

Sepahvand, Mohammad H.; Shahbazian, Roujman

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## Sibling correlation in risk attitudes: Evidence from Burkina Faso

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*Sibling Correlation in Risk Attitudes:  
Evidence from Burkina Faso*

*Mohammad H. Sepahvand, Roujman Shahbazian*

Department of Economics  
Uppsala University  
Box 513  
751 20 Uppsala  
Sweden

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SIBLING CORRELATION IN RISK ATTITUDES:  
EVIDENCE FROM BURKINA FASO

MOHAMMAD H. SEPAHVAND, ROUJMAN SHAHBAZIAN

# Sibling Correlation in Risk Attitudes: Evidence from Burkina Faso<sup>1</sup>

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Mohammad H. Sepahvand<sup>2</sup>, Roujman Shahbazian<sup>3</sup>

## Abstract

This study uses sibling correlation to investigate the importance of parental and household characteristics on three different risk domains collected in a nationally representative survey from Burkina Faso. Sibling correlations are between 0.51 and 0.83. The correlations are higher in the general risk domain compared to risk taking in financial matters and traffic. Moreover, the sibling correlation is higher for the younger generation of siblings than the older generation, and for sisters than brothers. We also explore which factors drive these correlations; parents' risk attitudes help explain these correlations, whereas socioeconomic outcomes, family structure, parental health and residential zone have only a limited contribution. We also find that gender is important in explaining the variation in sibling correlations. Mother's have a stronger contribution on daughter's correlation than fathers, whereas fathers help to explain the son's correlation to a larger extent.

**Keywords:** risk attitudes; family background; sibling correlations; Burkina Faso  
**JEL codes:** D1, D81, J6, Z1

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<sup>2</sup> Department of Economics, Uppsala University, Kyrkogårdsgatan 10, Box 513, 751 20 Uppsala, Sweden [mohammad.sepahvand@nek.uu.se](mailto:mohammad.sepahvand@nek.uu.se), Phone: (+46)18 – 471 00 00, Fax: (+46)18 – 471 14 78

<sup>3</sup> Swedish Institute for Social Research, Stockholm University, 106 91 Stockholm, Sweden [roujman.shahbazian@sofi.su.se](mailto:roujman.shahbazian@sofi.su.se)

# 1. Introduction

In recent decades, measuring risk attitudes as a core determinant of economic behaviour have attracted interest from researchers both in developing countries (e.g., Harrison et al., 2005; Yesuf and Bluffstone, 2009; Sepahvand and Shahbazian, 2017a) as well as developed countries (e.g., Brunello, 2002; Guiso and Paiella, 2005; Dohmen et al., 2011). In developed countries, risk attitudes have been argued to be a mechanism behind intergenerational transmission of socio-economic outcomes such as education, income, wealth and occupation (e.g., Bonin et al., 2007; Dohmen et al., 2012; Björklund et al., 2010). For instance, Lindquist et al., (2017) argue that the risk attitudes of parents are likely an important mechanism that contributes to sibling similarities in the choice of risky occupations, and capturing such variation is suggested to be an important avenue for future research. In a developing context, risk attitudes are of particular interest, since it is generally assumed that individuals are risk averse, thus hindering them in accessing formal credit markets or adopting new technologies. Thereby, understanding the mechanisms that generates and reproduces risk attitudes over time is an important aspect since it affects economic behaviour.

The family is a focal institution that shapes an individual's preferences. The emphasis is usually placed on the parent-child relationship, as indicated by the growing empirical literature on the transmission of attitudes between parents and children such as precautionary behaviour (Yeung et al., 2000), gender-roles (Fernandez et al., 2004), family values (Mason, 2007), trust and social capital (Tabellini, 2008) and non-cognitive abilities (Grönqvist et al., 2017). Transmission of risk attitudes has been investigated to a much lesser extent. However, there are some exceptions. Kimball et al. (2009) find a positive association between parents and their adult children's risk-taking with hypothetical income gambles questions. Dohmen et al., (2012) and Sepahvand and Shahbazian (2017b) show evidence for the existence of an intergenerational transmission of risk attitudes with self-reported risk questions. Although there is a tradition in economics and sociology of investigating family influences through intergenerational correlation (e.g., Björklund and Jäntti, 1997; Chadwick and Solon, 2002; Black et al., 2005; Mood et al., 2012; Blanden et al., 2013; Mood 2017), parental influence is only one of many ways through which individual's preferences are shaped. Besides genetic

endowments and parent-child socialization, factors such as neighbourhoods, schools and other intuitions may shape the child's choice for instance such as obtaining higher/lower levels of education, employment, income or risk. Therefore, sibling correlation has been argued to be a broader measure in capturing the influence of family and community background for outcomes in adult life (e.g., Solon et al., 1991; Conley and Glauber, 2008; Black and Devereux, 2011; Björklund and Jäntti, 2012). The reason is that sibling correlation has a straightforward interpretation: it is the fraction of the variation in an outcome that can be explained by factors that siblings share. Siblings who have grown up together share the same environment. Thus, sibling correlation is an omnibus measure of the importance of family background and community influence. Thereby, it captures anything that is shared by siblings both inside and outside the family (such as parental influence but also school, religious institutions and neighbourhood influence), while at the same time capturing anything that is not shared by siblings, (such as genetic traits not shared, different treatment of siblings and changes in neighbourhoods, schools etc.).

There are many different ways to elicit risk preferences (for an overview see Charness et al., 2013). This study uses the same form of self-reported risk questions as used in the German Socio-economic panel. These risk questions have been utilized in numerous studies.<sup>4</sup> Previous research has shown that self-reported risk questions have a high validity<sup>5</sup> and sufficient reliability<sup>6</sup>. The importance of reliability and reproducibility of scientific findings has recently been highlighted (e.g., Dreber et al., 2015; Camerer et al., 2016). Self-reported risk questions are a simple and cost-effective way to elicit risk preferences using large scale surveys. These risk measurements can be easily reproduced by other researchers both over

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<sup>4</sup> Such as in Ding et al., 2010; Dohmen et al., 2011; Wölbert and Riedl, 2013; Hardeweg et al., 2013; Liebenheim et al., 2015; Lönnqvist et al., 2015; Vieider et al., 2015; Jin et al., 2017; Beauchamp et al., 2017.

<sup>5</sup> The self-reported risk questions used in this study, has been proven to capture individuals risk preferences by comparing them to incentivized lottery experiments, in developed countries (e.g., Dohmen et al., 2011; Lönnqvist et al., 2015), emerging countries (e.g., Hardeweg et al., 2013), developing countries and comparatively for 30 countries (Vieider et al., 2015).

<sup>6</sup> The reliability of the self-reported risk questions in this study has been analyzed by Sepahvand and Shahbazian (2017a). They show that the reliability is satisfactory and to a large extent comparable to other studies using the same self-reported risk questions.

time and across countries, in order to deepen our understanding of individual's risk preferences.

By estimating sibling correlations in risk attitudes, we make three contributions to the literature. First, it allows us to measure the overall importance of family and community background as determinants of risk attitudes. To the best of our knowledge, only one study has estimated a baseline for sibling correlation in risk attitudes (Schnitzlein, 2014).<sup>7</sup> Our results indicate that these influences are larger than previously found based on intergenerational correlation studies on risk attitudes. As we later show, sibling correlation in risk attitudes for general risk taking is 0.73. To put these results in perspective, intergenerational correlation for general risk taking in the same context has been estimated to be 0.33 for father-child and 0.36 for mother-child (Sepahvand and Shahbazian 2017b).

