a binary variable that takes the value one if at least 10 people per 100,000 population died or got injured in the home country in a natural disaster in a given month-year, and the value zero otherwise. We also test the sensitivity of results to alternative thresholds. Another measure of severity is the percentage of population "affected" by the disaster (dead, injured, homeless, and in need of assistance). It is our less preferred definition, because of the likelihood of measurement errors in the numbers of homeless and in need of assistance.

Table 3 presents summary statistics on the incidence of natural disasters in the home countries of Australian migrants. One in five migrants have a disaster occurring in their home country in a given month. Most of these disasters are not severe (as per our definition). In a given month, only 0.14% of the migrants have a severe disaster, as defined by at least 10 deaths or injuries per 100,000 population, occurring in their home country. Over the analysis period (2004-2014), there were six such disasters, which affected

migrants from six countries (in the sample of the 30 largest migrant groups). Appendix Table B.2 lists these disasters and provides information on their locations, dates, and extent. The incidence of alternatively defined severe natural disasters is higher as expected. Close to 1% of Australian migrants had a natural disaster occurring in their home country that affected at least 1% of their home country population (in other words, 1000 people per 100,000 population). The incidence of naturals disasters is comparable among all migrants and largest migrant groups.

2.1 Estimating equations

To determine whether or not migrants are affected by severe natural disasters in their home countries, we estimate the following equations:

$$MH_{ijt} = \beta_0 + \sum_k \beta_k ND_{jk} + \alpha_j + \mu_t + u_{ijt}, \tag{1}$$
$$k = (last\_1\_to\_3\_mos, last\_4\_to\_6\_mos, \ldots, last\_16\_to\_18\_mos),$$

where i indexes individuals, j indexes country-of-birth, and t indexes month-year; MH_{ijt} is a binary variable denoting health care for mental health problems as measured by mental health drug use or at least one mental health specialist visit in a given month; ND_{jk} is an indicator for an occurrence of a severe disaster in a migrant's home country in period k; α_j is country-of-birth fixed-effect (FE), μ_t month-year FE, and u_{ijt} is a random error term. We allow for long-term mental health effects of natural disasters (up to 18 months initially). Because of the low monthly incidence of severe disasters, we aggregate monthly disaster data into quarters; that is, we estimate how migrant mental health in the current month is affected by a severe natural disaster in the past 1 to 3 months, the past 4 to 6 months, and so on up to the past 16-18 months.

Natural disasters are plausibly exogenous to migrant mental health conditional on country-of-birth and time FEs. Country-of-birth FE captures any time-invariant differences in mental health between migrants from different countries including cultural differences in reporting mental health issues or seeking medical care. Month-year FE accounts for any events common to all migrants that may affect their mental wellbeing, including any Australia-wide and worldwide shocks. Equation (1) is estimated by ordinary least squares (OLS), and standard errors are clustered at the country-of-birth level.

We also estimate a number of alternative specifications of Equation (1). One potential identification issue is endogenous sample selection, as individuals enter the sample when they either report possession of a HCCC or are observed using a HCCC in the administrative data. If migrants from certain countries are more likely to obtain a HCCC each

year, and HCCC eligibility is related to mental health, then the composition of each migrant group may change differentially across migrant groups. To account for this, we estimate the individual FE model, which controls for any time-invariant, unobserved, and individual-specific heterogeneity. We also re-estimate equation (1) using a balanced sample, that is, individuals who possess a HCCC throughout the analysis period. To allow for country-specific monthly and annual mental health shocks, we estimate a model with country-month and country-year FEs added. In another specification, we include country-specific linear trends (in addition to country and month-year FEs) to account for the possibility of differential changes in mental health over time across countries of birth.

Finally, we take into account the fact that some respondents are likely to have died or returned home during our analysis period. We can precisely identify only a small fraction of deaths (deaths in hospitals in 2006-09, a period during which the survey data is linked to hospital administrative records). As a robustness check we exclude the respondents who died in hospital during this period. Additionally, we exclude individuals who stop showing up in MBS data. A vast majority of our sample individuals attend a doctor or get a diagnostic test at least once a year. This is not surprising given that our sample is older and health care is heavily subsidized in Australia. Therefore, attrition from the MBS data may indicate that a person passed away or returned to their home country. Alternatively, there may be some healthy individuals who never use health care services. However, the estimates based on this restricted sample are useful, as together with the main estimates they can provide bounds for the true estimates of home country disaster effects on migrant mental health. If the people with the highest psychic costs die (or return home), the main estimates can be thought of as the lower bounds since they would have otherwise been most affected by shocks in their home countries. If in the exercise described above, we exclude the most mentally stable people and they are least affected by shocks in their home countries, these estimates can be thought of as upper bounds.

