HEIDELBERG UNIVERSITY

Essays in network economics

by

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Dedicated to my family

Chapter 1

Introduction

Network analysis is widely used to explicitly model connections between entities in a complex environment. It enables to think about complex processes along theoretical guidelines of network analysis and can be used to explore direct and indirect relationships between different objects. However, the modeling decisions influence the interpretability of the results. Considering the network representation in conjunction with the underlying processes is important as discussed in the book *Network analysis literacy: a practical approach to the analysis of networks* by Katharina Zweig (2016).

Since 1998, social network analysis has seen a surge of interest: coming from statistical physics, Duncan Watts, Albert-László Barabási, Uri Alon and others have transferred their methods and viewpoints to the analysis and modelling of complex systems as networks. Since the perspective is not only on social networks but also on biological, communication and other types of networks, it is better described as *complex network analysis*.

One of the foci in complex network analysis is the comparison with random networks, in order to determine those structures which are 'out of equilibrium' and where additional forces are needed to explain them (Watts and Strogatz 1998;

Barabási and Albert 1999; Shen-Orr, Milo, Mangan, et al. 2002; Milo, Shen-Orr, Itzkovitz, et al. 2004). For example a strong clusteredness of edges is in some cases non-expected and needs to be explained. The motivation behind this is an intuition well-known in physics: structure is costly and if there is no energy keeping it up, the structure deteriorates. This rule is stated as the second law of thermodynamics: in case of no external energy fed to the system (i.e. an isolated system), the entropy can never decrease (e.g. Clausius (1851) and Atkins (1984)). *Entropy* in this sense means that the system, given some structural constraints, will be totally randomized in all other aspects. For example, if a small volume of 0.1 litre full of gas is injected into a larger volume, say 1 litre, the initially high density of gas at the injection point is going to dissolve until the gas has the same density everywhere in the larger volume. While it is possible that all gas particles will one day meet again in one corner of the larger volume, it is very unlikely. But what if we actually find a higher density of gas in one corner of the larger volume? We will then assume that there is an additional external force which makes the atoms concentrate there for example the larger volume could be swirled around, creating a centrifugal force that causes the higher density at one end of the volume. A similar thought is behind the use of *random graph models*: if there is a quantifiable structure whose value is very far away from that found in a suitable random graph model, this finding hints at aspects of the network which are not yet taken into account. In physics, such a yet unexplained structure is especially interesting, if it shows up in very different contexts. The goal is then to find a universal force, a hitherto overlooked constraint, or a new type of law by which networks from very different complex systems are generated to explain the newly found structure. A typical line of research is to first quantify the special structure or behaviour of complex networks and how they differ from a reasonable random network. Those parts of the structure which are not yet explained by the random network model are analysed. These structures could be explained by a new model: the classic small-world article by Watts and Strogatz (Watts and

Strogatz 1998) and the article by Barabási and Albert which introduced scale-free networks (Barabási and Albert 1999). Another strain of research argues that if structures emerge far from equilibrium, represented by the random network the real-world network is compared with, then these substructures are likely to carry function for the complex system and are thus kept up against the pull of entropy. This is the underlying motivation for measures like the modularity proposed by Girvan and Newman (Girvan and Newman 2002; Newman and Girvan 2004), an algorithm for the one-mode projection of bipartite graphs by Zweig and Kaufmann (Zweig 2010; Zweig and Kaufmann 2011), network motifs as introduced by Alon et al. (Shen-Orr, Milo, Mangan, et al. 2002; Milo, Shen-Orr, Itzkovitz, et al. 2004), or the higher vulnerability of real-world networks compared to random networks (Albert, Jeong, and Barabási 2000).

The models and the general algorithms to detect non-random, statistically significant structures are basically *context-free* since the underlying motivation is to find *universal laws* and *universal structures*. In these endeavors, networks are only rarely associated with further, context-dependent features of the nodes or relationships between the nodes. The networks are rather based on a radical simplification of the exact circumstances. This radicalness has been very successful in identifying system-spanning processes of network construction and the structures they generate. The main goal of complex network analysis is to study real world networks and find underlying universal laws, explaining the evolution of such a network.

In general, social network analysis considers the social embeddedness and complex social relationship between people (e.g. Carrington, Scott, and Wasserman (2005) and Wasserman and Faust (1994)). For example, Wenger, Dykstra, Melkas, et al. (2007) analyses the association of marriage and fertility and the support networks for different countries. Social embeddedness is considered from different perspectives. Indirect measures of social embeddedness are attendance of religious service

and active membership in voluntary associations. It can be interpreted as an indicator for the integration in specific social groups. Another indirect measure of social embeddedness in informal networks is the frequency of contact with relatives, friends and neighbors. Additionally, a more direct approach is used to analyse the social support network beyond the involvement in separate social groups. They identify social network types, as described in Wenger (1991), which differ by their configuration of relationships, their size and their supportiveness.

Classical social network analysis is settled in a given context and often correlates the position of an individual with other parameters. The *network process* is then defined by the sets of paths actually used and the type of goods transported by the process (Borgatti 2005). There is ample literature on how data needs to be sampled to provide a reliable basis for such kind of analysis (i.e. how to transform raw data into a *network representation*, which actually represents the real network's structure in the given context) and how network analytic measures can be chosen to be suitable for the task at hand (Borgatti 2005; Butts 2009).

The content of the following three chapters concern different fields of application. However, the underlying driver is, in the respective context, the interconnection of data generating process, network and network analytic method to investigate the complex network of interest. These interconnections are described in Chapter 2.1 in more detail. We combine the work of Butts (2009) and Borgatti (2005) and discuss in context of an air transportation network the *trilemma of network analysis*[1]: The choice of the *network representation*, the *network process of interest* and the *network analytic method* are interdependent. The choice of any two dimensions influences the choice of the third. Given a *network representation* and a *network process*, a suitable path-based network analytic measure has to be chosen in order to quantify process-related aspects of the nodes in the network. Given

[1]Chapter 2 is a reprint of Isadora Dorn, Andreas Lindenblatt, and Katharina A. Zweig (2012). "The trilemma of network analysis". In: *2012 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining*, pp. 9–14.

a *network analytic measure* which is suitable for a given *network representation*, the result is only predictive for the subset of those network processes which follow the path set. This is implicitly used by the network measure. Finally, given a *network analytic measure* and a *network process* in a complex system, only the network representation to which the method can be applied and which contains all the necessary information on the paths used by the process, can be used (Dorn, Lindenblatt, and Zweig 2012).

In Chapter 2 we analyse the passengers journeys within the framework of complex network analysis. Since the early 1970*s* the U.S. air transportation market had to undergo many reforms. The Airline Deregulation Act (1978) allows airlines to choose the routes and time schedules as well as set the fares freely. Airlines formed hub-and-spoke systems and thereby transformed the air transportation network. Cooperation agreements and anti-trust immunity between airlines on certain routes allowed them to spread their network further and lower prices on inter-airline flights. (Brueckner, Lee, and Singer 2011). Mergers and liquidations of airlines further changed and are still changing the structure of these provided networks. Within the field of complex network analysis, air transportation is an active area of research. Due to this multifaceted evolution of the air transportation network and the availability of data diverse strands emerged in the economic literature. The strategies of the airlines and the results of competition have been extensively analysed, for a survey see Levine (1987) and Borenstein (1992). Several articles looked at the emergence of airline alliances and codesharing as well as the entrance of low cost carriers, which led to reduced ticket prices and a rise in consumer welfare (Brueckner, Lee, and Singer 2011; Gayle 2008). From a passenger's perspective the deregulation and the technological developments provide the opportunity for airlines to offer more frequent flights and more routes, either via a hub or direct. Direct flights from city A to city C and flights via a hub B

(A-B-C) are considered to be competing with each other in the same market (A-C) (Hüschelrath and Müller 2013). Also, air transportation networks have been analyzed by complex network analysis methods (Amaral, Scala, Barthélémy, et al. 2000; Barrat, Barthélemy, Pastor-Satorras, et al. 2004; Dall'Asta, Barrat, and Barthélemy 2006; Guimerá, Mossa, Turtschi, et al. 2005).

We first characterize the U.S. air transportation network from a network theoretical perspective. We then discuss the underlying assumption of two centrality measures and propose a measure which takes passenger journeys into account. The "anomaly" of some cities identified by classical centrality measures can partially be explained when observed journeys are considered. Furthermore, we incorporated the passenger's demand in the analysis of the robustness of an air transportation network which makes it seem even more vulnerable. However, it does not necessarily imply that the network is at high risk and we discuss possible interpretation of the result. Our aim is to point out what caveats but also what advantages complex network theory might bring with it.

In Chapter 3, we focus on social support networks of people in old age and the association with well-being and mental health.[2]. We rely on a large sample of respondents aged 50 and older from 16 European countries and make use of detailed social network data. We construct measures to reflect the characteristics of social support networks like size, relationships, geographical proximity, and closeness and analyze the association with well-being and mental health.

In Chapter 4, we discuss the association between religion and moral behavior and attitudes.[3] We use data from a survey on religious beliefs of a representative sample of the Dutch population. In the survey there are no direct data about

[2]Chapter 3 is a reprint of Christoph Becker, Isadora Kirchmaier, and Trautmann Stefan T. (2019). "Marriage, parenthood and social network: subjective well-being and mental health in old age". In: *PLOS ONE* 14.7, pp. 1–20

[3]Chapter 4 is a reprint of Isadora Kirchmaier, Jens Prüfer, and Stefan T. Trautmann (2018). "Religion, moral attitudes and economic behavior". In: *Journal of Economic Behavior & Organization* 148, pp. 282–300.

the social support network itself but indirect measures about social embeddedness like participation in the religous community and membership in organizations. We also use data of participants' parents' church membership and frequency of church attendance, when the participant was aged 15, to study intergenerational transmission of the religious belief and the observed association.

Chapter 2

The Trilemma of Network Analysis

The recent interest in network analysis is caused by the unprecedented accessibility to large datasets: there are huge, publicly available databases on protein-protein-interactions, air transportation, and street maps which easily lend themselves to a network representation. Once a network is created, all types of path-based network analytic measures can be easily applied: typical examples are centrality measures, but also some clustering algorithms and robustness analysis rely on path-based measures. Borgatti (2005) has claimed that centrality measures basically simulate dissemination processes of goods which use a certain subset of paths on the given network; they can thus only be used to describe processes which rely on the same type of good and the same subset of paths. Later, Butts (2009) pointed out that the results of a chosen network analytic method strongly vary with modeling decisions taken when turning raw data into networks. In this article we combine these two insights to the *trilemma of network analysis* which states that the network process of interest, the network representation, and the network analytic method cannot be chosen independently. We discuss on two real-world examples in the realm of air transportation networks how to choose a distance based measure with respect to the context of the data, re-computing similar analyses by Guimerá, Mossa, Turtschi, et al. (2005) and Dall'Asta, Barrat, and Barthélemy (2006). In

both cases, the path-based measures matching the network process of interest change the interpretation of the previous findings, which shows the potential in regarding the trilemma of network analysis[1].

2.1 Introduction

The new statistical view on complex networks is often rather data driven than theory driven: when a new data set is explored, the first step is to transform the data into some network and characterise it by various structural measures, especially centrality measures (Koschützki, Lehmann, Peeters, et al. 2005) or clustering algorithms (Newman 2010; Hanneman and Riddle 2005; Carrington, Scott, and Wasserman 2005). One of the interesting perspectives of a network representation is that indirect effects can be quantified: the influence of a person on the friend of a friend (Christakis 2011), the power of a person based on its position in the network (Bonacich 1987), but also the likelihood of a word to become crucial in solving a word-game puzzle (Iyengar, Zweig, Natarajan, et al. 2011), or the probability that an old computer virus becomes viral again (Pastor-Satorras and Vespignani 2001). Interest in an indirect effect already implies that the analysis focuses on something that is disseminated along the edges of the network. Based on Borgatti's seminal paper on the connection between network flows and centrality measures (Borgatti 2005), we will call such a dissemination a *network process* which is in a first approximation determined by the following characteristics: the type of good which is disseminated and the set of paths it uses, possibly

[1]The content of Chapter 2 has been published as Isadora Dorn, Andreas Lindenblatt, and Katharina A. Zweig (2012). "The trilemma of network analysis". In: *2012 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining*, pp. 9–14. Copyright

weighted by a probability with which a given path is used. Borgatti differentiates the type of good by how it moves through the network: is it indivisible like a book, can it be copied along the way like a virus or a meme, or can it be split up like money (Borgatti 2005)? Based on these features, the centrality of a node can be defined as the (expected) fraction of time the good will use the node on its way around the network (Borgatti and Everett 2006). This implies that each network process requires a centrality measure adapted to the type of good and the probability with which it uses a given path. Similarly, a centrality measure based on shortest paths can only produce meaningful results for a process that really uses shortest paths. Already small deviations from this pattern will lead to wrong results: Holme (2003) has shown that if a process mainly uses shortest paths but not at all times, betweenness centrality is no longer able to identify the most heavily used nodes. In this light, a path-based centrality measure like the closeness, betweenness, or stress centrality quantifies the centrality of nodes in a network process which uses shortest paths and uses all of them with the same probability. Its predictive value for processes with another usage of paths is in the best case unclear and in the worst case misleading. Similarly, clustering algorithms based on centralities, e.g., the one by Girvan and Newman based on betweenness centrality (Girvan and Newman 2002; Newman and Girvan 2004) or robustness analyses of networks where the most central nodes are iteratively removed (Albert, Jeong, and Barabási 2000), make certain assumptions about why a given node is central, although these assumptions are implicit by the choice of the centrality measure. We conclude that Borgatti's work, which is specific to centrality measures, can be generalized to stating a non-trivial dependency between path-based network analytic measures and the network process of interest.

In his paper "Revisiting the foundations of social network analysis", Butts (2009) has made a connection between a chosen network analytic measure like the centralization of a network and parameters governing the transformation of raw data

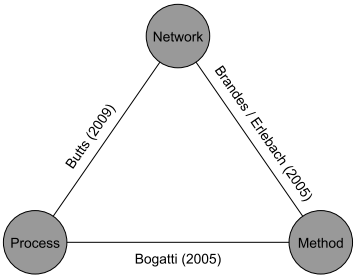


Figure 2.1: Trilemma of network analysis.

into a network representation: e.g., if connections are only used for some time in a larger time interval, the type of aggregation of these connections into one single network will strongly influence its structural appearance (Butts 2009). Finally, there is a comparably trivial connection between a network representation and the network analytic methods that can be applied to it: While most methods are designed for unipartite, unweighted, and undirected networks, all other representations require methods which can deal with multipartite, weighted, and/or directed networks (Brandes 2005). In summary, given a network representation and a network process, only one path-based network analytic measure is suitable to quantify the centrality (or other process-related aspects) of the nodes in the network. Given a network analytic measure which is suitable for a given network representation, the result is only predictive for the subset of those network processes which follow the path set which is implicitly used by the network measure. And finally, given a network analytic measure and a process in a complex system, only the network representation to which the method can be applied and which contains all the necessary information on the paths used by the process, can be used. We call the interdependence of these three dimensions the *trilemma of network analysis* since the choice of any two massively restricts the choice of the third. Fig. 2.1 schematically represents the interdependence between the choice of the network representation, the network process of interest, and a path-dependent network analytic measure.

Now that the stage is set, the rest of the article will show on two examples from the

area of air transportation how the interpretation of network analytic results can change if the trilemma of network analysis is regarded by matching the network process of interest with an appropriate network analytic method.

The article is organised as follows: Section 2.2 introduces the necessary graph definitions, Section 2.3 presents previous results, the air traffic data we used, and our network representation of it. In Section 2.4 we discuss journey-based betweenness and stress centralities. In Section 2.5 we discuss the journey-based robustness of the network. We summarize the results in Section 2.6 and conclude with a discussion of the results in Section 2.7.

2.2 Definitions

Let $G = (V, E, \Omega)$ be a tuple consisting of a set of nodes V, a set of edges $E \subseteq V \times V$ and $\Omega : E \to \mathbb{R}$ a weighting function on the edges. Two nodes v, w connected by an edge are said to be *neighbors*, and the *degree* $deg(v)$ of a node v is defined as the number of neighbors it has. The *strength* $s(x)$ of a node x is defined as the sum of weights of all edges to its neighbors.

A path $P(v, w) = (e_0, e_1, \cdots, e_k)$ is an ordered subset of edges in E such that $e_0 = (v, v_1)$, $e_k = (v_k, w)$ and for all $1 \leq i < k$ $e_i = (v_i, v_{i+1})$, i.e., a series of edges such that one can traverse from v to w. If no such path exists, the two nodes are *disconnected*. A *connected component* $C \subseteq V$ is a maximal set of nodes which are all pairwise connected with its *size* $|C|$. The *biggest connected component* (*bcc*) is the component containing the most nodes. The *length* $l(v, w)$ *of a path* $P(v, w)$ is given by the sum of the weights of its edges. The *distance* $d(v, w)$ of any two connected nodes is defined as the minimal path length of all paths between them and a path with this length is called a *shortest path*. Let σ_{vw} denote the number of all shortest paths between v and w, and let $\sigma_{vw}(x)$ denote the number

of all shortest paths in which x is contained but not as an endpoint. Then, the *betweenness centrality* $C_B(x)$ is defined as:

$$C_B(x) = \sum_{v \in V, w \in V} \frac{\sigma_{vw}(x)}{\sigma_{vw}} \tag{2.1}$$

The *stress centrality* $C_S(x)$ counts the number of shortest paths containing x (not as an endpoint):

$$C_S(x) = \sum_{v \in V, w \in V} \sigma_{vw}(x) \tag{2.2}$$

2.3 Previous Results and the Data

One of the datasets that is often analysed is air traffic data. Some of the data sources provide information on the capacity of scheduled flights, others provide information on the number of tickets sold.[2] A common network representation of this data, called the *air transportation network* (ATN), connects one airport or city to another if there is a flight from one to the other (Guimerá, Mossa, Turtschi, et al. 2005). We will re-evaluate two previous findings by regarding the trilemma of network analysis, namely one result on so-called *anomalous cities* and one on the robustness of the network.

2.3.1 Anomalous Cities

Given an ATN, the ranking of each city imposed by its degree and its betweenness centrality can be compared. The network models proposed at that time

[2]There are two types of air traffic data: scheduled-based air traffic data and journey-based air traffic data. Scheduled-based air traffic data provide information about the direct flights scheduled and their capacity (number of seats available). Journey-based air traffic data contain information about the actual direct flights conducted as well as the actual routes travelled by passengers, the journeys. Database provider of the first type of air traffic data are for example OAG and IATA (International air transportation association). Journey-based air traffic data within the US are provided for free by the US Bureau of Transportation Statistics and international data can be bought from Amadeus, the provider of a worldwide air travel booking system.

predicted that a node that has a high degree will also have a high betweenness centrality (Goh, Oh, Kahng, et al. 2003). However, the ATNs analysed so far contain some so-called *anomalous cities* which have a low degree but a high betweenness centrality (Guimerá, Mossa, Turtschi, et al. 2005; Dall'Asta, Barrat, and Barthélemy 2006). Guimerá, Mossa, Turtschi, et al. (2005) noticed that these *anomalous centralities* call for a new network model. They argue that the anomalous centralities arise as a result of a multicommunity structure in the ATN and that they can only be explained by geopolitical reasons:

> "Interestingly, besides these cities with relatively large degree, there are others, such as Anchorage (AK) and Port Moresby (Papua New Guinea), that, despite having small degrees, are among the most central in the network. [...] We hypothesize that the origin of such a behavior is the multicommunity structure of the network. We find the communities in the network and demonstrate that their structure can only be understood in terms of both geographical and political considerations (Guimerá, Mossa, Turtschi, et al. 2005, p.7796,p.7799)."

2.3.2 Robustness of ATNs

Dall'Asta, Barrat, and Barthélemy (2006) analysed the *robustness* of different ATNs. Robustness analysis of networks was introduced by Albert, Jeong, and Barabási (2000). The basic idea is to rank nodes by some measure and delete the highest ranked nodes recursively, simulating the result of an intentional attack on the most important nodes of the network. Albert, Jeong, and Barabási (2000) measured the *robustness* of the network by the number of remaining nodes in the biggest connected component. Dall'Asta, Barrat, and Barthélemy (2006) introduced weighted robustness measures for ATNs. The robustness is measured

for example by the highest sum of available seats carried by any connected component. While Albert, Jeong, and Barabási (2000) showed that networks with a right-skewed degree distribution are in general not very robust against intentional attacks, Dall'Asta, Barrat, and Barthélemy (2006) showed that ATNs are even less robust when weights such as capacity and distance are taken into account.

2.3.3 The Data

We used the Airline Origin and Destination Survey (DB1B) data set from the year 2010, provided by the US Department of Transportation (DOT 2018), as our raw data for an ATN. On a quarterly basis large[3] US airlines report information on 10% of their sold tickets for inner US flights. This database includes the exact sequence of the journeys (origin, stop-over airports, destination). We aggregate the data of all reporting airlines. For the analysis of the anomalies in Section 2.3.4 we combine airports with the same city ID as done by Guimerá, Mossa, Turtschi, et al. (2005) and supported by economic considerations (Brueckner, Lee, and Singer 2014; Bonnefoy and Hansman 2007).

2.3.4 ATN Representations

Although the literature generally refers to the ATN as a generic term, the air traffic data can essentially be modeled by different networks, depending on the interpretation of the nodes and edges: Nodes can either represent airports (Dall'Asta, Barrat, and Barthélemy 2006) or city areas with possibly more than one airport (Guimerá, Mossa, Turtschi, et al. 2005). Two of these nodes can be connected by edges representing the mere existence of a flight (Guimerá, Mossa, Turtschi, et al. 2005) or be assigned weights representing the number of flights (Bonnefoy and Hansman

[3]Airlines are considered as large if they own an air plane with a capacity of more than 60 passengers or offer flights to non-US airports.

2007), the total capacity of the planes, or other more involved measures (Dall'Asta, Barrat, and Barthélemy 2006).

In this article, the nodes of the ATN represent city areas where two city areas are connected if there is a flight from one of the corresponding cities to the other. Basically, we are interested in journeys as seen from a passenger's perspective. If someone flies from A to B, possibly with stop-overs in various other cities, we consider this as a *demanded journey*. This process of interest is described by the *set of journeys* $J(A, B)$, a multiset of paths for all observed origin-destination pairs. A typical element $j \in J$ describes the journey of a passenger as an ordered sequence of cities (airports), i.e. the specific path used. For example, $j = (e_{AB}, e_{BC}) = ((A, B), (B, C))$ represents a journey from city A to city C via city B.

2.4 Anomalous Cities

It was shown that some cities in a given ATN have a comparably low degree but high betweenness centrality and vice versa (Guimerá, Mossa, Turtschi, et al. 2005; Dall'Asta, Barrat, and Barthélemy 2006). Guimerá, Mossa, Turtschi, et al. (2005) find that some of the 25 most central cities (ranked by $C_B(v)$) are not among the 25 most connected cities (ranked by $deg(v)$) when using worldwide schedule-based air traffic data. These are for example Singapore, Port Moresby (Papua New Guinea) and Hong Kong. Within the US, these are the cities Anchorage, Seattle, Honolulu and Miami.

As discussed above, using the classical betweenness centrality already imposes the following assumptions on journeys: that there is demand to fly from every city to every other city, that this demand is equally distributed, and that shortest paths are being used. However, in the DB1B data set, only 40% of all possible

origin-destination pairs are actually demanded and the demand is far from uniform. Concerning the usage of shortest paths we note that if there are at least $3,700$ tickets contained in the DB1B data set for a given origin-destination pair, then there always exists a direct flight (aggregated over one year). However, the path used by a passenger is not always the shortest path available. We conclude that $C_B(v)$ does not match the network process of interest, the transportation of passengers in planes along routes demanded within one year.

2.4.1 Journey-based Centrality Measures

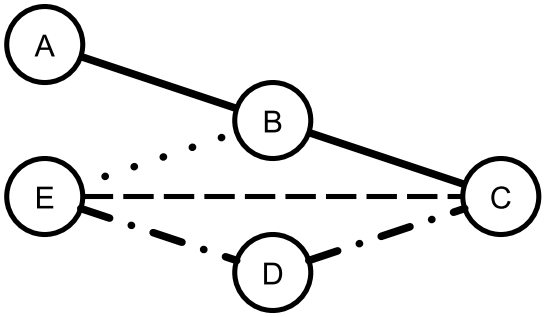
In order to characterise the centrality of cities according to the observed journeys we introduce the *journey-based stress centrality*. While the classic betweenness and stress centralities quantify the importance of a city in a network process where only shortest paths are used, we define the journey-based stress centrality $C_S^J(x)$ as the number of observed journeys in which x is a stop-over (cf. Dolev, Elovici, and Puzis (2010)):

$$C_S^J(x) = \sum_{v \in V} \sum_{w \in V} \delta^J(v, w, x) \tag{2.3}$$

where $\delta^J(v, w, x)$ denotes the number of journeys containing x as a stop-over[4]. The journey-based betweenness centrality $C_B^J(x)$ is analogously defined by normalizing each term with $\delta^J(v, w)$, the total number of journeys between v and w.

Fig. 2.2(a) visualizes the difference between the classical centrality measures and the journey-based centrality measures. From the example, it can be seen that the ranking can be completely reversed, depending on the observed journeys. Note that the journey-based betweenness centrality yields a different value for the nodes B and D and only the journey-based stress centrality ranks B and D the same.

[4]Derudder, Devriendt, and Witlox (2007) used this measure to analyse the role of hubs from a geographic perspective.



(a) Undirected Network

	A	B	C	D	E
C_B	0	3	1	0	1
C_B^J	0	1	0	0.5	0
C_S	0	4	2	0	2
C_S^J	0	1	0	1	0

(b) Centrality Measures

Figure 2.2: Example of a network in which the ranking of the centrality measures and the journey-based centrality measures differ. The journey set is $J = \{((A,B),(B,C)),(E,C),((E,D),(D,C)),(E,B)\}$. Different line styles are used to visualize the different journeys.

2.4.2 Results

From an economic point of view it can be expected that a node with a high journey-based centrality should have a high degree. For reasons such as economies of scale, airlines tend to organise their network in a star-shaped manner in order to lower their costs[5]. Therefore, a city which serves as a stop-over for many different routes should rather be one with direct connections to many other cities (Button 2002; Shaw 1993). Suppose that the number of a city's direct connections (degree) was relatively low compared to the number of passengers using the city as a stop-over (journey-based centrality). This implies that there were pairs of neighbors of this city which have a high demand. In a competitive market where the demand for a pair is high enough to profitably offer a direct flight, airlines will start to do so and the number of passengers using the city as a hub will decrease accordingly. If the

[5]Economies of scale refer to falling average (per unit) cost if an enterprise increases production. Under such circumstances it is more profitable for an airline to operate all flights from one airport than from several ones, as for example overhead costs can be saved.

demand does not allow for a direct flight, the airline will move the indirect flights to its hub and again the journey-based centrality will decrease. We thus agree with Guimerá, Mossa, Turtschi, et al. (2005) that cities for which a low degree and a high (journey-based) stress centrality are observed, are potential anomalies and need to be explained.

Using the DB1B dataset (445 cities and 10,190 unique edges) and the classic C_B we also found anomalies with low degree but relatively high centrality: these are three Alaskan cities such as Anchorage (ANC) (Guimerá, Mossa, Turtschi, et al. 2005; Dall'Asta, Barrat, and Barthélemy 2006), King Salmon (AKN) and Fairbanks (FAI), as well as Albuquerque (ABQ) and Portland (PDX)[6]. The results for the most central ones according to the stress centrality are similar (see Fig. 2.3). Only AKN is not an anomaly according to the classic stress centrality.

When using the new journey-based stress centrality C_S^J, the first result is that the anomalies are in general much less pronounced, i.e., their deviation from the curve is smaller (see Fig. 2.4 and compare with Fig. 2.3).

Interestingly, none of the previously identified anomalies regarding C_B are still anomalous (see Table 2.5) but there are newly identified ones regarding the C_S^J: *1)* Cincinnati (CVG), which had been a hub for Delta Air Lines until 2008, when the latter merged with Northwest Airlines and cancelled half of all their direct flights from Cincinnati. *2)* Honolulu (HNL), the hub of Hawaiian Airlines. Out of all observed stop-overs in HNL, 91% of these journeys started or ended on one of the smaller Hawaiian islands. I.e., Honolulu distributes incoming tourists to the islands and collects them back to send them home in larger airplanes, which are in general more cost-efficient. Finally, *3)* Mitchell International Airport (MKE), is anomalous as defined by Guimerá, Mossa, Turtschi, et al. (2005), but its rank difference is only two - rank 24 according to C_S^J and 26 according to *deg*.

[6]There were also cities which rank among the 25 most connected ones but not among the 25 most central ones. The absolute ranking difference is between 2 and 25. While these results are also interesting, we restrict the discussion to the cities in the upper left quadrant.

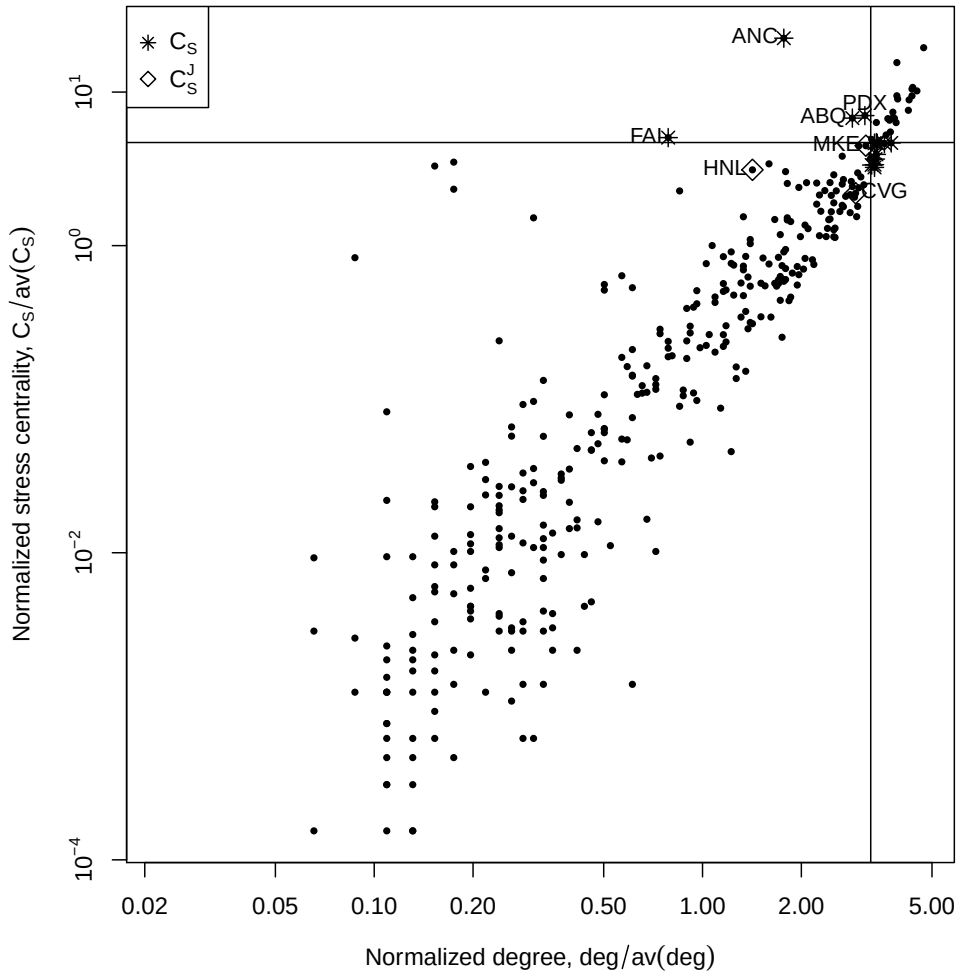


Figure 2.3: Degree versus centrality - stress centrality. A city is anomalous (denoted by a star) as defined by Guimerá, Mossa, Turtschi, et al. (2005) if its degree rank is higher than 25 (vertical line) but its betweenness (or stress) centrality rank is lower than 25 (horizontal line). It compares *deg* and C_S. A diamond symbol in Fig. 2.3 indicates an anomaly from Fig. 2.4 and vice versa.

In summary, most of the anomalies seem to be the result of a model which is not suitable to characterise the demand of passenger journeys. When using betweenness or stress centrality it is implicitly assumed that every pair of airports shows the same demand and passengers always travel on shortest paths. Using a journey-based centrality measure, i.e., taking only observed paths into account, the anomalies are in general less pronounced, and the set of anomalous cities changes completely. Those that are still found to be anomalous, can be explained with economic reasoning.

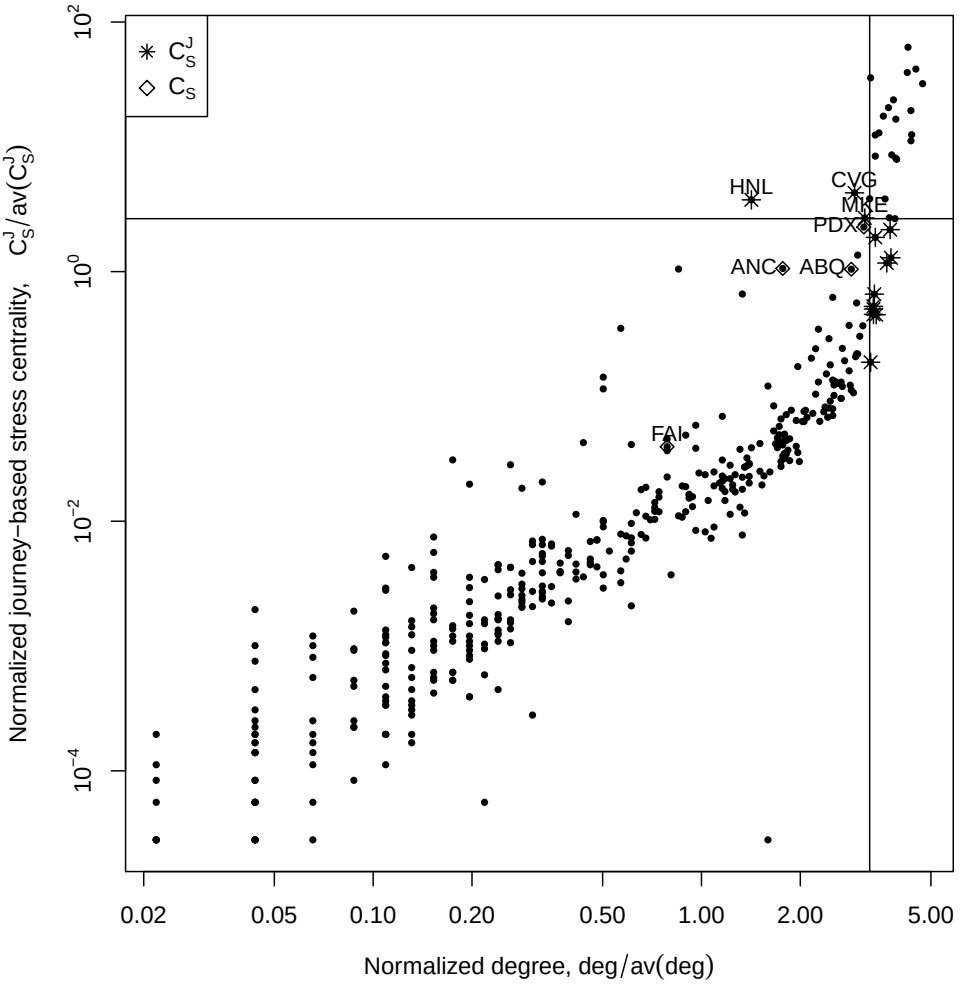


Figure 2.4: Degree versus centrality - journey-based stress centrality. A city is anomalous (denoted by a star) as defined by Guimerá, Mossa, Turtschi, et al. (2005) if its degree rank is higher than 25 (vertical line) but its betweenness (or stress) centrality rank is lower than 25 (horizontal line). It compares *deg* and C_S^J. A diamond symbol in Fig. 2.3 indicates an anomaly from Fig. 2.4 and vice versa.

In our second example, we show that also other network analytic measures like a robustness analysis can be influenced by the paths used in the network process of interest.

