WHAT HAPPENS WHEN WE RANDOMLY ASSIGN CHILDREN TO FAMILIES?*

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Abstract

I use a new data set of Korean-American adoptees who, as infants, were randomly assigned to families throughout the U.S. I examine the treatment effects from being assigned to a high income family, a high education family or a family with four or more children. I also examine the transmission of income, education and health characteristics from adoptive parents to adoptees. I compare these coefficients of transmission to the analogous coefficients for biological children in the same families. Being assigned to a large family reduces an adoptee's probablity of graduating from college by 8 percentage points (versus a 4.8 percent effect for non-adoptees). Having a college educated mother increases an adoptee's probability of graduating from college by 7 percentage points, but raises a biological child's probability of graduating from college by 26 percentage points. Transmission of drinking and smoking behavior from parents to children is as strong for adoptees as for non-adoptees. In contrast, for height, obesity, and income, transmission coefficients are significantly higher for non-adoptees than for adoptees. Sibling gender composition does not appear to affect adoptee outcomes, though the number of adoptee siblings versus biological siblings does matter.

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I. Introduction

Social scientists have long been interested in the effects of family and neighborhood environment on children's outcomes and the transmission of parental characteristics to children. For example, Black, Deveraux and Salavanes [2003] show that exogenous shocks to mother's education have small effects on children's educational attainment, while Currie and Moretti [2003] show that mother's education has a causal link to children's health. In a well known experiment Katz. Kling and Liebman [2001] and Ludwig, Duncan and Hirschfield [2001] look at the effects of moving to a different neighborhood on children's educational outcomes, employment and involvement with crime. And there are large literatures that deal with the effects of schools and neighborhoods on children's test scores, educational attainment, income, and health (e.g. Evans Oates and Schwab [1992], Case and Katz [1991], Hanushek, Kain and Rivkin [1998], Hoxby [2000]).

This paper uses adoption in infancy as a form of grand intervention in which children are assigned a particular set of adoptive parents, thereby creating exogenous variation in the family, neighborhood and school environment. The adoptees in the study are Korean-Americans placed by Holt International Children's Services during 1970-1984. The adoptees are randomly assigned to families. Conditional on the family being certified by Holt to adopt, Holt uses a strict queueing (first-come first-served) policy to assign Korean adoptees to families. I examine the degree to which child's income, educational and health outcomes are affected by the adoptive parents' inputs.[1]

I find that mother and father's level of education has a modest impact on the adoptees' educational attainment and income. For example, an additional year of mother's education raises the adoptee's years of education by .07 years. This effect is highly statistically significant, but is only 1/5 the size of the corresponding effect for non-adoptees (biological children raised in the same families). My estimated treatment effects for the adoptees are smaller than those found by Bjorkland Lindahl and Plug [2004], and this difference may be driven by the lack of selection of the Holt adoptees into families. Consistent with Case, Lin and McLanahan [2000], the quality-quantity tradeoff experienced by adoptees is very large. Growing up in a family of four or more children versus a smaller family reduces an adoptee's probability of attending college by 8 percentage points.[2]

The experiment of being adopted into one family versus another is potentially a much larger intervention than the experiments normally contemplated by social scientists. For example, the Moving to Opportunity experiment (Katz, Kling and Liebman [2001] and Kling, Ludwig and Katz [2004]) shifts the complier subjects neighborhoods and schools but generally leaves the family unit intact. And for most MTO subjects the intervention begins in adolescence rather than in infancy as in the case of adoption. Other experiments such as charter school lotteries (Cullen, Jacobs and Levitt [2004], Rouse [1998]) or school redistricting (Vigdor and Nechyba [2003]), create exogenous variation in the school attended by the child. without directly altering the neighborhood or family influences. And some experiments shift the peer group without shifting the school or neighborhood (Hoxby [2000], Angrist and Lang[2002], Sacerdote [2001], Zimmerman [2002], Foster [2003]).

Adoption into a high versus low SES family is in some ways the maximum possible intervention since every aspect of the adoptee's life is different. This is both good and bad for the interpretation and use of the estimates produced. On the positive side, I can argue that I am measuring an upper bound of the possible effects from policies that seek to improve child's

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[1] Economists have recently become interested in looking at the experiment of adoption and Bjorkland, Lindahl and Plug [2004] is the largest and most comprehensive study to date.

education or income by altering the school, neighborhood or family environment. Under strong assumptions, I can express my results as a percent of the variation in child outcomes that can be attributed to variation in nurture. On the negative side, I can not sort out causal pathways by which the parent's SES affects the children. Adoptive parent's income, education, neighborhood and school quality all co-vary in the known ways.

A natural question is whether or not adoption studies and mine in particular are relevant for understanding outcomes for non-adoptees. The first point to note is that slightly more than 2 percent of all children in the US live with an adoptive mother and father, so there are roughly 1.4 million adoptees under age 18 for whom adoption policy is directly relevant. But beyond this point, whenever we contemplate interventions to improve children's educational attainment and income, we are considering environmental interventions that are a subset of the massive intervention implied by sending an adoptee to a high education family rather than a low education family. Even though these families are all pre-screened as being eligible to adopt through Holt, I show that there is still a large amount of variation in family income, parental education, and in the outcomes for the biological children in the families.

The adoptees in the sample have roughly .9 fewer years of education than the non-adoptees in the same families. But there is still substantial overlap in the distribution of outcomes for adoptees and non-adoptees. The fact that all of the adoptees are Korean American may influence some of the findings and I raise this point several times in discussing the results.

[2] This might be a quality-quantity tradeoff or it might be something unmeasured about the large families of adoptees. Either way the effect is much stronger for adoptees than non-adoptees.

A Brief History of Holt and Korean-American Adoption and the Assignment Process

Harry and Bertha Holt effectively invented international adoption in Seoul, Korea in 1956. The Holts built a fortune in lumber, farming and fishing in Oregon. The Korean War created a large group of orphans and a smaller group of children of U.S. Servicemen with Korean mothers. The Holts successfully lobbied the U.S. Congress for changes in immigration law which facilitated adoption of Korean children by Americans. The South Korean government then set up a formal process for international adoptions. Roughly 60,000 Korean children have been adopted into US families since 1955, and Holt was involved in 2/3 of these. Holt currently places about 1,000 Korean adoptees per year, and hundreds more from China and from programs in Bulgaria, Ecuador, Guatemala, Hong Kong, India, Korea, Mongolia, Philippines, Romania, Thailand, and Vietnam.

The process of adopting through Holt's Korea program takes roughly 12-18 months from initial application to bringing home the adoptee. The major steps include filing an application, participating in several home study meetings, being matched with an adoptee, the adoptee flying to the U.S., and legally adopting the child in family court. This is an extensive and thorough process requiring numerous meetings with adoption agency officials and numerous exchanges of documents. In part due to South Korean law, adoptive parents must meet several criteria including a minimum family income and must be married for three years or longer.

