Social interactions, loneliness and collective health: A new angle on an old debate

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Abstract

Loneliness is increasingly being recognized as an important economic and public health issue. This paper investigates the relationship between historically rooted norms that drive individuals to conform to predefined behavioral standards and contemporary perceptions of social interactions and attitudes towards loneliness. Using a sub-population of second-generation immigrants, we identify an intergenerationally transmitted component of culture that reflects the importance of restrained discipline and rules characterizing highly intensive pre-industrial agricultural systems. We show that this cultural dimension influences perceptions of the quality of social relationships and significantly affects the likelihood of experiencing loneliness. The identified trait is then used to instrument loneliness in a two-stage model for health. We find that loneliness directly affects body mass index and some specific mental health issues. We argue, however, that loneliness may influence other health outcomes indirectly due to its economically significant effect on the increased body mass index. The results are robust to a battery of sensitivity checks. Our findings add to a growing body of research on the importance of attitudes in predicting significant economic and health outcomes, opening up a new channel via which deeply-rooted geographical, cultural, and individual characteristics may influence comparative economic development processes.

Keywords: Loneliness, ancestral characteristics, social norms, collective health, development.

JEL Classification: I12, I14, J14, D91, Z13.

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Declarations

1 Introduction

Loneliness is generally understood as the negative subjective experience arising when an individual perceives a significant mismatch between actual and desired social interactions (Perlman and Peplau, 1981; Peplau et al., 1982). In other words, individuals feel lonely when current circumstances do not fulfill their ideal targets (Erber and Gilmour, 2013).

Loneliness is widely recognized as being a 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. Extensive literature, prevalently psychological, 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 physical 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; Park et al., 2020, among many others).

Besides being a public health issue, loneliness is an economic problem, too. Lonely people are more likely to use healthcare services (e.g. doctor visits, hospital admissions). Thus, loneliness may be associated with higher healthcare expenditure (Kung et al., 2021). 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, most studies have relied on descriptive analysis or simple

multivariate regression models, which reveal little about causation. Reverse causality between loneliness and health produces spurious and/or underestimated effects of loneliness, making any valid causal inference impossible. In this paper, we propose an innovative strategy to deal with the issue of endogeneity of loneliness that consists of three steps. First, assuming that loneliness arises from the perceived discrepancy between the actual and desired quality of social relationships, we identify the intergenerationally transmitted component of culture related to socially imposed rules, norms, and traditions that constrain individuals to fit into predefined behavioral standards. To achieve this goal, we exploit a set of ancestral factors conducive to higher pre-industrial returns to agriculture that required restrained discipline, stricter rules, and adequate planning. Second, we show that this particular cultural trait strongly correlates with the occurrence of loneliness among second-generation migrants, who are identical in all aspects except for their parental cultural backgrounds. Third, once we've established a strong link between culturally embedded social norms and loneliness, we employ the derived component of culture as an instrument for loneliness in the model for health.

The individual-level data are drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE contains rich information on individuals' mental and physical health statuses and links information on the respondents' current situation to retrospective childhood data and parental origins. It also includes widely recognized measures of loneliness: an indirect measure (the three-item version of the Revised UCLA loneliness scale, Russell et al., 1978) and the single-item question which asks about loneliness directly. Moreover, the sample is representative of the older population (aged 50 or older), who is especially vulnerable to loneliness and its health-related implications (Vozikaki et al., 2018).

The main cultural indicators of interest are taken from Hofstede et al. (2010). More precisely, we

focus on the distinction between restraint and indulgent societies. The individuals originating from indulgent societies gratify the enjoyment of life without social restrictions that hamper one's freedom of choice, and are frequently involved in leisurely and other indulgent activities. Restraint societies, on the other hand, are characterized by stricter social norms and prohibitions. The prevalent belief in these cultures is that everybody should align with rules and norms governing socially acceptable behaviors. Life-control dimension, as a core component of restraint, therefore, captures the degree to which individuals feel they have completely free choice over their lives (Minkov, 2009; Hofstede et al., 2010). The residual component reflects the value placed on leisure and other indulgences.

To separate the life-control component, we exploit a set of characteristics of pre-industrial agricultural systems to account for the evolutionary process that triggered the emergence and transmission of restrained discipline and stricter rules across generations. More precisely, we rely on Galor and Özak (2016) and consider the pre-1500 crop yield potential and growth cycle, and their changes in the post-1500 period ("Columbian Exchange") as proxies for the intensity of agricultural production in the individual ancestors' country of origin. The potential link between agriculture and restraint can be traced back to Minkov (2009), according to which restraint is higher in societies with a strong cultural legacy of highly intensive agriculture. Regressing the index of restraint of contemporary cultures on this set of ancestral agro-climatic attributes, we isolate the predicted component of culture that reflects the importance attached to norms and prohibitions. Using an additional set of preferences, we then show that the predicted life-control dimension significantly correlates with attitudes toward rules and socially accepted behaviors, while the residual component predicts preferences for leisure and indulgence.

In order to identify the effect of culture on loneliness, we consider a sub-population of native individuals with one or both foreign-born parents (*i.e.,* second-generation immigrants). In such a

way, we are able to exploit the exogenous variation in parental cultural backgrounds while keeping the other country-specific factors invariant. Once we have established a robust association between the predicted life-control dimension and loneliness, we use it to instrument current experiences of loneliness in a two-stage model for health. Regarding potential concerns related to the exclusion restriction, we show that the predicted restraint has no effect on health outcomes, as well as on factors closely related to health, like risky behaviors and other individual-specific socio-economic characteristics. The only exception is the item related to depression (elicited as feelings of sadness or low spirits), which may partially overlap with the definitions of restraint and loneliness (Mann et al., 2022). As a precaution, we develop an alternative composite measure of mental problems that excludes this specific emotional disorder. Furthermore, the results of the over-identification test provide additional evidence that the exclusion restriction should not be violated. Finally, we show that a direct association between agro-climatic factors and loneliness would not fully capture the effects of rules and restrictions, because the historical agricultural potential captures other important aspects of individual preferences, such as patience (Galor and Özak, 2016), which are not directly related to loneliness. The effect of predicted restraint, on the other hand, is orthogonal to individual long-term orientation and other preference dimensions.

Our key findings are as follows. A one standard-deviation rise in the ancestral agricultural yield potential corresponds to a 7.1-point increase in restraint (as measured on a scale of 1 to 100). This effect remains strong and statistically significant even after controlling for historical urbanization rate and population density. The life-control component of the parental cultural backgrounds significantly affects the risk of loneliness independently of the variety and frequency of social connections. The effect of the aggregated measure of restraint is much weaker since it also captures the effect of the residual component related to leisure and other indulgences, which is not significantly related

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to loneliness.

As for the health outcomes, the instrumented loneliness has a direct impact on only mental disorders, a high body mass index, and, albeit marginally, mobility limitations. More specifically, a gradual increase in loneliness causes a 0.95-point increase in the intensity of emotional distress, a 3.14-point increase in the body mass index, and 1.14-point increase in mobility limitations. Statistically and economically significant effect of loneliness on emotional disorders is mainly driven by the increased risk of suicidal thoughts and feelings of guilt. These effects are significantly larger than those obtained from a simple OLS regression. Loneliness has no direct impact on the incidence of chronic conditions, limitations with activities of daily living, or the perception of general health. Moreover, we find no evidence linking loneliness to cognitive functioning, such as memory, literacy, and numeracy, as well as to diabetes, high blood pressure, ulcer, high blood cholesterol and stroke. The lack of a direct effect of loneliness on physical health-related outcomes does not rule out the possibility that feeling lonely may worsen individuals' physical conditions, as it may have an indirect impact on health due to its economically significant effect on body mass index. Finally, loneliness increases the prevalence of stomach pain and inflammation drug use by 11% and 6%, respectively. The results are robust to a number of sensitivity checks.

The evidence provided in this paper adds to a growing body of research on the importance of attitudes in predicting significant economic and health outcomes, opening up a new channel via which deeply-rooted cultural and individual characteristics may influence economic development processes. The link between loneliness and health and the resulting economic and social effects in both origin and destination countries complement the picture of the central role played by individual attitudes in comparative development.

The rest of the paper is organized as follows: Section 2 discusses the association between lone-

liness and culture. 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 sensitivity checks in Section 6. Section 7 concludes.

2 Cultural roots of loneliness

Aside from the common demographic and socioeconomic factors, a growing body of psychological literature suggests that certain cultural dimensions may also play a significant role in shaping individuals' social experiences (Heu et al., 2021b).[1] One cultural aspect that may potentially interact with loneliness is that related to the degree of social embeddedness of individuals in networks, *i.e.,* the quantity or variety 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, and are more independent from each other. Individuals in more socially embedded cultures, on the other hand, strongly integrate into cohesive groups and often make decisions based on what is best for the group rather than what is best for themselves.

Another dimension of culture intuitively linked to loneliness is that associated with the tightness of social restrictions that constrain individuals in choosing favored behavioral patterns, which may lead to less fulfilling and less responsive relationships. Even though individuals face the same target in terms of the extent of social relations (*i.e.,* quantity or variety), norms and restrictions may shape the evaluations of such relationships (*i.e.,* perceived quality). Social norms and relationship quality, hence, are closely related - tighter norms may potentially restrain individuals by imposing

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[1]The role of culture has been widely documented as an important factor in several dimensions, such as entrepreneurial activity (Erhardt and Haenni, 2022), educational choices (Figlio et al., 2019), long-term orientation and savings (Galor and Özak, 2016; Galor et al., 2020), risk aversion and investments in risky assets (Bernhofer et al., 2021), political and labor market participation (Alesina and Giuliano, 2011), domestic violence (Tur-Prats, 2018), tolerance toward immigration (Kovacic and Orso, 2023), among many others.

the socially acceptable way of behaving, which may differ from the desired one, and increase the odds of experiencing dissatisfaction with social life due to one's lack of freedom to choose behaviors and relationships. 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.[2] Interestingly, cultures that enforce a more severe compliance with rules and restrictions are those characterized by extended social ties and collectivism. Quality and variety, therefore, are distinct concepts, and there is no reason to assume *a priori* that higher (lower) quantity implies higher (lower) quality.

It is not straightforward which of these cultural dimensions wins the race in terms of affecting loneliness. The existing research has mainly focused on quantity of social interactions assuming that individuals in cultures with strong social networks and extended family ties (so-called "collectivist societies") should feel less lonely than individuals in societies with weaker social connections, tinier family ties and more individualistic values (so-called "individualistic societies"). 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), which may seem counter-intuitive. In some cases, the evidence provides contradictory findings (van Tilburg et al., 2004, Rokach et al., 2001, Jiang et al., 2018, Heu et al., 2019, Heu et al., 2021b). This mixed evidence 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. Second, attempts to identify the effect of culture across individuals who share the

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[2]Emotional isolation occurs when an individual does not have individually fulfilling, high-quality, or responsive relationships. Perceived isolation, instead, results from perceived ideal-actual discrepancies regarding social relationships (Heu et al., 2021b).

same current environment but were born and raised in different cultural contexts (Madsen et al., 2016) confound social values with the individuals' minority status, which may itself affect loneliness. Last, but not least, the issue might also be conceptual in nature and more emphasis should be put on alternative dimensions of culture. Indeed, several empirical findings suggest that the quality of social contacts is more relevant than their quantity in predicting loneliness (Pinquart and Sorensen, 2003; Hawkley et al., 2008; Beller and Wagner, 2018; Taylor et al., 2018; Heu et al., 2021b). If we place more emphasis on the quality of social interactions rather than their quantity, then individuals originating from cultures characterized by stricter social norms and prohibitions may be more at risk of loneliness compared to individuals in more indulgent societies where enjoyment of one's life is more loose, regardless of the extent of social networks or desired frequency of social interactions.

