STEPFATHER INVESTMENT AND REPRODUCTIVE OUTCOMES AMONG US COUPLES

by

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DEDICATION

To my parents, Odalys de la Cruz and Rafael Gomez.

Thank you for your unwavering support and encouragement.

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ABSTRACT

Although paternal investment in humans is highly variable, many males invest heavily in offspring. Biological fathers invest more in children than stepfathers, yet stepfathers do invest in their stepchildren, possibly to gain mating access to the mother. Stepfathers are also more likely to be abusive and antagonistic towards their stepchildren than biological fathers. Most previous research quantifies the investment of stepfathers in relation to biological fathers. However, no studies have explored how investment and relationship quality influences reproductive outcomes for stepfathers. I examine how stepfathers' relationship quality with stepchildren associates with stepfathers' reproductive success (number of biological children born to the couple) by utilizing the National Survey of Families and Households longitudinal survey of American couples. I also examine how mother's financial autonomy may moderate the relationship between investment and reproductive success. Results show some evidence that stepfather investment can improve reproductive success, but these results are not particularly strong and may be difficult to interpret.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

The combination of life history traits representative of human reproduction including altricial infants, slow maturation and relatively short interbirth intervals (Mace, 2000) means that women cannot parent children alone and depend on assistance from alloparents such as close kin, mates, and even non-kin (Hrdy, 2005). The amount of contribution from fathers in the childrearing process varies from culture to culture (Hewlett, 1992; Geary, 2000). According to the show-off hypothesis, men hunt to receive prestige and attract mates (Hawkes, 1991; Hawkes et al., 2001; Hawkes and Bliege Bird, 2002; Iredale et al., 2008). Other studies suggest that while sometimes men engage in displays of generosity with the purpose of attracting potential mates (Gurven et al., 2000), they do not do so at the cost of provisioning for family and close kin (Marlowe, 1999; Hill and Kaplan, 1993; Gurven and Hill, 2009). There is also some debate on whether paternal investment represents parental investment or mating effort. Some scholars have argued that human paternal investment is a form of mating effort (Hawkes et al., 1995; Van Schaik and Paul, 1996) while others indicate that fathers are motivated to invest in their biological children, particularly if these are the children of his current mate (Hewlett, 1992; Marlowe,1999; Hill and Kaplan, 1993; Ziker, Nolin, and Rasmussen 2016). It is likely that male provisioning is a mix of paternal investment and mating effort, and men switch between these two strategies depending on which is more beneficial in their situation or may engage in both simultaneously. Men tend to invest the most in their biological children who are also the children of their current mate and the

least in non-biological children of previous mates (Anderson et al., 1999a; Anderson et al., 1999b). Some studies have documented that paternal investment in genetic offspring is diminished by separation from the child's mother (Anderson et al., 1999a; Anderson et al., 1999b). Research shows that men choose to switch investment from prior family to current family when they have biological children within their current household (Manning and Smock, 2000). Most of the published literature on stepparents has focused on drawing comparisons between genetic fathers and stepfathers (Anderson et al., 1999a; Anderson et al., 1999b; Daly and Wilson, 1985; Rohwer et al., 1999). This literature documents that while, on average, stepfathers do not invest as much as co-resident genetic fathers, they do invest in the children of their current mate, sometimes equally to non-residential biological fathers.

Benefits of Investment in Stepchildren

Men face a tradeoff between investing in the stepchildren of a current mate versus putting themselves back in the marriage market until they find a partner without children. While investing in stepchildren may be costly, time spent in the marriage market does not come without risk. According to Anderson (2000), becoming a stepfather is a strategy that provides males with low mate value an opportunity to produce biological offspring. Anderson (2000) found that men who opted to marry women with children from a previous union had higher fertility than men who never married. A study of Swedish couples during the 1970s and 1980s found that children from previous unions did not dampen a couple's intention to share a biological child (Vikat et al., 1999). Based on U.S. data from 1985, about half of remarried women gave birth within 24 months of remarriage (Wineberg, 1990).

Antagonistic Behavior of Stepfathers

Infanticide by foreign males during takeovers is something which has been observed in several species, such as Hanuman langurs (Hrdy, 1977), mountain gorillas (Watts, 1989), house sparrows (Veiga, 1990), barn swallows (Shields and Crook, 1987) and lions (Pusey and Packer, 1994). While infanticide by a replacing male is rare in humans, these extreme cases do exist and are more frequent in some cultures than others. Research has indicated that stepfathers can be antagonistic towards stepchildren and their mother. Among Ache women, infanticide is not an uncommon practice if a mother believes there is a high risk that her child may be murdered by its stepfather (Hill and Hurtado, 1996). According to a study by Daly and colleagues (1993), men are more likely to assault their partners and children in the household if there are children fathered by a previous male. The presence of stepparents seems to constitute a risk factor for child abuse (Daly and Wilson, 1985; Stiffman et al., 2002). A fairly common finding in the literature is that stepfathers are more likely to kill their stepchildren in violent attacks targeted towards the stepchild where genetic parents are more likely to kill their children in the context of inter-parental conflict, this was replicated in a Swedish population (Nordlund and Temrin, 2007). However, another study conducted on a Swedish population found that children living with one stepparent did not suffer an increased risk of infanticide (Temrin et al., 2000). Research suggests the risk of fatal abuse increases for children residing with a stepfather compared to children living with two biological parents (Daly and Wilson, 1985; Stiffman et al., 2002). Children from stepparent families face additional risk factors as compared to children living with both biological parents. They are more likely to leave home at earlier ages (Aquilino, 1991; Kiernan, 1992; Davis

and Daly, 1997; White and Booth, 1985) and are more likely to leave education in order to enter employment (Kiernan, 1992).