Second, through sibling correlation we can explore the relative importance of various determinants discussed previously in the literature. What are the main factors that make children so similar? Parents' level of education has been shown to be an important determinant for risk taking (Dohmen et. al., 2011); however, is it relatively important alongside other parental socio-economic outcomes? How does family structure, such as mother's and father's age at first birth, marital status and parent's religious ideology influence the similarity of siblings? Risky behaviour has been suggested to be important to risk preferences (de Walque, 2014). Therefore, we investigate whether indicators such as parental health and if parents smoke or not, can explain some of the variation among sibling's risk attitudes.

Third, by measuring sibling correlation we gain an understanding of gender specific influences in different risk domains. Sepahvand and Shahbazian (2017b) show support for a gender-specific role model hypothesis in terms of risk attitudes. We therefore investigate the relative importance of fathers' and mothers' influence in the financial as well as the traffic risk domain on sibling similarities. As urbanization and the increase usage of motorized transportation, especially motorcycles, in developing countries has increased the last decades (e.g., Cervero,

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<sup>7</sup> Schnitzlein (2014) is the only study, we have been able to find, which computes sibling correlation for self-reported risk attitudes in Germany in a subsection of their analysis. Schnitzlein (2014) main focus is to analyze sibling correlation in permanent income, and do not apply the decomposition approach to sibling correlation in risk attitudes.

2013), traffic fatalities have also increased<sup>8</sup>. Our results show that the father's risk attitudes in traffic have a larger effect than the mother's on the size of the sibling correlation of risk attitudes in traffic. Previous campaigns designed to increase traffic safety, such as wearing a helmet, has been shown to be successful in many countries, such as India (Mohan et al., 2016), China (Chang et al., 2016) and Spain (García-Herrero et al., 2017). Therefore, our results have clear policy relevance, since by simple means like a public wearing helmet campaign - not only is likelihood of serious injury and mortality in traffic decreased, but also the fathers can influence their children to wear helmets.

We estimate sibling correlations of risk attitudes by using a nationally representative multipurpose Household Budget Survey (HBS) collected from all the 13 regions of Burkina Faso. The HBS was collected in 2014 from 10,800 households. All respondents 18 years and above in each household have provided answers to the risk questions, which are the outcome variables for our study. Our analytical sample consists of all adult siblings (at least two per household) who have provided answers to these risk questions and for whom we observe their mother's and father's characteristics. We have different sub-samples, such as younger and older generation of siblings, which will be described in more detail under section 3.

## **2. Burkina Faso**

Burkina Faso as a country of study is of particular interest as it is one of the most economically underdeveloped countries in the world. Thereby, its economic growth is conditioned on to what extent individuals can go from traditional sectors (such as agriculture) to more industrialized and technological ones. Burkina Faso is a landlocked country in West Africa, the agricultural sector constitutes around one third of its gross domestic product (GDP) and occupies around 80 per cent of the working age population.<sup>9</sup> In terms of investments, Burkina Faso was ranked as the 111<sup>th</sup> investment destination in the world<sup>10</sup>, which makes investments in the country a risky choice. Due to the climate, most of the population of Burkina Faso are

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<sup>8</sup> WHO's Road Safety database, estimated number of road traffic deaths by country, income level and type of road user: [http://www.who.int/gho/road\\_safety/mortality/en/](http://www.who.int/gho/road_safety/mortality/en/)

<sup>9</sup> Ministry of Agriculture Burkina Faso, <http://agriculture-bf.info/>.

<sup>10</sup> Euromoney Country Risk, <http://www.euromoneycountryrisk.com>



concentrated in the centre and south of the country, which is also why the northern regions are the poorest regions (INSD, 2015a). On average, there are approximately six children born per woman in Burkina Faso with a life expectancy estimated to be between 57 and 59 years old (INSD, 2015b). The relatively large amount of births per women in relation to population projections for 2014 of almost 18 million inhabitants (INSD, 2017) makes the country's population growth one of the highest in the world.

In Burkina Faso, the institutions are still under-developed and access to social services is scarce. There are inequalities in terms of who has access to these scarce services. Those who need social services the most (the poor in rural areas) have less access to it (INSD, 2015a). This has led to rapid urbanization. In addition, estimates show that around 50 per cent of the population is under 20 years old (INSD, 2015b). Despite that, the educational sectors share of GDP has increased and overall poverty was around 40 per cent in 2014 (INSD 2015a), the age demographic trend together with the large share of urbanization will increase the competition for urban jobs, which creates challenges for the institutions to create more opportunities in the urban non-agricultural occupational sector. As the institutions are still under-developed, individual's willingness to take risk to seek an occupation opportunity increases.

### **3. Data and analytical sample**

Our study is based on a multipurpose Household Budget Survey (HBS).<sup>11</sup> The HBS is a face-to-face, nationally representative panel survey covering 900 enumeration areas (EA)<sup>12</sup> with 12 households per EA, i.e., 10,800 households spread across the 13 regions of Burkina Faso.<sup>13</sup> The selection of the EAs is a random selection,

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<sup>11</sup> The main purpose of the HBS is to evaluate whether Burkina Faso has achieved the UN millennium goals, which is why each household is interviewed in four rounds during 2014. The HBS was conducted as a government cooperation project between the National Institute of Statistics and Demography (INSD, Institut National de la Statistique et de la Démographie) of Burkina Faso and Statistics Sweden (SCB), which provided the technical assistance. The project was financed by the Swedish International Development Cooperation Agency (Sida, or in French: Agence suédoise de coopération internationale au développement, Asdi).

<sup>12</sup> The enumeration area is a statistical defined geographical unit for sampling purpose.

<sup>13</sup> A pilot survey was also conducted during 2013 with 500 households, to test the questionnaires, the fieldwork operations and the data capture.

including both urban and rural areas. A two-stage stratified sampling technique is used. In the first stage, the EAs are drawn from a frame with a probability proportional to the number of households in the EA. The frame constitutes of 13,821 mapped EAs defined during the population census of 2006.<sup>14</sup> Then a listing procedure is conducted in each drawn EA in order to update the number of households, i.e., the frame of the second stage.<sup>15</sup> In the second stage, 12 households per EA are drawn with equal probability in each EA (INSD, 2013).<sup>16</sup>

This study focuses on three different risk questions in the HBS<sup>17</sup> that directly ask the respondent to assess his or her willingness to take risks in traffic, in financial matters and in general. These self-reported risk attitude questions were collected in the third (July-September) and fourth (October-December) rounds of 2014 as a separate module for all household members over the age of 17. We have adopted the same self-reported risk questions as those from the German Socioeconomic Panel, which has been used extensively in previous studies, and has also been empirically validated through field experiments as being a fruitful way of eliciting a reliable measurement of risk preferences (Dohmen et al., 2011; Hardeweg et al., 2013; Beauchamp et al., 2015; Vieider et al., 2015; Lönnqvist et al., 2015; Sepahvand and Shahbazian 2017a,b). The exact English wording of the questions is as follows: *“How do you see yourself: Are you a person who is fully prepared to take risks or do you try to avoid taking risks? On a scale from 1 to 10,*

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<sup>14</sup> A number of these EAs were updated in 2008.

<sup>15</sup> This listing procedure is also done in order to update the size of the EA for estimation of sampling weights.

<sup>16</sup> There were 27 permanent interviewing teams, each consisting of a controller, three interviewers and a driver. Each team covers around 33-35 EAs. The overall majority of the interviewers had at least the bachelor's degree, all were university students and many graduates. The interviewer teams stayed together during data collection periods and had daily discussions of experiences and problems encountered. The controllers and supervisors kept a tight check during the data collection and corrected for anomalies in the questionnaire. Approximately each week of data collection was followed by a detailed report by the supervisors. The advantage of having face-to-face interviews is that it is superior compared to other interview techniques, such as questionnaires, or/and telephone, as it provides a more accurate screening of the respondents (for instance in terms of sex, age, level of literacy, etc.), efficient interviewing time and quality checks of questions.