3 Results

3.1 Mental health drug use

We start by estimating how migrant mental health is affected by a major (severe) natural disaster in the home country (controlling for the country-of-birth and month-year effects). Table 4 shows that severe disasters, as measured by the rate of deaths or injuries caused by the disaster, have significant negative effects on mental health and that more severe disasters elicit larger effects. In the sample of the largest 30 migrant groups (panel A), a disaster in the home country that caused 1 or more deaths or injuries per 100,000

population increases mental health drug use by 0.18 percentage points, whereas a disaster that caused 5 (10) or more deaths or injuries per 100,000 population increases mental health drug use by 0.50 (0.61) percentage points. Although these figures may seem small, they correspond respectively to a 1.6%, 4.3%, and 5.3% increase relative to the average incidence of mental health drug use, which is not negligible. The effect of a major home country disaster on migrant mental health is strongest immediately after the disaster, but it persists for several months. For example, following a natural disaster in the home country that caused at least 10 deaths or injuries per 100,000 population migrant mental health drug use remains 0.37 and 0.41 percentage points higher 4 to 6 months and 7 to 9 months after the occurrence of the disaster, respectively.[13] Panel B of Table 4 shows that the coefficient estimates are comparable in the sample of all migrants; the coefficients are, however, more precisely identified in the sample of the largest 30 migrant groups. In the following analyses, we will present the results for the sample consisting of the 30 largest migrant groups.[14]

For comparison, we present the estimates of the effects of *any* natural disaster in the home country on migrant mental health. As shown in the first column of Table B.3, these effects are small and mainly statistically insignificant. This is not surprising, because many of the disasters recorded in EM-DAT data base are minor; migrants may not even be aware of them. The estimated effects are similar if we use the number of natural disasters (column 2) instead of the indicator for a natural disaster (column 1). We also do not find significant changes in migrant mental health if we define major disasters by the percentage of affected (dead, injured, homeless, or in need of assistance) population, as shown in Appendix Table B.4. In the following analyses, we define a major natural disaster as the disaster that caused at least 10 deaths or injuries per 100,000 population.

Results presented in Appendix Table B.5 show that the main findings are not driven solely by depression or anxiety drug use. We find significant increases in both depression and anxiety drug use following a major natural disaster in the home country. The effect on depression drug use is, however, more persistent. On the other hand, the effect on anxiety drug use in the first three months after the disaster is larger relative to the mean than the effect on depression drug use. In column (3) of Table B.5, we investigate whether the effects of home country natural disasters are larger for those who were previously treated for mental health conditions.[15] We expect these individuals to be especially vulnerable to

[13]Interestingly, the effects of less severe disasters (leading to 1 death or injury per 100,000 home country population) have longer lasting effects.

[14]The results for the sample of all migrants are comparable in size and usually less precisely estimated in all regressions. These estimates are available upon request.

[15]For this analysis, the sample is selected in the following way. First, we select the people who (1) were treated with either depression or anxiety drugs 19-24 months ago and (2) were *not* treated with with either depression or anxiety drugs 13-18 months ago. Thus these are the individuals who had mental health issues in the past, but have recovered, at least to the extent that they do not need medication

shocks such as home country natural disasters. Among the previously treated individuals, the effects are indeed substantially larger, but imprecisely identified, as the size of the sample is relatively small.

3.1.1 Heterogeneity

Next, we explore the heterogeneity in the effects of home country natural disasters on migrant mental health. We first check whether these effects vary by the distance between Australia and the home country.[16] The expected direction of the differential effects is ambiguous. The closer migrants are to their home countries, the more connected they can remain to their social networks and the easier it can be for them to help out in the event of a disaster, which in turn may reduce psychic costs. On the other hand, greater distance may reduce the strength of social and familial networks; also, distance may affect the exposure to information about the extent of a disaster. The results presented in column (1) of Table 5 support the first conjecture as a net effect. The probability of filling a script for mental health drugs in one to three months following a major disaster in the home country increases by 0.18 percentage points with each 1000 km (statistically significantly). The rest of the interactions are also positive, but not all of them are statistically significant.

We construct other proxies for connectedness to the home country and the strength of migrant networks. We do not find any evidence that mental health effects of home country disasters vary by the time since arrival to Australia, (column 2 of Table 5). However, these results may be explained by the limited variation in the time since arrival to Australia in our sample: most of the migrants arrived in Australia a long time ago and only a small proportion (5%) migrated to Australia in the past 10 years. Migrants with higher levels of social capital[17] are found to be more likely to fill a script for mental health drugs in one to three months after a major disaster in the home country (column 3 of Table 5). A potential explanation for this result is that people in one's social network may encourage an individual to seek mental health care. As mentioned above there is general reluctance to seek mental health treatment due to mental illness stigma, which is especially pronounced among migrants (Bharadwaj et al. 2017). In column (4) we investigate whether local networks of migrants from the same country affect how migrants react to a major disaster in the home country. There two potential reasons to expect

anymore. We then analyze, the effects of home country major natural disasters 1 to 3, 4 to 6, 7 to 9, and 10 to 12 months ago on the mental health drug use of these individuals in the current month.