2.5 Robustness of the ATN

Dall'Asta, Barrat, and Barthélemy (2006) analysed the vulnerability of the world-wide ATN using schedule-based data. They connected two airports with an edge if

City	*deg*	*s*	C_B	C_S	C_S^J
ANC	68	52	1	1	32
ABQ	35	43	11	14	34
FAI	103	114	14	23	117
PDX	27	24	17	13	26
AKN	130	306	20	41	277
CVG	33	39	73	63	19
HNL	79	23	42	43	22
MKE	26	31	27	31	24

Figure 2.5: Degree versus centrality - the ranks of the cities. A city is anomalous (denoted by a star) as defined by Guimerá, Mossa, Turtschi, et al. (2005) if its degree rank is higher than 25 but its betweenness (or stress) centrality rank is lower than 25. It shows the ranks of the anomalous cities according to C_B (first five) and to C_S^J (last three). Rank 1 means that the city had the highest measure, while rank 445 represents the lowest measure compared to all other cities; cities with a tie share the same rank.

there were scheduled flights and assigned the capacities of the flights as a weight. They quantified the network's integrity along two dimensions: *1)* Which centrality measure is best used to determine the next target (*attack strategy*)? and *2)* How vulnerable is the network with regard to different integrity measures?.

The process is simulated in the following way: In each round, the nodes with highest degree are computed and deleted together with their direct connections (*Recalculated attack-strategy (RAS)*). The *topological integrity* I_N after removing g nodes is then defined as the fraction of nodes in the biggest connected component. Additionally, Dall'Asta, Barrat, and Barthélemy (2006) measured the integrity I_S of the network, defined as the strength of the connected component with the maximal strength. They found that the weighted ATN is even more vulnerable than the topological integrity would suggest. After deleting the 2% most important nodes according to their degree, the topological integrity I_N is still about 80% of the initial size, while I_S already dropped to about 20%.

2.5.1 Journey-based Modeling of an Attack

The above model reflects the direct damage of an attack on ATNs. We will now refine the model by taking into account the damage on journeys that were using the attacked airport. We construct the ATN by connecting airports when a direct flight is observed and weight the edges by the total number of passengers using that connection. In the case of a simulated attack on an airport, we not only remove the airport (node) and thereby all its edges from the ATN. We also subtract the number of passengers that used this airport as a stop-over from all edge weights on the edges contained in their journeys. Thus, if there is a journey $j = ((A, B), (B, C), (C, D))$ with 100 passengers and C is deleted, the edge weight on (A, B) will also be decreased by 100. We measure the integrity of the network after removing g nodes by the percentage of remaining strength in the resulting network[7]:

$$I_{TS}(g) = \frac{\sum_{v \in V_g} s(v)}{\sum_{v \in V} s(v)} \tag{2.4}$$

We call this model of the damage of an attack the *recalculated attack strategy + journey deletion (RAS+J)*.

Under the RAS, the network disintegrates after the removal of 337 airports within 97 rounds. When modeling the attacks based on RAS+J, the network already disintegrates after the deletion of 199 airports within only 77 rounds. As shown in Fig. 2.6 the two models generate a different evolution of network disintegration.

In Fig. 2.7 and 2.8 we show that the topological integrity of the ATN is much faster destroyed when modeling the damage on journeys and that—to a lesser extent—also its strength is declining faster than in the first model.

[7] I_S and I_{TS} differ with respect to the numerator. While I_S takes only the strength of the connected component with the maximal strength into account I_{TS} uses the total strength of the remaining network. However, for the ATN based on inner US flights there is hardly any difference.

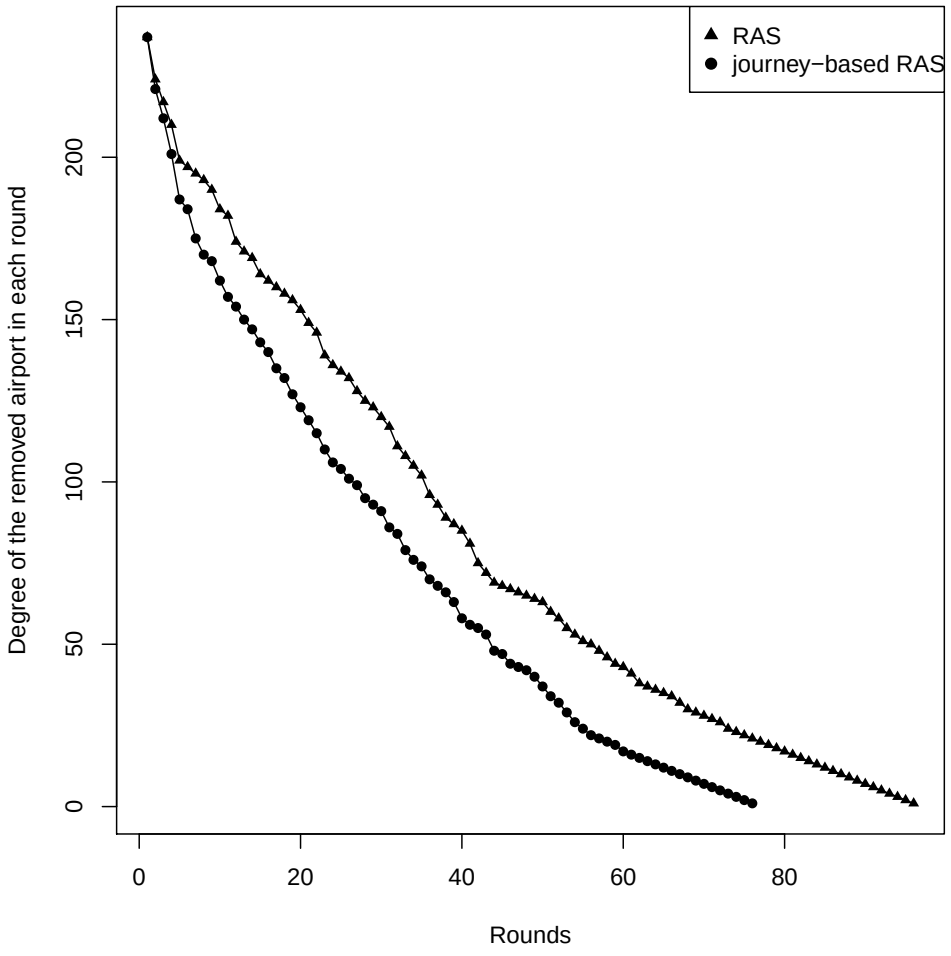


Figure 2.6: Vulnerability of the weighted ATN - maximal degree. The maximal degree in each round is depicted, when using RAS or RAS+J, respectively.

In summary, additionally modeling the damage of attacks based on journeys hints at an even higher vulnerability of ATNs than the first approximation which does not reflect the paths actually used by the network process of interest.

2.6 Summary

We showed on two examples how network representation, process of interest, and network analytic measure can be matched and that this approach changes network analytic findings based on them. The seemingly "anomalous" cities found when using degree and classic betweenness centrality are no longer anomalous when using

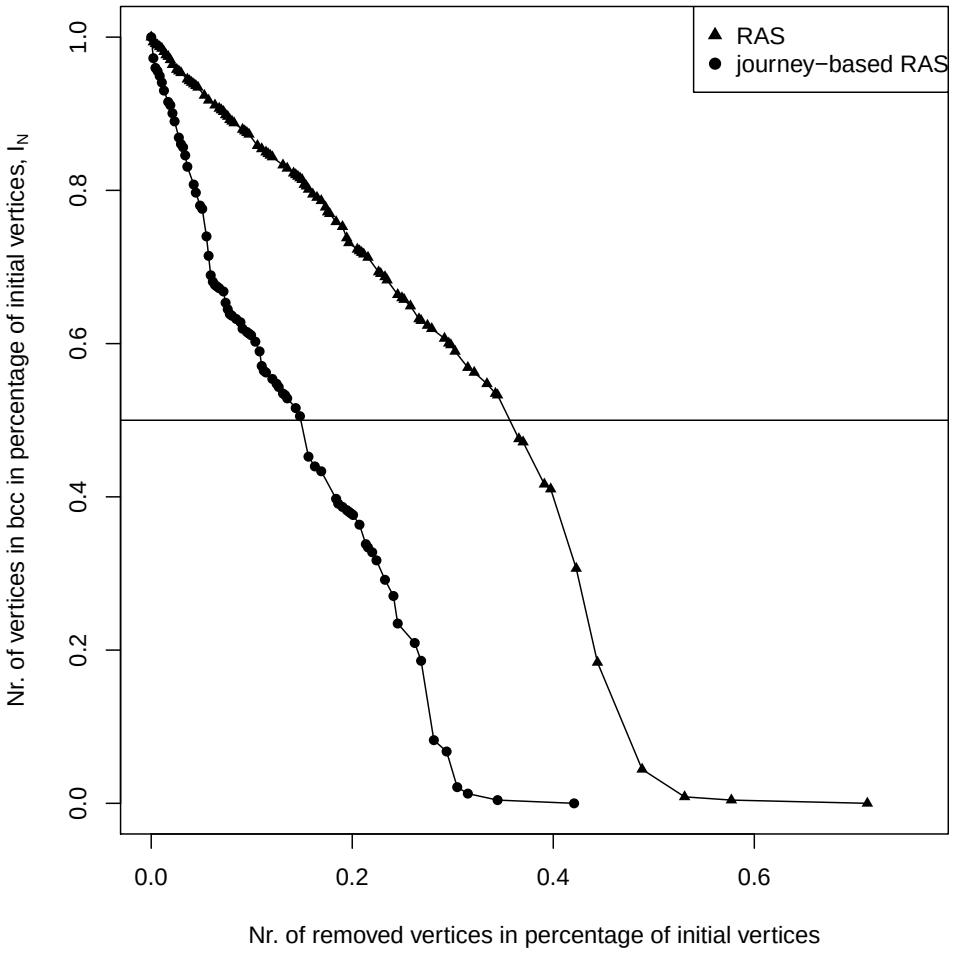


Figure 2.7: Vulnerability of the weighted ATN - topological integrity. The topological integrity I_N is shown for both strategies RAS or RAS+J. The solid line marks the loss of 50% of the integrity.

a journey-based centrality measure. Especially for some Alaskan cities, the difference in their ranks according to the number of direct connections and their ranks according to the number of observed stop-overs at the city is strongly reduced. However, other cities emerge as potential "anomalies", which can be explained by economic, demand-based reasons, e.g., the implementation of a home-base which leads to a star-shaped hub structure of the airline's ATN. The second result is that the ATN is even more fragile with respect to the network's topological integrity and also partly to its strength, when additionally taking the damage on journeys into account.

We have focused on one aspect of the network representation, namely the inclusion

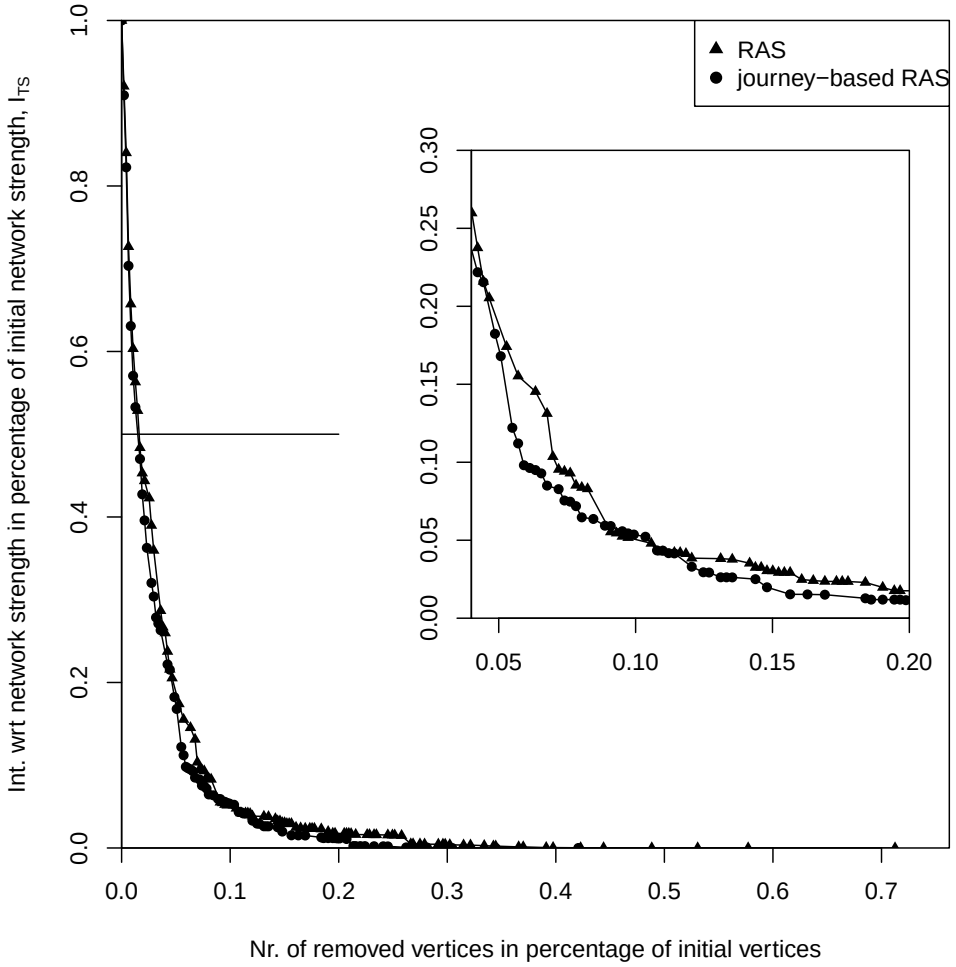


Figure 2.8: Vulnerability of the weighted ATN - integrity wrt. strength. The strength integrity I_{TS} is shown for both strategies RAS or RAS+J. The solid line marks the loss of 50% of the integrity. In the inset the integrity measures for the first 20% of removed nodes are shown.

of journey-based information. Another important aspect of network representation is aggregation over time and space (Butts 2009): the analysis presented here assumes that the aggregation of passenger journeys over one year is a reasonable model for the network process of interest. Using real-time data on passenger journeys might allow to additionally relate journeys with a temporal dimension, e.g., to analyse seasonal demand patterns.

2.7 Discussion

This article is not about introducing yet another centrality measure but advocates for a close matching of path-based network analytic measures, the network representation they are applied to, and the network process of interest. The two seminal papers on which the idea of a *trilemma of network analysis* is based on are both from sociologists which refer to examples from social network analysis (Borgatti 2005; Butts 2009). We have no doubts that, although our examples discuss a transportation network, the analysis can be valuable to all kind of social and complex networks. However, it seems that most social network analysts are aware of the epistemological discussion of what type of method can be applied to what type of network. The problem seems to be of a more recent nature, in which data miners and modelers of complex systems became interested in describing the structure of these systems in terms of networks (Borgatti, Mehra, Brass, et al. 2009; Carrington, Scott, and Wasserman 2005). In complex network analysis methods from sociology are used to explore large and very diverse networks in order to find universal laws and structures (Watts and Strogatz 1998; Barabási and Albert 1999; Newman 2010). It seems that problems mainly arise, when an *exploratory* network analysis turns into an *explanatory* one. We hope that the introduction of the *trilemma of network analysis* helps to avoid these problems by illustrating the interdependence of network representation, path-dependent network measure, and the network process of interest.

Chapter 3

Marriage, Parenthood and Social Network: Subjective Well-Being and Mental Health in Old Age

Parenthood, marital status and social networks have been shown to relate to the well-being and mental health of older people. Using a large sample of respondents aged 50 and older from 16 European countries, we identify the associations of well-being and mental health with family status. Making use of detailed social network data of the respondents, we also identify how different social support networks correlate with the well-being and health indicators. We observe positive associations for all network types, over and beyond any direct associations of family status with well-being. Results suggest that non-residential children are important providers of social support for their parents at older age. [1]

[1]The content of Chapter 3 has been published as Christoph Becker, Isadora Kirchmaier, and Trautmann Stefan T. (2019). "Marriage, parenthood and social network: subjective well-being and mental health in old age". In: *PLOS ONE* 14.7, pp. 1–20. We thank Luisa Kling for excellent research assistance, and Christian König-Kersting and Martin Vollmann for helpful comments on the paper. This paper uses data from SHARE Waves 1, 2, and 4, (DOIs: 10.6103/SHARE.w1.600, 10.6103/SHARE.w2.600, 10.6103/SHARE.w4.600), see Börsch-Supan, Brandt, Hunkler, et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6

3.1 Introduction

The link between family status (marital status and parenthood), well-being, and mental health is widely discussed in academic and popular discourses. Evidence suggests that being married or living with a partner can have a positive effect on life satisfaction (Mastekaasa 1994) and is associated with higher well-being, better mental health and fewer depressive symptoms in old age (Bures, Koropeckyj-Cox, and Loree 2009; Gibney, Delaney, Codd, et al. 2017; Buber and Engelhardt 2008).

Parenthood, on the other hand, does not appear to be associated with enhanced mental health (Evenson and Simon 2005; Hansen, Slagsvold, and Moum 2009; Hansen 2012). The risk of depression is especially pronounced for women with parenting stress and poor physical health, but less pronounced for those being supported by the partner (Manuel, Martinson, Bledsoe-Mansori, et al. 2012). Repeated cross-sectional data on US parents and non-parents shows a gap in subjective well-being between these two groups, which, however, becomes smaller over the period 1973 through 2008 due to decreased happiness of non-parents (Herbst and Ifcher 2016). A cross-country comparison finds only weak associations between life satisfaction and having children, with unclear direction (Mastekaasa 1994). However, there is also evidence that the relationship between children and well-being becomes more positive for older respondents (Mastekaasa 1994; Margolis and Myrskylä 2011). Depending on the life-cycle stage, the aspects of parenthood may thus differ, suggesting that the positive aspects of parenthood

(SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N° 211909, SHARE-LEAP: N° 227822, SHARE M4: N° 261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

dominate when getting older. Amongst others, the role of children as a form of social support may become important in the later stages of a person's life (Margolis and Myrskylä 2011).

According to the U.S. National Cancer Institute, social support is

> "a network of family, friends, neighbors, and community members that is available in times of need to give psychological, physical, and financial help" (NCI 2018).

There is evidence that such social support networks are related to less loneliness and more happiness (Litwin and Shiovitz-Ezra 2011; Litwin and Stoeckel 2014). While results on parenthood might be controversial and depend on the age of the studied population, there is widespread agreement that social support is associated with higher life satisfaction, and that social networks are an important factor for well-being (Pinquart and Sörensen 2000). Bringing these two branches of the literature together, we aim to shed light on the link between a person's family status, the resulting characteristics of their social networks, and their well-being and mental health, using a large sample of 55.000 middle-aged and older adults from 16 European countries. This sample was taken from the Survey of Health, Ageing and Retirement in Europe (SHARE, Börsch-Supan, Brandt, Hunkler, et al. (2013), Börsch-Supan, Brandt, Litwin, et al. (2015), and Malter and Börsch-Supan (2013)). In the first wave of the data set, there is some evidence that the number of residential children is associated with more depressive symptoms for people aged 60 and older (Litwin 2010). We aim to expand and generalize these findings using recently collected, detailed network data, across European countries. Parenthood, marital status and different types of social networks might help to sustain well-being and mental health in old age. Thus, our objective in the current study is to analyze the relationship of people's social networks with their well-being and mental health, over and beyond associations captured by family

status. We expand the range of outcome measures previously considered for this data set, and include four distinct measures of well-being and mental health that are often used in economics and psychology. These are the CASP-12 scale for quality of life, the EURO-D scale for depressive symptoms, and two single item measures life satisfaction and social support network satisfaction.

We use the full range of the SHARE data set, which includes people aged 50 and older; at this point in the life cycle, parents may have resident children, children living away from home, and grandchildren. We use network composition measures in order to determine network types (i.e., the relative relevance of spouses, children, friends and others), and control for network size and relational dynamics (contact frequency, closeness, and proximity) separately. Additionally, we calculate the network types for each country separately, taking cultural differences in network compositions into account.

Based on the current literature we test the following three hypotheses for the well-being and mental health of people aged 50 and older: i) A positive association with being married, ii) a positive association with the number of children and grandchildren not living at home, and iii) a positive association with having a strong social network, controlling for family structure.

We proceed as follows: Section 3.2 describes the data used and our methods to measure well-being, mental health and the characteristics of social support networks in detail. In Section 3.3 we present the results of our analysis. We first analyze the association of family status with well-being and mental health measures without taking the social network into account. We then take the network composition as criterion variables and use hierarchical clustering to determine social network types which differ mainly in their main source of social support. We then assess the relationship between the resulting social support network types

and outcome measures, controlling for family status, network size, and relational dynamics. Section 3.4 discusses our findings and provides concluding remarks.

3.2 Data and Methodology

3.2.1 Respondents

We use data from the cross-national panel database Survey of Health, Ageing and Retirement in Europe (SHARE), release 6.0.0., managed by the Munich Center for the Economics of Aging, Max Planck Institute for Social Law and Social Policy (Börsch-Supan, Brandt, Hunkler, et al. 2013; Börsch-Supan, Brandt, Litwin, et al. 2015; Malter and Börsch-Supan 2013). The cross-national panel database provides extensive data on health and socio-economic status. The target population is people of age 50 or older having their regular domicile in the respective country. Current partners are interviewed regardless of their age. We make use of SHARE wave 4 (Börsch-Supan 2017c) that was administered between 2010 and 2012 in 16 European countries, and includes a module on social network. We update missing constants with data from waves 1 (Börsch-Supan 2017a) and wave 2 (Börsch-Supan 2017b). We include respondents age 50 and older not living in a nursing home. The number of respondents differs by country. Over all countries, there are about 55.000 observations available. For an overview of the waves used, the modules and variables, and the total number of observations of each country, see Tables 3.11 and 3.12 in Section 3.5.

3.2.2 Demographic Factors

The SHARE dataset contains detailed data on demographics. Summary statistics of all demographic variables used in the analyses can be found in Table 3.13. The

demographic factor of interest is the family status, which we measure by the marital status, total number of children, children living at home, and grandchildren. Over all countries 70% of the respondents are married and 91% have children.

The marital status of each respondent is classified into the categories (1) married and living together with spouse, (2) registered partnership, (3) married and living separated from spouse, (4) never married, (5) divorced, (6) widowed. For the regression analysis we construct the dummy variables *married* which takes the value of one if the respondent is married or in a registered partnership, the dummy variable *divorced*, which takes the value of one if the respondent is divorced or living separated from spouse, and a dummy variable *widowed*. We include respondents living separately from their spouse in the dummy *divorced*, as living separately is often a preceding step to a divorce.

Parenthood is measured by the number of children alive and the number of resident children, including fostered, adopted and stepchildren. We define the four-category measure *children* with categories no children, one child, two children, and three or more children, and create the respective dummy variables for each category. We further construct the variables *resident children* and *grandchildren* which report for each respondent the number of children living with the family and the number of grandchildren.

Further demographics are used as controls. The set *Controls A* consist of gender, age (of the respondent at the time of the interview), age squared, and a dummy variable indicating the country of residence of the respondent to control for cultural differences. The set *Controls B* additionally includes dummies for being divorced, widowed, urban character of residence, being employed, self-employment, level of education according to the international classification of education ISCED-97 (Hoffmeyer-Zlotnik and Wolf 2003) and an indicator for the average monthly household income. In SHARE wave 4, each household respondent is asked to state

the overall after-tax income of the entire household in an average month of last year. If a respondent refuses to answer, the interviewer asks whether the respondent earns more, less or approximately the amount in certain bracketed values, which represent country-specific 25^{th}, 50^{th}, and 75^{th} percentiles of the reported household incomes from SHARE wave 2. We use the information from the stated household income and the unfolding brackets and define four categories for the average monthly household income: (1) Low income [0 to 25^{th} percentile], (2) Middle income [25^{th} to 50^{th} percentile], (3) Upper middle income [50^{th} percentile to 75^{th} percentile], and (4) High income [75^{th} percentile and higher]. The boundaries of the intervals are the country-specific bracket values of SHARE wave 4 (details and summary statistics in Table 3.12 in Section 3.5).

In order to control for health, we include a measure of self-assessed physical health (Would you say your health is: (1) poor, (2) fair, (3) good, (4) very good, and (5) excellent), and whether drugs for sleeping problems, anxiety or depression are taken.

3.2.3 Well-being and mental health indicators

Well-being can be defined as the psychological balance point between individually available resources and challenges (Dodge, Daly, Huyton, et al. 2012) and may be linked to many different aspects of life. In order to develop national well-being measures, the Office for National Statistics in the UK ran a public debate on the question through various platforms (Matheson 2011). The three most frequent answers to the question "What things matter most in your life? What is Well-being?" were "Health" , "Having good connections with friends and relatives" , and "Job satisfaction (and economic security)" (Evans 2011). Many empirical studies report a link between socioeconomic status, quality and quantity of social contacts, and well-being (Pinquart and Sörensen 2000). In our study, we use a broad set of

measures to map respondents' well-being: a simple single-item question regarding life satisfaction; the CASP-12 multi-item quality of life scale; a single-item question on social support network satisfaction; and the EURO-D depressive symptoms scale. We also use measures of health, education, and financial status as controls in our analyses (Diener and Suh 1997; Knesebeck, Wahrendorf, Hyde, et al. 2007).

In the following, we will discuss the three measures in more detail. Survey questions for each measure are shown in Table 3.1.

The first measure concerns a general feeling about the quality of life, the stated *Life satisfaction*. It is extracted by a single-item question in which respondents indicate on a scale from 0 (low satisfaction) to 10 (high satisfaction) how satisfied they are with their life. This scale has acceptable reliability and validity (Pavot and Diener 1993; Beckie and Hayduk 1997).

The second measure is the CASP-12, *quality of life* scale, which is designed to capture quality of life in old age (Hyde, Wiggins, Higgs, et al. 2003). Participants indicate for twelve statements whether they apply on a scale from 1 (often) to 4 (never). The twelve questions concern four dimensions of quality of life, control, autonomy, pleasure and self-realization, resulting in an aggregate index ranging from 12 (low quality of life) to 48 (high quality of life). We normalize it such that it ranges from 0 (low quality of life) to 10 (high quality of life).

The third measure concerns the stated *Network satisfaction*. Respondents indicate on a scale from 0 (low satisfaction) to 10 (high satisfaction) how satisfied they are with their social network. If respondents indicated that there is no person with whom they discuss matters or there is no one who is important to them, they were asked how satisfied they were with this fact.

The fourth measure is the EURO-D depression score (Prince, Reischies, Beekman, et al. 1999; Prince, Beekman, Deeg, et al. 1999). It is an indicator for depressive symptoms and captures aspects of mental health in late life. It has been

Table 3.1: Survey questions for well-being and mental health measures.

Measure	Question
Life satisfaction	On a scale from 0 to 10 where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?
CASP-12[a]	How often, if at all, have you experienced the following feelings and thoughts over the past four weeks:
Control	How often do you think your age prevents you from doing the things you would like to do?
	How often do you feel that what happens to you is out of your control?
	How often do you feel left out of things?
Autonomy	How often do you think that you can do the things that you want to do?
	How often do you think that family responsibilities prevent you from doing what you want to do?
	How often do you think that shortage of money stops you from doing the things you want to do?
Pleasure	How often do you look forward to each day?
	How often do you feel that your life has meaning?
	How often, on balance, do you look back on your life with a sense of well-being?
Self-Realization	How often do you feel full of energy these days?
	How often do you feel that life is full of opportunities?
	How often do you feel that the future looks good for you?
Network satisfaction	Overall, how satisfied are you with the relationship that you have with the persons we have just talked about? Please answer on a scale from 0 to 10 where 0 means completely dissatisfied and 10 means completely satisfied. You indicated that there is no one with whom you discuss matters and no one who is important to you for some other reason. How satisfied are you with this on a scale of 0-10, where 0 means completely dissatisfied and 10 means completely satisfied?
EURO-D[b]	Earlier we talked about your physical health. Another measure of health is your emotional health or well-being that is, how you feel about things that happen around you.
Depression	In the last month, have you been sad or depressed?
Pessimism	What are your hopes for the future?
Suicidality	In the last month, have you felt that you would rather be dead?
Guilt	Do you tend to blame yourself or feel guilty about anything?[c]
Sleep	Have you had trouble sleeping recently?
Interest	In the last month, what is your interest in things?[d]
Irritability	Have you been irritable recently?
Appetite	What has your appetite been like?[e]
Fatigue	In the last month, have you had too little energy to do the things you wanted to do?
Concentration	How is your concentration? For example, can you concentrate on a television program, film or radio program?
Enjoyment	Can you concentrate on something you read?
Tearfulness	What have you enjoyed doing recently?

[a] Index generated from questions on 4 different dimensions. The total score ranges from 12 (low quality of life) to 48 (high quality of life). The response options for each item are: 1.Often, 2. Sometimes, 3. Rarely, and 4. Never.
[b] Index generated from questions on 12 different dimensions. The total score ranges from 0 (not depressed) to 12 (very depressed). The responses are coded as: 0. No indication and 1. There is indication of the respective dimension.
[c] If the answer is unclear the follow-up question is: So, for what do you blame yourself?
[d] If the answer is unclear the follow-up question is: So, do you keep up your interests?
[e] If the answer is unclear the follow-up question is: So, have you been eating more or less than usual?

demonstrated to provide a valid comparison of depressive symptoms across European countries (Castro-Costa, Dewey, Stewart, et al. 2008; Prince, Beekman, Deeg, et al. 1999). The EURO-D depression score is generated from questions on 12 dimensions: Depression, pessimism, suicidality, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness. Respondents are asked whether there is an indication for each of these dimensions. It results in

an aggregate index ranging from 0 (not depressed) to 12 (very depressed). We normalize it such that it ranges from 0 (very depressed) to 10 (not depressed) and call it *Lack of depressive symptoms*.

Table 3.2 presents the means of the well-being measures for different subgroups of the sample.

Table 3.2: Well-being and mental health measures.

	Life satisfaction	Quality of life (CASP-12)	Network satisfaction	Lack of depressive symptoms (EURO-D)
(1) All	7.57	6.97	8.84	7.86
(2) Male	7.66	7.10	8.77	8.27
(3) Female	7.50	6.87	8.89	7.54
(4) # obs.	52248	50512	52513	51941

Rows (1)-(3) report the means of the well-being and mental health measures for all respondents and by gender. Row (4) reports the number of observations for all respondents.

Fig. 3.1 presents the average of the well-being measures at each age until 91 (see Fig. 3.4 in Section 3.5 for the age distribution). While network satisfaction and life satisfaction remain relatively stable, the quality of life index and lack of depressive symptoms index decline beyond age 65. The graphs for male and female respondents are rather similar, except for the lack of depressive symptoms index; male respondents have on average a 0.73 points higher index ($p < 0.01$, Mann-Whitney-U test; Fig. 3.5 in Section 3.5).

3.2.4 Social support networks

A social support network can be characterized by its size and composition (percentage of partner, children, other relatives, and friends in the network) and relational dynamics. In Wave 4, the SHARE respondents are asked to answer questions about their social support network along the dimensions (1) size, (2) relationship, (3) contact frequency, (4) proximity, and (5) closeness. Table 3.3 provides the survey questions and possible answers and categories.

Figure 3.1: Average well-being and mental health measure. Average well-being and mental health measure for all ages from 50 to 91 years. After age 91 the number of available observations drops to less than 50.

In order to identify the members of their *social support network,* the respondents were asked to mention the name of persons with whom they discuss important matters. The total number of persons in the social support network is its *size.* It is possible to mention up to seven persons, however this boundary is only mentioned if it is reached. Only 3% of the respondents reach this boundary. Most respondents state one, two or three persons as members of their social support network (28% , 25% , and 20% of the respondents, respectively; details in Table 3.14 in Section 3.5). Evidence suggests that the number of network members is positively linked with life satisfaction (Tomini, Tomini, and Groot 2016), but that in old age the network is reduced to members with close contact (Fung, Carstensen, and Lang 2001).

The *composition* of a network refers to the relationship type between each member. A person who has daily contact with two children and a person who has daily

contact with two friends have a social support network of equal size and contact frequency, however, they have a different main source of social support. In a meta-analysis, Pinquart and Sörensen (2000) provide evidence that the quantity of social contacts with friends is more strongly related with subjective well-being than the quantity of social contacts with family. They argue that friends are voluntary relationships, and they are typically members of the same age group or share similar preferences. Still, especially in older age, spouses and children are a crucial part of networks. Later in life, parents desire open communication, but low interference in each other's lives thereby maintaining independence in old age and minimizing intergenerational conflicts (Blieszner and Mancini 1987). Brandt, Haberkern, and Szydlik (2009) analyzed the type of support between older parents, their children and professional providers. They found that children play a central role in providing help for their parents in the household and with paperwork. In Southern Europe, they are more likely to also take over regular medical care. There can also be differences within family structures. Shanas (1979) provides evidence that the immediate family (partner and children) is the major social support during illness, and the extended family (children, siblings, and other relatives) is the tie to the community.

There are different ways to determine these different types of networks. One way is to construct network types, in which people are similar along family status (e.g. marital status, number of children and close relatives) and network measures (e.g. number of close friends, frequency of contact with family and friends, and frequency of attending social events). Commonly, there are four to five network types identified which differ in their relationship with well-being and mental health (Litwin and Shiovitz-Ezra 2011; Fiori, Antonucci, and Cortina 2006; Li and Zhang 2015; Litwin 1998). Another way to determine network types is to use only characteristics of the social network as criterion variables and control for family status separately. Litwin and Stoeckel (2014) use size, composition and relational

dynamic measures of the network and identify six networks (Spouse, Children, Spouse and Children, Other Family, Friend, and Other). They show that the network types are related differently to quality of life and that the frequency of the network types differs across European countries. We will follow a different approach, by using solely network composition to determine network types (i.e., the relative relevance of spouses, children, friends and others), allowing us to control for network size and relational dynamic separately. We calculate network types for each country separately, taking cultural differences in network compositions into account.

We classify the possible relationships into five categories: (1) Partner, (2) Children, (3) Other Relatives, (4) Friends, and (5) Others. Each of these categories comprises all types of relationships related to the category itself, i.e. the category Partner also includes the relationship "mother/father in law" (Table 3.3). The *relationship share* of each category in the network of a respondent is measured by the sum of the occurrence of the category divided by the network size. For each respondent, the relationship shares of all relationship categories sum to one.

We use the relationship share to determine country-specific support network types according to the main source of social support. The respondents who indicate that there is no person with whom they discuss important matters are excluded. For the remaining respondents, we use hierarchical clustering with the Ward method (Ward 1963) method to determine clusters which are similar with respect to the relationship shares. We choose to cut at six clusters and label them Partner, Children, Other Relatives, Family, Friends, and Diverse network. Using five clusters would not allow us to distinguish between the friends and the diverse network. Using more than six clusters does not provide an additional distinct network type for all countries for the five relationship categories used.

Apart from size and composition, a network is also characterized by relational

Table 3.3: Survey questions for social support network characteristics.

Network Size	
Looking back over the last 12 months, who are the people with whom you most often discussed important things?	
(1) Please give me the first name of the person with whom you most often discuss things that are important to you.	
(2) Is there anyone (else) who is very important to you for some other reason?[a]	
Network Relationship	
What is his/her relationship to you?	
Partner	Spouse/partner, mother-in-law, father-in-law
Children	Child, step-child/your current partner's child, son-in-law, daughter-in-law, grandchild
Other Relatives	Mother, Father, Stepmother, Stepfather, Brother, Sister, Grandparent, Aunt, Uncle, Niece, Nephew, other relatives
Friends	Friend
Others	(Ex-)colleague/co-worker, neighbour, ex-spouse/partner, minister, priest, or other clergy, therapist or other professional helper, housekeeper/home health care provider, none of these
Network Contact	
During the past twelve months, how often did you have contact either personally, by phone or mail?	
(1) Daily[b], (2) Several times a week, (3) About once a week, (4) About every two weeks, (5) About once a month, (6) Less than once a month, and (7) Never	
Network Proximity	
Where does he/she live?	
Less than 1km	(1) In the same household (2) In the same building (3) Less than 1 kilometre away
1km to 5km	(4) Between 1 and 5 kilometres away
5km to 25km	(5) Between 5 and 25 kilometres away
25km to 100km	(6) Between 25 and 100 kilometres away
100km to 500km	(7) Between 100 and 500 kilometres away
More than 500km	(8) More than 500 kilometres away[c]
Network Closeness	
How close do you feel to him/her?	
(1) Not very close (2) Somewhat close (3) Very close (4) Extremely close	

We classify the possible answers for network relationship into five categories and network proximity into six categories (in italics). For network contact and network closeness we use the same categories as in the interview.