A useful framework to categorize cultures along the quantity *versus* quality dimensions occasionally used in economics and other social sciences has been introduced by Hofstede et al. (1991), and further extended by Hofstede et al. (2010).[3] Together with the individualism - collectivism gradient, cultures can be categorized as well along the so-called *restraint - indulgence* dimension.[4] According to the authors, indulgent societies gratify the enjoyment of life without social restrictions that hamper one's freedom of choice, are frequently involved in leisurely activities, have lenient sexual norms, etc. Restraint societies, on the other hand, are characterized by stricter social norms and prohibitions. The core component of this cultural dimension is, therefore, "life-control", *i.e.*, the degree to which individuals feel they have completely free choice over their lives. The resid-

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[3]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. The authors develop a six-dimensional model of national culture on the values of its members and how these values relate to behavior. The six-dimension data matrix is available at `https://geerthofstede.com/research-and-vsm/dimension-data-matrix/`. For further details see Hofstede et al. (2010).

[4]As our focus is on the cultural traits specifically related to the quantity and quality of social relationships, we limit our analysis to the distinction between individualistic and restraint societies. The other four cultural dimensions are described in Appendix A.

ual component, on the other hand, captures the importance of leisure and other indulgences. 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 level of attributes rather they express the position of societies relative to each other.[5] Worth noting is that, Beugelsdijk and Welzel (2018) show that the values within each cultural dimension are transferred from parents to children, and rarely change in later life.[6]

3 Empirical strategy

3.1 Sample selection and identification strategy

Our identification strategy aims to exploit the culturally embedded degree of strength of socially imposed norms and prohibitions as a potential instrument for loneliness in the model for health. The identification of culture raises two major concerns. First, given the fact that traditional estimation approaches fail to separate the effect of selected dimensions of culture from the other country-specific factors such as economic and institutional arrangements, the identification of specific cultural traits 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 cultural backgrounds should experience different levels of loneliness.[7]

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[5]Table B.2 (in Appendix B) provides the full list of countries included in Hofstede et al.'s (2010) model of national culture and the corresponding index of individualism and restraint.

[6]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.

[7]The epidemiological approach relies on the following assumptions: i) cultural values and beliefs are vertically transmitted from parents to children, ii) cultural heritage is long-lasting, meaning that it affects individual's beliefs, emotions and choices throughout their life, iii) cultural values systematically vary across individuals having different

Considering second-generation immigrants, therefore, allows us to exploit the exogenous variation in parental cultural backgrounds while keeping the other country-specific factors invariant.

Second, the identification of the causal effect of loneliness requires that culture does not affect health through any other variable other than loneliness (exclusion restriction). The index of restraint, apart from the perception of life-control as a core dimension, captures as well some minor traits such as the importance of leisure activities, spending, and other forms of indulgence. If leisure and indulgence affect health-related behaviors, which in turn shape individuals' health outcomes, the overall measure of restraint would not be a good instrument for loneliness. Norms and restrictions governing social relationships, on the other hand, are less likely to have a direct impact on unhealthy lifestyles or other unobservable health-related factors, such as genetic predispositions. We cannot, however, *a priori* rule out their potential effects on health, in particular on some aspects of emotional disorders, or on some other socio-economic factor such as labor market participation and/or educational attainment (especially for women). Although the exclusion restriction cannot be formally tested, we provide compelling evidence that suggests that it is unlikely to be violated.[8]

In order to separate the two components of restraint, we exploit the historical processes in the ancestors' country of origin that may have contributed to the emergence and transmission of these community traits across generations. We claim that specific characteristics of ancestral economic systems during the pre-industrial era may have triggered the imposition of certain social norms, which had long-lasting effects on individuals' perceptions of social life. More precisely, highly intensive agricultural systems (*i.e.,* those with a higher potential yield) were characterized by hard work, alternation of food abundance and starvation, conflicts for the territory, and exploitation.

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cultural backgrounds; and iv) despite the heterogeneity in their cultural backgrounds, individuals living in the same country (or region) face identical economic and institutional arrangements.

[8]We will turn to this point deeply in the empirical and results sections.

Intensive production, hence, required restrained discipline and strict rules of conduct (Minkov, 2009). Higher exposure of ancestral populations to these factors in the pre-industrial era may have fostered adaptation and learning processes that have gradually increased the persistence of traits related to stronger discipline and stricter social norms in the population (Galor and Özak, 2016; Galor et al., 2020). If this conjecture is correct, then part of the cross-country variation in the degree of restraint attributable to ancestral agro-climatic factors may represent a good proxy for the strength of social norms in contemporary environments.

3.2   Hypotheses and empirical model

Our framework consists of a set of hypotheses. We first explore the origins of contemporary differences in restraint rooted in the pre-industrial intensity of agricultural production:

Hypothesis 1 Historical agricultural productivity and restraint
Higher historical intensities of production that triggered the imposition of restrained discipline and restrictions translate into a higher degree of restraint in contemporary environments.

The second 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 cultures increases the risk of loneliness:

Hypothesis 2 Social norms and loneliness
Individuals with cultural backgrounds characterized by stricter social norms and prohibitions are, on average, more likely to feel lonely, regardless of the extent of social networks, frequency of social interactions, and degree of integration into social groups, ceteris paribus.

The relationship between social norms and prohibitions and loneliness, hence, should hold regardless of the ideal variety of social connections. We do not rule out the possibility of loneliness

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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.

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

Hypothesis 3 Loneliness and health

Feeling lonely negatively affects emotional disorders and physical health-related outcomes and functional decline, ceteris paribus.

According to the above hypotheses, the strictness of social norms in contemporary societies is determined by ancestral characteristics. Stricter norms may, in turn, have a direct influence on an individual's perception of social life and increase the odds of experiencing loneliness, which has potentially negative effects on mental and physical health.

This chain mechanism can be analyzed as follows. To isolate the component of culture reflecting social norms and prohibitions (Hypothesis 1), we estimate the following OLS model:

$$Res_p = a_0 + b_0 \mathbf{Agr}_p^{anc} + c_0 \mathbf{Geo}_p + d_0 \mathbf{H_p} + \epsilon_p, \tag{1}$$

where Res_p indicates the degree of restraint in the parental country of origin, Agr_p^{anc} is the set of factors capturing pre-industrial agricultural potential, Geo_p is the vector of geographic and climatic conditions, and H_p contains additional historical controls at the parental country of origin level. According to the theory, the obtained predicted values, $\hat{Res}_p$, represent the component of parental culture related to social norms and restrictions.

In the second step, we estimate the relationship between ancestral culture and loneliness and quantify its direct effect on health by means of a two-stage instrumental variable model. The

empirical problem consists in estimating the following causal relationship:

$$Health_{i,p,c} = \alpha + \beta L_i + \psi \mathbf{X_i} + \rho FE_i + \eta_i, \tag{2}$$

where $Health_{i,p,c}$ is an indicator measuring mental or physical health of 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 controls.

In the first stage, we empirically validate Hypothesis 2 and regress loneliness on $\hat{Res}_p$ associated to individuals parents' country of origin and other covariates:

$$L_i = \alpha + \pi_{i1}\hat{Res}_{i,p} + \pi_{i2}\mathbf{X_i} + \pi_{i3}FE_i + \zeta_i \tag{3}$$

According to the theory, more stringent social norms should increase the risk of loneliness. The coefficient π_{i1}, hence, is expected to be positive. By plugging the first stage fitted values from Equation (3) in the second stage equation we obtain the reduced form model for health-related outcomes:

$$Health_{i,p,c} = \alpha + \beta \hat{L}_i + \psi \mathbf{X_i} + \gamma FE_i + error_i. \tag{4}$$

In all model specifications we cluster the robust standard errors at the country of residence and the parental country of origin level. Since the component of restraint predicted by historical agro-climatic factors originates from a different distribution with respect to the overall index of restraint, as a robustness check, we bootstrapped and clustered standard errors at the country of residence and the parental country of origin level. The results do not differ significantly.[9]

Concerning the exclusion restriction, we show that $\hat{Res}_{i,p}$ has no direct impact on health, and that it does not indirectly influence health through other factors, such as unhealthy behaviors (phys-

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[9]These results are available upon request.

ical activity and smoking) and socio-economic characteristics (education, wealth and being out of the labor market). The residual component of restraint (capturing leisure and other indulgences), on the other hand, significantly correlates with most of the health outcomes and some behavioral risks. Additionally, we show that the predicted component of restraint strongly influences individual opinions related to the compliance of rules and socially accepted behaviors, while the residual component shapes preferences for leisure and overall life satisfaction. Finally, we run an over-identification test, which provides further proof that the exclusion restriction should not be violated.

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.[10] We consider the data collected in four different waves, namely 5, 6, 7, and 8 (release 8.0.0).[11] What makes SHARE data particularly suited for the purposes of our analysis is the availability of a rich set of information on older 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 data.[12] Below we describe the variables used in the

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[10]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, behavioural 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.).

[11]The information on loneliness is not available in earlier survey rounds.

[12]In a similar fashion, the European Social Survey (ESS) collects information on individual attitudes, behavioral patterns, and parental origins and is representative of the entire population in terms of age structure. It contains only a direct question on loneliness and lacks most of the health outcomes considered in this study. The available indicators (such as body mass index, depressive symptoms, and single physical health issues) have been collected in one or a few survey rounds, resulting in a very low number of observations. For all these reasons, we did not consider ESS as an alternative analytical sample.

analysis. Table B.1 (in Appendix B) reports summary statistics, while Table B.3 (in Appendix B) reports the list of countries included in the analysis.