[16]Since Australia is located far away from most countries of the world, the distance to the home country is skewed to the left. Nonetheless, there is sufficient variation in the distance to the countries with major natural disasters in our analysis period: 3,457km to Indonesia, 4,158km New Zealand, 4,437km to Philippines, 7,474km to China, and 6,814km to Sri Lanka, and 12,734km to Chile.

[17]Social capital is measured by an index made up of four measures of social support. More information on the construction of this index is provided in Appendix A.2.

heterogeneity along this dimension. First, a migrant is likely to have more information about the disaster and its consequences if there are more migrants from the home country in his/her social environment. Second, migrants from the same country can support each other, which may reduce the need to rely on mental health medication. Consequently, the interactions between natural disaster dummies and the size of the local migrant network (as measured by the percentage of home country population in the local area according to 2006 census) can be positive or negative (or zero). We find that these interactions are negative, but statistically insignificant.[18],[19]

3.1.2 Sensitivity analysis

As discussed in Section 2.1, we check the robustness of our results to alternative model specifications. Table 6 shows that our results are not affected by the choice several alternative model specifications in that the coefficients on home country disaster indicators remain of similar sizes and statistical significance. For comparison, column (1) presents the results for the base specification that controls for the country-of-birth and month-year FEs. Including individual FE in fact slightly increases the sizes of the coefficients. The estimated effects of home country disasters are also somewhat higher in the balanced panel[20]. Failing to exclude deceased people from the sample does not bias the coefficients, as shown in column (4). Finally, adding country-of-birth linear trends (column 5) and country-year and country-month FE (column 6) does not affect the results.

As placebo tests, we regress other health conditions (psychosis[21], diabetes, cardiovascular disease, and asthma) on the set of home country disaster indicators. The incidence of these conditions is measured using the data on filled prescriptions, as in the case of mental health. Given that many health conditions, including those listed above, are related to stress, we do not necessarily expect to see nil effects.[22] We do expect, however, home country disasters to affect these conditions to a smaller extent than mental health

[18]Following Bertrand et al. (2000), we also create an alternative network measure that takes into account not only the size of the network, but also "quality" of the network, the latter measured by the proportion of home country population in the local area using mental health drugs. Appendix A.3 explains how this measure is constructed. In this specification we control for country-of-birth FE and local area FE. We do not find that the effect of home county disasters on migrant mental health would vary by this network measure either.

[19]Additionally, we find that there is no heterogeneity by home country GDP. As mentioned earlier, previous findings regarding the effects of home country GDP on migrant wellbeing are mixed. Our results suggest that variations in GDP do not affect the decrease in mental health following shocks in the home country. In other words, we do not find evidence of mitigating effects of GDP that would be motivated by GDP acting as a proxy for the speed of recovery.

[20]The balanced panel consists of individuals who purchased prescription drugs with a HCCC in 2006 or self-reported having a HCCC in 2006, which implies that they are in the sample in all the time periods.

[21]Psychosis is a serious mental health condition, which causes are complex and not completely understood. It is unlikely that exposure to the information about a natural disaster in the home country would cause psychosis, although it could potentially aggravate it.

[22]Stress can be especially harmful to people who are already vulnerable to these conditions.

conditions. The estimates presented in Table 7 support this hypothesis. We do not find any statistically significant effects on psychosis, diabetes, or cardiovascular disease up to 12 months after the occurrence of a major disaster in the home country. There are positive, but small and only marginally significant effects on asthma drug use.

As the final robustness check, we perform a perturbation test, in which we assign each individual the natural disaster history of another randomly selected individual in the sample. We then, re-estimate the base model[23] and save the coefficient estimates. We repeat this process 999 times. For this test, we used the balanced sample in order to avoid changing sample composition. The results are graphically presented in Figure 1. The graphs in this figure present the distributions of the coefficients on home country disaster indicators after 999 replications. The vertical lines correspond to the true coefficients based on the balanced sample presented in column (3) of Table 6. We expect the significant true coefficients to be in the right tails of the corresponding simulated distributions, which is what we find. We also calculate p-values for each coefficient by calculating the fraction of replications such that $|\hat{\beta}_i| > |\hat{\beta}_{true}|$, $i = 1, \ldots, 999$. The p-values that correspond to 1-3 month, 4-6 month, 7-9 month, and 10-12 month lag on home country disaster indicator are equal to 0.017, 0.130, 0.098, and 0.393, respectively. Hence, this perturbation test allows us to cleanly show that the results of randomly assigning someone else's shock does not produce the same results.