[a] The respondent can mention up to seven people. However, this boundary is not known in advance. Question (2) is repeated until the respondent answered that there is no one else important to him or he has already mentioned seven people.

[b] If the person mentioned is living in the same household, the question about the amount of contact is not asked. For that person, daily contact is assigned.

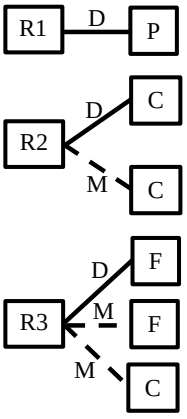
[c] For Belgium also the phrase "Living in another country" is used. We classify it as more than 500 km.

dynamics such as geographical proximity, contact frequency and interpersonal closeness. Frequent contact with one's children appears to be associated with less depressive symptoms, albeit irrelevant of geographical proximity (Buber and Engelhardt 2008). Closeness with the support network member affects the quality of the relationship. The number of close network members with frequent contact is positively related to less depressive symptoms (Oxman and Hull 1997). Especially elderly people rely on members of their immediate family (partner and children) during illness (Shanas 1979). SHARE provides different questions for these relational dynamics, which we use as controls in our analysis.

For contact frequency, the respondent is asked about the amount of contact with each person in his social support network over the last 12 months. The possible

answers are (1) daily, (2) several times a week, (3) about once a week, (4) about every two weeks, (5) about once a month, (6) less than once a month, and (7) never. We recode such that the measure ranges from 0 (never) to 6 (daily). As an overall measure of the amount of network contact of a respondent, we take the average over the answers for each person in his network and call it *contact index*. E.g., if the result is 6 it means that the respondent has daily contact with all persons in his network. If it is less than 6, he must have less than daily contact with at least some member of the network. The *contact share* is defined for each category (Daily, several times a week, about once a week, about every two weeks, about once a month, less than once a month, no contact in a year) as the sum of the occurrence of the category normalized by the network size. For each respondent, the contact shares of all contact categories sum to one. In Table 3.4 an example for the calculation of the measure is given.

Table 3.4: Example of network size, contact, and relationship measures.



Measure	R1	R2	R3
Network size	1	2	3
Contact index	6	4	3.33
Contact share			
Daily (D)	1	0.5	0.33
About once a month (M)	0	0.5	0.66
Relationship share			
Partner (P)	1	0	0
Children (C)	0	1	0.33
Friends (F)	0	0	0.66

R1: Respondent 1; R2: Respondent 2, R3: Respondent 3. Network size: number of persons mentioned by the respondent. Network contact categories: (0) Never, (1) Less than once a month, (2) About once a month, (3) About every two weeks, (4) About once a week, (5) Several times a week, and (6) Daily. Contact index: average over network contact categories. Contact share: for each network contact category the sum of occurrence divided by the network size. Network relationship categories: Partner, Children, Other relatives, Friends, Other. Relationship share: for each network relationship category the sum of occurrence divided by the network size

Similar measures are constructed for proximity and closeness. The respondent is asked how far the person lives and how close he feels to the person. The categories for closeness are (0) not very close (1) somewhat close (2) very close (3) extremely close; and for proximity (0) more than 500 km, (1) 100 km to 500 km, (2) 25 km to 100 km, (3) 5 km to 25 km, (4) 1 km to 5 km, and (5) less than 1 km. The average over the respective answers for each person in the respondent's network is the *proximity index* and *closeness index*. The *proximity share* and *closeness shares* are defined accordingly over the respective categories. Information on the correlation of marriage, the number of children, social network dimensions and well-being measures is given in Table 3.16 in Section 3.5. We observe that the correlations between features of the family status (e.g., married) and the respective network is positive but far from perfect. That is, both people with and without children may indicate that their social support network may predominantly consist of their partner (and similarly for the other network types).

For each country, a cluster is labelled as *Partner network*, *Children network*, *Other Relatives network*, *Friends network* or *Diverse network* if the mean of the relationship share (averaged over all people in the cluster) of the category Partner, Children, Other Relatives, Friends and Other is higher in that cluster than in all other clusters, respectively. The labeling of the clusters would mostly be unaffected if it were instead determined by the highest mean relationship share (averaged over all people in the cluster) within a cluster, i.e., comparing across relationship type. Additionally, we label a cluster with the highest sum of Partner share plus Children share plus Other Relatives share (excluding the clusters which are defined as Partner, Children, or Other Relatives network) as *Family networks*. A more formal definition for labeling the clusters and the country-specific average relationship shares is the following:

We have $k = 1, \ldots, 6$ clusters for each country. Let $\mathcal{N}_k$ be the set of respondents associated with cluster k and N_i be the network size of respondent i in cluster k.

We label each cluster in each country according to the following rules:

1. For each cluster k we calculate the average relationship share of each relationship R, where $R \in \{\text{Partner, Children, Other Relatives, Friends, Others}\}$:

$$avr\,(R)_k = \frac{1}{|\mathcal{N}_k|} \sum_{i \in \mathcal{N}_k} \frac{\#R_i}{N_i}$$

2. Then the clusters where $avr\,(\text{Partner})_k$ is highest is labelled as Partner Network type, where $avr\,(\text{Children})_k$ is highest is labelled as Children Network type, where $avr\,(\text{Other Relatives})_k$ is highest is labelled as Other Relatives Network type, and where $avr\,(\text{Friends})_k$ is highest is labelled as Friends Network type.

3. The cluster with the property that if excluding the Partner-, Children- and Other Relatives Cluster, it is the cluster with the highest average family relationship share. We label the cluster as the Family Network.

$$\frac{1}{|\mathcal{N}_k|} \sum_{i \in \mathcal{N}_k} \frac{\#\text{Partner}_i + \#\text{Children}_i + \#\text{Other Relatives}_i}{N_i}$$

4. The remaining cluster is labeled as the Diverse Network type.

We apply these rules for each country. We receive the same clusters if instead of finding the maximum over each cluster we find the maximum relationship share within each cluster and label the cluster accordingly. Exception is country Austria (AUT), there the Diverse network has the second highest of the Others relationship share (See Table 3.15). The country-specific average relationship shares are given in Table 3.15.

3.3 Results

3.3.1 Family status, well-being and mental health

We present results first in an aggregated way to illustrate the relevant patterns, and the robustness of the results with regards to confounding factors. Table 3.5 shows the associations of the three dimensions of well-being and mental health with family status (number of children, number of resident children, number of grandchildren and marital status) for all respondents (Panel I), male respondents (Panel II), and female respondents (Panel III), over all countries including country fixed effects (further country specific analysis are reported in Table 3.6).

The table shows the raw means for each well-being measure conditional on each explanatory variable. These simple averages demonstrate the observed patterns in an accessible way. The comparison of the raw mean values for the well-being measures gives an impression of the effects sizes of each explanatory variable. However, we indicate the significance of each comparison based on regression analyses of the dependent measure on the explanatory variables; the excluded category in the regression analyses is indicated in italics in the table. We show the significance level of the variable and the direction of the association, for the regressions including controls A and B, respectively. For each set of analyses, we also indicate the sample size of the raw means, which varies across analyses because of the variation in the number of respondents in the different modules of the SHARE surveys. We use ordinary least squares for all four measures for its ease of interpretation. Detailed results for each regression are in Tables 3.17 to 3.19 in Section 3.5.

Overall we observe that marriage is consistently positively correlated with well-being and lack of depressive symptoms. We find that children are positively correlated with well-being and lack of depressive symptoms. However, our analyses show that this overall positive association is due to children after they left home:

Table 3.5: Regressing well-being and mental health on family status for all countries.

	(I) Life satisfaction			(II) Quality of life (CASP-12)			(III) Network satisfaction			(IV) Lack of depressive symptoms (EURO-D)		
	N	Mean		N	Mean		N	Mean		N	Mean	
Panel I: All respondents												
Marriage												
Not married	15548	7.14		14902	6.67		15667	8.69		15477	7.50	
Married	36700	7.75	***A,B,+	35610	7.10	***A,B,+	36846	8.90	***A,B,+	36464	8.01	***A,+
Children												
No	4746	7.39		4569	6.92		4782	8.53		4731	7.81	
1	9613	7.37		9261	6.84	*A,+	9674	8.82	***A,B,+	9567	7.70	
2	21574	7.64	***A,B,+	20938	7.05	***A,B,+	21676	8.87	***A,B,+	21466	7.97	***A,**B,+
3 or more	16315	7.64	**A,+	15744	6.96	***A,+	16381	8.89	***A,B,+	16177	7.82	
Resident children			*A,***B,-			***A,B,-			*B,-			*B,-
Grandchildren			**B,+			***A,-			***A,B,+			***A,-
Panel II: Male respondents												
Marriage												
Not married	4576	7.17		4399	6.89		4610	8.42		4556	8.01	
Married	18271	7.78	***A,B,+	17750	7.15	***A,**B,+	18352	8.86	***A,B,+	18149	8.34	***A,+
Children												
No	2191	7.37		2114	6.99		2211	8.47		2186	8.15	
1	3885	7.49		3753	6.97	**A,+	3902	8.78	***A,*B,+	3855	8.18	
2	9595	7.73	***A,*B,+	9341	7.18	***A,**B,+	9642	8.81	***A,*B,+	9554	8.37	***A,*B,+
3 or more	7176	7.74	***A,+	6941	7.10	***A,+	7207	8.81	**A,+	7110	8.23	
Resident children						***A.B.-						
Grandchildren			**B,+			***A,-			***A,B,+			**A,-
Panel III: Female respondents												
Marriage												
Not married	10972	7.12		10503	6.58		11057	8.80		10921	7.29	
Married	18429	7.72	***A,B,+	17860	7.04	***A,B,+	18494	8.94	***A,B,+	18315	7.69	***A,+
Children												
No	2555	7.40		2455	6.85		2571	8.58		2545	7.53	
1	5728	7.29		5508	6.75		5772	8.85	***A,B,+	5712	7.39	*A,-
2	11979	7.57	**A,B,+	11597	6.95	**A,*B,+	12034	8.92	***A,B,+	11912	7.65	*B,+
3 or more	9139	7.56		8803	6.85		9174	8.95	***A,B,+	9067	7.50	
Resident children			**A,***B,-			***A,B,-						
Grandchildren						***A,-			***A,B,+			***A,-

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, +(-) indicates positive (negative) significant effect with the well-being and mental health measure; (I)-(IV) OLS Regression. Controls A: female, age, age^2, country dummy; Controls B: Controls A, divorced, widowed, education, urban character of residence, employment, self-employment, health status, medication for depressive symptoms, average monthly household income dummy for low, middle, upper middle, and high income (based on country-specific 25^{th}, 50^{th} and 75^{th} percentile of the average monthly household income reported in wave 2). Children: Dummy variable for having no children (excluded category), one child, two children, and three or more children. Resident children: Number of children living with their parents. If a respondent has no children then the value is set to 0. Grandchildren: Number of grandchildren. Married: Dummy variable if respondent is married or in registered partnership. Excluded category: Control A: Married but living separated from a spouse, never married, divorced, widowed, Control B: never married since a dummy variable for divorced and widowed is included in Control B. N indicates number of observations in each category for categorical variables.

we find negative effects for the number of resident children. Grandchildren correlate positively with life satisfaction and network satisfaction, but negatively with

quality of life and lack of depressive symptoms. While there are some differences in specific correlations, the overall picture is very similar for male and female respondents.

Social norms and customs concerning marriage, children and social networks in general might differ from country to country. As this might influence their effect on well-being and mental health, we control for differences across countries by conducting independent regressions for each country. Table 3.6 presents the country-specific results for all respondents using controls A.

Table 3.6: Regressing well-being and mental health on family status for each country.

	Married				1 child				2 children				3 or more children				Resident children				Grandchildren			
Country	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Austria	+	+	+	+	(+)	(+)	+	o	+	(+)	+	(+)	o	(+)	+	o	o	-	o	o	+	(-)	(+)	o
Belgium	+	+	+	+	o	o	(+)	o	o	o	+	o	o	o	+	o	o	o	o	o	o	o	o	o
Czech Rep.	+	+	+	+	o	o	o	o	(+)	o	o	o	o	o	o	o	o	o	o	o	o	o	+	o
Denmark	+	+	+	o	o	o	o	o	+	o	o	o	(+)	o	o	o	o	o	o	o	o	o	o	o
Estonia	+	+	+	+	o	(+)	+	o	+	+	+	+	+	+	+	+	-	-	o	-	o	o	+	-
France	+	+	o	+	-	-	+	-	o	o	+	o	o	o	+	o	o	-	o	o	(-)	-	o	o
Germany	+	+	+	o	o	o	o	o	o	o	o	o	o	o	o	o	-	o	o	o	-	o	o	-
Hungary	+	+	+	+	o	o	+	-	o	+	+	o	o	o	+	(-)	o	-	o	o	o	-	o	-
Italy	+	+	+	+	o	o	+	-	o	o	o	-	o	(-)	o	-	o	-	o	o	o	-	o	-
Netherlands	+	+	o	+	o	o	(+)	o	+	o	(+)	o	+	o	o	o	o	o	o	o	o	o	(+)	o
Poland	+	(+)	+	o	o	o	o	o	o	o	o	o	o	o	o	o	o	-	o	o	o	o	+	o
Portugal	+	o	+	o	o	o	o	o	(+)	(+)	o	o	(+)	+	o	o	o	-	o	o	-	-	o	-
Slovenia	+	+	(+)	+	o	o	+	o	o	o	o	o	o	o	o	o	o	o	o	o	o	(-)	+	(-)
Spain	+	+	+	+	o	o	+	o	o	+	+	o	o	o	+	o	o	-	o	-	o	-	o	-
Sweden	+	+	+	o	o	+	+	o	o	+	(+)	+	o	+	+	o	o	o	(+)	o	o	o	o	o
Switzerland	+	+	o	+	o	o	o	o	o	o	+	(+)	+	+	+	o	o	o	o	o	o	o	o	o

+/ - indicates positive/negative significant effect at 5% significance level; additionally (+),(-) indicates positive, or negative effect at 10% significance level, and o indicates that there is no significant effect at 10% level. Dependent Variables: (I) Life satisfaction, (II) CASP-12, (III) Network satisfaction, (IV) EURO-D. (I)-(IV) country-specific OLS Regression. Controls A: female, age, age2, country dummy. Children: A dummy variable for having no children (excluded category), one child, two children, and three or more children. Resident children: Number of children living with their parents. If a respondent has no children then the value is set to 0. Grandchildren: Number of grandchildren, Married: Dummy variable if respondent is married or in registered partnership. Excluded category: Married but living separated from a spouse, never married, divorced, widowed.

We indicated the sign and the significance of the different dimensions of parenthood and marriage for the four dependent measures. We observe that results are qualitatively consistent across countries, i.e., there are few sign contradictions.

However, there is clearly heterogeneity in the sense that we observe many null effects next to those effects replicating the overall effects shown in Table 3.5.

3.3.2 Social support networks

Table 3.7 presents the means of the network size, the composition measures, and relational dynamic measure of each category. For the distribution of the network size for each network type see Fig. 3.13. The Partner network is a rather distinct type. It consists only of the partner, i.e. has a size of one, and on average the contact share in the category daily has a value of 99% , i.e. the respondents have mostly daily contact. Respondents which are associated with a partner network typically feel extremely or very close with their partner.

The share of children in the network is highest for the Children network and the Family network. In both networks the second main source of support is the partner. The Children and Family network differ in terms of the means of the relationship shares and network size, while the average contact and closeness shares are quite similar.

The Other Relatives or Friends networks have a similar average contact share for the category daily or several times a week of 61% , while the Diverse network has on average a contact share of 69% in these two categories. For the Friends and Diverse network, on average 73% feel extremely or very close with the persons in the support network, while the Other Relatives network has an average closeness share of 81% in these two categories. The mean proximity share for each category is rather similar over all network types.

We have shown that network size, as well as contact, proximity, and closeness shares differ across network types on average (see Table 3.7). Fig. 3.2 presents the full distribution of the contact index for each network type (for the corresponding

graphical representations of the proximity and closeness indexes, see Fig. 3.7 and 3.8 in Section 3.5). Even network types which are rather similar with respect to the average contact shares such as the children and family networks, are rather different with respect to the individual network contact index. This means that the actual composition of the different contact categories in the individual social network is different for each network type, and we therefore include the contact, closeness, and proximity indexes as controls.

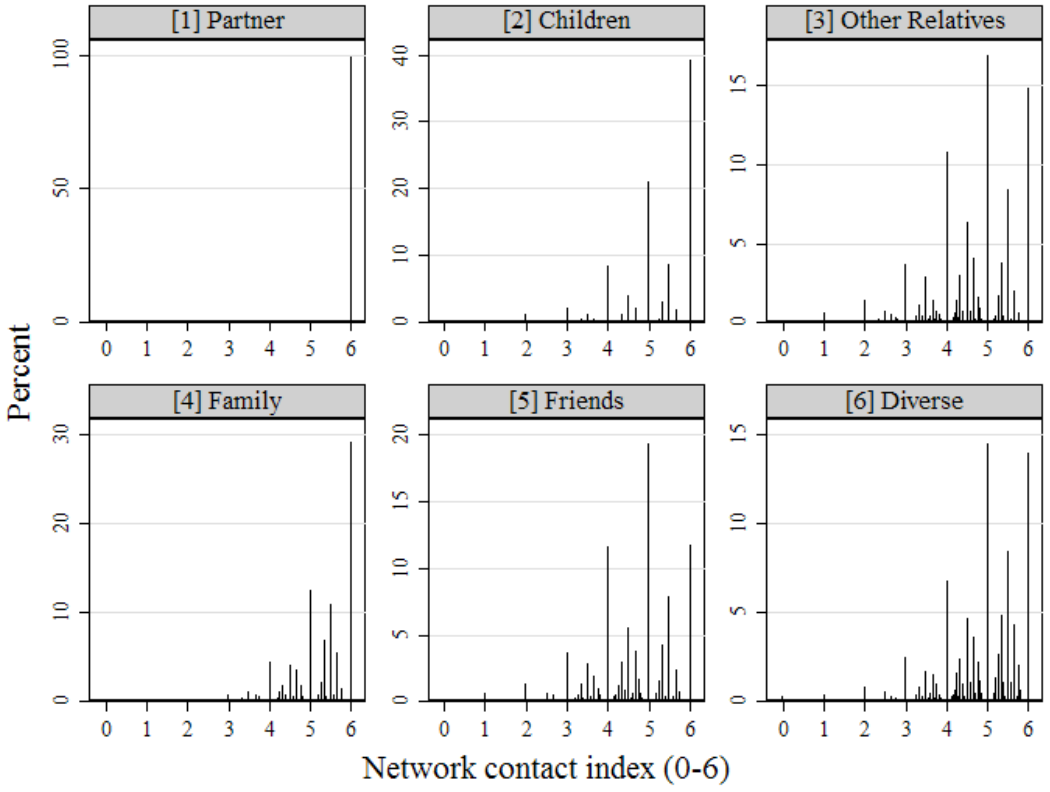


Figure 3.2: Distribution of the contact index by network type. Each value of the network contact index is represented by a line. The height of each line represents the percentage of the index having the respective value for a network type.

In Fig. 3.3 the distribution of the network types by gender is shown. The main difference between male and female subgroup regards the friends and family networks. While 26% of male respondents and 11% of female respondents are associated with a Friends network, 8% of male respondents and 15% of female respondents are associated with a Family network.

Table 3.7: Network characteristics by social network types.

	All	Partner	Children	Other relatives	Family	Friends	Diverse
	(1)	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)
Network size	2.60	1.00	1.93	2.88	3.21	2.95	3.53
Relationship share							
Partner	34%	100%	7%	18%	31%	14%	14%
Children	33%	0%	93%	11%	55%	10%	27%
Other Relatives	13%	0%	0%	58%	7%	8%	12%
Friends	16%	0%	0%	11%	7%	64%	12%
Others	6%	0%	0%	2%	1%	3%	34%
Contact index (0-6)	5.13	5.99	5.18	4.67	5.21	4.64	4.83
Contact share							
Never	0%	0%	0%	0%	0%	0%	0%
Less than once a month	2%	0%	1%	3%	1%	3%	3%
About once a month	4%	0%	3%	7%	3%	7%	6%
About every two weeks	6%	0%	4%	9%	5%	10%	7%
About once a week	13%	0%	14%	19%	13%	20%	15%
Several times a week	19%	0%	25%	22%	21%	26%	26%
Daily	56%	99%	53%	39%	58%	35%	43%
Closeness index (0-3)	2.25	2.50	2.35	2.12	2.38	1.99	2.04
Closeness share							
Not very close	1%	1%	1%	1%	1%	2%	4%
Somewhat close	14%	5%	9%	17%	9%	25%	24%
Very close	42%	38%	44%	49%	41%	46%	37%
Extremely close	42%	56%	46%	32%	49%	27%	36%
Proximity index (0-5)	3.99	4.98	3.69	3.51	3.90	3.74	3.86
Proximity share							
more than 500km	3%	0%	3%	4%	3%	3%	2%
100km - 500km	5%	0%	7%	9%	6%	5%	5%
25km - 100 km	8%	0%	11%	12%	9%	9%	9%
5km - 25km	15%	0%	19%	20%	15%	20%	19%
1km - 5km	13%	0%	16%	16%	13%	21%	16%
Less than 1km	56%	99%	44%	38%	54%	41%	48%
# obs.	50869	9254	6208	6894	13432	8498	6583
% obs.[a]	100%	18%	12%	14%	26%	17%	13%

Column (1) reports the percentages or means of respondents who have a social network and columns (C1)-(C6) for respondents associated with the respective network type. Network size: number of persons mentioned by the respondent. Relationship categories: Partner, Children, Other relatives, Friends, Other. Contact categories: (0) Never, (1) Less than once a month, (2) About once a month, (3) About every two weeks, (4) About once a week, (5) Several times a week, and (6) Daily. Closeness categories: (0) Not very close (1) Somewhat close (2) Very close (3) Extremely close. Proximity categories: (0) More than 500 km, (1) 100 km to 500 km, (2) 25 km to 100 km, (3) 5 km to 25 km, (4) 1 km to 5 km, and (5) Less than 1 km. Contact (closeness, proximity) index: it is defined for each respondent and is the average of the respective measure over all persons in his social support network. Relationship (contact, closeness, proximity) share: it is defined for each category of the measure and each respondent and is the sum of occurrence of each category divided by the size. Values from the same dimension may not add to 100% due to rounding.

[a] 1644 respondents report that they do not have a social network (see Table 3.14 in Section 3.5.)

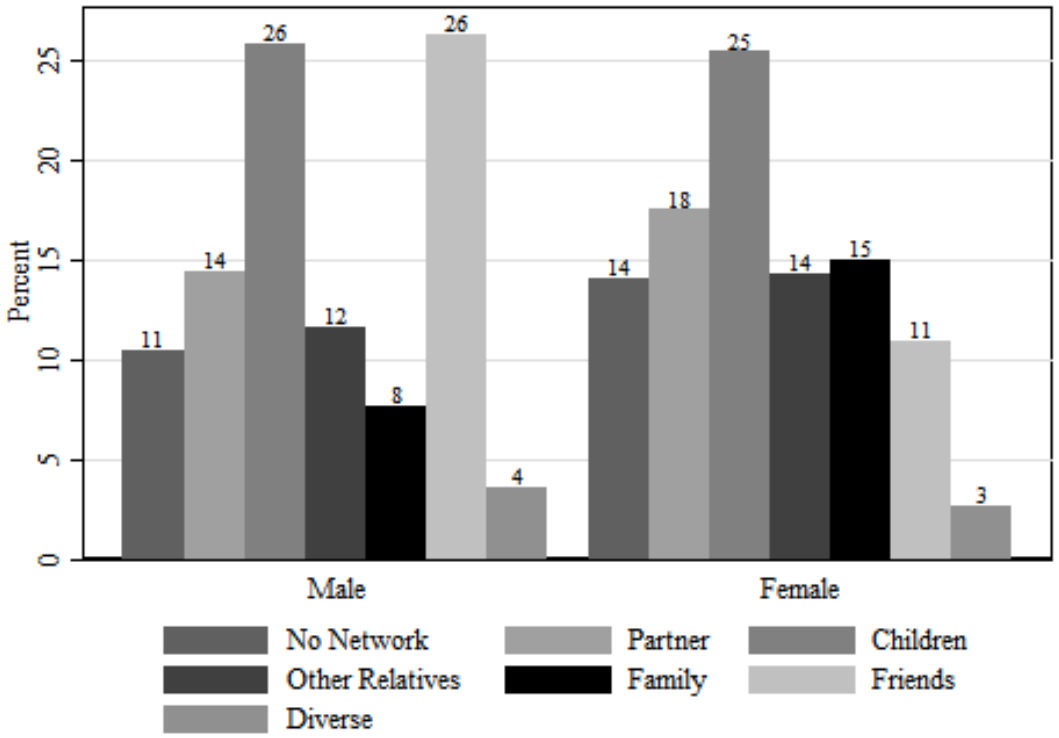


Figure 3.3: Distribution of social support network types by gender.

Table 3.8 presents the means of gender, age and family status and the number of observations for the different network types. There are 3% of the respondents who report to have no network. The No network type and Children network type are associated with the lowest share of respondents who are married. Most respondents who have no children are associated with the Other Relatives, the Friends, or the No network type. For the means of further demographic variables see Table 3.20 in Section 3.5.

3.3.3 Social network types, well-being and mental health

We can now turn to the relationship between network characteristic and well-being and mental health measures. Table 3.9 compares well-being and mental health for respondents who have a social support network, and those who have no network at all.

Table 3.8: Family status by social network types.

Network types	No Network	Partner	Children	Other relatives	Family	Friends	Diverse
	C0	C1	C2	C3	C4	C5	C6
Female	49%	35%	72%	61%	56%	61%	63%
Age at interview	67	65	71	63	66	64	65
Marital Status							
Married/registered partnership	50%	94%	41%	62%	86%	59%	60%
Divorced/living separated	15%	3%	12%	12%	6%	16%	14%
Widowed	23%	1%	45%	12%	7%	15%	19%
Parenthood							
Number of children	1.97	2.24	2.55	1.76	2.39	1.82	2.06
Having children	82%	92%	99%	77%	100%	83%	91%
No children	18%	8%	1%	23%	0%	17%	9%
One child	18%	15%	18%	18%	18%	21%	22%
Two children	35%	43%	40%	35%	47%	38%	41%
Three or more children	29%	33%	41%	24%	35%	24%	28%
Number of resident children	0.29	0.36	0.29	0.33	0.33	0.31	0.35
Having resident children	21%	24%	23%	23%	25%	22%	25%
No resident child[a]	75%	73%	77%	70%	75%	74%	72%
All children are resident[a]	8%	9%	5%	12%	7%	10%	10%
Number of grandchildren	2.59	2.60	3.89	1.85	2.97	1.91	2.36
Having grandchildren	64%	69%	87%	53%	79%	57%	66%
% obs.	3%	18%	12%	13%	26%	16%	13%

Columns (C0)-(C6) report the percentages or means of respondents associated with the respective network type. There are in total 52513 observations. Values from the same dimension may not add to 100% due to rounding.

We use the different network types as explanatory variable, and network size, family status variables and socioeconomic variables as controls (as in Table 3.5). We do not control for relational dynamics, because these measures are not defined for those who have no social support network. For the detailed results see Table 3.21 to Table 3.23 (regression results) and Table 3.24 (raw means conditional on network size) in Section 3.5.

We observe that, even after controlling for family status, all network types relate positively to measures of well-being, for both males and females. The effect is consistently observed for Life satisfaction and Network satisfaction. For CASP-12 the effect is observed for Partner and Friends network types for male respondents and for Partner, Family and Friends network types for female respondents. Interestingly, the positive relationship with Children network and Lack of depressive

Table 3.9: Regressing well-being and mental health on social support network types; controlling for network size and family status for all countries.

Dependent Variable	(I) Life satisfaction			(II) Quality of life (CASP-12)			(III) Network satisfaction			(IV) Lack of depressive symptoms (EURO-D)		
	N	Mean		N	Mean		N	Mean		N	Mean	
Panel I: All respondents												
Network type												
No network	1624	6.93		1555	6.48		1644	6.49		1615	7.59	
Partner	9209	7.71	***A,B,+	8944	7.05	***A,B,+	9254	8.98	***A,B,+	9145	8.21	***A,B,+
Children	6157	7.37	***A,B,+	5909	6.52		6208	9.10	***A,B,+	6116	7.49	***B,+
Other Relatives	6856	7.44	***A,B,+	6622	7.06	*B,+	6894	8.77	***A,B,+	6805	7.76	
Family	13381	7.77	***A,B,+	12989	7.05	*B,+	13432	9.05	***A,B,+	13316	7.98	*A.***B,+
Friends	8468	7.52	***A,B,+	8200	7.13	**B,+	8498	8.73	***A,B,+	8423	7.82	
Diverse	6553	7.5	***B,+	6293	6.92		6583	8.74	***A,B,+	6521	7.68	*A,-
Network size			***A,B,+			***A,B,+			***A,B,+			***A,**B,+
Panel I: Male respondents												
Network type												
No network	829	6.98		790	6.67		841	6.60		823	7.99	
Partner	5996	7.70	***A,B,+	5820	7.06	*A,B,+	6026	9.03	***A,B,+	5955	8.36	**A,B,+
Children	1755	7.77	***A,B,+	1695	7.03		1765	9.06	***A,B,+	1745	8.17	*B,+
Other Relatives	2656	7.47	***A,B,+	2576	7.15		2671	8.65	***A,B,+	2634	8.18	
Family	5895	7.77	***A,B,+	5732	7.07		5922	9.00	***A,B,+	5870	8.31	**B,+
Friends	3310	7.64	***A,B,+	3218	7.27	*A,B,+	3322	8.58	***A,B,+	3286	8.25	
Diverse	2406	7.65	**A,B,+	2318	7.16		2415	8.54	***A,B,+	2392	8.23	
Network size			***A,B,+			***A,B,+			***A,B,+			***A,+
Panel II: Female respondents												
Network type												
No network	795	6.88		765	6.29		803	6.38		792	7.18	
Partner	3213	7.71	***A,B,+	3124	7.03	***A,B,+	3228	8.90	***A,B,+	3190	7.93	***A,B,+
Children	4402	7.21	**B,+	4214	6.32		4443	9.12	***A,B,+	4371	7.22	**B,+
Other Relatives	4200	7.43	**B,+	4046	6.99		4223	8.84	***A,B,+	4171	7.49	
Family	7486	7.77	**A,***B,+	7257	7.04	*B,+	7510	9.10	***A,B,+	7446	7.72	***B,+
Friends	5158	7.45	*B,+	4982	7.05	*B,+	5176	8.82	***A,B,+	5137	7.55	
Diverse	4147	7.41	**B,+	3975	6.79		4168	8.86	***A,B,+	4129	7.36	
Network size			***A,B,+			***A,B,+			***A,B,+			***A,*B,+

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, +(-) indicates positive (negative) significant effect with the well-being measure; (I)-(IV) OLS Regression. Controls A: female, age, age^2, country dummy; Controls B: Controls A, divorced, widowed, education, household size, urban character of residence, retired, self-employment, health status, average monthly household income dummy for low, middle, upper middle, and high income (based on country-specific 25^{th}, 50^{th} and 75^{th} percentile of the average monthly household income reported in wave 2). Children, resident children, grandchildren and married included in both A and B. Network types: the excluded category is having no network. N indicates number of observations in each category for categorical variables.

symptoms mostly emerges only after inclusion of the full set of controls. Network size is positively related to all measures of well-being (Tomini, Tomini, and Groot 2016).

Table 3.10 shows results confined to respondents who indicated the presence of some social support network. For the detailed regression results see Table 3.25 to Table 3.27 in Section 3.5. The excluded category of the network type is the Partner network, which had consistently strong and significant associations in Table

3.9, and is taken as a benchmark here. We find that for Life satisfaction, CASP-12, and Lack of depressive symptoms, the more diverse networks have typically weaker effects than the Partner network, with the exception of the Friends network for CASP-12. In contrast, Network satisfaction is consistently higher for all other networks, except for the Diverse network. We also include network size, contact, closeness and proximity index. Fiori, Antonucci, and Cortina (2006) pointed out that support quality is an important factor for depressive symptoms. We find consistently that the closeness and contact measure is positively correlated with mental health and well-being. However, we observe a negative relationship of mere proximity with well-being and mental health. While for the associations with family status no relevant gender difference were observed, we observe that associations with network types differ for males and female respondents. For male respondents in most cases the effects of the network types are not significantly different from the Partner network. For the females, the above discussed associations show up significantly.

3.4 Discussion

In contrast to negative associations reported in many studies (for an overview see Hansen, Slagsvold, and Moum (2009), or the discussion in Nelson, Kushlev, English, et al. (2013) and Herbst and Ifcher (2016)), we find that children are positively correlated with well-being and lack of depressive symptoms, when controlling for residential status (resident children are negatively associated with well-being). This result is consistent with age-dependence in the correlation of children with well-being (Margolis and Myrskylä 2011; Mastekaasa 1994) and mental health (Buber and Engelhardt 2008; Hank and Wagner 2013). The results suggest that the finding of a negative link between children and well-being and mental health may not generalize to older people whose children have often left home already.

Table 3.10: Regressing well-being and mental health on social support network types; controlling for network size, relational dynamic measures, and family status for all countries.

	(I)	(II)	(III)	(IV)
Dependent Variable	Life satisfaction	Quality of life (CASP-12)	Network satisfaction	Lack of depressive symptoms (EURO-D)
Panel I: all respondents				
Network type[a]				
Children	***A,B,-	***A,B,-	***A,B,+	***A,*B,-
Other Relatives	***A,-		***A,B,+	***A,B,-
Family	***A,-	***A,-	***A,B,+	***A,-
Friends		***B,+	***A,B,+	***A,B,-
Diverse	***A,-	***A,-		***A,B,-
Network size	***A,B,+	***A,B,+	***A,B,+	***A,B,+
Contact Index	***A,B,+	***A,B,+	***A,B,+	**A,B,+
Closeness Index	***A,B,+	***A,B,+	***A,B,+	***A,B,+
Proximity Index	***A,-	***A,B,-	***A,B,-	**A,-
Panel II: male respondents[b]				
Network type [a]				
Children	*A,-	*A,-	***A,B,+	*A,-
Other Relatives		*B,+		*A,-
Family		*A,-		
Friends		***A,B,+		
Diverse				*A,-
Network size	***A,B,+	***A,B,+	***A,B,+	***A,*B,+
Contact Index	**A,B,+	**A,***B,+	***A,B,+	
Closeness Index	***A,B,+	***A,B,+	***A,B,+	***A,B,+
Proximity Index	**A,-	***A,-	***A,B,-	
Panel III: female respondents[b]				
Network type [a]				
Children	***A,B,-	***A,B,-	***A,B,+	***A,B,-
Other Relatives	***A,*B,-	***A,-	***A,B,+	***A,B,-
Family	***A,-	***A,**B,-	***A,B,+	***A,**B,-
Friends	***A,*B,-		***A,B,+	***A,B,-
Diverse	***A,*B,-	***A,*B,-	***A,B,+	***A,B,-
Network size	***A,B,+	***A,B,+	***A,B,+	***A,**B,+
Contact Index	***A,B,+	***A,B,+	***A,B,+	*A,B,+
Closeness Index	***A,B,+	***A,B,+	***A,B,+	***A,B,+
Proximity Index	**A,-	***A,**B,-	***A,B,-	**A,-

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, +(-) indicates positive (negative) significant effect with the well-being measure; (I)-(IV) OLS Regression. Controls A: female, age, age^2, country dummy; Controls B: Controls A, divorced, widowed, education, household size, urban character of residence, retired, self-employment, health status, average monthly household income dummy for low, middle, upper middle, and high income (based on country-specific 25^{th}, 50^{th} and 75^{th} percentile of the average monthly household income reported in wave 2). Children, resident children, grandchildren and married included in both A and B.

[a] Partner network is the excluded category

[b] Control female is excluded

As stress associated with balancing the competing demands of childcare, work and personal life decreases, once people get older and their children leave house, the importance of children as caregivers and social contacts might prevail. Evidence on grandchildren on the other hand is mixed: While they positively correlate with life and network satisfaction, this is not the case for depressive symptoms and perceived quality of life.