Holt International Children's Services Korea is in charge of matching children with qualified adoptive parents and does this in a way which randomizes children into families. Within the Korea program and conditional upon being qualified to adopt, children are matched to families on a first come, first served basis. Parents are not given the opportunity to specify gender or anything else about their future adoptee. The one exception to this rule is that families with all boys or all girls are allowed to request a child of the opposite gender. In practice, such a request is made infrequently. This does not present a problem for this study since I condition on adoptee gender in every specification. The only other opportunity parents have to specify a preference is to indicate that they would be open to adopting a child with special needs or a disability. I exclude all such adoptions from the sample.

Thus it is the timing of when applications are completed that creates the matching of parents to children, rather than any matching of parent and child characteristics. I provide evidence below that the child's weight in infancy and other pre-adoption characteristics are uncorrelated with adoptive parent characteristics such as family income, parental education etc.

Relation to the Adoption Literature

I follow the empirical approach of recent papers in economics including Bjorkland, Lindahl and Plug [2004], Sacerdote [2002], Das and Sjogren [2002], and Plug and Vijverberg [2003] in that I regress child outcomes on parent inputs, treating the adoptive parents as randomly assigned. The paper differs from the existing literature in several ways: First and most importantly the data set is constructed explicitly so that I have true random assignment of children to families. Second, I have a number of outcomes that weren't available to me or other economists in prior studies, such as drinking, smoking, asthma, obesity and selectivity of the college attended.

Third in addition to calculating straight transmission coefficients (from parents to children) for income and education, I take a broad approach and examine the effects of family size, family gender composition. This allows me to test for effects of family size and sibling gender in a context where the number and gender of siblings is randomly assigned to the child.

There is a large adoption literature outside of economics and it has focused mostly on estimating the heritability of IQ, as in Scarr and Weinberg [1978, 1981], and personality traits as in Loehlin, Horn, and Willerman [1985, 1987, 1994], and Plomin, Defries, and Fulker [1988, 1991, 1997]. I depart from this literature in two ways. First I focus on income, education and health outcomes rather than IQ and personality traits. Second, I use a simple experimental design (random assignment to adoptive family) without imposing the structural models used in the behavioral genetics literature.

A series of papers including Taubman [1988], Behrman and Taubman [1989] and Behrman, Rosenzweig and Taubman [1994] use comparisons of identical and fraternal twins to identify the nature and nurture components of educational attainment and obesity. These papers impose a structural model on the data in order to derive explicit formulae for the variance and covariance of outcomes for the two different types of twins and their offspring. The identification of nature versus nurture components comes from the fact that identical twins share precisely the same genes whereas fraternal twins do not, and from a series of assumptions regarding how much family environment and DNA is shared between siblings, first cousins, second cousins etc.

Empirical Framework and Interpretation of Transmission Coefficients

In the results below I regress the adoptee's outcomes on the parent's inputs. Alternatively I compare mean outcomes for treatment groups of adoptees where I form treatment groups on mother's education, or income or family size. I interpret these coefficients (and differences in means) as reduced form treatment effects. Assignment to treatment group is random due to Holt's adoption process. To my knowledge, all of the adoptees comply with their assigned treatment group (ie I assume no runaway children). Because of the randomization, I can interpret my estimates as the causal effect of being assigned to a particular type of family. However, within the treatment effect I cannot parse out the extent to which the effect is working through specific inputs such as mother's education, family income or unobserved factors such as school quality, neighborhood quality etc.

In addition to calculating a series of treatment effects, I also measure the transmission of characteristics from parent to child in a case where there is no genetic connection between the parent and child. As an accounting identity, we know that all effects of the parents on the children take place through initial endowments, through environment (nurture) effects, and through the interaction of the two.[3] For the transmission of education from mothers to children we might linearize the accounting identity in the following way:

(1) Child's years of education= α + $\beta 0$*birth mother's educ + $\beta 1$*adoptive or environmental mother's educ + $\beta 2$*birth mother's educ*adoptive mother's education + ε_i

The random assignment of adoptees to families ensures that birth mother's education is uncorrelated with adoptive mother's education. Thus we can regress the adoptee's educational attainment on adoptive mother's educational attainment and obtain an estimate of $\beta 1$. Even though birth mother's education and the interaction term are omitted variables, they are orthogonal to the adoptive mother's education and therefore $\beta 1$ is not biased by the omission of the second and third terms in (1).

For the non-adoptees, the birth mother is the environmental mother and so the two measures of mother's education are perfectly correlated. Regressing the non-adoptees educational attainment on mother's education and yields an estimate of ($\beta 0+\beta 1+\beta 2$).[4]

[3] As part of this interaction, initial endowments may themselves cause changes in environment as in Ridley [2003] and Dickens and Flynn [2001].

[4] Technically for the non-adoptees I could include mother's education and mother's education squared as separate regressors. If the functional form in (1) were literally true, then the coefficient on mother's education squared would be

I compute the ratio of the adoptee and the non-adoptee coefficients which is $\beta 1/(\beta 0+\beta 1+\beta 2)$. This is an estimate of the transmission of education through the level effect of environmental mother's education, as a percent of the total transmission of education from parent to child. Ideally I would like to give this ratio a broader interpretation, namely the percent of the child's education that is determined by nurture as opposed to initial endowments. To make this leap requires several very strong assumptions. First I need to assume that there are no interaction effects between initial endowments and family environment, i.e. $\beta 2=0$.[5]

This seems like a dubious assumption on both theoretical and empirical grounds. We know from previous studies including Sacerdote [2001] and Bjorland et al [2004] that the transmission coefficient for the non-adoptees (.30) is much higher than for the adoptees (.07). An assumption of no interactions amounts to assuming that the large transmission coefficient for the non-adoptees works almost exclusively through level effects of initial endowments. This is in fact precisely the assumption made by most behavioral genetics studies of heritability of IQ and other traits (e.g. Loehlin, Horn and Willerman [1987]) and this assumption partially explains the high estimated heritabilities found in the literature.

Second, I would need to make some assumptions about the 80 percent of the variation in child's educational attainment that is not explained by the observed factors. If I further assume that this variation is either uncorrelated with the nature and nurture factors of interest in my decomposition, or has the same nature/nurture breakdown as my observed factors, then I can claim

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$\beta 2$. This is clearly a strong functional form assumption. I instead think about the univariate regression I do run as being a very rough approximation to the unknown true function.

[5] If I allow interaction effects, then a nature nurture breakdown is non-sensical since the two factors work together and perhaps are even endogenously determined.

that my ratio $\beta 1/(\beta 0+\beta 1)$ is indeed the percent of educational attainment determined by family environment.

Data Description

We collected data on adoptive parents and their children using Holt records and a mail in survey.[6] The survey asks questions on the children's health, education, and income. We also collected basic demographic outcomes including marital status and number of children. Currently we only have surveys from the parents, but we intend to survey as many of the children as possible to validate the parents' responses. The family background (parental input) variables include parental income at the time of adoption, the education of the mother and father, drinking and smoking behaviors of the mother and father and height and weight for each. We have income as self reported on the surveys and we have income as reported in Holt records. We also have text fields for the occupations of the parents and children, but we have not yet mapped these to median incomes by occupation or other measures of SES.