<sup>17</sup> The HBS surveys the head of each household in the sample. It also surveys all other members present in the household at the time of the interview and collects demographic information for the remaining non-present members at the time of the interview. The HBS consists of a core module, which is repeated every round and additional modules, which are less frequent. The contents of the core module are concentrated around sections on household expenditure and labour force data. In both of these sections, important changes may occur at fairly short notice, hence seasonal variations will be well captured. Besides collecting household information, such as expenditure and consumption data, respondents are also asked to provide a range of personal information through rotating questionnaire modules.

*where 1 = not at all willing to take risk and 10 = very willing to take risk. A. In traffic (driving a car, motorcycle, bike, etc.), B. In financial matters, C. In general?”*

The HBS has an overall household response rate of approximately 95 per cent for the third and fourth round respectively, which gives us a low level of attrition. All respondents 18 years and above have answered all three risk questions. However, not all respondents answered at both time points. The number of responses in the 3<sup>rd</sup> round was 34,494, in 4<sup>th</sup> round was 33,066 and in both rounds by the same individuals is 31,677 for all three risk questions. In order to get a more reliable measurement of risk attitudes and decrease measurement error, the analysis in this study use the average of the two periods. However, all analysis was performed with responses separately for the 3<sup>rd</sup> and 4<sup>th</sup> round and the results are similar.<sup>18</sup> Sepahvand and Shahbazian (2017a) take a closer look at this data, and show the distribution and summary statistics of the risk questions used in this study.

Since we use a household survey, the siblings must live within the household. Therefore, there might be a suspicion that siblings who live in the household are a selective group. In a sub-Saharan African country such as Burkina Faso, a traditionally agricultural society with undeveloped public security mechanisms, it is common that the children who grow up in the household stay in the same household and take over the responsibility of the extended household (e.g., Cattell, 1990; Peil, 1995; Canning et al., 2015). It is not uncommon that the parents continue to live in the household, now as the child’s responsibility. Usually those children that take over the responsibility of a household, including the parents’ living conditions, are the sons. Thus, men within our data would not be a selective group. Women, due to the patriarchal norms that shape gender roles in a sub-Saharan African country such as Burkina Faso tend to leave the household that they grew up in after their marriage (e.g., Newman., 1984). This is also indicated by Table 1 (in section 3.1 below), as we have a lower share of daughters in the sample. There could potentially be a selection issue with those daughters that we observe in our sample, i.e., for instance those that stay in the household have different risk aversion than those that leave or compared to other members of the household.

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<sup>18</sup> Results available upon request.

Sepahvand and Shahbazian (2017b:29-30) show that those daughters that we observe in our sample are not a selective group in terms of their risk attitudes.

### 3.1. Descriptive statistics and variables

In order to be included in the analytical sample, respondents must be over 17 years old and have at least one sibling in the household. Thereafter, we divide the analytical sample into two sub-samples, which we call younger and older generation siblings. The younger generation siblings (i.e., Sample 2) are those siblings that are the children of the head of the household. The older generation siblings (i.e., Sample 3) are those that are the brother or sister of the head of the household. One important distinction between these two sub-samples is that we have almost full information about parents (such as risk attitudes) in sample 2, while there is limited information about parents in sample 3. In addition, this division between younger and older generation siblings allows us to calculate sibling correlation for the whole age distribution in Burkina Faso, and also capture different mechanisms that play a role between siblings from a younger and older generation (i.e., different generations).

We now turn to a first descriptive look of our outcome and main explanatory variables, and then we turn our attention to a set of exploratory variables of different parental and household characteristics, as illustrated in Table 1.

**Table 1: Descriptive statistic over three analytical samples, and divided between brothers and sister**

	Sample 1		Sample 2		Sample 3		Sample 2 (Brothers)		Sample 2 (Sisters)	
	Mean <i>s.d.</i>	#Obs	Mean <i>s.d.</i>	#Obs	Mean <i>s.d.</i>	#Obs	Mean <i>s.d.</i>	#Obs	Mean <i>s.d.</i>	#Obs
Child's risk in traffic	4,03 0,03	3504	4,14 0,05	1849	3,90 0,05	1655	4,49 0,05	1252	3,41 0,08	597
Child's risk in financial	5,06 0,03	3504	4,92 0,04	1849	5,22 0,05	1655	5,16 0,05	1252	4,41 0,08	597
Child's risk in general	4,51 0,03	3504	4,50 0,04	1849	4,53 0,05	1655	4,74 0,05	1252	3,97 0,08	597

<b>Child's age</b>										
18-29 years	0,62		0,78		0,44		0,77		0,81	
	0,01	3504	0,01	1849	0,01	1655	0,01	1252	0,02	597
30-39 years	0,23		0,18		0,29		0,19		0,15	
	0,01	3504	0,01	1849	0,01	1655	0,01	1252	0,01	597
40-49 years	0,08		0,03		0,13		0,03		0,03	
	0,00	3504	0,00	1849	0,01	1655	0,00	1252	0,01	597
50-59 years	0,04		0,01		0,07		0,01		0,01	
	0,00	3504	0,00	1849	0,01	1655	0,00	1252	0,00	597
60+ years	0,03		0,00		0,060		0,00		0,00	
	0,00	3504	0,00	1849	0,01	1655	0,00	1252	0,00	597
Child's average age	29,18		25,05		33,81		25,31		24,50	
	0,19	3504	0,15	1849	0,32	1655	0,18	1252	0,28	597
<b>Child's gender</b>										
Male	0,73		0,68		0,78		1,00		0,00	
	0,01	3504	0,01	1849	0,01	1655	0,00	1252	NA	597
Female	0,27		0,32		0,22		0,00		1,00	
	0,01	3504	0,01	1849	0,01	1655	NA	1252	0,00	597
<b>Main Explanatory Variables</b>										
<b>Mother's risk attitudes</b>										
Traffic	2,46		2,56		2,21					
	0,03	2414	0,04	1723	0,05	691				
Financial	3,95		4,17		3,40					
	0,04	2414	0,05	1723	0,07	691				
General	3,37		3,50		3,03					
	0,04	2414	0,04	1723	0,07	691				
<b>Father's risk attitudes</b>										
Traffic	3,11		3,19		2,15					
	0,05	1503	0,05	1391	0,11	112				
Financial	4,43		4,51		3,46					
	0,05	1503	0,05	1391	0,19	112				
General	3,97		4,06		2,92					
	0,05	1503	0,05	1391	0,15	112				
<b>Socio-economic status</b>										
<b>Mother's Education level</b>										
Low education	0,88		0,84		0,96					
	0,01	2414	0,01	1723	0,01	691				
Primary education	0,09		0,11		0,03					
	0,01	2414	0,01	1723	0,01	691				
Secondary education	0,04		0,05		0,01					
	0,00	2414	0,01	1723	0,00	691				
University	0,00		0,00		0,00					
	0,00	2414	0,00	1723	0,00	691				
<b>Father's Education level</b>										
Low education	0,77		0,76		0,86					
	0,01	1503	0,01	1391	0,03	112				
Primary education	0,14		0,15		0,13					
	0,01	1503	0,01	1391	0,03	112				
Secondary education	0,07		0,07		0,02					
	0,01	1503	0,01	1391	0,01	112				
University	0,02		0,02		0,00					
	0,00	1503	0,00	1391	0,00	112				