We observe that all types of networks have positive associations with our dependent measures over and beyond the direct effects of the underlying family status. Network characteristics such as size, closeness, contact frequency and proximity are also relevant indicators of well-being and mental health. For male respondents in most cases the effects of the network types are not significantly different from the Partner network. For female respondents, on the other hand, we observe more cases where associations of well-being and mental health with the Partner network type are significantly different from those for the other network types. Overall we find that especially the partner network is consistently positively correlated with well-being and mental health, despite the small network size of 1. This is in contrast to Litwin and Stoeckel (2013) and Litwin and Stoeckel (2014), who found that the Spouse network is not significantly related to well-being. However, because we control for network size separately, positive associations with size are captured by this variable. A remarkable feature of the findings in Table 8 is that network characteristics are positively associated with well-being and mental health even after controlling for the above-shown associations with family status indicators. That is, a healthy partner network captures more than just being married, as do other types of networks. This fits previous results suggesting that it is not being married per se, but being satisfied with the degree of reciprocity within the relationship that is associated with less depressive symptoms (Hank and Wagner 2013).

Taken together, our correlational results suggest that social networks may be important for well-being and mental health in old age. Spouses, partners and children are often the basis of long-lasting social networks, which can provide social support to elderly people. However, different forms of network may have similar effects, as especially for male respondents in our data suggest. This might derive from a level of trust and reciprocity implicit in all forms of networks. Networks may exert an influence on the person's life beyond the mere family status, for example by moderating influences of the environment on well-being. The direct association of family status with well-being and mental health may not capture such effects. Importantly, the current insights need to guide further research, with the next step the assessment of the causal direction of the reported associations. This will allow moving towards making recommendations for public policy to maintain the well-being and mental health of the elderly through social networks.

3.5 Supporting information

This section provides figures and tables with additional summary statistics and data analyses referred to in the main text.

3.5.1 Figures

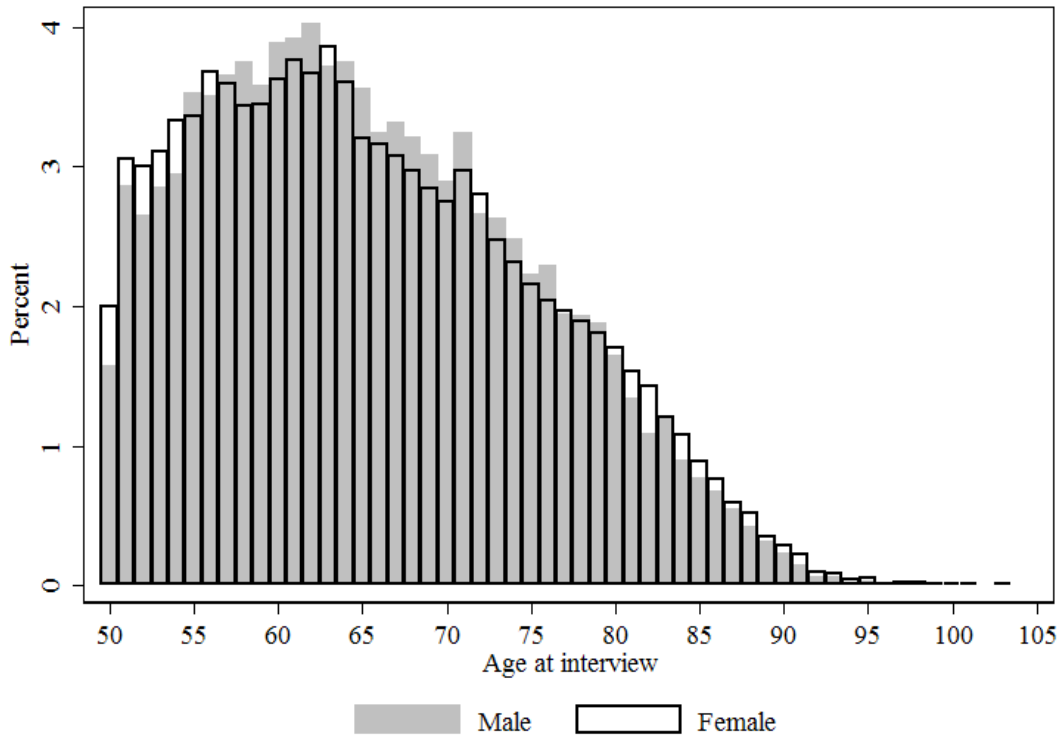


Figure 3.4: Age distribution. Percent of male (female) respondents for each age.

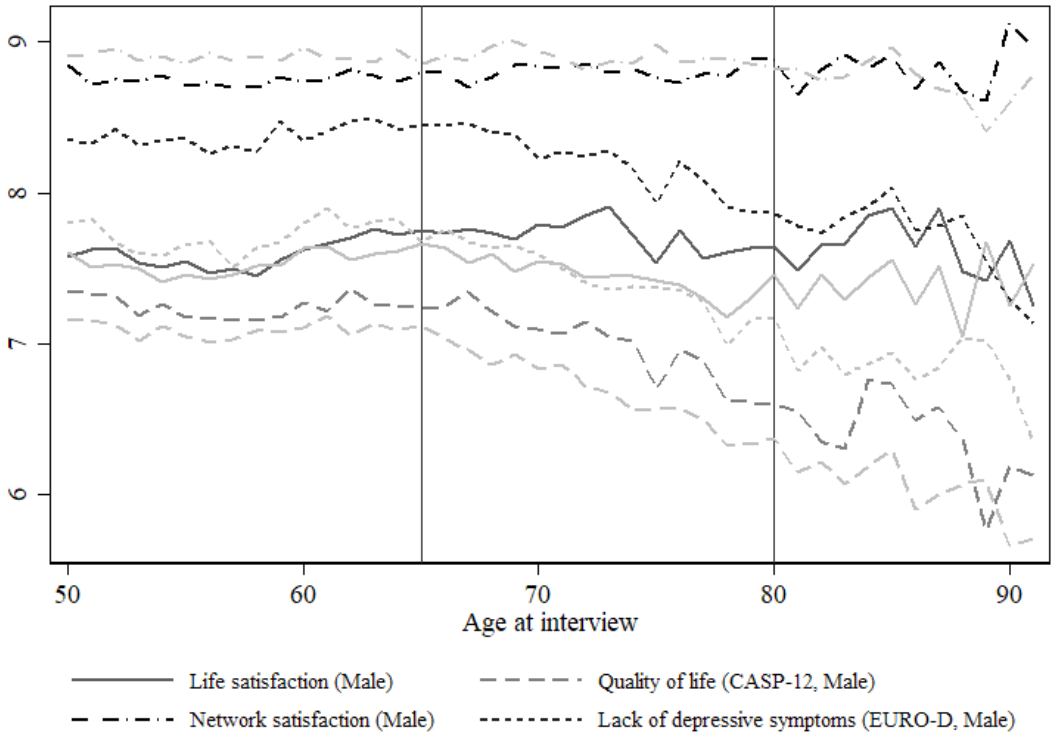


Figure 3.5: Average well-being and mental health measure, by gender. Average well-being and mental health measure for all ages from 50 to 91 years for male and female respondents. Male: black lines, Female: grey lines. After age 91 the number of available observations drops to less than 50

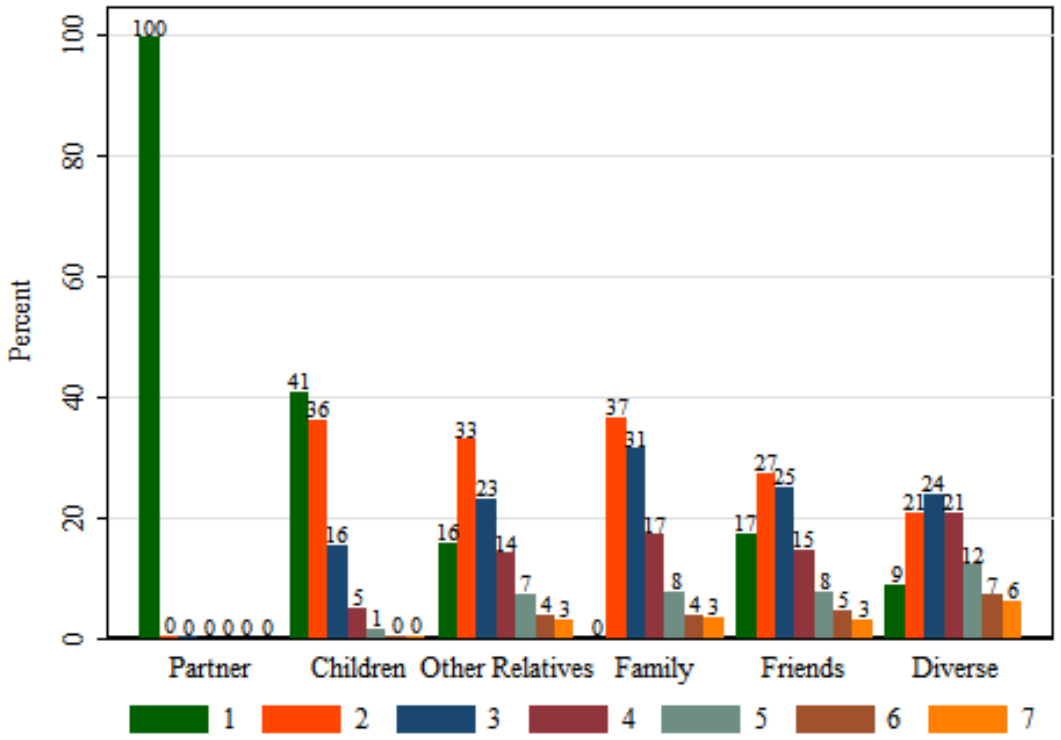


Figure 3.6: Network size by network type. For each network type, the size of the nth bar reflects the share of respondents having a network of size n, where $n = 1, \ldots, 7$.

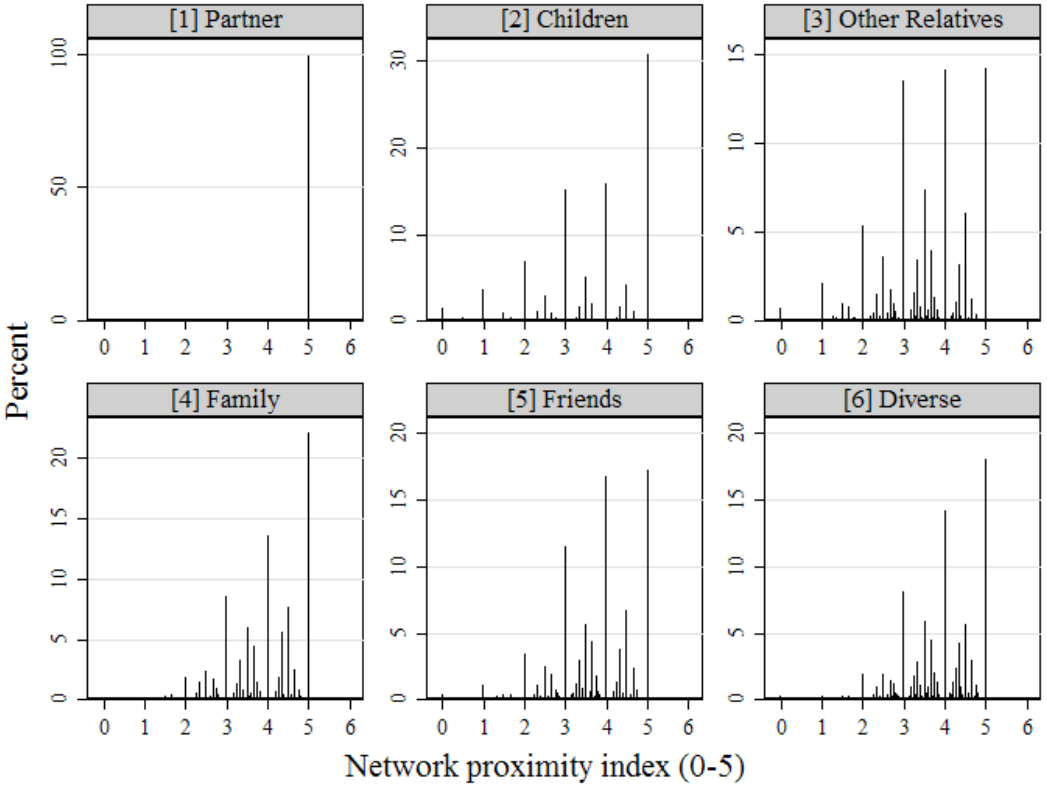


Figure 3.7: Distribution of the proximity index by network type. Each value of the network contact index is represented by a line. For each network type, the height of each line represents the percentage of the index having the respective value.

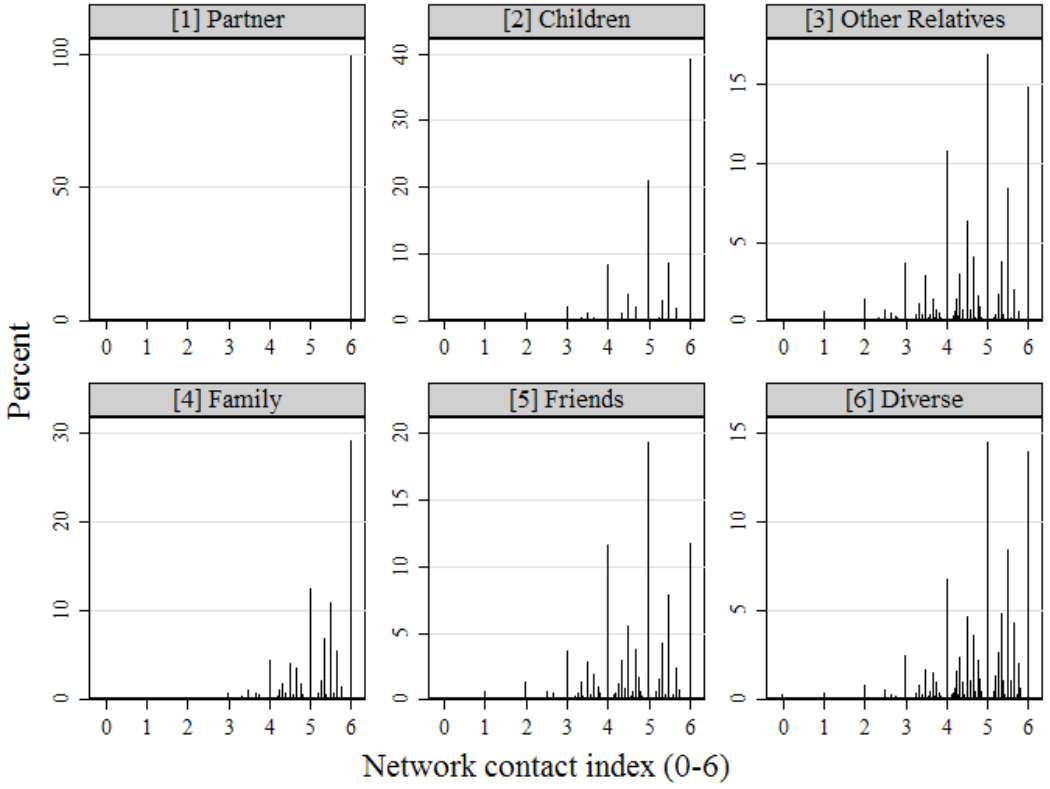


Figure 3.8: Distribution of the closeness index by network type. Each value of the network contact index is represented by a line. For each network type, the height of each line represents the percentage of the index having the respective value.

3.5.2 Tables

Table 3.11: Modules and Variables used from SHARE Release 6.0.0., Wave 4

Variable	Explanation
mergeid	Person identifier
coupleid	Couple identifier
country	Country of living
Coverscreen on individual level	
age_in	Age of respondent at the time of the interview
hhsize	Household size
gender	Gender of person living in the same household
yrbirth	Birth year of person living in the same household
relrpers	Relationship with person living in the household
fam_resp	Family respondent
hou_resp	Household respondent
Activities module	
ac012	How satisfied with life
Generated health variables module	
casp	CASP, quality of life (ac014-ac025)
eurod	EURO-D, depression scale (euro1-euro12, mh002-mh017)
Children module[a,b]	
ch001	Number of children
ch005	Gender of children
ch006	Year of birth of children
ch021	Number of grandchildren
Demographics module	
dn042	Male or female
dn014[b]	Marital Status
dn044	Marital Status has changed
Generated education variables module[b]	
isced1997_r	ISCED-97 coding of education
Employment and pension module	
ep005	Current job situation
ep009	Employed/Self-employed, current job
Generated housing variables module[c,b]	
areabldgi	Area of Living
Health module	
ph003	Health
ph011	Current Drugs
Household income module[c]	
hh017e	Average monthly income, last year
hh017v1	Average monthly income, low bracket
hh017v2	Average monthly income, middle bracket
hh017v3	Average monthly income, high bracket
hh017ub	Unfolding brackets, if respondent refuses to answer hh017e
Social network module	
sn005_1-sn005_7	Relationship with member of social network
sn006_1-sn006_7	Network Proximity
sn007_1-sn007_7	Network Contact
sn009_1-sn009_7	Network Closeness
sn012	How satisfied with network
sn017	If not having a network, how satisfied with that

[a] For each couple identifier the family respondent answers the question on behalf of the family.
[b] We use SHARE data from waves 1 (Börsch-Supan 2017a) and wave 2 (Börsch-Supan 2017b) which were administered between 2004 and 2005 and 2006 and 2007, respectively, to update responses which are coded as missing in the dataset of wave 4 because they did not change since wave 1 or 2.
[c] For each couple identifier the household respondent answers the question on behalf of the household.

Table 3.12: Number of observations and unfolding income brackets per country.

			Unfolding brackets in €			Percent of household income			
Country	# obs.	Percent	Low	Middle	High	[0,Low)	[Low,Middle)	[Middle,High)	[High,)
Austria	4808	9%	1500	2000	3000	30%	17%	24%	29%
Belgium	4844	9%	1500	2000	3000	28%	20%	24%	28%
Czech Republic	4898	9%	1629	2037	2851	84%	5%	2%	9%
Denmark	2074	4%	1342	2013	2684	9%	15%	16%	60%
Estonia	6330	12%	192	256	320	3%	4%	12%	81%
France	5111	10%	1500	2000	3000	33%	17%	23%	28%
Germany	1429	3%	1500	2000	3000	27%	21%	25%	27%
Hungary	2901	6%	1444	2166	2888	91%	2%	1%	6%
Italy	3317	6%	1500	2000	3000	45%	18%	18%	19%
Netherlands	2498	5%	1500	2000	3000	19%	22%	29%	30%
Poland	1486	3%	1418	1890	2363	82%	1%	1%	16%
Portugal	1837	3%	1500	2000	3000	64%	10%	7%	19%
Slovenia	2600	5%	1500	2000	3000	69%	12%	7%	11%
Spain	3081	6%	1500	2000	3000	57%	12%	10%	21%
Sweden	1816	3%	1108	2215	3323	7%	30%	30%	32%
Switzerland	3483	7%	1620	2025	2430	10%	5%	6%	79%
Total	52513								

Low, Middle, and High are the 25^{th}, 50^{th}, and 75^{th} percentile of the reported household incomes from SHARE wave 2 (Field time 2006-2007). If a respondent refuses to state the amount of the overall income, after tax that the entire household had in an average month of the last year the interviewer asks the following questions, starting with the lowest threshold: Do you earn a) more than this amount, b) less than this amount or c) approximately this amount. The boundaries of the intervals are the respective country-specific 25^{th}, 50^{th}, and 75^{th} percentile of the reported household incomes from SHARE wave 2 which are used as unfolding brackets in SHARE wave 4.

Table 3.13: Summary statistics of demographic variables.

	All (1)	Male (2)	Female (3)	All (4)
Female	56%	0%	100%	52513
Age at interview	66	66	66	52513
Parenthood				
Number of children	2.15	2.16	2.15	52513
Having children	91%	90%	91%	52513
No children	9%	10%	9%	52513
One child	18%	17%	20%	52513
Two children	41%	42%	41%	52513
Three or more children	31%	31%	31%	52513
Number of resident children[a]	0.33	0.36	0.31	52513
Having resident children	24%	24%	23%	52513
No resident child[b]	74%	73%	75%	47731
All children are resident[b]	9%	10%	8%	47731
Number of grandchildren	2.61	2.43	2.74	52513
Having grandchildren	69%	66%	71%	52513
Marital Status				
Married/registered partnership	70%	80%	63%	52513
Divorced/living separated	10%	8%	11%	52513
Widowed	14%	6%	21%	52513
Housing				
Household size	2.16	2.28	2.06	52513
Big city	14%	14%	15%	50879
Suburbs of big city	10%	11%	10%	50879
Large town	16%	16%	17%	50879
Small town	24%	24%	24%	50879
Rural area/village	35%	36%	34%	50879
Average monthly household income				
Low income	38%	35%	41%	48736
Middle income	13%	13%	12%	48736
Upper middle income	15%	15%	15%	48736
High income	34%	37%	32%	48736
Employed	25%	26%	23%	52466
Self-employed	6%	8%	4%	52466
Education[c]				
None	3%	2%	3%	52179
Primary school	19%	17%	21%	52179
Lower secondary school	19%	18%	21%	52179
Upper secondary school	34%	37%	32%	52179
Post-secondary non-tertiary education	5%	5%	5%	52179
First stage tertiary education	19%	21%	18%	52179
Second stage tertiary education	1%	1%	1%	52179
Health status				
Poor	12%	11%	13%	52500
Fair	30%	28%	31%	52500
Good	35%	36%	35%	52500
Very good	16%	18%	15%	52500
Excellent	7%	7%	6%	52500
Medication for depressive symptoms[d]	13%	8%	17%	52461

Columns (1)-(3) report the percentages or means of all respondents, and by gender. Column (4) shows the total number of observations. Values from the same dimension may not add to 100% due to rounding.

[a] Percentage conditional on having a child.

[b] The number of resident children is inferred from matching the age/gender information from the persons living with the family (Coverscreen module) and the age/gender information from the children of the respondents (Children module).

[c] SHARE is using the international classification of education ISCED-97 with which education can be classified according to internationally agreed set of definitions and concepts (Hoffmeyer-Zlotnik and Wolf 2003).

[d] Medication for depressive symptoms is equal to one if the respondent takes drugs for sleeping problems, anxiety or depression.

Table 3.14: Frequency of network size over all countries.

Network size	# obs.	Percent
0	1644	3%
1	14903	28%
2	13186	25%
3	10465	20%
4	6189	12%
5	3067	6%
6	1692	3%
7	1367	3%
Total	52513	

The network size is derived from the following questions: (1) Please give me the first name of the person with whom you most often discuss things that are important to you. (2) Is there anyone (else) who is very important to you for some other reason? Question (2) is repeated until the respondent answered that there is no one else important to him or he has already mentioned seven people.

Table 3.15: Average relationship share by network type for each country.

	Partner	Children	Other Relatives	Family	Friends	Diverse	Partner	Children	Other Relatives	Family	Friends	Diverse
AUT							**BEL**					
Network size	1.00	1.97	2.08	2.98	3.25	4.30	1.01	1.76	3.47	3.34	2.88	3.42
Relationship												
Partner	100%	0%	22%	38%	15%	11%	100%	0%	15%	25%	12%	12%
Children	0%	100%	0%	62%	8%	47%	0%	100%	6%	53%	4%	23%
Other relatives	0%	0%	78%	0%	15%	14%	0%	0%	51%	12%	4%	4%
Friends	0%	0%	0%	0%	52%	21%	0%	0%	20%	10%	79%	11%
All others	0%	0%	0%	0%	9%	6%	0%	0%	8%	0%	1%	49%
Contact index (0-6)	5.98	5.13	4.91	5.42	4.70	4.81	5.98	4.98	4.38	5.00	4.23	4.55
Closeness index (0-3)	2.84	2.73	2.51	2.84	2.39	2.61	2.64	2.41	2.10	2.36	1.98	1.92
Proximity index (0-5)	4.98	3.84	3.74	4.09	3.74	3.56	4.95	3.53	3.53	3.83	3.55	3.89
# obs.	870	411	240	932	1148	1138	532	365	1149	1295	770	583
% obs.	18%	9%	5%	20%	24%	24%	11%	39%	8%	21%	16%	4%
CHE							**CZE**					
Network size	1.00	2.58	2.21	4.35	2.93	3.65	1.01	1.68	2.16	2.94	2.69	2.74
Relationship												
Partner	100%	29%	29%	14%	21%	15%	100%	0%	19%	35%	12%	14%
Children	0%	71%	0%	41%	0%	2%	0%	100%	1%	57%	21%	19%
Other relatives	0%	0%	69%	15%	15%	10%	0%	0%	70%	7%	4%	6%
Friends	0%	0%	0%	24%	64%	24%	0%	0%	10%	0%	63%	6%
All others	0%	0%	1%	6%	0%	49%	0%	0%	0%	0%	0%	55%
Contact index (0-6)	5.99	4.99	4.60	4.44	4.30	4.22	5.99	5.12	4.71	5.21	4.76	4.85
Closeness index (0-3)	2.25	2.08	1.88	1.84	1.72	1.52	2.53	2.51	2.21	2.54	1.98	1.94
Proximity index (0-5)	4.96	3.77	3.47	3.40	3.54	3.58	4.98	3.83	3.81	4.05	3.95	4.12
# obs.	481	594	270	903	821	307	1094	639	344	1376	801	452
% obs.	14%	18%	8%	27%	24%	9%	23%	14%	7%	29%	17%	10%
DEU							**DNK**					
Network size	1.00	1.80	3.22	3.24	2.92	3.75	1.00	2.37	3.22	4.07	2.48	2.96
Relationship												
Partner	100%	0%	18%	30%	20%	14%	100%	30%	23%	14%	25%	26%
Children	0%	100%	7%	53%	3%	27%	0%	70%	0%	40%	0%	0%
Other relatives	0%	0%	53%	9%	3%	5%	0%	0%	50%	14%	0%	11%
Friends	0%	0%	16%	8%	73%	13%	0%	0%	25%	24%	74%	12%
All others	0%	0%	6%	0%	1%	41%	0%	0%	3%	9%	1%	51%
Contact index (0-6)	6.00	4.90	4.48	4.99	4.27	4.57	5.99	5.08	4.30	4.58	4.53	4.70
Closeness index (0-3)	2.27	2.09	1.90	2.09	1.76	1.64	2.78	2.45	2.17	2.21	2.15	1.82
Proximity index (0-5)	4.99	3.46	3.34	3.71	3.56	3.86	4.99	3.58	3.28	3.27	3.80	3.82
# obs.	191	110	193	607	151	142	322	351	379	519	268	189
% obs.	14%	8%	14%	44%	11%	10%	16%	17%	19%	26%	13%	9%
ESP							**EST**					
Network size	1.00	1.87	1.89	3.14	3.15	3.23	1.00	1.60	3.16	2.66	2.98	3.31
Relationship												
Partner	100%	0%	16%	33%	14%	11%	100%	0%	17%	41%	12%	11%
Children	0%	100%	0%	57%	17%	21%	0%	100%	30%	59%	20%	23%
Other relatives	0%	0%	83%	10%	11%	9%	0%	0%	49%	0%	9%	9%
Friends	0%	0%	0%	0%	57%	9%	0%	0%	4%	0%	57%	9%
All others	0%	0%	1%	0%	1%	50%	0%	0%	0%	0%	1%	48%
Contact index (0-6)	6.00	5.66	5.40	5.63	5.24	5.26	5.99	5.05	4.77	5.37	4.66	4.71
Closeness index (0-3)	2.62	2.55	2.42	2.55	2.23	2.14	2.14	2.05	1.92	2.07	1.71	1.60
Proximity index (0-5)	4.99	4.19	4.24	4.33	4.26	4.22	4.99	3.32	3.33	3.83	3.62	3.78
# obs.	559	335	241	1077	610	228	1233	742	1194	1099	1168	734
% obs.	18%	11%	8%	35%	20%	7%	20%	12%	19%	18%	19%	12%

	Partner	Children	Other Relatives	Family	Friends	Diverse	Partner	Children	Other Relatives	Family	Friends	Diverse
FRA							**HUN**					
Network size	1.01	1.83	2.94	3.22	3.12	3.32	1.01	1.96	2.40	2.79	2.95	3.95
Relationship												
Partner	100%	0%	16%	29%	10%	11%	100%	0%	21%	40%	18%	15%
Children	0%	100%	19%	54%	5%	22%	0%	100%	0%	60%	28%	41%
Other relatives	0%	0%	56%	1%	7%	13%	0%	0%	65%	0%	0%	23%
Friends	0%	0%	10%	15%	72%	4%	0%	0%	10%	0%	53%	5%
All others	0%	0%	0%	0%	7%	50%	0%	0%	4%	0%	0%	16%
Contact index (0-6)	5.99	4.86	4.57	4.98	4.34	4.66	5.99	5.39	5.02	5.62	5.02	5.13
Closeness index (0-3)	2.45	2.19	2.14	2.24	1.87	1.77	2.65	2.54	2.27	2.64	2.22	2.31
Proximity index (0-5)	4.96	3.05	3.14	3.46	3.40	3.66	4.99	3.96	3.88	4.23	4.05	3.93
# obs.	648	503	1169	1018	971	554	363	408	216	949	262	656
% obs.	13%	10%	24%	21%	20%	11%	13%	14%	8%	33%	9%	23%
ITA							**NLD**					
Network size	1.01	1.61	2.33	2.89	2.55	3.61	1.00	1.74	3.12	3.34	2.88	3.48
Relationship												
Partner	100%	0%	19%	39%	4%	20%	100%	0%	22%	27%	20%	17%
Children	0%	100%	0%	60%	2%	33%	0%	100%	5%	50%	3%	17%
Other relatives	0%	0%	69%	0%	4%	17%	0%	0%	55%	10%	5%	11%
Friends	0%	0%	12%	0%	86%	18%	0%	0%	18%	12%	71%	13%
All others	0%	0%	0%	0%	4%	11%	0%	0%	1%	0%	1%	43%
Contact index (0-6)	6.00	5.70	5.23	5.77	4.94	5.36	6.00	4.88	4.32	4.90	4.31	4.47
Closeness index (0-3)	2.53	2.41	2.10	2.52	1.92	2.21	2.87	2.63	2.40	2.64	2.24	2.14
Proximity index (0-5)	4.98	4.19	4.04	4.37	3.96	4.10	4.99	3.36	3.45	3.72	3.76	3.76
# obs.	582	362	341	714	273	818	432	167	411	795	325	350
% obs.	19%	12%	11%	23%	9%	26%	17%	7%	17%	32%	13%	14%
POL							**PRT**					
Network size	1.00	1.94	2.59	3.06	1.98	2.59	1.00	1.89	2.37	3.16	3.40	1.17
Relationship												
Partner	100%	0%	13%	31%	14%	12%	100%	0%	24%	32%	14%	0%
Children	0%	100%	5%	56%	0%	24%	0%	100%	4%	59%	19%	0%
Other relatives	0%	0%	60%	8%	0%	4%	0%	0%	72%	7%	14%	0%
Friends	0%	0%	15%	5%	86%	0%	0%	0%	0%	0%	44%	0%
All others	0%	0%	7%	0%	0%	61%	0%	0%	0%	2%	8%	100%
Contact index (0-6)	6.00	5.42	4.97	5.44	4.83	5.00	6.00	5.50	5.21	5.61	5.20	5.30
Closeness index (0-3)	2.45	2.35	2.04	2.40	1.69	1.69	2.72	2.53	2.37	2.50	2.05	1.70
Proximity index (0-5)	5.00	4.26	4.13	4.17	4.31	4.49	4.98	3.78	4.06	4.14	3.89	4.53
# obs.	368	287	127	521	53	74	343	232	149	692	352	35
% obs.	26%	20%	9%	36%	4%	5%	19%	13%	8%	38%	20%	2%
SVN							**SWE**					
Network size	1.00	1.50	2.60	2.72	2.68	2.77	1.01	2.49	2.67	3.96	2.17	2.67
Relationship												
Partner	100%	0%	17%	39%	14%	13%	100%	29%	20%	10%	26%	19%
Children	0%	100%	14%	59%	9%	15%	0%	71%	0%	44%	0%	0%
Other relatives	0%	0%	64%	2%	6%	9%	0%	0%	57%	16%	0%	11%
Friends	0%	0%	5%	1%	68%	3%	0%	0%	23%	24%	74%	14%
All others	0%	0%	0%	0%	3%	60%	0%	0%	0%	6%	0%	56%
Contact index (0-6)	5.99	5.56	5.10	5.71	4.89	4.97	6.00	5.07	4.43	4.64	4.66	4.72
Closeness index (0-3)	2.25	2.19	2.14	2.23	1.90	1.75	2.58	2.24	1.91	2.04	2.00	1.69
Proximity index (0-5)	4.98	4.13	4.06	4.48	4.04	4.37	5.00	3.36	2.92	3.09	3.52	3.61
# obs.	932	242	253	418	361	203	304	460	218	517	164	120
% obs.	39%	10%	11%	17%	15%	8%	17%	26%	12%	29%	9%	7%

Table 3.16: Correlation of family status, social network characteristics, well-being and mental health.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Number of children															
2	Number of resident children	0.23														
3	Married/registered partnership	0.14	0.11													
4	Life satisfaction	0.03	-0.01	0.15												
5	Quality of life (CASP-12)		-0.03	0.11	0.57											
6	Network satisfaction	0.05		0.07	0.25	0.18										
7	Lack of depressive symptoms (EURO-D)		0.01	0.12	0.44	0.55	0.12									
8	Network size	0.08	0.02	0.03	0.10	0.12	0.11	0.02								
	Relationship share															
9	Partner	0.05	0.05	0.47	0.08	0.06	0.05	0.14	-0.44							
10	Children	0.20	-0.01	-0.16	-0.04	-0.11	0.11	-0.08	0.19	-0.44						
11	Other Relatives	-0.17		-0.16	-0.03	0.01	-0.04	-0.03	0.14	-0.30	-0.28					
12	Friends	-0.12	-0.03	-0.19		0.07	-0.09	-0.01	0.17	-0.36	-0.32	-0.10				
13	Others	-0.07	-0.03	-0.13	-0.06	-0.04	-0.11	-0.06	0.06	-0.21	-0.18	-0.06	-0.08			
14	**Contact Index (0-6)**	0.06	0.13	0.21	0.01	-0.05	0.18	0.02	-0.36	0.50	0.01	-0.25	-0.35	-0.15		
15	**Closeness Index (0-3)**	0.08	0.05	0.14	0.14	0.08	0.35	0.08	-0.09	0.24	0.13	-0.10	-0.25	-0.25	0.35	
16	**Proximity Index (0-5)**	0.04	0.16	0.22		-0.07	0.03	0.02	-0.34	0.51	-0.20	-0.24	-0.19	-0.02	0.58	0.16

Correlations with a p-value smaller than 0.05 are shown. Network size: number of persons mentioned by the respondent. Relationship categories: Partner, Children, Other relatives, Friends, Other. Contact categories: (0) Never, (1) Less than once a month, (2) About once a month, (3) About every two weeks, (4) About once a week, (5) Several times a week, and (6) Daily. Closeness categories: (1) Not very close (2) Somewhat close (3) Very close (4) Extremely close. Proximity categories: (0) More than 500 km, (1) 100 km to 500 km, (2) 25 km to 100 km, (3) 5 km to 25 km, (4) 1 km to 5 km, and (5) Less than 1 km. Contact (closeness, proximity) index: it is defined for each respondent and is the average of the respective measure over all persons in his social support network. Relationship share: it is defined for each category of the measure and each respondent and is the sum of occurrence of each category divided by the size.

