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Loneliness and health among the elderly
The role of cultural heritage and relationship quality

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Abstract

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Keywords: Loneliness, relationship quality, culture, mental health, physical health.

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Declarations

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1 Introduction

Research shows that loneliness is an increasing problem in today's societies. In 2016, about 12% of EU citizens felt lonely more than half of the time. By the first months of 2020, this proportion had doubled to 25% (Baarck et al., 2021).

Loneliness is widely recognized as being a major public health issue. A meta-analytic review of nearly 150 studies by Holt-Lunstad et al. (2015) finds that the risk of premature mortality linked to loneliness is stronger than the risk associated with obesity and physical inactivity. Furthermore, it finds that loneliness is as bad for one's health as smoking 15 cigarettes a day. Extensive, prevalently psychological, literature also documents consistent associations between loneliness and mental and physical health. Studies reveal that lonelier individuals are at higher risk of depression, suicidal ideation and suicide attempts, cardiovascular disease and cognitive decline (Cacioppo et al., 2014a; Cacioppo and Cacioppo, 2018; Cacioppo and Hawkley, 2009; Cacioppo et al., 2014b; Leigh-Hunt et al., 2017; Steptoe et al., 2013; Stickley et al., 2013; Stickley and Koyanagi, 2016; Valtorta et al., 2016, among many others).

Besides being a public health issue, loneliness is an economic problem, too (Kung et al., 2021). Lonely people are more likely to use healthcare services (e.g. doctor visits, hospital admissions). Thus, loneliness may be associated with higher healthcare expenditure. The cost of loneliness to employers can be substantial and linked to increased absence, loss of productivity and increased voluntary turnover resulting from low job satisfaction (Michaelson et al., 2021). A first attempt at estimating the effects of loneliness on economic growth, finds that regions with a higher share of lonely people have a more limited capacity to generate additional wealth (Burlina and Rodríguez-Pose, 2021).

Despite this large body of evidence, studies so far are mainly based on descriptive analysis or simple multivariate regression models. Hence, they are only able to reveal *correlations* and cannot say anything about *causation*. Courtin and Knapp (2017) call for more research on causal pathways that "better links the evidence of the risk factors for loneliness [...] and their evidence on their impact on health". We are responding to this call and with this paper, we fill existing gaps in the related literature.

We estimate the causal impact of loneliness on a variety of health-related measures using individual-

level data drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE, Börsch-Supan, 2008). SHARE is a multidisciplinary longitudinal survey on ageing which focuses on individuals aged 50+ and their spouses. It contains rich information on individuals' mental and physical health statuses and allows us to link information on the respondents' current situation to retrospective childhood data, including parents' country of origin. It also includes questions that allow us to build metrics that correspond to widely recognized measures of loneliness: the three-item version of the Revised UCLA Loneliness scale (Russell et al., 1978) - an indirect measure of loneliness - and the single-item loneliness scale, which asks about loneliness directly. This set of features makes SHARE particularly suitable for our purposes.

To isolate the impact of loneliness on health, our identification strategy consists of three primary elements.

First, we explore the cultural roots of loneliness. A number of studies show the importance of culture, defined as the set of social values and norms shared by people in a place or time, in determining individual's experiences of loneliness. This literature mainly focuses on the distinction between *individualistic* and *collectivistic* cultures (Hofstede et al., 2010), which captures the *quantity* and extension of social networks within a society which are more limited in the former compared to the latter. Thus, respondents in individualistic societies with weaker social connection should feel more lonely compared to those in collectivistic societies. Yet, when it comes to cross-cultural comparisons, this association does not always hold and the evidence is still rather mixed (for example, Lykes and Kemmelmeier, 2014; Van Tilburg et al., 2004). We argue that the reason for these discrepancies is conceptual in nature. Loneliness is not just about the *quantity* or frequency of social interactions. Instead, it is the negative feeling arising from the perceived discrepancy between actual and optimal *quality* of social relationships. The key role of quality of social contacts in predicting loneliness has been already uncovered to a degree (Pinquart and Sörensen, 2003; Hawkley et al., 2008; Beller and Wagner, 2018). When evaluating actual social relations, individuals are more concerned with the *quality* of their social ties independent of the perceived optimal size of their social networks. Based on this evidence, we link loneliness to indulgent *vis-à-vis* restraint cultures (Hofstede et al., 2010), a specific cultural trait strongly associated with quality of relations, extraversion, happiness and high importance of having friends and positive feelings. While individuals in indulgent societies enjoy life without social restrictions,

in restraint societies the prevalent belief is that enjoyment is somewhat wrong. This represents a further contribution of our work to the related literature.

Second, we limit our main analytical sample to native individuals with at least one foreign-born parent (i.e. second-generation immigrants) to whom we assign the cultural trait belonging to their parents' country of origin. This "epidemiological approach" (Galor et al., 2020; Bernhofer et al., 2021, among other) allows us to separate the effect of culture from other country-specific factors, otherwise captured by a single "country effect". In other words, we exploit the exogenous variation in parental cultural background while keeping the other country-specific factors invariant.

Third, we use maternal cultural traits as an instrument for individual self-declared loneliness and estimate a direct causal effect of loneliness on multiple health outcomes.

Our key finding are as follows. First, we find strong evidence in support of the nexus between quality relations and loneliness. The risk of loneliness significantly increases among individuals with more restraint cultural backgrounds compared to their peers with more indulgent cultural heritages. This result holds independently of the variety and frequency of social interactions. Furthermore, we find that maternal cultural background shows a statistically significant effect on self-reported loneliness. This is in line with extant evidence on the inter-generational transmission of attitudes and behaviour (among the most recent contributions see Cipriani et al., 2013; Sgroi et al., 2020). In an extension of our analysis, we investigate one possible pathway by which some specific ancestral factors may have influence on the formation of cultural traits associated with higher levels of restraint in the modern era. Second, loneliness has a significant impact on individual's health status. More specifically, loneliness increases the probability of depression, suicidal ideation, and functional decline. Among physical health-related factors and medications, loneliness increases the likelihood of diabetes, hypertension and stroke. Notably, our identification strategy allows us to uncover a larger effect of loneliness on health than that found in a simple OLS setting, which confirms the presence of a strong reverse causality between loneliness and health. Our baseline results are robust to a number of sensitivity checks.

The rest of the paper is organized as follows: Section 2 explains the mechanisms behind the nexus be-

tween loneliness and cultural background while also describing the six-dimensions model of national culture developed by Hofstede et al. (2010). Section 3 presents the empirical strategy used to identify the causal impact of loneliness on health and Section 4 presents the data used. Our main results are discussed in Section 5, followed by some extensions of our analysis and sensitivity checks in Section 6 . Section 7 concludes.

2   Loneliness, cultural values and social embeddedness

Loneliness is generally understood as the negative experience (or feeling) arising when an individual perceives a significant mismatch between actual and desired (or ideal) social interaction (Perlman and Peplau, 1981; Peplau et al., 1982). In other words, individuals feel lonely when current circumstances do not fulfill their optimal targets (Erber and Gilmour, 2013). According to this definition, one might feel lonely despite enjoying a large social network and a high quantity of social connections (van Baarsen et al., 2001; Albert, 2021). Loneliness has broadly been recognized as a public health concern. A wealth of literature shows its negative association with nearly every dimension of health, including physical, cognitive and mental health (Beller and Wagner, 2018; Cacioppo et al., 2014a; Holt-Lunstad, 2018; Rico et al., 2018). Although less explored, the association between loneliness and poor economic outcomes has also been uncovered (Burlina and Rodríguez-Pose, 2021).

Recent research suggests that culture, defined as the set of social values and norms shared by people in a place or time, plays a prominent role in determining individual's experiences of loneliness. On the one hand, people with diverse cultural backgrounds may differ in the level of social interactions considered ideal. Two people with the same objective number of close relationships experience loneliness to a different extent if their level of desired relationships differ (Barreto et al., 2021). On the other hand, cultural values and norms influence one's assessment of the discrepancy between current and desired social interactions. Two people with the same level of desired social relationships feel more or less lonely according to how fulfilling their actual relationships are perceived (Barreto et al., 2021). In this context, loneliness emerges when one's social connectedness is not perceived to meet culturally determined standards of social relationships (Holt-Lunstad,

2018; Swader, 2018).

Relatedly, different cultures also have differential thresholds of loneliness above which the experience of loneliness can be considered a threat to individual's well-being (Beller and Wagner, 2018). In this respect, there is wide consensus on the difference between *chronic* and *transient* loneliness and their association with health. While the former represents a major health risk, the latter is seen as less harmful and as a signal to seek more meaningful relationships.

One way in which culture may interact with loneliness experiences is through its influence on how socially embedded individuals are in social networks, i.e. the *quantity* of social interactions people have. An important distinction here is between *less* and *more* socially embedded cultures. In the former, individuals are less embedded in tight social networks (e.g. families or communities), spend more time or are more likely to live alone, have less stable and less long lasting relationships, are more independent from each other when making choices and laxer rules governing social relationships (Heu et al., 2021b).

Quantitative evidence on the association between loneliness and level of social embeddedness in a country is mixed. Some studies suggest higher levels of loneliness in less compared to more socially embedded cultures (e.g., Van Tilburg et al., 2004). Others find evidence of the contrary (see e.g. Dykstra, 2009, for a review), which may seem counter-intuitive considering that living alone and a lack of romantic relationships are associated with higher risks of feeling lonely (Barjaková and Garnero, 2022).

A possible explanation for these discrepancies is that risk factors for loneliness also differ between different cultures. While solitude and social isolation represent the main risk factors in less socially embedded cultures, as we move towards cultures with more stricter rules governing social relationships, loneliness may arise as a result of one's lack of freedom to choose relationships (Heu et al., 2021b).

Another channel linking culture with loneliness experiences is through the perceived *quality* of social relationships. Indeed, the evaluation of actual social relations may rely also on quality of connections. Even though individuals face the same target in terms of the extent of social relations (i.e. quantity or variety), they may have different evaluations of such relationships (i.e. perceived quality). Quality and variety are distinct concepts and there is no reason to assume *a priori* that higher (lower) quantity implies

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higher (lower) quality. Although the association between quality of social contacts and loneliness is still scarce, existing evidence suggests that the quality of social contacts is more relevant than their quantity in predicting loneliness (Pinquart and Sörensen, 2003; Hawkley et al., 2008; Beller and Wagner, 2018). A similar pattern has been confirmed by Taylor et al. (2018). The authors find that qualitative aspects of social relationships were more strongly related to depression than the quantitative ones.

Focusing primarily on quantity or intensity of interactions may, hence, become misleading when comparing individuals across different cultures and with different perceptions of social relationships. Any attempt to dilute the exclusiveness of quantity would require to "quantify the quality" or the overall perception of social interactions which may (also) vary across cultures. In this regard, some cultural values or common mentality traits may be exploited to approximate the perception of social interactions between the members of one group or category of people from others.