<i>Household consumption 2014</i>						
Food consumption	973'		972'		974'	
	10'	3504	13'	1849	17'	1655
Non-food consumption	1023'		1088'		952'	
	12'	3504	18'	1849	16'	1655
<i>Mother having bank account</i>						
No bank account	0,90		0,87		0,98	
	0,01	2414	0,01	1723	0,01	691
Bank account	0,10		0,13		0,02	
	0,01	2414	0,01	1723	0,01	691
Missing	0,00		0,00		0,00	
	0,00	2414	0,00	1723	0,00	691
<i>Father having bank account</i>						
No bank account	0,77		0,76		0,96	
	0,01	1503	0,01	1391	0,02	112
Bank account	0,23		0,24		0,04	
	0,01	1503	0,01	1391	0,02	112
Missing	0,00		0,00		0,00	
	0,00	1503	0,00	1391	0,00	112
Household size	10,89		11,05		10,71	
	0,09	3504	0,12	1849	0,15	1655

#### Family Structure

<i>Mother's age at birth</i>						
13-19 years	0,10		0,14		0,06	
	0,01	3504	0,01	1849	0,01	1655
20-29 years	0,33		0,48		0,16	
	0,01	3504	0,01	1849	0,01	1655
30-39 years	0,20		0,25		0,13	
	0,01	3504	0,01	1849	0,01	1655
40+ years	0,07		0,07		0,07	
	0,00	3504	0,01	1849	0,01	1655
<i>Father's age at birth</i>						
13-19 years	0,00		0,00		0,00	
	0,00	3504	0,00	1849	0,00	1655
20-29 years	0,08		0,15		0,01	
	0,00	3504	0,01	1849	0,00	1655
30-39 years	0,18		0,32		0,03	
	0,01	3504	0,01	1849	0,00	1655
40+ years	0,16		0,28		0,04	
	0,01		0,01		0,00	
<i>Mother's religion</i>						
Catholic	0,28		0,28		0,22	
	0,01	1723	0,01	1723	0,02	691
Muslim	0,59		0,59		0,66	
	0,01	1723	0,01	1723	0,02	691
Protestant	0,08		0,08		0,06	
	0,01	1723	0,01	1723	0,01	691
Animism	0,05		0,05		0,06	
	0,01	1723	0,01	1723	0,01	691
<i>Father's religion</i>						
Catholic	0,27		0,27		0,25	
	0,01	1391	0,01	1391	0,04	112
Muslim	0,58		0,58		0,64	
	0,01	1391	0,01	1391	0,05	112
Protestant	0,07		0,07		0,02	
	0,01	1391	0,01	1391	0,01	112
Animism	0,07		0,07		0,09	
	0,01	1391	0,01	1391	0,03	112

<b>Mother's Marital status</b>						
Single	0,00		0,00		0,01	
	0,00	1723	0,00	1723	0,00	691
Married	0,82		0,82		0,26	
	0,01	1723	0,01	1723	0,02	691
Divorced	0,01		0,01		0,02	
	0,00	1723	0,00	1723	0,01	691
Widowed	0,16		0,16		0,71	
	0,01	1723	0,01	1723	0,02	691
<b>Father's Marital status</b>						
Single	0,00		0,00		0,00	
	0,00	1391	0,00	1391	0,00	112
Married	0,96		0,96		0,94	
	0,00	1391	0,00	1391	0,02	112
Divorced	0,00		0,00		0,02	
	0,00	1391	0,00	1391	0,01	112
Widowed	0,03		0,03		0,04	
	0,00	1391	0,00	1391	0,02	112
<b>Health</b>						
<b>Mother's health (15 past days)</b>						
Not sick	0,71		0,71		0,77	
	0,01	1723	0,01	1723	0,02	691
Sick	0,29		0,29		0,23	
	0,01	1723	0,01	1723	0,02	691
<b>Father's health (15 past days)</b>						
Not sick	0,71		0,71		0,73	
	0,01	1391	0,01	1391	0,04	112
Sick	0,29		0,29		0,27	
	0,01	1391	0,01	1391	0,04	112
<b>Mother smoking</b>						
Don't smoke	0,88		0,88		0,82	
	0,01	1723	0,01	1723	0,01	691
Smoke	0,12		0,12		0,18	
	0,01	1723	0,01	1723	0,01	691
<b>Father smoking</b>						
Don't smoke	0,78		0,78		0,72	
	0,01	1391	0,01	1391	0,04	112
Smoke	0,22		0,22		0,28	
	0,01	1391	0,01	1391	0,04	112
<b>Residential zone</b>						
Urban	0,59		0,59		0,47	
	0,01	1849	0,01	1849	0,01	1655
Rural	0,41		0,41		0,53	
	0,01	1849	0,01	1849	0,01	1655

*Notes:* The Table shows mean, standard deviation and number of observations for sibling, parents and household characteristics for rounds 3 and 4, for Sample 1-3. The variable Sick was not collected in the fourth round.

Table 1 shows the descriptive statistics of siblings for analytical samples 1-3, including subsamples of brothers and sisters. Table 1 show that the child's risk

taking in traffic is on average higher for younger (Sample 2) compared to older generations (Sample 3). However, when it comes to risk in financial matters, the sample of older siblings take on average a higher risk than younger ones. For general risk taking, it is quite similar on average. Brothers take on average higher risk than sisters in all risk domains.<sup>19</sup>

The age distribution of sample 2 is overwhelming younger, 78 per cent are between 18-29 years old, while the corresponding percentage is 44 for the older sample. Our analytical sample includes more male than female siblings.

Turning the attention to the main explanatory variables, we see that both mothers and fathers of younger siblings take more risk on average in all risk domains compared to parents of older siblings. This descriptive pattern is in line with previous research on the main determinants of risk taking in Burkina Faso, the older one becomes the less risk one tends to take (Sepahvand and Shahbazian 2017a). Comparing mothers to fathers, fathers of younger generation siblings (Sample 2) take on average more risk than mothers in all risk domains. However, the difference between the mother's and father's risk for the sample of older generation siblings (Sample 3) is more similar. This could be due to the smaller sample of fathers in Sample 3 and/or that fathers in Sample 3 are overrepresented in the oldest age category.

Our measures of parental socio-economic status include level of education, employment status, household consumption, access to a bank account and household size. We use mother's and father's level of education separately. Education level is given by four categories: Low, Primary, Secondary education and University.<sup>20</sup> The majority of parents have a low level of education, whereas mothers are less educated than fathers. The parents for the older generation (Sample 3) are less educated than the parents for the younger generation (Sample 2). The

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<sup>19</sup> Most previous research has shown that boys are more risk taking than girls (e.g., Cárdenas et al., 2012), and women more risk-averse than men (e.g., Donkers et al., 2001; Croson and Gneezy 2009; Andersson et al., 2016). However, some literature do not find any difference between men and women (e.g., Harrison et al., 2007; Fraser-Mackenzie et al., 2014) or criticizes the line of research that claim to have found gender differences in risk attitudes (Nelson, 2016).

<sup>20</sup> In those instances where there is a missing value on father's or mother's level of education (which is more common for the oldest respondents), we have coded them into the Low education category.



consumption variable, include the household's overall consumption in FCFA<sup>21</sup> for the entire year (all the four rounds) of 2014, divided into food and non-food consumption. A variable is also included for if mothers and fathers have a bank account, we see that there exists a larger fraction of mothers in our samples with no bank account compared to fathers.

Another category of variables relates to family structure. These variables include mother's and father's age at first birth, both parents' religion and marital status. Mother's and father's age at first birth are treated as categorical variables: 13-19, 20-29, 30-39 and 40 years and older. The mother's and father's religion are categorical variables including the following categories: Catholic, Muslim, Protestant and Animism. The marital status variable includes four categories: if the mothers or fathers are single, married, divorced or widowed.

Our third category of exploratory variables is related to parents' health, which includes an indicator whether the mother or father have been sick during the past 15 days. There is also information on parents' smoking habits, if they smoke or not.

Our variables indicating residential zone, include measures of whether siblings live in an urban or a rural area.