Socioeconomic Factors

It is important to consider that these studies examine correlations rather than causation. A study conducted by Malvaso et al. (2015) found that the higher rates of child injury in stepfamilies can be accounted for by other factors such as moving frequently and a mother's alcohol abuse. Another study conducted by Vogt Yuan and Hamilton (2006) found that close relationships with stepfathers improve child wellbeing. The study also found that the relationship quality between child and stepfather is mediated by maternal involvement (Vogt Yuan & Hamilton, 2006). It is possible that higher levels of conflict in stepfamilies are potentially a result of family composition rather than lack of genetic relatedness. In a Dutch study, adoptive families did not have an elevated risk of child maltreatment whereas one parent families, stepparent families, and large families did pose an elevated risk (van IJzendoorn et al., 2009). These findings indicate that socio-economic factors potentially play a crucial role in the experience of children living with stepparents.

Questions and Hypothesis

While much previous research has focused on the negative impact children experience living in stepfather households, we may predict that stepfathers who develop positive relationships with stepchildren gain greater benefits than those with antagonistic relationships (Lu, Zhu, and Chang, 2015; Vigil, Geary, and Byrd-Craven, 2006). While most research on stepfathers has focused on drawing comparisons between stepfathers and genetic fathers in investment strategies, there are no studies that look at whether the

relationship quality between stepfathers and stepchildren is associated with future reproduction of the stepfather and mother. In this study, I examine the association between stepfather-stepchild relationship quality and reproductive success of the stepfather / mother. I also examine the mother's context, including her education level and income, as this may influence her mate preference and in turn, the relationship between the stepfather and her children. For instance, if a mother can independently support herself and her offspring financially, then she may favor men with good parenting abilities over males with good financial prospects, while mothers without financial autonomy may have to favor men with good financial prospects over those with good parenting abilities. I make two predictions: 1) positive relationships between stepfathers and stepchildren will be correlated with reproductive success for the stepfather and 2) when mothers have greater financial autonomy, the association between stepfather-stepchild relationship and reproductive success will be greater, while less financial autonomy of the mother will reduce the association between stepfather-stepchild relationship and reproductive success.

CHAPTER TWO: METHODS

To examine these predictions, I utilized data from the National Survey of Families and Households (https://www.ssc.wisc.edu/nsfh/) (Sweet et al., 1988; Sweet and Bumpass, 1996; Sweet and Bumpass, 2002). This dataset collected extensive data on family dynamics, including an oversampling of single parent families as well as stepfamilies. The National Survey of Families and Households (NSFH) is conducted on U.S population through a representative sample (Sweet et al., 1988; Sweet and Bumpass, 1996; Sweet and Bumpass, 2002). One adult is chosen at random to be the primary respondent, and the survey is composed of three different waves. Wave 1 was conducted from 1987-1988 and interviews with primary respondents ranged from 40 minutes to an hour. Some components were self-administered because of sensitive information. During the first wave, the partner of the primary respondent was given a shorter questionnaire. Wave 2 interviews were conducted from 1992-1994 and primary respondents were interviewed along with their current partner, as well as their partners from Wave 1 (if relationship had been terminated). Telephone interviews were also conducted with focal children from Wave 1. Focal children are any children in the household who were between the ages of 13 and 18. Wave 3 interviews took place from 2001-2002, primary respondents were interviewed as well as partners from Wave 1 along with focal children from Wave 1, regardless of the status of these relationships.

Variables of Interest

The survey contains extensive interviews on primary respondents (Wave 1-3), their current partner (Wave 1-3), as well as stepchildren and biological children (Wave 2 and 3). Surveying 789 stepfamilies including primary respondents from the survey who were stepfathers and women whose current partner was a stepfather to their children. This study excludes any couples where the stepchildren are not living in the household or couples who began their relationship when the woman was 40 years old or older (given that women are less likely to reproduce after age 40) leaving a sample of 301. Relationship quality will be measured by two different variables: investment and antagonism. Antagonism will be quantified by how often stepfathers engage in antagonistic behavior with their children, measured as the average of how frequently the stepfather yells or how often they spank or slap the child which are both measured on a scale from 1 (never) through 4 (very often), averaged across all children in the household. Investment will be quantified as the average of how often the stepfathers invest time on their stepchildren, the exact variables include time engaging in private talks or activities with their stepchildren at home, how often he engages in leisure activities with them outside the home, and how often he helps them with homework. Investment will be averaged across these activities using the scale 1= never or rarely to 6= almost every day. Models will include the following control variables: marriage status of the couple (either married or cohabitating), the duration of their relationship (measured in years), number of stepchildren living in the household (biological children of the mother prior to remarriage), average age of those children, level of education of the mother, mother's income, as well as the presence of the stepfather's own biological children in the

household. The presence of previous biological children will be a categorical variable so that men without prior children are included in the category "no prior children". An additional analysis will examine whether there are significant interaction effects between mother's education / income and relationship quality, as I predict that the effect of relationship quality may be greater for mothers with more autonomy.