Parents were eligible for inclusion in the survey if they adopted a child through Holt's Korea program during 1970-1980, making the children ages 23-33 in 2003 when the survey was run. There were roughly 10,000 such families who met this criterion and we sent the survey to a random sample of 3,500 of these families. Our cover letter promised respondents a check for $50 and this was paid immediately upon receipt of a completed survey. We received back 1117 surveys for a response rate of 32 percent.

The survey collects outcomes for up to 5 children in the family. Fortunately, for the purposes of sample size, most families had more than one child, and in many cases families had more than one Holt adoptee from Korea. Table 2 shows a frequency tabulation of family sizes in the sample. Of the roughly 1100 families, 322 have two children, 297 have 3 children, and 213 have four children. Only 60 families have a single child, and that child is of course a Holt adoptee. Eighty three of our families have six or seven children, but unfortunately we only collected information on 5 of the children in these large families.[7]

Table 2 shows the fraction adoptees and fraction girls by family size. In single child families, where there is exactly one Holt adoptee, 78 percent of the adoptees are girls. In families of two children, 80 percent of the children are adoptees and 63 percent are girls. In the larger families, 55-60 percent of the children are adoptees and about 55 percent are girls.

We have data for both adoptees and non-adoptees in the family. We collected information on the non-adoptees (biological children of the parents) so that we could compare treatment effects and transmission coefficients across the two groups. We use all children in the family to calculate family size and to calculate gender ratios and percent adopted in each family. For the subsequent analysis of adoptees, we keep only Korean adoptees through Holt. We drop a small number of adoptees under 18 since it is very unlikely that their schooling is complete or that we have useful income data for them. Seven percent of the final sample is under age 21, and in all of our regressions we include a set of age dummies to allow for the fact that most of our outcomes including income, educational attainment and marital status vary by age.

Table 1 shows mean outcomes at the child level (as opposed to the family level). Thirty one percent of the adoptees are male versus 61 percent of the biological children. The adoptive families

[6] I say we because the effort required extensive work from Holt officers and employees and from a team of research assistants at Dartmouth.

clearly have more than the U.S. population average of boys among their biological children, which indicates that some families may be adopting in part to diversify away from boys. The adoptees are on average six years younger than the non-adoptees. The adoptees' average age at arrival in the U.S. is 1.7 years, with 28 percent of the adoptees being over age 1 at arrival. Below I test whether arrival age in this sample matters for outcomes and find no evidence that it does.

Forty seven percent of the adoptees have four years of college versus 65 percent for the non-adoptees. Conditional on graduating from a college for which we have U.S. News rankings and data, the adoptees graduate from colleges with roughly similar SAT scores and acceptance rates as the non-adoptees. The non-adoptees graduate from schools with a 75th percentile of SAT scores that is 15 points higher than the schools of the adoptees. The difference has a t-stat of 2.59. The survey measure of family income for the non-adoptees is much higher than for the adoptees: $61,000 per year versus $41,000 per year.

The adoptees are less likely to be married, but this is partially an age effect. Thirty four percent of the non-adoptees are classified as overweight (have a Body Mass Index >25) versus 24 percent of the adoptees. This could be correlated with the fact that the adoptees are all Korean and most of the non-adoptees are white, though I do not offer any theory as to why obesity should vary by race.

Twenty three percent of the adoptees smoke versus thirty two percent of the non-adoptees. Reported smoking rates among the adoptive parents are incredibly low at 3 percent for the adoptive mothers (when weighted at the child level not the family level). This could indicate that people

[7] We were not explicit about which 5 children to include in large families. We did ask the respondents to include their oldest adoptee through Holt.

who want to adopt or who are approved to adopt are unlikely to be smokers, or that the parents have learned to not admit to smoking in an adoption related survey.

Table 3 regresses pre-treatment variables for the adoptees on pre-treatment variables for the parents. Under the null of randomization of adoptees to families, we should see no relationship between adoptee and parent characteristics. The data are largely consistent with randomization. Mother and father's education and income are uncorrelated with the adoptee's height, and weight measured at the child's first contact with Holt. We only have this initial height and weight for a limited subset because we are still in the process of pulling information from Holt's paper records. For age at arrival, there is a small positive effect of parental income on child age and this effect is significant at the 10 percent level.

Results

In Table 4, I show transmission coefficients from parents to children for a variety of outcomes. In this table each coefficient is from a separate univariate regression in which I regress the child's outcome on the same outcome for the mother or parents. Very similar results obtain when I use the father's outcome instead of the mother's (not shown).

In the first row, I regress the child's years of education on the mother's. For the non-adoptees I find a coefficient of .298 which is larger than the OLS coefficient of .16 found by Black, Deveraux and Salvanes [2003] for Norway. The coefficient of transmission for the adoptees is a much smaller but still high statistically significant .07. Relative to Bjorland et al, I find a slightly larger coefficient for the non-adoptees and a smaller coefficient for the adoptees. In my sample, roughly 23 percent of the transmission of educational attainment can be assigned to level effects of environmental mother's education. In the Bjorkland et al's, this number is closer to 50 percent. One possible explanation for the difference may be positive selection of adoptees into families in the Swedish data. In fact when I run the same regression for non-Holt adoptees in the same family (where there is no random assignment) I find a much higher coefficient of .16 which is close to the Bjorland Lindahl Plug estimate.

When I switch the outcome measure to a dummy variable for graduation from college rather than educational attainment, I find a similar result. The transmission coefficient for the adoptees is .07 versus .26 for the non-adoptees. This indicates that 28 percent of the transmission coefficient for non-adoptees works through level effects associated with the mother's college status.

Health outcomes show a very different pattern of transmission than do educational outcomes. Unsurprisingly, parents transmit their height to their biological children much more strongly than to their adoptive children. The relevant coefficients are .46 and .05. Interestingly, body mass index is also transmitted much more strongly to non-adoptees than to adoptees.[8] The transmission coefficient for the non-adoptees is .23 versus .02 for the adoptees. This latter finding could be interpreted in one of several ways. It may be that BMI and obesity have a huge genetic component which accounts for the much stronger parent to non-adoptee correlation that we see. Or it may be the interaction between having genes for obesity and having parents who eat a lot that accounts for the strong transmission to non-adoptees.

A third related possibility is that because the Korean American adoptees do not necessarily resemble the parents physically, the adoptees do not take cues from the parent's eating and weight in setting their own eating and exercise habits. To investigate whether interactions between parent and child race are relevant in determining these transmission coefficients, I ran the same regression for

[8] Vogler et. al. [1995] have the same finding.

240 non-Holt adoptees. I do not have race for these adoptees, but I do know birth country. Interestingly, I find the same low transmission coefficient of BMI from parents to adoptees (a statistically insignificant .02) when I look at the non-Holt adoptees. This suggests that the result is true for adoptees in general, and not just Korean adoptees.

