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Intergenerational transmission of risk attitudes: The role of gender, parents and grandparents in Burkina Faso

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Department of Economics

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*Intergenerational Transmission of Risk
Attitudes: The Role of Gender, Parents and
Grandparents in Burkina Faso*

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INTERGENERATIONAL TRANSMISSION OF RISK ATTITUDES:
THE ROLE OF GENDER, PARENTS AND GRANDPARENTS IN BURKINA FASO

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Intergenerational Transmission of Risk Attitudes: The Role of Gender, Parents and Grandparents in Burkina Faso¹

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Abstract

This study investigates the intergenerational transmission of risk attitudes for three risk domains in Burkina Faso. First, our results shows a strong transmission of attitudes from parents to children. Although, estimates from intergenerational transmission of risk attitudes in developing countries should not be compared directly with those from developed countries, our results goes in the same direction as previous literature from Germany. That is risk attitudes are transmitted from; parents to children, local environment to children and positive assortative mating of parents strengthens the parents' transmission of attitudes to her child. Second we analyze three generations of risk attitude transmission. Our results indicates that it exist a transmission of risk attitudes from grandparents to their grandchildren. The strength and significance of this socialization decreases when we control for parents risk attitudes. Third, since there are strong gender roles in Burkina Faso, we test if mothers and fathers transmission of risk attitudes on their daughter is the same as on their son. We find that mother's transmission of risk attitudes is stronger on their daughters than sons. For fathers the pattern is reverse. However, our findings show that it exist a heterogeneity in the transmission of risk attitudes in male and female dominated risk domains. This gives support for the gender-specific role model hypothesis in terms of risk attitudes.

Keywords: risk attitudes; inter and multigenerational transmission; socialization; Burkina Faso

JEL codes: D81, J6, Z1

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1. Introduction

During the past decade, risk taking has emerged as a central concept for understanding economic behavior under uncertainty (e.g. Guiso and Paiella 2005; Tanaka et al., 2010; Dohmen et al., 2011; Hardweg et al., 2013). Yet, for the societal contexts most characterized by salient uncertainty, developing countries, the notion of risk taking has been awarded little empirical investigation. In many developing regions, formal financial services and social security are scarce or under developed, political climate is highly volatile and demographic pressure ensue a constant pressure on labor markets and infrastructure. During such harsh conditions of uncertainty about the imminent future, investments are impeded. From this follows that risk taking behavior may be of particular importance to explain economic as well as social behavior on the individual level. Previous research has looked at what individual characteristics determines risk taking in developed (Dohmen et al., 2012) and developing sub-Saharan (Sepahvand and Shahbazian 2017) countries. The findings indicate that individual characteristics such as gender, parental education, own education and age are important determinants of risk attitudes. However, the literature remain sparse and several gaps exist, in particular regarding the intergenerational transmission of risk behavior. Therefore, the aim of this paper is to provide evidence on if there exist an intergenerational and multigenerational transmission of risk attitudes in a developing country. And investigate if risk attitudes are gendered depending on specific risk domains.

By using a dataset from Burkina Faso, we make several contributions to the economic literature. Following Dohmen et al., (2012), first we analyze if intergenerational transmission of risk attitudes from parents to children exist in a development setting for risk taking in general, traffic and financial matters. By so doing, we also investigate whether prevailing attitudes in the local environment are transmitted to the child (in addition to attitudes from parents) and test as a robustness check if parents through positive assortative mating instill their own attitudes in the child. Second, we investigate if it exist a multigenerational transmission of risk attitudes from grandparents to children. This allows us to analyze what role grandparents play in addition to the main

caregiver (i.e. the parents) for children. Third, since there are strong traditional gender roles in Burkina Faso, we test if mothers and fathers transmission of risk attitudes on their daughter is the same as on their son. This is important as Burkina Faso lack strong and stable institutions, the role of the family and the norms within it becomes more relevant for individual decision making. Fourth, as traffic is a male dominated domain while the daily financial transaction performed in a household is female dominated in Burkina Faso, we would analyze whether children are more or less influenced by their father or mother in the gendered risk domains of traffic and financial matters.

We use a multipurpose Household Budget Survey (HBS) covering 10 800 household in all the 13 regions of Burkina Faso, collected during the four quarters (rounds) of 2014. The self-reported risk attitudes has been collected in the third and fourth rounds of the year 2014 as separate modules for all household members over the age of 17.⁴ Our analytical sample has 2 120 children for whom we observe the attitudes of both parents, hence we also have 2 120 parental couples for studying assortative mating of parents as a robustness check.⁵ Moreover, we have 140 children whom we both have the attitudes of parents and one grandparent.⁶ Information about the region or neighborhood of all individuals are also recorded, so that we can match individuals to an average risk attitude in their local environment. Previous research has examined the validity of the same self-reported risk question that we use by comparing it to lottery type field experiment both 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). These findings show that self-reported risk question have a high validity. There is an ongoing scholar discussion about the reliability of self-reported risk attitudes. Some argues that risk attitudes are more prone to have an measurement error which must be dealt with (e.g. Beauchamp et al. 2017) while other argue that any changes in risk attitudes between two time periods could be due to an exogenous shock (e.g. Dohmen et al., 2016). Sepahvand and Shahbazian (2017) have analyzed the test-

⁴ The third round was conducted during the months July to September and the fourth round during October to December 2014. Furthermore, a noteworthy feature of our data is that it allows the study of children at a wide variety of ages, rather than just adolescents.

⁵ We have excluded all polygamous households from our analytical sample.

⁶ We have: 228 child and grandmother couples, and 89 child and grandfather couples.

retest reliability of this study's risk questions, and find they are satisfactory and to a large extent comparable to other test-retest reliability analysis by previous research using the same self-reported risk questions. Since the data used in this paper contains self-reported risk attitudes at two time-period, the average of the two time-periods are used to increase the reliability of the measures, which is an additional strength of this study.

Our findings shows a positive and strong transmission of risk attitudes between generations. We see that it exist a transmission of attitudes from both mother and father on their child's risk taking within different contexts. The intergenerational transmission is robust even when including the influence of the local environment. The findings of this study also indicate a multigenerational transmission of risk attitude in Burkina Faso. However, the magnitude decreases when controlling for parents risk attitudes, implying a mediating role for the parents between the grandparents and children. Moreover, since there are strong gender roles in Burkina Faso, we find that the transmission of attitudes from mothers have a stronger associative effect on their daughters risk attitudes compared to their sons. For fathers we see the reverse effect. Furthermore, the results show that it exist a heterogeneity in the intergenerational transmission of risk attitudes across risk domains. For instance, in the male dominated risk domain (traffic) the transmission of risk attitudes from fathers to daughters is relatively stronger than in the female dominated risk domain (financial matters). While the transmission of risk attitudes from mothers to sons is relatively stronger in the female dominated risk domain (financial matters) than in the male dominated risk domain (traffic). This gender heterogeneity in risk domains implies that children are socialized more by the parents in the domain they are more exposed to.

2. Transmission of (*risk*) attitudes and why it should take place

Economists have for a long time assumed that individuals are endowed with stable attitudes over time that are identical across individuals (Stigler and Becker 1977). Until recently, there has been limited discussion of how and/or from whom these

attitudes are endowed. The literature focusing on intergenerational transmission assumes the family to be an important institution for the endowment of attitudes, in particular the transmission from parents to children (Bisin and Verdier 2000). In addition to the role of parent for children's attitudes there is a growing literature within sociology and economics investigating the role of grandparents through a multiple generational approach. The argument is that grandparents who are present in the life of their grandchildren, could also be a source of transmission in shaping individuals attitudes. Moreover, intergenerational transmission of attitudes can be gendered and be affected both by the person who is transmitting the attitude (father or mother) but also the person who is transmitted (son or daughter). But why should transmission of risk attitudes between generations take place and be gendered?

The issue of what causes the transmission of risk attitudes between generations is important to address. One channel for transmission of risk attitudes between parents and children is obviously nature. There is a stand in the literature which argues that the influence of parents on child personality is solely determined by genetic (Harris 1995). However, there are other stands which argues that parents or other adults, in their role as caregivers, are able to socialize children by exerting effort and transmitting their attitudes to them. This does not rule out that genetics plays a role as well, but rather that socialization and genetics are not mutually exclusive processes. There are many socialization theories, with somewhat different mechanism, explaining how socialization across generations would take place. The aim of this paper is not to distinguish these underlying mechanism from each other, rather the purpose is to offer explanations for why there should be transmission across generation and that the transmission is likely to be gendered. Therefore, this paper takes its starting point from the model proposed by Bisin and Verdier (2000) by first testing two channels for attitude transmission; i. the influence of parents or/and grandparents, and ii. the influence of risk attitudes form the surrounding population. Thereafter, through Social learning theory (Bandura 1977) and role modeling, explaining how transmission of risk attitudes across generations can be gendered.

2.1 Direct and oblique socialization

The model proposed by Bisin and Verdier (2000), starts by assuming that parents are endowed with some paternalistic altruism with respect to their children. Parents care for the (future) wellbeing of their children, but can only envision their children's future situation through their own preferences. That is why parents have a motivation to transmit their own preferences to their children. Bisin and Verdier (2000) model the transmission of attitudes/preferences as occurring through socialization. They assume that children are born with not-well-defined attitudes, and acquire their attitudes through observation, imitation and adoption (i.e. socialization) of attitudes with which they are matched either through direct or oblique/indirect transmission of attitudes between generations.⁷

The direct socialization goes through parents, but can also be argued to hold for grandparents. The incentive for parents to socialize their children is assumed to be because of altruism. However, parents' altruism is guided by the belief that their own attitudes are the best for the child to have.⁸ Thereby, predicting a positive correlation between parents and children's attitudes. One extension of this direct socialization is that parents engage in positive assortative mating. Thereby, in order to be sure that they transmit their attitude to their children, they actively seek out a partner that are similar to them. Becoming a single parent (either due to divorce, separation or deciding to raise the child by one self) might be an indication of not having similar attitudes. Thereby predicting a weaker association between transmission from single parents to children. Direct socialization can also go from grandparents to children, in particular if there is a daily interaction between them, such as living in the same household. Thereby, predicting a positive association between the transmission of grandparents to children's attitudes.

⁷ In the Appendix we have made an attempt to model the socialization model of Bisin and Verdier (2000) more formally. However, the focus of this paper is not the formal model in the Appendix.

⁸ This particular form of "empathy" from the parents is crucial in the analysis, as it assume that parents always want to socialize their children to their own attitudes, because children with attitudes different from their parents would choose actions that do not maximize their parents attitudes

The oblique socialization occurs when the socialization efforts of the parents fails (e.g. absence or death), and the child is influenced by a randomly determined individual from the surrounding population. The oblique socialization can be operationalized by taking the average regional risk attitude (Dohmen et al., 2012). Thereby, oblique socialization can be a confounder between the transmission from parents to children's attitudes.

2.2 Gendered transmission of attitude

Models of transmission of attitudes within the family have typically abstracted away from aspects such as gender, as the models are adopted for developed countries institutional settings. In this paper, due to that we are looking at attitude transmission in a developing country with scarce or under-developed institutions, the family becomes a highly important and vital institution in shaping individuals attitudes. Therefore, we include additional explanations that could capture other mechanisms of socialization, such as the role of gender. Social learning theory is one such explanation which provides a framework for understanding how individuals develop their attitudes across generations and how it can be gendered. That is individuals acquire their beliefs and attitudes through observation of others' behaviors and reinforcement (Bandura 1977). Socialization is an important factor in Social learning theory. For instance, children observe and pay attention to their surrounding and might imitate their behavior. This is true for both their local environment (neighborhood) and their parents and grandparents (since grandparents are usually the primary source of caretakers if both parents are working in developing countries where social services are scare). Although, this imitation does not need to be gender appropriate, there are several elements that make it more likely for girls and boys to reproduce the behavior the society (or/and their nearest environment) considers appropriate for their gender. First, children are more likely to imitate the parents/role models if they are similar to each other, i.e. have the same sex. Second, parents (and other adults in the children's surrounding) will respond to the behavior of their children with either reinforcement or punishment. For instance, parents might be more encouraging towards a boy to go outside the house, thus be more exposed to traffic. Even if

parents might not punish a girl if she would venture outside of the household (thus be more exposed to traffic), they are more likely not to encourage them to do so. In all, if children view their same-sex parent performing a distinct set of activities they will be more likely to model their own behavior and attitudes after those exhibited by the parents. Thereby, predicting that the transmission from mothers to daughters be stronger compared to from fathers to daughter, and the transmission from father to sons be stronger compared from mothers to sons.