## **4. Modelling Sibling Correlation and how to Estimate it**

In order to calculate sibling correlation in risk attitudes,  $\rho$ , estimates of the within-family variation,  $\sigma_b^2$ , and the between-family variation,  $\sigma_a^2$ , is needed to be estimated. We follow the same procedure as previous research (e.g., Solon et al., 1991; Solon 1999; Björklund et al. 2010; Lindquist et al., 2017), and estimate this variation by using a mixed-effects model. We have modified it so that to measure sibling correlation for risk attitudes.

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<sup>21</sup> FCFA, franc CFA is the currency used in Burkina Faso and some other West and Central African countries. The abbreviation CFA stands for African Financial Community (Communauté Financière Africaine). The exchange rate with the euro is fixed (1 euro = 655.957 XOF).

We start by having a measure for our outcome variable risk attitude, denoted by  $r_{ij}$ , for sibling  $j$  in family  $i$ . The risk attitudes are then modelled as follows:

$$r_{ij} = X_{ij}^T \beta + \varepsilon_{ij}, \quad (1)$$

where the vector,  $X_{ij}^T$ , include gender and age dummies and other control variables that we will come to later on below. These dummies are treated as fixed effects. The residual term,  $\varepsilon_{ij}$ , is an individual-specific component representing an individual's position in the overall distribution of risk taking, whose population variance is given by  $\sigma_\varepsilon^2$ . The residual,  $\varepsilon_{ij}$ , is decomposed as follows:

$$\varepsilon_{ij} = a_i + b_{ij}. \quad (2)$$

The terms on the right hand side of equation (2) are treated as random effects;  $a_i$  is a permanent component shared by all siblings in family  $i$ , what makes siblings similar, and  $b_{ij}$  is a permanent component unique to sibling  $j$  in family  $i$ . These terms are assumed to be independent of each other. This assumption is important for us, as it allows us to divide the permanent component into a part that is perfectly shared by all siblings in the family ( $a_i$ ) and a part that is perfectly uncorrelated and hence unique among siblings ( $b_{ij}$ ). The variance of  $\varepsilon_{ij}$  is then

$$\sigma_\varepsilon^2 = \sigma_a^2 + \sigma_b^2. \quad (3)$$

The first term,  $\sigma_a^2$ , captures the variance in the permanent risk attitudes that is due to difference between families. The second term,  $\sigma_b^2$ , captures the variance in the permanent risk attitudes within families. These two components are then used to calculate the correlation in the permanent risk attitudes between siblings,  $\rho$ , which is the main focus of our analysis in this study

$$\rho = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_b^2} \equiv \text{corr}(\varepsilon_{ij}, \varepsilon_{ij'}). \quad (4)$$

Equation (4) shows the fraction of the overall variance of the permanent component that is due to shared family and community background. Or put differently, this share coincides with the correlation in risk attitudes of randomly drawn pairs of siblings, which is why  $\rho$  is called a sibling correlation.

We can estimate the sibling correlation in risk attitudes,  $\rho$  of equation (4), by using estimates of the between-family variation,  $\sigma_a^2$ , and the individual within-family variation,  $\sigma_b^2$ . These can be obtained by estimating the following mixed-effects model:

$$r_{ij} = X_{ij}^T \beta + a_i + b_{ij}, \quad (5)$$

where gender and age dummies for siblings are included in  $X_{ij}^T$  as a baseline. We estimate equation (5) using Stata's *mixed* command. The variance components are estimated using maximum likelihood. As part of Stata's *mixed* command's standard output it is possible to get  $\rho$  with a 95% confidence interval.

In order to explain some of the household-level variance in risk attitudes between siblings it is possible to incorporate household-level predictors into the model. For example, gender of the siblings, their age and level of education (their own and parents) may determine individual's risk attitudes in Burkina Faso (Sepahvand and Shahbazian 2017a). Therefore, we would be able to investigate how much of what the siblings share is captured by adding covariates to  $X_{ij}^T$  in equation (1), and examine if these characteristics generate any difference in sibling correlations. This would be done through creating different categories of variables from parental and household characteristics we expect to affect the sibling risk correlation. Thereby, we would be able to detect what variables that influence risk attitudes through  $a_i$ , meaning how much of the sibling similarities in risk attitudes they account for. As baseline, our sibling correlations include controls for the age and gender of the sibling. This decomposition approach has been used by previous literature examining what determines sibling similarities in various outcomes such as income (e.g., Björklund et al., 2010), cognitive and non-cognitive skills (e.g., Anger and Schnitzlein, 2017), earnings and wages (e.g., Mazumder, 2008) and criminal behaviour (e.g., Hederö Eriksson et al., 2016), it has not been used to investigate the determinants of sibling similarities in risk attitudes. To illustrate our decomposition approach, consider for instance the inclusion of mother's and father's risk attitudes in  $X_{ij}^T$ . These two additional variables should reduce the residual variation in sibling's risk attitudes and produce a lower estimate of the between-family variation,  $\sigma_a^{2*}$ , than the estimate produced at baseline without adding these two controls,  $\sigma_a^2$ . We can interpret the difference between these two

estimates,  $\sigma_a^2 - \sigma_a^{2*}$ , as an upper bound on the amount of variance in the family component that can be explained by parent's risk attitudes. It is considered an upper bound as it includes other mechanism/factors influencing children's risk attitudes that are correlated with parent's risk attitudes, such as gender, education, religion, health, residential zone. This decomposition approach will also produce a new sibling correlation,  $\rho^*$ . Since there exist a strong intergenerational transmission of risk attitudes in Burkina Faso (Sepahvand and Shahbazian, 2017b), we expect this new sibling correlation to be much lower than then one obtained at baseline,  $\rho$ . As this is the first study examining sibling similarities in risk attitudes, the degree to which a control variable lowers the sibling correlation after being included provides a metric for judging its importance in explaining sibling similarities. However, this does not allow us to make a causal interpretation.

A sibling correlation can therefore be viewed as the consequence of “*common genes, common environment, or the influence of one brother on the other*” Jencks et al. (1979:10). Thereby, it includes any social or genetic traits shared by siblings, such as parental resources, parental influence (for instance cultural and ethical inheritance or aspirations), genetics and experiences at place of worship (e.g., mosque or church), neighbourhood and school. Any genetic or social traits which are not shared by the siblings, would be captured by the individual component  $b_{ij}$ . If these non-shared factors are relatively more important than shared factors for risk attitudes, the variance of the family effect will be small relative to the variance of the individual effect. Thereby leading to the sibling correlation,  $\rho$  in equation (4), being low. In the other case, the more important the effect that sibling do share are,  $a_i$ , the larger is the sibling correlation.

#### **4.1. Comparison to the intergenerational transmission of risk**

In order to show the relationship between intergenerational transmission, which we will call  $\beta$ , and sibling correlation in risk attitudes,  $\rho$ , we need to extend our modelling framework in section 4 above.<sup>22</sup> The family component in equation (2) can be decomposed into one part due to parental risk

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<sup>22</sup> Follow the same procedure as previous research (e.g., Solon 1999; Adermon and Gunnarsson 2017; Lindquist et al., 2017).

attitudes  $r_i$  and one part due to other factors which are uncorrelated with parental risk attitudes,  $z_i$ :

$$a_i = \beta r_i + z_i. \quad (6)$$

Substitution into equation (1) gives

$$r_{ij} = X_{ij}^T \delta + \beta r_i + \varepsilon_{ij}, \quad (7)$$

where the residual,  $\varepsilon_{ij}$ , is decomposed as follows:

$$\varepsilon_{ij} = z_i + b_{ij}. \quad (8)$$

Equation (7) is the intergenerational regression of child risk on parental risk that is also used by Sepahvand and Shahbazian (2017b). Taking variance on both sides of equation (6) and dividing by total variance in risk,  $\sigma_r^2$ , gives

$$\frac{\sigma_a^2}{\sigma_r^2} = \beta^2 + \frac{\sigma_z^2}{\sigma_r^2}. \quad (9)$$

The left-hand side of equation (9) is identical to the sibling correlation as defined in equation (4). Equation (9) shows that sibling correlation is proportional to the squared intergenerational coefficient in risk attitudes. Equation (9) also shows that the sibling correlation captures additional family background factors that are not captured by intergenerational correlation. This is empirically shown by previous research. Mazumder (2008) and Björklund (2010) indicate in the context of income mobility that more than half of the family backgrounds and community effects that siblings share do not correlate with their parents' income.