Two final outcomes of interest are dummy variables for drinking and smoking. The coefficient of transmission for smoking is just as high for the adoptees as for the non-adoptees. Unfortunately this is not measured with great precision, probably because so few of the parents smoke. For drinking, the coefficient for the adoptees is .14 which is 64 percent as large as the coefficient for the non-adoptees of .23. Overall, it appears that the level effects of family environment are a much bigger component of transmission for drinking and smoking than for years of education.[9]

In Table 5, I switch from looking at transmission coefficients for these outcomes to looking at the r-squareds in regressions of child outcomes on all the observed family background characteristics. Each cell in the table reports the r-squared from a regression of the outcome on mother's and father's years of education, college status, smoking and drinking status, height, weight, and obesity and overweight status. I also include as regressors family income and number of children in the family.

For the non-adoptees, I can explain 19 percent of the variation in years of education using the observables about the parents. For the adoptees, I can explain 5 percent of the variation, making the ratio of adoptee r-squared to non-adoptee r-squared 28 percent. This is similar to ratio of adoptee to non-adoptee transmission coefficients of 23 percent shown in Table 4. The r-squared ratios for height, body mass index and smoking and drinking also show a similar pattern to that of Table 4. The percentage of adoptees' variation in smoking that can be explained is 69 percent as large as the percentage of non-adoptees variation in smoking. In contrast a much smaller percentage of variation in height and BMI can be explained for adoptees than for non-adoptees.

Figures 2 and 3 show scatterplots of the results in Tables 4 and 5. In Figure 2, I graph the non-adoptee coefficient against the adoptee coefficient for nine different outcomes. The 45 degree line represents outcomes for which the two transmission coefficients are equal. Eight of the nine outcomes fall above the 45 degree line meaning that the non-adoptee coefficient is larger. The outcomes closest to the 45 degree line are drinking and smoking, indicating that for these outcomes, adoptees and non-adoptees are similar in the degree to which they acquire their parent's habits. Obesity is also near the 45 degree line, but only 6 percent of children are classified as obese. BMI and overweight status have much more variation and are significantly above the 45 degree line.

In Appendices 2-4 I show the enormous impacts of family size on adoptees' outcomes and that the impacts of family size are smaller for the non-adoptees. Appendices 2 and 2A show mean outcomes for adoptees by family size. In single child families, 52 percent of adoptees graduate from a college that is ranked by US News. (The other 48 percent either don't graduate from college or graduate from a non-US News college.). For families of 3, 5, and 7 children the adoptee's graduation rate falls to 44 percent, 37 percent, and 19 percent respectively. Adoptee's years of education also drops as family size increases, ranging from 15.3 years for adoptees in single child families to 14.1 years in 7 child families. (See my discussion of Table 6 for a comparison of this slope to that found by Butcher and Case [1994] in the PSID.)

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[9] Again, by "level effects" I mean the coefficient on environmental mother's outcome in equation (1), as opposed to the

The non-adoptees also experience a drop in years of education and in probability of graduating from a US News college as family size increases. However the slope is much less steep than for the adoptees. Non-adoptees in a family of 2 children have a 55 percent chance of graduating from a US News college versus 46 percent for non-adoptees in a family of 7 children.

There are at least two ways to interpret this result. The first is that there is a strong quality-quantity tradeoff at work, and this tradeoff bites particularly hard for the adoptees. The second possibility is that the larger families are fundamentally different on unobservables in a way that is differentially bad for adoptees. Either of these interpretations supports the Case, I-Fen Lin and McLanahan's [2000] result that adoptees in blended families experience more of a resource constraint than the biological children of the parents.

Table 6 proceeds to regressions of educational outcomes on parent characteristics. Each column is a separate regression including both adoptees and non-adoptees in the sample. The base category is always the adoptees. For the parental characteristics I allow for separate slopes for adoptees and non-adoptees by including interactions between parental characteristics and a dummy for being a biological child of the parent. (The slope for the adoptees is the baseline and the slope for the non-adoptees is the sum of the baseline coefficient plus the interaction term.) The regressions include, but do not report, age dummies and a dummy for biological child.[10]

Column (1) uses years of education as the outcome. In the first two rows I repeat a key result from Table 4, namely that the coefficient on mother's education is .08 for the adoptees and .207 higher for the non-adoptees. Each additional child in the family reduces an adoptee's expected

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coefficient on biological mother's outcome or the coefficient on the interaction term.

[10] I suppress the latter to avoid confusion. The intercept for biological children is generally negative, but that's because the slope on regressors like mother's education is so much steeper for the biological children.

years of education by .15 years and the effect is highly statistically significant. However, for non-adoptees, the slope on number of children is only -.07 instead of -.15. The difference between these two coefficients is not statistically significant, though economically it's very significant. Either of these slopes is significantly smaller than the coefficient of -.28 for women in the PSID in Case and Butcher [1994]. Technically we should be comparing the -.07 for non-adoptees to their -.28. One explanation for the difference is that there are more unobserved differences between small and large PSID families than between the small and large families in my sample. This seems possible given that my families have all been approved to adopt by Holt.

Log of parental income is not statistically significant in predicting child's years of education, which may be a statement about the measurement error in my income variable. The male adoptees have significantly lower educational attainment than the female adoptees, with a coefficient of -.54 years on the dummy for male. The gender effect for the non-adoptees is roughly 0 years, adding the -.55 and .50 on the interaction of male and biological child.

Column (2) shows that similar results obtain when I use father's education rather than mothers and column (3) shows that when I include both father's and mother's education, both matter to some degree.

Columns (4) and (5) show that controlling for other characteristics, mother's college status has huge effects on the probability that the adoptee graduates college and graduates from a US News ranked college. Adoptees with a college educated mother are 9 percentage points more likely to obtain a college degree themselves, relative to adoptees whose mothers do not have four years of college. This is a 19 percent effect at the means. Adoptees with a college educated mother are 14 percentage points more likely to obtain a degree from a US News ranked college versus adoptees whose mother does not have four years of college. This is a 36 percent effect at the means.

Conditional on attending (not necessarily graduating from) a US News listed college, mother's and father's education and family income do not have a statistically significant effect on the selectivity of the college attended. Doubling family income is associated with the adoptee attending a school that has SAT scores (measured at the 75^{th} percentile) that are 5 points higher. This is roughly .04 standard deviations higher in the distribution of the 75^{th} percentile of SAT scores by school.

Table 7 examines treatment effects of parent characteristics on several health outcomes including smoking, drinking, and obesity. The key results in Table 7 are similar to those from the univariate regressions in Table 4. Adoptees experience a large treatment effect from their mother's drinking and smoking behavior, but there is little influence of mother's body mass index on the adoptee's BMI or obesity. In column (1), adoptive mother's drinking raises the adoptee's probability of drinking by 19 percent. The effect for the non-adoptees is 28 percent and the difference between the coefficients is significant at the 5 percent level. Male adoptees are more likely to drink than female adoptees and each additional year of mother's education raises the adoptee's probability of drinking by 1.2 percent.