However, given that gender is not only an inborn quality in individuals but rather a social construction which appears in daily life activities (West and Zimmerman 1987), it is not surprising that some specific activities are mostly performed by either men or women in Burkina Faso. Example of these gender specific activities are exposure to traffic and financial transactions. Men tend to larger extend go on long trips (for migration and/or seasonal work) and work longer periods outside of the household. Women conduct more of the household work and work which is in close proximity of the household. They are also more likely to stay home when it is dark outside (to prepare the meal, take care of the children etc.) and if they go out they tend to not do it alone. Therefore, both girls and boys are more likely to be exposed to traffic when accompanied with their fathers than mothers. When it comes to financial transactions the opposite applies. For instance women are usually in charge of the daily financial transactions, such as buying groceries at the market (most likely accompanied by the children). Men are more in charge of larger but less frequent financial transactions, such as buying a house and motorcycle. Thereby, predicting that fathers exert a relatively stronger influence in traffic on their daughters than they do in financial matters, and mothers exert a relatively stronger influence in financial matters on their sons than they do in traffic.

2.3 Previous literature on transmission of (risk) attitudes

Even though previous research on the transmission of risk attitudes from parents to children is limited (one exception being the study by Dohmen et al., 2012), the transmission of attitudes in other areas has received more attention in the economic literature (for an overview see Guiso et al., (2006)). In order to

demonstrate the importance of socialization within the family, this section provides first a brief overview of previous empirical studies over transmission of attitudes on diverse economical outcomes, and then link to literature on how intergenerational transmission can be gendered.

Fernandez et al. (2004) use World War II as a shock to women's labour force participation, in order to look at their daughters labour force participation. They found that married women whose mother's worked during WWII, were more likely themselves to work, compared to those married women whose mother's did not worked during WWII. Furthermore, they also found that sons of working mothers show preferences for working wives compared to sons of non-working mothers. Bisin and Verdier (2000) analyses whether or not there is an intergenerational transmission of ethnic and religious traits of marital segregation decisions in US. They find that homogamy (i.e. intragroup marriage) is more prevalent in minority groups. They argue that the mechanism is through family socialization of ethnic and religious traits. Tabellini (2008) focuses on the determinants behind which individuals who choose to cooperate with each other, i.e. attitudes toward trust and social capital. His study relies on cultural explanation which is transmitted from parents to their children, in order to explain attitudes such as trust. Jennings et al., (2009) utilizes longitudinal data in US in order to analyze political socialization within the family. Their findings show that children are more likely to adopt their parents' political orientation if the family is highly politicized.

To the best of our knowledge, there is no previous study on the transmission of three generational risk attitudes. However, there are some studies focusing on fertility behaviors across three generation in Sweden (e.g. Kolk 2014), which finds that grandparents have a small independent association on their grandchildren's' fertility behaviors, but this association is limited to grandparents with very high fertility. In three generational wealth mobility in Sweden (e.g. Adermon et al., 2016), the correlation between grandparents' and their grandchildren's wealth is positive but most of it is mediated through the parents' wealth. Therefore, even if grandparents' seems to affect their grandchildren, conditional on parents, their effect is small.

The only previous study analyzing whether intergenerational transmission of risk attitudes are gendered or not is Dohmen et al., (2012). Their finding do not indicate any heterogeneity in Germany. However, in a country such as Burkina Faso where the differences between men and women are larger than Germany, and traditional gender roles more established, it is not unconceivable to assume intergenerational transmission to be gendered. Furthermore, there is an extensive literature about the intergenerational transmission of gender roles based on time use data, which focuses on parental influences on children's gendered division of housework (Blair, 1992; Cunningham, 2011a; Cunningham, 2001b; Evertsson, 2006; Alvarez and Miles, 2011). The findings all indicate that children tend to take on similar gender behavior and attitudes that their same-sex parent do when it comes to household work. The underlying argument is that gender role apprehension accords rather early in life and it become fixed and unalterable (Cunningham 2001b; Wight 2008).

3. Data

Our data is from the multipurpose Household Budget Survey (HBS) conducted in Burkina Faso as a panel during four quarters (rounds) of 2014. The HBS is a national representative survey including 10 800 households. Three questions on willingness to take risk in general, financial matters and in traffic have been asked separately to over 33 000 individuals 18 years and above in round 3 and 4. The overall household response rate is approximately 95 percent for the 3rd and 4th round. The number of responses in the 3rd round is 34 494, in 4th round is 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, we use the average of the two time periods. However all analysis have been performed with responses for both 3rd and 4th round and the results are similar.⁹

The analytical sample consist of those children who have valid self-reported risk responses for both the 3rd and 4th round, as well as both of their parents. That is the analytical sample consist of 2120 children (as well as mothers

⁹ Results available upon request.

and fathers) from 1 339 households. By doing so we are able to test for the presence of direct transmission of attitudes and control for and address the degree of assortative mating of parents. We would also be able to analyze how similar risk attitudes are depending of gender, that is analyze whether boys(girls) are more likely to be more similar to their fathers or their mothers risk attitude. Moreover, since we measure risk attitudes in different domains, we are able to address if the degree of transmission between generations are similar for risk taking in general, traffic or financial matters. Furthermore, we have unique household, denominations area and region identifiers which enable us to analyze the impact of the surrounding population (i.e. local environment) on children's risk attitudes and hence test for the presence of oblique transmission of attitudes.

An additional strength of the HBS is that we have access to other family members, such as grandparents. Thereby, we are able to look at if grandparents risk attitudes have an additional association on their grandchildren, net of parents. This would also allow us to delve deeper into the theory of multi-generational transmission of attitudes in terms of if it exist a transmission from grandparents' on the child's risk attitudes.

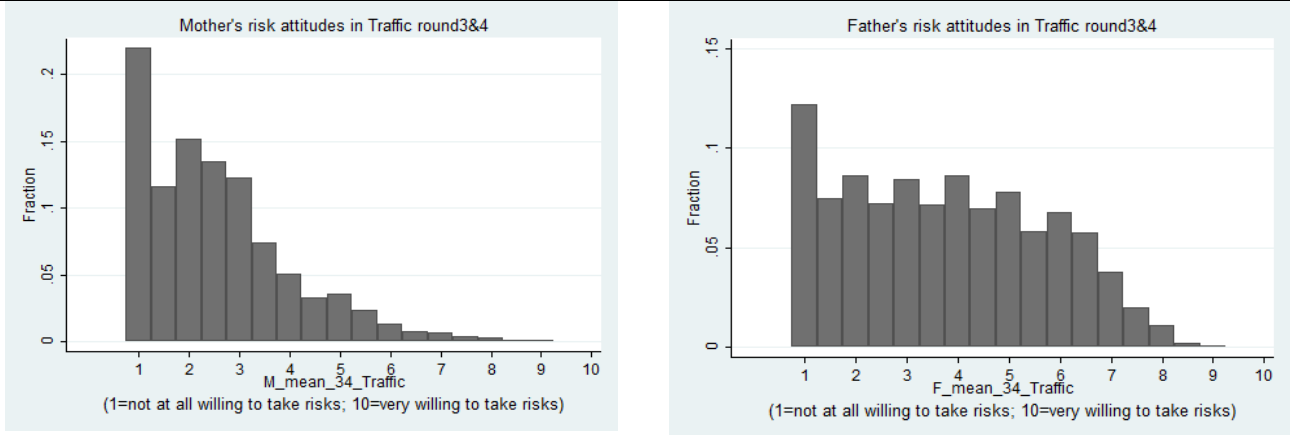
3.1 Descriptive data and variables

If there is a relationship between parental risk attitudes and their children's, there has to be a variation in parents' willingness to take risk, as the risk attitudes of mothers and fathers are the main explanatory variables in this study. Figure 1 shows the fraction of mothers and fathers response (on a scale from 1 to 10) to the three different self-reported questions, illustrated in Panel A to C. Figure 1 shows clearly that mothers are less willing to take risks than fathers. The fact that women tend to report to be less risk willing in their response have also been found by Sepahvand and Shahbazian (2017), in their analysis they use a larger sample than in this study.¹⁰

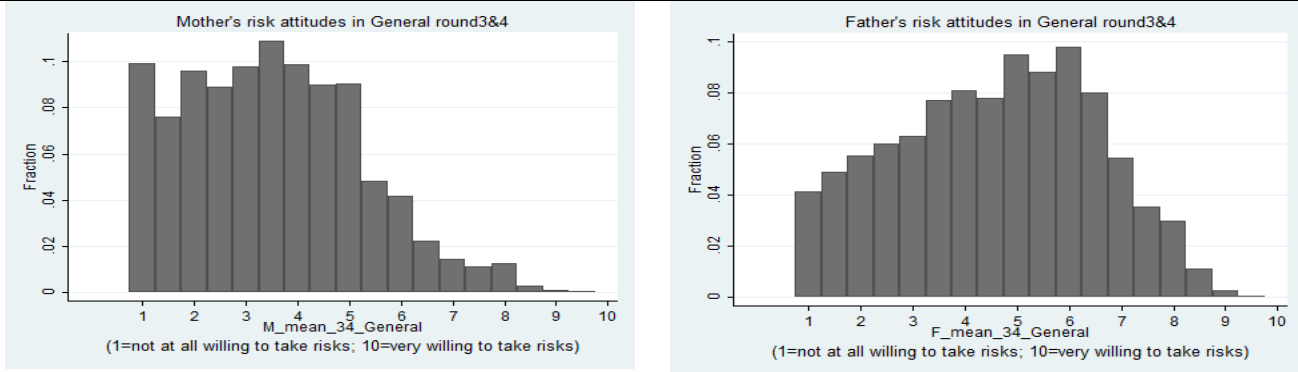
¹⁰ In additional OLS regressions, Sepahvand and Shahbazian (2017) find that other individual characteristics such as individual's age, experiencing food shortage, having access to a bank account are also significantly related to risk attitudes across different domains.

Figure 1: Parents' willingness to take Risks, average of 3&4

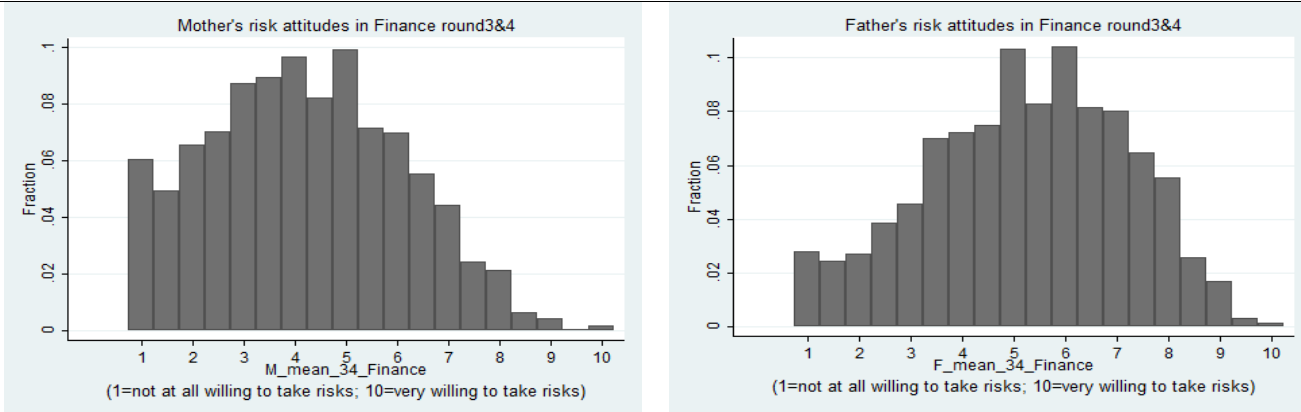
Panel A: Risk attitudes in Traffic



Panel B: Risk attitudes in General



Panel C: Risk attitudes in Financial matters



Note: On the x-axes we have the distribution of responses for mothers and fathers to the risk questions in traffic, general and financial matters on a scale from 1 to 10, where 1=not at all willing to take risk and 10=very willing to take risk as the average of the 3rd and 4th round. And the y-axis is in fractions.

4. Result

4.1 Results for: parents → children

Previous research has indicated that willingness to take risk are correlated across domains, where taking risk in general could be a proxy for other risk domains in developed (Dohmen et al., 2011) and developing sub-Saharan (Sepahvand and Shahbazian 2017) countries. Moreover with the recent integration of individual-difference psychology into economics (e.g. Almlund et al., 2011 and Borgans et al., 2008) risk attitudes could arguably be domain specific (Weber et al., 2002) and gendered. Therefore, we would conduct our analysis with the general self-reported risk question, and deepen our analysis by checking our results for risk attitudes in traffic and financial matters.