Cultural indices and historical economic potential

The main cultural indicator of interest is degree of restraint taken from Hofstede et al. (2010).[13] The index varies between 0 (full indulgence) and 100 (full restraint). This measure is positively correlated with the importance ascribed to social norms and prohibitions (life-control), and leisure (and other indulgences) as a personal value. The set of ancestral agro-climatic conditions of the parental country of origin conducive to higher historical returns on agriculture, restrained discipline and adequate planning are taken from Galor and Özak (2016) and include: (i) the yield (measured in millions of kilo calories per hectare per year), (ii) growth cycle (measured in days) for the crop that maximizes potential yield before the Columbian Exchange (Putterman and Weil, 2010), and (iii) the post-1500 changes in the yield and growth cycles of the dominant crop due to the Columbian Exchange. Crop growth cycle measures the days elapsed from the planting to full maturity. The evolution of crop yield in the post-1500 period, on the other hand, captures the expansion of agricultural potential when all regions were equally able to adopt all crops for agricultural production. Since crop yield in the parental country of origin is distinct from that in the country of residence, the estimated effect of the historical agricultural potential of the parental country of origin should capture the culturally embodied effect of crop yield on traits related to norms and restrictions and

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[13]Hofstede's cultural dimension variables have been extensively used in the empirical literature. For example, Figlio et al. (2019) use the index of long-term orientation as a proxy for time preferences when explaining educational choices, Galor and Özak (2016) test the association between historical agricultural potential and long-term orientation as well as other cultural dimensions, while Kovacic and Orso (2023) explore the causal effects of long-term orientation on individuals' perceptions of immigration. Moreover, (Proto and Oswald, 2017) include Hofstede's cultural dimensions as control variables in their model exploring cross-country differences in happiness and their link with genetic advantages in the well-being of their populations, while (Hanushek et al., 2021) employ them as alternatives for patience and risk-taking behavior included in the Global Preference Survey.

their transmission across generations. Furthermore, we also include a set of geographical factors potentially correlated with agricultural productivity such as absolute latitude, mean elevation above sea level, terrain roughness, neolithic transition timing, precipitation, percentage of population living in tropical, sub-tropical and temperate zones, distance to coast or navigable rivers, as well as landlocked region dummies.

Health outcomes

We consider six health indicators: EURO-D depression scale (Prince et al., 1999), which ranges from 1 (absence of depressive symptoms) to 12 (severe depressive symptoms);[14] number of mobility, arm function and fine motor limitations; number of limitations with activities of daily living (ADL); body mass index (BMI); number of chronic diseases, and self-assessed health (ranging from 1 (excellent) to 5 (poor)).[15] As a sensitivity check, we generate an alternative EURO-D measure that excludes the item eliciting self-assessed depressive symptoms since it may conceptually overlap with loneliness and/or generate concerns regarding the exclusion restriction. 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. In addition, we consider a set of binary variables referring to the consumption of drugs (medicines) for six health problems: anxiety, sleeping problems, cholesterol, diabetes, pain and high blood pressure. The onset

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[14]The EURO-D depression scale consists of 12 elements connected to psychological health: depression, pessimism, willingness to die, guilt complexes, sleeping difficulties, lack of interests, irritability, lack of appetite, fatigue, lack of concentration, inability to take pleasure from normal activities and a tendency to cry. Each item is of equal weighting and is reported with a 0 if the symptom is absent and a 1 when it is present.

[15]As for the ADL measure, the respondents are given a list of fifteen everyday activities (such as dressing, bathing, shopping, etc.) 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. Mobility limitations, on the other hand, comprise activities such as climbing, lifting heavy weights, pulling large objects, etc. 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.

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of these factors is captured by a set of binary variables.

Loneliness

To assess loneliness, a short three-item version of the Revised UCLA Loneliness scale (henceforth, R-UCLA) was used (Hughes et al., 2004; Russell et al., 1978). It has been shown that this tool has favorable psychometric characteristics (Hughes et al., 2004). The exact wording of the items are: *How often do you feel isolated from others?*, *How often do you feel you lack companionship?*, *How often do you feel left out?*. In each case, the available responses are: *1. Often, 2, Some of the time, 3. Hardly ever or never.* A sum score was computed, therefore the scale ranges from 3 (not lonely) to 9 (very lonely). A multi-item measure that does not mention loneliness directly can be particularly useful when dealing with particular population groups, such as older people because they 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.

Other controls

Among demographics, we include age, gender, marital status, number of children, and whether a respondent lives alone in the household.[16] Socio-economic variables include the highest educational attainment and occupational status. The retrospective SHARELIFE component of the survey allows us to consider a set of early-life conditions called "Adverse Childhood Experiences (ACE)". According to the adult attachment theory proposed by Hazan and Shaver (1987), early social experiences are likely to influence adult attachment styles and general perception of social relations.

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[16]Marital status is dichotomized into a binary variable, assigning value 1 if the respondent is legally married, or in a legally registered civil union, and 0 otherwise.

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. Moreover, adverse childhood conditions have been shown to have a significant impact on health and unhealthy behaviors (Kovacic and Orso, 2022; Brugiavini et al., 2022). This set of variables includes the exposure to child neglect and childhood physical abuse, either from mother, father or third parties.[17] As a sensitivity check, we consider an additional set of childhood circumstances, including financial hardship, the number of books at home, the absence of a parent, loneliness in childhood, and the respondents' health status when they were 15 years old. Finally, we control for the frequency of contact with kids, participation in socially related activities in the last 12 months, the informal care received by or provided to family members from outside the household, a friend or neighbor, and a set of behavioral risks including frequency of sports activity and smoking.

5 Results

Historical roots of restraint

As per Minkov (2009)'s intuition, the societies' contemporary levels of restraint could be traced back to the historical intensity of their agricultural systems. In order to test this conjecture, in Table 1 we show the relationship between agricultural potential during the pre-1500 period and crop expansion associated with Columbian Exchange in the post-1500 period and contemporary restraint, controlling for continental fixed effects and other geographic and climatic conditions that may have influenced historical agricultural productivity. In order to account for immigration patterns of

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[17]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 as problematic/negative, if the respondent answers "4. Fair" or "5. Poor". Physical harm, on the other hand, is addressed by the following question: *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.*

ancestral populations in the post-1500 period and potential mismatches between the crop yield in the parental country of origin and the crop yield to which their ancestors were exposed prior to migration, we follow (Galor and Özak, 2016) and adjust crop yield, growth cycle, and timing of transition to agriculture to capture the geographical attributes that existed in the homelands of the ancestral populations of each contemporary country of origin (models "mRIV7" - "mRIV9").[18] This adjustment permits the analysis to capture the culturally embodied transmission rather than the direct effect of geography (Galor and Özak, 2016). We also account for pre-industrial 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.

The findings confirm the intuition underlying Hypothesis 1. Increased degrees of restraint are closely linked to higher crop yield potential in the pre-1500 period. A one-standard-deviation rise in the ancestry-adjusted agricultural yield potential (for a given growth cycle) corresponds to a 7.1-point increase in contemporary restraint, while a one standard deviation increase in the change in yield in the course of the Columbian Exchange increases restraint by 8.56 points (model "mRIV7"). Even after controlling for urbanization and population density, the effect of historical yield remains strong and statistically significant. 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 (communitarian) families and village communities, characterized by strong family ties, rules and social norms. In more urbanized societies, on the other hand, the predominant family structure was nuclear (Hofstede et al., 2010) based on weaker ties, more freedom and independence of family members (Todd, 1990; Duranton et al., 2009).

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[18]In particular, for each country of origin, the adjusted crop yield is the weighted average of the crop yield in the countries where the ancestral populations resided.

	mRIV1 not adj.	mRIV2 not adj.	mRIV3 not adj.	mRIV4 not adj.	mRIV5 not adj.	mRIV6 not adj.	**mRIV7 adj.**	mRIV8 adj.	mRIV9 adj.
Crop Yield (pre-1500)	5.945*** (2.067)	7.126*** (2.071)	7.133*** (2.161)	8.676*** (2.592)	9.262*** (2.786)	6.180 (3.933)			
Crop Yield Change (post-1500)		4.463* (2.527)	2.136 (2.968)	3.524 (3.325)	3.115 (3.441)	-1.987 (3.609)			
Crop G. Cycle (pre-1500)				-4.442* (2.269)	-2.329 (2.255)	-0.144 (6.835)			
Crop G. Cycle Change (post-1500)				2.386 (2.521)	3.448 (2.923)	7.325** (2.872)			
Crop Yield (Anc., pre-1500)							7.099*** (2.416)	8.230*** (2.525)	8.594** (3.930)
Crop Yield Change (Anc., post-1500)							8.555** (3.615)	8.729** (3.719)	2.975 (3.042)
Crop Growth Cycle (Anc., pre-1500)							-8.129** (3.753)	-5.037 (4.005)	-5.269 (6.463)
Crop G. Cycle Change (Anc., post-1500)							2.401 (2.595)	3.097 (2.810)	7.228** (2.840)
Population density in 1500 CE						-6.184*** (1.720)		-5.879*** (1.730)	
Urbanization rate in 1500 CE						-4.791** (2.201)			-4.209* (2.390)
Absolute Latitude			-7.926 (5.667)	-12.311** (6.154)	-9.444 (6.198)	-4.305 (7.066)	-13.920** (6.622)	-10.386 (6.668)	-9.520 (7.304)
Mean Elevation			4.008 (2.725)	2.295 (2.625)	0.850 (2.506)	-1.666 (4.302)	0.683 (2.634)	-0.160 (2.480)	-1.511 (5.183)
Terrain Roughness			-4.188 (2.923)	-4.180 (2.850)	-2.373 (2.550)	-0.066 (2.742)	-2.363 (2.682)	-1.187 (2.441)	0.970 (2.803)
Precipitation			-5.370 (3.969)	-5.065 (3.820)	-4.031 (3.671)	-8.159** (3.862)	-7.630* (4.222)	-6.658 (4.216)	-10.287** (4.622)
Pct. Land in Tropics			-3.489 (4.082)	-5.179 (4.341)	-5.612 (4.459)	2.125 (5.136)	-3.399 (4.215)	-3.545 (4.269)	1.913 (6.010)
Continent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neolithic Transition Timing	No	No	No	No	No	No	Yes	Yes	Yes
N. Observations	88	88	88	88	88	64	86	86	64

Notes: *The table shows the association between historical agro-climatic conditions (pre-1500 potential crop yield and growth cycle, and their change in the post-1500 period) and restraint (measured on a scale of 0 to 100). The method of estimation is OLS. Robust standard errors clustered at the country level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table 1: The effect of historical agro-climatic conditions on contemporary restraint. Country-level analysis based on Hofstede et al. (2010) and Galor and Özak (2016).