The effects for smoking in column (2) show a somewhat similar pattern though the coefficients are smaller and less statistically significant. Mother's smoking raises the adoptee's probability of smoking by 11 percent (significant at the 10 percent level), and the effect for the non-adoptees is not statistically significantly different.

The effects for BMI and obesity are quite the opposite. Mother's BMI, overweight and obesity status has a huge effect for her biological children but very little effect for the adoptees. If the mother is classified as overweight, the non-adoptees are 19 percent more likely to be overweight whereas the non-adoptees are .1 percent more likely to be overweight.

Table 8 shows treatment effects for the adoptee's family income and marital status. The most interesting fact in column (1) is that the adoptee's number of siblings has a large negative effect on income. Each additional child in the family reduces the adoptee's current income (as reported in the survey) by 4.1 percent. The male adoptees have substantially lower family incomes than the female adoptees.

Parental income at time of adoption appears to have little effect on the adoptee's current income. In contrast, for the non-adoptees, the transmission coefficient from parents income to child is .21 (adding the two relevant coefficients). As mentioned above, this coefficient is at the lower end of transmission estimates produced by Altonji and Dunn [1991], Solon [1992], Zimmerman [1992], Mulligan [1997], and Bjorkland and Jantti [1997]. I attribute this fact both to measurement error and the possibility that low income families who are selected for adoption by Holt are probably not representative of low income families in general. In particular such families may have unobserved higher than average human capital, wealth and earnings potential.

Column (3) in Table 8 regresses the adoptees and non-adoptees *own* number of children on their family size. Growing up in a large family is associated with having more children, though the effects are small in size. For the adoptees, each additional sibling they have is associated with having .03 more children.

Table 9 asks whether the family's mix of adoptees and non-adoptees affects an adoptee's outcomes. College attendance and educational attainment appear to be the only outcomes that are affected. There is some benefit to being the only adoptee in the family, controlling for family size. In columns (1)-(3) I show this effect three different ways, using graduation from a US News ranked college as the outcome.

In column (1), I limit the sample to families of three children and include dummies for each possible family structure, namely 1, 2, or 3 adoptees. I run the regression without a constant or any controls so that the coefficients are just the mean probability of graduating from a US News college for each group. Adoptees with two non-adoptees as siblings are 49 percent likely to graduate from a US News college. In families with two adoptees and one non-adoptee, the adoptees are only 37 percent likely to graduate from a US News college. The t-test for the difference in these two coefficients has a p-value of .08.

In column (2) I use the whole sample (all family sizes) and include dummies for each family size. The key right hand side variables of interest are dummies for 1) being the only adoptee in the family, 2) having a mix of adoptee and non-adoptee siblings, or 3) having only adoptee siblings. Being the only adoptee raises the probability of graduating from a US News college by 8.6 percentage points. This category is statistically significantly different from the other two categories.

In column (3) I use family fixed effects and identify the interaction terms of being the only adoptee, or being an adoptee with adoptee and non-adoptee siblings. Being the only adoptee confers an advantage of a 10.1 percent increase in the likelihood of graduating from a US News college. In this same fixed effects specification, being the only adoptee results in obtaining .17 more years of education, and a 5.7 percent increase in the chance of having four years of college (from any college).[11] Despite the effects of family structure on adoptee's educational attainment, there are no corresponding effects on family income, drinking, or obesity. (Shown in columns (4)-(6)).

In Table 10, I ask whether effects differ by the adoptee's gender.[12] I limit the sample to the adoptees and allow for separate male and female slopes on the parental inputs. Columns (1) and (3)-(5) show that the treatment effects of parent characteristics do not differ by gender for educational attainment, 75th SAT percentile of the adoptee's college, drinking or smoking. In column (2) the dependent variable is graduating from a US News ranked college. Male adoptees obtain a much smaller benefit from mother's college status than do female adoptees. Having a college educated mother raises women adoptee's probability of graduating from a US News college by 15.8 percentage points. But the male adoptee's give up 11.8 percentage points of this advantage for a net positive effect of 4 percentage points.

The outcome variable in column (6) is body mass index. Each additional year of mother's education reduces male adoptee's BMI by .20, but has little effect for female adoptees. The effect for men (adding the two relevant coefficients) is statistically different from zero.

In Table 11, I examine whether the gender mix of children in the family affects the adoptees' outcomes. The short answer is no. I again limit the sample to just the adoptees. Following Butcher and Case [1994], I regress outcomes on the fraction girls in the family and dummies for any sibling being a boy and any sibling being a girl. Columns (1) –(3) use graduation from a US News college as the outcome variable. The three regressions are for just male adoptees, just female adoptees, and

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[11] These last two results are not shown.
[12] My interest here is in part due to the fact that many of the Moving to Opportunity effects differ greatly by youth's gender Kling, Ludwig and Katz [2004].

all adoptees respectively. In none of the columns do we observe any statistically significant effects from gender composition.

Finally, in Table 12, I ask whether any of the key treatment effects differ by age at arrival in the U.S.. I limit the sample to adoptees and interact parental inputs with a dummy for arriving at age 1 or older Recall from Table 1 that 28 percent of the adoptees are older than 1 at arrival. Throughout Table 12, I do not find any significant difference in treatment effects based upon arrival age.

Conclusion

In this paper, I examine a sample of Korean-American adoptees who were randomly assigned to families in infancy. Being assigned to a high education family has enormous treatment effects for these adoptees. Adoptees are 9 percent more likely to have four years of college if their mothers do. Each additional year of mother's educational attainment raises the adoptee's educational attainment by .07 years.

The largest treatment effects for the adoptees are either caused by or strongly correlated with the number of children in the family. Each additional child added to the family is associated with a .15 year decrease in the adoptee's educational attainment and a 3 percent reduction in the probability of attending college. These large effects from family size may imply that there is a quality quantity tradeoff that is particularly steep for adoptees, relative to non-adoptees. Or, the family size effects may be picking up important unobserved difference between large and small adoptive families.

Mother's drinking and smoking have a large effect on the probability that the adoptee drinks and smokes. If a mother drinks, the adoptee is 19 percent more likely to do so, and if the mother smokes, the adoptee is 11 percent more likely to smoke.

In addition to computing these transmission coefficients for the adoptees, I also compute them for the non-adoptees in the same family. I take the ratio of the adoptee coefficient to the non-adoptee coefficient as a measure of the percent of transmission that takes place through the level effects of family environment, as opposed to effects that work through initial endowments and the interaction of environment and endowments. The transmission of educational attainment and college status to adoptees is roughly 25 percent as large as the transmission of educational attainment and college status to non-adoptees. For educational outcomes, the level effects of parental education are quite important, but only about one quarter of the story.

For height and obesity, there is strong transmission from parents to their biological children and almost no transmission of these outcomes from parents to adoptees. For example, the transmission coefficient on body mass index is .02 for adoptees and .23 for non-adoptees.