Statistical Analysis

To determine whether stepfather investment is associated with future reproduction, I determined the distribution of the dependent variable (number of offspring born to the mother and stepfather). The number of future offspring is best represented by a Poisson model (where the mean and variance of the distribution are equal) so this model is used to examine the effects of stepfather investment and antagonism on future fertility. Given that the number of births is relatively low, I also conduct a logistic regression model where I compare those who go on to have biological offspring with those who do not. These models are analyzed using R version 4.0.3. Assumptions are checked to verify appropriate model fit.

The sample size of 301 should provide sufficient power to identify effects, given an alpha value of 0.05, power of 0.9, base rate of births of 0.25, meaning 25% of couples will have a birth in each year, and an effect size of 1.5. Based on data from 1985, about 50% of women have a birth within 24 months of remarriage, suggesting a rate of birth of about 25% of couples in each year (Wineberg, 1990). Since this type of analysis has not been done before, it is hard to predict an effect size. Unfortunately, I am limited by the number of stepfather/stepchildren families included in the survey as they are only a fraction of families followed in longitudinal studies.

CHAPTER THREE: RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics of the sample. There are 301 couples who are followed that meet the inclusion criteria. On average, men had 1.5 stepchildren. When examining the distribution of investment activities, the proportion of men reporting that they engage in activities is quite broad with some men reporting that they never engage in activities and others reporting that they engage in activities every day. Although the original sample size was 301, some participants failed to respond to all the questions, particularly in Wave 2 thus there are some missing responses for relationship duration and whether or not the couple went on to have their own biological children. Mother's education was measured on a scale from zero (no formal education) through twenty (doctorate/professional degree). Future fertility was measured using a continuous and a binary variable, where the binary variable indicates that the couple went on to have one or more children.

Table 1 Descriptive statistics of variables

Continuous variables	**Mean**	**SD**	**N**	**Missing**
number of stepchildren	1.54	0.81	301	0%
(average) age of stepchildren	10.53	4.44	301	0%
mother's income ($)	11,679	15,714.58	283	5.98%
stepfather's income ($)	21,575.33	17,421.44	263	12.62%
relationship duration	9.29	4.06	231	23.26%
mother's education	12.34	2.26	298	1.00%
Investment (average of investment variables)	3.46	1.24	301	0.00%
Antagonism (average of antagonism variables	2.21	0.68	300	0.33%
Number of biological children	0.26	0.58	246	18.27%
Binary variables	**Yes**	**No**	**N**	**Missing**
had children	50	191	241	19.93%
biological children in household	106	195	301	0%
married?	241	60	301	0%
	Female	**Male**	**N**	**Missing**
Sex of main respondent	66	235	301	0%
Categorical variables	**N**		**Total N**	**Missing**
Private talks			**269**	**10.63%**
Never	39	12.96%		
once a month/less	54	17.94%		
several times a month	57	18.94%		
about once a week	50	16.61%		

several times a week	47	15.61%		
almost everyday	22	7.30%		
Outside activities	**N**		**301**	**0%**
Never	29	9.63%		
once a month/less	55	18.27%		
several times a month	103	34.22%		
about once a week	60	19.93%		
several times a week	33	10.96%		
almost everyday	22	7.30%		
Home activities	**N**		**300**	**0.33%**
Never	24	7.97%		
once a month/less	44	14.62%		
several times a month	56	18.60%		
about once a week	45	14.95%		
several times a week	84	27.90%		
almost everyday	47	15.61%		
Reading/ Doing homework	**N**		**297**	**1.33%**
Never	68	22.59%		
once a month/less	38	12.62%		
several times a month	52	17.28%		
about once a week	37	12.29%		
several times a week	65	21.59%		
almost everyday	37	12.29%		
Spank/Slap	**N**		**298**	**0.99%**

Never	116	38.54%		
Seldom	125	41.53%		
Sometimes	50	16.61%		
very often	7	2.33%		
Yell	**N**		**299**	**0.66%**
Never	34	11.30%		
Seldom	89	29.57%		
Sometimes	140	46.51%		
very often	36	11.96%		

*Note: mother's education was quantified using numbers ranging from 0-20 with 0 being equivalent to no formal education and 20 being the equivalent of a PhD or professional degree.

Base Model: Examining Control Variables

First, I examined the confounding variables to determine if they were predictive of future fertility outcomes using two models: Poisson model (predicting number of additional offspring) and logistic model (predicting whether the couple had any additional children). The number of stepchildren had no effect on whether the couple would go on to have children (Poisson: B= -.34, p=.155) (Logistic: B= -.44, p=.133). The age of stepchildren was highly significant on whether the couple would have children, this finding was consistent across all models (Poisson: B= -.22, p<.001) (Logistic: B=-.3, p<.001), where older average age of stepchildren had an overall negative effect on fertility. The income of mothers (Poisson: B=.03, p=.612) (Logistic: B= .009, p=.799) and stepfathers (Poisson: B =-.02, p=.65) (Logistic: B =.06, p=.521) was also not a significant confounding variable in either model. Mother's education was not a

significant predictor of future fertility in either model (Poisson: B=.02, p=.744). (Logistic: B= .07, p=.502). Marriage status (Poisson: B= .54, p=.127) (Logistic: B= 1.01, p=.08) and relationship duration had no effect on whether the couple would go on to have children. Since average age of stepchildren is the only significant predictor of future fertility, it is the only control variable I include in subsequent models (see below).