Social norms and loneliness

Part of the restraint predicted by ancestral agro-climatic factors should reflect the culturally embedded life-control dimension conducive to stronger discipline and compliance with rules, whereas the residual component is likely to capture the value placed on leisure and other indulgences. Before delving into the relationship between norms and loneliness, we present additional evidence demonstrating that two components of restraint actually capture different preference dimensions. Table B.4 (in Appendix B) considers a wide range of individual opinions regarding compliance with rules, norms, traditions, and socially acceptable behavior, as well as preferences for leisure and having fun, regressed on the predicted restraint and residuals from model "mRIV7" (Table 1), together with the full set of individual specific demographic and socio-economic characteristics. Since these alternative preferences are not available in SHARE, in this exercise we rely on the European Social Survey (ESS henceforth), a biennial cross-country survey covering a large set of European countries.[19] Models L1 - L4 refer to preferences for leisure and indulgence, while models R1 - R4 consider attitudes toward rules and socially accepted behaviors. Predicted restraint strongly correlates with rules and norms, while it has no effect on leisure and indulgence. In particular, cultural backgrounds characterized by more stringent social norms and restrictions translate into a higher importance attached to socially acceptable behavior, respect of traditions and customs, safe and controlled environment, and lower tolerance towards members of the LGBT community (panel A). The residual component of restraint related to leisure does not correlate with the compliance of rules but significantly impacts preferences for seeking fun and things that give pleasure in life (panel C). Since agro-cultural factors have

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[19]ESS is a cross-sectional survey carried out every two years starting from 2002 (round 1) to 2018 (round 9). It contains nationally representative samples of individuals who reside in private households regardless of nationality, citizenship, or language, and collects information on beliefs, attitudes, and behavioral patterns.

been shown to be good predictors of contemporary time preferences (Galor and Özak, 2016; Galor et al., 2020), in panel B we control for the Hofstede et al. (2010)'s index of long-term orientation to rule out the possibility that part of the restraint predicted by historical agricultural productivity captures the component of individual time preferences. The effect of our proxy for social norms is unaltered.

As a next step, we explore the effects of the predicted restraint on loneliness. Table 2 reports the coefficients from an OLS model in which loneliness is regressed on the parental cultural backgrounds and the full set of covariates. In some models we control for the parental degree of individualism from Hofstede et al. (2010) as a proxy for the average size of social networks at the parental country of origin. Together with the standard definition of second-generation immigrants, *i.e.*, natives with either one or both foreign-born parents, we also consider two alternative definitions, namely, native individuals with a foreign-born mother and a native or foreign-born father, those with a foreign-born father and a native or foreign-born mother, and second-generation immigrants with both foreign-born parents (Table B.5 in Appendix B).[20]

The results strongly support Hypothesis 2. Parental cultural backgrounds with a stronger tendency to frame individual behavior according to social norms and restrictions positively affect the risk of loneliness. This is true independently of the variety of connections or the extent of social networks as approximated by the index of individualism (column [2], [4] and [6]).

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[20]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 feel "marginalized" compared to their peers 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). The difference in means of loneliness between second-generation immigrants and the rest of the population in our sample, however, is not statistically different from 0, which alleviates potential concerns related to representativity. 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 ($p = 0.315$).

	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA
RIV (pred), M	0.009***	0.008***			0.008***	0.007***
	(0.002)	(0.001)			(0.002)	(0.001)
Individualism, M		-0.001				-0.000
		(0.002)				(0.002)
RIV (pred), F			0.006*	0.006**	0.004	0.005
			(0.003)	(0.003)	(0.004)	(0.003)
Individualism, F				-0.001		-0.000
				(0.002)		(0.002)
Age	0.002***	0.001***	0.002**	0.001	0.002**	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.036	0.038	0.029	0.018	0.029	0.015
	(0.049)	(0.056)	(0.049)	(0.058)	(0.050)	(0.062)
Low Education	0.143**	0.121*	0.147**	0.133**	0.146**	0.118*
	(0.062)	(0.062)	(0.063)	(0.063)	(0.064)	(0.062)
High Education	-0.106**	-0.091*	-0.108**	-0.088**	-0.108**	-0.089*
	(0.046)	(0.049)	(0.046)	(0.042)	(0.046)	(0.049)
Retired	-0.108	-0.082	-0.110	-0.089*	-0.108	-0.102**
	(0.084)	(0.053)	(0.081)	(0.046)	(0.084)	(0.041)
Unemployed	0.091	0.092	0.147	0.186	0.135	0.153
	(0.128)	(0.138)	(0.131)	(0.125)	(0.132)	(0.138)
Disabled	0.587***	0.645***	0.541***	0.587***	0.545***	0.585***
	(0.135)	(0.120)	(0.145)	(0.122)	(0.147)	(0.129)
Employed	-0.306***	-0.286***	-0.297***	-0.294***	-0.301***	-0.311***
	(0.104)	(0.088)	(0.093)	(0.066)	(0.095)	(0.065)
Married	-0.249**	-0.277***	-0.252***	-0.240**	-0.257***	-0.262**
	(0.098)	(0.104)	(0.097)	(0.107)	(0.098)	(0.108)
Divorced	-0.191*	-0.214*	-0.168	-0.139	-0.174	-0.154
	(0.115)	(0.121)	(0.117)	(0.132)	(0.118)	(0.132)
Widowed	-0.181	-0.167	-0.176	-0.133	-0.179	-0.142
	(0.157)	(0.159)	(0.155)	(0.155)	(0.156)	(0.157)
Number of children	-0.021*	-0.031**	-0.025**	-0.037***	-0.024**	-0.036***
	(0.011)	(0.014)	(0.011)	(0.012)	(0.011)	(0.012)
Lives alone	0.472***	0.436***	0.455***	0.458***	0.455***	0.437***
	(0.033)	(0.024)	(0.032)	(0.012)	(0.033)	(0.032)
Poor HH (when 10)	0.104	0.115	0.104	0.094	0.106	0.104
	(0.072)	(0.075)	(0.075)	(0.074)	(0.073)	(0.076)
N. books (when 10)	-0.017	-0.021	-0.012	-0.012	-0.011	-0.014
	(0.013)	(0.016)	(0.014)	(0.014)	(0.014)	(0.016)
Harm (parents or third)	0.242***	0.238***	0.239***	0.236***	0.240***	0.230***
	(0.047)	(0.051)	(0.048)	(0.055)	(0.048)	(0.058)
Relationship (adverse)	0.054	0.047	0.061	0.074	0.060	0.066
	(0.044)	(0.048)	(0.043)	(0.047)	(0.043)	(0.050)
Absent parent	0.028	0.025	0.012	-0.001	0.013	-0.008
	(0.062)	(0.065)	(0.052)	(0.048)	(0.053)	(0.049)
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5451	5646	5205	5646	5080

Notes: *The table shows the association between the predicted restraint (measured on a scale of 0 to 100) in parental countries of origin and loneliness (measured on a scale of 3 to 9). The method of estimation is OLS. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table 2: Direct association between predicted restraint and loneliness (UCLA loneliness scale) among second-generation immigrants.

Interestingly, only the mother's cultural heritage shows a significant impact, indicating that parents' cultural origins have unequal effects on shaping children's attitudes in the process of social-ization and perception of the quality of their social relationships. 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). The results also suggest that loneliness is particularly pronounced for individuals living alone and among those with disabilities.[21]

Similarly, adverse early life conditions such as the absence of a parent or a low-quality parent-child relationship correlate positively with loneliness.[22] Meanwhile, more educated, married, and/or employed individuals with more kids feel less lonely. 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 evidence in Table B.6 (in Appendix B) further confirms the strength of the life-control dimension of restraint in predicting loneliness. The association between loneliness and the aggre-gated measure of restraint is lower in magnitude (column [1]) since it also captures the effect of the residual component, which is not directly related to social norms and the quality of social relation-ships.[23] Indeed, the coefficient of the residual component of restraint is not statistically different from zero (column [2]). On the other hand, ancestral crop yield (as the main proxy for historically rooted rules and discipline) positively correlates with loneliness, which can be attributed to ances-tral processes that have contributed to the emergence and persistence of cultural traits reflected in the contemporary degree of restraint (column [3]). In the presence of the predicted restraint,

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[21]The results do not change significantly if we exclude from the sample the individuals affected by some forms of disability (4.2% of the sample).

[22]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.

[23]The residual part of restraint is given by residuals from model "mRIV7" (Table 1).

the effect of ancestral crop yield vanishes (column [4]). Since historical crop yield potential also captures other aspects of individual preferences which are not directly related to loneliness, such as patience and generalized trust (Galor and Özak, 2016), in Table B.7 (in Appendix B) we show that the indicator of long-term orientation from Hofstede et al. (2010) as well as the component of time preferences captured by Galor and Özak (2016) have no effect on loneliness and do not alter the statistical and economic significance of predicted restraint.[24] Moreover, the life-control component of restraint does not capture other cultural characteristics, such as masculinity (intensity of internal cooperation and competition), uncertainty avoidance (aversion to ambiguity) and power distance (the level of hierarchy and inequality of power). Finally, the results in column [7] show that originating from countries in which the predominant family structure is of the "stem" or "communitarian" type (*i.e.,* authoritarian families characterized by tight ties where rules and social norms are strongly transmitted across generations) has no impact on the effect of restraint.

Loneliness and health

The vast majority of the existing research on loneliness and health is based on multivariate regression models that link self-reported loneliness to a variety of health outcomes, ranging from emotional disorders to physical or cognitive decline. These studies generally reveal correlations and can say little about causation. Longitudinal studies (Mann et al., 2022, among others), on the other hand, alleviate the issue of endogeneity to some extent, but they do not completely solve the problem, since the coefficient on the lagged loneliness variable cannot be interpreted as a causal effect because it may be confounded by unobserved heterogeneity or omitted variables (Wooldridge,

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[24]The predicted component of long-term orientation is obtained from a model equivalent to "mRIV7" (Table 1), in which we regressed the index of time preferences from Hofstede et al. (2010) on the full set of agro-climatic factors and controls from Galor and Özak (2016).

2010).

In order to isolate the direct effect of loneliness, we estimate a two-stage model where self-reported loneliness has been instrumented with the maternal country of origin's life-control component of restraint. Before discussing the main results, a word of caution regarding the validity of exclusion restriction is advisable. First, we cannot a priori rule out potential direct cultural effects on health, especially on some aspects of emotional disorders, such as depression or anxiety as they may partly overlap with loneliness from a conceptual point of view (Mann et al., 2022; Badcock et al., 2023). Second, the exclusion restriction requires that the effect of culture does not pass through factors closely related to health, like risky health behaviors and/or other individual specific socio-economic characteristics. Although the exclusion restriction cannot be directly tested, in Table B.8 (In Appendix B) we show that the predicted component of restraint has no effect on physical health outcomes and has only a marginally positive effect on EURO-D (panel A). This latter evidence is primarily driven by the association between culture and self-reported depressive symptoms, which may, to some extent, be attributed to the conceptual intersection of loneliness and depression. As a precaution, we develop an alternative EURO-D measure (EURO alt) that excludes this specific emotional disorder. The effect of predicted restraint vanishes. Interestingly, overall restraint, RIV (raw), significantly correlates with mental health indicators, ADL and BMI, as well as with being physically inactive (Panel B). This effect is driven by the residual component of restraint (Panel C). Finally, the instrument is not significantly associated with individuals' educational attainment, wealth, or being out of the labor market (Panel A). While the absence of a direct link between maternal restraint and health does not imply that the exclusion restriction has been fully met, these findings may be viewed as reassuring.