In contrast, parents appear to transmit drinking and smoking behavior to adoptees and non-adoptees at nearly the same rate. The smoking coefficient for adoptees is 125 percent as large as for non-adoptees. The drinking coefficient for adoptees is 69 percent as large as for non-adoptees. In contrast, parents transmit very little of their height, body mass index or obesity to adoptees.

I also investigated the influences of family structure (number of adoptees versus non-adoptees) and gender composition on adoptee outcomes. Being the only adoptee in the family raises the adoptee's educational attainment by .17 years and probability of college graduation by about 10 percent. I do not find any effects of family structure on other outcomes such as earnings or obesity.

Some of the treatment effects do differ by adoptee's gender. Having a mother with four years of college only gives male adoptees a 3 percent increase in their probability of college graduation, versus the 11 percent increase experienced by female adoptees. The male adoptees have significantly lower educational attainment and family income relative to female adoptees; the men are 15 percent less likely to have four years of college.

Overall, this study yields several useful conclusions. First, in a case with random assignment of children to families, the tradeoff between child quality and quantity appears particularly strong. Second, there is a strong level effect of family environment on child education and income. However transmission of education and income for adoptees is much less strong than for non-adoptees. Hence, by definition, either initial endowments or the interaction between family environment and initial endowments must be driving a large portion of the transmission of income and education to children. Smoking and drinking habits are transmitted almost equally strongly to adoptees and non-adoptees. Perhaps most interesting is the fact that parents do not transmit a tendency for obesity to their adoptees. This might indicate that parental bad examples of eating and exercise also interact with physical resemblance in order to create obese children.

Random assignment via adoption is a form of grand experiment that is unlikely to be reproduced in policies designed to aid children in general. But for many policies, these data trace out an upper bound for the effects that can be achieved via shifts in family income, or neighborhood quality, or schools. I hope that the treatment effects observed here will guide other social scientists in understanding what determines child outcomes and the possible scope for policy intervention.

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Table 1
Summary Statistics for Adoptees and Biological Children in Same Families

	Adoptees			Biological			
Means for Children	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	T Stat for Difference
Child is Male	1677	0.31	0.46	1240	0.61	0.49	16.76
Child Age	1669	28.03	4.92	1243	34.00	6.67	27.82
Child Age at Adoption	1651	1.73	1.66				
Child Adopted at Age 1+	1651	0.28	0.45				
Child's Years Education	1659	14.75	2.10	1226	15.65	2.37	10.85
Child has 4+ Years College	1659	0.47	0.50	1226	0.65	0.48	9.92
SAT 25th Percentile of Child's College	765	1019.06	116.02	677	1032.81	121.63	2.2
SAT 75th Percentile of Child's College	767	1224.75	108.24	680	1239.82	112.93	2.59
Acceptance Rate of Child's College	774	0.70	0.17	686	0.68	0.19	-2.03
Child's Graduated from a College w/ US News Rank	1456	0.39	0.49	1130	0.52	0.50	6.64
Child's Family Income	1511	41.37	34.36	1168	61.00	42.74	13.18
Child Married? (0-1)	1657	0.38	0.48	1220	0.65	0.48	15.26
Child's Number of Children	1584	0.51	0.91	1187	1.22	1.31	16.76
Child Overweight (0-1)	1592	0.24	0.42	1192	0.34	0.47	5.82
Child Obese (0-1)	1592	0.06	0.23	1192	0.07	0.25	1.01
Child Smokes	1659	0.23	0.42	1215	0.11	0.32	-8.19
Child Drinks	1643	0.58	0.49	1198	0.66	0.48	3.99
Mother's Years Education	1660	15.15	2.46	1238	15.07	2.44	-0.81
Mother Has 4+ Years College	1660	0.53	0.50	1238	0.51	0.50	-0.97
Parent's Family Income At Adoption	1646	32.92	24.48	1231	32.62	24.96	-0.33
Parent's Family Income Now	1646	78.18	44.41	1231	79.16	44.89	
Mother Has 4+ Years College	1588	0.18	0.39	1187	0.15	0.36	-2.08
Mother Is Overweight	1588	0.46	0.50	1187	0.42	0.49	-2.08
Mother Smokes	1647	0.03	0.17	1225	0.02	0.14	-1.8
Mother Drinks	1644	0.34	0.46	1224	0.35	0.47	0.93

Table 2
Frequency and Composition of Family Sizes
In the Sample

Families have at least one Holt adoptee from Korea in order to be included in the sample. Family size is as reported by parents. We have data on up to 5 children in each family.

Total Number of Children in Family	Number of Families	Fraction Adoptees	Fraction Girls
1	60	1.000	0.783
2	322	0.803	0.626
3	297	0.592	0.555
4	213	0.549	0.527
5	107	0.558	0.539
6	42	0.548	0.542
7	41	0.643	0.545

Table 3
Child's Pre-Treatment Characteristics
Vs. Parent's Pre-Treatment Characteristics

	(1) Weight at initial social history lbs	(2) Height at initial social history inches	(3) Child's Age at Arrival	(4) Child is Male
Mother's Years of Education	-0.043	-0.052	-0.011	0.006
	(0.132)	(0.118)	(0.022)	(0.006)
Father's Years of Education	-0.003	0.043	-0.022	0.000
	(0.107)	(0.093)	(0.019)	(0.005)
Log Parent's Household Income	0.345	0.261	0.156	0.018
	(0.403)	(0.360)	(0.076)*	(0.018)
Mother's BMI	-0.060	-0.049	-0.004	0.001
	(0.055)	(0.054)	(0.010)	(0.002)
Mother Drinks	0.756	1.057	-0.166	0.006
	(0.622)	(0.579)	(0.125)	(0.027)
Father Drinks	0.358	-0.157	-0.131	0.017
	(0.634)	(0.590)	(0.139)	(0.028)
Mother's Height Inches	0.057	-0.019	-0.029	0.012
	(0.096)	(0.088)	(0.017)	(0.004)**
Father's Height Inches	0.045	0.033	0.024	0.002
	(0.092)	(0.085)	(0.019)	(0.004)
Father's BMI		0.033	0.017	0.002
		(0.060)	(0.013)	(0.003)
Constant	4.739	21.321	1.651	-0.856
	(9.846)	(8.383)*	(1.801)	(0.397)*
Observations	428	440	1389	1410
R-squared	0.018	0.016	0.021	0.009

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Variable	Obs	Mean	Std. Dev.	Min	Max
weight initial	479	11.23	5.30	4	24.4
height initial	494	23.42	4.95	2.7	39.8

Table 4
Size of Nurture Effect Relative to Total Effect Using Transmission Coefficients From Parents To Children I.e. Coefficient on Parent's Outcome When Child's Outcome is Dependent Variable

Each coefficient is from a separate univariate regression of child's outcome on mother's outcome. I show separate coefficients for the adoptees and the biological children in the same families.