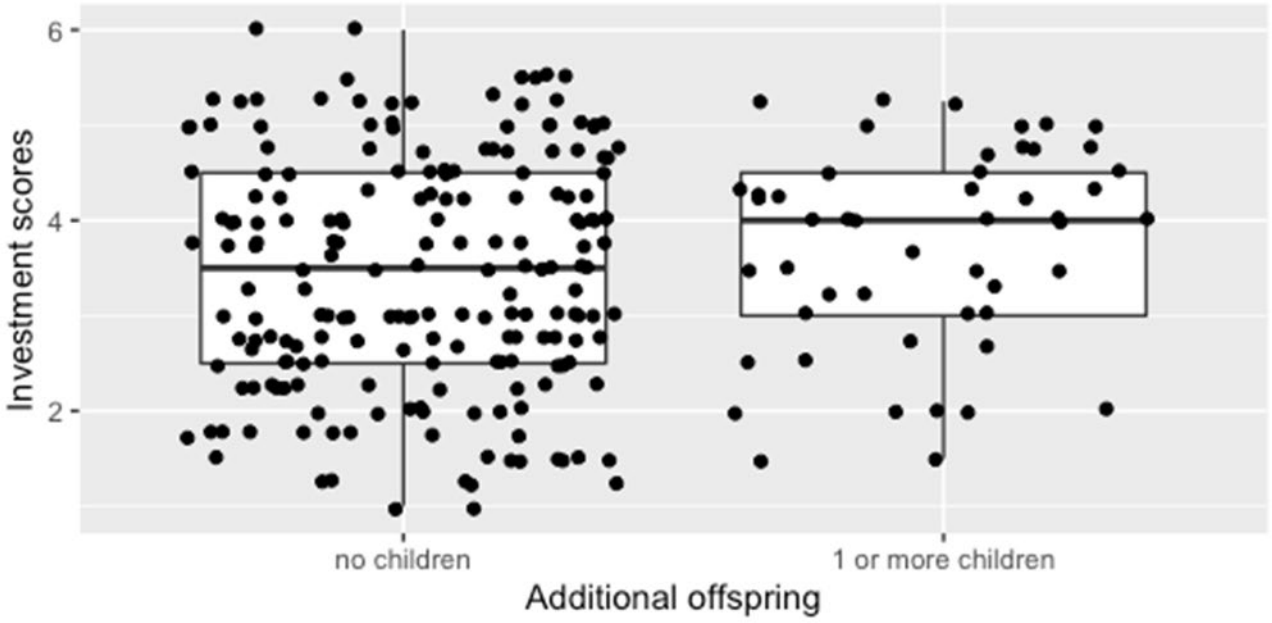

Figure 1 Boxplot of Stepfathers' investment scores based on whether or not the couple had children. Investment scores were acquired by taking the average of all of the investment categories. On average men who went on to have one or more children tend to have slightly higher investment scores than men who had no biological children

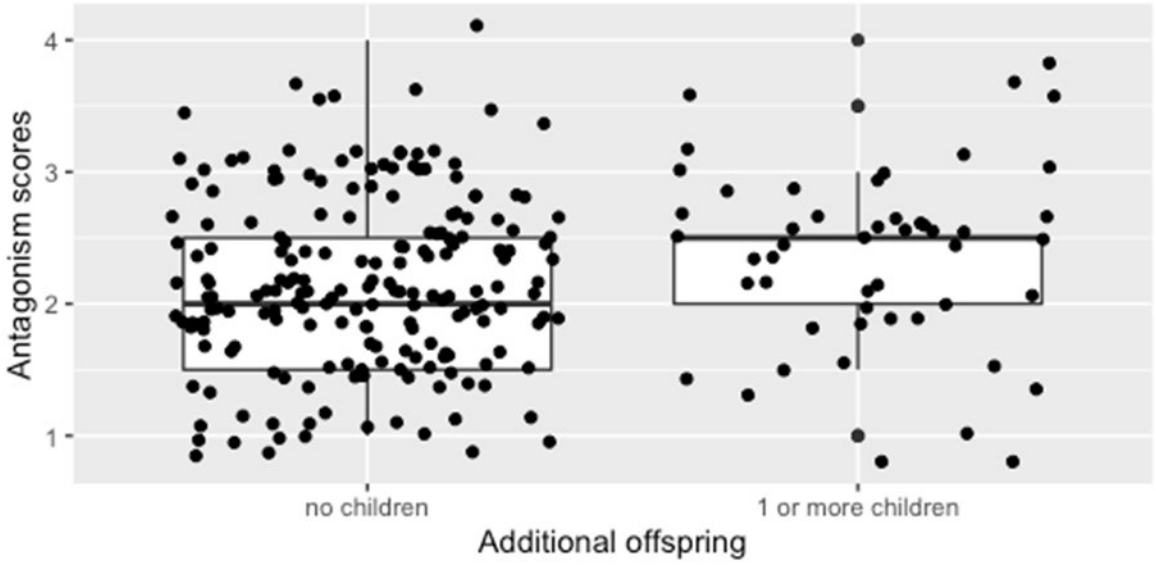

Figure 2 Boxplot of Stepfathers' antagonism scores based on whether or not the couple had children. Antagonism scores were acquired by acquiring the average of all of the antagonism categories. Stepfather's who went on to have one or more child also had slightly higher antagonism scores however this was not significantly different.