As a next step, in Table B.9 (in Appendix B) we replicate a simple OLS model on a full-sample

of individuals, regressing a set of physical and mental health outcomes on individuals' self-assessed loneliness as measured by the reduced UCLA scale. Loneliness appears to be correlated with most of the health outcomes considered: feeling lonely is significantly associated with an increased risk of mental disorders (as measured by the original EURO-D scale as well as by the modified one excluding depression), mobility limitations, and overall poorer health. However, drawing conclusions from these findings is difficult because the estimated effects do not account for the presence of reverse causality, resulting in a spurious and/or underestimated true effect of loneliness on health.[25]

Table 3 reports our main results from a two-stage IV model.[26] According to the Stock and Yogo (2005) rule of thumb, the F-statistic confirms the strength of our instrument. Feeling lonely increases the likelihood of mental disorders, a high body mass index, and, albeit marginally, mobility limitations. More specifically, a gradual increase in loneliness causes a 0.95-point increase in the intensity of emotional distress (as measured by the EURO-alt scale) and a 3.14-point increase in the body mass index. The effect on mental disorders is primarily driven by an increased likelihood of suicidal thoughts and feelings of guilt (Table B.12, in Appendix B). This result is in line with Beutel et al., 2017 and Bennardi et al., 2019. Interestingly, loneliness has no impact on the incidence of chronic conditions, limitations with activities of daily living, or the perception of general health. This is consistent with Bekhet and Zauszniewski (2012) who find no association between loneliness and chronic conditions, 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

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[25]In addition, in Table B.10 (in Appendix B) we report the coefficients from a panel model using lagged loneliness as a predictor of the onset of mental and physical health outcomes. The results do not change significantly, although the estimated effects are somewhat reduced.

[26]Our baseline specification considers second-generation immigrants defined as native individuals with one or both foreign-born parents. The maternal predicted restraint for individuals with foreign-born fathers and native mothers is identical to their country of birth predicted restraint. The results, however, are robust to the exclusion of these individuals, *i.e.*, when we focus only on second-generation immigrants with foreign-born mothers (Table B.11). For the sake of space and clarity, we do not present the first-stage coefficients for the other explanatory and control variables since they have already been reported in Table 2 (column [1]).

lonely individuals.

	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA	(7) UCLA
1st stage							
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	24.862	24.862	24.862	24.995	21.264	24.514	24.862
2nd stage	EURO-D	EURO-alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.240***	0.952***	1.142*	0.368	3.138**	0.043	0.312
	(0.392)	(0.339)	(0.683)	(0.266)	(1.227)	(0.692)	(0.364)
Full set of *regressors from Table 2*	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5821	5792	5820	5522	5823

Notes: *The table shows the direct effect of loneliness on second generation immigrants' health outcomes. Abbreviations: "ADL" - number of limitations with activities of daily living, "BMI" - body mass index, "SAH" - self-assessed health. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is ivreg2. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1, associated to maternal country of origin. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 3: The effect of loneliness on health among second-generation immigrants.

Furthermore, the lack of an effect of loneliness on limitations in daily activities is not aligned with previous research findings (Buchman et al., 2010; Perissinotto et al., 2012). It is worth noting that, when compared to OLS estimates in Table B.9, the effect of instrumented loneliness is 2.05 times larger in magnitude than the non-instrumented one for depressive symptoms and 4.6 for mobility. The body mass index, on the other hand, turns to be significant with an economically important effect.[27] Finally, the effects of loneliness are not altered by health-related risky behaviors, such as physical inactivity, few intense sports and smoking (Table B.14, in Appendix B).

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[27]To further confirm the validity of predicted restraint as an instrument for loneliness, in Table B.13, we show that the overall index of restraint performs significantly worse. The effect of instrumented loneliness on BMI vanishes, while its effect on mental disorders remains significant and doubles in magnitude. The weakness of the aggregate measure is due to the fact that its leisure component does not correlate with loneliness and distorts the effect of the life-control dimension, which is in line with the evidence reported in Table B.6.

When considering individuals' cognitive functioning, such as memory, literacy, and numeracy, as well as physical health-related factors separately (Table 4), loneliness does not seem to have any direct effect, which is not entirely consistent with Richard et al. (2017), among others. This result, however, should not be interpreted as the absence of any linkage between loneliness and physical health issues. Loneliness is likely to increase the likelihood of physical health problems indirectly through its economically significant impact on BMI. Indeed, being overweight or obese is significantly associated with the occurrence of chronic diseases, hypertension, diabetes, and high blood cholesterol (Table B.15, in Appendix B). The same indirect channel may hold true for functional and mobility limitations.

1st stage	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA	(7) UCLA	(8) UCLA
RIV (pred)	0.010***	0.010***	0.010***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	10.599	10.599	10.599	24.312	24.312	24.312	24.312	24.312
2nd stage	MEMO	NUM	FLUE	PRESS	CHOL	DIAB	ULCER	STROKE
Loneliness (UCLA)	0.344	-0.052	-0.758	-0.145	-0.099	0.055	0.061	0.034
	(0.369)	(0.264)	(2.144)	(0.207)	(0.115)	(0.051)	(0.073)	(0.065)
Full set of regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	4202	4202	4202	5818	5818	5818	5818	5818

Notes: *The table shows the direct effect of loneliness on second generation immigrants' health outcomes. Abbreviations: "MEMO" - memory, "NUM" - numeracy, "FLUE" - fluency, "PRESS" - pressure, "CHOL" - cholesterol, "DIAB" - diabetes. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is ivreg2. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1, associated to maternal country of origin. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table 4: The effect of loneliness on cognitive functioning and single health outcomes (physical) among second-generation immigrants.

In addition to mental health and BMI, loneliness significantly affects the prevalence of drug

use for pain and inflammation (Table 5). Being lonely increases the probability of medication for stomach pain by 11%, and for inflammation by 6%. This result is consistent with the existing literature showing that some markers of systematic inflammation are higher among lonely individuals (Nersesian et al., 2018; Smith et al., 2020), which, in turn, may increase the risk of cardiovascular diseases and other physical health issues and functional decline.

1st stage	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA	(7) UCLA	(8) UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	24.166	24.166	24.166	24.166	24.166	24.166	24.166	24.166
2nd stage	CHOL	PRESS	CORON	PAIN	SLEEP	ANX	STOM	INFL
Loneliness (UCLA)	-0.089	-0.185	-0.112	0.137	-0.060	-0.038	0.109*	0.058*
	(0.071)	(0.202)	(0.116)	(0.095)	(0.065)	(0.071)	(0.066)	(0.033)
Full set of								
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5820	5820	5820	5820	5820	5820	5820	5820

Notes: *The table shows the direct effect of loneliness on second generation immigrants' drug consumption. Abbreviations: "CHOL" - drugs for high blood cholesterol, "PRESS" - drugs for hypertension, "CORON" - drugs for coronary diseases, "ANX" - drugs for anxiety, "STOM" - drugs for stomach burns, "INFL" - drugs for suppressing inflammation. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is ivreg2. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1, associated to maternal country of origin. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table 5: The effect of loneliness on drug consumption among second-generation immigrants.

6 Sensitivity analysis

In this section, we test the robustness of the results from our baseline specification in Table 3, including: i) a direct question on loneliness; ii) controls for the frequency of contact with children (for a sub-set of individuals with offspring); iii) socially related activities in the last 12 months; iv) health status in the first 15 years of life and loneliness in childhood; and v) whether an individual

provided or received informal care (help) from a family member from outside the household, a friend or neighbor.

Table B.16 (in Appendix B) reports the effects of loneliness when the individuals are directly asked whether and how often they feel lonely. Loneliness is significant only for mobility and body mass index, even though the predicted restraint results a weak instrument (F-test=6.029). This is not surprising given that direct mention of loneliness may be problematic when dealing with specific population groups, such as the older people. This is because older individuals are often reluctant to admit to loneliness (Qualter et al., 2021). Furthermore, there is variation across cultures in how people understand the term "loneliness", which may bias the results.

The likelihood of loneliness may be influenced as well by the frequency of parent-offspring interactions (contacts). In Table B.17, Panel A (in Appendix B) 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). The effects of loneliness are robust and similar to those shown in Table 3. Similarly, participating in voluntary or charity work, sporting activities, or socializing with others through games and other types of entertainment is negatively associated with loneliness (Panel B). The effects of the culturally embodied social norms and restrictions remain unaltered, strengthening the postulate according to which the feeling of loneliness is shaped by the perception of quality instead of the frequency of interaction. Accounting for these additional factors does not alter the impact of loneliness on health, which remains within the range reported in the baseline specification.

In addition to the above set of socially-related activities, loneliness may be influenced as well by the presence of relatives, friends, or neighbors in times of need, or by giving help to the others. The results in Table B.18 (in Appendix B) show that individuals providing help to the other relatives,

neighbors or friends are, on average, less lonely, while those receiving help from others are more likely to experience loneliness. Providing or receiving help, however, does not alter the effect of restraint, nor it resizes the impact of loneliness on health.

Individuals' current health and/or feelings of loneliness may be influenced in part by similar childhood experiences or inherited health problems. In order to account for these additional factors, in Table B.19 (in Appendix B) we control for loneliness episodes (Panel A) and health conditions in childhood, *i.e.,* when individuals were aged 10 (Panel B). The statistical and economic significance of loneliness remains robust. Compared to the baseline specification in Table 3, the size of the effects of mental health and body mass index is larger, especially when health conditions in childhood are taken into account.

7   Conclusions

In this paper, we revisit an old debate about the impact of loneliness on health. The vast majority of the existing research is based on cross-country and longitudinal analyses that generally reveal correlations but can say little about causation. Furthermore, loneliness appears to correlate with most of the health outcomes considered, making any targeted policy intervention difficult.

Here we present an attempt to isolate the direct effect of loneliness on different physical health indicators as well as on emotional disorders. In an effort to account for the endogeneity of self-declared loneliness, we exploit historical processes that have contributed to the emergence of specific cultural traits closely related to the importance of social norms and restrictions that potentially restrain individuals by imposing the socially acceptable way of behaving. The proposed culturally embedded life-control dimension strongly correlates with current experiences of loneliness and represents a valid instrument for loneliness in a two-stage model for health.

We find that loneliness has a direct impact on only mental disorders, a high body mass index, and, albeit marginally, mobility limitations. The effect of loneliness on emotional disorders is mainly driven by the increased risk of suicidal thoughts and feelings of guilt. In contrast to previous research, loneliness has no impact on the incidence of chronic conditions, limitations with activities of daily living, or the perception of general health. Moreover, we find no effect of loneliness on cognitive functioning, such as memory, literacy, and numeracy, as well as on physical health-related factors such as diabetes, high blood pressure, ulcers, high blood cholesterol, and stroke. We emphasize, however, that this result should not be interpreted as the absence of any linkage between loneliness and physical health issues, since loneliness is likely to increase the likelihood of physical health problems indirectly through its economically significant impact on BMI. Finally, we find some evidence on the effect of loneliness on the prevalence of drug use for stomach pain and inflammation. These effects are significantly larger than those obtained from traditional estimation methods and are robust to a number of sensitivity checks.