2.1 Dimensions of culture

According to Goert Hofstede culture is "the collective programming of the mind that distinguishes the members of one group or category of people from others" which starts "within the family, it continues within the neighborhood, at school, in youth groups, at the workplace, and in the living community" (Hofstede et al. (2010), pg.6). Cultural norms, hence, are acquired and learned during the life-course. The authors develop a six-dimensional model of national culture showing the effects of a culture on the values of its members and how these values relate to behavior.[1] The values reflecting cultural differences have been grouped into the following dimensions:[2]

1. **Indulgence versus Restraint**. This dimension is closely related to "happiness" (or subjective well-being) and strongly associated with a high importance of having friends. According to the authors, indulgent societies are generally happier since they gratify enjoying life without social restrictions that

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[1]Initially developed to analyze how the culturally embodied beliefs differ in terms of work objectives (Hofstede et al. (1991)), the model has been further expanded by Hofstede et al. (2010) using the data from the Chinese Values Survey and from the World Values Survey data for representative samples of the population in 93 societies. For details see Hofstede et al. (2010).

[2]The six-dimension data matrix available at `https://geerthofstede.com/research-and-vsm/dimension-data-matrix/`.

hamper one's freedom of choice, involve frequently in leisurely activities with friends or alone, actively involve in sports, have lenient sexual norms, etc. Restraint societies, on the other hand, are characterized by stricter social norms and prohibitions. The prevalent belief in these cultures is that the enjoyment of different types of indulgence (leisurely activities, spending, sports etc.) is somewhat wrong. The cognitive evaluation of one's life and/or a description of one's feeling is generally more positive in indulgent than in restraint societies.[3] Indeed, Kuppens et al. (2006) show that individuals from indulgent societies are more likely to remember positive feelings (emotions). In a similar fashion, McCrae (2002) finds that indulgence correlates positively with extraversion and negatively with neuroticism (tendency to experience negative feelings).

2. **Uncertainty Avoidance**. This dimension refers to a society's tolerance for ambiguity. It is conceptually different from risk avoidance. Cultures oriented to uncertainty avoidance are more prone to support stricter rules, laws, and norms aimed at reducing the ambiguity and offering "one-size-fits-all" solutions. On the other side, cultures accepting ambiguity prefer fewer rules and more freedom in expressing different opinions. According to Hofstede et al. (2010), this dimension is conceptually associated to indulgence.[4]

3. **Individualism versus Collectivism**. Roughly speaking, individualism and collectivism are about the degree to which people in a society are integrated into groups. Collectivistic cultures are those in which people strongly integrate into cohesive groups, often extended families (so-called "joint" families) that continue protecting them in exchange for unquestioning loyalty. Individuals identify themselves with the society and have greater emphasis on the welfare of the entire group. Individualistic cultures, on the other side, are characterized by looser ties between the members of the society. Everyone is expected to look after him/herself and his/her immediate family (so-called "stem" families). Having a "close, intimate friend" is a value that is more likely in individualist societies.

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[3]Indulgence does not require the realization of life satisfaction and positive emotional feelings at the same time. As stated by the authors, these two traits are somewhat related but the correlation is not very strong.

[4]However, the authors did not find objective ways of measuring and theorizing this association.

4. **Long Term versus Short Term Orientation**. This dimension defines the extent to which a society looks toward the future rather than resorting to the past. Short-term oriented societies look to the past experiences to deal with the current challenges, and maintain a rather static and fixed mindset. Long-term oriented cultures, on the other side, are more flexible, susceptible to change, and ready to cope with uncertain future challenges. Moreover, long term oriented societies value relationships while short term oriented societies focus more on tradition.

5. **Masculinity versus Femininity**. Masculinity is about the distinction of gender roles. In masculine societies gender roles are clearly distinct. Men are supposed to be assertive, tough, and focused on material success; women are supposed to be more modest, tender, and concerned with the quality of life. Femininity stands for a society in which social gender roles overlap: both men and women are supposed to be modest, tender, and concerned with the quality of life.[5]

6. **Power Distance**. Power distance measures how people in a society relate to each other on a hierarchical scale. High power distance cultures assign a higher weight to a person or authority, while low power distant societies emphasize the equal treatment of everyone.

The extent to which different cultures score within each dimension is captured by an index normalized between 0 and 100. The indices do not measure the absolute levels of attributes rather they express the position of societies relative to each other. As shown by Beugelsdijk and Welzel (2018), the values within each cultural dimension are transferred from parents to children, and rarely change in later life. By comparing two successive generations 30 years apart, the authors find only a modest worldwide shift towards more indulgence. However, the position of countries relative to each other remained the same. The country scores hence can be assumed to be stable over time.

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[5]Hofstede et al. (2010), page 140.

2.2   Culture and loneliness

When it comes to loneliness, understanding which cultural dimension (if any) affects the propensity to feel lonely (net of the other individual and country characteristics) is not straightforward. First of all, we should define the criteria according to which one dimension should be preferred over another. One crucial factor that can make a difference is the distinction between "*quantity*" and "*quality*" of social interactions. In this regard, both individualism and indulgence may be considered relevant, with the former pointing more at variety and the latter focusing more on quality and overall satisfaction. If we assign more weight to quantity, then collectivist cultures with strong social networks and extended family ties, should feel less lonely than individualist societies with weaker social connections, tinier family ties and more individualistic values. Yet, when it comes to cross-cultural comparative data, this association generally does not hold. The empirical evidence mostly reports lower levels of loneliness in individualistic than in collectivist societies (Dykstra (2009), Lykes and Kemmelmeier (2014), Fokkema et al. (2012), van Tilburg et al. (1998), Anderson (1999)), or provides contradictory findings (van Tilburg et al. (2004), Rokach et al. (2001), Jiang et al. (2018), Heu et al. (2019), Heu et al. (2021b)).

The ambiguity may be due to several factors. First, most empirical studies based on traditional cross-country comparisons fail to separate the effect of culture from other country-specific factors such as economic and institutional arrangements. Second, the attempts to identify the effect of culture across individuals who share the same current environment but have different national origins (*i.e.*, first-generation immigrants) confound social values with the individuals' minority status, which may itself affect loneliness. In addition, this strategy runs into selection problems since the factors influencing the probability of migrating may also affect the individual's general attitudes toward loneliness. We will return to this point in Section 3.

The inconsistency between loneliness and culture may be conceptual in nature. Individualism reflects cultural values that may influence ideals about how people should be socially embedded (Heu et al., 2019), whereas restraint is more likely to shape satisfaction with the quality of actual social relationships, regardless of their variety. Individuals living in indulgent societies are generally less restricted in their every-day activities and beliefs and have positive feelings, which makes them happier and overall more satisfied with

life. Individual freedom and weaker rules are perceived as qualities. In restraint societies, on the other hand, the enjoyment of different types of indulgence is less acceptable and more restricted by social norms, and the cognitive evaluation of life and feelings is generally more negative. Figure 1 confirms this intuition: populations in countries characterized by intermediate and high values of the restraint index are also experiencing higher shares of dissatisfaction (left hand-side panel).[6]. The positive relationship between restraint and dissatisfaction holds for both high, and intermediate and low levels of individualism. Individualism itself, on the other hand, does not show any clear correlation with overall satisfaction (right hand-side panel).

Figure 1: Degree of dissatisfaction (%) with personal relationships versus restraint and individualism
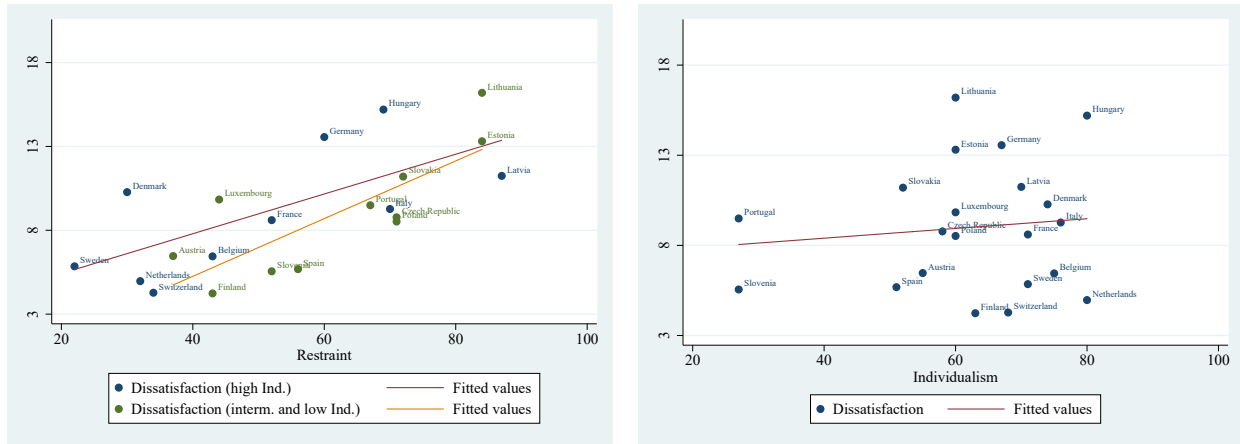
Source: 2018 Gallup Survey and Hofstede et al. (2010).

Figure 2 shows the average level of loneliness among individuals aged 50 or older in 26 European countries and Israel against the indices of restraint and individualism from Hofstede et al. (1991) and Hofstede et al. (2010).[7] The association between loneliness and restraint indicates that individuals originating from restraint societies are on average more susceptible to feel lonely. The correlation remains strong even for parental cultural backgrounds (right hand-side panel). Individualistic societies, on the other hand, report lower loneliness which is in line with the majority of the existing empirical evidence. However, compared to the

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[6]The country-level data on satisfaction comes from the 2018 World Gallup survey, available at `https://stats.oecd.org/index.aspx?lang=en` (Accessed: December 7, 2021). Satisfaction with personal relationships refers to the mean score of survey respondents who rate their satisfaction with their personal relationships on an 11-point scale, from 0 (not at all satisfied) to 10 (completely satisfied). The variable refers to the respondent's opinions or feelings about the degree of satisfaction with his or her personal relationships.

[7]The averages are based on the respondents from the Survey of Health Ageing and Retirement in Europe (SHARE), waves 5, 6, 7, and 8 for which the information on loneliness was available (Börsch-Supan (2008)).

restraint dimension, the pattern is less pronounced and the dispersion is higher. If satisfaction is more important than quantity, then a greater general tendency to evaluate negatively actual social relationships as a result of restraint societies' stricter social norms and prohibitions may increase the risk of loneliness. This assumption finds support in Heu et al. (2021b)'s *culture-loneliness framework* according to which more restrictive norms about social relationships positively influence the likelihood of emotional and perceived isolation.