Table 2 Correlation Matrix

	Private talks		**Outside activities**		**Home activities**	
	R	**P-value**	**R**	**P-value**	**R**	**P-value**
Private talks	1.00	N/A	0.48	<0.01	0.63	<0.01
Outside activities	0.48	<0.01	1.00	N/A	0.55	<0.01
Home activities	0.63	<0.01	0.55	<0.01	1.00	N/A
Reading/Doing HW	0.64	<0.01	0.47	<0.01	0.51	<0.01
Spank/Slap	0.21	<0.01	0.11	0.06	0.26	<0.01
Yell	-0.02	0.76	-0.08	0.15	0.09	0.11
	Reading/Doing HW		**Spank/Slap**		**Yell**	
	R	**P-value**	**R**	**P-value**	**R**	**P-value**
Private talks	0.64	<0.01	0.21	<0.01	-0.02	0.76
Outside activities	0.47	<0.01	0.11	0.06	-0.08	0.15
Home activities	0.51	<0.01	0.26	<0.01	0.09	0.11
Reading/Doing HW	1.00	N/A	0.12	0.04	-0.05	0.40
Spank/Slap	0.12	0.04	1.00	N/A	0.37	<0.01
Yell	-0.05	0.40	0.37	<0.01	1.00	N/A

To examine whether investment or antagonism influenced later fertility outcomes, I ran a correlation matrix in order to see if there was a correlation between investment variables and antagonism variables (Table 2). All four investment variables were correlated with each other as were antagonism variables while the correlation across investment and antagonism variables were less strongly and, in some cases, there was a negative correlation (Table 2). I ran two models: a Poisson model (predicting number of future offspring) and a logistic regression model (predicting whether any children were produced). I included the average age of stepchildren as a control variable, since it was the only significant control variables. First, I ran both models using the composite variables of all the investment and antagonism variables. Neither investment (Poisson: B=.06, p=.615) (Logistic: B=.01, p=.94) or antagonism (Poisson: B= .135, p= .48) (Logistic: B=.15, p=.59) had a significant effect on the number of biological children.

I decided to run investment and antagonism variables separately, in order to see if any of the individual variables had a significant effect. In one of the models (see Table 5 & 6) I included all of the investment and antagonism variables which applied to men with younger stepchildren (under 5) as well as older stepchildren (5-18). In this model none of these independent variables were significant. Investment variables include the time stepfathers spend engaging in outside activities (Poisson: B=.02, p=.57) (Logistic: B=-.2, p=.364), home activities (Poisson: B= -.13, p=.992) (Logistic: B= .04, p=.242), reading or helping with homework (Poisson: B= .15, p=.07) (Logistic: B= .15, p=.157). Antagonism variables were also not significant on whether the couple would go on to have their own biological children, including how often they yell (Poisson: B=.06, p=.72) (Logistic: B=.16, p=.53) and spank/slap (Poisson: B= .11, p=.53) (Logistic: B=-.004,

p=.987) their stepchild. I decided to run two additional models in which I added private talks. The reason why I decided to run private talks in a separate model was because this variable was only included for men who had older stepchildren. When private talks was added to the Logistic and Poisson models (see Table 5 & 6, right columns), the frequency in which stepfathers engaged in private talks with their stepchildren had no significant effect on births (Poisson: B= .016, p= .9)(Logistic: B= .03, p= .87) however reading/ doing homework had a positive effect on the number of biological children the couple went on to have (Poisson: B= .269, p= .0262), these findings were not replicated in the logistic model (B= .198, p= .214).

Table 3 Logistic regression model predicting the likelihood that couples had at least one offspring based on the average of antagonism and investment scores

	Had biological kids		
	B	**SE**	**P-value**
Intercept	0.68	1.020	0.504
Antagonism average	0.15	0.27	0.59
Investment average	0.01	0.16	0.94
Average age	-0.26	0.05	<0.001

Table 4 Poisson regression model predicting number of future offspring based on the average of antagonism and investment scores.

	Number of biological children		
	B	**SE**	**P-value**
Intercept	-0.07	0.730	0.919
Antagonism average	0.135	0.19	0.48
Investment average	0.06	0.12	0.615
Average age	-0.21	0.03	<0.001

Table 5 Logistic regression model with all investment and antagonism variables. Left column excludes the frequency of "private talks" (a variable only included for older children) while the right column includes the frequency of "private talks" variable.