A few implications derive from our work. Loneliness poses a serious threat to health, both directly and indirectly, with repercussions both from a social and economic point of view. Cultural heritage may play a prominent role in shaping individuals' experiences of loneliness. In this context, the need to implement effective policies targeted at reducing loneliness becomes imperative. When designing loneliness interventions, policymakers will also have to account for the diverse ways in which individuals experience loneliness across societies or groups with different cultural backgrounds.

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A   Appendix A

Hofstede et al. (1991) and Hofstede et al.'s (2010) dimensions of culture

In addition to the two cultural dimensions described in Section 2, (Hofstede et al., 1991) and Hofstede et al.'s (2010) six-dimensional model of national culture includes the following four cultural dimensions:

1. **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.[28]

2. **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.

3. **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.

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

4. **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.[29]

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

B Appendix B

Table B.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Loneliness (UCLA)	3.869	1.336	3	9	5823
Loneliness (direct)	2.703	0.570	1	3	5823
RIV (raw), M	63.115	16.987	22	96	5823
RIV (raw), F	62.819	17.725	22	96	5646
RIV (pred), M	60.552	6.665	32.591	76.673	5823
RIV (pred), F	60.888	6.709	20.66	89.384	5646
RIV (res), M	2.563	14.669	-32.346	27.456	5823
RIV (res), F	1.931	15.222	-32.346	27.456	5646
Individualism, M	57.132	15.618	25	91	5451
Individualism, F	57.481	15.719	20	91	5215
Stem, M	0.298	0.458	0	1	5023
Stem, F	0.304	0.46	0	1	4630
EURO - D	2.309	2.128	0	12	5823
EURO alt	1.914	1.852	0	11	5823
EURO-D: Depression	0.41	0.492	0	1	5816
EURO-D: Pessimism	0.142	0.349	0	1	5804
EURO-D: Suicide	0.066	0.248	0	1	5813
EURO-D: Guilt	0.093	0.29	0	1	5803
EURO-D: Sleep	0.361	0.48	0	1	5821
EURO-D: Interest	0.072	0.258	0	1	5819
EURO-D: Irritability	0.316	0.465	0	1	5814
EURO-D: Appetite	0.078	0.269	0	1	5822
EURO-D: Fatigue	0.343	0.475	0	1	5819
EURO-D: Concentration	0.124	0.329	0	1	5812
EURO-D: Enjoyment	0.082	0.274	0	1	5816
EURO-D: Tearfulness	0.241	0.427	0	1	5812
Mobility limitations	1.405	2.151	0	10	5823
ADL	0.164	0.618	0	6	5821
BMI	27.319	5.053	13.62	73.462	5792
Chronic diseases	1.746	1.586	0	11	5820
SAH	3.101	1.059	1	5	5823
No physical activity	0.08	0.271	0	1	5823
Int. sport	2.422	1.323	1	4	5819
Smoking	0.482	0.5	0	1	5823
Memory	2.901	0.942	1	5	4202
Numeracy	3.651	0.989	1	5	4420
Fluency	22.98	7.072	0	93	4202
Hypertension	0.4	0.49	0	1	5818
Cholesterol	0.239	0.426	0	1	5818

Variable	Mean	Std. Dev.	Min.	Max.	N
Diabetes	0.135	0.341	0	1	5818
Ulcer	0.042	0.2	0	1	5818
Stroke	0.033	0.178	0	1	5818
Drugs for: pressure	0.42	0.494	0	1	5820
Drugs for: coronary	0.088	0.284	0	1	5820
Drugs for: pain	0.139	0.346	0	1	5820
Drugs for: sleep	0.075	0.264	0	1	5820
Drugs for: anxiety	0.076	0.266	0	1	5820
Drugs for: stomach	0.09	0.286	0	1	5820
Drugs for: inflammation	0.025	0.156	0	1	5820
Lonely (when 10)	0.691	0.968	0	3	5810
Poor health (when 10)	0.135	0.341	0	1	4942
Activities: voluntary	0.188	0.391	0	1	5807
Activities: training	0.167	0.373	0	1	5807
Activities: sport club	0.321	0.467	0	1	5807
Activities: comm. org.	0.076	0.264	0	1	5807
Activities: reading	0.818	0.386	0	1	5807
Activities: games	0.51	0.5	0	1	5807
Contact: daily	0.257	0.437	0	1	4192
Contact: frequent	0.271	0.444	0	1	4192
Contact: fair	0.298	0.457	0	1	4192
Contact: rare	0.175	0.38	0	1	4192
Informal care (received)	0.197	0.398	0	1	5286
Informal care (given)	0.308	0.462	0	1	5286
Age	65.452	8.651	50	96	5823
Female	0.588	0.492	0	1	5823
Low Education	0.236	0.425	0	1	5823
High Education	0.297	0.457	0	1	5823
Retired	0.545	0.498	0	1	5823
Unemployed	0.023	0.149	0	1	5823
Disabled	0.042	0.2	0	1	5823
Employed	0.328	0.47	0	1	5823
Married	0.67	0.47	0	1	5823
Divorced	0.133	0.34	0	1	5823
Widowed	0.121	0.326	0	1	5823
Number of children	2.206	1.345	0	14	5823
Lives alone	0.226	0.419	0	1	5823
N. books (when 10)	2.595	1.269	1	5	5823
Poor HH (when 10)	0.218	0.413	0	1	5823
Absent parent	0.149	0.356	0	1	5823
Harm (parents or third)	0.304	0.46	0	1	5823
Relationship (adverse)	0.553	0.497	0	1	5823

Table B.2: List of countries included in (Hofstede et al., 2010) and the corresponding index of individualism and restraint.

Country	Individ.	RIV	Country	Individ.	RIV
Albania	.	85	Italy	76	70
Algeria	.	68	Jamaica	39	.
Andorra	.	35	Japan	46	58
Argentina	46	38	Jordan	.	57
Australia	90	29	Korea	18	71
Austria	55	37	Kosovo	.	85
Azerbaijan	.	78	Kyrgyzstan	.	61
Bangladesh	20	80	Latvia	70	87
Belarus	.	85	Lithuania	60	84
Belgium	75	43	Luxembourg	60	44
Benin	78	.	North Macedonia	.	65
Bosnia and Herzegovina	.	56	Malaysia	26	43
Brazil	38	41	Mali	.	57
Bulgaria	30	84	Malta	59	34
Burkina Faso	.	82	Mexico	30	3
Canada	80	32	Moldova	.	81
Central African Republic	73	.	Morocco	46	75
Chile	23	32	Netherlands	80	32
China	20	76	New Zealand	79	25
Colombia	13	17	Nigeria	.	16
Costa Rica	15	.	Norway	69	45
Croatia	33	67	Pakistan	14	100
Cyprus	.	30	Panama	11	.
Czech Republic	58	71	Peru	16	54
Denmark	74	30	Philippines	32	58
Dominican Republic	.	46	Poland	60	71
Ecuador	8	.	Portugal	27	67
Egypt	.	96	Puerto Rico	.	10
El Salvador	19	11	Romania	30	80
Estonia	60	84	Russian Federation	39	80
Finland	63	43	Rwanda	.	63
France	71	52	Saudi Arabia	.	48
Georgia	.	68	Serbia	25	72
Germany	67	60	Singapore	20	54
Ghana	.	28	Slovakia	52	72
Greece	35	50	Slovenia	27	52
Guatemala	6	.	South Africa	65	37
Hong Kong	25	83	Spain	51	56
Hungary	80	69	Suriname	47	.
Iceland	.	33	Sweden	71	22
India	48	74	Switzerland	68	34
Indonesia	14	62	Taiwan	17	51

Country	Individ.	RIV	Country	Individ.	RIV
Iran	41	60	Tanzania	.	62
Iraq	.	83	Thailand	20	55
Ireland	70	35	Trinidad and Tobago	16	20
Israel	54	.	Turkey	37	51
Uganda	.	48	Venezuela	12	0
Ukraine	.	86	Viet Nam	20	65
United Kingdom	89	31	Zambia	.	58
United States of America	91	32	Zimbabwe	.	72
Uruguay	36	47			

Source: (Hofstede et al., 2010).

Table B.3: List of countries included in the analysis.

SG immigrants	Country of interview (27)
	Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxembourg, Portugal, Slovenia, Estonia, Croatia, Lithuania, Bulgaria, Cyprus, Finland, Latvia, Malta, Romania, Slovakia.

SG immigrants	Country of origin Mother (62)
	Albania, Algeria, Argentina, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Egypt, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, India, Indonesia, Iran, Iraq, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Republic of Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States of America, Uruguay, Venezuela, Viet Nam.

Table B.4: Direct association between predicted and residual restraint and second-generation immigrants' attitudes. European Social Survey (ESS), rounds 2-9.

	L1 How happy	L2 New adventures	L3 Have good time	L4 Have fun & pleasure	R1 Behave properly	R2 Traditions & customs	R3 Sexual minorities	R4 Safe environm.
FB Mother								
panel A								
RIV (pred)	0.001	0.001	0.001	-0.002	0.006***	0.004**	-0.004**	0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
panel B								
RIV (pred)	0.001	0.001	0.001	-0.002	0.006***	0.004***	-0.004***	0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LTO, M	0.002**	0.000	-0.001	0.000	-0.001*	-0.003***	0.003***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
panel C								
RIV (res)	-0.001	-0.002	0.000	0.003***	0.001	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
N. Observations	16690	16484	16490	16478	16480	16503	16282	16450
FB Father								
panel A								
RIV (pred)	0.001	0.001	0.000	-0.001	0.003*	0.004**	-0.005***	0.003**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
panel B								
RIV (pred)	0.001	0.001	0.000	-0.001	0.003*	0.003**	-0.005***	0.003**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
LTO, F	0.002*	-0.001	-0.001*	0.001	-0.002***	-0.003***	0.003**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
panel C								
RIV (res)	-0.002	0.001	0.001	0.002	0.001	0.000	0.001	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N. Observations	15666	15479	15486	15477	15477	15502	15279	15446
Full set of								
individual char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The set of dependent variables includes: How happy are you (L1); Important to seek adventures and have an exciting life (L2); Important to have a good time (L3); Important to seek fun and things that give pleasure (L4); Important to behave properly (R1); Important to follow traditions and customs (R2); Gays and lesbians free to live life as they wish (R3), and Important that government is strong and ensures safety (R4). The full set of individual characteristics includes: age, female, low education, high education, white collar, marital status, household size, number of kids, unemployed, retired, disabled, homemaker, employed, still in education, have worked abroad, atheist, parent white collar. The method of estimation is OLS. RIV (pred) and RIV (res) stay respectively for predicted and residual values of restraint from model "mRIV7", Table 1. Significance levels:* ***** $p < 0.1$**,** ****** $p < 0.05$**,** ******* $p < 0.01$*.*

Table B.5: Direct association between predicted restraint and loneliness (UCLA loneliness scale) among second-generation immigrants (alternative definitions).