3.2 Mental health specialist visits

Consistent with the results on mental health drug use, we find an increase in mental health specialist visits following a major natural disaster in the home country. These results are presented in Table 8. Importantly, we find the effects of major home country disasters on both concessional and non-concessional individuals.[24] There are some differences in the dynamics of the effects between the two groups. Among concessional individuals, the probability of visiting a mental health specialist increases by 0.3 percentage points (33% relative to the mean) in the first three months following a major home country disaster, and this effect persists for another three months. Among non-concessional individuals, there is no change in mental health specialist visits immediately after the disaster, but after 4 to 6 months the probability of a visit increases by 0.18 percentage points (21% relative to the mean), and this increase persists up to 12 months. We find comparable

[23] As in the base model, we control for month-year fixed-effects and ("fake") country-of-birth FEs in these estimations.

[24] As explained above, for the analysis of mental health drug use we can only use individuals who have a HCCC and thus face lower co-payments. On the other hand, we have information on mental health specialist visits, for all individuals.

effects on both psychiatrist and psychologist visits (results not reported, but available upon request).

4 Conclusion

The idea of psychic costs has been a long standing explanation for lower than expected migration rates. However, specific empirical evidence of these costs has been elusive. We provide a clear case for the existence of psychic costs by showing that migrant mental health in destination countries is affected by home country natural disasters. This effect is greater by distance to the home country, and by the severity of the natural disaster. Also this effect is persistent over long periods of time. In doing so we contribute towards the understanding of migration and remittance dynamics.

Our findings suggest several areas for future research. Our results are reduced form and as such do not identify the mechanism(s) behind these impacts. For example, the mental health response could be the result of additional financial stress on migrants who feel compelled to send more money to their home country in the wake of a natural disaster. A translation of these mental health impacts into economic costs that would say measure work days lost or productivity losses would be a valuable exercise and so would a study linking the presence and size of psychic costs to the phenomenon of return migration. Finally, another area of future work is to examine more closely how these effects vary with characteristics associated with migration. While we use distance to home country and fraction of people from the home country in the local area as sources of heterogeneity, more comprehensive measures of migrant networks would lead to a better understanding of the nature of psychic costs and possible mitigating influences.

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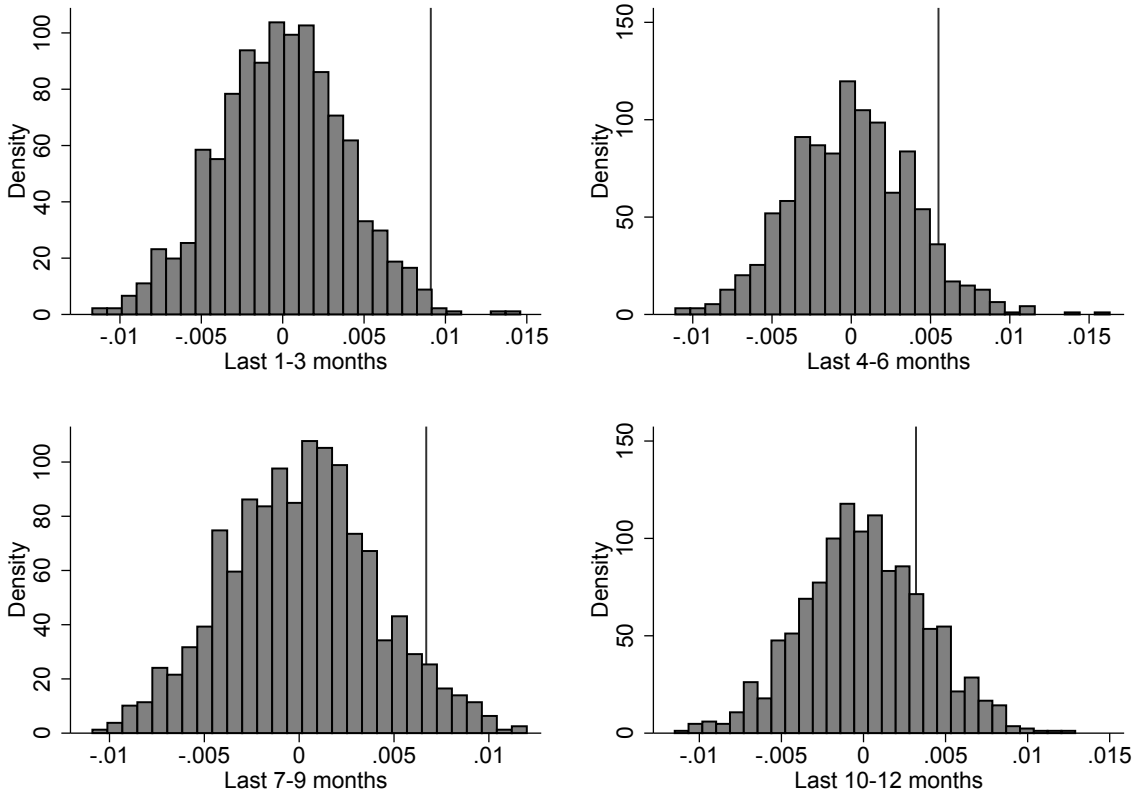
FIGURE 1: Major home-country disasters and migrant mental health drug use: perturbation test



Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups observed throughout the analysis period (balanced sample). The sample size is 2,345,970. The perturbation test is based on 999 replications. In each replication, individuals are randomly assigned to the natural disaster history of another individual in the sample. Major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. All regressions control for "fake" country-of-birth and month-year fixed-effects. The vertical lines represent the "true" coefficients, presented in Table 6 column (3).