	Had a biological child					
	B	**SE**	**P-value**	**B**	**SE**	**p-value**
Intercept	0.685	1.100	0.533	0.006	1.257	0.996
outside activities	-0.199	0.172	0.249	-0.308	0.205	0.133
home activities	0.044	0.156	0.779	0.113	0.196	0.564
reading/doing homework	0.152	0.123	0.217	0.198	0.159	0.214
spank/slap	-0.004	0.255	0.987	-0.068	0.218	0.808
yell	0.156	0.248	0.529	0.323	0.276	0.242
average age	-0.274	0.053	<0.001	-0.257	0.06	<0.001
private talks				0.029	0.179	0.871

Table 6 Poisson model predicting number of future offspring with all investment and antagonism variables. Left column excludes "private talks" variable, while the right column includes it.

	Had a biological child					
	B	**SE**	**P-value**	**B**	**SE**	**p-value**
Intercept	0.192	0.79	0.808	-0.436	0.967	0.632
outside activities	0.022	0.115	0.85	-0.086	0.145	0.553
home activities	-0.128	0.109	0.243	-0.109	0.144	0.449
reading/doing homework	0.153	0.085	0.071	0.269	0.121	0.026
spank/slap	0.113	0.18	0.532	0.044	0.21	0.831
yell	0.065	0.177	0.715	0.218	0.208	0.296
average age	-0.239	0.04	<0.001	-0.223	0.047	<0.001
private talks				0.016	0.13	0.9

Table 7 Interaction of education with investment

	Poisson Model			**Logistic Model**		
	B	**SE**	**p-value**	**B**	**SE**	**p-value**
Intercept	-1.64	2.86	0.57	1.42	3.17	0.66
Average age of stepchildren	-0.21	0.03	<0.001	-0.26	0.05	<.001
Education	0.16	0.24	0.501	-0.03	0.26	0.9
Investment	0.6	0.7	0.39	-0.05	0.81	0.96
Education*Investment	-0.05	0.06	0.43	0.004	0.07	0.94

Table 8 Interaction of education with antagonism

	Poisson Model			Logistic Model		
	B	**SE**	**p-value**	**B**	**SE**	**p-value**
Intercept	1.4	2.16	0.517	2.76	3.13	0.38
Average age of stepchildren	-0.21	0.03	<0.001	-0.26	0.05	<.001
Education	-0.1	0.17	0.56	-0.17	0.25	0.5
Antagonism	-0.33	0.93	0.72	-0.69	1.35	0.6
Education*Antagonism	0.04	0.08	0.61	0.07	0.1	0.52

Table 9 Interaction of income with investment

	Poisson Model			Logistic Model		
	B	**SE**	**p-value**	**B**	**SE**	**p-value**
Intercept	1.34	0.97	0.16	3.32	1.5	0.03
Average age of stepchildren	-0.204	0.03	<0.001	-0.27	0.05	<.001
Income	-0.18	0.12	0.15	-0.31	0.17	0.08
Investment	-0.32	0.27	0.22	-0.73	0.4	0.07
Income*Investment	0.06	0.03	0.09	0.1	0.05	0.04

Table 10 Interaction of income with antagonism

	Poisson Model			Logistic Model		
	B	**SE**	**p-value**	**B**	**SE**	**p-value**
Intercept	-0.08	0.96	0.94	0.65	1.34	0.63
Average age of stepchildren	-0.2	0.04	<0.001	-0.26	0.05	<.001
Income	0.04	0.12	0.75	0.01	0.17	0.95
Antagonism	0.12	0.39	0.75	0.03	0.55	0.96
Income*Antagonism	-0.002	0.05	0.96	0.02	0.07	0.83

Interactions: Does Mother's Education or Income Moderate These Effects?

I ran a Poisson model (predicting number of future offspring) and a logistic regression model (predicting whether the couple had any future offspring) in order to see if mother's education moderates the relationship between stepfather's investment/antagonism and future fertility (see Tables 7 & 8). There was no significant interaction between mother's education and stepfather's antagonism towards their stepchildren (Poisson: p= .61) (Logistic: p= .52). Also, there was no significant interaction between mother's level of education and investment (Poisson: p= .43) (Logistic: p= .94). The only variables which had a significant interaction were income and investment (Poisson: p=.04) however the interaction was not significant in the Logistic model, although the p value was still low when compared to the p value for the other interactions (Logistic: p=.09).

I ran the same models in order to look at the interaction between mother's income and stepfather's antagonism towards their stepchildren (Tables 9 & 10). No interaction was found between income and antagonism (Poisson: p=.96) (Logistic: p=.83).