	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA
FB Mother						
RIV (pred), M	0.011***	0.011***			0.011***	0.011***
	(0.002)	(0.003)			(0.003)	(0.003)
RIV (pred), F			0.007	0.007	-0.000	0.001
			(0.005)	(0.005)	(0.006)	(0.006)
Individualism, M		-0.000				0.000
		(0.002)				(0.003)
Individualism, F				0.000		0.001
				(0.002)		(0.004)
N. Observations	4135	3761	4029	3724	4029	3597
FB Father						
RIV (pred), M	0.012***	0.011***			0.011**	0.010***
	(0.004)	(0.004)			(0.004)	(0.003)
RIV (pred), F			0.005	0.005	0.002	0.001
			(0.004)	(0.004)	(0.004)	(0.004)
Individualism, M		-0.000				-0.001
		(0.002)				(0.002)
Individualism, F				-0.001		-0.001
				(0.001)		(0.002)
N. Observations	3901	3616	3803	3358	3803	3319
Both FB parents						
RIV (pred), M	0.013**	0.011*			0.019**	0.007
	(0.006)	(0.006)			(0.008)	(0.010)
RIV (pred), F			0.006	0.007	-0.008	0.002
			(0.007)	(0.007)	(0.010)	(0.011)
Individualism, M		-0.001				-0.005
		(0.003)				(0.005)
Individualism, F				0.001		0.005
				(0.002)		(0.005)
N. Observations	2140	1855	2114	1809	2114	1770
Full set of regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The table shows the association between the predicted restraint (measured on a scale of 0 to 100) in parental countries of origin and loneliness (measured on a scale of 3 to 9) for alternative definitions of second-generation immigrants. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is OLS. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.6: Direct association between restraint (raw), agro-climatic proxies and loneliness (UCLA loneliness scale) among second-generation immigrants.

	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA
RIV (raw)	0.004***			
	(0.001)			
RIV (res)		0.002		
		(0.002)		
Crop Yield (Anc., pre-1500)			0.148**	0.093
			(0.074)	(0.081)
Crop Yield Change (Anc., post-1500)			0.098	0.035
			(0.136)	(0.121)
Crop Growth Cycle (Anc., pre-1500)			-0.114	-0.054
			(0.117)	(0.123)
Crop Growth Cycle Change (Anc., post-1500)			-0.098	-0.113
			(0.088)	(0.093)
RIV (pred)				0.007**
				(0.004)
Full set of				
regressors from Table 2	Yes	Yes	Yes	Yes
Full set of geo factors and neolithic				
transition timing from Table 1	No	No	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5823	5823

Notes: *The table shows the association between the index of restraint restraint (measured on a scale of 0 to 100) in parental countries of origin and loneliness (measured on a scale of 3 to 9) among second-generation immigrants. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is OLS. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$**, **** $p < 0.05$**, ***** $p < 0.01$.

Table B.7: Direct association between predicted restraint, alternative cultural characteristics and loneliness (UCLA loneliness scale) among second-generation immigrants.

	(1) UCLA	(2) UCLA	(3) UCLA	(4) UCLA	(5) UCLA	(6) UCLA	(7) UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.008***	0.008***	0.008***	0.009***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
LTO		0.002					
		(0.001)					
LTO (pred)			0.000				
			(0.002)				
Uncertainty Avoidance				0.002			
				(0.002)			
Power Distance					0.001		
					(0.001)		
Masculinity						0.000	
						(0.001)	
Family: Stem							0.020
							(0.032)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5823	5451	5451	5451	5023

Notes: *The table shows the association between the index of restraint restraint (measured on a scale of 0 to 100) in parental countries of origin and loneliness (measured on a scale of 3 to 9) among second-generation immigrants. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is OLS. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. Classification of the predominant family types is taken from Todd (1990). Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$ *Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.*

Table B.8: Direct effect of restraint on health and socio-economic characteristics.

Panel A	EURO-D	MOBILITY	ADL	BMI	CHRONIC	SAH		
RIV (pred)	**0.011***	0.010*	0.003	0.027	0.000	0.003		
	(0.006)	(0.006)	(0.002)	(0.017)	(0.005)	(0.003)		

	Depress.	Pessimism	Suicide	Guilt	Sleep	Interest	Irritab.	Appetite
RIV (pred)	0.003*	0.001	0.001	0.001	0.001	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

	Fatigue	Concentr.	Enjoyment	Tearful.	EURO alt	Ph.Inact.	Sport	Smoking
RIV (pred)	0.001	0.000	0.000	0.002	**0.008**	0.001	0.004	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	**(0.005)**	(0.001)	(0.003)	(0.001)

	Tertiary	Wealth	Homemaker
RIV (pred)	-0.000	-0.001	0.000
	(0.002)	(0.007)	(0.001)

Panel B	EURO-D	MOBILITY	ADL	BMI	CHRONIC	SAH		
RIV (raw)	**0.007****	0.004	0.002**	0.026**	0.001	0.001		
	(0.003)	(0.003)	(0.001)	(0.010)	(0.002)	(0.001)		

	Depress.	Pessimism	Suicide	Guilt	Sleep	Interest	Irritab.	Appetite
RIV (raw)	0.001*	0.000	0.001**	0.001*	0.001*	-0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)

	Fatigue	Concentr.	Enjoyment	Tearful.	EURO alt	Ph.Inact.	Sport	Smoking
RIV (raw)	0.000	0.001**	0.000	0.002***	**0.006****	0.001*	0.003	-0.001
	(0.001)	(0.000)	(0.000)	(0.001)	**(0.003)**	(0.000)	(0.002)	(0.001)

Panel C	EURO-D	MOBILITY	ADL	BMI	CHRONIC	SAH		
RIV (res)	**0.006***	0.002	0.002**	0.027**	0.001	0.001		
	(0.003)	(0.003)	(0.001)	(0.011)	(0.003)	(0.002)		

	Depress.	Pessimism	Suicide	Guilt	Sleep	Interest	Irritab.	Appetite
RIV (res)	0.001	0.000	0.001*	0.001*	0.001*	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)

	Fatigue	Concentr.	Enjoyment	Tearful.	EURO alt	Ph.Inact.	Sport	Smoking
RIV (res)	0.000	0.001**	0.000	0.002**	**0.006****	0.001	0.002	-0.000
	(0.001)	(0.000)	(0.000)	(0.001)	**(0.003)**	(0.000)	(0.002)	(0.001)

Notes: *The table shows the direct effect of predicted restraint on second generation immigrants' health outcomes and selected socio-economic characteristics. All model specifications control for country of residence and wave of interview, as well as for the full set of individual characteristics from Table 3. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is OLS. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.9: Direct association between loneliness and health among second-generation immigrants. OLS model.

	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	0.541***	0.464***	0.246***	0.061***	0.023	0.099***	0.115***
	(0.032)	(0.028)	(0.030)	(0.011)	(0.069)	(0.022)	(0.013)
Age	0.010**	0.008*	0.041***	0.007***	-0.069***	0.038***	0.018***
	(0.005)	(0.004)	(0.006)	(0.002)	(0.014)	(0.004)	(0.002)
Female	0.678***	0.525***	0.499***	0.009	-0.406	0.063	-0.009
	(0.066)	(0.055)	(0.078)	(0.020)	(0.263)	(0.055)	(0.033)
Low Education	0.176**	0.192**	0.421***	0.095***	0.794***	0.245***	0.165***
	(0.081)	(0.080)	(0.096)	(0.028)	(0.238)	(0.066)	(0.039)
High Education	-0.099	-0.109	-0.161*	-0.030	-0.358	-0.138**	-0.195***
	(0.077)	(0.066)	(0.084)	(0.018)	(0.218)	(0.058)	(0.037)
Retired	-0.001	-0.021	-0.177	-0.036	0.852**	0.005	-0.023
	(0.110)	(0.095)	(0.163)	(0.051)	(0.371)	(0.112)	(0.058)
Unemployed	0.527**	0.414**	-0.426*	-0.085	-0.813	-0.177	0.047
	(0.221)	(0.189)	(0.240)	(0.051)	(0.515)	(0.132)	(0.108)
Disabled	1.350***	1.183***	1.993***	0.455***	0.468	1.284***	0.946***
	(0.194)	(0.167)	(0.214)	(0.087)	(0.528)	(0.178)	(0.098)
Employed	-0.038	-0.070	-0.412***	-0.045	-0.302	-0.269***	-0.181***
	(0.115)	(0.102)	(0.154)	(0.039)	(0.398)	(0.095)	(0.056)
Married	-0.016	-0.001	-0.361**	-0.073	-0.768	-0.201*	-0.157**
	(0.129)	(0.115)	(0.176)	(0.049)	(0.472)	(0.113)	(0.062)
Divorced	0.250*	0.227*	-0.098	-0.015	-0.502	0.015	-0.009
	(0.140)	(0.128)	(0.166)	(0.052)	(0.449)	(0.113)	(0.067)
Widowed	0.144	0.137	0.245	0.026	-0.174	0.059	0.017
	(0.168)	(0.153)	(0.182)	(0.051)	(0.607)	(0.121)	(0.068)
Number of children	0.031	0.022	0.059**	0.008	0.105	-0.009	-0.011
	(0.021)	(0.019)	(0.026)	(0.008)	(0.067)	(0.019)	(0.012)
Lives alone	-0.152	-0.163	-0.361***	-0.051	-0.548	-0.212*	-0.135**
	(0.117)	(0.107)	(0.137)	(0.050)	(0.376)	(0.115)	(0.066)
Poor HH (when 10)	0.154**	0.130**	0.143	-0.019	0.615*	0.043	0.086**
	(0.071)	(0.059)	(0.108)	(0.019)	(0.353)	(0.059)	(0.043)
N. books (when 10)	-0.081***	-0.080***	-0.052	0.002	-0.203**	-0.034	-0.047***
	(0.029)	(0.023)	(0.041)	(0.012)	(0.081)	(0.023)	(0.013)
Harm (parents or third)	0.190**	0.174**	0.204*	0.040	-0.052	0.229***	0.000
	(0.086)	(0.079)	(0.116)	(0.027)	(0.244)	(0.057)	(0.030)
Relationship (adverse)	0.103*	0.053	-0.044	-0.030*	-0.221	-0.147***	-0.005
	(0.058)	(0.048)	(0.067)	(0.017)	(0.177)	(0.049)	(0.033)
Absent parent	0.050	0.036	0.219*	0.013	0.595*	0.099	0.036
	(0.080)	(0.072)	(0.114)	(0.031)	(0.321)	(0.074)	(0.042)
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5823	5821	5792	5820	5823
R Squared	0.248	0.240	0.213	0.086	0.079	0.172	0.286

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. The method of estimation is OLS. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.10: Direct association between loneliness and health among second-generation immigrants. Random effects model with lagged loneliness as a predictor.

	EURO-D	EURO-D alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (lag)	0.268***	0.218***	0.108***	0.028**	-0.013	0.057***	0.068***
	(0.029)	(0.029)	(0.030)	(0.011)	(0.055)	(0.020)	(0.014)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	3157	3157	3157	3157	3132	3156	3157

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is random effect model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$*,* ****** $p < 0.05$*,* ******* $p < 0.01$*.*

Table B.11: The effect of loneliness on health among second-generation immigrants with foreign-born mothers.