TABLE 1: Summary statistics: Concessional vs non-concessional individuals

	Non-concessional	Concessional
	(1)	(2)
First-generation migrant	0.235	0.247
Male	0.469	0.460
Age	57.508	70.917
University degree	0.351	0.135
Bottom quartile of annual HH income (< $20k)	0.044	0.441
Bottom SEIFA quintile	0.073	0.121
Sample size	13,142,006	15,703,184

Notes: Observations are person-month-year records with non-missing information on HCCC status either in the survey or administrative data. HH stands for household. SEIFA stands for the SEIFA Index of Relative Socioeconomic Advantage and Disadvantage and is a measure of the socioeconomic status of the local areas in Australia.

TABLE 2: Summary statistics: natives vs migrants

	Australia-born	All migrants	30 largest migrant groups	47 largest migrant groups
	(1)	(2)	(3)	(4)
Male	0.447	0.501	0.501	0.500
Age	70.708	71.552	71.831	71.721
University degree	0.121	0.175	0.172	0.173
Bottom HH income quartile	0.428	0.482	0.471	0.477
Bottom SEIFA quintile	0.129	0.098	0.095	0.096
Any MH drugs>0	0.140	0.118	0.119	0.119
Depression/Anxiety drugs>0	0.136	0.114	0.115	0.115
Depression drugs>0	0.108	0.085	0.086	0.085
Anxiety drugs>0	0.040	0.040	0.040	0.040
MH professional visits>0	0.009	0.010	0.009	0.009
Psychiatrist visits>0	0.004	0.005	0.004	0.005
Psychologist visits>0	0.005	0.005	0.005	0.005
Sample size	11,826,068	3,877,116	3,464,024	3,675,502

Notes: The sample consists of concessional individuals (HCCC holders). MH stands for mental health; HH stands for household. SEIFA stands for the SEIFA Index of Relative Socioeconomic Advantage and Disadvantage and is a measure of the socioeconomic status of the local areas in Australia. Migrants from countries with at least 200 individuals in the sample are included in column (3). Migrants from countries with at least 100 individuals in the sample are included in column (4).

TABLE 3: Monthly incidence of natural disasters, percent

	All migrants	30 largest migrant groups	47 largest migrant groups
	(1)	(2)	(3)
Natural disaster	20.03	21.14	20.48
Dead/injured >= 1 per 100,000	1.10	1.12	1.11
Dead/injured >= 5 per 100,000	0.22	0.20	0.21
Dead/injured >= 10 per 100,000	0.14	0.13	0.14
Geophysical	0.10	0.11	0.11
Climatological	0.00	0.00	0.00
Hydrological	0.00	0.00	0.00
Meteorological	0.03	0.02	0.03
Affected pop >=1%	1.04	1.08	1.02
Affected pop >=5%	0.33	0.34	0.32
Affected pop >=10%	0.07	0.06	0.06
Sample size	3,877,116	3,464,024	3,675,502

Notes: The sample consists of concessional individuals (HCCC holders). Migrants from countries with at least 200 individuals in the sample are included in column (2). Migrants from countries with at least 100 individuals in the sample are included in column (3). Geophysical disasters are earthquakes, mass movements, and volcanic activities. Climatological disasters are wildfires. Hydrological disasters are floods and landslides. Meteorological disasters are storms and extreme temperatures. Affected individuals include dead, injured, left homeless, or requiring assistance.

TABLE 4: Major home country disasters (as measured by deaths/injuries per 100,000) and migrant mental drug use