Table 3.17: Regressing well-being and mental health on family status for all countries, all respondents.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Married/registered partnership	0.56***	0.44***	0.30***	0.20***	0.21***	0.26***	0.28***	0.039
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.321)
[1] Having 1 child	0.0046	-0.025	0.066*	0.028	0.22***	0.17***	-0.043	-0.015
	(0.891)	(0.466)	(0.035)	(0.362)	(0.000)	(0.000)	(0.206)	(0.651)
[2] Having 2 children	0.18***	0.11***	0.19***	0.11***	0.24***	0.19***	0.11***	0.095**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)
[3] Having 3 or more children	0.11**	0.057	0.13***	0.051	0.23***	0.17***	0.021	0.019
	(0.001)	(0.113)	(0.000)	(0.123)	(0.000)	(0.000)	(0.555)	(0.588)
Number of resident children	-0.031*	-0.054***	-0.097***	-0.12***	-0.016	-0.023*	-0.020	-0.027*
	(0.019)	(0.000)	(0.000)	(0.000)	(0.130)	(0.047)	(0.152)	(0.033)
Number of grandchildren	-0.0050	0.010**	-0.022***	-0.00015	0.015***	0.018***	-0.020***	-0.0022
	(0.173)	(0.003)	(0.000)	(0.961)	(0.000)	(0.000)	(0.000)	(0.521)
Controls								
Female	-0.030	0.053***	-0.15***	-0.041**	0.14***	0.15***	-0.65***	-0.51***
	(0.056)	(0.001)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
Age at interview	0.023*	0.043***	0.12***	0.13***	-0.013	-0.0099	0.12***	0.11***
	(0.030)	(0.000)	(0.000)	(0.000)	(0.136)	(0.307)	(0.000)	(0.000)
Age at interview, squared	-0.00014	-0.00015	-0.0010***	-0.00098***	0.000088	0.000078	-0.00100***	-0.00077***
	(0.068)	(0.062)	(0.000)	(0.000)	(0.166)	(0.265)	(0.000)	(0.000)
sh_country==[2]BEL	-0.53***	-0.45***	-0.78***	-0.65***	-0.65***	-0.65***	-0.49***	-0.29***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.094**	-0.12***	0.26***	0.029	-0.36***	-0.39***	-0.011	-0.20***
	(0.005)	(0.000)	(0.000)	(0.375)	(0.000)	(0.000)	(0.758)	(0.000)
sh_country==[4]CZE	-0.99***	-0.62***	-1.44***	-1.00***	-0.42***	-0.37***	-0.24***	0.13***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[5]DEU	-0.56***	-0.46***	-0.27***	-0.15***	-0.43***	-0.42***	-0.26***	-0.14**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.002)
sh_country==[6]DNK	0.27***	0.021	0.24***	-0.033	0.061	-0.00070	0.15***	-0.031
	(0.000)	(0.589)	(0.000)	(0.343)	(0.052)	(0.983)	(0.000)	(0.437)
sh_country==[7]ESP	-0.76***	-0.37***	-1.10***	-0.54***	-0.31***	-0.25***	-0.69***	-0.21***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.58***	-1.24***	-1.23***	-0.80***	-0.45***	-0.38***	-0.95***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-1.01***	-0.84***	-0.54***	-0.29***	-0.58***	-0.56***	-0.68***	-0.40***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.60***	-1.03***	-1.38***	-0.68***	-0.17***	-0.10*	-0.95***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.012)	(0.000)	(0.000)
sh_country==[11]ITA	-0.74***	-0.51***	-1.68***	-1.37***	-0.39***	-0.36***	-0.62***	-0.37***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.29***	-0.35***	0.24***	0.19***	-0.62***	-0.65***	0.076	0.069
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.054)	(0.069)
sh_country==[13]POL	-0.93***	-0.36***	-1.20***	-0.53***	-0.25***	-0.17***	-1.03***	-0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
sh_country==[14]PRT	-1.31***	-0.64***	-2.16***	-1.32***	-0.095*	0.098*	-1.17***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.020)	(0.000)	(0.000)
sh_country==[15]SVN	-0.89***	-0.60***	-0.17***	0.22***	-0.44***	-0.39***	-0.38***	-0.12**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
sh_country==[16]SWE	0.031	-0.10*	-0.20***	-0.31***	-0.086*	-0.13***	0.024	-0.017
	(0.456)	(0.015)	(0.000)	(0.000)	(0.017)	(0.000)	(0.574)	(0.682)
Divorced/living separated		-0.10*		-0.050		-0.0082		-0.13**
		(0.034)		(0.225)		(0.849)		(0.003)
Widowed		0.067		0.10**		0.13**		-0.15***
		(0.151)		(0.010)		(0.002)		(0.001)
[1] Suburbs of big city		0.0080		0.017		0.033		-0.079**
		(0.793)		(0.528)		(0.219)		(0.010)
[2] Large town		0.038		0.019		0.077**		-0.067*
		(0.183)		(0.456)		(0.002)		(0.016)
[3] Small town		0.11***		0.066**		0.092***		0.024
		(0.000)		(0.005)		(0.000)		(0.340)
[4] Rural area/village		0.059*		0.045*		0.034		0.0038
		(0.022)		(0.048)		(0.116)		(0.876)
Employment, current job		0.18***		0.17***		0.026		0.093***
		(0.000)		(0.000)		(0.171)		(0.000)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Self-employment, current job		0.15***		0.16***		-0.018		0.066*
		(0.000)		(0.000)		(0.543)		(0.042)
[1] Primary school		0.10		0.37***		0.013		0.24***
		(0.081)		(0.000)		(0.793)		(0.000)
[2] Lower secondary school		0.14*		0.46***		0.011		0.32***
		(0.019)		(0.000)		(0.828)		(0.000)
[3] Upper secondary school		0.18**		0.58***		0.029		0.42***
		(0.002)		(0.000)		(0.568)		(0.000)
[4] Post-secondary non-tertiary education		0.25***		0.69***		0.053		0.49***
		(0.000)		(0.000)		(0.359)		(0.000)
[5] First stage tertiary education		0.26***		0.64***		0.0021		0.42***
		(0.000)		(0.000)		(0.967)		(0.000)
[6] Second stage tertiary education		0.43***		0.77***		0.016		0.42***
		(0.000)		(0.000)		(0.856)		(0.000)
[1] Fair		1.03***		1.12***		0.15***		1.24***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.52***		1.80***		0.17***		1.96***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.86***		2.18***		0.31***		2.28***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.18***		2.50***		0.45***		2.40***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.49***		-0.61***		-0.092***		-1.20***
		(0.000)		(0.000)		(0.000)		(0.000)
[1] Middle income		0.16***		0.19***		0.018		0.082**
		(0.000)		(0.000)		(0.429)		(0.002)
[2] Upper middle income		0.23***		0.21***		0.028		0.067**
		(0.000)		(0.000)		(0.206)		(0.008)
[3] High income		0.24***		0.25***		0.018		0.059*
		(0.000)		(0.000)		(0.402)		(0.013)
_cons	6.95***	3.91***	4.41***	0.86*	9.18***	8.73***	5.10***	2.64***
	(0.000)	(0.000)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)
N	52248	46969	50512	45539	52513	47161	51941	46690
R^2	0.12	0.24	0.19	0.37	0.03	0.04	0.10	0.31
adjusted R^2	0.12	0.24	0.19	0.37	0.03	0.04	0.10	0.31

Table 3.18: Regressing well-being and mental health on family status for all countries, male respondents.

	Life satisfaction		CASP quality of life (0-10)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Married/registered partnership	0.57***	0.49***	0.28***	0.18**	0.40***	0.36***	0.30***	0.065
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.239)
[1] Having 1 child	0.069	-0.010	0.14**	0.035	0.16***	0.12*	0.035	0.016
	(0.167)	(0.840)	(0.004)	(0.455)	(0.000)	(0.013)	(0.469)	(0.729)
[2] Having 2 children	0.24***	0.097*	0.29***	0.13**	0.16***	0.10*	0.16***	0.094*
	(0.000)	(0.040)	(0.000)	(0.004)	(0.000)	(0.021)	(0.000)	(0.032)
[3] Having 3 or more children	0.18***	0.029	0.24***	0.056	0.13**	0.067	0.059	-0.010
	(0.000)	(0.573)	(0.000)	(0.249)	(0.004)	(0.179)	(0.235)	(0.835)
Number of resident children	-0.0084	-0.027	-0.094***	-0.11***	-0.023	-0.027	-0.018	-0.032
	(0.648)	(0.134)	(0.000)	(0.000)	(0.166)	(0.107)	(0.309)	(0.059)
Number of grandchildren	-0.0030	0.015**	-0.025***	-0.0018	0.015***	0.018***	-0.015**	-0.000094
	(0.566)	(0.004)	(0.000)	(0.707)	(0.001)	(0.000)	(0.004)	(0.985)
Controls								
Age at interview	0.055***	0.085***	0.14***	0.15***	-0.031*	-0.029	0.13***	0.12***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.024)	(0.066)	(0.000)	(0.000)
Age at interview, squared	-0.00038**	-0.00046***	-0.0012***	-0.0011***	0.00023*	0.00024*	-0.0011***	-0.00088***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.023)	(0.036)	(0.000)	(0.000)
sh_country==[2]BEL	-0.46***	-0.45***	-0.73***	-0.68***	-0.59***	-0.61***	-0.34***	-0.26***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.12*	-0.14**	0.23***	-0.041	-0.29***	-0.39***	0.036	-0.19***
	(0.013)	(0.007)	(0.000)	(0.399)	(0.000)	(0.000)	(0.476)	(0.000)
sh_country==[4]CZE	-0.93***	-0.55***	-1.42***	-0.97***	-0.34***	-0.28***	-0.12*	0.23***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)	(0.000)
sh_country==[5]DEU	-0.55***	-0.46***	-0.30***	-0.20**	-0.41***	-0.41***	-0.13	-0.040
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.053)	(0.547)
sh_country==[6]DNK	0.21***	-0.062	0.18**	-0.12*	0.12*	0.020	0.19***	0.0060
	(0.000)	(0.263)	(0.001)	(0.015)	(0.015)	(0.704)	(0.001)	(0.910)
sh_country==[7]ESP	-0.62***	-0.32***	-0.89***	-0.42***	-0.29***	-0.21***	-0.23***	0.053
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.378)
sh_country==[8]EST	-1.68***	-1.35***	-1.36***	-0.91***	-0.47***	-0.43***	-0.89***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-0.96***	-0.82***	-0.46***	-0.28***	-0.56***	-0.56***	-0.51***	-0.32***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.55***	-1.02***	-1.32***	-0.65***	-0.16**	-0.10	-0.71***	-0.21**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.115)	(0.000)	(0.001)
sh_country==[11]ITA	-0.64***	-0.51***	-1.52***	-1.30***	-0.37***	-0.35***	-0.40***	-0.29***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.24***	-0.36***	0.26***	0.15**	-0.54***	-0.59***	0.23***	0.13*
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.011)
sh_country==[13]POL	-0.85***	-0.34***	-1.13***	-0.48***	-0.23**	-0.15	-0.84***	-0.33***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.051)	(0.000)	(0.000)
sh_country==[14]PRT	-1.06***	-0.58***	-2.02***	-1.29***	-0.063	0.14*	-0.76***	-0.23**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.286)	(0.039)	(0.000)	(0.002)
sh_country==[15]SVN	-0.96***	-0.66***	-0.13*	0.25***	-0.40***	-0.37***	-0.31***	-0.072
	(0.000)	(0.000)	(0.035)	(0.000)	(0.000)	(0.000)	(0.000)	(0.224)
sh_country==[16]SWE	0.026	-0.18**	-0.29***	-0.45***	-0.050	-0.12	0.030	-0.064
	(0.670)	(0.003)	(0.000)	(0.000)	(0.392)	(0.055)	(0.623)	(0.273)
Divorced/living separated		0.0044		0.023		-0.061		-0.12
		(0.951)		(0.715)		(0.380)		(0.063)
Widowed		0.085		0.10		0.0013		-0.23**
		(0.281)		(0.143)		(0.987)		(0.001)
[1] Suburbs of big city		0.0081		0.022		0.071		-0.060
		(0.858)		(0.595)		(0.092)		(0.152)
[2] Large town		0.042		0.057		0.12**		-0.065
		(0.318)		(0.132)		(0.002)		(0.094)
[3] Small town		0.098*		0.099**		0.14***		0.049
		(0.013)		(0.005)		(0.000)		(0.165)
[4] Rural area/village		0.060		0.085*		0.13***		0.034
		(0.113)		(0.011)		(0.000)		(0.315)
Employment, current job		0.29***		0.21***		0.047		0.13***
		(0.000)		(0.000)		(0.125)		(0.000)
Self-employment, current job		0.21***		0.22***		0.023		0.074
		(0.000)		(0.000)		(0.574)		(0.059)
[1] Primary school		0.23*		0.40***		0.077		0.18*
		(0.011)		(0.000)		(0.350)		(0.034)
[2] Lower secondary school		0.24*		0.50***		0.10		0.26**
		(0.010)		(0.000)		(0.233)		(0.003)

	Life satisfaction		CASP quality of life (0-10)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[3] Upper secondary school		0.27**		0.62***		0.11		0.29**
		(0.003)		(0.000)		(0.177)		(0.001)
[4] Post-secondary non-tertiary education		0.37***		0.66***		0.17		0.28**
		(0.000)		(0.000)		(0.080)		(0.005)
[5] First stage tertiary education		0.32***		0.67***		0.11		0.26**
		(0.000)		(0.000)		(0.210)		(0.003)
[6] Second stage tertiary education		0.45***		0.77***		0.013		0.22
		(0.000)		(0.000)		(0.922)		(0.079)
[1] Fair		1.05***		1.12***		0.13**		1.20***
		(0.000)		(0.000)		(0.002)		(0.000)
[2] Good		1.49***		1.76***		0.15***		1.84***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.83***		2.14***		0.30***		2.12***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.11***		2.45***		0.43***		2.22***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.44***		-0.57***		-0.081*		-1.22***
		(0.000)		(0.000)		(0.039)		(0.000)
[1] Middle income		0.23***		0.26***		0.061		0.13***
		(0.000)		(0.000)		(0.096)		(0.000)
[2] Upper middle income		0.29***		0.31***		0.041		0.16***
		(0.000)		(0.000)		(0.253)		(0.000)
[3] High income		0.26***		0.31***		0.076*		0.11***
		(0.000)		(0.000)		(0.023)		(0.001)
_cons	5.79***	2.29***	3.65***	0.081	9.66***	9.11***	4.40***	2.41***
	(0.000)	(0.000)	(0.000)	(0.876)	(0.000)	(0.000)	(0.000)	(0.000)
N	22847	20648	22149	20067	22962	20735	22705	20518
R^2	0.12	0.25	0.18	0.36	0.04	0.05	0.06	0.27
adjusted R^2	0.12	0.25	0.18	0.36	0.04	0.04	0.06	0.27

Table 3.19: Regressing well-being and mental health on family status for all countries, female respondents.

	Life satisfaction		CASP quality of life (0-10)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Married/registered partnership	0.55***	0.39***	0.30***	0.21***	0.11***	0.18***	0.27***	0.034
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.531)
[1] Having 1 child	-0.052	-0.030	0.0058	0.027	0.24***	0.20***	-0.11*	-0.030
	(0.243)	(0.521)	(0.892)	(0.512)	(0.000)	(0.000)	(0.020)	(0.518)
[2] Having 2 children	0.12**	0.13**	0.11**	0.091*	0.29***	0.25***	0.059	0.11*
	(0.004)	(0.005)	(0.008)	(0.023)	(0.000)	(0.000)	(0.195)	(0.018)
[3] Having 3 or more children	0.062	0.082	0.044	0.049	0.29***	0.25***	-0.013	0.058
	(0.201)	(0.102)	(0.334)	(0.276)	(0.000)	(0.000)	(0.807)	(0.253)
Number of resident children	-0.056**	-0.081***	-0.10***	-0.13***	-0.021	-0.027	-0.021	-0.028
	(0.004)	(0.000)	(0.000)	(0.000)	(0.150)	(0.083)	(0.310)	(0.151)
Number of grandchildren	-0.0051	0.0077	-0.019***	0.0012	0.013***	0.016***	-0.023***	-0.0040
	(0.311)	(0.117)	(0.000)	(0.774)	(0.000)	(0.000)	(0.000)	(0.400)
Controls								
Age at interview	-0.00017	0.013	0.10***	0.12***	-0.0033	-0.0031	0.11***	0.099***
	(0.991)	(0.407)	(0.000)	(0.000)	(0.760)	(0.804)	(0.000)	(0.000)
Age at interview, squared	0.000024	0.000065	-0.00095***	-0.00089***	0.0000030	0.0000075	-0.00091***	-0.00067***
	(0.819)	(0.553)	(0.000)	(0.000)	(0.971)	(0.934)	(0.000)	(0.000)
sh_country==[2]BEL	-0.60***	-0.44***	-0.82***	-0.63***	-0.70***	-0.66***	-0.60***	-0.31***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.072	-0.11*	0.29***	0.092*	-0.41***	-0.39***	-0.034	-0.20***
	(0.110)	(0.019)	(0.000)	(0.037)	(0.000)	(0.000)	(0.496)	(0.000)
sh_country==[4]CZE	-1.04***	-0.68***	-1.45***	-1.02***	-0.47***	-0.43***	-0.32***	0.061
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.215)
sh_country==[5]DEU	-0.55***	-0.46***	-0.24***	-0.11	-0.44***	-0.42***	-0.35***	-0.22***
	(0.000)	(0.000)	(0.000)	(0.060)	(0.000)	(0.000)	(0.000)	(0.001)
sh_country==[6]DNK	0.32***	0.093	0.30***	0.039	0.027	-0.0022	0.14*	-0.054
	(0.000)	(0.082)	(0.000)	(0.414)	(0.501)	(0.959)	(0.017)	(0.350)
sh_country==[7]ESP	-0.87***	-0.42***	-1.27***	-0.65***	-0.31***	-0.26***	-1.06***	-0.42***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.52***	-1.15***	-1.14***	-0.71***	-0.43***	-0.34***	-1.00***	-0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-1.06***	-0.86***	-0.60***	-0.30***	-0.60***	-0.55***	-0.81***	-0.46***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.64***	-1.03***	-1.43***	-0.69***	-0.17***	-0.086	-1.13***	-0.43***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.092)	(0.000)	(0.000)
sh_country==[11]ITA	-0.82***	-0.52***	-1.81***	-1.45***	-0.40***	-0.36***	-0.79***	-0.43***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.33***	-0.34***	0.22***	0.23***	-0.68***	-0.69***	-0.039	0.031
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.490)	(0.569)
sh_country==[13]POL	-0.99***	-0.38***	-1.25***	-0.57***	-0.25***	-0.17**	-1.17***	-0.54***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)
sh_country==[14]PRT	-1.51***	-0.70***	-2.28***	-1.34***	-0.12*	0.076	-1.50***	-0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)	(0.161)	(0.000)	(0.000)
sh_country==[15]SVN	-0.85***	-0.54***	-0.20***	0.20***	-0.47***	-0.40***	-0.44***	-0.15*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)
sh_country==[16]SWE	0.040	-0.035	-0.13*	-0.20***	-0.10*	-0.13**	0.036	0.026
	(0.495)	(0.542)	(0.017)	(0.000)	(0.025)	(0.007)	(0.556)	(0.655)
Divorced/living separated		-0.18**		-0.10		0.0076		-0.13*
		(0.004)		(0.057)		(0.890)		(0.033)
Widowed		0.015		0.099		0.14*		-0.13*
		(0.796)		(0.058)		(0.010)		(0.029)
[1] Suburbs of big city		0.0035		0.011		0.0056		-0.098*
		(0.933)		(0.774)		(0.868)		(0.022)
[2] Large town		0.032		-0.012		0.039		-0.070
		(0.399)		(0.727)		(0.214)		(0.069)
[3] Small town		0.11**		0.036		0.053		0.00086
		(0.003)		(0.256)		(0.064)		(0.981)
[4] Rural area/village		0.056		0.0087		-0.034		-0.021
		(0.108)		(0.777)		(0.225)		(0.544)
Employment, current job		0.078*		0.13***		0.00029		0.055
		(0.013)		(0.000)		(0.991)		(0.083)
Self-employment, current job		0.084		0.087		-0.086		0.070
		(0.113)		(0.074)		(0.065)		(0.215)
[1] Primary school		0.019		0.34***		-0.018		0.25***
		(0.802)		(0.000)		(0.773)		(0.001)
[2] Lower secondary school		0.060		0.42***		-0.041		0.33***
		(0.433)		(0.000)		(0.518)		(0.000)

	Life satisfaction		CASP quality of life (0-10)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[3] Upper secondary school		0.11		0.53***		-0.020		0.48***
		(0.158)		(0.000)		(0.752)		(0.000)
[4] Post-secondary non-tertiary education		0.15		0.69***		-0.016		0.62***
		(0.083)		(0.000)		(0.829)		(0.000)
[5] First stage tertiary education		0.23**		0.60***		-0.073		0.51***
		(0.004)		(0.000)		(0.267)		(0.000)
[6] Second stage tertiary education		0.45**		0.76***		0.097		0.61***
		(0.001)		(0.000)		(0.384)		(0.000)
[1] Fair		1.01***		1.12***		0.17***		1.26***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.54***		1.82***		0.19***		2.03***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.88***		2.21***		0.33***		2.41***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.23***		2.53***		0.47***		2.55***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.51***		-0.62***		-0.10***		-1.17***
		(0.000)		(0.000)		(0.000)		(0.000)
Middle income		0.10**		0.14***		-0.0070		0.054
		(0.004)		(0.000)		(0.816)		(0.145)
Upper middle income		0.19***		0.13***		0.024		0.0055
		(0.000)		(0.000)		(0.409)		(0.877)
High income		0.23***		0.21***		-0.015		0.037
		(0.000)		(0.000)		(0.583)		(0.271)
_cons	7.81***	5.16***	4.88***	1.40**	9.12***	8.85***	5.02***	2.37***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
N	29401	26321	28363	25472	29551	26426	29236	26172
R^2	0.12	0.24	0.20	0.38	0.03	0.04	0.08	0.29
adjusted R^2	0.12	0.24	0.20	0.38	0.03	0.04	0.07	0.29

Table 3.20: Demographic characteristics by network type.

Network types	No Network	Partner	Children	Other relatives	Family	Friends	Diverse
	C0	C1	C2	C3	C4	C5	C6
Housing							
Household size	1.90	2.43	1.86	2.10	2.31	2.00	2.07
Big city	11%	12%	11%	14%	13%	21%	17%
Suburbs of big city	7%	10%	10%	12%	11%	10%	10%
Large town	16%	16%	19%	14%	17%	16%	15%
Small town	24%	23%	23%	26%	25%	23%	23%
Rural area/village	41%	39%	37%	33%	35%	30%	35%
Average monthly household income							
Low income	52%	38%	47%	29%	39%	34%	40%
Middle income	12%	12%	11%	14%	13%	12%	13%
Upper middle income	12%	14%	12%	17%	15%	16%	16%
High income	24%	36%	29%	40%	33%	37%	32%
Employed	19%	25%	13%	31%	23%	28%	28%
Self-employed	5%	6%	3%	5%	5%	7%	5%
Education							
None	5%	2%	5%	2%	3%	2%	2%
Primary school	25%	18%	30%	16%	20%	14%	17%
Lower secondary school	21%	20%	22%	19%	19%	16%	20%
Upper secondary school	31%	37%	28%	34%	34%	35%	34%
Post-secondary non-tertiary education	3%	4%	4%	5%	4%	6%	5%
First stage tertiary education	14%	17%	11%	23%	18%	25%	20%
Second stage tertiary education	1%	1%	0%	1%	1%	2%	1%
Health status							
Poor	15%	12%	18%	10%	11%	10%	12%
Fair	28%	28%	34%	30%	30%	28%	31%
Good	38%	36%	30%	36%	36%	36%	34%
Very good	13%	16%	13%	16%	16%	19%	16%
Excellent	6%	7%	5%	8%	7%	8%	7%
Medication for depression symptoms[a]	11%	8%	16%	14%	13%	15%	15%

Columns (C0)-(C6) report the report the percentages or means of respondents associated with the respective network type.

[a] Medication for depression symptoms is equal to one if the respondent takes drugs for sleeping problems, anxiety or depression.

Table 3.21: Regressing well-being and mental health on network types controlling for network size and family status for all countries, all respondents.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Partner	0.44***	0.46***	0.20***	0.20***	2.37***	2.47***	0.30***	0.32***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
[2] Children	0.21***	0.28***	-0.082	0.028	2.42***	2.50***	0.021	0.19***
	(0.001)	(0.000)	(0.123)	(0.572)	(0.000)	(0.000)	(0.723)	(0.001)
[3] Other Relatives	0.21***	0.26***	0.066	0.12*	2.14***	2.24***	0.0040	0.098
	(0.000)	(0.000)	(0.219)	(0.014)	(0.000)	(0.000)	(0.946)	(0.086)
[4] Family	0.30***	0.37***	0.037	0.12*	2.30***	2.40***	0.12*	0.25***
	(0.000)	(0.000)	(0.477)	(0.014)	(0.000)	(0.000)	(0.034)	(0.000)
[5] Friends	0.21***	0.24***	0.10	0.15**	2.03***	2.13***	0.0013	0.095
	(0.000)	(0.000)	(0.051)	(0.002)	(0.000)	(0.000)	(0.982)	(0.088)
[6] Diverse	0.12	0.23***	-0.083	0.045	1.97***	2.07***	-0.12*	0.045
	(0.055)	(0.000)	(0.135)	(0.385)	(0.000)	(0.000)	(0.044)	(0.440)
Size of social network	0.097***	0.065***	0.11***	0.069***	0.057***	0.054***	0.053***	0.017**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
Married/registered partnership	0.48***	0.38***	0.24***	0.17***	0.10***	0.13***	0.20***	-0.022
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.576)
[1] Having 1 child	-0.018	-0.054	0.087**	0.035	0.10***	0.074*	-0.056	-0.047
	(0.589)	(0.125)	(0.006)	(0.260)	(0.000)	(0.014)	(0.105)	(0.172)
[2] Having 2 children	0.13***	0.062	0.19***	0.097**	0.095***	0.069*	0.075*	0.055
	(0.000)	(0.064)	(0.000)	(0.001)	(0.000)	(0.019)	(0.023)	(0.092)
[3] Having 3 or more children	0.055	0.0015	0.12***	0.036	0.077**	0.046	-0.018	-0.026
	(0.124)	(0.967)	(0.000)	(0.280)	(0.008)	(0.149)	(0.619)	(0.473)
Number of resident children	-0.027*	-0.050***	-0.094***	-0.12***	-0.015	-0.021	-0.015	-0.024
	(0.045)	(0.000)	(0.000)	(0.000)	(0.135)	(0.057)	(0.281)	(0.058)
Number of grandchildren	-0.0054	0.0093**	-0.021***	-0.00045	0.012***	0.015***	-0.021***	-0.0032
	(0.138)	(0.009)	(0.000)	(0.884)	(0.000)	(0.000)	(0.000)	(0.349)
Controls								
Female	-0.044**	0.041**	-0.17***	-0.060***	0.11***	0.11***	-0.64***	-0.50***
	(0.005)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age at interview	0.020	0.041***	0.11***	0.13***	-0.013	-0.011	0.12***	0.11***
	(0.064)	(0.000)	(0.000)	(0.000)	(0.099)	(0.219)	(0.000)	(0.000)
Age at interview, squared	-0.00011	-0.00013	-0.00099***	-0.00095***	0.000088	0.000086	-0.00097***	-0.00076***
	(0.161)	(0.110)	(0.000)	(0.000)	(0.140)	(0.192)	(0.000)	(0.000)
sh_country==[2]BEL	-0.53***	-0.44***	-0.78***	-0.65***	-0.63***	-0.63***	-0.49***	-0.29***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.089**	-0.12***	0.26***	0.026	-0.37***	-0.41***	-0.022	-0.22***
	(0.008)	(0.000)	(0.000)	(0.424)	(0.000)	(0.000)	(0.533)	(0.000)
sh_country==[4]CZE	-0.94***	-0.60***	-1.38***	-0.97***	-0.37***	-0.35***	-0.24***	0.12**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
sh_country==[5]DEU	-0.56***	-0.47***	-0.26***	-0.15**	-0.45***	-0.43***	-0.28***	-0.16***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[6]DNK	0.27***	0.033	0.26***	-0.015	0.035	-0.014	0.15***	-0.038
	(0.000)	(0.398)	(0.000)	(0.660)	(0.272)	(0.685)	(0.000)	(0.335)
sh_country==[7]ESP	-0.75***	-0.38***	-1.07***	-0.54***	-0.33***	-0.30***	-0.70***	-0.23***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.55***	-1.21***	-1.19***	-0.77***	-0.42***	-0.36***	-0.94***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-0.98***	-0.82***	-0.52***	-0.29***	-0.51***	-0.50***	-0.67***	-0.38***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.58***	-1.03***	-1.34***	-0.67***	-0.18***	-0.12**	-0.94***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
sh_country==[11]ITA	-0.67***	-0.47***	-1.60***	-1.34***	-0.25***	-0.22***	-0.58***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.28***	-0.35***	0.25***	0.20***	-0.64***	-0.67***	0.075	0.063
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.058)	(0.095)
sh_country==[13]POL	-0.89***	-0.35***	-1.13***	-0.50***	-0.25***	-0.18***	-1.04***	-0.49***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[14]PRT	-1.30***	-0.66***	-2.13***	-1.32***	-0.13***	0.036	-1.19***	-0.38***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.364)	(0.000)	(0.000)
sh_country==[15]SVN	-0.82***	-0.55***	-0.091*	0.27***	-0.31***	-0.26***	-0.39***	-0.13**
	(0.000)	(0.000)	(0.024)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
sh_country==[16]SWE	0.045	-0.094*	-0.17***	-0.29***	-0.14***	-0.18***	0.019	-0.034
	(0.288)	(0.027)	(0.000)	(0.000)	(0.000)	(0.000)	(0.667)	(0.416)
Divorced/living separated		-0.11*		-0.047		-0.021		-0.14**
		(0.025)		(0.250)		(0.600)		(0.002)
Widowed		0.072		0.13**		0.091*		-0.15***
		(0.123)		(0.002)		(0.024)		(0.001)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Suburbs of big city		0.013		0.032		0.015		-0.087**
		(0.681)		(0.248)		(0.546)		(0.004)
[2] Large town		0.047		0.037		0.077**		-0.074**
		(0.098)		(0.139)		(0.001)		(0.008)
[3] Small town		0.11***		0.080***		0.089***		0.018
		(0.000)		(0.001)		(0.000)		(0.490)
[4] Rural area/village		0.069**		0.066**		0.033		-0.0040
		(0.007)		(0.003)		(0.116)		(0.871)
Employment, current job		0.17***		0.17***		0.025		0.097***
		(0.000)		(0.000)		(0.180)		(0.000)
Self-employment, current job		0.15***		0.16***		-0.021		0.072*
		(0.000)		(0.000)		(0.475)		(0.026)
[1] Primary school		0.087		0.35***		-0.034		0.23***
		(0.135)		(0.000)		(0.454)		(0.000)
[2] Lower secondary school		0.12*		0.44***		-0.044		0.32***
		(0.048)		(0.000)		(0.340)		(0.000)
[3] Upper secondary school		0.15*		0.54***		-0.041		0.41***
		(0.012)		(0.000)		(0.380)		(0.000)
[4] Post-secondary non-tertiary education		0.21**		0.64***		-0.018		0.49***
		(0.002)		(0.000)		(0.735)		(0.000)
[5] First stage tertiary education		0.22***		0.58***		-0.070		0.42***
		(0.000)		(0.000)		(0.139)		(0.000)
[6] Second stage tertiary education		0.39***		0.71***		-0.050		0.42***
		(0.000)		(0.000)		(0.545)		(0.000)
[1] Fair		1.02***		1.11***		0.14***		1.24***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.51***		1.78***		0.16***		1.95***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.84***		2.16***		0.30***		2.28***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.17***		2.48***		0.44***		2.40***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.50***		-0.61***		-0.094***		-1.19***
		(0.000)		(0.000)		(0.000)		(0.000)
[1] Middle income		0.15***		0.19***		-0.0028		0.080**
		(0.000)		(0.000)		(0.898)		(0.002)
[2] Upper middle income		0.23***		0.21***		0.016		0.070**
		(0.000)		(0.000)		(0.469)		(0.006)
[3] High income		0.24***		0.24***		0.00069		0.061*
		(0.000)		(0.000)		(0.973)		(0.010)
_cons	6.61***	3.62***	4.20***	0.72*	7.13***	6.70***	5.04***	2.55***
	(0.000)	(0.000)	(0.000)	(0.035)	(0.000)	(0.000)	(0.000)	(0.000)
N	52248	46969	50512	45539	52513	47161	51941	46690
R^2	0.13	0.25	0.20	0.38	0.12	0.13	0.10	0.31
adjusted R^2	0.13	0.25	0.20	0.38	0.12	0.13	0.10	0.31

Table 3.22: Regressing well-being and mental health on network types controlling for network size and family status for all countries, male respondents.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Partner	0.46***	0.44***	0.16*	0.16*	2.28***	2.39***	0.19**	0.22**
	(0.000)	(0.000)	(0.019)	(0.015)	(0.000)	(0.000)	(0.008)	(0.001)
[2] Children	0.32***	0.33***	0.038	0.11	2.27***	2.38***	0.059	0.20*
	(0.000)	(0.000)	(0.616)	(0.141)	(0.000)	(0.000)	(0.472)	(0.011)
[3] Other Relatives	0.26**	0.27***	0.098	0.14	1.94***	2.05***	0.0095	0.094
	(0.001)	(0.001)	(0.191)	(0.052)	(0.000)	(0.000)	(0.905)	(0.226)
[4] Family	0.37***	0.40***	0.054	0.12	2.15***	2.26***	0.089	0.20**
	(0.000)	(0.000)	(0.455)	(0.086)	(0.000)	(0.000)	(0.245)	(0.006)
[5] Friends	0.31***	0.30***	0.15*	0.17*	1.80***	1.92***	0.014	0.084
	(0.000)	(0.000)	(0.037)	(0.021)	(0.000)	(0.000)	(0.856)	(0.271)
[6] Diverse	0.23**	0.23**	-0.0027	0.050	1.70***	1.81***	-0.043	0.057
	(0.007)	(0.006)	(0.972)	(0.511)	(0.000)	(0.000)	(0.599)	(0.474)
Size of social network	0.076***	0.052***	0.089***	0.055***	0.050***	0.048***	0.041***	0.016
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.081)
Married/registered partnership	0.50***	0.43***	0.25***	0.17**	0.22***	0.15**	0.24***	0.019
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.007)	(0.000)	(0.739)
[1] Having 1 child	0.040	-0.038	0.14**	0.035	0.056	0.041	0.019	-0.011
	(0.427)	(0.473)	(0.003)	(0.452)	(0.175)	(0.365)	(0.699)	(0.813)
[2] Having 2 children	0.20***	0.058	0.28***	0.12**	0.029	0.014	0.13**	0.060
	(0.000)	(0.229)	(0.000)	(0.008)	(0.452)	(0.753)	(0.004)	(0.179)
[3] Having 3 or more children	0.12*	-0.016	0.22***	0.040	-0.0073	-0.035	0.025	-0.047
	(0.019)	(0.757)	(0.000)	(0.414)	(0.866)	(0.457)	(0.617)	(0.344)
Number of resident children	-0.0067	-0.025	-0.094***	-0.11***	-0.020	-0.024	-0.017	-0.030
	(0.713)	(0.162)	(0.000)	(0.000)	(0.199)	(0.129)	(0.339)	(0.072)
Number of grandchildren	-0.0033	0.014**	-0.025***	-0.0020	0.013**	0.016***	-0.016**	-0.00068
	(0.528)	(0.007)	(0.000)	(0.672)	(0.002)	(0.000)	(0.003)	(0.889)
Controls								
Age at interview	0.052**	0.083***	0.14***	0.15***	-0.031*	-0.025	0.13***	0.12***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.016)	(0.080)	(0.000)	(0.000)
Age at interview, squared	-0.00036**	-0.00044***	-0.0012***	-0.0011***	0.00022*	0.00021*	-0.0011***	-0.00087***
	(0.003)	(0.000)	(0.000)	(0.000)	(0.019)	(0.048)	(0.000)	(0.000)
sh_country==[2]BEL	-0.43***	-0.43***	-0.71***	-0.68***	-0.54***	-0.56***	-0.32***	-0.25***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.13**	-0.13*	0.23***	-0.048	-0.28***	-0.39***	0.042	-0.19***
	(0.007)	(0.010)	(0.000)	(0.325)	(0.000)	(0.000)	(0.419)	(0.000)
sh_country==[4]CZE	-0.88***	-0.53***	-1.37***	-0.95***	-0.32***	-0.27***	-0.11*	0.23***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.032)	(0.000)
sh_country==[5]DEU	-0.54***	-0.46***	-0.28***	-0.19**	-0.41***	-0.41***	-0.13	-0.047
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.063)	(0.478)
sh_country==[6]DNK	0.24***	-0.038	0.20***	-0.11*	0.11*	0.017	0.20***	0.0077
	(0.000)	(0.500)	(0.000)	(0.030)	(0.021)	(0.751)	(0.001)	(0.886)
sh_country==[7]ESP	-0.61***	-0.33***	-0.87***	-0.42***	-0.31***	-0.27***	-0.23***	0.045
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.459)
sh_country==[8]EST	-1.65***	-1.33***	-1.32***	-0.90***	-0.46***	-0.43***	-0.88***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-0.91***	-0.79***	-0.44***	-0.28***	-0.46***	-0.47***	-0.49***	-0.31***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.53***	-1.02***	-1.29***	-0.65***	-0.17**	-0.12*	-0.70***	-0.21***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.045)	(0.000)	(0.001)
sh_country==[11]ITA	-0.58***	-0.46***	-1.46***	-1.27***	-0.21***	-0.19***	-0.37***	-0.27***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.22***	-0.35***	0.28***	0.16**	-0.55***	-0.60***	0.24***	0.13**
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.010)
sh_country==[13]POL	-0.81***	-0.33***	-1.07***	-0.46***	-0.27***	-0.21**	-0.84***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)
sh_country==[14]PRT	-1.05***	-0.59***	-2.00***	-1.30***	-0.083	0.080	-0.76***	-0.24**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.133)	(0.208)	(0.000)	(0.001)
sh_country==[15]SVN	-0.89***	-0.63***	-0.052	0.29***	-0.30***	-0.29***	-0.30***	-0.068
	(0.000)	(0.000)	(0.393)	(0.000)	(0.000)	(0.000)	(0.000)	(0.253)
sh_country==[16]SWE	0.059	-0.16*	-0.25***	-0.43***	-0.11	-0.18**	0.041	-0.073
	(0.336)	(0.011)	(0.000)	(0.000)	(0.060)	(0.004)	(0.501)	(0.222)
Divorced/living separated		-0.0038		0.027		-0.094		-0.13*
		(0.958)		(0.663)		(0.151)		(0.049)
Widowed		0.085		0.11		-0.054		-0.25***
		(0.284)		(0.110)		(0.466)		(0.001)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Suburbs of big city		0.010		0.033		0.038		-0.066
		(0.817)		(0.420)		(0.344)		(0.114)
[2] Large town		0.049		0.072		0.11**		-0.071
		(0.252)		(0.057)		(0.003)		(0.070)
[3] Small town		0.10**		0.11**		0.13***		0.044
		(0.010)		(0.002)		(0.000)		(0.210)
[4] Rural area/village		0.068		0.10**		0.12***		0.029
		(0.073)		(0.002)		(0.000)		(0.398)
Employment, current job		0.29***		0.22***		0.058*		0.13***
		(0.000)		(0.000)		(0.044)		(0.000)
Self-employment, current job		0.21***		0.21***		0.032		0.078*
		(0.000)		(0.000)		(0.407)		(0.045)
[1] Primary school		0.21*		0.39***		0.019		0.18*
		(0.019)		(0.000)		(0.798)		(0.038)
[2] Lower secondary school		0.22*		0.48***		0.037		0.26**
		(0.019)		(0.000)		(0.634)		(0.003)
[3] Upper secondary school		0.24**		0.59***		0.037		0.28**
		(0.007)		(0.000)		(0.628)		(0.001)
[4] Post-secondary non-tertiary education		0.34**		0.62***		0.070		0.27**
		(0.001)		(0.000)		(0.421)		(0.005)
[5] First stage tertiary education		0.29**		0.63***		0.034		0.26**
		(0.002)		(0.000)		(0.659)		(0.003)
[6] Second stage tertiary education		0.41**		0.72***		-0.064		0.23
		(0.002)		(0.000)		(0.605)		(0.080)
[1] Fair		1.05***		1.12***		0.11**		1.20***
		(0.000)		(0.000)		(0.004)		(0.000)
[2] Good		1.48***		1.75***		0.14***		1.84***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.82***		2.13***		0.28***		2.12***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.10***		2.44***		0.41***		2.22***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.44***		-0.58***		-0.078*		-1.22***
		(0.000)		(0.000)		(0.036)		(0.000)
[1] Middle income		0.22***		0.26***		0.037		0.13***
		(0.000)		(0.000)		(0.289)		(0.000)
[2] Upper middle income		0.29***		0.30***		0.022		0.16***
		(0.000)		(0.000)		(0.522)		(0.000)
[3] High income		0.26***		0.30***		0.057		0.11***
		(0.000)		(0.000)		(0.071)		(0.001)
_cons	5.42***	1.99**	3.37***	-0.14	7.81***	7.14***	4.35***	2.33***
	(0.000)	(0.001)	(0.000)	(0.786)	(0.000)	(0.000)	(0.000)	(0.000)
N	22847	20648	22149	20067	22962	20735	22705	20518
R^2	0.13	0.25	0.18	0.36	0.13	0.14	0.06	0.27
adjusted R^2	0.13	0.25	0.18	0.36	0.13	0.14	0.06	0.27