## 5. Result

### 5.1. Results for baseline estimation

Table 2 shows estimates of the sibling correlations for three samples: Full (i.e., Sample 1), Younger (i.e., Sample 2) and Older generation (i.e., Sample 3).<sup>23</sup>

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<sup>23</sup> We use standardized version of the risk measures in all the tables, in order to have a transparent comparison of coefficients with future studies. The standardization is conducted separately of the child's, the mother's and the father's risk attitudes. Our results do not include any singletons.

Previous research has indicated that age is an important determinant of risk attitudes, but is it equally important for sibling correlations across the younger and older generations? One way to answer this question is to investigate the robustness of our baseline estimates of sibling correlation in Table 2.<sup>24</sup> The sibling correlations across the different samples indicate that over 70% of the total variation in risk attitudes in traffic and general are due to shared family backgrounds and community influences. The corresponding estimation is over 60% for sibling risk correlation in financial matters. For general risk taking there seems to be age heterogeneity in risk attitudes; siblings belonging to the younger generation have a higher correlation (0.76) compared to those from the older generation (0.70). The same pattern is detected for risk in financial matters, sibling risk correlation for younger (0.64) is higher than older (0.58). However, the sibling correlations between the younger and older generation in traffic are somewhat similar.

**Table 2: Baseline estimation for the three analytical samples and risk domains**

	Sample 1	Sample 2	Sample 3
	<b>Traffic</b>		
Sibling corr. s.e.	0,72 (0,01)	0,72 (0,02)	0,71 (0,02)
	<b>Financial</b>		
Sibling corr. s.e.	0,61 (0,01)	0,64 (0,02)	0,58 (0,02)
	<b>General</b>		
Sibling corr. s.e.	0,73 (0,01)	0,76 (0,01)	0,70 (0,02)

*Notes:* Shows baseline estimates for sibling correlation in traffic, financial and general risk attitudes. Sample 1 is the Full sample of siblings, Sample 2 is the Younger generation of siblings and Sample 3 is the Older generation of siblings. Sample 1 to 3 uses the average risk attitude of the sibling between round 3 and 4 as the dependent variable. The dependent variable is measured on a scale from 1 to 10, where 1 = not at all willing to take risk and 10 = very willing to take risk in general. The sibling's gender and age are included as controls in the baseline estimates. Standard errors in parentheses are clustered at the household level.

<sup>24</sup> The sibling characteristics of gender and age are added to the vector  $X_{ij}^T$  in equation (5) for the three samples of siblings.

## 5.2. Results for parents' risk attitudes

What is it that makes the risk attitudes of siblings so similar? Previous research find empirical support for an intergenerational correlation of risk attitudes in Burkina Faso (Sepahvand and Shahbazian 2017b), hence we expect parents risk attitudes to influence sibling risk correlation. In Table 3 panel B-D we estimate this for the Younger generation of siblings (i.e. Sample 2) by including mother's, father's and both parents' risk attitudes as controls to our baseline correlation estimation method.

When controlling for both parents' risk attitudes, the sibling correlation for risk taking in general drops by 32% from 0.76 to 0.52. This indicates that parents' risk attitudes have a strong associative relationship on the sibling correlation. When including mother's and father's risk attitudes in general separately, we detect a drop in the estimated sibling risk correlations by 29% from mothers and 24 % from fathers.<sup>25</sup> This provides an initial indication that there might be some heterogeneity in terms of gender. Moreover, these magnitudes of the importance of parents' risk attitudes echo those that would be expected from previous estimates of sibling correlations in income, education and crime for Sweden and Denmark. Björklund et al., (2010) found an 18 % reduction in the sibling correlation in income after controlling for father's occupation. Bredtmann and Smith (2016) show that controlling separately for mother's (father's) occupation decreases sibling correlation in completing upper secondary education by 23% (21%). Hederos Eriksson et al., (2016) study the different factors that could potentially explain why siblings are similar in terms of their criminal behaviour. Their results imply that sibling associations in criminal behaviour decrease by at most 21 % when controlling for parental criminality.

Sepahvand and Shahbazian (2017b) argue that traffic is a more male-dominated domain, while financial matters is a more female-dominated domain in Burkina Faso. The strong association detected from mother's risk taking on sibling correlation in general risk attitudes is reversed for sibling risk correlation in traffic. Instead, in the risk domain of traffic, the father's risk attitudes seem to be somewhat

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<sup>25</sup> Sibling risk correlation in general drops with 29% to 0.54 when controlling separately for mother's risk attitudes. This drop is more compared to when controlling separately for father's risk attitude, which drops the sibling risk correlation in general by 24% to 0.58.

more important, as it accounts for a larger percentage drop than mothers: 24% from fathers compared to 20% from mothers. However, in the more female-dominated risk domain (i.e., risk in financial matters), mothers seems to be more influential than fathers on siblings, as the siblings risk correlation in financial matters drops by 16% from mother's and only 8% from father's influence.

**Table 3: Baseline estimation for sample 2 (younger generation), and controlling for mothers and fathers risk attitudes**

Traffic				Financial			General		
Panel A: Baseline Estimates									
Sibling corr. s.e.	0,72 (0,02)			0,64 (0,02)			0,76 (0,01)		
	↓	↓%		↓	↓%		↓	↓%	
Panel B: Mother's risk attitudes									
Sibling corr. s.e.	0,57 (0,02)	0,15	20%	0,54 (0,02)	0,10	16%	0,54 (0,02)	0,22	29%
Panel C: Father's risk attitudes									
Sibling corr. s.e.	0,55 (0,02)	0,17	24%	0,58 (0,02)	0,05	8%	0,58 (0,02)	0,18	24%
Panel D: Mother's & Father's risk attitudes									
Sibling corr. s.e.	0,51 (0,03)	0,21	29%	0,56 (0,03)	0,08	12%	0,52 (0,03)	0,24	32%

*Notes:* Shows coefficient estimates for sibling correlation in traffic, financial and general risk attitudes. Sample 2 uses the average risk attitude of the sibling between round 3 and 4 as the dependent variable. The mother's and father's average risk attitudes between the 3<sup>rd</sup> and 4<sup>th</sup> round are included separately and jointly as the main explanatory variables. ↓ gives the absolute decrease in sibling correlation. %↓ gives the percentage decrease. Standard errors in parentheses are clustered at the household level.

### 5.3. Results for brothers and sisters

Previous research has given support to the gender-specific role model hypothesis in terms of risk attitudes: since there are strong gender roles in Burkina Faso, the transmission of attitudes from mothers have a stronger associative effect



on their child in the female dominated domain, and for fathers the effect is reverse (Sepahvand and Shahbazian 2017b). Therefore, we will investigate if sibling risk correlation depends on the siblings' gender<sup>26</sup>, and the gender of the parents'.