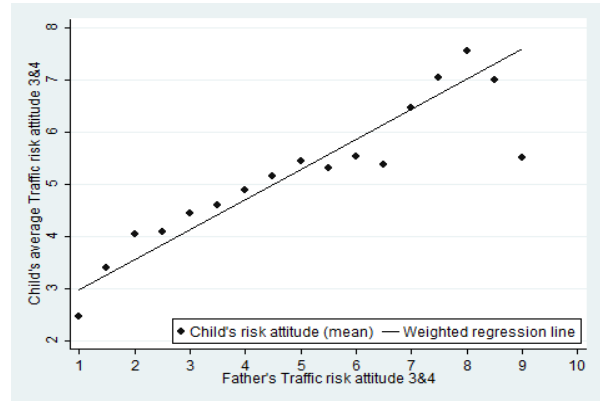
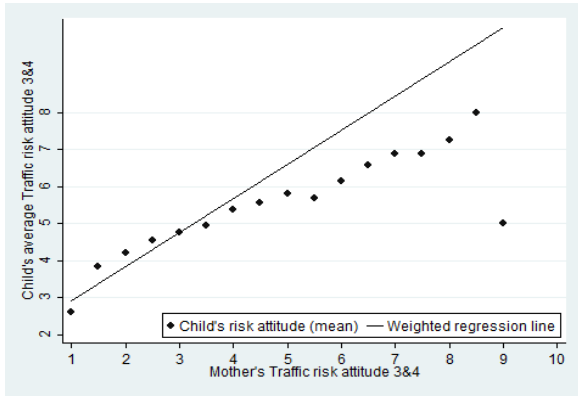
We begin our analysis by looking at Figure 2, which gives us a first glimpse of the pattern in willingness to take risk in general between parents and children. Figure 2 shows children's average willingness to take risk in three domains (illustrated in Panel A to C), for each given scale (from 1 to 10) of their parents self-reported risk attitudes. The regression lines in Figure 2 are based on a weighted regression of children's general risk attitudes on their mother's and father's general risk attitudes.¹¹ Figure 2 indicates a positive relationship between children's willingness to take risk and their mother's or father's willingness to take risk in general. The same positive relationship is also seen for risk taking in traffic and financial matters¹².

¹¹ The weights include the amount of children whose mothers or fathers states a particular value on the self-reported risk question.

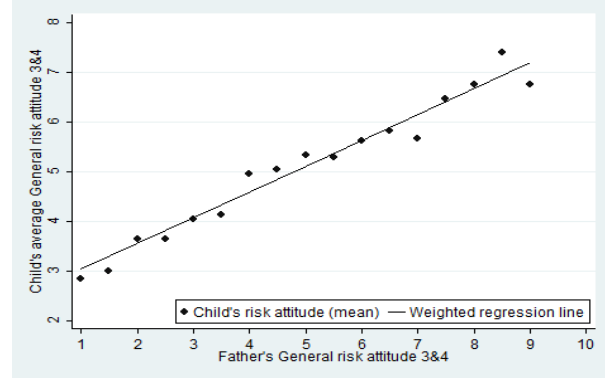
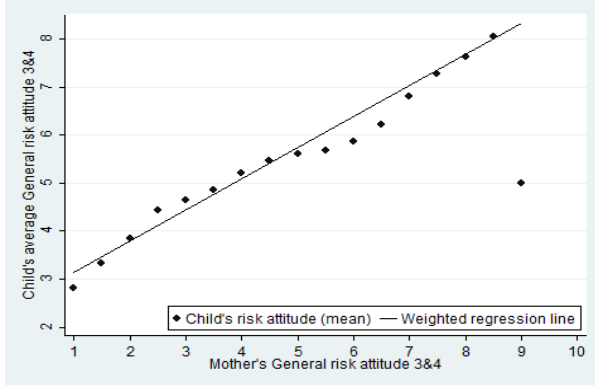
¹² We note that there are outliers for mothers and fathers at value 9 on the traffic risk question, mothers at value 9 on the general risk question and fathers at value 9.5 on the risk question for financial matters. These outliers have little impact on the slope of the weighted regression lines of figure 2, as there are very few mothers and fathers at value 9 for traffic, mothers at value 9 for general and fathers at value 9.5 in financial matters as seen from Figure 1 Panel A (traffic), Panel B left (general) and Panel C right (financial matters).

Figure 2: Relationship between the Risk attitudes of Parents and Children, average 3&4

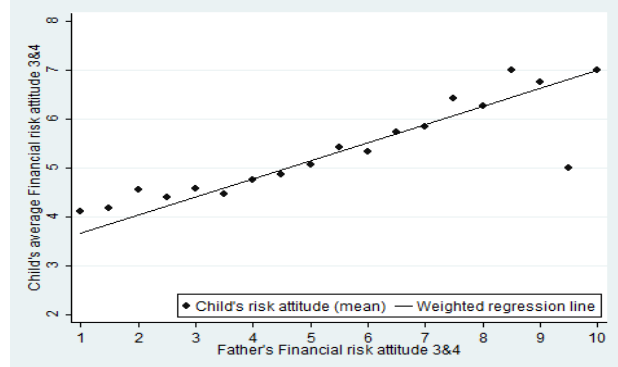
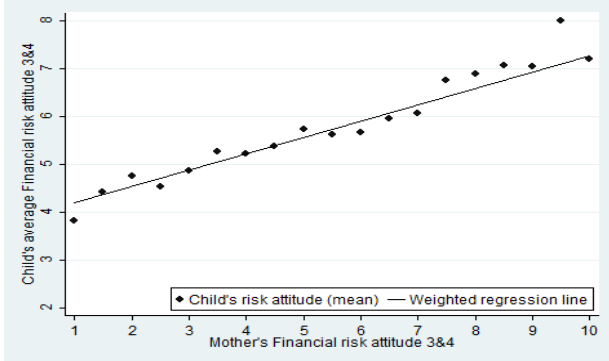
Panel A: Risk attitudes in Traffic



Panel B: Risk attitudes in General



Panel C: Risk attitudes in Financial matters



Note: On the x-axes we have the distribution of responses for mothers and fathers to the risk questions in general, traffic and financial matters on a scale from 1 to 10, where 1=not at all willing to take risk and 10=very willing to take risk as the average of the 3rd and 4th round. And the y-axis is the children's average self-reported willingness to take risks for a given willingness to take risks of mothers and fathers in general, traffic and financial matters as the average of the 3rd and 4th round.

The average age of children in the sample is 24.4 years old (SD 6.27). The oldest child is 56 years old. Half of the children in the sample are older than 22 years old. The average age of mothers is 49.8 (SD 8.97) and fathers 60.6 years old (SD 10.75).

In order to be able to determine the joint role of the different individual characteristics, in Table 1 we have conducted regression estimations with children's willingness to take risk in general as the dependent variable regressed on the main explanatory variables being children's mother's and father's willingness to take risk in general, while controlling for several confounding factors such as sex, age, years of education, religion, consumption, welfare, health and marital status of the child and both parents, and also region and residence (urban/rural).¹³ For a detailed overview of the control variables used in this study see Sepahvand and Shahbazian (2017). We estimate our regressions in Table 1 using ordinary least squares (OLS) models and report robust standard errors that allow for clustering at the household level.¹⁴ The same procedure have been performed for risk taking in traffic and in financial matters. More formally our baseline regression estimations in Table 1 are based on the following linear equation:

$$r_{childi} = \beta_0 + \beta_1 r_{motheri} + \beta_2 r_{fatheri} + \beta_3 X_i^T + e_i \quad (10)$$

where r_{childi} is the risk attitudes of child i and $r_{motheri}$ and $r_{fatheri}$ are the risk attitudes of mother i and father i . The vector X_i^T is a set of control variables.

¹³ We use standardized version of the risk measures in all the tables and as similar controls as possible, in order have a transparent comparison of coefficients with previous and future studies. The standardization is conducted separately of the child, the mother, the father, the grandparents and the regional risk attitudes.

¹⁴ We have also conducted the same regressions for the whole sample (31 677 obs) with interval, binary and Ordered Probit regression as a robustness check. In all cases we find similar qualitative results. Before estimating all regressions using Probit and Ordered Probit models, we transformed our risk attitudes measurements from its 1 to 10 ordinal scale to a binary variable with 1-5 being 0 and 6-10 being 1, following similar procedure as previous literature (such as Dohmen et al., 2011).

Table 1: The relationship between children's and parents' risk attitudes in General, Traffic and Finance

Dependent variable:	<i>Child's general risk</i>			<i>Child's traffic risk</i>			<i>Child's finance risk</i>			Dohmen et al. 2012		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	<i>general</i>	<i>traffic</i>	<i>finance</i>
Mother's willingness to take risk	0.40*** (0.03)	0.37*** (0.03)	0.36*** (0.03)	0.26*** (0.03)	0.21*** (0.03)	0.22*** (0.03)	0.30*** (0.03)	0.31*** (0.03)	0.33*** (0.03)	0.149*** (0.02)	0.147*** (0.02)	0.136*** (0.02)
Father's willingness to take risk	0.26*** (0.03)	0.34*** (0.03)	0.33*** (0.03)	0.38*** (0.04)	0.46*** (0.04)	0.45*** (0.04)	0.17*** (0.03)	0.26*** (0.03)	0.22*** (0.03)	0.153** (0.02)	0.143** (0.02)	0.136** (0.02)
Additional controls:												
Height of child and both parents (cm)	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Female (=1)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Age of child and both parents (years)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Education of child and both parents (years)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Living in a Urban area (ref: rural area)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Region in Burkina Faso (13 regions)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Religion of child and both parents	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Indicators of Household Consumption	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Indicators of Household welfare	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Health status of child and both parents	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Marital status	No	No	Yes	No	No	Yes	No	No	Yes	No	No	No
Constant	0.11*** (0.02)	-0.87*** (0.12)	-0.02 (0.61)	0.35*** (0.02)	-0.01 (0.13)	0.66** (0.66)	-0.01 (0.02)	-1.27 (0.15)	-0.44 (0.69)	-0.729 (0.759)	NA NA	NA NA
Observations	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,985	2,637	2,892
R-squared	0.431	0.525	0.555	0.353	0.448	0.476	0.191	0.317	0.391	0.208	0.23	0.21
OLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. Shows coefficient estimates (OLS) for risk attitudes in general, traffic and financial matters. Model (1) to (3) use the child's average risk attitude in general, traffic and financial matters 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, traffic and finance. Welfare and consumption controls are in logs. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively. There are also additional columns indicating the results from previous research to allow for comparability.

Starting with risk attitudes in general, Table 1, M1 indicates that on average children show a higher willingness to take risk in general as their parents' willingness to take risk in general increases. The coefficient estimates for mother's and father's willingness to take risk are significant and has the same sign as previous research (Dohmen et al., 2012), indicating that children's risk attitudes are correlated to parents attitudes. However the magnitude of this coefficient is different for mother and father. This provides an initial indication that there might exist a heterogeneity in terms of gender in the intergenerational correlation between parents and children, an issue that we would analyze more in detail in section 4.5 below.

M2 and M3 in Table 1, includes additional control variables, such as sex and age as controls which previous research has shown to have a significant association with risk attitudes in Burkina Faso. We see that the positive relationship between children's and mother's and father's willingness to take risk continue to stay intact and significant.

To see if the intergenerational correlation in risk attitudes are robust, an identical re-estimation of risk attitudes in general is conducted, with the sole difference that the main explanatory variables are willingness to take risk in traffic and financial matters. Table 1 shows that the coefficient estimates for mother's and father's risk attitudes are significant for the domains of risk taking in traffic and financial matters. Thus the estimates show that the results remain robust. However, there is a heterogeneity in risk attitudes across domains. For instance the strong association detected from mothers risk attitudes on children's willingness to take risk in general, is reversed for risk taking in traffic. Instead, in Table 1 we see that fathers seems to have a stronger effect than mothers on children's willingness to take risk in traffic.

4.1.1 Heterogeneity in risk attitudes across domains

The results so far have indicated a heterogeneity in risk attitudes across domains. It could be that risk attitudes in one domain (such as financial) predicts risk attitudes in other domains (such as traffic). If that is the case, it would be quite damaging to the interpretation of our results. Consequently, it is necessary to

conduct a detailed analysis over whether parents' risk attitudes in all three domains can predict the children's risk attitude in a specific risk domain. In Table 2, children's willingness to take risk in one particular domain has been regressed on parents' willingness to take risk in all domains simultaneously. More formally in principle it is the same baseline regression as Eq. (10) but with the following modification:

$$r_{childij} = \beta_0 + \beta_1 r_{motherij} + \beta_2 r_{fatherij} + \beta_3 r_{motherik} + \beta_4 r_{fatherik} + \beta_5 r_{motheril} + \beta_6 r_{fatheril} + \beta_7 X_i^T + e_{ij} \quad (11)$$

where $r_{childij}$ is the risk attitudes of child i in context j and $r_{motherij}$ and $r_{fatherij}$ are the risk attitudes of mother i and father i for context j, k and l where $j, k, l \in \{General, Traffic, Finance\}$ and $j \neq k \neq l$. The vector X_i^T is the same set of control variables as in Eq. (10).