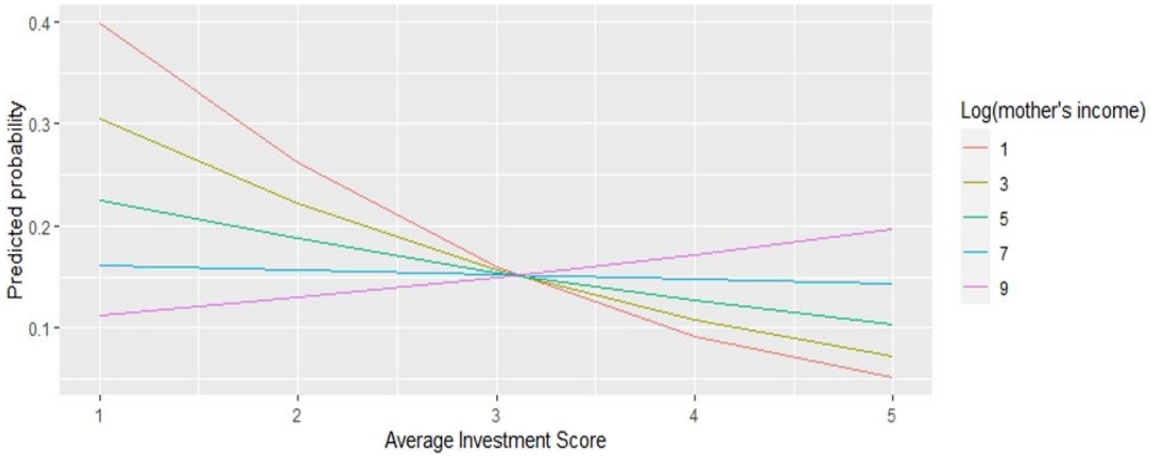

Figure 3 Linear graph of interaction between mother's income and average investment of stepfathers. We see the effect is stronger for lower income women as represented by the red line. For lower income women investment seems to have a negative effect on fertility.

CHAPTER 4: DISCUSSION

My analyses showed that investment in stepchildren had minimal impact on whether the stepfathers would go on to have their own biological children. The only variable with a significant effect on biological children was the frequency stepfathers spend reading/doing homework with stepchildren, which was significant in the model that included the variable, amount of time in private talks. This significant result only occurred in the Poisson model, but not the logistic model, suggesting that the effect is not very robust. One variable which was highly significant on whether couples would go on to have children was the average age of stepchildren. This makes sense since women with younger children tend to be younger while women with older children tend to be older, although my analyses did not control for maternal age, so it is impossible to determine if age of the children or age of the mother drives these effects. Also, some studies have shown that women with older first children are less likely to have a second child regardless of the woman's age (Wang et al., 2019).

Although the frequency of reading/doing homework with stepchildren was the only investment variable that was significant and it was only significant in Poisson model, it is still a compelling finding. Reading and doing homework became significant when private talks was added to the model. This is possibly because this effect is more significant for couples with older school age children (since the private talks variable limited the sample to older children). The effect was only significant in the Poisson model and not the logistic model, meaning that time spent doing homework or reading did not have a significant effect on whether the couple would have another child, but it

had an effect on how many children the couple went on to have. The reason reading and doing homework had the strongest effect, particularly for couples with school aged children can probably be attributed to helping with homework being more of a necessity than any of the other investment variables. By helping children with homework, stepfathers are sharing the responsibility of domestic labor, and taking the burden off their female partners. This finding supports what's been consistently found in the literature, when working women still do a disproportionate amount of domestic labor fertility drops (Raybould and Sear, 2020).

I predicted that there would be an interaction between mother's income / education and investment / antagonism based on the logic that women who have more resources and more bargaining power would expect their partners to invest more in direct care or at the very least would choose a partner who is not antagonistic towards their children. There was no interaction between mothers' level of education and income and their partner's level of antagonism. Also, the interaction between mother's income and investment was still somewhat weak. One reason why the interactions between women's level of education and stepfather level investment or antagonism was not significant could be a result of mate selection. Men who are less likely to invest and are more likely to act antagonistically towards stepchildren were probably not chosen as a mate in the first place. A study found that women value traits associated with family commitment in their partners and females who had children from previous unions were more likely to demand these traits associated with commitment such as "reliable", "balanced", and "emotional" than women who had no children from previous unions (Bereczkei et al., 1997). The same study found that women who mentioned having children from previous

unions made higher demands in general than women who did not mention having children. However, there are studies which contradict these findings. Some studies have found that women who have children tend to partner with lower quality mates (Graefe and Lichter, 2007; Lichter and Qian, 2008). Thus, it is also possible that level of education does not significantly increase the bargaining power of women who already have children, which may explain the lack of a significant interaction. I was able to find a significant interaction between investment and income, however this was only evident in the logistic model, not the Poisson model thus it is difficult to decipher how robust this effect truly is. However, the significance of the interaction does somewhat support my hypothesis that stepfathers who invest more are a bit more likely to have additional children when partnered with high income women, but the effect appears to be negative when partnered with lower-income women. As I've previously cited, in dual income households, fertility increases when men contribute more to domestic labor (Raybould and Sear, 2020). Unfortunately, information on income was collected at time of interview (during the relationship with the stepfather), so many women had low incomes because they were not participating in paid employment. Stay-at-home women may have needed less direct investment from their male partners, which may explain this negative effect.

There was no correlation between stepfather's income and future reproductive success, which could be a result of low fertility outcomes for most couples in the US. Total fertility rate (TFR) in the US in 1990 was 2.08 remaining mostly flat through 2001 where TFR was 2. This corresponds to my finding that only 20.7% of couples went on to have more children following remarriage (Hamilton et al., 2003). In many societies with

natural fertility, wealth is one of the most important predictors of a man's reproductive success. Among pastoralists, wealthier men tend to have higher rates of reproductive success (Mulder, 1987; Flinn, 1986) and among foragers, better hunters also have higher rates of reproductive success (Smith, 2004). Although in US populations men with higher income don't have more children on average, they are more likely to marry and if divorced more likely to remarry, as well as less likely to remain childless (Hopcroft, 2020).