	Adoptee's Outcome Regressed on Mother's Outcome	Biological Child's Outcome Regressed on Mother's	Ratio of Adoptee Transmission to Biological	T-stat for Difference in Coefficients
Years of Education	0.069	0.298	0.232	6.174
	(0.021)**	(0.032)**		
Log Household Income	-0.077	0.159	-0.484	4.198
	(0.037)*	(0.051)**		
Has 4+ Years College	0.072	0.255	0.282	4.704
	(0.026)**	(0.031)**		
Height Inches	0.049	0.456	0.107	5.602
	(0.037)	(0.057)**		
Obese	0.028	0.107	0.262	2.316
	(0.017)	(0.029)**		
Overweight	0.004	0.185	0.022	4.901
	(0.023)	(0.030)**		
BMI	0.018	0.233	0.077	5.493
	(0.020)	(0.035)**		
Smokes	0.096	0.077	1.247	0.223
	(0.066)	(0.076)		
Drinks (0-1)	0.210	0.303	0.693	2.470
	(0.027)**	(0.033)**		
Observations	1642.000	1213.000		

Table 5
Variance Explained By Nurture Effects And Total Variance Explained

Each R-squared is from a separate regression of child's outcome on mother's and father's education, college status, smoking and drinking status, number of children, family income, height, weight, obesity and overweight status

Child's Outcome	R-squared Adoptees	R-squared Biological Children	Ratio (adoptees/ biological)
Years of Education	0.053	0.187	0.281
Has 4+ Years of College	0.060	0.181	0.332
Graduated from A US News Ranked College	0.073	0.132	0.550
SAT 75th Percentile of College 2003	0.025	0.078	0.320
Acceptance Rate of College 2003	0.038	0.058	0.656
Log (Income)	0.113	0.056	2.014
Family Income	0.069	0.058	1.191
Drinks? (0-1)	0.079	0.174	0.454
Smokes? (0-1)	0.024	0.035	0.690
Has Asthma	0.012	0.020	0.603
BMI	0.012	0.128	0.096
Overweight? (0-1)	0.014	0.065	0.219
Height in Inches	0.016	0.169	0.094
Married?	0.068	0.041	1.671
Number of Children	0.078	0.138	0.564

Table 6
Effects of Family Environment on Educational Outcomes

Each column is a separate regression. Dependent variables are years of education, a dummy for having 4 or more years of college, the 25th and 75th percentiles of the SAT distribution and the acceptance rate for the child's college. The last three are measured in 2003 and only for colleges ranked by US News. Regressions include (but suppress) age dummies and a separate intercept for biological children.

	(1) Child's Years of Education	(2) Child's Years of Education	(3) Child's Years of Education	(4) Child Has 4+ Years College	(5) Child Four Year College Ranked by US News	(6) 25th Percentile SAT of Child's College	(7) 75th Percentile SAT of Child's College	(8) Acceptance Rate of Child's College
Mother's Years of Education	0.081		0.066					
	(0.021)**		(0.025)**					
Biological Child * Mothers Years Educ	0.207		0.093					
	(0.037)**		(0.043)*					
Number of Children	-0.154	-0.150	-0.153	-0.027	-0.037	-3.744	-2.966	0.003
	(0.037)**	(0.037)**	(0.037)**	(0.008)**	(0.008)**	(3.518)	(3.146)	(0.005)
Bio Child* Number Children	0.086	0.083	0.097	0.008	0.012	0.906	-1.177	-0.002
	(0.065)	(0.063)	(0.063)	(0.013)	(0.014)	(5.150)	(4.991)	(0.008)
Log Parent's HH Income	-0.047	-0.014	-0.047	-0.022	-0.026	1.217	4.537	0.007
	(0.079)	(0.081)	(0.080)	(0.020)	(0.021)	(7.771)	(6.850)	(0.012)
Bio Child* Log Family Income	0.140	0.167	0.142	0.068	0.063	3.955	3.919	-0.030
	(0.134)	(0.131)	(0.131)	(0.027)*	(0.029)*	(10.444)	(9.893)	(0.016)
Child is Male	-0.535	-0.506	-0.524	-0.128	-0.113	-1.053	0.996	0.000
	(0.110)**	(0.109)**	(0.110)**	(0.026)**	(0.027)**	(9.283)	(8.480)	(0.014)
Bio Child * Male	0.497	0.447	0.483	0.086	0.089	13.865	4.865	-0.007
	(0.174)**	(0.170)**	(0.169)**	(0.037)*	(0.043)*	(13.449)	(12.418)	(0.021)
Father's Years of Education		0.046	0.017					
		(0.019)*	(0.022)					
Biological Child * Fathers Years Education		0.239	0.204					
		(0.031)**	(0.037)**					
Mother Has 4+ Years College				0.091	0.140	-6.891	-4.604	0.011
				(0.025)**	(0.027)**	(9.051)	(8.225)	(0.014)
Bio Child* Mother Has 4+ Years College				0.143	0.089	30.551	22.836	-0.031
				(0.038)**	(0.041)*	(13.838)*	(12.923)	(0.022)
Constant	13.548	14.023	13.703	0.545	0.618	1,056.256	1,270.472	0.662
	(0.840)**	(0.813)**	(0.840)**	(0.198)**	(0.198)**	(35.928)**	(27.762)**	(0.055)**
Observations	2772	2750	2736	2772	2486	1391	1396	1409
R-squared	0.144	0.155	0.169	0.141	0.097	0.016	0.018	0.015

Table 7
Effects of Family Environment on Health Outcomes

Each column is a separate regression. Dependent variables are child's BMI and dummies for drinking, smoking, obese and overweight. BMI is defined from self reported weight and height. Overweight is defined as a BMI >=25 and obese is having a BMI > =30. Each column is a separate regression. Regressions include (but suppress) age dummies and a separate intercept for biological children.

	(1) Child Drinks (yes/no)	(2) Child Smokes (yes/no)	(3) Child's BMI	(4) Child Overweight	(5) Child Obese
Mother Drinks	0.194				
	(0.028)**				
Bio Child* Mother drinks	0.082				
	(0.040)*				
Mother Smokes		0.111			
		(0.066)			
Bio Child* Mother smokes		-0.060			
		(0.087)			
Mother's BMI			0.014		
			(0.020)		
Bio Child* Mother's BMI			0.218		
			(0.040)**		
Mother Overweight				0.001	
				(0.023)	
Bio Child* Mother Overweight				0.189	
				(0.037)**	
Mother Obese					0.025
					(0.018)
Bio Child* Mother Obese					0.082
					(0.035)*
Mother's Years of Education	0.012	0.002	-0.075	-0.012	-0.003
	(0.005)*	(0.005)	(0.044)	(0.005)*	(0.003)
Biological Child * Mothers Years	0.003	-0.012	0.023	0.003	-0.000
Educ	(0.008)	(0.007)	(0.075)	(0.008)	(0.005)
Number of Children	-0.008	0.005	-0.027	0.003	-0.002
	(0.009)	(0.008)	(0.066)	(0.007)	(0.004)
Bio Child* Number Children	0.006	-0.009	0.121	0.011	0.006
	(0.014)	(0.010)	(0.123)	(0.013)	(0.008)
Log Parent's Household Income	-0.002	0.006	-0.108	0.007	0.001
	(0.020)	(0.019)	(0.176)	(0.019)	(0.012)
Bio Child* Log Family Income	-0.009	0.005	-0.010	0.026	-0.023
	(0.028)	(0.026)	(0.294)	(0.034)	(0.018)
Child is Male	0.069	0.136	1.552	0.182	0.029
	(0.026)**	(0.024)**	(0.210)**	(0.025)**	(0.014)*
Bio Child * Male	0.050	-0.061	0.045	0.020	-0.039
	(0.041)	(0.031)*	(0.346)	(0.038)	(0.022)
Observations	2697	2743	2593	2593	2593
R-squared	0.079	0.048	0.101	0.082	0.020

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 8
Effects of Family Environment on Income, Marital Status, Number Kids Outcomes

Each column is a separate regression. Regressions include (but suppress) age dummies and a separate intercept for biological children.