Table 2 indicates a positive and significant diagonal pattern of estimated coefficients. This implies that when we control for risk attitudes in all domains, children's risk attitudes in a given domain have a higher association and is more significant with those of their parents risk attitudes in the same domain. For instance parents' attitudes in general are the best indicator for children's attitudes in the same domain. Moreover, the pattern seen in Table 2 is a further evidence of similarity across generations and risk domains.

4.2 Result for: assortative mating (*i.e. between parents*)

According to Verdier and Bisin (2000) one mechanism behind the socialization from parents to their children is positive assortative mating. However, theoretically assortative mating could be either positive or negative (Lam, 1988). For instance, assuming that the family is a provider of production of joint utility, in certain production decisions the couple could optimize its utility by being diversified in its risk attitudes such as one being risk-lover and the other more averse (Chiappori and Reny 2006). Hence, there could be an urge for negative assortative mating by the couples. Consequently, whether there is a negative or positive assortative mating between couple becomes an empirical question.

Table 2: Robustness of the relationship between children's and parents' risk attitudes across domains

Dependent variable: <i>Child's risk in</i>	General	Traffic	Financial
Mother's willingness to take risk in general	0.44*** (0.04)	0.03 (0.05)	0.11** (0.05)
Father's willingness to take risk in general	0.30*** (0.04)	0.02 (0.05)	-0.06 (0.05)
Mother's willingness to take risk in traffic	-0.07* (0.03)	0.18*** (0.04)	-0.00 (0.04)
Father's willingness to take risk in traffic	0.09** (0.04)	0.46*** (0.05)	0.03 (0.04)
Mother's willingness to take risk in finance	-0.05* (0.03)	0.04 (0.04)	0.26*** (0.04)
Father's willingness to take risk in finance	-0.03 (0.03)	-0.06* (0.03)	0.23*** (0.04)
Additional controls:			
Female (=1)	Yes	Yes	Yes
Age of child and both parents (years)	Yes	Yes	Yes
Education of child and both parents (years)	Yes	Yes	Yes
Living in a Urban area (ref: rural area)	Yes	Yes	Yes
Region in Burkina Faso (13 regions)	Yes	Yes	Yes
Religion of child and both parents	Yes	Yes	Yes
Indicators of Household Consumption	Yes	Yes	Yes
Indicators of Household welfare	Yes	Yes	Yes
Health status of child and both parents	Yes	Yes	Yes
Marital status	Yes	Yes	Yes
Constant	-0.07 (0.61)	0.53 (0.67)	-0.47 (0.69)
Observations	2,120	2,120	2,120
R-squared	0.559	0.479	0.395
OLS	Yes	Yes	Yes

Note. Shows coefficient estimates (OLS) for general, traffic and financial risk attitudes. Use the child's average risk attitude in general, traffic and financial matters 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, traffic and financial matters. Welfare and consumption controls are in logs. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively.

Table 3 shows the results for the transmission of risk attitudes between spouses.¹⁵ The dependent variable is the female partner (mothers) risk attitudes.

¹⁵ More formally: $r_{motheri} = \beta_0 + \beta_1 r_{fatheri} + \beta_2 X_i^T + e_i$ where $r_{motheri}$ is the risk attitudes of mother i and $r_{fatheri}$ is the risk attitudes of father i .

The results shows that there is a strong positive association between the male partner (fathers) risk attitudes and their spouses' risk attitudes (mothers). The coefficient estimates are robust across model specifications, as shown from M1-3 in Table 3. This is an indication of positive assortative mating along the dimension of risk taking, i.e. individuals are in couple with other individuals that have similar attitudes. Important to note: as shown in Table 3, the same strong and positive effect in traffic and financial matters is found, i.e. the effect is not domain driven.

4.2.1 Homogenous and Heterogeneous risk attitudes

To further deepen our analysis about positive assortative mating and the transmission of attitudes, we return to our initial estimations from Table 1, but with the difference that the focus is on mothers with homogenous attitudes compared to single mothers that are more frequent in Burkina Faso than single fathers. Because if positive assortative mating is in line with the theory of attitude transmission, then those mothers that have similar or homogenous attitudes as their partners should have a stronger influence on their child's attitudes (i.e. direct transmission of attitudes) compared to single mothers. According to the theory of attitude transmission, it is assumed that single-divorced parents are less effective in socializing the child than homogenous parents' (Bisin and Verdier 2000). Hence another reason for why individuals tend to seek a partner with similar attitudes, i.e. positive assortative mating. However, what if there is no optimal match of partner. Then the assumption above could be false, as a single parent could have as a possible scenario stronger influence on the child as the sole role model, compared to rather matching with a randomly chosen individual. Therefore the individual might continue as a single parent. We believe that this scenario might hold for developed countries, but not for a developing sub-Saharan country like Burkina Faso with strong gender roles. For instance in Burkina Faso where women are less empowered compared to more developed countries, it would be more difficult economically for the women to be a single parent, and socially due to the stigmatization.

Table 3: The relationship between female and male parents' risk attitudes in General, Traffic and Finance

Dependent variable:	<i>Mother's general risk</i>			<i>Mother's traffic risk</i>			<i>Mother's finance risk</i>			Dohmen et al. 2012		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	<i>general</i>	<i>traffic</i>	<i>finance</i>
Father's willingness to take risk in general	0.78*** (0.02)	0.80*** (0.03)	0.79*** (0.03)	-	-	-	-	-	-	0.262*** (0.02)	-	-
Father's willingness to take risk in traffic	-	-	-	0.81*** (0.03)	0.84*** (0.03)	0.82*** (0.03)	-	-	-	-	-	-
Father's willingness to take risk in finance	-	-	-	-	-	-	0.58*** (0.03)	0.59*** (0.03)	0.58*** (0.03)	-	-	-
Additional controls:												
Height of parents (cm)	No	No	No	No	No	No	No	No	No	Yes	-	-
Age of both parents (years)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	-	-
Education of both parents (years)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Living in a Urban area (ref: rural area)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Region in Burkina Faso (13 regions)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Religion of both parents	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Indicators of Household Consumption	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Indicators of Household welfare	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Health status of both parents	No	No	Yes	No	No	Yes	No	No	Yes	No	-	-
Constant	0.15*** (0.08)	-0.22* (0.11)	1.53* (0.79)	0.20*** (0.03)	-0.30** (0.12)	-0.04 (0.97)	0.11*** (0.03)	0.08*** (0.15)	2.22*** (0.83)	NA	-	-
Observations	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	3,112	-	-
R-squared	0.610	0.616	0.645	0.585	0.596	0.629	0.360	0.364	0.430	0.297	-	-
OLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-

Note. Shows coefficient estimates (OLS) for risk attitudes in general, traffic and financial matters. Model (1) to (3) use the mother's average risk attitude in general, traffic or financial matters 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, traffic or financial matters. Welfare and consumption controls are in logs. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively. There is also an additional column indicating the results from previous research for risk attitudes in general to allow for comparability.

Table 4: The relationship between children's and similarity of mothers' attitudes in General, Traffic and Finance

Dependent variable:	<i>Child's general risk</i>		<i>Child's traffic risk</i>		<i>Child's finance risk</i>		<i>Child's general risk</i>		Dohmen et al. 2012		<i>Child's finance risk</i>	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
Mother's willingness to take risk in general	0.60*** (0.03)	0.68*** (0.02)	-	-	-	-	0.336*** (0.102)	0.285*** (0.025)	-	-	-	-
Mother's willingness to take risk in traffic	-	-	0.50*** (0.03)	0.65*** (0.03)	-	-	-	-	-	-	-	-
Mother's willingness to take risk in finance	-	-	-	-	0.40*** (0.03)	0.56*** (0.03)	-	-	-	-	-	-
Additional controls:												
Height of child and mothers (cm)	No	No	No	No	No	No	Yes	Yes	-	-	-	-
Female (=1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	-
Age of child and mothers (years)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	-
Constant	-0.09 (0.14)	-0.61*** (0.12)	0.40*** (0.15)	0.15 (0.13)	-0.04 (0.15)	-0.85*** (0.15)	NA NA	NA NA	-	-	-	-
Observations	1,126	1,828	1,126	1,776	1,126	1,517	111	2,286	-	-	-	-
R-squared	0.403	0.521	0.316	0.399	0.188	0.358	0.177	0.116	-	-	-	-
OLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	-

Note. Shows coefficient estimates (OLS) for general, traffic and financial risk attitudes. Model (1) to (2) use the child's average risk attitude in general, traffic or financial matters 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, traffic or financial matters. Model (1) shows estimates for single mothers and Model (2) for homogeneous mothers (absolute difference between parental risk attitudes of less than 1 S.D). Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively. There are also two additional columns to indicate the results from previous research for risk attitudes in general to allow for comparability.

Table 5: The relationship between children's, grandmother's and parents' risk attitudes in General, Traffic and Finance

Dependent variable:	<i>Child's general risk</i>				<i>Child's traffic risk</i>				<i>Child's finance risk</i>			
	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
Mother's willingness to take risk	-	-	-	-0.01 (0.19)	-	-	-	0.26 (0.17)	-	-	-	-0.16 (0.20)
Father's willingness to take risk	-	-	-	0.71*** (0.14)	-	-	-	0.48*** (0.18)	-	-	-	0.71*** (0.14)
Grandmother's willingness to take risk	0.54*** (0.09)	0.54*** (0.09)	0.51*** (0.08)	0.25** (0.12)	0.61*** (0.08)	0.58*** (0.08)	0.65*** (0.09)	-0.01 (0.11)	0.54*** (0.11)	0.60*** (0.11)	0.52*** (0.12)	0.34 (0.21)
Additional controls:												
Female (=1)	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Age of child and grandmother (years)	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Education of child and grandmother (years)	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Living in a Urban area (ref: rural area)	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Region in Burkina Faso (13 regions)	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Religion of child and grandmother	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Indicators of Household Consumption	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Indicators of Household welfare	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Health status of child and grandmother	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Marital status	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Age of both parents (years)	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Education of both parents (years)	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Religion of both parents	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Health status of both parents	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Constant	0.07 (0.07)	-0.14 (0.55)	-0.28 (2.76)	6.11** (2.48)	0.22*** (0.07)	-0.08 (0.49)	-2.52 (2.42)	-0.77 (2.51)	0.16* (0.09)	-1.08* (0.59)	-1.14 (2.60)	2.55 (3.09)
Observations	228	228	228	132	228	228	228	132	228	228	228	132
R-squared	0.200	0.252	0.417	0.773	0.202	0.305	0.438	0.661	0.165	0.238	0.396	0.676
OLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. Shows coefficient estimates (OLS) for risk attitudes in general, traffic and financial matters. Model (1) to (4) use the child's average risk attitude in general, traffic or financial matters 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, traffic or finance. Model (1) shows estimates for grandmothers without additional controls, Model (2) and (3) for grandmothers with additional controls and Model (4) including parents. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively.

In Table 4 we estimate the relationship between the child and mother's risk attitudes, for those children that live with a single mother and those that live with a mother living together with a spouses with homogenous attitudes. Our coefficient estimates are in line with the theory. We see that single mother's influence on their child's risk attitudes is less than those mother's living with a spouses with similar risk attitudes. For instance, mother's living with a partner that have homogenous attitudes, as indicated by M2 in Table 4, have a stronger association on their child's risk attitudes in general compared to single mothers in M1. This effect is consistent across domains for traffic and financial matters.

4.3 Results for three-generational (*i.e.* *grandparents* → *grandchildren*)

So far we have been investigating the transmission of attitudes mainly from the parents towards the child. Another form of direct transmission of attitudes between generations, can be the direct socialization that goes from grandparents to children, especially if they life in the same household and have a daily interaction. Table 5 shows the estimates for the transmission of attitudes from grandmothers to children¹⁶ where M1-3 shows the stepwise inclusion of controls variables. However as previous research has showed the transmission of other outcomes between three generations (Kolk 2014 and Adermon et al., 2016) can be mediated by parents. More formally our baseline regression estimations in Table 5 are based on the following linear equation:

$$r_{childi} = \beta_0 + \beta_1 r_{grandparenti} + \beta_2 X_i^T + e_i \quad (11)$$

where r_{childi} is the risk attitudes of child i and $r_{grandparenti}$ is the risk attitudes of grandmother i (or grandfather i). In Model (4) we also add parents' risk attitudes

$$r_{childi} = \beta_0 + \beta_1 r_{motheri} + \beta_2 r_{fatheri} + \beta_3 r_{grandparenti} + \beta_4 X_i^T + e_i \quad (12)$$

¹⁶ The same estimations are conducted but for grandfathers and available upon request, as the sample size for grandfathers is smaller.