Table 3.23: Regressing well-being and mental health on network types controlling for network size and family status for all countries, female respondents.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Partner	0.45***	0.50***	0.29***	0.29***	2.38***	2.48***	0.48***	0.46***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
[2] Children	0.15	0.27**	-0.11	0.022	2.57***	2.65***	0.041	0.22**
	(0.087)	(0.002)	(0.136)	(0.747)	(0.000)	(0.000)	(0.641)	(0.007)
[3] Other Relatives	0.16	0.26**	0.061	0.13	2.34***	2.43***	0.020	0.12
	(0.058)	(0.003)	(0.426)	(0.061)	(0.000)	(0.000)	(0.819)	(0.135)
[4] Family	0.25**	0.36***	0.044	0.14*	2.47***	2.55***	0.16	0.30***
	(0.003)	(0.000)	(0.559)	(0.050)	(0.000)	(0.000)	(0.060)	(0.000)
[5] Friends	0.13	0.21*	0.082	0.17*	2.25***	2.34***	0.0080	0.12
	(0.133)	(0.013)	(0.279)	(0.016)	(0.000)	(0.000)	(0.928)	(0.128)
[6] Diverse	0.041	0.23**	-0.11	0.066	2.20***	2.29***	-0.15	0.063
	(0.647)	(0.009)	(0.157)	(0.363)	(0.000)	(0.000)	(0.095)	(0.458)
Size of social network	0.11***	0.074***	0.12***	0.077***	0.058***	0.056***	0.059***	0.016*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.040)
Married/registered partnership	0.47***	0.33***	0.22***	0.17***	0.054**	0.12*	0.16***	-0.034
	(0.000)	(0.000)	(0.000)	(0.001)	(0.004)	(0.011)	(0.000)	(0.536)
[1] Having 1 child	-0.070	-0.060	0.039	0.040	0.11**	0.089*	-0.12*	-0.062
	(0.124)	(0.203)	(0.372)	(0.348)	(0.004)	(0.029)	(0.015)	(0.195)
[2] Having 2 children	0.068	0.070	0.11**	0.085*	0.12***	0.10**	0.027	0.065
	(0.119)	(0.131)	(0.008)	(0.040)	(0.001)	(0.010)	(0.559)	(0.163)
[3] Having 3 or more children	-0.0012	0.017	0.042	0.036	0.13**	0.11*	-0.055	0.0093
	(0.980)	(0.742)	(0.368)	(0.435)	(0.001)	(0.015)	(0.306)	(0.859)
Number of resident children	-0.048*	-0.075***	-0.095***	-0.13***	-0.020	-0.025	-0.010	-0.021
	(0.012)	(0.000)	(0.000)	(0.000)	(0.148)	(0.084)	(0.616)	(0.276)
Number of grandchildren	-0.0056	0.0062	-0.018***	0.00098	0.010**	0.012**	-0.024***	-0.0052
	(0.264)	(0.203)	(0.000)	(0.812)	(0.005)	(0.001)	(0.000)	(0.276)
Controls								
Age at interview	-0.0037	0.0096	0.097***	0.11***	-0.0057	-0.0085	0.11***	0.100***
	(0.792)	(0.526)	(0.000)	(0.000)	(0.586)	(0.467)	(0.000)	(0.000)
Age at interview, squared	0.000064	0.000092	-0.00088***	-0.00084***	0.000024	0.000050	-0.00089***	-0.00068***
	(0.535)	(0.401)	(0.000)	(0.000)	(0.758)	(0.554)	(0.000)	(0.000)
sh_country==[2]BEL	-0.61***	-0.45***	-0.84***	-0.63***	-0.70***	-0.67***	-0.62***	-0.31***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.045	-0.12*	0.27***	0.088	-0.44***	-0.42***	-0.071	-0.23***
	(0.326)	(0.011)	(0.000)	(0.050)	(0.000)	(0.000)	(0.157)	(0.000)
sh_country==[4]CZE	-0.99***	-0.65***	-1.39***	-0.99***	-0.41***	-0.39***	-0.34***	0.036
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.467)
sh_country==[5]DEU	-0.57***	-0.47***	-0.24***	-0.10	-0.47***	-0.44***	-0.39***	-0.25***
	(0.000)	(0.000)	(0.000)	(0.087)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[6]DNK	0.30***	0.094	0.29***	0.057	-0.023	-0.030	0.11	-0.076
	(0.000)	(0.082)	(0.000)	(0.243)	(0.581)	(0.492)	(0.067)	(0.193)
sh_country==[7]ESP	-0.86***	-0.42***	-1.24***	-0.65***	-0.35***	-0.31***	-1.08***	-0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.49***	-1.13***	-1.11***	-0.68***	-0.41***	-0.30***	-1.00***	-0.46***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-1.03***	-0.84***	-0.59***	-0.30***	-0.55***	-0.52***	-0.80***	-0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.62***	-1.02***	-1.37***	-0.67***	-0.20***	-0.11*	-1.11***	-0.43***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.019)	(0.000)	(0.000)
sh_country==[11]ITA	-0.74***	-0.48***	-1.71***	-1.40***	-0.26***	-0.23***	-0.74***	-0.40***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[12]NLD	-0.34***	-0.35***	0.22***	0.23***	-0.71***	-0.72***	-0.059	0.015
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.303)	(0.777)
sh_country==[13]POL	-0.95***	-0.37***	-1.18***	-0.53***	-0.23***	-0.15*	-1.21***	-0.58***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.000)	(0.000)
sh_country==[14]PRT	-1.51***	-0.72***	-2.25***	-1.34***	-0.16***	0.012	-1.54***	-0.50***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.819)	(0.000)	(0.000)
sh_country==[15]SVN	-0.77***	-0.49***	-0.13*	0.25***	-0.30***	-0.22***	-0.46***	-0.17**
	(0.000)	(0.000)	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
sh_country==[16]SWE	0.024	-0.038	-0.12*	-0.18***	-0.16***	-0.18***	0.0013	-0.0066
	(0.678)	(0.511)	(0.025)	(0.001)	(0.001)	(0.000)	(0.983)	(0.911)
Divorced/living separated		-0.18**		-0.10		0.014		-0.13*
		(0.003)		(0.058)		(0.786)		(0.032)
Widowed		0.023		0.12*		0.12*		-0.12*
		(0.705)		(0.025)		(0.020)		(0.037)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[1] Suburbs of big city		0.010		0.028		0.00070		-0.11*
		(0.802)		(0.443)		(0.983)		(0.013)
[2] Large town		0.043		0.0086		0.048		-0.078*
		(0.256)		(0.798)		(0.109)		(0.042)
[3] Small town		0.11**		0.052		0.057*		-0.0069
		(0.002)		(0.097)		(0.040)		(0.848)
[4] Rural area/village		0.068		0.033		-0.029		-0.032
		(0.053)		(0.275)		(0.279)		(0.359)
Employment, current job		0.075*		0.13***		-0.0089		0.063*
		(0.017)		(0.000)		(0.709)		(0.048)
Self-employment, current job		0.084		0.082		-0.098*		0.077
		(0.111)		(0.092)		(0.034)		(0.175)
[1] Primary school		0.0061		0.32***		-0.061		0.25***
		(0.935)		(0.000)		(0.275)		(0.001)
[2] Lower secondary school		0.039		0.39***		-0.097		0.33***
		(0.609)		(0.000)		(0.095)		(0.000)
[3] Upper secondary school		0.076		0.49***		-0.091		0.48***
		(0.321)		(0.000)		(0.118)		(0.000)
[4] Post-secondary non-tertiary education		0.12		0.64***		-0.078		0.62***
		(0.189)		(0.000)		(0.260)		(0.000)
[5] First stage tertiary education		0.17*		0.53***		-0.15*		0.51***
		(0.025)		(0.000)		(0.012)		(0.000)
[6] Second stage tertiary education		0.42**		0.71***		0.065		0.61***
		(0.003)		(0.000)		(0.558)		(0.000)
[1] Fair		1.00***		1.10***		0.15***		1.27***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.53***		1.80***		0.19***		2.03***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.86***		2.19***		0.31***		2.40***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.22***		2.51***		0.47***		2.54***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.51***		-0.63***		-0.11***		-1.16***
		(0.000)		(0.000)		(0.000)		(0.000)
[1] Middle income		0.095**		0.13***		-0.026		0.051
		(0.007)		(0.000)		(0.362)		(0.170)
[2] Upper middle income		0.18***		0.13***		0.011		0.010
		(0.000)		(0.000)		(0.690)		(0.770)
[3] High income		0.22***		0.20***		-0.036		0.041
		(0.000)		(0.000)		(0.174)		(0.225)
_cons	7.46***	4.85***	4.65***	1.25**	6.88***	6.70***	4.91***	2.21***
	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)
N	29401	26321	28363	25472	29551	26426	29236	26172
R^2	0.13	0.25	0.21	0.38	0.12	0.13	0.081	0.3
adjusted R^2	0.13	0.25	0.21	0.38	0.12	0.13	0.08	0.29

Table 3.24: Well-being and mental health measures conditional on network size over all country.

	Life satisfaction			Quality of life (CASP-12)			Network satisfaction			Lack of depressive symptoms (EURO-D)		
Size	All (1)	Male (2)	Female (3)	All (1)	Male (2)	Female (3)	All (1)	Male (2)	Female (3)	All (1)	Male (2)	Female (3)
0	6.93	6.98	6.88	6.48	6.67	6.29	6.49	6.60	6.38	7.59	7.99	7.18
1	7.45	7.58	7.32	6.80	6.97	6.61	8.86	8.89	8.83	7.89	8.25	7.49
2	7.48	7.61	7.38	6.84	7.03	6.69	8.90	8.83	8.95	7.81	8.26	7.46
3	7.62	7.75	7.54	7.07	7.21	6.97	8.95	8.86	9.02	7.83	8.26	7.56
4	7.76	7.83	7.72	7.18	7.27	7.12	8.95	8.82	9.03	7.90	8.34	7.63
5	7.82	7.92	7.76	7.34	7.50	7.26	8.96	8.87	9.00	7.92	8.43	7.66
6	7.99	8.06	7.96	7.45	7.55	7.39	8.96	8.82	9.03	8.01	8.46	7.80
7	8.04	8.06	8.03	7.46	7.44	7.47	8.99	8.84	9.07	8.01	8.35	7.83

For each well-being and mental health measure column (1)-(3) represent the average conditional on the network size for all respondents and by gender.

Table 3.25: Regressing well-being and mental health on network types controlling for network size, relational dynamics and family status for all countries, all respondents with social support network.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[2] Children	-0.22***	-0.12***	-0.29***	-0.15***	0.14***	0.12***	-0.28***	-0.084*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)
[3] Other Relatives	-0.12***	-0.059	-0.053	0.025	0.097***	0.092***	-0.25***	-0.14***
	(0.000)	(0.072)	(0.093)	(0.400)	(0.000)	(0.000)	(0.000)	(0.000)
[4] Family	-0.10***	-0.023	-0.14***	-0.039	0.076***	0.068***	-0.16***	-0.022
	(0.000)	(0.403)	(0.000)	(0.115)	(0.000)	(0.001)	(0.000)	(0.422)
[5] Friends	-0.052	-0.029	0.057	0.11***	0.13***	0.12***	-0.21***	-0.12***
	(0.101)	(0.352)	(0.058)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
[6] Diverse	-0.15***	-0.055	-0.13***	-0.011	0.043	0.032	-0.34***	-0.18***
	(0.000)	(0.109)	(0.000)	(0.713)	(0.085)	(0.220)	(0.000)	(0.000)
Size of social network	0.099***	0.074***	0.11***	0.074***	0.073***	0.072***	0.052***	0.024***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average contact 0-6	0.064***	0.066***	0.068***	0.066***	0.18***	0.17***	0.032**	0.030**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.009)	(0.008)
Average closeness 0-3	0.32***	0.26***	0.30***	0.24***	0.70***	0.68***	0.17***	0.11***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average proximity 0-5	-0.041***	-0.0045	-0.076***	-0.030***	-0.052***	-0.053***	-0.033**	0.019
	(0.000)	(0.657)	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.063)
Married/registered partnership	0.44***	0.33***	0.21***	0.14***	-0.013	0.027	0.18***	-0.042
	(0.000)	(0.000)	(0.000)	(0.000)	(0.338)	(0.385)	(0.000)	(0.290)
[1] Having 1 child	-0.050	-0.083*	0.056	0.0039	0.023	-0.00071	-0.069*	-0.065
	(0.140)	(0.018)	(0.082)	(0.901)	(0.332)	(0.978)	(0.049)	(0.060)
[2] Having 2 children	0.098**	0.035	0.15***	0.064*	0.028	0.0041	0.058	0.037
	(0.002)	(0.291)	(0.000)	(0.036)	(0.216)	(0.872)	(0.083)	(0.264)
[3] Having 3 or more children	0.028	-0.019	0.086*	0.0080	0.019	-0.0071	-0.034	-0.038
	(0.438)	(0.610)	(0.013)	(0.811)	(0.439)	(0.797)	(0.368)	(0.294)
Number of resident children	-0.030*	-0.058***	-0.089***	-0.12***	-0.027**	-0.030**	-0.010	-0.030*
	(0.025)	(0.000)	(0.000)	(0.000)	(0.003)	(0.002)	(0.459)	(0.024)
Number of grandchildren	-0.0072	0.0064	-0.021***	-0.0016	0.0095***	0.010***	-0.021***	-0.0046
	(0.052)	(0.077)	(0.000)	(0.600)	(0.000)	(0.000)	(0.000)	(0.188)
Controls								
Female	-0.074***	0.016	-0.19***	-0.083***	0.055***	0.051***	-0.65***	-0.51***
	(0.000)	(0.319)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age at interview	0.028*	0.047***	0.12***	0.13***	0.0039	0.0032	0.12***	0.11***
	(0.010)	(0.000)	(0.000)	(0.000)	(0.583)	(0.686)	(0.000)	(0.000)
Age at interview, squared	-0.00016*	-0.00018*	-0.0011***	-0.00100***	-0.000013	-0.0000018	-0.0010***	-0.00079***
	(0.047)	(0.032)	(0.000)	(0.000)	(0.806)	(0.975)	(0.000)	(0.000)
sh_country==[2]BEL	-0.37***	-0.31***	-0.62***	-0.52***	-0.27***	-0.28***	-0.40***	-0.23***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.35***	0.10**	0.51***	0.25***	0.21***	0.20***	0.100**	-0.12**
	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.009)	(0.001)
sh_country==[4]CZE	-0.80***	-0.50***	-1.25***	-0.88***	-0.044	-0.046	-0.16***	0.17***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.092)	(0.121)	(0.000)	(0.000)
sh_country==[5]DEU	-0.33***	-0.27***	-0.036	0.038	0.067	0.067	-0.15**	-0.076
	(0.000)	(0.000)	(0.464)	(0.405)	(0.076)	(0.093)	(0.003)	(0.114)
sh_country==[6]DNK	0.44***	0.18***	0.39***	0.11**	0.36***	0.32***	0.22***	0.017
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.665)
sh_country==[7]ESP	-0.66***	-0.33***	-0.99***	-0.49***	-0.17***	-0.16***	-0.66***	-0.21***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.30***	-1.01***	-0.96***	-0.59***	0.16***	0.20***	-0.81***	-0.34***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-0.80***	-0.66***	-0.36***	-0.16***	-0.11***	-0.12***	-0.58***	-0.32***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.49***	-0.97***	-1.25***	-0.61***	0.0041	0.026	-0.88***	-0.33***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.890)	(0.429)	(0.000)	(0.000)
sh_country==[11]ITA	-0.54***	-0.39***	-1.48***	-1.27***	0.0061	-0.0024	-0.52***	-0.33***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.819)	(0.931)	(0.000)	(0.000)
sh_country==[12]NLD	-0.21***	-0.28***	0.32***	0.26***	-0.45***	-0.49***	0.12**	0.100**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.009)
sh_country==[13]POL	-0.72***	-0.23***	-0.95***	-0.37***	0.15***	0.18***	-0.96***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[14]PRT	-1.19***	-0.58***	-2.04***	-1.26***	0.10**	0.23***	-1.14***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
sh_country==[15]SVN	-0.67***	-0.43***	0.066	0.38***	0.064*	0.074*	-0.30***	-0.069
	(0.000)	(0.000)	(0.114)	(0.000)	(0.047)	(0.034)	(0.000)	(0.120)
sh_country==[16]SWE	0.24***	0.079	0.012	-0.13**	0.31***	0.26***	0.12**	0.055
	(0.000)	(0.065)	(0.770)	(0.002)	(0.000)	(0.000)	(0.009)	(0.209)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Divorced/living separated		-0.11*		-0.047		-0.014		-0.12**
		(0.026)		(0.257)		(0.695)		(0.006)
Widowed		0.075		0.13**		0.10**		-0.15***
		(0.112)		(0.002)		(0.004)		(0.001)
[1] Suburbs of big city		-0.0012		0.031		0.021		-0.090**
		(0.968)		(0.256)		(0.365)		(0.003)
[2] Large town		0.023		0.031		0.073***		-0.092***
		(0.413)		(0.223)		(0.001)		(0.001)
[3] Small town		0.089***		0.068**		0.062**		0.0053
		(0.001)		(0.004)		(0.001)		(0.838)
[4] Rural area/village		0.059*		0.072**		0.044*		-0.0075
		(0.021)		(0.002)		(0.020)		(0.764)
Employment, current job		0.17***		0.16***		0.011		0.099***
		(0.000)		(0.000)		(0.514)		(0.000)
Self-employment, current job		0.15***		0.16***		-0.033		0.077*
		(0.000)		(0.000)		(0.224)		(0.018)
[1] Primary school		0.10		0.37***		-0.051		0.24***
		(0.092)		(0.000)		(0.192)		(0.000)
[2] Lower secondary school		0.14*		0.47***		-0.049		0.33***
		(0.022)		(0.000)		(0.223)		(0.000)
[3] Upper secondary school		0.16**		0.56***		-0.067		0.43***
		(0.009)		(0.000)		(0.094)		(0.000)
[4] Post-secondary non-tertiary education		0.23**		0.66***		-0.041		0.50***
		(0.001)		(0.000)		(0.386)		(0.000)
[5] First stage tertiary education		0.23***		0.59***		-0.085*		0.43***
		(0.000)		(0.000)		(0.040)		(0.000)
[6] Second stage tertiary education		0.37***		0.70***		-0.091		0.41***
		(0.000)		(0.000)		(0.197)		(0.000)
[1] Fair		1.01***		1.11***		0.11***		1.24***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.49***		1.77***		0.12***		1.95***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.81***		2.13***		0.20***		2.26***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.12***		2.44***		0.32***		2.38***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.49***		-0.61***		-0.090***		-1.19***
		(0.000)		(0.000)		(0.000)		(0.000)
[1] Middle income		0.15***		0.19***		0.0018		0.082**
		(0.000)		(0.000)		(0.927)		(0.002)
[2] Upper middle income		0.23***		0.21***		0.010		0.068**
		(0.000)		(0.000)		(0.598)		(0.008)
[3] High income		0.23***		0.23***		-0.022		0.059*
		(0.000)		(0.000)		(0.215)		(0.016)
_cons	5.71***	2.78***	3.19***	-0.26	6.12***	6.05***	4.62***	2.12***
	(0.000)	(0.000)	(0.000)	(0.457)	(0.000)	(0.000)	(0.000)	(0.000)
N	50624	45591	48957	44214	50869	45770	50326	45316
R^2	0.14	0.25	0.21	0.38	0.16	0.17	0.11	0.31
adjusted R^2	0.14	0.25	0.21	0.38	0.16	0.17	0.11	0.31

Table 3.26: Regressing well-being and mental health on network types controlling for network size, relational dynamics and family status for all countries, male respondents with social support network.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[2] Children	-0.11*	-0.049	-0.12*	-0.014	0.15***	0.15***	-0.10*	0.041
	(0.029)	(0.330)	(0.015)	(0.762)	(0.000)	(0.000)	(0.043)	(0.399)
[3] Other Relatives	-0.083	-0.039	0.023	0.084*	0.044	0.048	-0.11*	-0.040
	(0.090)	(0.405)	(0.621)	(0.049)	(0.222)	(0.207)	(0.026)	(0.370)
[4] Family	-0.055	0.013	-0.086*	0.0013	0.028	0.026	-0.074	0.030
	(0.161)	(0.734)	(0.020)	(0.969)	(0.297)	(0.356)	(0.052)	(0.400)
[5] Friends	0.038	0.038	0.15***	0.16***	0.050	0.057	-0.063	-0.033
	(0.411)	(0.395)	(0.000)	(0.000)	(0.158)	(0.123)	(0.164)	(0.428)
[6] Diverse	-0.042	-0.033	0.0076	0.048	-0.045	-0.061	-0.12*	-0.059
	(0.406)	(0.508)	(0.876)	(0.289)	(0.249)	(0.131)	(0.023)	(0.212)
Size of social network	0.077***	0.059***	0.084***	0.059***	0.064***	0.065***	0.041***	0.022*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.018)
Average contact 0-6	0.055**	0.053**	0.052**	0.051***	0.17***	0.16***	0.031	0.021
	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.000)	(0.075)	(0.196)
Average closeness 0-3	0.30***	0.23***	0.30***	0.23***	0.70***	0.69***	0.17***	0.11***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average proximity 0-5	-0.045**	-0.0031	-0.076***	-0.028	-0.048***	-0.045***	-0.024	0.025
	(0.006)	(0.848)	(0.000)	(0.051)	(0.000)	(0.000)	(0.131)	(0.102)
Married/registered partnership	0.44***	0.37***	0.22***	0.14*	0.063**	0.043	0.22***	0.0011
	(0.000)	(0.000)	(0.000)	(0.016)	(0.009)	(0.385)	(0.000)	(0.984)
[1] Having 1 child	0.0044	-0.065	0.098*	-0.0076	-0.018	-0.036	-0.0053	-0.042
	(0.931)	(0.210)	(0.042)	(0.872)	(0.608)	(0.357)	(0.915)	(0.388)
[2] Having 2 children	0.16***	0.030	0.22***	0.068	-0.035	-0.049	0.10*	0.030
	(0.001)	(0.530)	(0.000)	(0.126)	(0.296)	(0.186)	(0.025)	(0.503)
[3] Having 3 or more children	0.092	-0.033	0.17***	0.0011	-0.046	-0.068	0.0093	-0.064
	(0.076)	(0.538)	(0.001)	(0.982)	(0.218)	(0.099)	(0.856)	(0.198)
Number of resident children	-0.010	-0.030	-0.090***	-0.11***	-0.033*	-0.038**	-0.014	-0.033
	(0.577)	(0.097)	(0.000)	(0.000)	(0.015)	(0.007)	(0.432)	(0.055)
Number of grandchildren	-0.0056	0.011*	-0.024***	-0.0025	0.0086*	0.010*	-0.015**	-0.0014
	(0.304)	(0.032)	(0.000)	(0.602)	(0.023)	(0.011)	(0.003)	(0.773)
Controls								
Age at interview	0.057***	0.084***	0.15***	0.16***	-0.016	-0.015	0.14***	0.12***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.165)	(0.236)	(0.000)	(0.000)
Age at interview, squared	-0.00039**	-0.00044***	-0.0012***	-0.0012***	0.00013	0.00014	-0.0012***	-0.00090***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.109)	(0.119)	(0.000)	(0.000)
sh_country==[2]BEL	-0.29***	-0.32***	-0.58***	-0.57***	-0.23***	-0.26***	-0.25***	-0.20***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.35***	0.055	0.46***	0.14**	0.26***	0.19***	0.15**	-0.11*
	(0.000)	(0.310)	(0.000)	(0.006)	(0.000)	(0.000)	(0.005)	(0.041)
sh_country==[4]CZE	-0.77***	-0.45***	-1.26***	-0.89***	-0.023	-0.0063	-0.053	0.27***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.561)	(0.891)	(0.316)	(0.000)
sh_country==[5]DEU	-0.34***	-0.29***	-0.076	-0.029	0.052	0.046	-0.0020	0.049
	(0.000)	(0.000)	(0.294)	(0.666)	(0.364)	(0.442)	(0.978)	(0.460)
sh_country==[6]DNK	0.36***	0.074	0.31***	-0.013	0.36***	0.29***	0.26***	0.047
	(0.000)	(0.189)	(0.000)	(0.793)	(0.000)	(0.000)	(0.000)	(0.378)
sh_country==[7]ESP	-0.52***	-0.27***	-0.78***	-0.37***	-0.14**	-0.12*	-0.18**	0.069
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.016)	(0.003)	(0.252)
sh_country==[8]EST	-1.42***	-1.15***	-1.09***	-0.72***	0.13**	0.13**	-0.75***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.005)	(0.000)	(0.000)
sh_country==[9]FRA	-0.75***	-0.65***	-0.28***	-0.16**	-0.089*	-0.10*	-0.41***	-0.26***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.027)	(0.017)	(0.000)	(0.000)
sh_country==[10]HUN	-1.45***	-0.97***	-1.21***	-0.61***	-0.023	-0.0067	-0.66***	-0.18**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.621)	(0.901)	(0.000)	(0.004)
sh_country==[11]ITA	-0.47***	-0.41***	-1.36***	-1.23***	0.032	0.025	-0.34***	-0.27***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.419)	(0.557)	(0.000)	(0.000)
sh_country==[12]NLD	-0.17***	-0.30***	0.32***	0.19***	-0.41***	-0.45***	0.27***	0.16**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
sh_country==[13]POL	-0.64***	-0.19*	-0.90***	-0.34***	0.15**	0.18**	-0.75***	-0.29***
	(0.000)	(0.027)	(0.000)	(0.000)	(0.009)	(0.004)	(0.000)	(0.000)
sh_country==[14]PRT	-0.93***	-0.50***	-1.92***	-1.24***	0.14**	0.28***	-0.73***	-0.21**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.000)	(0.006)
sh_country==[15]SVN	-0.75***	-0.51***	0.081	0.39***	0.070	0.063	-0.22***	-0.0019
	(0.000)	(0.000)	(0.201)	(0.000)	(0.154)	(0.252)	(0.000)	(0.975)
sh_country==[16]SWE	0.22***	-0.012	-0.094	-0.29***	0.32***	0.26***	0.13*	0.014
	(0.000)	(0.848)	(0.132)	(0.000)	(0.000)	(0.000)	(0.035)	(0.814)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Divorced/living separated		-0.0057		0.033		-0.054		-0.100
		(0.938)		(0.605)		(0.342)		(0.128)
Widowed		0.094		0.12		0.020		-0.25**
		(0.242)		(0.078)		(0.750)		(0.001)
[1] Suburbs of big city		-0.00046		0.034		0.033		-0.069
		(0.992)		(0.401)		(0.368)		(0.102)
[2] Large town		0.025		0.060		0.086*		-0.096*
		(0.553)		(0.115)		(0.011)		(0.015)
[3] Small town		0.074		0.092**		0.085**		0.028
		(0.060)		(0.008)		(0.006)		(0.430)
[4] Rural area/village		0.049		0.11**		0.096**		0.022
		(0.194)		(0.001)		(0.001)		(0.524)
Employment, current job		0.29***		0.21***		0.027		0.12***
		(0.000)		(0.000)		(0.297)		(0.000)
Self-employment, current job		0.21***		0.22***		0.0031		0.073
		(0.000)		(0.000)		(0.929)		(0.063)
[1] Primary school		0.24*		0.41***		-0.025		0.20*
		(0.012)		(0.000)		(0.721)		(0.026)
[2] Lower secondary school		0.25**		0.53***		0.022		0.29**
		(0.008)		(0.000)		(0.751)		(0.001)
[3] Upper secondary school		0.26**		0.61***		-0.0095		0.31***
		(0.006)		(0.000)		(0.891)		(0.001)
[4] Post-secondary non-tertiary education		0.37***		0.65***		0.057		0.30**
		(0.001)		(0.000)		(0.472)		(0.003)
[5] First stage tertiary education		0.30**		0.65***		-0.0024		0.29**
		(0.002)		(0.000)		(0.973)		(0.002)
[6] Second stage tertiary education		0.39**		0.72***		-0.089		0.23
		(0.004)		(0.000)		(0.393)		(0.079)
[1] Fair		1.06***		1.13***		0.10**		1.22***
		(0.000)		(0.000)		(0.002)		(0.000)
[2] Good		1.49***		1.76***		0.098**		1.86***
		(0.000)		(0.000)		(0.004)		(0.000)
[3] Very good		1.81***		2.11***		0.19***		2.13***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.08***		2.42***		0.30***		2.22***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.43***		-0.58***		-0.081*		-1.21***
		(0.000)		(0.000)		(0.013)		(0.000)
[1] Middle income		0.23***		0.25***		0.026		0.14***
		(0.000)		(0.000)		(0.394)		(0.000)
[2] Upper middle income		0.30***		0.31***		0.021		0.17***
		(0.000)		(0.000)		(0.494)		(0.000)
[3] High income		0.26***		0.29***		0.038		0.12***
		(0.000)		(0.000)		(0.166)		(0.001)
_cons	4.79***	1.50*	2.37***	-1.00	6.84***	6.61***	3.71***	1.85**
	(0.000)	(0.014)	(0.000)	(0.062)	(0.000)	(0.000)	(0.000)	(0.001)
N	22018	19941	21359	19390	22121	20021	21882	19815
R^2	0.13	0.25	0.19	0.37	0.17	0.17	0.066	0.28
adjusted R^2	0.13	0.25	0.19	0.37	0.17	0.17	0.065	0.28

Table 3.27: Regressing well-being and mental health on network types controlling for network size, relational dynamics and family status for all countries, female respondents with social support network.