Table 4 shows the risk correlation for brothers and sisters. Looking at our baseline estimates of sibling risk correlation in panel A, the difference between brother and sister correlations are different across risk domains. Sisters have a higher correlation in risk than brothers across all the three risk domains. Our estimate for brothers' and sisters' correlation of risk attitudes in general is higher than previous estimates for Germany (Schnitzlein 2014), which is the only previous estimate we have found for comparing our baseline of sibling correlation in risk attitudes. Schnitzlein (2014), applying the same measure of self-reported risk taking as our measure, estimate brothers' correlation to 0.40 and sisters' correlation in risk attitudes to 0.36. The fact that there is a higher correlation in risk attitudes within the family in Burkina Faso than Germany has also been found in previous studies. Sepahvand and Shahbazian (2017b) focusing on intergenerational transmission of risk attitudes show that the estimates for Burkina Faso are higher compared to those found by Dohmen et al., (2012) for Germany, using the same risk measurements.

For risk taking in general, Table 4 panel B and C shows that mothers have a stronger influence on sisters and fathers have a stronger effect on brothers' correlation. Moreover, Table 4 panel B and C shows strong gender heterogeneity within the risk domains of financial matters and traffic. We see that when controlling only for mother's risk attitudes in the female dominated risk domain (i.e., financial matters), the drop in the sisters' correlation in risk attitudes is higher compared to when controlling only for father's risk attitudes. The drop in the brothers' correlation in financial risk taking is similar when controlling only for mothers (8%) or fathers (7%).

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<sup>26</sup> There is a well-established previous literature looking at brother and sisters correlation within various outcomes, such as earnings (e.g., Björklund et al., 2002; Conley and Glauber 2008), income (e.g., Björklund et al., 2009; Jäntti and Jenkins 2015), education (e.g., Benin and Johnson, 1984; Hauser and Wong, 1989; Holmlund 2005) and cognitive and non-cognitive skills (e.g., Anger and Schnitzlein, 2017).

**Table 4: Baseline estimation for brothers and sister (sample 2), and controlling for mothers and fathers risk attitudes**

Traffic							Financial							General							
Brothers				Sisters			Brothers				Sisters			Brothers				Sisters			
Panel A: Baseline Estimates																					
Sibling corr.		0,78		0,81			0,69			0,74				0,80			0,83				
s.e.		(0,02)		(0,02)			(0,02)			(0,03)				(0,01)			(0,02)				
↓		↓%		↓			↓			↓				↓			↓				
Panel B: Mother's risk attitudes																					
Sibling corr.		0,69	0,09	11%	0,62	0,19	23%	0,63	0,06	8%	0,62	0,11	15%	0,67	0,13	16%	0,56	0,27	33%		
s.e.		(0,02)		(0,04)			(0,03)			(0,04)				(0,02)			(0,05)				
Panel C: Father's risk attitudes																					
Sibling corr.		0,65	0,13	16%	0,67	0,14	17%	0,64	0,05	7%	0,69	0,05	7%	0,66	0,15	18%	0,70	0,13	15%		
s.e.		(0,03)		(0,05)			(0,03)			(0,05)				(0,03)			(0,04)				
Panel D: Mother's & Father's risk attitudes																					
Sibling corr.		0,64	0,13	17%	0,60	0,21	26%	0,64	0,05	7%	0,62	0,11	16%	0,65	0,16	20%	0,56	0,28	33%		
s.e.		(0,03)		(0,06)			(0,03)			(0,05)				(0,03)			(0,06)				

*Notes:* Shows coefficient estimates for brothers and sisters correlation in traffic, financial and general risk attitudes. ↓ gives the absolute decrease in sibling correlation. %↓ gives the percentage decrease. Standard errors in parentheses are clustered at the household level.

In the male dominated risk domain of traffic, brothers' correlation in risk drops by 16 % when controlling for fathers compared to 11 % when controlling for mothers. Indicating that fathers have a stronger influence on sons' risk taking compared to mothers. But interestingly, mothers seems to be more important for sisters' correlation in traffic than fathers, as sisters' correlation drops by 23% when controlling only for mothers compared to a drop of 17% when including only fathers. It should be noted that the influence of fathers on sisters is still relatively high, and the father's effect for both brothers and sisters is quite similar.

Overall, these findings give additional support to the gender-specific role model hypotheses in terms of the covariation of risk attitudes within the family.

**Table 5: Baseline estimation for Sample 2 (i.e., younger generation), and controlling for four broad categories of indicators**

Traffic				Financial			General		
Panel A: Baseline Estimates									
Sibling corr. s.e.	0,72 (0,02)			0,64 (0,02)			0,76 (0,01)		
	↓	↓%		↓	↓%		↓	↓%	
Panel B: Parent's risk attitudes									
Sibling corr. s.e.	0,51 (0,03)	0,21	29%	0,56 (0,03)	0,08	12%	0,52 (0,03)	0,24	32%
Panel C: Socioeconomic outcomes									
Sibling corr. s.e.	0,70 (0,02)	0,02	2%	0,66 (0,02)	0,02	3%	0,75 (0,01)	0,01	1%
Panel D: Family structure									
Sibling corr. s.e.	0,71 (0,02)	0,01	2%	0,66 (0,02)	0,02	4%	0,75 (0,01)	0,00	1%
Panel E: Parental health									
Sibling corr. s.e.	0,71 (0,02)	0,01	2%	0,66 (0,02)	0,02	4%	0,75 (0,01)	0,00	1%
Panel F: All above									
Sibling corr. s.e.	0,50 (0,03)	0,22	31%	0,52 (0,02)	0,12	19%	0,49 (0,03)	0,26	35%

*Notes:* Shows coefficient estimates for sibling correlation in traffic, financial and general risk attitudes. Socioeconomic status, Family structure and Parental health are included as separate controls. ↓ gives the absolute decrease in sibling correlation. % ↓ gives the percentage decrease. Standard errors in parentheses are clustered at the household level.

## 5.4. Results for parental and household characteristics

To further investigate what other parental and household characteristics that influence sibling similarities in risk attitudes, we include three broad categories with indicators alongside parental risk attitudes one at a time and simultaneously as controls. These are socio-economic status, family structure and parental health indicators.

Table 5 shows that sibling correlation drops the most when controlling for parents' risk attitudes, with 29 % for traffic, 12% for financial and 32 % for general. It can also be noted that none of the three other broad categories of indicators has a strong association with risk attitudes.

## 5.5. Results for urban/rural

As many sub-Saharan African countries are facing large urbanization, with urban areas soon constituting most of the society, we are interested in exploring if there are any differences in sibling similarities between rural and urban areas. Table 6 shows that sibling correlation in risk attitudes are influenced almost equally between rural and urban area for all three risk domains.

**Table 6: Baseline estimation for Sample 2 (i.e. younger generation), and controlling for living in urban or rural area**

Traffic				Financial			General		
Panel A: Baseline Estimates									
Sibling corr. s.e.	0,72 (0,02)			0,64 (0,02)			0,76 (0,01)		
	↓	↓%		↓	↓%		↓	↓%	
Panel B: Urban									
Sibling corr. s.e.	0,72 (0,01)	0,00	1%	0,63 (0,02)	0,00	0%	0,75 (0,01)	0,01	1%
Panel C: Rural									
Sibling corr. s.e.	0,71 (0,02)	0,01	1%	0,66 (0,02)	0,01	2%	0,75 (0,01)	0,01	2%

*Notes:* Shows coefficient estimates for sibling correlation in traffic, financial and general risk attitudes. The residential zone (Urban or Rural) are included separately as explanatory variables. ↓ gives the absolute decrease in sibling correlation. %↓ gives the percentage decrease. Standard errors in parentheses are clustered at the household level.

## **5.6. Comparison to the intergenerational transmission of risk**

Sepahvand and Shahbazian (2017b) investigate if transmission of risk attitudes exists for a nationally representative sample of children and both their parents from Burkina Faso, while in this study we use the full, younger and older generation samples of siblings, with and without parents, to detect any underlying mechanism that will influence sibling risk correlations. It should be noted that this study about sibling risk correlation differs from Sepahvand and Shahbazian (2017b) in terms of method and design.