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	27.909	27.909	27.909	27.909	25.424	27.312	27.909

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	0.817**	0.629**	0.737	0.223	2.822**	-0.234	0.041
	(0.330)	(0.315)	(0.572)	(0.248)	(1.438)	(0.645)	(0.309)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	4083	4083	4083	4083	4058	4081	4083

Notes: *The table shows the direct effect of loneliness on second generation immigrants' with foreign born mothers physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$*,* ****** $p < 0.05$*,* ******* $p < 0.01$*.*

Table B.12: The effect of loneliness on single components of the EURO-D scale among second-generation immigrants.

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	23.775	27.375	24.112	24.319	24.796	24.610
2nd stage	depression	pessimism	suicide	guilt	sleep	interest
Loneliness (UCLA)	0.284***	0.091	0.110***	0.090**	0.130	0.014
	(0.091)	(0.064)	(0.041)	(0.041)	(0.105)	(0.048)
N. Observations	5816	5804	5813	5803	5821	5819

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	27.705	24.810	24.676	26.037	25.138	25.126
2nd stage	irritability	appetite	fatigue	concentr.	enjoy	tears
Loneliness (UCLA)	0.091	0.055	0.132	0.043	0.019	0.176
	(0.094)	(0.105)	(0.170)	(0.104)	(0.044)	(0.129)
N. Observations	5814	5822	5819	5812	5816	5812
Full set of regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The table shows the direct effect of loneliness on single components of the EURO-D depression scale. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.13: The effect of loneliness on health among second-generation immigrants. RIV not predicted ("raw").

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (raw)	0.004***	0.004***	0.004***	0.004***	0.004**	0.004**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1st Stage F	6.706	6.706	6.706	6.650	6.345	6.350	6.706
2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	2.006***	1.771**	1.142	0.577*	7.189	0.141	0.372
	(0.750)	(0.696)	(0.937)	(0.334)	(4.954)	(0.816)	(0.691)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5823	5821	5792	5820	5823

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (raw) stays for the index of restraint from Hofstede et al. (2010). The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.14: The effect of loneliness on health among second-generation immigrants. Additional controls for behavioral risks.

Physically inactive

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	19.922	19.922	19.922	19.988	16.753	19.461	19.922
2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.183***	0.888**	0.941	0.325	3.127**	-0.030	0.254
	(0.440)	(0.374)	(0.696)	(0.285)	(1.301)	(0.737)	(0.358)
No physical activity	0.482	0.544	1.712***	0.370*	0.093	0.605	0.492**
	(0.420)	(0.345)	(0.417)	(0.197)	(1.216)	(0.426)	(0.230)
N. Observations	5823	5823	5823	5821	5792	5820	5823

Few intense sports

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	23.080	23.080	23.080	23.183	19.804	22.671	23.080
2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.186***	0.905**	0.982	0.350	2.940**	-0.050	0.253
	(0.428)	(0.370)	(0.692)	(0.267)	(1.178)	(0.671)	(0.337)
Few int. sports	0.121**	0.121***	0.326***	0.038*	0.208**	0.177***	0.134***
	(0.051)	(0.042)	(0.067)	(0.022)	(0.092)	(0.052)	(0.029)
N. Observations	5819	5819	5819	5817	5788	5816	5819

Smoking daily

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
1st Stage F	24.651	24.651	24.651	24.782	21.130	24.314	24.651
2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.279***	0.989***	1.178*	0.374	3.168**	0.057	0.318
	(0.431)	(0.374)	(0.709)	(0.272)	(1.242)	(0.701)	(0.365)
Ever smoked daily	0.214***	0.201***	0.192**	0.036	0.167	0.074	0.034
	(0.075)	(0.064)	(0.076)	(0.023)	(0.162)	(0.064)	(0.038)
N. Observations	5823	5823	5823	5821	5792	5820	5823

Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.15: The effect of BMI on physical health outcomes among second-generation immigrants.

Panel A	CHRONIC	SAH	PRESS	CHOL	DIAB	ULCER	STROKE
BMI (continuous)	0.063***	0.028***	0.025***	0.007***	0.015***	-0.000	0.001**
	(0.005)	(0.004)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)

Panel B	CHRONIC	SAH	PRESS	CHOL	DIAB	ULCER	STROKE
BMI: Overweight	0.282***	0.099**	0.150***	0.068***	0.050***	0.007	0.001
	(0.057)	(0.039)	(0.015)	(0.015)	(0.011)	(0.006)	(0.006)
BMI: Obese	0.743***	0.361***	0.321***	0.085***	0.169***	-0.000	0.011
	(0.067)	(0.044)	(0.019)	(0.020)	(0.021)	(0.007)	(0.008)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5789	5792	5787	5787	5787	5787	5787

Notes: *The table shows the direct association between BMI and second generation immigrants' physical health outcomes. "Overweight" indicates BMI between 25 and 30, "Obese" indicates BMI above 30. Reference category: normal weight and underweight. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.16: The effect of loneliness on health among second-generation immigrants. Direct question for loneliness.

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
1st Stage F	6.029	6.029	6.029	5.972	6.174	5.876	6.029
2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (direct)	4.183	3.211	3.853*	1.241	10.880***	0.144	1.051
	(2.663)	(2.005)	(2.276)	(0.802)	(4.193)	(2.315)	(0.914)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	5823	5823	5823	5821	5792	5820	5823

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels:* ***** $p < 0.1$, ****** $p < 0.05$, ******* $p < 0.01$.

Table B.17: The effect of loneliness on health among second-generation immigrants. Additional controls for the frequency of contact with kids and participation in socially related activities.

Panel A: contact kids

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.012***	0.012***	0.012***	0.012***	0.012***	0.011***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Frequent contact	0.016	0.016	0.016	0.013	0.018	0.015	0.016
	(0.036)	(0.036)	(0.036)	(0.035)	(0.038)	(0.036)	(0.036)
Fair contact	0.110***	0.110***	0.110***	0.111***	0.113***	0.106***	0.110***
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.033)	(0.032)
rare contact	0.336***	0.336***	0.336***	0.335***	0.333***	0.334***	0.336***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
1st Stage F	14.690	14.690	14.690	14.765	13.838	14.730	14.690

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.507***	1.254***	1.046**	0.299	3.677***	0.263	0.306
	(0.244)	(0.194)	(0.442)	(0.274)	(0.883)	(0.485)	(0.268)
N. Observations	4192	4192	4192	4191	4169	4189	4192

Panel B: activities

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Voluntary	-0.117**	-0.117**	-0.117**	-0.117**	-0.112*	-0.116*	-0.117**
	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)
Training course	-0.022	-0.022	-0.022	-0.021	-0.026	-0.022	-0.022
	(0.044)	(0.044)	(0.044)	(0.044)	(0.046)	(0.044)	(0.044)
Sport, social club	-0.128***	-0.128***	-0.128***	-0.127***	-0.128***	-0.127***	-0.128***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.033)	(0.034)	(0.034)
Political or comm. org.	0.014	0.014	0.014	0.015	0.016	0.014	0.014
	(0.058)	(0.058)	(0.058)	(0.058)	(0.059)	(0.058)	(0.058)
Books	-0.311***	-0.311***	-0.311***	-0.312***	-0.314***	-0.312***	-0.311***
	(0.072)	(0.072)	(0.072)	(0.072)	(0.074)	(0.072)	(0.072)
Games	-0.080**	-0.080**	-0.080**	-0.082**	-0.079**	-0.082**	-0.080**
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
1st Stage F	10.929	10.929	10.929	10.949	9.452	10.741	10.929

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.435***	1.060***	1.357**	0.459	3.911***	0.094	0.286
	(0.432)	(0.390)	(0.632)	(0.296)	(1.517)	(0.786)	(0.381)
N. Observations	5807	5807	5807	5805	5776	5804	5807
Full set of regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table B.18: The effect of loneliness on health among second-generation immigrants. Additional controls for informal care (provided and received).

Panel A: care provided

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.011***	0.011***	0.011***	0.011***	0.011***	0.010***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Informal care (given)	-0.089**	-0.089**	-0.089**	-0.092**	-0.088**	-0.089**	-0.089**
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
1st Stage F	38.301	38.301	38.301	38.744	33.992	38.449	38.301

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.394***	1.137***	1.036***	0.332*	3.190***	0.186	0.328
	(0.431)	(0.354)	(0.313)	(0.184)	(0.549)	(0.558)	(0.277)
N. Observations	5286	5286	5286	5284	5255	5283	5286

Panel B: care received

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.011***	0.011***	0.011***	0.011***	0.011***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Informal care (received)	0.131***	0.131***	0.131***	0.131***	0.134***	0.133***	0.131***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
1st Stage F	41.027	41.027	41.027	41.497	36.470	41.075	41.027

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.366***	1.118***	1.080***	0.340*	3.210***	0.197	0.339
	(0.449)	(0.363)	(0.314)	(0.176)	(0.554)	(0.538)	(0.278)
N. Observations	5286	5286	5286	5284	5255	5283	5286
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

Table B.19: The effect of loneliness on health among second-generation immigrants. Additional controls for loneliness and health in childhood.

Panel A: loneliness

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Lonely (when 10)	0.233***	0.233***	0.233***	0.234***	0.231***	0.233***	0.233***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
1st Stage F	11.315	11.315	11.315	11.327	10.005	10.931	11.315

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.472***	1.145***	1.486**	0.462	4.314***	0.095	0.405
	(0.462)	(0.399)	(0.642)	(0.315)	(1.520)	(0.859)	(0.430)
N. Observations	5810	5810	5810	5808	5780	5807	5810

Panel B: health

1st stage	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA	UCLA
RIV (pred)	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Health (when 10 yrs.)	0.252***	0.252***	0.252***	0.252***	0.255***	0.252***	0.252***
	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
1st Stage F	9.997	9.997	9.997	9.997	8.959	9.919	9.997

2nd stage	EURO-D	EURO alt	MOBILITY	ADL	BMI	CHRONIC	SAH
Loneliness (UCLA)	1.667**	1.317*	0.936	0.349	5.763**	-0.181	0.342
	(0.843)	(0.721)	(0.957)	(0.304)	(2.708)	(0.927)	(0.477)
Health (when 10 yrs.)	0.257	0.283	0.488*	0.025	-1.509	0.607**	0.202
	(0.305)	(0.266)	(0.253)	(0.089)	(0.990)	(0.258)	(0.162)
Full set of							
regressors from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country (of residence)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave of interview	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	4942	4942	4942	4942	4918	4941	4942

Notes: *The table shows the direct effect of loneliness on second generation immigrants' physical and mental health outcomes. RIV (pred) stays for predicted values of restraint from model "mRIV7", Table 1. The full set of individual characteristics includes age, female, low education, high education, white collar, marital status, number of children, occupational status, living alone dummy, financial hardship during childhood, adverse childhood conditions, and absence of one or both both parents during childhood. The method of estimation is IV linear regression model. Robust standard errors clustered at the country of origin and country of residence level are reported in parenthesis. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*