	≥1/100,000 deaths/injuries		≥5/100,000 deaths/injuries		**≥10/100,000 deaths/injuries**	
	(1)		(2)		(3)	
A. 30 largest migrant groups						
Disaster in last...						
1-3 months	0.0018*	(0.0010)	0.0050**	(0.0021)	0.0061***	(0.0016)
4-6 months	0.0031***	(0.0010)	0.0030*	(0.0015)	0.0037**	(0.0016)
7-9 months	0.0031***	(0.0010)	0.0037***	(0.0011)	0.0041***	(0.0014)
10-12 months	0.0020**	(0.0009)	0.0009	(0.0015)	0.0011	(0.0022)
13-15 months	0.0015**	(0.0007)	−0.0005	(0.0019)	−0.0010	(0.0028)
16-18 months	0.0018	(0.0011)	0.0005	(0.0020)	0.0019	(0.0030)
Mean (dep var)	0.1152		0.1152		0.1152	
Sample size	3,464,024		3,464,024		3,464,024	
B. All migrant groups						
Disaster in last...						
1-3 months	0.0014	(0.0009)	0.0040**	(0.0017)	0.0038**	(0.0018)
4-6 months	0.0021**	(0.0010)	0.0023*	(0.0012)	0.0020	(0.0014)
7-9 months	0.0025***	(0.0009)	0.0029**	(0.0012)	0.0030**	(0.0014)
10-12 months	0.0013	(0.0009)	−0.0001	(0.0015)	−0.0010	(0.0023)
13-15 months	0.0016**	(0.0007)	−0.0007	(0.0018)	−0.0023	(0.0029)
16-18 months	0.0012	(0.0010)	0.0002	(0.0018)	0.0004	(0.0026)
Mean (dep var)	0.1141		0.1141		0.1141	
Sample size	3,877,116		3,877,116		3,877,116	

Notes: The sample consists of concessional individuals. Standard errors are clustered at the country-of-birth and presented in parentheses. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE 5: Major home country disasters and migrant mental health drug use: heterogeneity by connectedness and strength of social networks

	Distance to HC, 1000km	Years since arrival	Social capital index	HC population in postcode, %
Disaster in last...	(1)	(2)	(3)	(4)
1-3mos	−0.0035	−0.0013	0.0070***	0.0088***
	(0.0033)	(0.0115)	(0.0014)	(0.0022)
4-6mos	−0.0020	−0.0019	0.0042**	0.0068**
	(0.0051)	(0.0086)	(0.0016)	(0.0025)
7-9mos	−0.0059*	0.0009	0.0048***	0.0063***
	(0.0034)	(0.0109)	(0.0011)	(0.0023)
10-12mos	−0.0030	−0.0039	0.0013	0.0043
	(0.0065)	(0.0122)	(0.0020)	(0.0028)
1-3mos*X	0.0018***	0.0002	0.0093**	−0.0010
	(0.0006)	(0.0004)	(0.0039)	(0.0006)
4-6mos*X	0.0011	0.0001	0.0028	−0.0013
	(0.0010)	(0.0003)	(0.0071)	(0.0010)
7-9mos*X	0.0019**	0.0001	0.0012	−0.0010
	(0.0007)	(0.0003)	(0.0045)	(0.0009)
10-12mos*X	0.0008	0.0001	−0.0004	−0.0014
	(0.0014)	(0.0004)	(0.0087)	(0.0008)
Mean (dep var)	0.1147	0.1152	0.1153	0.1153
Sample size	3,264,210	3,464,024	3,234,326	3,448,410

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. Major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. HC stands for home country; area refers to the postcode that an individual lives in. X stands for the migrant characteristic that is interacted with the lagged incidence of the disaster. All regressions control for X and country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE 6: Major home country disasters and migrant mental health drug use: alternative model specifications

	Base	Individual FE	Balanced panel	Dead excluded	CoB trends	CoB-yr & CoB-mo FE
Disaster in last...	(1)	(2)	(3)	(4)	(5)	(6)
1-3 mos	0.0061***	0.0080***	0.0091***	0.0057*	0.0072***	0.0047**
	(0.001)	(0.0018)	(0.0019)	(0.0030)	(0.0013)	(0.0022)
4-6 mos	0.0037**	0.0055***	0.0055**	0.0037*	0.0048***	0.0035***
	(0.021)	(0.0015)	(0.0023)	(0.0021)	(0.0015)	(0.0010)
7-9 mos	0.0041***	0.0061***	0.0067**	0.0046**	0.0049***	0.0052**
	(0.006)	(0.0013)	(0.0030)	(0.0021)	(0.0016)	(0.0020)
10-12 mos	0.0011	0.0038*	0.0032	0.0011	0.0016	0.0019*
	(0.620)	(0.0021)	(0.0038)	(0.0018)	(0.0027)	(0.0011)
Mean (dep var)	0.1152	0.1152	0.1397	0.1212	0.1152	0.1152
Sample size	3,464,024	3,464,024	2,345,970	3,145,408	3,464,024	3,464,024

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. A major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. Regressions in columns (1), (3), (4), and (5) control for country-of-birth and month-year fixed-effects. The regression in column (2) controls for individual and month-year fixed-effects. The regression in column (5) controls for country-of-birth and month-year fixed-effects and country-specific linear trends. The regression in column (6) controls for country-year and country-month fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE 7: Placebo tests: Major home country disasters and other drug use by migrants