Starting with the attitude transmission from grandmothers, we detect a strong assortative relationship on the child's risk attitudes in general as shown from Table 5 (i.e. M1-3). The same strong influence is shown for risk taking in traffic and financial matters. However when including the parents' risk attitudes into the model, the transmission of grandmothers gets weaker. This is an indication that the intergenerational transmission of attitudes of parents' (i.e. the main caregiver) has a stronger effect than the mutigenerational transmission of risk attitudes of grandparents' to the child. The same associative pattern can be seen across the domains of risk taking in general, traffic and financial matters.

4.4 Result for environment → children

The previous results above, indicate a strong positive impact of intergenerational and mutigenerational transmission of attitudes, i.e. parents' and grandparents' risk attitudes influence child's risk attitudes. However, there could be other individuals in the surrounding environment that influence the child's risk attitudes, such as local role models as stated by oblique transmission of attitudes between generations. As a result mediating the direct transmission from parents to children.

Previous research has operationalized the oblique transmission by taking the attitudes of the child's surrounding region as a proxy for the local environment (Dohmen et al., 2012). However, we believe that there might be a difference between the close and far local environment. Therefore we would not only look at the risk attitudes from the child's region but also how the closer neighborhood (the enumeration area) affect the child's attitudes¹⁷. When calculating the risk attitudes of the child's local environment, we follow previous literature (Dohmen et al., 2012) and obtain an average of the risk attitudes for all the residence living in that environment.

¹⁷ The enumeration areas is a statistical defined area for sampling purpose. We could use provinces, but as we want an environment that is more local to the child, enumeration areas is even more disaggregated than provinces.

4.4.1 Regional risk attitudes

Table 6 shows the stepwise results for when including parents risk attitudes (M1), the average regional risk attitude (M2) and additional control variables (M3). Starting with risk attitudes in general, the regional willingness to take risk have a positive and significant associative effect on child's general risk taking. However, average regional willingness to take risk does not mediate the influence of parents. The same pattern can be seen for regional risk attitudes in traffic and financial matters, i.e. the child's risk attitudes are associated by the regional attitudes as well. That is in none of the risk domains does the oblique transmission mediate the direct transmission of risk attitudes. The influence of parents on their children is robust. However when taking a closer look at our estimations, we see a difference across domains. For risk taking in general and traffic, the effect from regional attitudes are strong and positive, but never stronger in magnitude than the parental transmission of risk attitudes (except for mothers in traffic). But for risk taking in financial matters we see a stronger regional associative effect on the child's risk attitudes, stronger than their parents'.

We concluded that our results are consistent with the theory of transmission of attitudes, that it exist a channel of transmission of attitudes from the local environment on the child's attitudes. Moreover, our coefficient estimation from M3 indicates that the local environment risk attitudes is in line with previous research. For instance we see that estimations on mother's and father's willingness to take risk are robust across model specifications in Table 6, i.e. they do not fundamentally change when including regional attitudes. This is also consistent with our results from Table 1 M3, showing that when controlling for region, it does not affect the intergenerational transmission of attitudes between parents and children.

When re-estimating our results for risk attitudes from the closer neighborhood (enumeration area)¹⁸ we see in principal the same results as Table 6.

¹⁸ These results are available upon request.

Table 6: The relationship between children's, parents' and regional risk attitudes in General, Traffic and Finance

Dependent variable:	<i>Child's general risk</i>			<i>Child's traffic risk</i>			<i>Child's finance risk</i>			Dohmen et al. 2012		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	<i>general</i>	<i>traffic</i>	<i>finance</i>
Mother's willingness to take risk	0.37*** (0.03)	0.35*** (0.03)	0.36*** (0.03)	0.21*** (0.03)	0.20*** (0.03)	0.20*** (0.03)	0.31*** (0.03)	0.28*** (0.03)	0.29*** (0.03)	0.141*** (0.02)	-	-
Father's willingness to take risk	0.34*** (0.03)	0.32*** (0.03)	0.32*** (0.03)	0.46*** (0.04)	0.45*** (0.04)	0.45*** (0.04)	0.26*** (0.03)	0.24*** (0.03)	0.23*** (0.03)	0.134*** (0.02)	-	-
Average regional willingness to take risk		0.21*** (0.04)	0.21*** (0.04)		0.20*** (0.05)	0.23*** (0.05)		0.43*** (0.06)	0.40*** (0.06)	0.461*** (0.08)	-	-
Additional controls:												
Height of child and both parents (cm)	No	No	No	No	No	No	No	No	No	Yes	-	-
Female (=1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Age of child and both parents (years)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Education of child and both parents (years)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Living in a Urban area (ref: rural area)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Region in Burkina Faso (13 regions)	No	No	Yes	No	No	Yes	No	No	Yes	Yes	-	-
Constant	-0.87*** (0.12)	-0.85*** (0.12)	0.05 (0.87)	-0.01 (0.13)	0.00 (0.12)	0.25 (0.97)	-1.27*** (0.15)	-1.18*** (0.15)	-1.78 (1.06)	-1.408** (0.676)	-	-
Observations	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120	3,333	-	-
R-squared	0.525	0.533	0.535	0.448	0.453	0.455	0.317	0.342	0.353	0.121	-	-
OLS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-

Note. Shows coefficient estimates (OLS) for risk attitudes in general, traffic and financial matters. Model (1) to (3) use the child's average risk attitude in general, traffic or financial matters 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, traffic and financial matters. Average willingness to take risk is based on per region calculation. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively. Additional controls include number of residents and age and gender composition of the region. There is also an additional column indicating the results from previous research for risk attitudes in general to allow for comparability.

Table 7: The relationship between son-daughter and parents' risk attitudes in General, Traffic and Financial matters

Dependent variable: <i>Child's risk in</i>	General		Traffic		Financial	
	Daughter	Son	Daughter	Son	Daughter	Son
Mother's willingness to take risk in general	0.58*** (0.05)	0.27*** (0.04)	-	-	-	-
Father's willingness to take risk in general	0.22*** (0.05)	0.40*** (0.04)	-	-	-	-
Mother's willingness to take risk in traffic	-	-	0.46*** (0.05)	0.11*** (0.03)	-	-
Father's willingness to take risk in traffic	-	-	0.30*** (0.06)	0.53*** (0.04)	-	-
Mother's willingness to take risk in finance	-	-	-	-	0.50*** (0.05)	0.23*** (0.04)
Father's willingness to take risk in finance	-	-	-	-	0.23*** (0.05)	0.27*** (0.04)
Additional controls:						
Female (=1)	Yes	Yes	Yes	Yes	Yes	Yes
Age of child and both parents (years)	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-1.63*** (0.19)	-0.79*** (0.14)	-1.06*** (0.20)	0.08 (0.14)	-2.08*** (0.25)	-1.14 (0.17)
Observations	564	1,556	564	1,556	564	1,556
R-squared	0.660	0.449	0.564	0.365	0.433	0.228
OLS	Yes	Yes	Yes	Yes	Yes	Yes

Note. Shows coefficient estimates (OLS) for general, traffic and financial risk attitudes for daughters and son separately. Use the child's average risk attitude 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, traffic or financial matters. Robust standard errors in parentheses are clustered at the household level. All model specifications include a constant. ***, **, * indicate significance at the 1%, 5% and 10 level respectively.

4.5 Results for gender differences (*i.e. parental gender & children's*)

As discussed earlier, in Burkina Faso traffic is more male dominated while the daily financial transactions are female dominated. Thereby, the fact that different risk domains are gendered is likely to affect the transmission of attitudes between generations.

As a first step, in order to detect any gender difference across domains we turn to the results in Table 1, where a clear shift is seen when it comes to parents' influence on their child's risk attitudes between risk taking in traffic to financial matters. Table 1 shows that the association between fathers and their children in traffic is stronger than the association between mothers and their children. The opposite is evident for risk taking in financial matters, the association between mothers and children are stronger than between fathers and children. Since risk taking domains are gendered, the socialization of daughters and sons might also be gendered.

Table 7 divide the sample by child's gender and re-estimate the same regressions as in Table 1. Table 7 shows a strong gender difference between mother's and father's depending if the child is a girl or boy. Mothers have a stronger associative influence on their daughter's willingness to take risk, independent of domain. For instance daughters are more associatively influenced by their mother's willingness to take risk in general compared to their fathers. Further, mothers have also a lesser associatively influence on their sons risk taking in general compared to their spouses. Focusing on fathers, Table 7 shows that they affect their son's risk taking more compared to their wives. Also, fathers associatively influence their daughters risk taking less compared to their spouses. These patterns, are indications that it exist strong gender roles in terms of transmission of risk attitudes between generations. To assure that these patterns are not reflected by issue related to our relatively smaller sample size for daughters (564) compared to sons (1 556) we compare as sensitivity tests the mean value of risk attitudes for daughters and other non-relatives in the same household. The average risk attitudes for daughters (non-relatives) are 3.9 (4.0)

for risk taking in general, 3.4 (3.3) for risk taking in traffic and 4.3 (4.2) for risk in financial matters. As another sensitivity test we compare the mean value of women in our analytical sample to all other women that have answered our risk attitude questions. The difference between the analytical sample women (other women) is 3.7 (3.6), 2.9 (2.7) and 4.3 (4.2) for risk taking in general, traffic and financial matters. We see the same pattern but with higher mean values when doing the same comparison for men. When comparing the mean value for risk attitudes of unmarried daughters and sons living in the same household, we get a correlation of 0.97. These tests gives us an indication the daughters in our sample are not a selective group.

The results in Table 7 also indicates that different risk domains are gendered. We see not just that father's relationship with their son's risk taking is more than their daughters or compared to their spouses. The associative effect is much stronger in a male dominated domain such as traffic compared to risk taking in general and financial matters. We see that in traffic father's transmission of risk attitudes on their son is stronger than mother's. Moreover, the associative relationship for risk taking in traffic between father and son is stronger than father and daughter. However, the results from Table 7 show a gender heterogeneity within the risk domains of traffic and financial matters. In the male dominated risk domain (traffic) the transmission of risk attitudes from fathers to daughters is relatively stronger than in the female dominated risk domain (financial matters). While the transmission of risk attitudes from mothers to sons is relatively stronger in the female dominated risk domain (financial matters) than in the male dominated risk domain (traffic). This gender heterogeneity in risk domains implies that children are socialized more by the parents in the domain they are more exposed to.

Overall, there seems to be support for the gender-specific role-model hypothesis in terms of risk attitudes.

5. Conclusion

In developing countries there is a great need for individuals to take risk in order to reach unforeseen opportunities; to venture into new occupations, adopt new technologies, to increase the mobility in the labour market, investing in new upcoming opportunities etc. However, in developing countries formal financial services and social security are scarce or underdeveloped, making the family as an institution an important arena for shaping individuals risk taking. This paper replicates the findings of Dohmen et al., (2012) by analyzing the intergenerational transmission of risk attitudes in three different domains (general, traffic and financial matters) in Burkina Faso for 2 120 children for whom risk attitudes of both their mother and father is observed. The papers findings are consistent with Dohmen et al., (2012), with some exceptions.

We find that parents are important in transmitting their risk attitudes to their children. For the risk domains in general, traffic and financial matters, both the mother and father have a positive and strong association on their child's risk taking. These findings opens for comparison to literature in intergenerational transmission of other outcomes as well. For instance, a strong and positive correlation between parents and children attitudes, could add to the explanation of why children choose similar education and occupation as their parents. This is in particular important for understanding the patterns of choices in developing countries with under-developed institutions. One mechanism behind the transmission of risk attitudes could be that parents engage in positive assortative mating, as they have partners with similar risk attitudes and that the transmission of attitudes from single mothers towards the child is weaker compared from mothers living with a partner with similar attitudes. This finding could add to understanding why couples engage in similar risky behavior. For instance, smoking is still an issue in developing countries. Studies such as Fernández et al. (2005) show that there is a correlation in smoking among couples, i.e. if you smoke your partner smokes too. This could be related to positive assortative mating in terms of risk attitudes, such as engaging in the risky behavior of smoking (de Walque 2014).

We find support for the argument that transmission of risk attitudes are multigenerational. Grandparents have a positive association on their grandchildren's risk attitudes, but the magnitude of this association decreases when controlling for the main caregiver of the child (i.e. parents). This could imply that parents have a mediating role between grandparents and children.

Our findings show support for the existence of an oblique socialization, the local environment have a positive association on the child's risk attitudes. However, the transmission from the local environment seems to be a confounder between the parents and children's risk attitude transmission. The role of parents on the child's risk attitudes remain robust even when including the risk taking of the local environment. These findings contribute to understanding neighborhood effects. For example why would you engage in risky behaviors such as drug use or crime if your parents are not engaged in those behaviors. Previous research shows that drug use and crime of individuals are linked to other role models in the local environment (e.g. Case and Katz 1991). Putting this in a development setting where access to police, social security and other related institutions are scarce, it becomes even more important to understand the transmission of attitudes from the local environment towards the child.