Figure 2: Loneliness (country mean) across cultural dimensions in Hofstede et al. (2010)
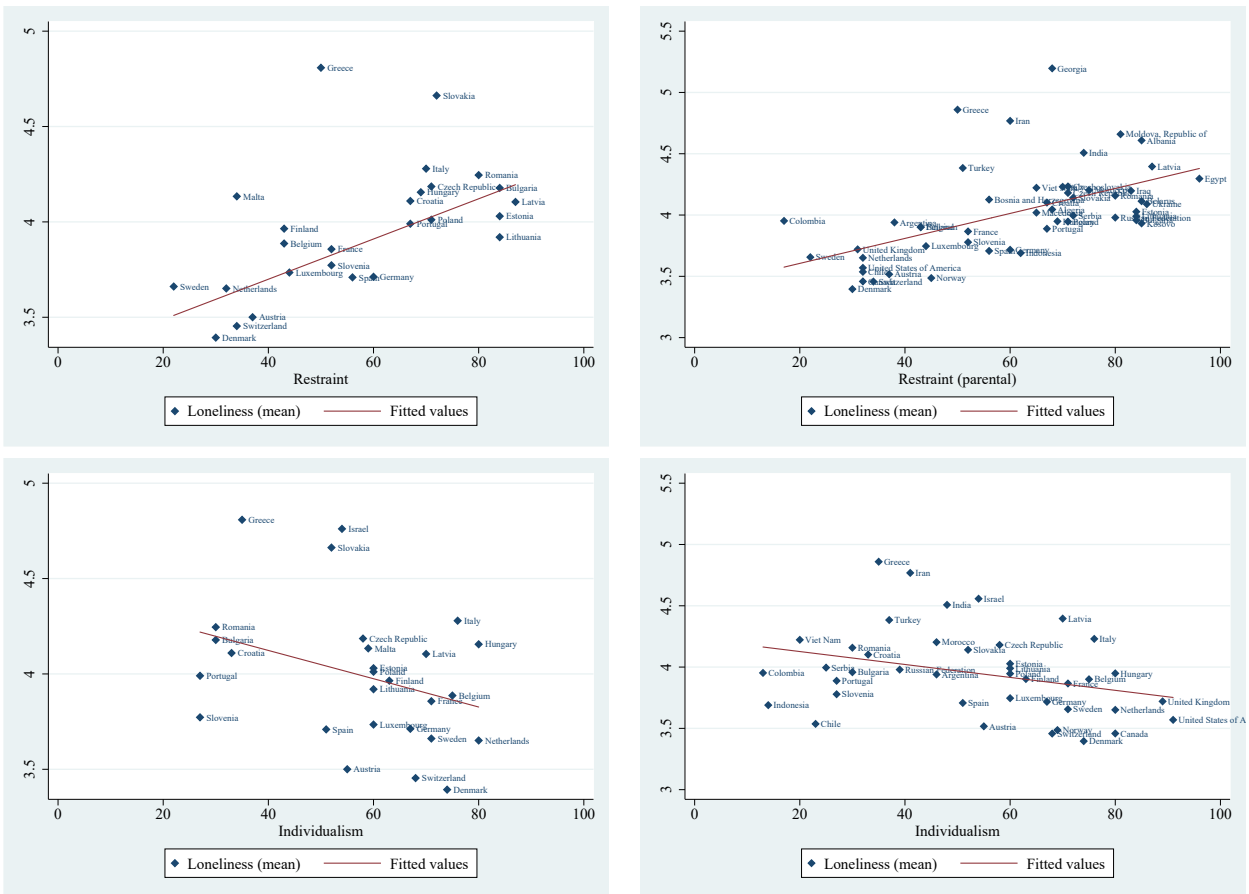
The comparison between variety and quality yields conflicting predictions of loneliness also when it comes to family structures, which may be closely related to culture (Hofstede et al. (2010)). There are two basic types of families, namely stem (or nuclear) and extended (or joint). Stem or nuclear families are generally

associated with weaker social ties, more freedom and less restrictions. These features are characteristic for individualistic and/or indulgent societies. Extended families, on the other hand, despite their stronger ties and larger social networks, are characterized by stricter social norms and less freedom in individuals' decision making, which is in line with broad definitions of collectivism and/or restraint. The "variety argument" applied to the family type - culture nexus would make individuals originating from stem families more lonely compared to the extended ones, while the "quality argument" would predict the opposite. If this conjectures ares true, the ambiguity in the relationship between culture and loneliness may be conceptual in nature.

Tipping the balance from quantity to quality may represent a valuable step to put the puzzle between culture and loneliness together. In what follows we present our empirical strategy and hypotheses. We first establish the robust relationship between loneliness and restraint, and explore the roots of cultural values embodied in historical processes that may have influenced the formation of cultural norms and beliefs, and their transmission across generations. Once we make the culture identification, we move to the second part of the analysis and estimate a direct causal effect of loneliness on multiple health outcomes.

3 Empirical strategy

3.1 Identification strategy

As already mentioned in the previous section, the ambiguity in the relationship between culture and loneliness may be both conceptual and empirical. Given the fact that traditional estimation approaches fail to separate the effect of culture from the other country-specific factors such as economic and institutional arrangements, which all contribute to a single "country effect" (Giuliano (2007)), the identification of culture should compare individuals born and raised in the same economic and institutional environments but whose cultural values are potentially different. This strategy underlies the so-called "epidemiological approach" (Giuliano (2007), Fernández (2011), Galor and Özak (2016), Galor et al. (2020), Bernhofer et al. (2021)), and focuses on native individuals with one or both foreign-born parents (*i.e.*, second-generation immigrants). For the cultural hypothesis to be consistent, immigrants who are identical in all aspects except for their cul-

tural backgrounds should experience different levels of loneliness. The epidemiological approach relies on three main assumptions: i) cultural values and beliefs are vertically transmitted from parents to children, ii) cultural values systematically vary across individuals having different cultural backgrounds; and iii) despite the heterogeneity in their cultural backgrounds, individuals living in the same country (or region) face identical economic and institutional arrangements. Our main analytical sample, therefore, consists of native individuals with one or both foreign-born parents. This identification strategy allows us to exploit the exogenous variation in parental cultural backgrounds while keeping the other country-specific factors invariant.

3.2   Hypotheses

Our first hypothesis tests the assumption that a greater general tendency to evaluate actual social relationships negatively as a result of the stricter social norms and prohibitions that characterize restraint societies increases the risk of loneliness:

Hypothesis 1 *Relationship quality and loneliness*
Individuals with cultural backgrounds characterized by positive cognitive evaluations of one's life and feelings are, on average, less likely to feel lonely, ceteris paribus.

The relationship between negative evaluations of relationship quality and loneliness should hold independently of the optimal variety of social connections. We do not rule out the possibility of loneliness occurring at all levels of social embeddedness (van Staden and Coetzee (2010), Heu et al. (2021a)), but argue that individual satisfaction with social situations is more important than the size of social networks or the degree of physical isolation. Figure 3 illustrates this point: low or high levels of the degree of social integration into groups are, on average, associated with different levels of indulgence.

Figure 3: Indulgence versus individualism (parental), second generation immigrants.
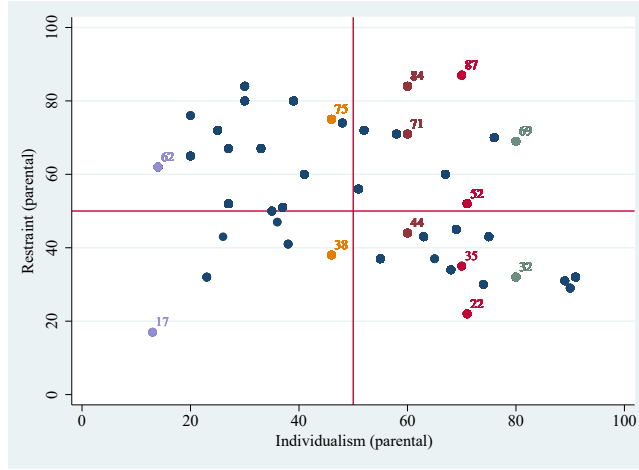
Formally, two individuals, i and j, with the same optimal targets in terms of social embeddedness, $E(x_i) = E(x_j) = E(\overline{x})$, have different evaluations of actual relationships, $x < E(\overline{x})$. Suppose that $x_i > x_j$. Since loneliness is conceptualized as an unpleasant feeling arising from perceived discrepancy between existing and optimal quality, *i.e.*, $L = |x - E(\overline{x})|$, the individual with a higher evaluation of actual social embeddedness will feel less lonely, *i.e.*, $L(x_i) < L(x_j)$. This yields our second hypothesis:

Hypothesis 2 *Relationship quality and variety, and loneliness*

Individuals with cultural backgrounds characterized by positive cognitive evaluations of their lives and feelings are, on average, less likely to feel lonely, regardless of the extent of social networks, frequency of social interactions, and degree of integration into social groups, ceteris paribus.

Finally, to analyze the relationship between culture, loneliness and health, we empirically validate the following hypothesis:

Hypothesis 3 *Loneliness increases the likelihood of mental and physical health problems*

Increasing loneliness negatively affects mental and physical health-related outcomes and functional decline,

ceteris paribus.

3.3   Empirical model

According to our hypotheses, the perception of relationship quality may have a direct influence on loneliness, which in turn affects the individuals' mental and physical health. This chain mechanism can be analyzed by means of a two-stage estimation model. In the first stage, we estimate the effect of culture on loneliness (Hypotheses 1 and 2), while in the second one we quantify the causal effect of loneliness on health (Hypothesis 3). The empirical problem, therefore, consists in estimating the following causal relationship:

$$Health_{i,p,c} = \alpha + \beta L_i + \psi X_i + \rho FE_i + \eta_i, \tag{1}$$

where $Health_{i,p,c}$ is a mental or physical health problem indicator associated with individual i with parental ancestry p, born and currently residing in country c, L_i denotes a measure of the individual i's loneliness, X_i is a full set of individual level characteristics, and FE_i are the country of current residence and wave fixed effects.

In the first stage we empirically validate Hypothesis 1 by estimating the effects of parental cultural backgrounds and other covariates on loneliness:

$$L_i = \alpha + \pi_{i1}RES_i + \pi_{i2}X_i + \pi_{i3}FE_i + \zeta_i \tag{2}$$

where RES_i denotes the index of restraint of the parental country of origin. In order to verify Hypothesis 2, we separately estimate Equation 2 by adding the index of individualism associated to individual $i's$ parental country of origin, IND_i:

$$L_i = \alpha + \pi_{i1}RES_i + \pi_{i2}IND_i + \pi_{i3}X_i + \pi_{i4}FE_i + \zeta_i \tag{3}$$

Since we expect that more restraint cultural backgrounds increase the risk of loneliness, the coefficient π_{i1} is expected to be positive. By plugging the first stage fitted values from Equation (2) in the second stage equation we obtain the reduced form model for health-related outcomes:

$$Health_{i,p,c} = \alpha + \beta \widehat{L_i} + \psi X_i + \gamma FE_i + error_i. \tag{4}$$

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Since loneliness is expected to affect the incidence of mental and physical health problems, the empirical validation of Equation (4) should yield a positive coefficient of L.

Given the particularities of our empirical strategy, in all model specifications robust standard errors are clustered both at the country of residence and the parental country of origin level.

4 Data

The individual-level data employed in this study are drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE, Börsch-Supan (2008)). SHARE is a multidisciplinary longitudinal survey on ageing which focuses on individuals aged 50+ and their spouses. The survey contains both the regular and retrospective waves (SHARELIFE). The regular rounds collect information on the individuals' current situation, such as health, working situation, social network/relations, accommodation, economic situation/assets, behavioral risks, and expectations. In addition, two survey rounds add retrospective information on multiple dimensions of the respondents' past (health, health care, accommodation, working career, household situation and performance at school during childhood, number of children, childbearing for women, emotional experiences in early life, relationship with parents, adverse childhood experiences, etc.). What makes SHARE data particularly suited for the purposes of our analysis is the availability of a rich set of information on individuals' physical and mental health conditions, as well as drug consumption. In addition, the retrospective component of the SHARE data allows to link the information on the respondents' current situation to the retrospective childhood/adulthood data. Below we describe the variables used in the analysis. Summary statistics are set up in Table 12 in the Appendix.