Human females rely on a variety of other alloparents to help raise offspring (Hrdy, 2005). According to the grandmother hypothesis, one potential reason why women live past their reproductive age could be to aid their daughter's reproduction (Hawkes et al., 1998). In subsistence societies, grandmothers are primarily responsible for provisioning weaned children, allowing daughters to have another child sooner (Hawkes, O'Connell, and Blurton Jones 2001). A cross cultural study conducted by Sear and Mace (2008) on the relationship between alloparent presence and child survivorship found that fathers have little effect on child survival and aside from mothers it is often extended family, particularly grandmothers have a more impactful effect on child survival, although this only examined survival through the first five years of life. According to a study by Schaffnit & Sear (2017), high paternal investment can sometimes have a negative effect on future reproduction because it may suggest that the partner is unemployed. The correlation between investment and fertility is highly dependent on context. In the Netherlands, practical support from family is positively correlated with women's fertility (Kaptijn et al., 2010; Thomese and Liefbroer, 2013) while in Asian countries only support from in-laws has positive effect on fertility

(Thornton et al., 1986; Chi and Hsin, 1996; Tsay and Chu, 2005; Fukukawa, 2013). Evidence supports that humans rely on many alloparents, in fact often times other alloparents surpass fathers in terms of significance. It is possible that women aren't making fertility decision solely based on paternal investment and instead they are making their reproductive decisions based on the availability of other alloparents, which were not captured in this study.

Another explanation for the lack of significant findings in this research could be that women cannot determine a man's likely paternal investment through men's investment in stepchildren. Based on a study conducted by Fine et al. (1998), stepfamilies often disagree on what the role of stepparents should be. It is possible that mothers come to the conclusion that how a man is as a stepfather is not a good proxy for what he will be like with his biological children, explaining the null effect of stepfather investment on future fertility (Ganong and Coleman, 1995; Levin, 1993).

Limitations of the Study

One potential limitation of the study is the smaller sample size. Although, based on a power analysis I conducted, it would take a sample of about 15,284 in order to find a significant effect with the given effect size. The large size of the theoretical sample may suggest that these differences are small across investment scores thus this may not be an issue with lack of power. In addition, not all of the respondents answered all the questions, especially during Wave 2 where couple's fertility and relationship duration was tracked. Other factors which would have improved the study, would be controlling for mothers' age as well as stepfathers' age. Although man's age is not perceived as having a very strong effect on fertility, some studies have found that women with older

husbands tend to have less children (Wang et al., 2019). Another factor I would control for is for the number of children the stepfather has. However, it is possible that this may not have such a strong effect since men are less likely to live with their children. Also, whether men had children living in the household did not significantly impact the couple's fertility. Another limitation to the study was that there was not a lot of variation in couple's fertility. It is difficult to analyze fertility as an effect in a population where fertility tends to be relatively low (Dribe et al. 2017). In this particular study, not many couples went on to have children, the effect would be stronger if there were more couples who went on to have at least one or more children, increasing the sample size could potentially fix this.

Future Directions

In a few bird species grown offspring delay dispersion and remain with their parents in order to help rear successive broods and litters (Gowaty and Lennartz, 1985). In bird species, helpers of the nest are more likely to be sons (Lennartz, 1983). The gender of the helper tends to shift when looking at humans. Turke (1988) found that elder daughters in particular have a positive effect on a woman's fertility. However, a study conducted by Hames and Draper (2004) found that the sex of the eldest children had no effect on mother's fertility or the survival of their offspring. Although in my study, the presence of older stepchildren had a negative effect on fertility it would be interesting to see how the gender of these older stepchildren affects future fertility. It is possible that stepchildren who have a positive relationship with their stepfathers may be more likely to care for younger siblings.

Humans cooperate significantly when it comes to reproduction and childrearing (Hrdy, 2005). As previously stated during the discussion session, the amount of investment from fathers does not always contribute to child survivorship or future fertility (Hewlett, 1992; Geary, 2000) and mothers often rely on the assistance of a variety of alloparents (Hrdy, 2005). For a future study, it would be interesting to include mother's kin network and support from kin as a potential variable influencing women's fertility.

Based on my results, I suspect that there may be a tradeoff between father's material investment and paternal investment. The kind of support which is optimal for fertility probably varies based on the mother's own situation, the needs of lower income women or women who don't work are probably different from the needs of higher income working women. A study on female fertility intentions in South Korea found that higher levels of paternal investment in terms of childcare enhanced women's intentions to have second child, this was particularly pronounced among working women (Park et al., 2010).

Conclusion

It is safe to conclude that none of the findings were highly significant in this particular study. Although, the few significant changes we were able to find seem to trend towards a similar direction. These findings do support my hypothesis that stepfathers who invest more in their stepchildren do benefit from some reproductive success in certain contexts. Higher investment from stepfathers tend to pay off in dual income households, and to some extent higher investment may lead to having more children although it may not affect the likelihood of having another child. It is possible that if the study was

improved, for instance in the ways I have outlined above, then we would be able to find more robust and consistent findings.

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