We find that intergenerational transmission of risk attitudes is gendered in Burkina Faso. Mothers have a stronger association on their daughters risk attitudes, compared to their sons. Fathers have a stronger associative effect on their sons than their daughters risk attitudes, i.e. the effect on transmission is reverse compared to mothers. However, our findings show that it exist a heterogeneity in the transmission of risk attitudes across risk domains and gender. In the male dominated domain of risk taking in traffic, the intergenerational transmissions of risk attitudes for fathers towards their daughters is relatively stronger than risk attitudes in financial matters (i.e. the female dominated risk domain). For mothers, we see the reverse effect, mothers have a relatively stronger effect on their sons in financial matters that is a more female dominated domain than in the male dominated domain of traffic. These findings show that models of intergenerational attitude transmission applied to a developing country setting, should include aspects such as gender.

Overall, our findings indicate that mechanisms such as multigenerational and local environment matters in the transmission of risk attitudes towards the child. However, what matters more, is the intergenerational transmission of attitude transmission, i.e. the transmission of attitudes from parents to children. We also see indications that positive associative mating could play a role to strengthen the intergenerational transmission. But more importantly, compared to previous research on developed countries, we see that it exist a gender dimension for attitudes transmission from parents to child in risk domains that are male and female dominated.

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Appendix

--- Work in progress ---

A.1 Model of transmission of attitudes

Parents are endowed with some paternalistic altruism with respect to their children within the model of socialization and transmission of attitudes between generations (Bisin and Verdier 2000). Children are born with not-well-defined attitudes. Instead children acquire their attitudes through observation, imitation and adoption (i.e. socialization) of attitudes with which they are matched either through direct or oblique/indirect transmission of attitudes between generations. The socialization of children (observation, imitation and adoption) is assumed to be an economic choice of parents (Becker 1996). Parents care for the future wellbeing of their children, however only through the filter of their own preferences. Therefore, parents have a motivation to transmit their own attitudes and beliefs toward their children.¹⁹

The purpose of this section is to present a model framework that shows the socialization mechanisms of intergenerational transmission of attitudes. We assume these mechanisms to be centered on the role of the parents. Therefore, we will also show what role the type of parents (i.e. if parents have homogenous or heterogeneous attitudes) have in the development of the attitudes of the child. Our model is an extension of the model introduced by Bisin and Verdier (2000).

A.1.1 Direct and oblique transmission of attitudes

The motivation for parents to socialize her child despite the fact that socialization is costly comes from that a parent is altruistic²⁰ and is involved in a matching process (Bisin and Verdier 2000). This matching process can as mentioned above

¹⁹ Otherwise children with attitudes different from their parents' would choose actions that do maximize their own and not their parents' attitudes. In general, if one specific attitude for instance enlarges substantially the economic opportunities of the children, the parents might want to socialize them to this particular attitude even if different from their own. For instance in Burkina Faso, even though there is a large demand for workers within the agricultural sector, the younger generations still leaves the rural for urban areas, as they do not want to work within agriculture.

²⁰ This altruism is assumed to be paternalistic, meaning that parents wish to transmit through socialization their own attitudes to their child.

be divided in two mechanism, direct or oblique/indirect transmission of attitudes between generations (Bisin and Verdier 2000). In the direct transmission of attitudes, parents want to exert a direct socialization effort to influence their child's process of attitude formation.²¹ However the effective socialization of the child to a specific attitude is determined by the interaction of the direct socialization effort of the parents and the indirect more oblique influence from role models in the local environment or region. The direct transmission of attitudes operates at the level of the parents. Parents which have similar or homogenous attitudes have a more efficient socialization of their attitudes towards their child compared to heterogeneous parents (i.e. parents with dissimilar attitudes). Therefore the individual's choice of partner do determine her ability to transmit her attitudes to her child. We assume that it is a rational choice of individuals to search for a partner with similar attitudes, but that there is a search cost involved. Before starting to model the socialization mechanisms of intergenerational transmission of attitudes between parent and child, we will show how individuals are matched in homogenous or heterogeneous partners. To understand this with respect to our setting, we will in this section lay out a modified version of the model of cultural transmission and socialization developed by Bisin and Verdier (2000, 2010). We do this modelling framework to form testable hypothesis that we will show evidence for in our empirical section.

A.1.1.1 Matching of individuals into partners

In our model the choice of partner is a function of the desire to socialize the child²², whom would be the outcome of the partnership. Because each individual want to transfer her own attitudes to her child. As mentioned above we assume that individuals have a search cost of finding the optimal partner (i.e. partner with similar attitudes). For simplicity, our model that describes the matching of

²¹ Examples of socialization efforts could be investing time in children, choosing the school of and which neighborhood to live in.

²² Of course there are many other factors that is involved in the decision to choose a partner. But previous studies show that individuals are highly concerned about the attitudes of their potential child when deciding to form a family (Rosenblatt et al. 1995; Bisin et al. 2004).

individuals with other individuals is organized through a partner game.²³ Let's assume that all individuals can search for a partner in a restricted pool where everyone admitted has the same attitudes. Let's assume that we have two attitudes A and B where $A \neq B$, and a restricted pool for each attitude. Hence, we have two restricted pools where individuals with the same attitude can match. But there is a direct cost of getting admitted to these pools and other costs in terms of other unmodeled desirable characteristics of a match. The probability of finding a homogenous partner is endogenously chosen by each individual. With probability α^A an individual with attitude A enters the restricted pool for attitude A and match homogenously with another individual. Let a^A be the fraction of individuals with attitude A who are matched homogenously with another individual in their restricted pool.²⁴ Moreover, the individual with attitude A chooses α^A , the probability of being matched in the restricted pool (where all mates have attitude A) at a cost. The cost associated with this choice of α^A given the share of individuals with attitude A in the population (a^A) is $H1(\alpha^A)$. With probability $1-\alpha^A$ an individual of attitude A does not match in the same restricted pool. This individual would then enter a common unrestricted pool made of all individuals who have also not been matched in their respective restricted pools. All individuals take the composition of the common pool as given. In this common unrestricted pool individuals are matched randomly. The probability that an individual with attitude A in the common pool is matched homogenously (conditional of not having found a partner in the restricted pool) is²⁵

$$\pi^A(\alpha^A, a^A, a^B, z^A) = \alpha^A + (1-\alpha^A) \left(\frac{[(1-a^A)z^A]}{[(1-a^A)z^A + (1-a^B)(1-z^A)]} \right) \quad (X1)$$

where z^A is the fraction of individuals with attitude A in the population and the second term on the right-hand side of (X1) represents the fraction of individuals with attitude A that are homogenously matched in the common pool.

Alternatively, $z^A = q^A$. Because the choice of partner is a function of the desire to socialize the child whom would be the outcome of the partnership, it

²³ Assume that each individual matches at most one other individual in their life. Hence, do not assume infinitely repeated relationships.

²⁴ In equilibrium by symmetry all individuals with the same attitude behave identically, hence $\alpha^A = a^A$

²⁵ Denotes the probability that an individual with attitude A is matched with another individual with attitude A .

is important to incorporate a probability that captures this effect. We know that with matches in the common pool we can not claim with certainty that these matches would be homogenous matches, as they are random. If the matches are not homogenous, there is a probability that the future child of the couple will pick the attitude of a role model chosen randomly in the local environment that is not his/her parents' attitudes. We incorporate this effect by the notation q^A , which comes from the oblique/indirect transmission of attitudes from parents to child. In oblique/indirect transmission there is still a probability q^A that the child would end up with the same attitude as the parents, i.e. A .

In summary the preference for socialization of the child drives the choice of partner by individuals. Therefore, each individual is allowed to affect the probability to be matched with a partner that has similar attitudes. In the end of section A.1.1.2, we will show which optimal α^A each individual chose through maximizing the probability of being matched in the common pool.

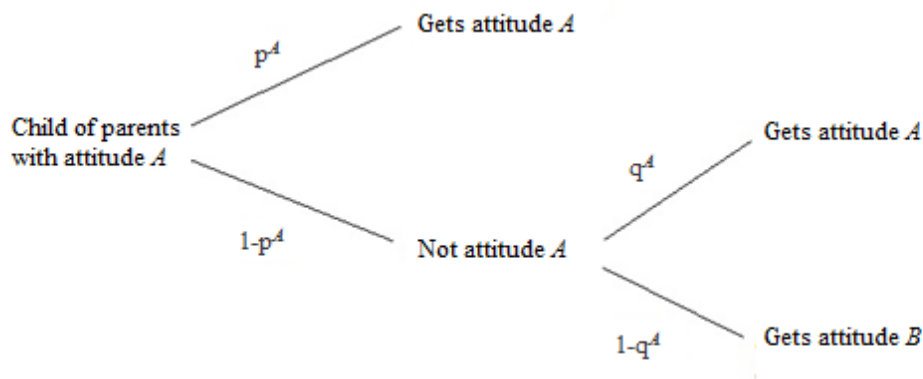
A.1.1.2 Attitude transmission

Let's now go over to the socialization process of attitude transmission from parents to child. Our model framework models intergenerational transmission of attitudes as a mechanism that interacts direct transmission of attitudes in terms of socialization inside the family (i.e. parent-child or grandparents-child) with oblique/indirect transmission of attitudes in terms of socialization outside of the family (e.g. region-child). The child is socialized through direct transmission by its parents (or if parents are not present grandparents). If the direct transmission of attitudes is not efficient, a child is influenced by a role model in the local environment, such as the neighborhood. The model assumes that parents with similar attitudes conduct a more efficient socialization of the child compared to parents with dissimilar attitudes²⁶. Let's assume that we have two attitudes, A and B . In the direct transmission of attitudes parents are assumed to encourage the child to have attitudes similar to their own, as they believe that their own attitudes

²⁶ There are some evidence for this in the previous literature. Children with parents of same religion have stronger religious commitments than those with parents of mixed religion (Ozorak, 1989; Erickson 1992).

are the best for the child to have. The child would then end up with attitude A , and adopt her parents' attitudes with a certain probability p^A . However, with probability $1-p^A$, the transmission of attitudes from parents' to child fail, and through so called oblique/indirect transmission of attitudes the child is matched with an individual of the local environment and adopts the attitudes of that individual. In oblique/indirect transmission of attitudes (i.e. when parents have heterogeneous attitudes or are absent or no longer alive) there is still a probability q^A that the child would end up with the same attitude as the parents, i.e. A . However, if not socialized by either the mother or father, with probability $1-q^A$ the child picks a role model in the local environment with attitude B ($B \neq A$) that is different from her parents (i.e. the child picks attitude A with probability q^A and attitude B with probability $1-q^A$, if not socialized directly by the parents). Figure A1 below illustrates this socialization process.

Figure A1: The socialization process between parents and child



Note: When both parents have similar attitudes, in this case attitude A , the direct transmission of attitudes occurs with probability p^A , and the child gets the same attitude as her parents. But if the direct transmission of attitudes do not occur, with probability $1-p^A$, the child would pick up the attitude of a role model in the local environment and there is chance that the child would get the same attitude A , q^A . Or the child would pick up attitude B with probability $1-q^A = q^B$

The socialization for individuals with attitude A and B can also be illustrated through the following system of equations

$$\Pi^{AA} = p^A + (1-p^A) q^A \quad (Y1)$$

$$\Pi^{AB} = (1-p^A) (1-q^A) = (1-p^A) q^B, \text{ where } B \neq A \quad (Y2)$$

Equation (Y1) states the probability that the child of parent with attitude A will also have attitude A . Equation (Y2) states the probability that the child of parent with attitude A will have attitude bundle B .

$$\Pi^{BB} = p^B + (1 - p^B) (1 - q^A) = p^B + (1 - p^B) q^B, \text{ where } B \neq A \quad (\text{Y3})$$

$$\Pi^{BA} = (1 - p^B) q^A = (1 - p^B) (1 - q^B), \text{ where } B \neq A \quad (\text{Y4})$$

Equation (Y3) states the probability that the child of parent with attitude B will also have attitude B . Equation (Y4) states the probability that the child of parent with attitude B will have attitude A .

Equations (Y1) and (Y3) illustrates the system of equations for an individual living with a partner with similar attitudes. And equations (Y2) and (Y4) for an individual living with a partner with dissimilar attitudes.

The advantages of finding a partner with similar attitudes is that it gives option of direct transmission of attitude to the child. The probability of direct transmission among parents with same attitude (say A), p^A , is chosen endogenously by parents. However we assume that socialization of the child is costly, as it requires parental resources (e.g. time invested in the child). This cost increase with the probability of successful direct transmission of attitude A from parents to child. This cost can be denoted $H_2(p^A)$ where $H_2'(p^A) > 0$ for all p^A , $a^A \in [0, 1]$ with $p^A \neq a^A$.