Health outcomes

We consider six health indicators: EURO-D depression scale (Prince et al. (1999)) ranging from 1 (absence of depressive symptoms) to 12 (severe depressive symptoms); number of limitations with activities of daily living (ADL); suicidal intentions; body mass index (BMI); number of chronic diseases, and self-assessed

health (ranging from excellent to poor). In addition, we consider a set of binary variables referring to the consumption of drugs (medicines) for six health problems, namely anxiety, sleeping problems, cholesterol, diabetes, pain and high blood pressure. As for the ADL measure, the respondents are given a list of ten everyday activities and asked to declare whether they have any difficulty doing each of these activities excluding any difficulties that they expect to last less than three months. Similarly, for chronic diseases, the respondents are given a list with 21 different items and asked how many of them they have been diagnosed or for how many they are currently being treated for or bothered by. Together with the overall prevalence (intensity of occurrence) of chronic diseases, we also estimate separately the effect of loneliness on five different physical health-related factors, namely diabetes, high blood pressure, stomach or duodenal ulcer, and peptic ulcer, high blood cholesterol and stroke. The onset of these factors is captured by a set of binary variables.

Loneliness

To assess loneliness, a short three-item version (Hughes et al. (2004)) of the Revised UCLA Loneliness scale (Russell et al. (1978)) was used (in each case with three options: "often", "some of the time", "hardly ever or never"). A sum score was computed, therefore the scale ranges from 3 (not lonely) to 9 (very lonely). The exact wording of the items were: "How often do you feel isolated from others?", "How often do you feel you lack companionship?", "How often do you feel left out?". It has been shown that this tool has favorable psychometric characteristics (Hughes et al. (2004)). A multi-item measure that does not mention loneliness directly can be particularly useful when dealing with particular population groups, such as older people. This is because older people are often reluctant to admit to loneliness (Qualter et al. (2021)). Also, there is variation in how people understand the term "loneliness" and a multi-item measure that does not mention loneliness directly can help to alleviate these concerns.

In addition to a multi-item measure of loneliness, we also consider a direct explicit measure on how often the respondent feels lonely addressed in the question "How often do you feel lonely?" with the following response categories: 1. Often; 2. Some of the time, and 3. Hardly ever or never. We consider that an individual feels lonely if s/he answers "Often" or "Some of the time".

Other controls

As for the other individual-level characteristics, we consider a rich set of demographic and socio-economic information. Among demographics, we include age, gender, marital status, number of children, and whether a respondent lives alone in the household. Marital status is dichotomized into a binary variable, assigning value 1 if the respondent says he/she is legally married, or in a legally registered civil union, and 0 corresponds to separated, divorced or never married. Socio-economic variables include the highest educational attainment and occupational status. In addition, we control for the highest level of parental educational attainment (whether either one or both parents hold a tertiary degree). Finally, to account for the household financial situation, we include the household net worth (assets) and total expenditure (in deciles).[8]

Second, retrospective data allows us to consider a set of childhood circumstances. We control for a specific set of early-life conditions called "Adverse Childhood Circumstances". According to the adult attachment theory proposed by Hazan and Shaver (1987), early experiences in attachment relationships are likely to influence adult attachment styles and general perception of social relations. The authors suggest that individuals with secure attachments early in life tend to be more positive about themselves and their relationships than their peers with insecure early-life attachments. In order to control for these condition we rely on the retrospective SHARELIFE component of the survey which asks respondents to report information on exposure to child neglect and childhood physical abuse, either from mother, father or third parties. More precisely, we consider the following item capturing the quality of the child-parent relationship: *How would you rate the relationship with your mother/your father (or the woman/man that raised you)? 1. Excellent 2. Very good 3. Good 4. Fair 5. Poor.* The relationship with mother/father in childhood is rated that is problematic/negative, if the respondent answers "4. Fair" or "5. Poor". As a sensitivity check, we consider an additional set of childhood circumstances including physical abuse during childhood, absence of a parent, and the respondents' health status when they were 15 years old. In addition, we check whether the inclusion of the frequency of contact with children resizes the effect of loneliness. Finally, we also control

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[8]We also considered total household income as an alternative to household expenditure and net assets. The results do not change significantly.

for genetic and linguistic distances between country of residence and parental country of origin.[9] As shown by Becker et al. (2020), these measures significantly correlate with differences in preferences such as risk aversion, altruism, positive and negative reciprocity, patience and trust, with the effects being particularly pronounced for prosocial traits. Linguistic distances measure the degree to which two countries' languages differ from each other (Fearon (2003)). Genetic distances, on the other hand, quantify the expected genetic distance between two randomly drawn individuals, one from each country, according to the contemporary composition of the population (Spolaore and Wacziarg (2009), Spolaore and Wacziarg (2018)). We use the composite measure of ancestral or temporal distance that is computed as the unweighted average of the standardized values (z-scores) of linguistic and genetic distances.

5   Results

Culture and loneliness

Table 1 reports the coefficients from a linear model in which the individual's self-declared loneliness is regressed on their parental cultural backgrounds (approximated with the indices of restraint and/or individualism) and the full set of covariates. Together with the standard definition of second-generation immigrants, *i.e.*, natives with either one or both foreign-born parents (columns 1 and 2), we also consider two alternative definitions, namely, native individuals with a foreign-born mother and native father (columns 3 and 4), and those with a foreign-born father and native mother (columns 5 and 6).[10] We do not report the results for the subset of immigrants with both foreign-born parents because the sample coverage was not sufficient to produce reliable estimates.

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[9]Physical harm and lack of understanding are addressed by the following questions: "How often did your mother/your father push, grab, shove, throw something at you, slap or hit you? 1. Often 2. Sometimes 3. Rarely 4. Never", and "How much did your mother/your father (or the woman/man that raised you) understand your problems and worries? 1. A lot 2. Some 3. A little 4. Not at all".

[10]Even though second-generation immigrants (approximately 10% of the sample) were born and raised in the same economic and institutional environment as native individuals, they may still be "stigmatized" because of their parental foreign origin and/or because they belong to ethnic enclaves (minorities), which may affect the risk of loneliness (Madsen et al. (2016)). Figure 4 in the Appendix shows the incidence of loneliness (measured on a 3-item UCLA scale) among natives and second-generation migrants. The difference in means of loneliness between second-generation immigrants and the rest is not statistically different from 0, which alleviates potential concerns related to the representativity of our sample. The t-test statistic is -1.0470 with a corresponding two-tailed p-value $0.2951 > 0.05$. Furthermore, according to the Kolmogorov-Smirnov test, the null hypothesis of equal distribution of loneliness between second-generation immigrants and the rest of the sample cannot be rejected ($p = 0.315$).

The results strongly support Hypotheses 1 and 2. Indeed, the coefficients of parental restraint confirm that cultural backgrounds with a stronger tendency to evaluate negatively the quality of actual social relationships positively affect the risk of loneliness. This is true independently of the other characteristics of social embeddedness, such as the variety of connections or the extent of social networks as approximated by the index of individualism. Interestingly, only the mother's attitudes show a significant impact, indicating that parents have unequal effects on children's attitudes in the process of socialization. This is in line with the existing empirical evidence on inter-generational transmission of attitudes and behavior (Fernández et al. (2004), Cipriani et al. (2013), Dohmen et al. (2012), Farré and Vella (2013), Dohmen et al. (2011), Sgroi et al. (2020), among others).

Table 1: The effect of culture on loneliness. SG immigrants (either or both parents born abroad; only mother born abroad; only father born abroad).

Variable	Either or both	Either or both	Only Mother	Only Mother	Only Father	Only Father
Restraint_Mother	0.005***	0.004***	0.006***	0.005***		
	(0.001)	(0.001)	(0.002)	(0.002)		
Restraint_Father	-0.000	-0.001			0.001	0.001
	(0.002)	(0.002)			(0.001)	(0.001)
Individualism_Mother		-0.001		-0.001		
		(0.002)		(0.002)		
Individualism_Father		0.001				-0.001***
		(0.002)				(0.000)
Age	0.002	0.000	0.002	0.000	0.000	-0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Female	0.045	0.026	-0.010	-0.026	0.096**	0.090*
	(0.040)	(0.050)	(0.060)	(0.074)	(0.047)	(0.050)
Low Education	0.146**	0.105*	0.199***	0.175**	0.143***	0.101**
	(0.058)	(0.055)	(0.071)	(0.069)	(0.053)	(0.050)
High Education	-0.079	-0.076	-0.027	-0.024	-0.115	-0.108
	(0.057)	(0.060)	(0.058)	(0.055)	(0.093)	(0.097)
Retired	-0.067	-0.070	-0.143*	-0.127	-0.145	-0.134
	(0.084)	(0.068)	(0.083)	(0.096)	(0.129)	(0.142)
Unemployed	0.071	0.046	0.066	0.048	-0.021	-0.053
	(0.117)	(0.144)	(0.111)	(0.152)	(0.134)	(0.178)
Disabled	0.578***	0.574***	0.436***	0.483***	0.491***	0.493***
	(0.129)	(0.138)	(0.038)	(0.033)	(0.133)	(0.157)
Employed	-0.277***	-0.304***	-0.409***	-0.416***	-0.368***	-0.388***
	(0.104)	(0.082)	(0.124)	(0.126)	(0.123)	(0.126)
Married	-0.200***	-0.188**	-0.270***	-0.313***	-0.193***	-0.154*
	(0.071)	(0.089)	(0.095)	(0.107)	(0.066)	(0.082)
Divorced	-0.114	-0.098	-0.131	-0.184	-0.172**	-0.148
	(0.105)	(0.142)	(0.130)	(0.157)	(0.083)	(0.117)
Widowed	-0.113	-0.102	-0.100	-0.110	-0.189	-0.154
	(0.146)	(0.163)	(0.203)	(0.221)	(0.158)	(0.177)
Number of children	-0.035**	-0.041**	-0.044***	-0.053***	-0.054**	-0.067***
	(0.016)	(0.016)	(0.010)	(0.013)	(0.025)	(0.024)
Live alone	0.407***	0.413***	0.343***	0.311***	0.497***	0.520***
	(0.107)	(0.086)	(0.113)	(0.103)	(0.154)	(0.121)
Education parents (tertiary)	-0.085	-0.076	-0.084	-0.073	-0.122	-0.092
	(0.102)	(0.099)	(0.120)	(0.119)	(0.112)	(0.110)
Relationship parents (adverse)	0.120**	0.120**	0.125*	0.122*	0.107**	0.111**
	(0.048)	(0.057)	(0.066)	(0.073)	(0.048)	(0.051)
Absent parent	0.106*	0.060	0.137*	0.118	0.091	0.037
	(0.056)	(0.060)	(0.074)	(0.083)	(0.073)	(0.077)
HH net wealth	-0.058***	-0.059***	-0.058***	-0.063***	-0.054***	-0.057***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
HH expenditure	0.007	0.003	-0.001	-0.003	0.002	-0.004
	(0.014)	(0.012)	(0.015)	(0.014)	(0.018)	(0.017)
Additional controls:						
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	4395	3956	3315	3022	2944	2604

Notes: *The table reports the coefficients of linear estimations (OLS). Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Culture, loneliness and health

In light of the empirical evidence established in Table 1, the degree of restraint associated with maternal cultural backgrounds may represent a suitable instrument for loneliness in the model for health. Table 2 reports the coefficients from a two-stage model where self-reported loneliness has been instrumented with

the parental degree of restraint. According to the Stock and Yogo (2005) rule of thumb, the F-statistic (24.04) confirms the strength of our instrument (column 1). Even though the exogeneity of the instrument cannot be directly tested, there is no reverse effect of the individuals' health outcomes on the instrument since it refers to parental conditions and is independent of current economic and institutional arrangements. Since we control for a rich set of individual-specific controls such as the level of education, financial situation and living conditions, occupational status, parental education, and a set of adverse early-life conditions, the existence of direct effects of parental cultural backgrounds on health through omitted variables is significantly reduced.