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
[2] Children	-0.32***	-0.19***	-0.44***	-0.26***	0.21***	0.18***	-0.47***	-0.20***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
[3] Other Relatives	-0.20***	-0.11*	-0.17***	-0.063	0.20***	0.18***	-0.43***	-0.26***
	(0.000)	(0.019)	(0.000)	(0.138)	(0.000)	(0.000)	(0.000)	(0.000)
[4] Family	-0.17***	-0.082	-0.24***	-0.12**	0.18***	0.16***	-0.32***	-0.12**
	(0.000)	(0.052)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.007)
[5] Friends	-0.16***	-0.11*	-0.069	0.028	0.25***	0.23***	-0.41***	-0.24***
	(0.001)	(0.020)	(0.111)	(0.502)	(0.000)	(0.000)	(0.000)	(0.000)
[6] Diverse	-0.26***	-0.11*	-0.28***	-0.093*	0.16***	0.14***	-0.57***	-0.31***
	(0.000)	(0.031)	(0.000)	(0.038)	(0.000)	(0.000)	(0.000)	(0.000)
Size of social network	0.11***	0.085***	0.12***	0.084***	0.075***	0.075***	0.060***	0.024**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
Average contact 0-6	0.069***	0.075***	0.082***	0.078***	0.18***	0.18***	0.036*	0.039*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.033)	(0.012)
Average closeness 0-3	0.34***	0.29***	0.31***	0.26***	0.69***	0.67***	0.17***	0.12***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average proximity 0-5	-0.036**	-0.0026	-0.074***	-0.031**	-0.054***	-0.058***	-0.038**	0.017
	(0.007)	(0.847)	(0.000)	(0.009)	(0.000)	(0.000)	(0.006)	(0.204)
Married/registered partnership	0.43***	0.30***	0.19***	0.13**	-0.045**	0.016	0.15***	-0.057
	(0.000)	(0.000)	(0.000)	(0.008)	(0.008)	(0.704)	(0.000)	(0.314)
[1] Having 1 child	-0.091*	-0.088	0.024	0.020	0.041	0.022	-0.12*	-0.070
	(0.045)	(0.061)	(0.582)	(0.630)	(0.197)	(0.528)	(0.016)	(0.145)
[2] Having 2 children	0.051	0.045	0.094*	0.067	0.065*	0.042	0.023	0.056
	(0.239)	(0.322)	(0.025)	(0.110)	(0.034)	(0.217)	(0.629)	(0.235)
[3] Having 3 or more children	-0.022	-0.0067	0.019	0.018	0.063	0.040	-0.064	0.00077
	(0.659)	(0.897)	(0.694)	(0.699)	(0.064)	(0.291)	(0.232)	(0.988)
Number of resident children	-0.050*	-0.083***	-0.089***	-0.13***	-0.027*	-0.027*	-0.0047	-0.029
	(0.011)	(0.000)	(0.000)	(0.000)	(0.027)	(0.039)	(0.824)	(0.148)
Number of grandchildren	-0.0071	0.0032	-0.017***	-0.00072	0.0096**	0.0096**	-0.024***	-0.0072
	(0.157)	(0.513)	(0.000)	(0.863)	(0.002)	(0.003)	(0.000)	(0.138)
Controls								
Age at interview	0.0066	0.022	0.11***	0.12***	0.015	0.011	0.11***	0.11***
	(0.643)	(0.142)	(0.000)	(0.000)	(0.109)	(0.268)	(0.000)	(0.000)
Age at interview, squared	0.0000036	0.0000092	-0.00093***	-0.00090***	-0.000095	-0.000070	-0.00092***	-0.00071***
	(0.972)	(0.933)	(0.000)	(0.000)	(0.157)	(0.345)	(0.000)	(0.000)
sh_country==[2]BEL	-0.43***	-0.29***	-0.66***	-0.48***	-0.30***	-0.30***	-0.52***	-0.24***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[3]CHE	0.33***	0.14**	0.56***	0.33***	0.17***	0.19***	0.066	-0.12*
	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.222)	(0.027)
sh_country==[4]CZE	-0.83***	-0.52***	-1.24***	-0.87***	-0.062	-0.074	-0.25***	0.093
	(0.000)	(0.000)	(0.000)	(0.000)	(0.066)	(0.053)	(0.000)	(0.065)
sh_country==[5]DEU	-0.31***	-0.25***	0.0034	0.099	0.079	0.086	-0.26***	-0.16*
	(0.000)	(0.000)	(0.958)	(0.107)	(0.119)	(0.109)	(0.000)	(0.017)
sh_country==[6]DNK	0.49***	0.27***	0.46***	0.21***	0.35***	0.34***	0.20**	-0.0061
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.919)
sh_country==[7]ESP	-0.78***	-0.38***	-1.16***	-0.60***	-0.19***	-0.19***	-1.03***	-0.44***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[8]EST	-1.22***	-0.90***	-0.87***	-0.49***	0.16***	0.24***	-0.85***	-0.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[9]FRA	-0.84***	-0.67***	-0.43***	-0.15***	-0.13***	-0.14***	-0.70***	-0.37***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
sh_country==[10]HUN	-1.52***	-0.96***	-1.27***	-0.61***	0.024	0.061	-1.05***	-0.41***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.525)	(0.148)	(0.000)	(0.000)
sh_country==[11]ITA	-0.60***	-0.39***	-1.57***	-1.30***	-0.013	-0.021	-0.66***	-0.37***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.711)	(0.570)	(0.000)	(0.000)
sh_country==[12]NLD	-0.25***	-0.26***	0.32***	0.32***	-0.49***	-0.51***	-0.0047	0.064
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.936)	(0.244)
sh_country==[13]POL	-0.79***	-0.26***	-1.00***	-0.40***	0.15**	0.19***	-1.12***	-0.54***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
sh_country==[14]PRT	-1.39***	-0.64***	-2.14***	-1.27***	0.075	0.19***	-1.47***	-0.47***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.089)	(0.000)	(0.000)	(0.000)
sh_country==[15]SVN	-0.61***	-0.37***	0.050	0.38***	0.061	0.092*	-0.36***	-0.11
	(0.000)	(0.000)	(0.369)	(0.000)	(0.147)	(0.038)	(0.000)	(0.081)
sh_country==[16]SWE	0.24***	0.15**	0.084	-0.0020	0.28***	0.25***	0.11	0.086
	(0.000)	(0.009)	(0.134)	(0.970)	(0.000)	(0.000)	(0.089)	(0.159)

	Life satisfaction		Quality of life (CASP-12)		Network satisfaction		Lack of depressive symptoms (EURO-D)	
	A	B	A	B	A	B	A	B
Divorced/living separated		-0.17**		-0.10		-0.00083		-0.13*
		(0.005)		(0.061)		(0.986)		(0.043)
Widowed		0.035		0.12*		0.11*		-0.12*
		(0.555)		(0.026)		(0.014)		(0.040)
[1] Suburbs of big city		-0.0068		0.026		0.014		-0.11*
		(0.870)		(0.478)		(0.629)		(0.010)
[2] Large town		0.020		0.0073		0.062*		-0.092*
		(0.592)		(0.829)		(0.022)		(0.018)
[3] Small town		0.098**		0.044		0.047		-0.016
		(0.006)		(0.159)		(0.065)		(0.654)
[4] Rural area/village		0.065		0.039		0.0066		-0.033
		(0.065)		(0.199)		(0.784)		(0.344)
Employment, current job		0.085**		0.13***		-0.0057		0.071*
		(0.006)		(0.000)		(0.789)		(0.026)
Self-employment, current job		0.10*		0.088		-0.091*		0.093
		(0.044)		(0.072)		(0.034)		(0.102)
[1] Primary school		0.013		0.34***		-0.068		0.25**
		(0.869)		(0.000)		(0.155)		(0.001)
[2] Lower secondary school		0.053		0.41***		-0.10*		0.33***
		(0.493)		(0.000)		(0.042)		(0.000)
[3] Upper secondary school		0.084		0.50***		-0.11*		0.48***
		(0.281)		(0.000)		(0.030)		(0.000)
[4] Post-secondary non-tertiary education		0.12		0.65***		-0.11		0.62***
		(0.176)		(0.000)		(0.059)		(0.000)
[5] First stage tertiary education		0.19*		0.55***		-0.15**		0.53***
		(0.016)		(0.000)		(0.003)		(0.000)
[6] Second stage tertiary education		0.41**		0.68***		-0.039		0.58***
		(0.005)		(0.000)		(0.696)		(0.000)
[1] Fair		0.98***		1.09***		0.11***		1.25***
		(0.000)		(0.000)		(0.000)		(0.000)
[2] Good		1.50***		1.78***		0.13***		2.01***
		(0.000)		(0.000)		(0.000)		(0.000)
[3] Very good		1.81***		2.15***		0.21***		2.37***
		(0.000)		(0.000)		(0.000)		(0.000)
[4] Excellent		2.14***		2.45***		0.34***		2.50***
		(0.000)		(0.000)		(0.000)		(0.000)
Drugs for depression		-0.51***		-0.61***		-0.099***		-1.15***
		(0.000)		(0.000)		(0.000)		(0.000)
[1] Middle income		0.099**		0.14***		-0.011		0.051
		(0.005)		(0.000)		(0.656)		(0.172)
[2] Upper middle income		0.17***		0.13***		0.0029		0.0057
		(0.000)		(0.000)		(0.905)		(0.874)
[3] High income		0.21***		0.20***		-0.064**		0.035
		(0.000)		(0.000)		(0.007)		(0.302)
_cons	6.32***	3.68***	3.57***	0.12	5.75***	5.85***	4.65***	1.81***
	(0.000)	(0.000)	(0.000)	(0.795)	(0.000)	(0.000)	(0.000)	(0.001)
N	28606	25650	27598	24824	28748	25749	28444	25501
R^2	0.14	0.25	0.22	0.39	0.16	0.17	0.083	0.29
adjusted R^2	0.14	0.25	0.22	0.39	0.16	0.16	0.082	0.29

Chapter 4

Religion, moral attitudes and economic behavior

Using data for a representative sample of the Dutch population with information about participants' religious background, we study the association between religion and moral behavior and attitudes. We find that religious people are less accepting of unethical economic behavior (e.g., tax evasion, bribery) and report more volunteering. They are equally likely as non-religious people to betray trust in an experimental game, where social behavior is unobservable and not directed to a self-selected group of recipients. Religious people also report lower preference for redistribution. Considering differences between denominations, Catholics betray less than non-religious people, while Protestants betray more than Catholics and are indistinguishable from the non-religious. We also explore the intergenerational transmission and the potential causality of these associations[1].

[1]The content of Chapter 4 has been published as Isadora Kirchmaier, Jens Prüfer, and Stefan T. Trautmann (2018). "Religion, moral attitudes and economic behavior". In: *Journal of Economic Behavior & Organization* 148, pp. 282–300. We are grateful for helpful comments by Johan Graafland, Gillian Hadfield, Laurence Iannaccone, Michael McBride, two anonymous reviewers and the editor, as well as seminar audiences at the University of Southern California, Tilburg University and the SIOE 2016 conference (Paris). In this paper use is made of data of the LISS (Longitudinal Internet Studies for the Social sciences) panel administered by CentERdata (Tilburg University, The Netherlands). All errors are our own.

4.1 Introduction

Thirty-nine percent of the participants in a representative panel of the Dutch population (used in this paper) have some religious affiliation. In contrast, sixty-five percent of those participants' parents were church members when our participants were aged 15. This significant decline, which documents a trend in line with other studies on the Netherlands,[2] is exemplary for the development of church membership and attendance in Western Europe (Tracey 2012) but occurs despite an increase in the importance of religiosity in much of the rest of the world (Berger 2001).

Our question is whether such a decline in the membership in religious organisations might be associated with changes in the social cohesion of the economy. More specifically, what is the relationship of religiosity with what we dub moral attitudes and behaviors: social behavior; redistribution of income; charity; and trustworthiness in economic interactions? Using a detailed data set on the general Dutch population, we first document the correlation of moral attitudes with religious affiliation and differences across denominations. We next assess whether these associations are transmitted from parents to their children when these are adults themselves. The observed associations may be caused by a pathway from religiosity to attitudes (via indoctrination), from attitudes to church membership (via self-selection, as the classical "religious communities as club goods" model of Iannaccone (1998) suggests), or by unobserved factors driving both attitudes and church membership. As a third step in the analysis, we therefore investigate the potential causality of the associations.

Research in economics and finance has paid much attention to the role of religion, and has uncovered some persistent relationships between religion and economic

[2]See e.g. Becker and De Hart (2006). Stoffels and P. (2005) report the following development of church membership in the Netherlands: 1970 : 75%; 1980 : 69%; 1990 : 64%; 2000 : 50%; 2005 : 45%.

behavior. Important areas of investigation concerned the link between religion and risk taking and financial investment (Kumar, Page, and Spalt 2011; Noussair, Trautmann, Van de Kuilen, et al. 2013); managerial decision making (Hilary and Hui 2009; Filistrucchi and Prüfer 2018); education and human capital (Glaeser and Sacerdote 2008; Becker and Woessmann 2009); innovation (Bénabou, Ticchi, and Vindigni 2015); and with economic and financial development (Barro and McCleary 2003; Guiso, Sapienza, and Zingales 2003; Guiso, Sapienza, and Zingales 2006). Studying World Value Survey data, Guiso, Sapienza, and Zingales (2003) focused on the role of economic attitudes rather than outcomes.[3] While their data are fascinating as they cover a cross-section of 66 countries and many different religions and demographic data, we complement the approach of Guiso, Sapienza, and Zingales (2003) by studying religiosity and moral attitudes of a representative sample of the population of one country, the Netherlands, and one main religion, Christianity, with a highly detailed data set (see details in section 4.2). On top, we combine survey data with the results of an experimental game played on the panel with real monetary payoffs.

The association between religion and moral attitudes and behavior is widely discussed in academic and popular discourses (e.g., Armstrong (2015); Shariff, Piazza, and Kramer (2014)). On the one hand, there is the potential effect of religion on behavior through ethical standards imposed on the faithful by their religion's moral code. For example, charity is an important aspect in many religions. On the other hand, there is the perception that much aggression and violence has been justified in religious terms throughout human history (e.g., Dalai Lama (2015)).

[3] Guiso, Sapienza, and Zingales (2003, p.231) justify the focus on attitudes as follows:

> "We reduce the effect of potentially spurious factors by looking at people's attitudes rather than at their economic outcome. Asking somebody his view on cheating on taxes is different from asking him if he has cheated on his taxes. The first question, however, is more appropriate for our purposes than the second. The decision of whether to actually cheat is affected greatly by the probability of being caught. This is a function of a country's law enforcement, not of an individual's attitude. Therefore, looking at attitudes is a better way of identifying the effect of religious beliefs on people's preferences."

Empirically, there is indeed little agreement on whether adherence to a faith is correlated with more or with less ethical behavior (e.g. Hermann (2001), Section 2, on crime; Sablosky (2014), on generosity). Empirical assessments are complicated by the fact that morality differs for religious and non-religious people, and across faiths (Shariff, Piazza, and Kramer 2014). Moreover, religious affiliation may affect opportunity sets, which affects revealed behavior but not necessarily attitudes. For example, Schneider, Linsbauer, and Heinemann (2015) report a positive link between religion and the shadow economy. They argue that it is not clear whether the effect is due to attitudes toward the state and taxation, or rather due to close-knit religious communities proving more opportunities for informal transactions. Clearly, the argument may also run in the other direction, where religious communities may provide more opportunity for charitable work and giving.

In the current paper, we aim to study a set of ethical judgements and behavior relevant to economic interactions, using individual-level variation in religiosity and ethical behavior. Using a demographically representative data set of Dutch households, we study whether religious people hold stricter views regarding a set of moral judgements (e.g., tax evasion, bribery), whether they favor income redistribution more or less, and whether they spend more or less time on charity and care than non-religious people. We also study whether they behave more trustworthy in an abstract experimental game with real monetary payoffs, as well as their self-reported trustworthiness. These dependent measures provide insight into moral attitudes, and have direct relevance to the effectiveness of economic institutions.[4] For instance, to which degree can other members of a society be expected to behave opportunistically; or which type of citizens may be more prone to help others when the help is organised by a socially visible organisation or a less visible

[4]Alesina and Giuliano (2015) provide a recent survey on the literature studying culture, institutions, and the associated economic effects. A consistently occurring determinant of culture in that article is religion. Keefer and Knack (2008) refer to these attitudes as norms of civic cooperation, and stress their importance for economic interactions by reducing enforcement costs.

informal network, as opposed to the state? We observe various dimensions of religiousness: church membership, frequency of attendance, frequency of prayer, as well as two measures of belief in God and theological concepts. In our data, there are two significant religious subgroups, Catholics and Protestants, and we study whether there are differences between adherents of these Christian denominations. Importantly, the variation in a person's religious background as observed in the current Dutch data set has shown to be related to attitudes toward financial risk (Noussair, Trautmann, Van de Kuilen, et al. 2013). That is, in the sample that we study, religion is an attribute of people's identity that is linked to economically relevant behavior. The novel question concerns whether associations with ethical judgement and behavior can be observed.

Our results can be summarised as follows. We find that religious people report more moral judgements (less accepting of ethical lapses), and report more hours of volunteering and informal care. However, in an abstract experimental game with an anonymous partner, religious people are equally likely to betray the other person's trust as the non-religious. At the same time, they are also less favorable towards increasing income redistribution than the non-religious. Importantly, these results are robust across the different dimensions of religiosity (participation vs. beliefs) that we observe. This is remarkable given that previous research suggests that social aspects of participation and private religious believes may have different associations with economic behavior and attitudes (e.g., McCleary and Barro (2006) and Noussair, Trautmann, Van de Kuilen, et al. (2013)). We find modest differences between Christian denominations. Protestants are more likely to spend time volunteering. In contrast, for the behavior in the experimental game, we find that Catholics betray less than non-religious people, while Protestants betray more than Catholics and are indistinguishable from the non-religious. We show that these results are mostly due to the very 'orthodox' Protestants (Graafland 2017), defined by high frequency of church attendance.

Using data on the participants' parents' church membership and frequency of attendance when the participant was aged 15, we study the intergenerational transmission of the observed associations. We find evidence that religious upbringing is linked to moral attitudes and behavior when our participants are adults. We discuss possible pathways for this correlation across generations. Probing the endogeneity of religiosity in the association with moral attitudes, we find that the association persists if we control for non-religious organisational membership and participants' politics, both of which may proxy general social attitudes and behavior transmitted from parents to children. Using parental religious indicators as instruments, i.e. explicitly assuming a unique pathway from parental religion to children's religion, we find no evidence for a direct selection story in the spirit of club good models underlying the link between moral attitudes and religion.

The remainder of the paper is laid out as follows. In the next section we describe the data and define our variables of interest. Section 4.3 gives results for religiosity in general, and Section 4.4 gives results on denomination differences. Section 4.5 considers the intergenerational transmission, and Section 4.6 probes the endogeneity of religiosity. Section 4.7 provides a concluding discussion.

4.2 Data and methodology

4.2.1 Participants

We use data from the LISS panel, managed by CentERdata, a research center affiliated with Tilburg University. The LISS panel consists of approximately 7000 individuals from about 4500 households, who complete a questionnaire over the internet each month. Respondents are reimbursed for the costs of completing the questionnaires four times a year. Additionally, incentivized economic experiments

are conducted routinely on the LISS panel. A payment infrastructure is available to pay participants according to their decisions in experimental tasks.

In terms of observable background characteristics, the LISS panel is a representative sample of the Dutch population.[5] A large number of background variables are available, including data from a survey on religious beliefs and participation. We make use of various modules of the LISS data that were administered between 2008 and 2012. Sample sizes for the different analyses vary according to the number of panel members who participated in each of the relevant modules. Exact samples sizes for each part of the analysis, and a list of all LISS modules that we have used for the current study, are provided in the Online Appendix.[6]

4.2.2 Measurement of religiosity and religious participation

The survey on religion that LISS participants have completed contains data on the religious activities and beliefs of the survey participants at the date of the survey. The Netherlands are diverse in terms of faiths, with similar shares of Protestants and Catholics, and a large share of non-members (Table 4.1 for details). Within the group of church members, there is much variation in the level of activity and belief. Attendance ranges from irregular visits to attending service multiple times a week; some groups hold beliefs in a literal interpretation of the Bible. In terms of organisation, in the Netherlands the faithful are members of the local congregation of their church, for which they pay regular voluntary contributions (through bank transfers), additionally to offerings collected during services. Through a registry that is connected to the municipality registration, churches can keep track of their members when they move to another parish. Our data are based on self-reports of membership.

[5] See https://www.lissdata.nl/lissdata/about-panel for details on the panel structure and representativeness.

[6] Available in the online supplementary material of Kirchmaier, Prüfer, and Trautmann (2018) and at https://heidata.uni-heidelberg.de/dataverse/awiexeco.

Table 4.1 provides summary statistics of responses in five dimensions of religious activity that we employ as explanatory variables in our analyses. We show these summary statistics for different (sub)groups of the panel. In column (1) we report the means for each variable over all observations. In columns (2), (3) and (4) we report the mean for the subsample of church members, Roman Catholics and Protestants, respectively. For example, the second row of the table indicates that 19% of all panel members are Catholic, while 48% of all church members on the panel are Catholic.

The first dimension we consider is church membership. We define a dummy variable for being a *church member* of any religious group, as well as dummy variables for *Roman Catholic*, *Protestant* and *Other faiths*.[7] While these variables are measured with little noise, they are uninformative on the strength of religious beliefs or activities. We thus define as the second dimension the frequency of church attendance. Attendance is measured on a six-point scale ranging from "never" through "only on special religious days" to "every day". As shown in Table 4.1, some of the categories apply to only a small share of the population. We aggregate these dimensions to obtain a 3-category measure *Church Attendance* ranging from never, through less than once a week (i.e., irregularly), to at least once a week (i.e., regularly). We also create the respective dummy variables for each category. We also differentiate between non-orthodox and orthodox church members (see Graafland (2017), for a discussion of strictly protestant groups in the Netherlands), to be able to detect characteristics that correlate with strong religious affiliation. For Catholics and Protestants, we define church members as *orthodox* if they attend church at least once a week, and as *non-orthodox* if they attend church less than once a week or never. The next dimension concerns private religious activity, in the form of praying. Private *Prayer* is less socially visible than church attendance and may thus have different underlying goals and determinants. As with church

[7]Summary statistics separated by orthodox and non-orthodox subgroups are shown in Table 4.12 in the Appendix.

Table 4.1: Summary statistics: religion.

	# Obs.	All (1)	Church members (2)	Catholics (3)	Protestants (4)
Religious status					
Church membership	5581	39%			
Roman Catholic	5561	19%	48%		
Protestant	5561	15%	40%		
Other faiths	5561	5%	13%		
Orthodox Roman Catholic[a]	1024			10%	
Orthodox Protestants[a]	857				44%
Church attendance					
More than once a week	5599	4%	10%	3%	13%
Once a week	5599	7%	18%	8%	31%
At least once a month	5599	6%	15%	16%	16%
Only at special days	5599	12%	22%	31%	12%
Rarely	5599	13%	17%	21%	15%
Never	5599	57%	17%	21%	12%
Private prayer					
More than once a week	5587	25%	55%	37%	73%
Once a week	5587	3%	6%	8%	4%
At least once a month	5587	4%	6%	8%	4%
Only at special days	5587	3%	5%	7%	2%
Rarely	5587	16%	17%	24%	11%
Never	5587	49%	11%	16%	6%
Belief in God					
Degree of belief in God (0–5)	5656	2.36	3.78	3.30	4.19
Strong belief in God [b]	5656	43%	78%	69%	88%
Belief in theological concepts					
Believe in life after death	3724	50%	75%	63%	85%
Believe in existence of heaven	4024	37%	72%	49%	88%
Believe in existence of hell	4796	13%	28%	8%	39%
Believe in existence devil	4784	16%	34%	10%	51%
Believe that Adam and Eve existed	3704	38%	65%	40%	82%
Believe in Bible as the word of God	4454	37%	76%	60%	91%
Believe that prayer makes sense	4235	49%	91%	85%	96%
Belief in theological concepts (0–7)	1866	2.50	5.29	3.29	6.09
Strong belief in theological concepts [b]	1866	45%	90%	75%	97%

Percentages or means of all (1), church members (2), Roman Catholics (3) and Protestants (4) are reported. The first column shows the number of observations for sample (1) except for Orthodox Roman Catholic and Protestant. There the number of observations for sample (3) and (4) are reported, respectively.
[a] Defined as those Catholic/Protestant participants who visit church at least once a week.
[b] Indicator for degree of belief in God [resp. belief in theological concepts]: 0 ($\leq$ median), 1 ($>$ median). Values from the same dimension may not add to 100% due to rounding.

attendance, we define a 3-category measure ranging from *never*, through *less than once a week*, to *at least once a week*, and create the respective dummy variables for each category.

The next two categories concern the internal aspects of religion, that is, religious beliefs. We define two categories. First, *Belief in God* is reported on a six-point

scale ranging from 0: "I do not believe in God" to 5: "I believe without any doubt in God". We also define the dummy variables of *strong belief* and *weak belief in God*, based on the median split of the answers to the Belief in God variable. Second, we measure the strength of *beliefs in theological concepts* by a count of the number of affirmative answers on a set of seven questions asking the participants whether they believe in specific Christian theological concepts. These are (i) *life after death*, (ii) *existence of heaven*, (iii) *the Bible as the word of God*, (iv) *existence of hell*, and (v) *the devil*, (vi) that *Adam and Eve existed*, and (vii) that it *makes sense to pray*.[8] We also define the dummy variables of *strong belief in theological concepts* and *weak belief in theological concepts* based on the median split of the aggregated answers to the strength of religious belief variable. Information on the correlation among the different measures of religiosity is provided in the Online Appendix.

Taken together, our data allow us to distinguish between the theological dimension ("believing") and the social dimension ("belonging") of religion and thereby to relate our findings to the literature (e.g., Barro and McCleary (2003) and Noussair, Trautmann, Van de Kuilen, et al. (2013)). In this context, *Belief in God*, *belief in theological concepts*, and *private praying* relate to "believing", whereas *church membership* and *church attendance* relate to "belonging".

4.2.3 Ethical judgements and behavior

We consider six dependent measures of ethics, shown in Table 4.2 (dependent variables shown in italics; information on the correlation among the different measures are provided in the Online Appendix).

[8]Cronbach's alpha for the seven questions about belief in theological concepts equals 0.94, indicating a unique factor driving the answer to these questions. Sample sizes are reduced here because respondents who answered questions with "maybe" or "I don't know" were treated as missing values.

Table 4.2: Summary statistics: ethical judgement and behavior.

	# Obs.	All (1)	Church members (2)	Catholics (3)	Protestants (4)
Moral judgment[a]					
Social benefit fraud	565	8.53	8.62	8.56	8.67
Cheating on tax	565	7.64	7.76	7.65	7.96
Stealing someone else's car for a joyride	564	8.66	8.73	8.77	8.74
Lying out of self-interest	565	6.78	7.10	7.05	7.25
Adultery	565	7.55	8.02	7.89	8.28
Accepting a bribe	564	8.23	8.53	8.59	8.56
Fare evasion in public transport	564	7.38	7.62	7.61	7.60
Moral judgment[b]	562	7.82	8.05	8.00	8.15
Preferences for redistribution					
Prefer lower income differences in society[c]	5022	2.80	2.79	2.84	2.76
Public charity					
Hours spent on voluntary work per week[d]	5638	3.10	3.85	3.93	3.94
Private charity					
Hours spent on informal care per week	5638	1.95	2.21	2.14	2.33
Unobservable charity: trust game					
Responder honors the trust	470	51%	56%	62%	48%
Self-perceived trustwortiness					
People can trust me	3161	5.06	5.16	5.19	5.17

Percentages or means of all (1), church members (2), Roman Catholics (3) and Protestants (4) are reported. The first column shows the number of observations for sample (1).

[a] Individual questions were asking whether activity can be justified, individual statements scored on a scale of 0 (always) to 9 (never).

[b] Aggregate measure normalized such that zero indicates low and 9 indicates high moral judgement.

[c] On a scale from 0 (prefer an increase in income differences) to 4 (prefer a decrease in income differences).

[d] Includes hours spent on informal care. For one individual the time spent on voluntary work was 24 h per day. Since this is not plausible, we excluded this observation.

The first measure is an aggregate index of moral judgements. Participants indicated for seven unethical behaviors whether they thought that these were justified on a scale from 0 (always justified) to 9 (never justified). The seven questions concern a wide range of ethical behaviors: (i) claiming state benefits which you are not entitled to; (ii) cheating on tax; (iii) stealing someone else's car for a joyride; (iv) lying out of self-interest; (v) having an affair despite being married; (vi) accepting a bribe; and (vii) not paying the fare for public transport.[9] Taking the average of the seven questions and renormalizing low ethics to zero we obtain our aggregate indicator *Moral judgement*, ranging from 0 (low ethics) to 9 (high

[9]Cronbach's alpha for the seven questions about moral judgment is 0.68. From a factor analysis we observe only one factor with eigenvalue greater than 1, suggesting that answers to the questions are driven by a unique source.

ethics). Information on the correlation among the different moral judgements is provided in the Online Appendix.

Our second measure concerns the stated *preference for redistribution*. Participants indicated their views on income differences on a scale from 0 (differences should be larger) to 4 (differences should be smaller). Norms of sharing and generosity exist in all religions, and may thus potentially affect attitudes towards inequality and redistribution.

The next three measures focus on actual behavior rather than on stated judgements and preferences. The third measure indicates the participant's reported number of *hours of voluntary work* that he or she performs on average per week. The reported hours of voluntary work could be due to work in one or possibly more than one of the following categories: *volunteering in organisations*, *informal care*, or *other types of volunteering*. Table 4.13 in the Appendix gives an overview of the distribution of volunteers over different categories.

The fourth measure indicates the participant's reported number of *hours of informal care* that he or she performs on average per week. Informal care was mostly provided through personal support and housekeeping. While volunteering in organisations might have a strong social visibility component, especially if performed within a close-knit community, informal care is less visible and potentially less socially rewarding. We may thus consider it a stronger test of charity and brotherly love. For 28% of those who do some volunteering, their activity consists of only informal care. In analyses of volunteering we include a dummy variable for these participants because informal care might be different in its nature from other types of volunteering.

The fifth measure derives from an experimental game performed on the LISS panel with real monetary payments (see Trautmann, Kuilen, and Zeckhauser (2013)), which is depicted in Fig. 4.1.

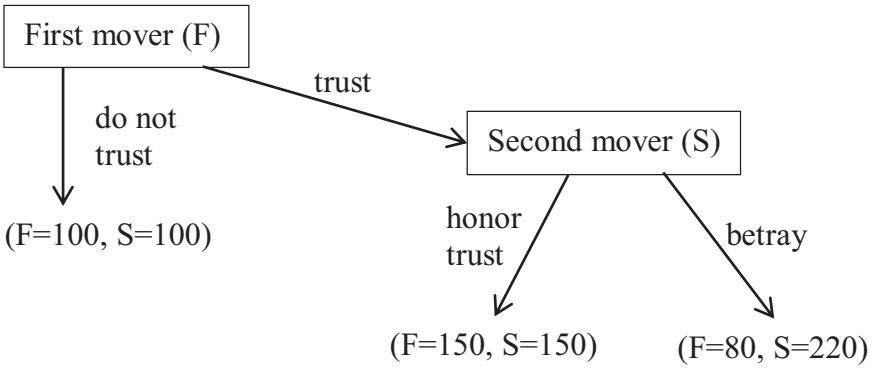


Figure 4.1: Unobservable charity: the trust game.

In particular, for $N = 470$ panel participants, we observe their decision to honor trust as a second mover in a trust game played with another (real) panel participant for monetary payments.[10] The trust game is defined as follows. The first mover chooses between two actions: not trust, which directly yields 100 points for each player, and trust, which increases the total payoff for the two players to 300, but turns responsibility for dividing it over to the second mover, the trustee. After the first mover's choice of trust, the second mover then has to decide between *honoring trust*, which yields 150 points for each player, and the *betraying trust*, which yields 80 points for the first mover and 220 points for the second mover (i.e., herself or himself). Each point is worth 5 eurocents, roughly 7 American cents at the time of the experiment (in October 2011). In the experiment, second movers have to indicate what they will do if given responsibility, without knowing yet whether or not the first mover acts trustfully. Actions are neutrally labeled as actions A and B for the first mover and as 1 and 2 for the second mover. Terms such as trust or honoring trust are never used. The game is one-shot, non-repeated, and anonymous; therefore, the second mover has no strategic incentive to honor the first mover's trust. However, participants may think it is unethical to betray (i.e., to cut the payoff to) a first mover who has expanded the pie in the hope that the second mover will reward trust, thus leading to greater payoffs for both.

[10] We focus on the second mover's choice as it directly relates to ethical behavior, which is not the case for trust. Guiso, Sapienza, and Zingales (2003) and Renneboog and Spaenjers (2012) report that religious people are more trusting than non-religious people, while Alesina and La Ferrara (2002) find no effect of religion on trust.

Participants are matched at random and paid, according to the two participants' choices.

The results of this game are particularly interesting from the perspective of economic governance institutions because they capture an extreme situation: The players have a strong incentive to betray trust (and thereby earn EUR 11 instead of EUR 7.50, with a mouse click) without fearing any legal or social repercussion. If they resist the temptation to betray the anonymous trustor in this extreme situation, where only their own ethical standards may prevent them from simple profit-maximization, they can be expected to cooperate even more in other social dilemma situations, where reputational losses, shame, or social exclusion await them.

Finally we consider a measure of stated self-perceived Trustworthiness. Participants indicate to what extent they agree with the statement that people can trust them, on a scale from 0 (disagree entirely) to 6 (agree entirely). The measure allows us to observe possibly biased self-perceptions of trustworthiness when compared to the experimental betrayal measurement.

4.2.4 Control variables

We control for various demographic attributes in our analyses. Table 4.3 provides summary statistics of the control variables. The set *Controls A* consist of the unambiguously exogenous variables of gender and age . The set *Controls B* additionally includes a set of socioeconomic background variables. These consist of *marital status*, *number of children living in the household*, *personal net monthly income (median split)*, *urban vs. rural character of residence*, *health status*, as well as *educational* and *occupational status* (*self-employed* or not).

Table 4.3: Summary statistics: control variables.

	# Obs.	All (1)	Church members (2)	Catholics (3)	Protestants (4)
Demographics					
Age	11422	39.82	53.82	56.32	53.98
Male	11422	49%	43%	44%	43%
Number of at home living children	11422	1.25	0.85	0.71	0.85
Having a partner	11422	81%	78%	79%	80%
Divorced	11422	6%	7%	8%	6%
Married	11422	46%	68%	68%	70%
Housing					
Urban character of residence (0–4) [a]	11360	1.96	1.83	1.84	1.65
Education					
Higher education	11422	24%	31%	31%	31%
Employment					
Self-employed	6362	5%	4%	4%	6%
Personal net monthly income (€)	10801	1186	1529	1502	1546
Health					
Health status (0–4) [b]	5718	2.10	2.07	2.03	2.12
Membership in organization					
Being a member [c]	5647	51%	54%	55%	58%
Cultural	5647	13%	17%	17%	18%
Environmental, peace, animal rights	5647	10%	8%	8%	10%
Humanitarian aid, human rights	5647	6%	6%	5%	6%
Political party	5647	4%	7%	4%	10%
Sports, outdoor	5647	35%	33%	37%	32%
Social society	5647	7%	10%	10%	12%
Political orientation					
Political orientation (0–10)[d]	4624	5.39	5.75	5.74	5.97
Right leaning indicator[e]	4624	37%	41%	39%	46%

Percentages or means of all (1), church members (2), Roman Catholics (3) and Protestants (4) are reported. Controls A: age, male; Controls B: Control A and number of at home living children, having a partner, divorced, married, urban character of residence, personal net monthly income, education, health status, self-employment.

[a] From 0 (least urban) to 4 (most urban).

[b] From 0 (poor health) to 4 (excellent health).

[c] Dummy variable indicating the membership in at least one of the following types of organizations: cultural, environmental, peace, or animal rights, humanitarian aid or human rights, political party, sports or outdoor, and social society.

[d] From 0 (most left wing) to 10 (most right wing).

[e] Indicator for Political orientation variable being strictly above median (i.e., right wing).

4.3 Results: church membership, religious activities and beliefs

We present results in an aggregated way that illustrates the relevant patterns and the robustness of the results. All detailed results are given in the accompanying Online Appendix. In Table 4.4 we show the correlation of the five dimensions of

religiosity with our six measures of ethics. For each religious explanatory variable, the table shows the marginal effects and significance levels for both sets of controls A and B, demonstrating the observed patterns in an accessible way.[11] The excluded category in the regression analyses is indicated in italics in the table. For each set of analyses we also indicate the sample size of the group comparisons, which vary across analyses because of the variation in the number of participants in the different modules of the LISS surveys.

The following patterns emerge from the analyses. First, we observe positive associations of the religious indicators with moral judgements, on volunteering, and on informal care. These associations are consistent across the five dimensions of religiosity. That is, although the correlations vary in size and significance across different measures, there is little indication of a systematic qualitative difference between participation and belief measures for these outcome measures. Comparison of the general volunteering measure with the informal care measure shows the correlations for the latter are less pronounced, and most strongly show up for private prayer. Both praying and informal care are activities conducted in private, where the social dimension of the activity is weaker than for other activities such as church membership and attendance. Although private prayer and church attendance are positively correlated, there seems to be a group of religious people spending more time than others both on privately exercising their religion and on informal care. In contrast, church membership and attendance per se seem to be less strongly related to the more private domains of charity. We also observe that the size of the associations is economically relevant. For example, for volunteering we find that church members volunteer about 1.3 h more per week than non-members, a difference of about 40%. Differences are even more pronounced for attendance and prayer. Differences in informal care are somewhat less substantial in economic terms, falling in the range of 10% to 15%.

[11] Additional analyses in Tables B5 and B6 in the online appendix demonstrate the robustness of the results with respect to wealth differences.

Table 4.4: Religiosity and ethics – adjusted predictions.