	Psychosis	Diabetes	Cardiovascular disease	Asthma
Disaster in last...	(1)	(2)	(3)	(4)
1-3 months	−0.0005	0.0022	0.0011	0.0006
	(0.0004)	(0.0030)	(0.0027)	(0.0007)
4-6 months	−0.0004	0.0017	0.0023	0.0012*
	(0.0006)	(0.0013)	(0.0034)	(0.0006)
7-9 months	−0.0011	0.0012	0.0047	0.0009
	(0.0007)	(0.0022)	(0.0064)	(0.0018)
10-12 months	−0.0002	0.0050*	0.0042	−0.0008
	(0.0008)	(0.0025)	(0.0038)	(0.0012)
Mean (dep var)	0.0087	0.0699	0.4975	0.0616
Sample size	3,464,024	3,464,024	3,464,024	3,464,024

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. Major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE 8: Major home country disasters and mental health specialist visits by migrants

	Concessional		Non-concessional	
Disaster in last...	(1)		(2)	
1-3 months	0.0030***	(0.0005)	0.0004	(0.0011)
4-6 months	0.0024***	(0.0006)	0.0018***	(0.0006)
7-9 months	0.0002	(0.0004)	0.0006	(0.0008)
10-12 months	0.0009*	(0.0005)	0.0028***	(0.0008)
Mean (dep var)	0.0091		0.0086	
Sample size	3,464,024		2,747,346	

Notes: The sample consists of individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. Major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

FOR ONLINE PUBLICATION

A Data Appendix

A.1 Identifying drugs for particular conditions

Table A.1: ATC codes used to identify drugs for different health conditions

Disease/Health Condition	ATC codes
Depression	N06AXXX, N06CXXX
Anxiety	N05BXXX, N05CXXX
Psychosis	N05AXXX
Cardiovascular diseases	CXXXXXX
Diabetes	A10XXXX
Asthma	R03XXXX

A.2 Constructing the social capital index

The social capital index is based on four survey questions:

1. How many times in the last week did you:
   (a) spend time with friends or family who do not live with you?
   (b) talk to someone (friends, relatives or others) on the telephone?
   (c) go to meetings of social clubs, religious groups or other groups you belong to?
2. How many people outside your home, but within one hour of travel, do you feel you can depend on or feel very close to?

All questions are open-ended, that is, respondents can provide any numbers. We aggregate the information contained in these questions using principal component factor analysis. One factor with eigenvalue greater than one is produced. By definition the social capital factor (index) has mean zero and a standard deviation equal to one.

A.3 Constructing alternative network measure

To take into account both the size and the "quality" of local migrant network, we construct the following variable, as per Bertrand et al. (2000):

$$N_{jk} = S_{jk} * MH_{jk}, \tag{2}$$

where S_{jk} measures the size of the network and MH_{jk} measures its quality. Specifically, S_{jk} is the density of migrant group j in local area (post code) k, and MH_{jk} is the incidence of mental health drug use in migrant group j in local area k. To avoid underweighting of smaller migrant groups we correct the size of network by the size of the network in the state of New South Wales (NSW). Specifically, S_{jk} is measured as:

$$S_{jk} = \frac{n_{jk}/n_j}{N_j/N}, \tag{3}$$

where n_{jk} the number of migrants from country j in local area k, n_k is the total population of local area k, N_j is the number of migrants from country j in NSW, and N is the total population of NSW.

B Additional tables and figures

Table B.1: 30 largest Australian migrant groups

	Persons	Percent	Cumulative %
United Kingdom	17,000	41.14	41.14
New Zealand	2,764	6.69	47.83
Germany	2,042	4.94	52.77
Netherlands	2,015	4.88	57.65
Italy	1,549	3.75	61.40
China	1,136	2.75	64.15
Ireland	750	1.81	65.96
Philippines	707	1.71	67.67
Malta	670	1.62	69.29
Greece	635	1.54	70.83
India	635	1.54	72.37
South Africa	625	1.51	73.88
Vietnam	599	1.45	75.33
Lebanon	545	1.32	76.65
United States of America	523	1.27	77.92
Poland	476	1.15	79.07
Egypt	469	1.13	80.2
Hungary	432	1.05	81.25
Austria	413	1.00	82.25
Croatia	336	0.81	83.06
Indonesia	294	0.71	83.77
Canada	282	0.68	84.45
Fiji	281	0.68	85.13
Malaysia	281	0.68	85.81
Sri Lanka	276	0.67	86.48
Hong Kong (SAR of China)	268	0.65	87.13
Chile	266	0.64	87.77
Czech Republic	245	0.59	88.36
France	214	0.52	88.88
Korea, Republic of (South)	210	0.51	89.39

Notes: A "large" migrant group is defined by the presence of at least 200 concessional individuals from the country in the sample.