In line with the results from Table 1, the first stage coefficients (column 1) suggest that loneliness is particularly pronounced for individuals living alone and among those with disabilities. Similarly, adverse early life conditions such as the absence of a parent or a low-quality parent-child relationship correlate positively with loneliness, while wealthier, married, and/or employed individuals with more kids feel less lonely.[11] These findings are in line with previous research (Beutel et al. (2017); Menec et al. (2019); Soest et al. (2018); Hajek and König (2020)).

The results from the second-stage (columns 2-6) suggest that loneliness directly increases the probability of depression, suicidal ideation, functional decline, and body mass index. A gradual increase in loneliness causes a 1.81 point increase in the intensity of depressive symptoms as measured by the EURO-D scale (ranging from 0 to 12), a 10.1 percent increase in the probability of suicidal intentions, 0.45 more limitations in daily activities, and a 4.5 point increase in body mass index. Finally, loneliness does not significantly influence the incidence of chronic conditions or the perception of general health. This result is in line with Bekhet and Zauszniewski (2012) who finds no association between loneliness and physical health indicators (number of chronic conditions and functional status), but contradicts Richard et al. (2017) and Jessen et al. (2017) who report a significantly higher likelihood of self-reported chronic diseases and impaired health conditions in lonely individuals. On the other hand, evidence for a negative effect of loneliness on reductions

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[11]The interpretation of the association between loneliness and emotional experiences such as the parent-child relationship requires caution since it may be subject to recall bias and "coloring". However, by assessing the internal and external consistency of the measures of childhood socio-economic status and health, Havari and Mazzonna (2015) found that overall respondents seem to remember fairly well their childhood conditions.

in daily activities appears to be well established (Buchman et al. (2010); Perissinotto et al. (2012)). When considering physical health-related factors separately (Table 3) we see that loneliness increases the probability of diabetes by 6% and high blood pressure by 12%.[12] This is in line with Richard et al. (2017) although the estimated effect of loneliness here is much lower.

The results do not change significantly when we define second-generation immigrants as native individuals with a foreign-born mother and a native father (Table 14).[13] Finally, it is worth noting that the effect of instrumented loneliness is 3.5 times larger in magnitude than the non-instrumented one for depressive symptoms, 2.5 for suicidal intentions, and 6.4 times larger for functional decline, which confirms the presence of a strong reverse causality between loneliness and health. In addition to health outcomes, loneliness significantly affects the prevalence of drug use for sleeping problems, anxiety, pain, and high blood pressure (Table 4). Being lonely increases the probability of medication for high blood pressure by 14%, for anxiety by 3.3% , for pain by 8.4% and for sleeping problems by 4.5%. The effect of loneliness on major depressive disorder and anxiety is in line with the evidence from cross-sectional studies (Domènech-Abella et al. (2018), Jeuring et al. (2018)).

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[12]The dependent variables are all binary, *i.e.*, they equal 1 if an individual suffers from a specific health problem, and 0 otherwise. A consistent estimation of the direct effects of loneliness on binary health outcomes requires a non-linear IV estimation technique, such as a recursive bivariate probit model, in which both the dependent and the endogenous variable are binary. For this purpose, we dichotomize loneliness as measured on a 3-item UCLA scale such that non-lonely individuals (UCLA score = 3) assume value 0 and all those scoring more than 3 assume value 1.

[13]We also performed the estimation on native individuals with both parents born in a country different from the respondent's country of birth and residence. Nevertheless, the size of the sample drops significantly, which makes the interpretation of the results difficult. These estimations, however, are available upon request.

Table 2: The effect of loneliness on health outcomes. Baseline specification. SG immigrants (either or both parents born abroad).

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.005***						
	(0.001)						
Loneliness (R-UCLA)		1.806***	0.103**	0.449***	4.475*	0.039	0.220
		(0.481)	(0.046)	(0.098)	(2.449)	(0.506)	(0.379)
Age	0.003	0.001	0.001	0.004	-0.059***	0.037***	0.016***
	(0.002)	(0.008)	(0.001)	(0.003)	(0.019)	(0.004)	(0.002)
Female	0.060	0.586***	0.014***	-0.008	-0.563	0.021	-0.023
	(0.041)	(0.015)	(0.003)	(0.017)	(0.419)	(0.098)	(0.045)
Low Education	0.152***	0.076	0.012	0.014	0.076	0.254***	0.176***
	(0.058)	(0.189)	(0.007)	(0.056)	(0.632)	(0.089)	(0.067)
High Education	-0.085*	-0.006	-0.010	0.004	0.124	-0.117	-0.178***
	(0.051)	(0.169)	(0.013)	(0.030)	(0.382)	(0.096)	(0.067)
Retired	-0.074	0.173	0.004	0.032	0.829	-0.007	0.023
	(0.077)	(0.198)	(0.023)	(0.071)	(0.622)	(0.085)	(0.063)
Unemployed	0.057	0.317	0.039	-0.061	-1.441	-0.214	0.092
	(0.114)	(0.314)	(0.040)	(0.085)	(0.973)	(0.134)	(0.075)
Disabled	0.576***	0.549	0.033	0.218**	-2.518*	1.254***	0.778***
	(0.118)	(0.342)	(0.040)	(0.099)	(1.481)	(0.324)	(0.226)
Employed	-0.282***	0.301	0.005	0.077	0.725	-0.303**	-0.135
	(0.104)	(0.266)	(0.029)	(0.075)	(0.931)	(0.128)	(0.130)
Married	-0.222***	0.346	-0.002	0.104	0.125	-0.126	-0.072
	(0.076)	(0.266)	(0.020)	(0.090)	(1.031)	(0.147)	(0.076)
Divorced	-0.138	0.451**	0.031	0.124	-0.081	0.050	0.016
	(0.114)	(0.176)	(0.029)	(0.089)	(0.866)	(0.116)	(0.072)
Widowed	-0.154	0.361	0.009	0.170**	0.639	0.137	0.037
	(0.150)	(0.262)	(0.026)	(0.073)	(1.031)	(0.102)	(0.078)
Number of children	-0.031***	0.054	0.009**	0.017	0.222**	-0.032	-0.013
	(0.011)	(0.044)	(0.004)	(0.011)	(0.094)	(0.025)	(0.015)
Live alone	0.419***	-0.705***	-0.038*	-0.223***	-2.624***	-0.233	-0.206
	(0.100)	(0.154)	(0.021)	(0.065)	(0.987)	(0.242)	(0.188)
Education parents (tertiary)	-0.097	0.190	0.006	0.031	-0.759	-0.048	-0.070
	(0.100)	(0.127)	(0.010)	(0.041)	(0.535)	(0.051)	(0.059)
Relationship parents (adverse)	0.116**	0.002	-0.010*	-0.080***	-0.651*	-0.066	-0.022
	(0.049)	(0.043)	(0.005)	(0.014)	(0.346)	(0.078)	(0.049)
Absent parent	0.154**	-0.049	-0.006	-0.045	-0.062	0.166*	-0.040
	(0.063)	(0.172)	(0.014)	(0.040)	(0.600)	(0.093)	(0.060)
HH net wealth	-0.052***	0.038	0.001	0.009	0.166	-0.047	-0.042*
	(0.009)	(0.026)	(0.004)	(0.007)	(0.120)	(0.032)	(0.023)
HH expenditure	0.007	-0.000	0.001	0.002	-0.064	0.014**	-0.003
	(0.014)	(0.026)	(0.001)	(0.006)	(0.074)	(0.006)	(0.005)
Loneliness (R-UCLA)		0.516***	0.041***	0.073***	0.047	0.099***	0.101***
NO instruments		(0.066)	(0.007)	(0.017)	(0.081)	(0.023)	(0.017)
Additional controls:							
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	24.04	—	—	—	—	—	—
1st stage p-value	0.0002	—	—	—	—	—	—
N. Observations	4579	4579	4579	4579	4579	4579	4579

Notes: *The table reports the coefficients of two-stage linear estimations (ivreg2). Robust standard errors are clustered at the country of residence and parental country of origin level. Abbreviations: 1ST - first stage estimates; 2ND - second stage estimates; SAH - self-assessed health. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table 3: The effect of loneliness on physical health: single outcomes. SG immigrants (either one or both born abroad).

Variable	1ST Loneliness	2ND Chol.	2ND Diabetes	2ND Pressure	2ND Ulcer	2ND Stroke
Restraint	0.002***					
	(0.001)					
Feels lonely (dich. UCLA)		-0.183***	0.060***	0.117***	-0.011	0.019*
		(0.023)	(0.016)	(0.032)	(0.021)	(0.010)
Age	0.001	0.002**	0.000	0.003***	-0.000	0.000*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Female	0.008	0.012	-0.010***	-0.007	-0.005	-0.003*
	(0.020)	(0.009)	(0.004)	(0.007)	(0.004)	(0.002)
Low Education	0.047**	0.036**	0.009*	0.027**	0.006	0.007**
	(0.021)	(0.015)	(0.005)	(0.013)	(0.005)	(0.003)
High Education	-0.026*	-0.023**	-0.003	-0.014*	-0.008*	0.001
	(0.015)	(0.010)	(0.004)	(0.008)	(0.005)	(0.002)
Retired	-0.013	-0.014	0.001	0.001	0.007	0.002
	(0.010)	(0.019)	(0.007)	(0.011)	(0.009)	(0.004)
Unemployed	-0.031	-0.028	-0.016	-0.018	-0.006	-0.005
	(0.042)	(0.034)	(0.011)	(0.018)	(0.013)	(0.007)
Disabled	0.135***	0.101***	0.017*	0.060***	0.032**	0.015***
	(0.033)	(0.029)	(0.010)	(0.020)	(0.015)	(0.006)
Employed	-0.094***	-0.077***	-0.020***	-0.031**	-0.014	-0.006
	(0.025)	(0.020)	(0.008)	(0.016)	(0.012)	(0.004)
Married	-0.086***	-0.037*	-0.015*	-0.026*	-0.018*	-0.001
	(0.019)	(0.022)	(0.008)	(0.013)	(0.011)	(0.005)
Divorced	-0.079***	-0.014	-0.016*	-0.015	0.003	0.004
	(0.030)	(0.025)	(0.008)	(0.012)	(0.009)	(0.004)
Widowed	-0.046	-0.004	-0.004	-0.003	0.012	-0.000
	(0.041)	(0.024)	(0.008)	(0.014)	(0.008)	(0.004)
Number of children	-0.011*	-0.009**	-0.003**	-0.005**	-0.001	0.000
	(0.006)	(0.004)	(0.001)	(0.003)	(0.001)	(0.001)
Live alone	0.126***	0.039*	0.002	0.027*	-0.017***	-0.000
	(0.033)	(0.021)	(0.006)	(0.016)	(0.006)	(0.003)
Education parents (tertiary)	-0.041	-0.029*	-0.010*	-0.026**	-0.001	-0.000
	(0.033)	(0.017)	(0.006)	(0.011)	(0.006)	(0.003)
Relationship parents (adverse)	0.062***	0.026**	0.004	0.008	0.002	0.001
	(0.015)	(0.012)	(0.003)	(0.008)	(0.003)	(0.002)
Absent parent	0.057	0.033*	0.015**	0.022**	0.011**	0.004
	(0.035)	(0.018)	(0.007)	(0.009)	(0.005)	(0.004)
HH net wealth	-0.013***	-0.006**	-0.004***	-0.004***	-0.003**	-0.001
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
HH expenditure	0.002	0.002	-0.000	-0.000	0.000	0.001
	(0.004)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Additional controls:						
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	10.10	—	—	—	—	—
1st stage p-value	0.0058	—	—	—	—	—
N. Observations	4575	4575	4575	4575	4575	4575

*Notes: The table reports the average marginal effects of bivariate probit estimations (biprobit). Robust standard errors are clustered at the country of residence and parental country of origin level. Abbreviations: 1ST - first stage estimates; 2ND - second stage estimates. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 4: The effect of loneliness on drug consumption. SG immigrants (either one or both born abroad).