Dimension of religiosity	Moral judgment (0–9)			Preference for redistribution (0–4)			Hours spent on voluntary work per week[a]			Hours spent on informal care per week			Honor trust in trust Game			Self-perceived trustworthiness (0–6)		
	(1)			(2)			(3)			(4)			(5)			(6)		
	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B
Church membership																		
Not a church member	192	7.71	7.76	2928	2.91	2.92	3216	3.31	3.45	3216	2.32	2.49	245	49%	48%	1763	5.04	5.04
Church member	152	7.93	7.93*A,#B	1906	2.78	2.80***A,B	2070	4.65	4.84 ***A,B	2070	2.64	2.71#A	189	55%	54%	1164	5.14	5.13*A#B
Church attendance																		
Never	201	7.74	7.79	2771	2.92	2.92	3017	3.16	3.32	3018	2.24	2.38	245	52%	52%	1682	5.08	5.09
Less than once a week	111	7.81	7.80	1540	2.81	2.85**A,*B	1683	4.33	4.50***A,B	1682	2.65	2.81*A,B	136	49%	49%	924	5.07	5.06
Once a week or more	37	8.28	8.31***A,B	543	2.67	2.68***A,B	604	5.77	5.95***A,B	604	2.68	2.75#A	53	52%	50%	334	5.07	5.03
Praying																		
Never	157	7.79	7.85	2378	2.89	2.91	2580	3.22	3.33	2581	2.14	2.25	206	53%	53%	1414	5.06	5.05
Less than once a week	92	7.68	7.63#B	1114	2.82	2.84#A	1208	4.04	4.29***A,B	1208	2.83	2.99**A,B	90	48%	49%	685	5.06	5.09
Once a week or more	98	8.00	8.06#A,*B	1355	2.82	2.84#A,B	1502	4.72	4.90***A,B	1501	2.61	2.74*A,B	138	52%	50%	836	5.13	5.11
Belief in God																		
Belief ≤ Median	217	7.72	7.75	2837	2.88	2.90	3068	3.56	3.69	3069	2.28	2.44	240	51%	49%	1695	5.05	5.04
Belief > Median	133	7.98	8.03**A,B	2038	2.83	2.83*B	2283	4.19	4.41***A,B	2282	2.64	2.73*A	196	53%	53%	1265	5.11	5.11
Belief in theological concepts																		
Belief ≤ Median	62	7.66	7.63	910	2.86	2.86	966	3.07	3.08	967	2.12	2.27	77	52%	47%	549	4.94	4.95
Belief > Median	54	8.06	8.06*A,B	687	2.75	2.73#A,*B	799	4.58	4.88***A,B	798	2.59	2.65	78	51%	52%	451	5.08	5.02#A

Column N presents the number of observations of the raw mean for each category. Columns A and B present adjusted predictions for each ethical measure for the regression including Controls A, B, respectively. The average marginal effect is the difference between the adjusted prediction of the category and the excluded category. The excluded category is indicated in italics. The significance of each comparison is based on regression analyses of the ethical measure on the dimensions of religiosity including Controls A or B. $\#p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, Regression type: (1)–(4), and (6): Tobit regression; (5): Probit regression. Controls A: age, male; Controls B: Controls A, number of children, partner, divorced, married, urban character of residence, median split indicator of personal net monthly income, education, health status, self-employment.

[a] We include additionally a dummy variable taking the value 1 if no voluntary work other than informal care is done. Throughout all regressions this dummy variable is significant for both specifications.

Consistent with the view that observability is important, we find no association of religion with trustworthiness in the anonymous experimental game. Indeed, simple mean comparisons across categories show that there are no systematic differences across the percentages of trustworthy choices across groups in the trust game. Thus, the lack of a significant correlation is not merely due to a lack of statistical power. Similar results were obtained by Benjamin, Choi, and Fisher (2016), who find that making people's religious identity more salient has no significant effect on generosity in dictator games (while they do find various other effects). The absence of link between prayer or beliefs and behavior in the anonymous game puts the above discussed charitable behavior of those who pray in private into perspective. Presumably, informal care, while less observable than other types of charity, is special in the sense that it is directed to those close to the person who volunteers for the activity. Interestingly, self-reported trustworthiness is largely consistent with the absence of differences in the experimental game. Although church members perceive themselves as more trustworthy than non-members do, no significant differences are found for the other indicators of religiosity.

Finally, we observe a negative association of religiosity with preference for redistribution. The result replicates findings for the US reported in Guiso, Sapienza, and Zingales (2006), as well as experimental results by Neustadt (2011), who finds that religious people have a negative willingness to pay for redistribution. The result is also consistent with evidence from cross-country studies (Elgin, Goksel, Gurdal, et al. 2013), and suggests that the reported cross-country results are indeed related to religiosity rather than other, unobserved institutional differences. Theoretically, these differences are sometimes explained in terms of membership in religious groups as an insurance against adverse life events: religious individuals prefer less income redistribution by the state because the church provides some degree of insurance (Scheve, Stasavage, et al. 2006). This explanation is roughly consistent with our data because the correlation with redistribution seems weaker

for the measures of belief and private prayer. More generally, the distinction between indicators of religious belief and indicators of participation has been emphasized in previous work (Keely 2003; Noussair, Trautmann, Van de Kuilen, et al. 2013). In our current study, such a distinction is thus only suggested for redistribution preferences.

The overall picture that emerges from the analyses shows that religious people seem to hold stronger moral values and show more pro-social activity in the form of volunteering. Presumably, volunteering will be observable by others, and directed towards certain goals and groups that match well with a person's religious identity. In contrast, there seems to be no generally stronger tendency towards social behavior or generosity among religious people. In an anonymous setting where the participant could either share an amount of money with another person who trusted her, or keep the money for herself, religious people are just as likely as non-religious (or less religious) people to not reciprocate trust.[12]

To get more insights into the mechanisms underlying our results on religious affiliation in general, we will next provide analyses that look at the roles of different Christian denominations. Moreover, the category-predictions for multi-category variables shown in Table 4.4 suggest that the affiliations may not just relate to the religious vs. non-religious comparison, but also to the strength of the religious affiliation. We will thus also consider how strongly people are involved in religious activities. As a benchmark for the economic significance of the associations with religion in our data, we also consider the role of people's political attitudes (as a dependent variable) on moral judgements and behavior.

[12]Participants with "other faiths" may be culturally different from the Christian or non-member majority, and may hold different norms in their communities. Excluding participants with other faiths from the analyses in Table 4.4 to control for such effects does not affect the reported results (results available in the Online Appendix).

4.4 Results: catholics and protestants

Table 4.5 present results on the role of denominations, in particular regarding the differences between the significant subgroups in our sample, Catholics and Protestants.

The setup of the table is identical to the setup described for Table 4.4.[13] We consider three types of comparisons. First, we compare Catholics, Protestants, and others to the non-religious. Then we directly compare Catholics to Protestants. Third, we additionally distinguish between orthodox and non-orthodox members of these denominations, where orthodox refers to believers with very regular church attendance (at least once per week) and non-orthodox attend church less than once per week.

Panel Denomination I in Table 4.5 basically replicates results shown in Table 4.4. Although not all coefficients are significant, the patterns of Table 4.4 emerge here for all denominations, with one exception. For Catholics, we observe a positive association with trustworthiness in the experimental game, compared to the non-religious. Interestingly, the finding holds also true for the self-reported trustworthiness measure. Panel Denomination II refines these results. It shows that Protestants spend more time on volunteering than Catholics do, but that they are less likely to share equally with the first-mover in the trust game. Table Denomination III demonstrates the role of orthodox adherents of each denomination for these results. Compared to the group of non-orthodox Catholics, orthodox Protestants hold the strictest moral judgements of the four groups. Both orthodox Catholics and Protestants spend more time on volunteering than the non-orthodox. The negative attitude towards redistribution among the religious is strongest for orthodox Protestants, who are also least likely to honor trust in the trust game.

[13] Additional analyses in Tables B5 and B7 in the online appendix demonstrate the robustness of the results with respect to wealth differences.

Table 4.5: Religiosity and ethics – adjusted predictions.

Dimension of religiosity	Moral judgment (0–9)			Preference for redistribution (0–4)			Hours spent on voluntary work per week[a]			Hours spent on informal care per week			Honor trust in trust game			Self-perceived Trustworthiness (0–6)		
	(1)			(2)			(3)			(4)			(5)			(6)		
	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B
Denomination I																		
Not a church member	192	7.71	7.77	2928	2.91	2.92	3216	3.31	3.45	3216	2.33	2.51	245	49%	47%	1763	5.04	5.04
Catholic	78	7.81	7.82	935	2.81	2.83*A.B	982	4.28	4.29***A,B	982	2.60	2.57	92	60%	61%#A,*B	569	5.15	5.17*A,B
Protestant	57	8.04	8.08**A,*B	756	2.72	2.75***A,B	818	5.21	5.50***A,B	818	2.49	2.59	75	47%	45%	456	5.14	5.10
Other Religion	14	7.99	7.92	202	2.85	2.76	250	4.41	5.05**A,***B	250	3.34	3.79*A,**B	22	62%	56%	128	5.08	5.07
Denomination II																		
Catholic	78	7.94	7.95	935	2.88	2.89	982	4.45	4.47	982	2.82	2.84	92	62%	63%	569	5.18	5.19
Protestant	57	8.15	8.20#B	756	2.80	2.82#A	818	5.29	5.67*A,**B	818	2.71	2.91	75	49%	47%#A,*B	456	5.16	5.13
Denomination III																		
Non-orthodox Catholic	72	7.96	7.96	830	2.90	2.91	874	4.25	4.23	874	2.84	2.83	81	59%	62%	507	5.16	5.18
Orthodox Catholic	6	7.76	7.85	102	2.73	2.78	103	5.96	6.29*A,B,	103	2.46	2.73	9	75%	67%	59	5.32	5.31
Non-orthodox Protestant	34	7.96	8.07	427	2.85	2.85	462	4.57	5.08#B	462	2.44	2.80	44	51%	50%	259	5.20	5.18
Orthodox Protestant	23	8.40	8.39**A,*B	328	2.74	2.77**A,*B	355	6.23	6.40***A,B	355	3.09	3.07	31	45%	42%#B	197	5.11	5.05
Political orientation																		
Left leaning	180	7.72	7.77	2879	3.05	3.07	2772	3.97	4.05	2773	2.43	2.50	246	56%	55%	1565	5.07	5.06
Right leaning	102	7.90	7.89#A	1659	2.44	2.45***A,B	1597	3.70	3.84	1597	2.29	2.38	122	50%	51%	893	5.13	5.11

Column N presents the number of observations of the raw mean for each category. Columns A and B present adjusted predictions for each ethical measure for the regression including Controls A, B, respectively. The average marginal effect is the difference between the adjusted prediction of the category and the excluded category. The excluded category is indicated in italics. The significance of each comparison is based on regression analyses of the ethical measure on the dimensions of religiosity including Controls A or B. $\#p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, Regression type: (1)–(4), and (6): Tobit regression; (5): Probit regression. Controls A: age, male; Controls B: Controls A, number of children, partner, divorced, married, urban character of residence, median split indicator of personal net monthly income, education, health status, self-employment.

[a] We include additionally a dummy variable taking the value 1 if no voluntary work other than informal care is done. Throughout all regressions this dummy variable is significant for both specifications.

Thus, we do observe clear variation between denominations, consistent with previous empirical work on differences between Catholics and Protestants, for instance in terms of management style, which is closely related to the current social attitudes (Filistrucchi and Prüfer 2018). However, for our results on trustworthiness, there is little evidence yet in the literature. For example, Fehr, Fischbacher, Von Rosenbladt, et al. (2002) implement a sequential prisoners' dilemma in a survey of a representative sample of the German population. They show that denomination has no influence on the trustworthiness of the second-mover, i.e. on how much money they transfer to the first mover.

Given the reported associations in Tables 4.4 and 4.5 , we can ask how these differences across denominations, as well as those between religious and non-religious participants in general, compare to other benchmarks associated with differences in moral attitudes. To this end we report the variation of our moral behaviors across the political spectrum: political attitudes directly relate to many ethical and social issues, and we would expect them to have substantial associations with our ethics measures. We use a median split indicator based on a question that asks participants to place themselves on a 10-point scale of the political spectrum, from 0 meaning "left" to 10 meaning "right." Using self-reported political party preferences, Trautmann, Kuilen, and Zeckhauser (2013) show that the indicator maps exactly on the spectrum of Dutch political parties, as it is typically perceived.

Except for preferences for redistribution, we do not find any significant associations with political orientation (panel Political orientation in Table 4.5). That shows that a person's moral attitudes and behavior is closely linked to her religion, and more so than to her politics. This is consistent with views that people sometimes vote for parties that do not represent their interest in economic policy terms (Frank 2004).

We obtain a set of more nuanced results by studying the correlation between political orientations across religious subgroups. This is motivated by recent findings in the United States, that religion and political attitudes appear to be closely intertwined. Based on Pew Research Center (2014), Catholics are more likely to vote Democrats than Protestants and Protestants are more likely to vote Republicans than Catholics. In our Dutch sample, a different picture arises. Table 4.6 shows that there is no significant difference in political orientation between (non-)orthodox Catholics and Protestants in the Netherlands.

Table 4.6: Denomination and politics.

Denomination	*N*	Mean political orientation[a]
Non-orthodox Catholic	758	5.68[b]
Orthodox Catholic	90	6.20[c]
Non-orthodox Protestant	383	5.77[b]
Orthodox Protestant	307	6.21[c]

[a] Mean of political orientation conditional on belonging into the respective group; 0 (most left wing) to 10 (most right wing).
[b,c] Entries that do not share the same letter differ significantly from each other at at least 10% significance level, Wilcoxon tests.

However, we find that frequent churchgoers have significantly more right-wing attitudes than those who attend church less than once per week. We will come back to the potential role of political attitudes in Section 4.6 when investigating potential channels underlying the observed correlations.

4.5 Intergenerational transmission of moral attitudes

Expecting that both religious affiliation and moral norms are typically transmitted across generations, we next examine whether the observed associations between religiosity and ethics hold when we extend the analysis to indicators of the participants' parent's religiosity. We use the church membership of the participant's

parents and their frequency of attending church when the participant was aged 15 (summary statistics in Table 4.14 in the Appendix), to test if religious upbringing correlates with ethical judgement/behavior of the participant today. Table 4.7 shows the pattern of the parents' and the participants' church membership.

Table 4.7: Participants' vs. participants' parents' church membership.

	Parents	
Participant	Church member	No church member
Church member	2021 (37%)	137 (2%)
No church member	1535 (28%)	1812 (33%)

There are in total 5505 observations with information on both: church membership of the participant and the church membership of the parents of the participant at age 15. Spearman's rho is 0.49 with p-value < 0.001.

Parental membership status is strongly correlated with participants' membership status ($\rho = 0.49, p < 0.001$). If membership status differs between the parents and the participant, this is almost exclusively in the direction of a participant not being a church member whose parents were church members.

Table 4.8 shows results for the association of parental membership and church attendance, respectively, when the participant was aged 15 with our six measures of ethics, replicating the analyses in the first two panels of Table 4.4.

We find that for both membership and church attendance the pattern of relationships found for the participants' own religious indicators above is replicated. This constitutes evidence for an intergenerational transmission of the association between religion and moral attitudes.

4.6 Investigating causality

The associations identified in the previous sections provide important insights regarding the different moral contexts in more or less religious environments. An

Table 4.8: Parents' church membership and church attendance and participants' ethics: intergenerational transmission – adjusted predictions.

Dimension of religiosity	Moral judgment (0–9)			Preference for redistribution (0–4)			Hours spent on voluntary work per week[a]			Hours spent on informal care per week			Honor trust in trust game			Self-perceived trustworthiness (0–6)		
	(1)			(2)			(3)			(4)			(5)			(6)		
	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B	N	A	B
Church membership																		
Not a church member	108	7.68	7.80	1643	2.93	2.92	1849	3.27	3.44	1849	2.28	2.42	140	50%	45%	1035	5.04	5.05
Church member	240	7.89	7.88*A	3175	2.82	2.85**A,#B	3429	4.15	4.30***A,B	3429	2.55	2.67	293	53%	54%	1887	5.10	5.09
Church attendance																		
Never	103	7.68	7.79	1562	2.95	2.93	1730	3.17	3.37	1731	2.17	2.28	144	50%	49%	955	5.02	5.03
Less than once a week	84	7.75	7.73	1187	2.80	2.83***A,*B	1332	3.77	3.92**A,*B	1331	2.39	2.56	91	55%	53%	692	5.07	5.08
Once a week or more	161	7.94	7.95*A	2099	2.82	2.86***A,#B	2240	4.34	4.46***A,B	2240	2.65	2.77*A,B	201	51%	52%	1289	5.13	5.12*A

Column N presents the number of observations of the raw mean for each category. Columns A and B present the adjusted predictions for each ethical measure for the regression including Controls A, B, respectively. The average marginal effect is the difference between the adjusted prediction of the category and the excluded category. The excluded category is indicated in italics. The significance of each comparison is based on regression analyses of the ethical measure on the dimensions of religiosity including Controls A or B. $\#p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, Regression type: (1)–(4), and (6): Tobit regression; (5): Probit regression. Controls A: age, male; Controls B: Controls A, number of children, partner, divorced, married, urban character of residence, median split indicator of personal net monthly income, education, health status, self-employment.

[a] We include additionally a dummy variable taking the value 1 if no voluntary work other than informal care is done. Throughout all regressions this dummy variable is significant for both specifications.

additional important step is the identification of the underlying mechanisms leading to these associations. For example, coming back to the question posed in the Introduction, does a decline in church membership have an effect on moral behavior and attitudes? Or is it that different types of people select in or out of religious groups (Keely 2003; Iannaccone 1998)? While an unambiguous identification of the causal mechanism will not be feasible given the available data, in this section we make an attempt to probe the potential pathway from religious indoctrination by parents to moral behavior of their children years later.

In Section 4.5 we observed that parental religion, and not just the participants' current religion, correlates with participants' moral behavior. This suggests that a direct self-selection channel, according to which believers with lower moral judgement and volunteering levels leave the church, cannot fully explain the relationship. To further explore this mechanism, we conduct a 2-stage instrumental variable regression for each dependent variable with each religious dimension, using the two sets of control variables. We instrument the respondent's religious indicators by the parents' membership and their degree of activity (church attendance) when the participant was aged 15. The model is given by the two-stage structure

$$\hat{x}_i = \hat{\alpha}_1 + z_i\hat{\beta}_1 + c_i\hat{\gamma}_1 \tag{4.1}$$

$$E\left(y_i^*|\hat{x}_i, c_i\right) = \alpha + \hat{x}_i\beta + x_i\gamma \tag{4.2}$$

where z_i is a vector of dummy variables for parents' membership and degree of activity (church attendance) of the parents, x_i is the participant's measure of religiosity considered, and c_i is the vector of the control variables A or B. $\hat{x}_i$, $\hat{\alpha}_1$, $\hat{\beta}_1$, and $\hat{\gamma}_1$ are the fitted values of the first stage regression. y_i denotes the ethics measure under consideration. The approach thus assumes that the parents' religion is a strong determinant of the participant's religion, and that any influence of

parental religion on moral behavior participant runs only through the participant's religion. That is a strong assumption given the multitude of potential social and genetic transmission channels fur cultural traits, such as religion, and moral and social behavior. However, if endogeneity is driven by self-selection at the level of the participant, we may identify it in this setup if the correlations observed in Table 4.4 vanish if participants' religiosity is instrumented by their parents' religiosity. Below we will come back to alternative channels for the association of parental religion and participants' ethics. Table 4.9 shows the results for the instrumented variable in the second stage regressions for each of our dependent variables.[14]

The results do not support the self-selection explanation. We find that the results for the instrumented variables replicate the previously observed pattern of associations. An interesting difference with the previously observed pattern is that for preference for redistribution and for informal care, the instrumental variable regressions indicate a more consistent relevance across the dimensions of religiosity. The above discussed distinction between social participation and internal beliefs may thus not be substantial, but potentially be related to larger measurement error in some dimensions. Indeed, marginal effects are somewhat larger than those found in the regression analyses in Section 4.3. Attenuation due to measurement bias is a likely candidate for this effect, given the self-reported and self-perception nature of our religious indicators. However, unobserved factors may also be at play, which we consider next.

While a pathway from moral attitudes to religious affiliation and practice is not directly supported by our analyses, there may be unobserved factors that influence

[14]Table 4.15 reports the test statistics for under-identification and weak identification. Overall Kleibergen and Paap (2006) tests indicate the clear relevance of the instruments for the five different dimensions of religiosity of the participant. We can reject the null hypothesis that the instruments are not correlated with the different dimensions of religiosity of the participant in all cases (p-value < 0.01). We can reject the null hypothesis that the instruments are weak except for the combination of moral judgment with belief in theological concepts.

Table 4.9: Instrumental variables: parents' church membership and church attendance – average marginal effects.

Dimension of religiosity	Moral judgment (0–9)		Preference for redistribution (0–4)		Hours spent on voluntary work per week[a]		Hours spent on informal care per week		Honor trust in trust game		Self-perceived trust-worthiness (0–6)	
	(1)		(2)		(3)		(4)		(5)		(6)	
	A	B	A	B	A	B	A	B	A	B	A	B
Church membership												
Not a church member												
Church member	0.38	0.19*A	−0.23	−0.12***A	2.03	1.98***A,B	0.71	0.76#A,B	2%	9%	0.15	0.12#A
Church attendance												
Never Attend												
Attend[b]	0.44	0.32*A	−0.29	−0.15***A,#B	2.29	2.18***A,B	0.84	0.85*A,#B	1%	7%	0.19	0.16#A
Praying												
Never Pray												
Pray[b]	0.46	0.28*A	−0.29	−0.14***A,#B	2.45	2.29***A,B	0.91	0.89*A,#B	1%	7%	0.18	0.16#A
Belief in God												
Belief ≤ Median												
Belief > Median	0.63	0.29*A	−0.28	−0.15***A,#B	2.58	2.45***A,B	0.93	0.94*A,#B	4%	13%	0.19	0.15#A
Belief in theological concepts												
Belief ≤ Median												
Belief > Median	1.17	1.30#A,B	−0.23	−0.15#A	2.99	2.67***A,B	1.68	1.30*A	8%	13%	0.33	0.29#A

Columns A and B present the average marginal effects for each ethical measure for the regression including Controls A, B, respectively. The excluded category is indicated in italics. The significance of each comparison is based on regression analyses of the ethical measure on the dimensions of religiosity including Controls A or B. The dimension of religiosity is instrumented by the parents' church membership and the parents' church attendance at the responder's age 15. $\#p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, Regression type: Maximum likelihood estimator, (1)–(4), and (6): 2. Stage Tobit regression; (5): 2. Stage Probit regression. Controls A: age, male; Controls B: Controls A, number of children, partner, divorced, married, urban character of residence, median split indicator of personal net monthly income, education, health status, self-employment.

[a] We include additionally a dummy variable taking the value 1 if no voluntary work other than informal care is done. Throughout all regressions this dummy variable is significant for both specifications.

[b] The categories "attend church (resp. pray) less than once a week" and "attend church (resp. pray) at least once a week" are combined into one category.

both. In particular, the correlation between parental religion and participants' moral attitudes might be driven by some predisposition of the parents, leading to selection into the church for more moral individuals, and which is then transmitted to the children through genetic and cultural channels other than religiosity. While we find no evidence for selection at the participants' level, it is conceivable that for the parents' generation, where church membership was far more common and important, leaving the church was much stronger related to attitudes and behavior (rather than a general lack of interest).

We consider two variables that are closely linked to these unobserved aspects that may result in a correlation between religion and moral attitudes at the parents' level, absent a causal effect from religion to ethics. First, a general level of sociability may positively influence church attendance and time spent on voluntary work and care. Second, political attitudes correlate with religious attitudes, but clearly also with the moral attitudes and behavior we observe. To control whether the partial correlations of religious activities and beliefs with our ethics measures are possibly driven by the unobserved degree of sociability and political preferences, we include controls for both aspects in the basic framework presented in Section 4.3. For political preferences we use the political orientation indicator introduced in Section 4.4. Sociability we measure through information on the participant's membership in other, non-religious organisations, available from the Social Integration and Leisure module of the LISS panel. Indeed, we find that children of church members are relatively more likely to be members in other, non-religious organisations than are children of parents who were no church members. Summary statistics on these variables are given at the bottom of Table 4.3. We include dummy variables for each type of organisation.

Results for the associations between religious measures and ethics in the specifications where we control for these alternative pathways (additionally to the full set of Controls B) are shown in Table 4.10.

Table 4.10: Controlling for membership in organizations and political orientation.

Dimension of religiosity	Moral judgment (0–9) (1)	Preference for redistribution (0–4) (2)	Hours spent on voluntary work per week[a] (3)	Hours spent on informal care per week (4)	Honor trust in trust game (5)	Self-perceived trustworthiness (0–6) (6)
Church membership						
Not a church member	7.72	2.88	3.41	2.49	49%	5.05
Church member	7.94#	2.80*	4.75***	2.43	58%	5.14#
Church attendance						
Never	7.75	2.89	3.30	2.30	54%	5.10
Less than once a week	7.77	2.83	4.37***	2.65	52%	5.08
Once a week or more	8.33***	2.72**	5.81***	2.59	49%	5.04
Praying						
Never	7.77	2.87	3.33	2.21	54%	5.05
Less than once a week	7.63	2.82	4.21**	2.90*	50%	5.13
Once a week or more	8.07*	2.85	4.74***	2.49	53%	5.11
Belief in God						
Belief ≤ Median	7.72	2.86	3.64	2.41	51%	5.04
Belief > Median	7.99*	2.84	4.39***	2.52	56%	5.15*
Belief in theological concepts						
Belief ≤ Median	7.69	2.80	3.10	2.40	46%	4.95
Belief > Median	8.02	2.78	4.93***	2.46	56%	5.03

We present the adjusted predictions for each ethical measure for the regression including Controls B and controlling for political orientation and membership in organizations. The average marginal effect is the difference between the average adjusted prediction of the category and the excluded category. The excluded category is indicated in italics. The significance of each comparison is based on regression analyses of the ethical measure on the dimensions of religiosity including dummy variables indicating the membership in following types of organizations: cultural, environmental, peace, or animal rights, humanitarian aid or human rights, political party, sports or outdoor, and social society and an indicator for political orientation variable being strictly above median (i.e., right wing) and Controls B. $\#p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ Regression type: (1)–(4), and (6): Tobit regression; (5): Probit regression. Controls B: age, male, number of children, partner, divorced, married, urban character of residence, median split indicator of personal net monthly income, education, health status, self-employment.

[a] We include additionally a dummy variable taking the value 1 if no voluntary work other than informal care is done. Throughout all regressions this dummy variable is significant.

The previously observed pattern replicates. Some associations become smaller and less significant, notable those for preference for redistribution. Organisational membership and political orientation are linked to the moral attitudes considered here, and may contribute to the association with religious variables shown in Table 4.4. However, overall the findings in Table 4.4 persist when controlling for these variables.

In sum, the robustness of our basic results when instrumenting with parental religion (given the discussed caveats) or when controlling for alternative pathways

for the link between religious affiliation and moral attitudes and activities, does not allow us to reject the pathway from indoctrination to ethics. Moreover, the observed consistency of our results across the different dimensions of religiosity (except for preference for redistribution) also suggests that a simple selection process does not fully explain the observed associations: if social types select into social activities in churches, this may not necessarily lead them to hold stronger religious beliefs. However, because we cannot eliminate the possibility that other, unobserved factors affect both religiosity and ethics, we abstain from strong conclusions regarding causal effects.

4.7 Conclusion

We started with the observation that church membership and religiosity is much less prevalent in the generation of respondents in our sample of the Dutch population, compared to the generation of their parents. Our question was whether a religious environment differs from a less religious one in terms of moral attitudes and behaviors that are a key ingredient to economic interaction. Our results suggest that this is the case. We find that religious people differ from non-religious people by holding stricter moral attitudes, and by spending more time on volunteering and informal care. Moreover, the religious have lower preferences for redistribution. However, we do not find differences in trustworthiness between the religious and the non-religious in an anonymous experimental game, and that church membership alone (rather than indicators of potentially private, religious activities) is not a strong predictor for the time someone spends on informal care. This suggests that observability of charitable deeds and the fact that the recipient of charity is typically selected from the participant's social network, both of which relate to the "belonging" aspect of religious activities, play an important role for these activities. Our observations thus indicate that a religious society might be

quite different in terms of social fabric, both its formal and its informal institutions, compared to a non-religious society. Our findings on parents' religion show that such differences may be persistent.

Zooming in on different Christian denominations, we find several differences. Catholics are more generous in the anonymous trust game returns. Protestants have a lower preference for redistribution, but spend more time on volunteering. These effects are especially pronounced for orthodox Protestants, who also hold stricter moral attitudes. The content and structure of a religious denomination, over and beyond the distinction between the religious and non-religious, seems associated with attitudes and behaviors relevant to economic institutions (Filistrucchi and Prüfer 2018).

The interpretation of the observed associations in terms of causal pathways is not trivial though. Religious affiliation affecting moral attitudes, and moral attitudes leading to selection into church, are both conceivable. Unobserved factors may affect both church membership and moral attitudes. With the current data, we cannot unambiguously identify causal effects. However, we probe whether we can reject the interpretation in terms of a causal effect from religion to moral behavior. We find no evidence suggesting self-selection of moral individuals into churches. Unobservable factors may matter,but controlling for political orientation and membership in organisations to proxy for social attitudes and the general level of sociability does not reduce the associations substantially. While our data thus do not reject the pathway from religiosity to behavior, we abstain from strong conclusions regarding causality. Future research may make progress in this dimension by using events that externally affect church membership, such as scandals affecting some congregations or parishes more strongly than others. Moreover, even if a causal effect from religion to moral behavior could be clearly established, it were unclear whether such an effect would work through indoctrination, social pressure, or opportunities (e.g. in the case where church organisations offer more

opportunities to participate in volunteering; or where they offer social insurance). Given the associations established in the current paper, these are important questions to approach next, to provide insights into the underlying mechanisms in the relationship between religion and moral attitudes and behavior.

4.8 Appendix

This appendix provides Tables with additional summary statistics and data analyses referred to in the main text.

Table 4.11: Denominations of Other Faiths.

Denomination	% of Other faiths
Eastern Orthodox Christian Church	3%
Other Christian church community	43%
Hinduism	5%
Buddhism	3%
Judaism	1%
Islam	39%
Other non-Christian religion	6%

There are in total 272 observations of Other faiths.

Table 4.12: Summary statistics: religion, by religious subgroup.

	Non-orthodox Catholics (1)	Orthodox Catholics (2)	Non-orthodox Protestants (3)	Orthodox Protestants (4)
Church attendance				
More than once a week		25%		30%
Once a week		75%		70%
At least once a month	18%		29%	
Only at special days	35%		22%	
Rarely	24%		27%	
Never	23%		22%	
Private Prayer				
More than once a week	31%	87%	54%	97%
Once a week	8%	6%	5%	3%
At least once a month	9%	2%	8%	
Only at special days	8%	2%	4%	
Rarely	27%	2%	19%	
Never	17%	2%	11%	
Belief in God				
Degree of belief in God (0–5)	3.18	4.28	3.81	4.68
Strong belief in God [a]	66%	92%	81%	97%
Belief in theological concepts				
Believe in life after death	62%	75%	74%	95%
Believe in existence of heaven	45%	82%	79%	97%
Believe in existence of hell	6%	21%	16%	67%
Believe in existence devil	8%	23%	24%	81%
Believe that Adam and Eve existed	37%	63%	74%	90%
Believe in Bible as the word of God	56%	88%	84%	98%
Believe that prayer makes sense	84%	95%	92%	100%
Belief in theological concepts (0–7)	3.05	5.09	4.99	6.60
Strong belief in theological concepts [a]	74%	87%	90%	100%

Percentages or means of non-orthodox Roman Catholics (1), Orthodox Roman Catholics (2), Non-orthodox Protestants (3) and Orthodox Protestants (4) are reported. Orthodox is defined as those Catholic/Protestant participants who visit church at least once a week. Values from the same dimension may not add to 100% due to rounding.

[a] Indicator for degree of belief in God [resp. belief in theological concepts]: 0 ($\leq$ median), 1 ($>$ median).

Table 4.13: Summary statistics: reported hours of volunteering > 0.

	All (1)	Church members (2)	Catholics (3)	Protestants (4)
Reported hours of ...				
Volunteering[a]	7.36	7.31	7.73	6.97
Volunteering w/o informal care only[b]	6.40	6.73	7.52	6.07
Informal care[c]	4.58	4.18	4.20	4.08
Informal care only[d]	9.88	9.44	8.31	12.00
Informal care				
Do informal care[c]	49%	48%	53%	40%
Do informal care only[d]	28%	21%	25%	15%
Volunteering in organizations				
Do volunteering in organizations	52%	55%	50%	61%
Sports or outdoor	19%	16%	18%	16%
Cultural	9%	9%	10%	9%
Trade Union	1%	1%	1%	1%
Business, agrarian	2%	2%	2%	2%
Consumers' organization, automobile club	1%	1%	1%	2%
Humanitarian aid or human rights	6%	6%	4%	8%
Environmental, peace or animal rights	2%	2%	2%	2%
Religious	13%	25%	13%	34%
Political party	2%	2%	1%	3%
Science, education, teachers'	5%	6%	6%	7%
Social society	6%	7%	8%	6%
Other organization, free to join	11%	12%	13%	11%
Other volunteering				
Not in organization and not informal care	41%	47%	48%	48%

Sample of participants who reported hours of volunteering greater than zero. Percentages or means of all (1) ($N = 2375$), church members (2) ($N = 1090$), Roman Catholics (3) ($N = 500$) and Protestants (4) ($N = 463$) are reported.

[a] Hours of voluntary work can be due to work in one or more of three different categories: informal care, volunteering in organizations, or other types of volunteering.

[b] Participants who do only informal care are excluded.

[c] Participants who do informal care and possible other types of volunteering.

[d] Participants who only do informal care.

Table 4.14: Summary statistics: religion of parents when participant was aged 15.

	# Obs.	All (1)	Church members (2)	Catholics (3)	Protestants (4)
Religious status					
Church membership	5574	65%			
Roman Catholic	5556	34%	53%		
Protestant	5556	24%	38%		
Other faiths	5556	6%	9%		
Orthodox Roman Catholic[a]	1897			65%	
Orthodox Protestants[a]	1350				64%
Church attendance					
More than once a week	5602	11%	17%	12%	19%
Once a week	5602	31%	47%	52%	45%
At least once a month	5602	6%	10%	9%	11%
Only at special days	5602	12%	14%	16%	10%
Rarely	5602	6%	6%	6%	6%
Never	5602	33%	6%	4%	9%

Percentages or means of parents when participant was aged 15 of all (1), church members (2), Roman Catholics (3) and Protestants (4) are reported. The number of observations for sample (1) is reported in the first column.
[a] For Orthodox Catholic and Protestant the number of observations for sample (3) and (4) are reported, respectively.

4.9 Supplementary materials

Supplementary material associated with this article can be found in the online version of Kirchmaier, Prüfer, and Trautmann (2018) at doi: 10.1016/j.jebo.2018.02.022, and at https://heidata.uni-heidelberg.de/dataverse/awiexeco.

Table 4.15: Instrumental variables: parents' church membership and church attendance – test statistics.

Test statistics	Moral judgment (0–9)		Preference for redistribution (0–4)		Hours spent on voluntary work per week		Hours spent on informal care per week		Honor trust in Trust Game		Self-perceived Trustworthiness (0–6)	
	(1)		(2)		(3)		(4)		(5)		(6)	
	A	B	A	B	A	B	A	B	A	B	A	B
Kleibergen-Paap Wald rk F statistic[a]:												
Church membership	67.73	49.06	695.60	550.50	761.70	603.90	761.60	603.70	118.50	110.70	445.50	371.40
Church attendance	39.16	26.22	439.30	325.10	483.30	368.00	484.00	368.10	59.73	45.45	299.20	239.90
Praying	23.44	16.46	367.40	292.40	399.20	321.50	400.00	321.60	52.81	47.23	247.80	209.50
Belief in God	17.52	21.53	342.70	289.00	361.20	299.60	362.30	299.90	62.40	45.55	230.10	200.60
Belief in theol. concepts	6.17	5.42	151.50	122.60	168.10	133.10	169.80	133.70	28.38	22.52	100.30	86.66

Kleibergen-Paap rk LM p-value[b]: $p < 0.001$, except for combination of moral judgment and belief in theological concepts; there p-value < 0.01.

The first stage statistics are from STATA routine ivreg2, 2SLS.

[a] Weak identification test: Under the null hypothesis the instruments are weakly correlated with the endogenous regressor (heteroskedasticity-robust multivariate analogues to the 1. stage F statistic, for one endogenous regressor it is equal to the standard robust 1. stage F statistic). We apply the Stock and Yogo (2005) critical values. The critical values for the maximal bias of the 2SLS estimator to be no more than 5% (10%, 20%, 30%) of the bias of the OLS estimator are 13.91 (9.08, 6.46, 5.39) for one endogenous regressor and three instruments.

[b] Underidentification test. The null hypothesis of the Kleibergen Paap rk LM test is that the structural equation is underidentified, i.e. the instruments are not correlated with the endogenous regressor (Kleibergen and Paap 2006).

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