Let V^{AB} denote the utility that a parent with attitude A derives from a child with attitude B . And V^{AA} the utility that a parent with attitude A derives from a child with attitude A . We assume that V^{AA} and V^{AB} are exogenously given (and independent of q^A), which implies that $V^{AA} > V^{AB}$ for all A and B with $A \neq B$.²⁷ When $V^{AA} > V^{AB}$ a parent have an incentive to socialize her child to her own

²⁷ The model assumes that individuals engage in positive assortative mating. Thus they seek a partner with the same attitude. Because, the transmission of attitudes from parents is weak if parents have different attitudes. Therefore positive assortative mating is a rational choice by individuals to obtain optimal direct transmission of attitudes as they desire to pass on their own attitudes to a child. And also because a crucial assumption is that we assume that parents can perceive the welfare of their child only through the filter of their own preference (i.e. V^{AA} and V^{AB} are exogenously given). This assumption is called imperfect empathy (Bisin and Verdier 2010). This assumption means that each parent attributes to her child the utility the parent herself would have gotten in the position of the child. Therefore, the utility that a parent perceives from a child with the same attitude as the parent should be higher than the utility from a parent with a child that has a parent with different attitude ($V^{AA} > V^{AB}$ if $A \neq B$).

attitude. The utility of the child for each parent (i.e. the value of parental socialization choice) in a family where parents have similar attitude (hence direct transmission of attitudes) say A, is the solution of the following maximization problem²⁸

$$W^A_{\text{Homo}}(q^A) = \max_{p^A} [p^A + (1-p^A)q^A] V^{AA} + (1-p^A)(1-q^A) V^{AB} - H2_{\text{Homo}}(p^A) \text{ with } A \neq B \quad (\text{X2})$$

Or

$$W^A_{\text{Homo}}(q^A) = \max_{p^A} \Pi^{AA} V^{AA} + \Pi^{AB} V^{AB} - H2_{\text{Homo}}(p^A) \text{ with } A \neq B \quad (\text{X2})$$

subject to (Y1-Y2) where $W^A_{\text{Homo}}(q^A)$ is the gain from socializing the child through direct transmission of attitudes, hence parents with homogamous attitudes.²⁹ So parent with attitude A, given socialization is costly, choose p^A to maximize equation (X2). Maximizing equation (X2) with respect to p^A we get the following first-order condition:

$$H2^A_{\text{Homo}}(p^A) = (\partial \Pi^{AA} / \partial p^A) V^{AA} + (\partial \Pi^{AB} / \partial p^A) V^{AB} \quad (\text{X2}^*)$$

or with respect to p^B

$$H2^A_{\text{Homo}}(p^B) = (\partial \Pi^{BB} / \partial p^B) V^{BB} + (\partial \Pi^{BA} / \partial p^B) V^{BA} \quad (\text{X2}^{**})$$

Substituting in (Y1-Y4) in equations (X2*) and (X2**) we get the optimal p^A and p^B

$$H2^A_{\text{Homo}}(p^A) = (V^{AA}-V^{AB}) (1- q^A) \quad (\text{X2}_1^*)$$

or with respect to p^B

$$H2^A_{\text{Homo}}(p^B) = (V^{BB}-V^{BA}) q^A \quad (\text{X2}_1^{**})$$

In order to have interior solutions $p \in [0, 1]$ we need that $H2^A_{\text{Homo}}(0)=0$ and $H2^A_{\text{Homo}}(1)>0$, It follows from equation (X2_1*) and (X2_1**) that the optimal level of p^A and p^B are $p^A = (q^A, V^{AA}-V^{AB})$ and $p^B = (q^B, V^{BB}-V^{BA})$ with

²⁸ We do not write any explicit endogenous fertility problem for the parents, because one extra optimization problem would make the model intractable. We assume that parents take as given a constant fertility rate.

²⁹ $W^B_{\text{Homo}}(q^B)$ is the symmetry of $W^A_{\text{Homo}}(q^A)$.

$$\partial p^A (q^A, V^{AA}-V^{AB}) / \partial q^A = - (V^{AA}-V^{AB}) / H2^{\text{Homo}} (p^A (q^A, V^{AA}-V^{AB})) < 0$$

and

$$\partial p^B (q^B, V^{BB}-V^{BA}) / \partial q^B = (V^{BB}-V^{BA}) / H2^{\text{Homo}} (p^B (q^B, V^{BB}-V^{BA})) > 0$$

where $\Delta V^A = V^{AA} - V^{AB}$ is the subjective utility gain of having a child with attitude A given imperfect empathy on the parts of the parents, $\Delta V^A > 0$. ΔV^A measures the relative value of the child with the same attitude as the parent. We will return to ΔV^A below due to the gender of the parent.

The utility of a child in a family where parents have dissimilar attitudes is different. Because in a family where each parent have not found her optimal match, there is no search cost, and hence no direct transmission of attitudes but oblique/indirect. The utility of the child for a parent with attitude A with a partner with heterogamous attitudes is

$$W^A_{\text{Hetero}}(q^A) = q^A V^{AA} + (1 - q^A) V^{AB} \quad (\text{X3})$$

From equations X2 and X3 we see that each individual's desire to find an optimal match would drive the equilibrium partner rate to complete homogamy couples, given no search cost. As a consequence the option to socialize children provided by a parent with a partner with similar attitudes is valued by individuals in the matching of partners, hence as a consequence $W^A_{\text{Homo}}(q^A) > W^A_{\text{Hetero}}(q^A)$ for all $0 < q^A < 1$. Therefore as we have search cost, there would not exist complete homogamy.

In the model that we have described so far, parents' transmission of attitudes to the child depends on the parents' relative value of the child with the same attitudes as theirs, hence why $\Delta V^A > 0$. So far ΔV^A have been treated as an exogenous parameter in our model. However, this is too restrictive an assumption. The endogeneity of ΔV^A can originate in many different situations for socialization, we just have to justify it. In not so dissimilar matching contexts as ours, the payoffs that an individual may obtain is likely to be influenced by the distribution of attitudes in the population (Bisin and Verdier 2010). We believe that the endogeneity of ΔV^A originate in the gender of parents that affect the parents' transmission of attitudes to the child. Further, we believe that mother's

transmission of attitudes to the daughter is different from that of father to son. Moreover, irrespective if parents themselves have similar or dissimilar attitudes, the utility that a parent derives from a child, is different if the parent-child is mother-daughter, in relation to father-son. Therefore i.) V^{AB} for mother-daughter $\neq V^{AB}$ for father-son; ii.) V^{AB} for mother-daughter $> V^{AB}$ for mother-son; iii.) V^{AB} for father-daughter $< V^{AB}$ for father-son. The same condition as in i.)-iii.) applies in symmetry to V^{AA} .

While the implications of the endogeneity of ΔV^A in terms of gender for the socialization of / transmission of attitudes to the child need to be derived case-by-case, a reduced form analysis is however useful, to clarify our reasoning. Let X denote the gender of the individual. Suppose for instance that each parent (mother or father) and child (daughter and son) chooses $x \in X$ to maximize $u^A(x^A)$ so that under imperfect empathy, direct transmission of attitude A depends on $\Delta V^A(x^A) = u^A(x^A) - u^A(x^B)$. The implication of the endogeneity of ΔV^A is the following:

When ΔV^A depends on x , imperfect empathy does not necessarily imply that $\Delta V^A > 0$.

As a consequence of the endogeneity of ΔV^A in terms of gender, the value of mother's socialization choice/transmission of attitudes to the child is stronger than the father's socialization/transmission of attitudes: $W^A_{\text{HomoMother}}(q^A) > W^A_{\text{HomoFather}}(q^A)$ and $W^A_{\text{HeteroMother}}(q^A) > W^A_{\text{HeteroFather}}(q^A)$. Moreover, mother's socialization to her daughter is stronger than to her son, and father's socialization to his son is stronger than to his daughter. So $W^A_{\text{HomoMotherDaughter}}(q^A) > W^A_{\text{HomoMotherSon}}(q^A)$, $W^A_{\text{HeteroMotherDaughter}}(q^A) > W^A_{\text{HeteroMotherSon}}(q^A)$ and $W^A_{\text{HomoFatherSon}}(q^A) > W^A_{\text{HomoFatherDaughter}}(q^A)$, $W^A_{\text{HeteroFatherSon}}(q^A) > W^A_{\text{HeteroFatherDaughter}}(q^A)$.

Alternatively, the utility of a child in a family where parents have different gender is different. Because in a family with a mother and father the cost of socialization/transmission of attitude A to the child also depends on the gender of the child, $x^A \in \{\text{Daughter, Son}\}$. The gender of the child requires different parental resources: mother's tend to invest more time in their daughter compared

to son and father's more on their son than daughter. This cost increase with the probability of successful direct transmission of attitude A from mother and father to their daughter or son. This cost can be denoted $H2_i(p^A, x^A)$ where $\partial H2_i(p^A, x^A) / \partial p^A > 0$, $\partial H2_i(p^A, x^A) / \partial x^A > 0$ for all $p^A \in [0, 1]$, $x^A \in \{\text{Daughter, Son}\}$ and $i \in \{\text{Mother, Father}\}$ with $p^A \neq x^A$ and $H2_{\text{Mother}}(p^A, x^A) \neq H2_{\text{Father}}(p^A, x^A)$. Moreover, $H2_{\text{Mother}}(p^A, \text{Daughter}^A) < H2_{\text{Mother}}(p^A, \text{Son}^A)$ and $H2_{\text{Father}}(p^A, \text{Daughter}^A) > H2_{\text{Father}}(p^A, \text{Son}^A)$.

The utility of the child for mother and father (i.e. the value of parental socialization choice) in a family where parents have similar attitude say A but different gender, is the solution of the following maximization problem

$$W^A_{\text{Homoi}}(q^A) = \max_{p^A} [p^A + (1-p^A)q^A] V^{AA} + (1-p^A)(1-q^A) V^{AB} - H2_i(p^A, x^A) \quad (\text{X2_A})$$

or

$$W^A_{\text{Homoi}}(q^A) = \max_{p^A} \Pi^{AA} V^{AA} + \Pi^{AB} V^{AB} - H2_i(p^A, x^A) \quad (\text{X2_A})$$

with $A \neq B$ and $i \in \{\text{Mother, Father}\}$

subject to (Y1-Y2) where $W^A_{\text{Homoi}}(q^A)$ is the gain from socializing the child through direct transmission of attitudes by the mother or father, with homogamous attitudes.³⁰ So parent with attitude A , given socialization is costly, choose p^A to maximize equation (X2_A).

The utility of a child in a family where parents have dissimilar attitudes is the same as equation X3.

Individuals that are in couple also divorce. This means that a parent is chosen to socialize the child. We assume that each partner have an exogenous probability d of divorcing. We can further assume that divorce occurs before the parents' attitudes are transmitted to the child. Then we assume that one of the parents is chosen randomly to form a single-parent family.³¹ We further assume that transmitting attitudes to the child is more costly for single-parents compared to parents/couples. But compared to parents with dissimilar attitudes, the single

³⁰ $W^B_{\text{Homoi}}(q^B)$ is the symmetry of $W^A_{\text{Homoi}}(q^A)$.

³¹ However in the case of Burkina Faso, this is usually the mother.

parent have a technology to socialize the child, as the single-parent is the only parent for the child. Then the utility of the child in a single-parent family is the solution of the following maximization problem

$$W^A_{\text{Single}}(q^A) = \max_{p^A} [p^A + (1-p^A)q^A] V^{AA} + (1-p^A)(1-q^A) V^{AB} - H3_{\text{Single}}(p^A) \quad (\text{X4})$$

subject to (Y1-Y2) where $W^A_{\text{Single}}(q^A)$ is the gain from socializing the child through transmission of attitudes and $H3_{\text{Single}}(p^A)$ the socialization cost function of single-parent families. We assume that $H3_{\text{Single}}(p^A) > H2_{\text{Homo}}(p^A)$ and $H3'_{\text{Single}}(p^A) > H2'_{\text{Homo}}(p^A)$ but that $H3_{\text{Single}}(p^A) < H2_{\text{Hetero}}(p^A)$ for all $p^A \in [0, 1]$. Meaning parents with similar attitudes have a more efficient direct transmission of attitudes and hence more efficient technology to socialize the child (due to lower cost of socialization) than a single-divorce-parent. But compared to parents with dissimilar attitudes, the cost for socializing the child is lower for a single-divorce-parent.