Sepahvand and Shahbazian (2017b) estimate an intergenerational transmission from mother's (father's) risk towards their child of 0.36 (0.33) for general, 0.22 (0.45) for traffic and 0.33 (0.22) for financial matters, which according to equation (9) in section 4.1 above corresponds to a sibling correlation in risk taking of 0.13 (0.11) for general, 0.05 (0.20) for traffic and 0.11 (0.05) for financial matters. This is much lower than our sibling correlations in Table 3, indicating that family background factors uncorrelated with parental risk are important for the formation of child risk (i.e., the second term on the right-hand side of equation (9)). This is also shown by our results in Table 3 (for Sample 2), which shows that controlling for mother's (father's) risk attitudes reduces the sibling correlation by 0.22 (0.18) for risk in general, 0.15 (0.17) for risk in traffic and 0.10 (0.05) for risk in financial matters.

These results show that beside what can be explained by parental risk factors, shared background factors explain a large variation for siblings' risk formation.

## **6. Conclusion**

This study focuses on sibling correlation for a sub-Saharan African country, Burkina Faso. The institutional setting, in particular the lack of strong institutions and the important role of the family is an important trait for many developing countries that faces huge challenges ahead. The majority of previous research on sibling correlations has focused on various economic outcomes that are likely to

hold for developed countries, with strong institutions and different degrees of social security. This study helps to fill the gap in the literature in understanding economic decision making in developing countries. As our risk measurement is fairly easy and cost-effective for researchers and practitioners to implement in other countries with the same setting, it allows for comparison across time and countries. This is important, since recently replicability and reproducibility of scientific findings have reemerged as a salient factor (Dreber et al., 2015; Camerer et al., 2016), by being able to use and analyse the same measures as previous studies.

Evidence of high sibling correlation in risk attitudes is also relevant for other literature. Previous research shows a relationship between risk attitudes and education (e.g., Guiso and Paiella 2005; Brunello 2002), entrepreneurship (e.g., Cramer et al., 2002; Caliendo et al., 2009) and occupation (e.g., Bonin et al., 2007). A large body of evidence has shown strong persistence in outcomes such as income, education, occupational choice and entrepreneurship across generation and emphasis that shared family background provides an additional channel which makes children to end up with similar outcomes partly because they have been under similar influence and thus make the same patterns of choices.

This study explored which and how much of parent's and the household characteristics matter for explaining sibling similarities in risk attitudes. We extend the literature on the parent-child transmission of risk attitudes, by using a broader measure in capturing family and community influences, i.e., sibling correlation, which to the best of our knowledge has not been shown before for risk attitudes.<sup>27</sup> The measurement of sibling correlations in risk attitudes is important in understanding how risk attitudes are shaped and is the main contribution of this study. When comparing our results to previous research on the intergenerational transmission of risk attitudes, we detect that sibling correlation shows that parents' willingness to take risk is important for shaping risk attitudes but that there is more than just parents' risk taking that plays a role. Controlling for parents' risk taking reduces the sibling correlation at most by 33 %. However, still shared background factors besides parents' risk attitudes constitutes approximately 60% of the

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<sup>27</sup> Although Schnitzlein (2014) estimates a baseline for sibling correlation in risk attitudes in a subsection of his study. He does not analyze the importance of family background and community influences, such as mother's and father's risk attitudes, education, income, occupation and residential zone.

correlation among sibling's risk taking. It is an empirical question to understand what these other factors are and be able to quantify their influence on sibling similarities. For instance, these other shared factors could be the socialization between siblings such as supporting each other in particular among same-sex siblings by sharing experiences or/and the parenting style, which might lead to siblings creating similar attitudes.

To explore the heterogeneity that might exist in sibling correlations, we have estimated sibling correlations across three different risk domains, younger and older generations and for brothers and sisters separately. Our analyses address both the literature on gender differences in risk attitudes and the emerging debate in economics about the integration of individual-difference psychology into economics (e.g., Almlund et al., 2011; Borghans et al., 2008) where the argument is that risk attitudes are domain specific (e.g., Weber et al., 2002; Dohmen et al., 2011, Beauchamp et al., 2017). We found that more of the similarities of siblings in risk attitudes are due to shared family backgrounds and community influences in the risk domains of traffic and general compared to financial matters. For the general and financial risk domains, there seems to be a difference between younger and older generations. The younger generation of siblings have a higher correlation compared to the older generation. This might be due to the fact that during the life-course the shared background changes, younger siblings have more similar experiences compared to older siblings. Brothers have a lower sibling correlation than sisters, in all the three risk domains.

What is it that families and communities give children that make them so similar in terms of risk attitudes? Our decomposition approach, shows that parental characteristic, in particular parents' risk attitudes play an important role in shaping risk attitudes. When controlling for both parents risk attitudes, their contribution to the sibling correlations are 32% for general, 29% for traffic and 12% for risk taking in financial matters. These magnitudes of the drop in the sibling correlations for risk attitudes is in line with previous estimations from developed countries of sibling correlation such as criminal behaviour (e.g., Hederos Eriksson et al., 2016), education (e.g., Bredtmann and Smith, 2016) and income (e.g., Björklund et al., 2010). By contrast, other parental and household characteristics

such as socioeconomic status, family structure, parental health and residential zone account for small shares of the sibling correlations in risk attitudes.

Why are sibling correlations different for different risk domains? Previous research on risk attitudes in Burkina Faso has shown that the transmission of attitudes from mother to child is different from father to child if it takes place in a female or male-dominated risk domain (Sepahvand and Shahbazian, 2017b). In the more male dominated risk domain of traffic, fathers account for a larger contribution to the sibling correlation than mothers. The pattern is reversed for sibling correlation in the more female dominated risk domain of financial matters. Mothers account for 16% to the sibling correlation compared to the contribution from fathers, which is 8%. Furthermore, we also see that mothers' contribution to sisters' correlation in the more female dominated risk domain of financial matters is stronger compared to the father's. In the male-dominated risk domain of traffic, we see the reverse pattern, including only father's risk attitudes drop the brother correlation by 16% compared to the mother's contribution, which accounts for 11%. However, the influence of fathers on sisters is still relatively high in traffic. This gives support to the gender-specific role model hypothesis in terms of risk attitudes.

Burkina Faso has one of the highest traffic-related fatalities relative to other countries in terms of population and usage of motor vehicles.<sup>28</sup> Our results show that the influence from the father's risk taking in traffic is larger than mothers for their children's risk attitudes. Therefore, designing traffic security campaigns, such as wearing a helmet, could shape individual's attitudes to wearing helmets and consequently reduce the likelihood of serious injury and mortality in traffic.

The results in this paper are not without limitations. Most importantly, when trying to understand the determinants of sibling similarities, we cannot claim that we have causal estimates. Our results are rather a part of an exploratory approach that give indications of those factors that can and cannot explain the main share of sibling similarities. In addition, since we analyse to which extent siblings are similar, per default we cannot claim that our results hold for single-child families. However, since Burkina Faso is one of the countries in the

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<sup>28</sup> WHO's Road Safety database, estimated number of road traffic deaths by country, income level and type of road user: [http://www.who.int/gho/road\\_safety/mortality/en/](http://www.who.int/gho/road_safety/mortality/en/)



world with the highest fertility rate, six children per mother (INSD, 2015b), single-child families are a silent factor. Future avenues for research can be to first validate these results for risk attitudes to other countries in order to detect country-specific effects, in particular when it comes to gender roles. Second, future studies could examine if different parenting style has an influence on sibling similarities. Third, genetics might play an important role in shaping risk attitudes, however, the magnitude of it is an empirical question that must and should be addressed by future research.

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