Variable	1ST Loneliness	2ND Sleeping	2ND Chol.	2ND Anxiety	2ND Pain	2ND Diabetes	2ND Pressure
Restraint	0.002***						
	(0.001)						
Feels lonely (dich. UCLA)		0.048***	0.071*	0.033*	0.084***	0.058***	0.138***
		(0.014)	(0.038)	(0.017)	(0.015)	(0.017)	(0.023)
Age	0.001	0.001***	0.002***	-0.000	0.000*	0.001**	0.003***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Female	0.009	0.016***	-0.007	0.023***	0.015***	-0.010***	-0.006
	(0.020)	(0.003)	(0.006)	(0.007)	(0.005)	(0.003)	(0.007)
Low Education	0.046**	0.013***	0.020**	0.018**	0.018***	0.006	0.030**
	(0.021)	(0.004)	(0.010)	(0.007)	(0.004)	(0.004)	(0.013)
High Education	-0.025*	-0.004	-0.003	0.005	-0.004	-0.003	-0.013*
	(0.015)	(0.003)	(0.005)	(0.004)	(0.003)	(0.004)	(0.007)
Retired	-0.013	0.003	0.004	0.002	-0.002	-0.003	-0.003
	(0.010)	(0.006)	(0.009)	(0.007)	(0.006)	(0.006)	(0.010)
Unemployed	-0.031	0.011	0.007	0.008	-0.014	-0.013	-0.013
	(0.042)	(0.010)	(0.015)	(0.011)	(0.011)	(0.009)	(0.017)
Disabled	0.135***	0.044***	0.053**	0.062***	0.034***	0.007	0.048***
	(0.034)	(0.007)	(0.023)	(0.015)	(0.008)	(0.008)	(0.016)
Employed	-0.094***	-0.005	-0.029**	-0.015*	-0.020***	-0.021***	-0.032**
	(0.025)	(0.006)	(0.013)	(0.008)	(0.006)	(0.007)	(0.013)
Married	-0.086***	0.006	-0.012	-0.001	0.004	-0.014**	-0.025*
	(0.019)	(0.006)	(0.012)	(0.008)	(0.007)	(0.007)	(0.013)
Divorced	-0.079***	0.006	-0.001	-0.000	0.002	-0.012*	-0.015
	(0.030)	(0.006)	(0.012)	(0.008)	(0.007)	(0.007)	(0.012)
Widowed	-0.046	0.005	0.003	-0.001	0.010	-0.006	0.001
	(0.041)	(0.008)	(0.012)	(0.009)	(0.007)	(0.007)	(0.013)
Number of children	-0.012*	-0.002	-0.004*	-0.005***	0.000	-0.002*	-0.006***
	(0.006)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Lives alone	0.126***	0.014**	0.005	0.014*	0.009*	0.002	0.016
	(0.033)	(0.006)	(0.008)	(0.008)	(0.005)	(0.006)	(0.013)
Education parents (tertiary)	-0.042	-0.001	-0.017**	-0.002	-0.007	-0.011**	-0.025***
	(0.032)	(0.005)	(0.008)	(0.007)	(0.007)	(0.005)	(0.009)
relationship parents (adverse)	0.062***	0.007*	0.000	0.012**	0.004	0.004	0.011
	(0.016)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)	(0.008)
Absent parent	0.057	0.006	0.016*	-0.000	0.008**	0.014***	0.014
	(0.035)	(0.004)	(0.009)	(0.005)	(0.004)	(0.005)	(0.008)
HH net wealth	-0.013***	-0.001	-0.000	-0.002**	-0.003***	-0.003***	-0.003**
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HH expenditure	0.002	0.000	0.001	-0.000	0.001	-0.000	0.000
	(0.004)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Additional controls:							
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	10.15	—	—	—	—	—	—
1st stage p-value	0.0057	—	—	—	—	—	—
N. Observations	4576	4576	4576	4576	4576	4576	4576

Notes: *The table reports the average marginal effects of bivariate probit estimations (biprobit). Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

6 Extensions and sensitivity analysis

In this section, we test the robustness of the results from our baseline specification. We first investigate one possible pathway by which some specific ancestral factors may have influenced the formation of cultural traits associated with a higher level of restraint in the modern era, and then we assess the predictive power of these historical proxies in explaining the effects of loneliness on health. Second, we perform several sensitiv-

ity tests on the baseline specification from Table 2, including: i) direct question on loneliness (short, 3-item version); ii) inclusion of additional adverse childhood conditions and health status early in life; iii) control for the frequency of contact with children (for a sub-set of individuals with offspring); and iv) inclusion of genetic and linguistic distances between the respondents' country of birth and parental country of origin as strong correlates with prosocial traits Falk et al. (2018) and Becker et al. (2020)). These additional factors may represent important correlates of loneliness and health outcomes later in life.

Restraint, loneliness and health in a historical perspective

As in the case of most social traits, there may be plenty of factors that have contributed to the formation of cultural characteristics. In order to strengthen the previous findings, we test one possible channel through which some specific ancestral factors may have influenced the emergence of predominant cultural characteristics and their transmission across generations. Hofstede et al. (2010) and Minkov (2009) suggest that the origins of observed differences in restraint across countries may be rooted in the pre-industrial intensity of agricultural production. Highly intensive agricultural systems were characterized by hard work, alternation of food abundance and starvation, conflicts for the territory, and exploitation. Moreover, high intensity of production required restrained discipline, adequate planning, and savings for the future (Hofstede et al. (2010)). Higher exposure of ancestral populations to these factors in the pre-industrial era may have triggered adaptation and learning processes that have gradually increased the persistence of traits related to stronger discipline and stricter social norms in the population.

Table 5 shows the relationship between agricultural potential during the pre-1500 period and crop expansion associated with "Columbian Exchange" (the expansion of suitable crops for cultivation in the post-1500 period), and restraint, taking into account continental fixed effects and other climatic conditions that may have influenced agricultural productivity. The findings back up Minkov (2009)'s intuition. Increased degrees of restriction are closely linked to higher crop yield potential in the pre-1500 period. A one-standard-deviation rise in agricultural yield potential corresponds to a 5.67-point increase in restraint (column 3). After controlling for the expansion of crops accessible for cultivation in the post-1500CE period, the effect

of crop yield is reduced, but it is still significant at the 10% significance level.

We also account for past population density and urbanization, which may have been influenced positively by higher crop yield potential and, as a result, had a direct impact on the degree of restraint. In this way, we are able to separate the effect of potential crop yield from the long-term effect of the other historical traits. Even after controlling for urbanization and population density, the effect of historical yield remains statistically significant.

Table 5: The effect of ancestral agricultural and climatic conditions on degree of restraint.

Variable	Yield	Yield	Yield	Yield,CE	Yield,CE
Crop Yield (Anc., pre-1500)	2.678**	3.348**	5.672***	2.639*	3.829*
	(1.337)	(1.389)	(1.543)	(1.354)	(2.090)
Crop Growth Cycle (Anc., pre-1500)	-0.139	-0.065	-0.614***	0.027	-0.289
	(0.121)	(0.130)	(0.220)	(0.117)	(0.322)
Crop Yield Change (post-1500)				-4.917	-4.679
				(3.590)	(4.413)
Crop Growth Cycle Change (post-1500)				5.210*	7.518**
				(2.899)	(3.157)
Absolute Latitude	-11.864	-7.480	-10.284	-7.864	-9.063
	(7.492)	(7.742)	(8.309)	(7.253)	(7.855)
Neolithic Transition Timing	-0.218	1.302	1.943	-0.149	-1.933
	(4.188)	(4.215)	(5.581)	(3.421)	(5.352)
Mean Elevation	2.733	1.509	-4.191	-0.205	-2.971
	(3.016)	(3.204)	(5.864)	(2.677)	(5.518)
Terrain Roughness	-4.350	-2.664	0.948	-1.949	0.458
	(2.995)	(2.796)	(3.470)	(2.716)	(3.053)
Pct. Land in Tropics	-5.683	-5.968	-3.132	-5.718	-1.539
	(4.401)	(4.561)	(5.658)	(4.275)	(5.248)
Precipitation	-5.749	-4.222	-8.539	-5.079	-8.453*
	(5.149)	(5.056)	(5.193)	(4.316)	(4.647)
Population density in 1500 CE		-0.492**		-0.552***	
		(0.191)		(0.160)	
Urbanization rate in 1500 CE			-0.630		-0.802*
			(0.473)		(0.461)
R2	0.449	0.490	0.547	0.532	0.585
N. Observations	88	88	64	88	64

Notes: *The results are based on data from Galor and Özak (2016) and Hofstede et al. (2010). Robust standard errors are clustered at the country of level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

The negative and economically significant effects of urbanization and population density may be attributed to the fact that highly intensive agricultural societies were characterized by extended families and village communities, whereas in more urbanized societies, the predominant family structure was nuclear (Hofstede et al. (2010)). Finally, the predicted power of ancestral agricultural potential is further confirmed in Table 6, where we regress loneliness on the predicted restraint from Table 5 (column 5). In line with the results from Table 1, only the mother's attitudes show a significant impact on loneliness. Finally, the

findings in Table 7 show that culture, even when approximated by historical agro-climatic conditions, is a good instrument for loneliness. The effects of loneliness on mental health, functional decline, and BMI, are very similar to those reported in Table 2 for the baseline specification.

Table 6: The effect of culture on loneliness. SG immigrants (either or both parents born abroad; only mother born abroad; only father born abroad).

Variable	Either or both	Either or both	Either or both	Only mother	Only father
Restraint_Mother (fitted)	0.008***		0.009***	0.009**	
	(0.003)		(0.003)	(0.003)	
Restraint_Father (fitted)		0.002	-0.000		0.002
		(0.003)	(0.004)		(0.003)
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes
Additional controls:					
Country of residence	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes
N. Observations	4402	4202	4030	3151	2758

Notes: *The table reports the coefficients of linear estimations (OLS). Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 7: The effect of loneliness on health outcomes. Baseline specification. SG immigrants (either or both parents born abroad).