TABLE B.2: Major home country disasters in analysis period affecting Australian migrants from 30 largest migrant groups

Disaster type	Country	Locations	Date	Deaths	Injuries	In need of assistance	Homeless	Deaths/ injuries per 100,000	Percent population affected
Tsunami	Indonesia	Aceh province (Nangroe Aceh Darussalam) (Sumatra), Sumatera Utara	26-Dec-04	165,708	0	0	532,898	74	0.31
Tsunami	Sri Lanka	Jaffna, Kilinochchi, Mullaitivu, Trincomalee, Batticaloa, Ampara, Hambanthota, Matara, Galle, Kalutara, Colombo, Gampaha, Puttalam,Vavuniya districts	26-Dec-04	35,399	23,176	516,130	480,000	305	5.49
Ground movement	Indonesia	Yogyakarta, Central Java	27-May-06	5,778	137,883	2,340,745	699,295	63	1.39
Ground movement	China	Wenchuan country, Wenchuan, Beichuan, Deyang, Mianyang, Yingxiu (Wenchuan), Mianzhu, Chengdu, Aba (Ava prefecture, Sichuan province), Gansu, Shaanxi, Chongqing, Yunnan, Shanxi, Guizhou, Hubei, Hunan, Henan provinces	12-May-08	87,476	366,596	45,610,000	0	34	3.48
Ground movement	Chile	Concepcion (Biobio province); O'Higgins; Valparaiso; La Araucania; Metropolitana Santiago; Maule	27-Feb-10	562	10,334	1,861,222	800,000	64	15.70
Ground movement	New Zealand	Christchurch	22-Feb-11	181	1,500	300,000	0	38	6.88
Tropical cyclone	Philippines	Samar, Leyte, Cebu, Iloilo, Capiz, Aklan and Palawan provinces	8-Nov-13	7,354	28,689	16,078,181	0	37	16.52

Source: EM-DAT.

TABLE B.3: Any home country disaster and migrant mental health drug use

	Any disaster		Number of (any) disasters	
Disaster in last...	(1)		(2)	
1-3 months	0.0010*	(0.0005)	0.0013	(0.0008)
4-6 months	0.0008	(0.0005)	0.0009	(0.0007)
7-9 months	0.0007	(0.0006)	0.0010	(0.0009)
10-12 months	0.0008**	(0.0003)	0.0012**	(0.0005)
13-15 months	0.0004	(0.0004)	0.0006	(0.0006)
16-18 months	0.0002	(0.0004)	0.0003	(0.0005)
Mean (dep var)	0.1152		0.1152	
Sample size	3 ,464,024		3,464,024	

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE B.4: Major home country disasters (as measured by percentage of population affected) and migrant mental health drug use

	Affected ≥1%		Affected ≥5%		Affected ≥10%	
Disaster in last...	(1)		(2)		(3)	
1-3 months	0.0003	(0.0011)	0.0006	(0.0014)	0.0031	(0.0037)
4-6 months	−0.0005	(0.0012)	0.0005	(0.0019)	0.0034	(0.0040)
7-9 months	0.0015**	(0.0007)	0.0034***	(0.0007)	0.0056	(0.0046)
10-12 months	−0.0003	(0.0008)	−0.0010	(0.0007)	0.0045	(0.0053)
13-15 months	0.0006	(0.0005)	0.0002	(0.0008)	0.0017	(0.0050)
16-18 months	0.0002	(0.0008)	−0.0008	(0.0018)	0.0056	(0.0069)
Mean (dep var)	0.1152		0.1152		0.1152	
Sample size	3,464,024		3,464,024		3,464,024	

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. Affected individuals include dead, injured, left homeless, or requiring assistance. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.

TABLE B.5: Major home country disasters and migrant mental health drug use: heterogeneity by type of mental health condition and history of illness

	Depression	Anxiety	Depression/Anxiety, History of illness
Disaster in last...	(1)	(2)	(3)
1-3 months	0.0039**	0.0042***	0.0248
	(0.0018)	(0.0012)	(0.0173)
4-6 months	0.0039***	0.0003	0.0179
	(0.0014)	(0.0011)	(0.0135)
7-9 months	0.0036**	0.0018**	0.0124
	(0.0014)	(0.0008)	(0.0093)
10-12 months	0.0009	0.0014	−0.0173
	(0.0013)	(0.0022)	(0.0122)
Mean (dep var)	0.0856	0.0401	0.1024
Sample size	3,464,024	3,464,024	116,863

Notes: The sample consists of concessional individuals from the 30 largest Australian migrant groups. Standard errors are clustered at the country-of-birth and presented in parentheses. Major disaster is defined as a disaster that caused 10 or more deaths or injuries per 100,000 population. All regressions control for country-of-birth and month-year fixed-effects. * denotes statistical significance at the 10% level, ** denotes statistical significance at the 5% level, and *** denotes statistical significance at the 1% level.