A.1.1.3 Equilibrium

In our model of socialization the maximization problem for an individual with attitude A is to choose the probability of matching in the restricted pool, knowing that if she is matched with a homogenous partner, she has access to efficient technology to socialize her child with the same attitudes as her own, i.e. direct transmission of attitudes. Therefore an individual with attitude A chooses $\alpha^A \in [0, 1]$ for given a^A, a^B, q^A , to maximize her probability of matching

$$\pi^A(\alpha^A, a^A, a^B, q^A) [W^A_{\text{Homo}}(q^A) - W^A_{\text{Hetero}}(q^A)] - H1(\alpha^A) \quad (\text{X5})$$

Subject to $\pi^A(\alpha^A, a^A) = \alpha^A + (1-\alpha^A)a^A$ and $\pi^A(\alpha^A, a^B) = (1-\alpha^A)a^B$

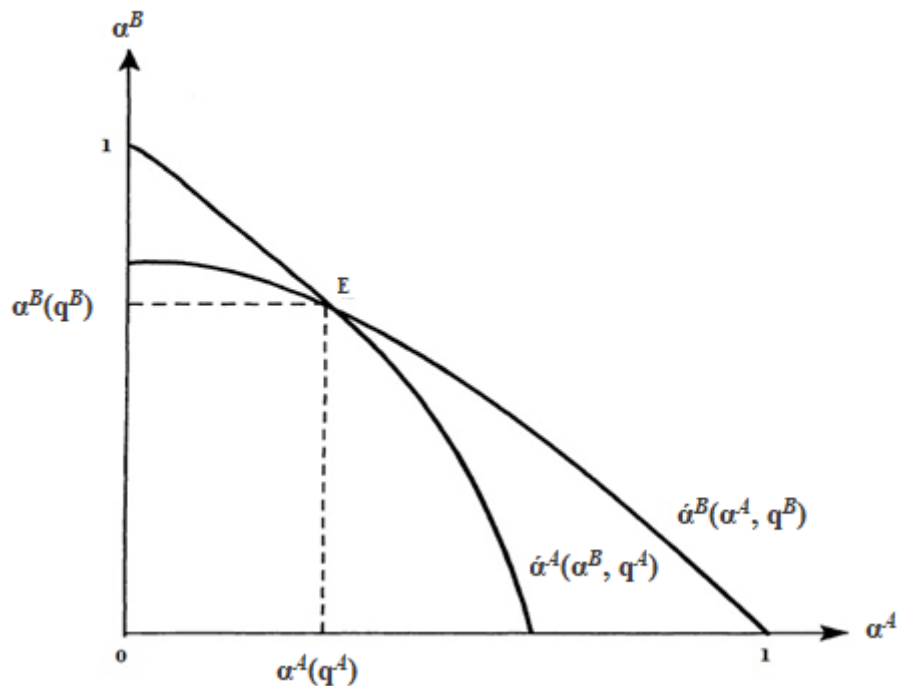
given a^A and a^B where $A \neq B$

where $\pi^A(\alpha^A, a^A, a^B, q^A)$ is the probability of homogenous matching of individuals with attitude A , $W^A_{\text{Homo}}(q^A)$ is the expected utility of a parent with attitude A living with a partner with similar/homogenous attitude (i.e. A) in which there is a direct transmission of attitudes to thier child, while $W^A_{\text{Hetero}}(q^A)$ is the expected utility of

a parent with attitude A living with a partner with dissimilar/heterogeneous attitude (i.e. B) in which there is an oblique/indirect transmission of attitudes to their child, and individuals with attitude A can affect the probability of being matched in their restricted pool by choosing α^A at a cost $H1(\alpha^A)$. Individuals with attitude A and B interact nontrivially in the partner game. An individual with attitude A 's maximization problem depends via $\pi^A(\alpha^A, a^A, a^B, q^A)$ on a^B (the fraction of individuals with attitude B in the restricted pool). Therefore, the more individuals with attitude B in the restricted pool, the less of them in the common pool. Hence, better for individuals with attitude A of not entering their own restricted pool, and instead being matched in the common pool.

The maximization of equation X5 for each individual with attitude A provides an optimal α^A as a function of a^A , a^B and q^A . Bisin and Verdier (2000) shows that under convexity and regularity assumptions there exist a unique symmetric Nash equilibrium of the partner game. Given this symmetric Nash equilibrium, all individuals with attitude A choose the same α^A and a^A , as through the Law of large numbers $a^A = \alpha^A$.

Figure A2: The equilibrium in socialization between parent and child



Note: The best reply functions ($\acute{\alpha}^A(\alpha^B, q^A)$ and $\acute{\alpha}^B(\alpha^A, q^B)$) are downward sloping, reflecting the fact that choosing α^A or α^B are strategic substitutes.

One can derive the partnerships best reply functions $\acute{\alpha}^A(\alpha^B, q^A)$ for individuals with attitude A as a function of α^B and q^A . As illustrated from Figure X2 these best reply functions, $\acute{\alpha}^A(\alpha^B, q^A)$ and $\acute{\alpha}^B(\alpha^A, q^B)$, are downward sloping in the space (α^A, α^B) . Intuitively it means that when individuals of attitude B tends to match more with a partner with similar attitudes in their restrictive pool (higher α^B), it is less likely for an individual with attitude A to find a partner with similar attitudes in their restrictive pool (lower α^A) but more likely to find a match in the common pool. Therefore, individuals with attitude A would need to spend a higher cost to find a match in their restricted pool.

The symmetric Nash equilibrium of the partner game in figure A2 is represented by the mappings $\alpha^A(q^A)$ and $\alpha^B(q^B)$ which are fixed points of the best replies of individuals with attitude A and B . The probability of homogenous matching for individuals with attitude A is a function of q^A in equilibrium, denoted $\pi^A(q^A)$. Under convexity and regularity assumptions on costs $H1(\alpha^A)$ and $H2(p^A)$, there exists a unique intersection point E of the best reply functions. This intersection point is a unique symmetric Nash equilibrium of the partner game.

Moreover, there is a well-defined solution of the direct transmission of attitudes from parents with similar attitudes (say attitude A) to the child. In fact this is the same as the solution to the maximization in equation X1 denoted. To start with the equilibrium in the partner game, the probability for the population of individuals of matching with a partner with similar attitudes (say A) is

$$\pi^A(q^A) = \pi(\alpha^A(q^A), \alpha^B(1-q^A), q^A)$$

while the equilibrium direct transmission rate, the probability of transmitting the parents own attitudes (say A) to the child is

$$P^{AA}(q^A) = p^A(q^A) + (1 - p^A(q^A))q^A$$

A.1.1.4 Results

Several implications can be derived from the partner game and the model of socialization of the child.

PROPOSITION 1. For any $0 < q^A < 1$ in equilibrium we have i.) the probability of matching in the restricted pool for individuals with attitude A ($\alpha^A(q^A)$) and the direct socialization effort/transmission of parents with attitude A on their child ($p^A(q^A)$) are strictly positive; the rate of homogenous matches of the population with attitude A is greater than the rate of homogenous matches associated with random matching, $\pi^A(q^A) > q^A$; the probability of direct transmission of attitude A is greater than oblique/indirect transmission, $P^{AA}(q^A) > q^A$; ii.) $\alpha^A(q^A)$ and $p^A(q^A)$ are decreasing in the fraction of the population with attitude A , q^A . Proposition 1. i.) implies that agents have incentives to search for homogenous matches (i.e. $\alpha^A(q^A) > 0$) and conditional on being matched homogenous, to transmit their attitudes to their child ($p^A(q^A) > 0$), given the convexity assumptions on costs $H1(\alpha^A)$ and $H2(p^A)$. Therefore, the matching process is biased to homogenous matches ($p^A(q^A) > q^A$), and the socialization is biased to direct transmission of attitudes ($P^{AA}(q^A) > q^A$).

PROPOSITION 2. For any $0 < q^A < 1$ in equilibrium we have i.) the probability of matching in the restricted pool for individuals with attitude A ($\alpha^A(q^A)$) and the direct socialization effort/transmission of parents with attitude A on their child ($p^A(q^A)$) and the rate of homogenous matches and socialization of the population with attitude A , $\pi^A(q^A)$, $P^{AA}(q^A)$, are decreasing in the cost of direct transmission of attitudes, $H2(p^A)$; ii.) $\alpha^A(q^A)$ and $\pi^A(q^A)$ are decreasing in the cost of homogenous matches $H1(\alpha^A)$, while $p^A(q^A)$ and $P^{AA}(q^A)$ are unaffected; iii.) $\alpha^A(q^A)$ and $\pi^A(q^A)$ are increasing in the degree of ΔV^A . Given convex enough cost $H1(\alpha^A)$ $\alpha^A(q^A)$ is decreasing and $\pi^A(q^A)$ is increasing, in the degree of ΔV^B . $p^A(q^A)$ and $P^{AA}(q^A)$ are increasing in ΔV^A but not changed by ΔV^B . Proposition 2. i.) implies that $\alpha^A(q^A)$ and $p^A(q^A)$ are decreasing in $H2(p^A)$. Therefore if $H2(p^A) > 0$ would have a negative effect on the probability of finding a match in the restricted pool and the probability of direct transmission of attitudes towards the child. Because the advantages for the individual to enter the restricted pool is that all

other individuals that are there have the same attitudes, say attitude A . But if the cost of entering the restricted pool is high, the best reply curve ($\alpha^A(\alpha^B, q^A)$) in Figure X2 are downward sloping. Proposition 2. ii.) implies $\alpha^A(q^A)$ and $\pi^A(q^A)$ are decreasing and $p^A(q^A)$ and $P^{AA}(q^A)$ are not changed by $H1(\alpha^A)$. Proposition 2. iii.) implies that a higher ΔV^A implies a higher probability of entering the restricted pool and an increase in direct transmission of attitude toward the child. Hence why the best reply curve ($\alpha^A(\alpha^B, q^A)$) in Figure X2 would have a shift upwards, which leads to increasing $\alpha^A(q^A)$. Proposition 2. iii.) also implies that a higher ΔV^B would decrease $\alpha^A(q^A)$ but not effect $p^A(q^A)$. A higher ΔV^B implies that $\alpha^B(q^B)$ and $p^B(q^B)$ increase, hence an upward shift of the best reply curve ($\alpha^B(\alpha^A, q^B)$) in Figure X2. Therefore if the probability for an individual with attitude A to match with a partner with dissimilar attitude in the common pool decreases. This would make that the individual have no/low incentive to enter the restricted pool, as she/he can be matched in the common pool, hence the equilibrium level of $\alpha^A(q^A)$ would be smaller. Proposition 2. iii.) also implies that given convex enough cost $H1(\alpha^A)$, the probability of homogenous matches increase for both the individuals with attitude A and B ,

A.1.1.5 Extension of the model

As mentioned earlier, individuals that are in couple also divorce. The utility of the child in a single-parent family is the solution of the following maximization problem in equilibrium

$$\pi^A(\alpha^A, a^A, a^B, q^A) [(1 - d)W^A_{\text{Homo}}(q^A) + dW^A_{\text{Single}}(q^A)] + [1 - \pi^A(\alpha^A, a^A, a^B, q^A)][(1 - d)W^A_{\text{Hetero}}(q^A) + dW^A_{\text{Single}}(q^A)] - H1(\alpha^A) \quad (\text{X6})$$

where $W^A_{\text{Single}}(q^A)$ is the gain from socializing the child through transmission of attitudes from a single parent, and $W^A_{\text{Homo}}(q^A)$ and $W^A_{\text{Hetero}}(q^A)$ from a parents with similar and dissimilar attitudes.

PROPOSITION 3. For any $0 < q^A < 1$ in equilibrium we have i.) the probability of matching in the restricted pool for individuals with attitude A ($\alpha^A(q^A)$) and the direct socialization effort/transmission of parents with attitude A on their child ($p^A(q^A)$) are decreasing in d , the probability of divorce. However, the probability of divorce does not affect the socialization transmission of parents

with similar attitudes and single-divorced-parent ($p^A_{\text{Homo}}(q^A)$ and $p^A_{\text{Single}}(q^A)$) and their rate of socialization ($P^{AA}_{\text{Homo}}(q^A)$ and $P^{AA}_{\text{Single}}(q^A)$) are also unaffected; ii.) the direct socialization effort/transmission of similar-attitude-parents with attitude A on their child ($p^A_{\text{Homo}}(q^A)$) is higher than single-divorce-parent ($p^A_{\text{Single}}(q^A)$), as well as their respective socialization rates, $P^{AA}_{\text{Homo}}(q^A)$ is greater than $P^{AA}_{\text{Single}}(q^A)$. Proposition 3. i.) implies that if the probability of divorce is higher there would be a lower probability of homogenous matches between individuals and direct transmission of attitudes to the child. Because individuals, due to the higher d , would anticipate that the match would not succeed, when searching for an individual in the partner game. Therefore, there is lesser incentive for individuals to find homogenous matches hence a lesser incentive for individuals to enter their restricted pool, as the value of these matches is lower due to higher d . This lesser incentive comes from the fact that individuals would anticipate a divorce due to the higher d , which means that the child would be socialized inefficiently. Proposition 3. i.) implies that in equilibrium parents with similar attitudes have a more efficient technology to socialize the child by direct transmission of attitude compared to a single-divorce-parent, hence why $p^A_{\text{Homo}}(q^A) > p^A_{\text{Single}}(q^A)$.

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