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Fitted values	0.008***						
	(0.003)						
Loneliness (R-UCLA)		1.893***	0.033	0.412*	4.957*	0.285	0.474
		(0.705)	(0.092)	(0.218)	(2.892)	(0.565)	(0.407)
Additional controls:							
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	9.40	—	—	—	—	—	—
1st stage p-value	0.0074	—	—	—	—	—	—
N. Observations	4402	4402	4397	4402	4402	4402	4402

Notes: *The table reports the coefficients of two-stage linear estimations (ivreg2). Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Additional sensitivity checks

Tables 8 - 11 report the additional robustness checks for the results from our baseline specification in Table 2. The evidence in Table 8 confirms the strength of parental restraint even when the individuals are directly asked whether and how often they feel lonely. In line with the previous findings, the effect of loneliness is significant for mental health, suicidal intentions, functional decline, and body mass index.

Being lonely translates into a 9.2 unit increase in depression and 2.2 more limitations in daily activities, and increases the probability of suicidal intent by 52%.

Table 8: The effect of loneliness on health outcomes. SG immigrants (either or both parents born abroad), short question on loneliness (3-items).

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.001***						
	(0.000)						
Feels lonely		9.157***	0.517*	2.198***	23.785*	0.541	1.333
		(2.234)	(0.311)	(0.504)	(13.352)	(2.740)	(2.029)
N. Observations	4699	4699	4691	4699	4699	4699	4699
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	59.44	—	—	—	—	—	—
1st stage p-value	0.0056	—	—	—	—	—	—

Notes: *The method of estimation is bi-variate probit. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Similarly, the inclusion of an additional adverse childhood condition (harm from parents) and health conditions in early life does not alter the effect of loneliness (Table 9) except for suicide intentions and functional decline, which slightly increase in magnitude.

Table 9: The effect of loneliness on health outcomes. SG immigrants (either or both parents born abroad), additional adverse childhood conditions and health status during childhood

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.005***						
	(0.001)						
Loneliness (R-UCLA)		1.765***	0.133**	0.487***	5.330*	-0.146	0.224
		(0.663)	(0.052)	(0.139)	(2.994)	(0.480)	(0.422)
Relationship parents (adverse)	0.058	-0.011	-0.016***	-0.088***	-0.431	-0.131**	-0.036
	(0.050)	(0.046)	(0.005)	(0.013)	(0.329)	(0.059)	(0.036)
Harm from parents	0.098*	-0.068	0.008	-0.023	-0.441	0.131	-0.039
	(0.056)	(0.114)	(0.012)	(0.021)	(0.451)	(0.081)	(0.064)
Harm from third parties	0.252***	-0.214	0.006	-0.058	-1.264	0.153	-0.034
	(0.053)	(0.266)	(0.025)	(0.059)	(0.960)	(0.269)	(0.167)
Understanding parents (lack of)	0.161***	0.111	0.010	-0.013	-0.887*	0.172**	0.017
	(0.050)	(0.161)	(0.014)	(0.031)	(0.537)	(0.084)	(0.065)
Health when 15yo	0.040	0.073	0.001	0.012	-0.275	0.147***	0.112***
	(0.028)	(0.046)	(0.004)	(0.018)	(0.270)	(0.028)	(0.028)
N. Observations	4040	4040	4035	4040	4040	4040	4040
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	20.70	—	—	—	—	—	—
1st stage p-value	0.0005	—	—	—	—	—	—

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

The likelihood of loneliness may be influenced as well by the frequency of parent-offspring interactions (contacts). In Table 10 we control for three different frequency levels (with contact on a daily basis as the reference category): frequent contact (several times a week), fair contact (once a week or every two weeks) and rare contact (once a month, less than once a month, never). Loneliness is positively associated with rare contact with children, and the effects are similar to those shown in Tables 2 and 9.

Table 10: The effect of loneliness on health outcomes. SG immigrants (either or both parents born abroad). Sub-sample with kids: frequency of the contact with children

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.007***						
	(0.001)						
Loneliness (R-UCLA)		1.748***	0.086	0.369***	4.648***	0.265	0.181
		(0.455)	(0.059)	(0.095)	(1.155)	(0.448)	(0.299)
Frequent contact	0.029	-0.007	-0.004	-0.022	0.038	0.079*	-0.027
	(0.052)	(0.093)	(0.013)	(0.023)	(0.238)	(0.047)	(0.046)
Fair contact	0.130**	-0.140	-0.010	-0.046	-0.671*	-0.003	0.039
	(0.057)	(0.229)	(0.014)	(.)	(0.405)	(0.053)	(0.081)
Rare contact	0.362***	-0.283	-0.003	-0.082	-1.995**	0.073	0.072
	(0.111)	(0.331)	(0.025)	(0.067)	(0.819)	(0.139)	(0.132)
N. Observations	2806	2806	2804	2806	2806	2806	2806
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	33.33	—	—	—	—	—	—
1st stage p-value	0.0000	—	—	—	—	—	—

Notes: *The method of estimation is ivreg2. Reference category: every-day contact. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Finally, as expected, genetic and linguistic distances reduce the effect of loneliness. This is not surprising evidence since these measures strongly correlate with cross-cultural differences in prosocial traits. However, the effect of loneliness on mental health remains highly significant.

Table 11: The effect of loneliness on health outcomes. SG immigrants (either or both parents born abroad), temporal distances from Becker et al. (2020)

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.005***						
	(0.001)						
Loneliness (R-UCLA)		1.342***	0.046	0.294*	6.382*	-0.180	0.209
		(0.468)	(0.062)	(0.176)	(3.757)	(0.745)	(0.554)
Ancestral distance (z-score)	-0.034	0.016	-0.015*	0.001	0.350	-0.056	-0.036
	(0.029)	(0.060)	(0.008)	(0.011)	(0.325)	(0.061)	(0.039)
N. Observations	3609	3609	3605	3609	3609	3609	3609
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (SHARE wave)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	11.44	—	—	—	—	—	—
1st stage p-value	0.0038	—	—	—	—	—	—

Notes: *The table shows the [...] Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

7 Conclusions

In this paper, we estimate the direct causal effect of loneliness on a variety of health outcomes using a sample of second-generation immigrants in Europe. In an effort to account for the endogeneity of self-declared loneliness, we use maternal cultural background as an instrument for loneliness. We therefore also assess the importance of cultural heritage is shaping individuals' perceptions of loneliness.

We contribute to the related literature in a number of ways. First, we link loneliness to the degree of *restraint* of a society, a specific cultural trait strongly associated with quality of relations, extraversion, happiness and high importance of having friends and positive feelings. In an extension of our analysis, we also investigate one possible pathway by which some specific ancestral factors may have influence on the formation of cultural traits associated with higher levels of restraint in the modern era. Second, in order to separate the effect of culture from other country-specific factors, we focus on a sample of second-generation immigrants to whom we assign the cultural trait belonging to their parents' country of origin. Third, we estimate a direct causal effect on loneliness on multiple health outcomes.

We uncover a strong relationship between the *quality* of relations and loneliness. The risk of loneliness significantly increases among individuals with more restraint cultural backgrounds compared to their peers with more indulgent cultural heritages. This result holds independently of the variety and frequency of social interactions. Based on this evidence, we use maternal cultural background as an instrument for individuals' self-declared loneliness in our model of health, which proves to be a strong and valid instrument. This is in line with extant evidence on the inter-generational transmission of attitudes and behaviour from mothers to their children. We find that loneliness has a significant impact on individual's health status. More specifically, loneliness increases the probability of depression, suicidal ideation, and functional decline. Among physical health-related factors and medications, loneliness increases the likelihood of diabetes, hypertension and stroke. Our baseline results are robust to a number of sensitivity checks.

Our results are in line with the related literature, which however only shows *correlations* and no *causation* between loneliness and health. More importantly, our identification strategy allows us to uncover a larger effect of loneliness on health than that found in simple descriptive and regression analysis, which confirms

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the presence of a strong reverse causality between loneliness and health.

A few implications derive from our work. Cultural heritage and expectations play a prominent role in shaping individuals' experiences of loneliness. Furthermore, loneliness poses a greater threat to health than had been found previously. The social and economic costs of loneliness may be even higher than those already foreseen. In this context, the need to implement effective policies and interventions targeted at reducing loneliness becomes even more imperative. However, one-size-fits-all solutions may not be the most appropriate. When designing loneliness interventions, policy makers will also have to account for the diverse ways in which individuals experience loneliness across societies with different cultural backgrounds.

8 Appendix

Table 12: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Loneliness (R-UCLA)	3.883	1.355	3	9	4579
Feels lonely	0.234	0.423	0	1	4578
Restraint_Mother	63.637	16.905	0	96	4579
Restraint_Father	63.211	17.774	22	96	4395
Individualism_Mother	56.619	15.787	12	91	4286
Individualism_Father	56.969	15.667	20	91	4068
Age	64.303	8.547	50	94	4579
Female	0.584	0.493	0	1	4579
Depression scale EURO-D	2.305	2.126	0	12	4579
Suicidality (part of EURO-D)	0.066	0.248	0	1	4573
Adl	0.165	0.614	0	6	4579
Body mass index (bmi)	27.408	5.078	15.571	73.462	4579
Number of chronic diseases	1.694	1.557	0	11	4579
Self-perceived health (SAH)	3.083	1.078	1	5	4579
High blood cholesterol	0.24	0.427	0	1	4575
High blood pressure or hypertension	0.389	0.487	0	1	4575
Diabetes or high blood sugar	0.133	0.34	0	1	4575
Stomach or duodenal ulcer, peptic ulcer	0.045	0.207	0	1	4575
Chronic lung disease	0.057	0.232	0	1	4575
Stroke	0.029	0.167	0	1	4575
Drugs for: sleep problems	0.076	0.265	0	1	4576
Drugs for: high blood cholesterol	0.226	0.418	0	1	4576
Drugs for: anxiety or depression	0.075	0.263	0	1	4576
Drugs for: joint pain	0.136	0.343	0	1	4576
Drugs for: diabetes	0.119	0.323	0	1	4576
Drugs for: high blood pressure	0.402	0.49	0	1	4576
Low Education	0.237	0.425	0	1	4579
Medium Education	0.461	0.499	0	1	4579
High Education	0.302	0.459	0	1	4579
Retired	0.497	0.5	0	1	4579
Unemployed	0.026	0.16	0	1	4579
Disabled	0.045	0.207	0	1	4579
Employed	0.368	0.482	0	1	4579
Married	0.679	0.467	0	1	4579
Divorced	0.131	0.338	0	1	4579
Widowed	0.112	0.315	0	1	4579
Number of children	2.236	1.363	0	14	4579
Lives alone	0.211	0.408	0	1	4579
Parental education (tertiary, either one or both)	0.161	0.368	0	1	4579
Relationship parents (adverse)	0.549	0.498	0	1	4579
Absent parent	0.116	0.32	0	1	4579
Harm from parents	0.278	0.448	0	1	4527
Harm third parties	0.083	0.276	0	1	4579
Understanding parents (lack of)	0.436	0.496	0	1	4552

Variable	Mean	Std. Dev.	Min.	Max.	N
Every-day contact	0.279	0.449	0	1	3195
Frequent contact	0.271	0.445	0	1	3195
Fair contact	0.279	0.449	0	1	3195
Rare contact	0.17	0.376	0	1	3195
Ancestral distance (z-score)	-0.769	0.816	-3.35	0.683	3609
Health when 15yo	2.314	1.155	1	6	4112
HH net assets (deciles)	6.609	2.58	1	10	4579
HH expenditure (deciles)	4.917	2.935	1	9	4579

Figure 4: Loneliness across natives and second-generation immigrants, 3-item UCLA loneliness scale.
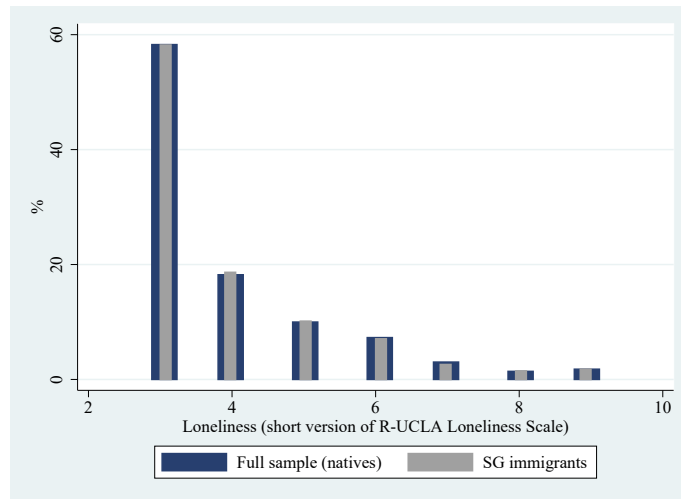
Table 13: The effect of loneliness on health outcomes. Full sample (first-generation immigrants excluded).

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.007***						
	(0.001)						
Loneliness (R-UCLA)		1.496***	0.116***	0.304***	2.042	0.384	0.326
		(0.375)	(0.044)	(0.080)	(1.455)	(0.303)	(0.201)
Age	0.006***	0.006	0.000	0.007***	-0.058***	0.034***	0.017***
	(0.002)	(0.004)	(0.000)	(0.001)	(0.010)	(0.002)	(0.002)
Female	0.094***	0.513***	0.003	-0.017	-1.016***	0.055	-0.020
	(0.034)	(0.049)	(0.006)	(0.013)	(0.286)	(0.048)	(0.029)
Low Education	0.100***	0.114**	0.007	0.023*	0.335	0.122***	0.153***
	(0.028)	(0.047)	(0.006)	(0.013)	(0.237)	(0.036)	(0.024)
High Education	-0.013	-0.100***	-0.006**	-0.019**	-0.530***	-0.081***	-0.154***
	(0.018)	(0.037)	(0.003)	(0.009)	(0.076)	(0.023)	(0.017)
Retired	-0.157***	-0.078	0.001	0.007	0.354	0.047	-0.005
	(0.026)	(0.094)	(0.010)	(0.020)	(0.313)	(0.061)	(0.043)
Unemployed	0.120**	0.076	0.006	-0.044**	-1.032***	-0.115	-0.005
	(0.054)	(0.089)	(0.011)	(0.018)	(0.222)	(0.072)	(0.051)
Disabled	0.561***	0.553**	0.027*	0.379***	-0.472	0.849***	0.733***
	(0.080)	(0.216)	(0.016)	(0.044)	(0.855)	(0.190)	(0.128)
Employed	-0.258***	0.054	0.005	0.049**	-0.167	-0.227***	-0.149**
	(0.038)	(0.134)	(0.012)	(0.024)	(0.398)	(0.077)	(0.058)
Married	-0.239***	0.212*	0.014	0.059**	0.716*	0.110	0.013
	(0.057)	(0.127)	(0.011)	(0.026)	(0.404)	(0.079)	(0.055)
Divorced	-0.055	0.125	0.013	0.018	-0.048	0.001	-0.045*
	(0.037)	(0.087)	(0.008)	(0.014)	(0.162)	(0.060)	(0.026)
Widowed	0.077**	0.043	0.008	0.012	0.307**	0.015	-0.075***
	(0.035)	(0.081)	(0.010)	(0.024)	(0.139)	(0.056)	(0.023)
Number of children	-0.022***	0.052***	0.003	0.006*	0.202***	0.010	0.005
	(0.006)	(0.015)	(0.002)	(0.003)	(0.045)	(0.014)	(0.008)
Live alone	0.256***	-0.438***	-0.024*	-0.098***	-0.697*	-0.100	-0.124**
	(0.041)	(0.103)	(0.012)	(0.028)	(0.398)	(0.092)	(0.054)
Education parents (tertiary)	0.012	0.044**	0.006	0.006	-0.720***	-0.002	-0.074***
	(0.022)	(0.021)	(0.004)	(0.008)	(0.103)	(0.034)	(0.020)
Relationship parents (adverse)	0.143***	0.063	-0.009	-0.034***	-0.190	0.045	0.069**
	(0.020)	(0.061)	(0.007)	(0.013)	(0.206)	(0.047)	(0.031)
Absent parent	0.031	0.118***	0.013***	-0.012	0.173	0.114***	0.037**
	(0.021)	(0.035)	(0.004)	(0.014)	(0.119)	(0.029)	(0.019)
HH net wealth	-0.036***	-0.036***	-0.001	-0.003	-0.062	-0.045***	-0.041***
	(0.005)	(0.013)	(0.002)	(0.004)	(0.059)	(0.010)	(0.009)
HH expenditure	0.013***	0.006	0.000	0.002	-0.025	0.002	-0.003
	(0.002)	(0.007)	(0.001)	(0.002)	(0.027)	(0.005)	(0.003)
Country (of residence) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (round) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	85.72	—	—	—	—	—	—
1st stage p-value	0.0000	—	—	—	—	—	—
N. Observations	53011	53011	53002	53011	53011	53011	53011

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table 14: The effect of loneliness on health outcomes. SG immigrants (only mother born abroad).

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Restraint	0.006***						
	(0.002)						
Loneliness (R-UCLA)		1.815***	0.091*	0.443**	5.603**	0.191	0.101
		(0.654)	(0.049)	(0.173)	(2.564)	(0.661)	(0.447)
Age	0.002	0.002	0.001	0.002	-0.052**	0.038***	0.015***
	(0.004)	(0.006)	(0.001)	(0.004)	(0.024)	(0.006)	(0.001)
female	-0.010	0.610***	0.016**	0.015	-0.113	0.030	-0.008
	(0.060)	(0.052)	(0.008)	(0.029)	(0.788)	(0.114)	(0.048)
Low Education	0.199***	0.061	0.014*	0.048	0.009	0.295**	0.229**
	(0.071)	(0.235)	(0.008)	(0.070)	(0.761)	(0.137)	(0.097)
High Education	-0.027	-0.071	-0.013	0.007	0.162	-0.034	-0.173***
	(0.058)	(0.205)	(0.014)	(0.034)	(0.460)	(0.096)	(0.049)
Retired	-0.143*	0.297	0.020	0.089	1.509	0.102	0.072
	(0.083)	(0.251)	(0.020)	(0.081)	(0.999)	(0.141)	(0.086)
Unemployed	0.066	0.394	0.067	-0.011	-1.431	-0.199	0.168*
	(0.111)	(0.352)	(0.049)	(0.103)	(1.278)	(0.152)	(0.089)
Disabled	0.436***	0.851**	0.065**	0.366***	-2.380*	1.276***	0.892***
	(0.038)	(0.348)	(0.028)	(0.099)	(1.241)	(0.398)	(0.217)
Employed	-0.409***	0.510	0.023	0.138	2.089	-0.173	-0.136
	(0.124)	(0.408)	(0.034)	(0.117)	(1.344)	(0.232)	(0.173)
Married	-0.270***	0.443	0.008	0.110	0.745	-0.188	-0.166*
	(0.095)	(0.327)	(0.018)	(0.125)	(1.282)	(0.212)	(0.095)
Divorced	-0.131	0.584***	0.048	0.095	0.068	-0.003	-0.061
	(0.130)	(0.192)	(0.032)	(0.099)	(1.165)	(0.105)	(0.076)
Widowed	-0.100	0.308	0.021	0.177	0.518	0.049	-0.067
	(0.203)	(0.293)	(0.018)	(0.110)	(1.439)	(0.144)	(0.077)
Number of children	-0.044***	0.064	0.008	0.017	0.289***	-0.020	-0.017
	(0.010)	(0.061)	(0.006)	(0.014)	(0.101)	(0.032)	(0.016)
Live alone	0.343***	-0.563*	-0.033	-0.201*	-2.535**	-0.332	-0.182
	(0.113)	(0.327)	(0.029)	(0.108)	(1.265)	(0.238)	(0.189)
Education parents (tertiary)	-0.084	0.166	0.007	0.040	-0.883	0.050	-0.053
	(0.120)	(0.152)	(0.012)	(0.056)	(0.737)	(0.063)	(0.048)
Relationship parents (adverse)	0.125*	-0.063	-0.004	-0.097***	-0.628	-0.105	0.001
	(0.066)	(0.075)	(0.006)	(0.032)	(0.492)	(0.096)	(0.062)
Absent parent	0.137*	0.023	-0.009	-0.010	0.285	0.196	0.033
	(0.074)	(0.217)	(0.017)	(0.050)	(0.775)	(0.120)	(0.073)
HH net wealth	-0.058***	0.061	-0.001	0.012	0.277**	-0.038	-0.048*
	(0.009)	(0.045)	(0.005)	(0.012)	(0.122)	(0.043)	(0.028)
HH expenditure	-0.001	0.020	0.002*	0.006	-0.044	0.015**	-0.001
	(0.015)	(0.023)	(0.001)	(0.006)	(0.105)	(0.006)	(0.006)
Country (of residence) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (round) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	11.19	—	—	—	—	—	—
1st stage p-value	0.0041	—	—	—	—	—	—
N. Observations	3315	3315	3310	3315	3315	3315	3315

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels:* * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 15: The effect of loneliness on health outcomes. SG immigrants (either one or both born abroad), individualism vs. collectivism.

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Individualism	-0.001						
	(0.002)						
Loneliness (R-UCLA)		3.536	0.387	1.352	12.886	1.416	1.370
		(4.007)	(0.507)	(1.771)	(22.258)	(2.094)	(2.269)
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (round) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	0.47	—	—	—	—	—	—
1st stage p-value	0.5013	—	—	—	—	—	
N. Observations	4286	4286	4280	4286	4286	4286	4286

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 16: The effect of loneliness on health outcomes. SG immigrants (either one or both born abroad), uncertainty avoidance.

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Uncertainty Avoidance	0.002						
	(0.002)						
Loneliness (R-UCLA)		0.955	0.158	0.147	1.963	-0.509	-0.446
		(0.782)	(0.143)	(0.224)	(6.073)	(1.040)	(0.813)
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (round) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	0.72	—	—	—	—	—	
1st stage p-value	0.4090	—	—	—	—	—	
N. Observations	4286	4286	4280	4286	4286	4286	4286

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 17: The effect of loneliness on health outcomes. SG immigrants (either one or both born abroad), power distance.

Variable	1ST Loneliness	2ND Eurod	2ND Suicide	2ND Adl	2ND Bmi	2ND Chronic	2ND SAH
Power Distance	0.001						
	(0.002)						
Loneliness (R-UCLA)		1.579**	0.200	0.588	5.299	1.292	0.467
		(0.801)	(0.168)	(0.392)	(9.670)	(1.171)	(0.712)
Full set of v. Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year (round) FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F	0.64	—	—	—	—	—	—
1st stage p-value	0.4368	—	—	—	—	—	
N. Observations	4286	4286	4280	4286	4286	4286	4286

Notes: *The method of estimation is ivreg2. Robust standard errors are clustered at the country of residence and parental country of origin level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

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