	(1) Log Child's Household Income	(2) Child is Married	(3) Number of Children	(4) Has Children
Mother's Years of Education	-0.016	-0.005	-0.022	-0.011
	(0.010)	(0.005)	(0.010)*	(0.005)*
Biological Child * Mothers Years Educ	0.019	-0.001	-0.021	-0.007
	(0.013)	(0.008)	(0.020)	(0.008)
Number of Children	-0.041	0.011	0.032	0.020
	(0.015)**	(0.008)	(0.016)*	(0.008)**
Bio Child* Number Children	0.038	-0.005	0.070	0.007
	(0.023)	(0.013)	(0.037)	(0.014)
Log Parent's Household Income	0.044	-0.023	-0.044	-0.007
	(0.036)	(0.020)	(0.042)	(0.020)
Bio Child* Log Family Income	0.162	0.012	-0.077	-0.023
	(0.057)**	(0.032)	(0.089)	(0.031)
Child is Male	-0.143	-0.109	-0.176	-0.095
	(0.042)**	(0.024)**	(0.042)**	(0.023)**
Bio Child * Male	0.222	0.064	-0.034	0.036
	(0.063)**	(0.038)	(0.085)	(0.036)
Observations	2608	2775	2674	2674
R-squared	0.210	0.188	0.265	0.223

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 9
Effects of Family Structure On Outcomes
I.e. Number of Adoptees and Biological Siblings

Each column is a separate regression. Columns (3)-(6) include family fixed effects and estimate the interaction effects of adoptee*family structure variables.

	(1) Child Four Year College Ranked by US News	(2) Child Four Year College Ranked by US News	(3) Child Four Year College Ranked by US News (family f.e.)	(4) Log Child's Household Income (family f.e.)	(5) Child Drinks (yes/no) (family f.e.)	(6) Child Overweight (family f.e.)
Family Has One Adoptee Two Biological	0.489					
	(0.043)**					
Family Has Two Adoptees, One Biological	0.371					
	(0.052)**					
Family Three Adoptees, Zero Biological	0.447					
	(0.053)**					
Bio Child* Family Has One Adoptee Two Biological	0.078					
	(0.047)					
Bio Child* Family Has Two Adoptees, One Biological	0.086					
	(0.067)					
Child is Only Adoptee in Family		-0.083	-0.078	-0.279	-0.061	-0.096
		(0.029)**	(0.028)**	(0.046)**	(0.025)*	(0.028)**
Adoptee*Family Has Both Adoptees and Biological		-0.169	-0.179	-0.285	-0.059	-0.101
		(0.028)**	(0.031)**	(0.049)**	(0.028)*	(0.031)**
Adoptee* Family Has 2+ Adoptees and No Biological		-0.158				
		(0.031)**				
Family Has 1 Child		0.121				
		(0.085)				
Family Has 2 Children		0.168				
		(0.052)**				
Family Has 3 Children		0.160				
		(0.050)**				
Family Has 4 Children		0.140				
		(0.051)**				
Family Has 5 Children		0.085				
		(0.057)				
Family Has 6 Children		0.012				
		(0.067)				
Family Has 7 Children		0.000				
		(0.000)				
Constant		0.399	0.489	3.684	0.632	0.309
		(0.047)**	(0.010)**	(0.017)**	(0.009)**	(0.010)**
Observations	663	2586	2586	2679	2841	2784
R-squared	0.504	0.034	0.602	0.577	0.587	0.438

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 10
Do Effects Differ by Adoptee's Gender?

Sample is limited to adoptees. Each column is a separate regression. Perhaps for college going.

	(1) Child's Years of Education	(2) Child Four Year College Ranked by US News	(3) 75th Percentile SAT of Child's College	(4) Child Drinks (yes/no)	(5) Child Smokes (yes/no)	(6) Child's BMI
Child is Male	0.221	-0.092	-95.927	0.354	0.068	0.827
	(0.946)	(0.195)	(60.488)	(0.211)	(0.223)	(2.377)
Mother's Years of Education	0.086			0.014	0.001	-0.030
	(0.027)**			(0.007)*	(0.005)	(0.051)
Male* Mother's Years Education	-0.059			-0.012	0.003	-0.172
	(0.051)			(0.012)	(0.010)	(0.096)
Number of Children	-0.154	-0.044	-3.274	-0.020	0.003	0.015
	(0.044)**	(0.010)**	(3.499)	(0.011)	(0.009)	(0.075)
Male* Number Children	0.035	0.019	7.133	0.005	0.000	-0.057
	(0.073)	(0.016)	(6.530)	(0.017)	(0.017)	(0.141)
Log Parent's Household Income	0.045	0.031	9.562	0.054	0.009	-0.348
	(0.104)	(0.027)	(7.926)	(0.029)	(0.021)	(0.211)
Male* Log(Family Income)	-0.019	-0.011	16.357	-0.033	0.006	0.496
	(0.197)	(0.047)	(15.014)	(0.044)	(0.046)	(0.406)
Mother Has 4+ Years College		0.158	-9.411			
		(0.034)**	(9.625)			
Male *Mother 4+ Years College		-0.118	3.550			
		(0.059)*	(17.914)			
Mother's Drinks Per Day				0.099		
				(0.041)*		
Male* Mother's Drinks Per Day				0.053		
				(0.056)		
Mother Smokes					0.112	
					(0.084)	
Male* Mother Smokes					-0.010	
					(0.172)	
Mother's BMI						-0.006
						(0.020)
Male * Mother's Body Mass Index						0.054
						(0.044)
Observations	1613	1414	751	1579	1596	1498
R-squared	0.040	0.057	0.010	0.034	0.025	0.043

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 11
Does the Gender Mix Matter for Adoptees?

Sample is limited to adoptees. Each column is a separate regression. Column (1) is just for girls and column (2) is just for boys.

	(1) Child Four Year College Ranked by US News (boys)	(2) Child Four Year College Ranked by US News (girls)	(3) Child Four Year College Ranked by US News (all adoptees)	(4) Child's Years of Education (all adoptees)	(5) Child Drinks (yes/no) (all adoptees)	(6) Child Smokes (yes/no) (all adoptees)
Fraction Girls in Family	0.106	0.003	-0.274	0.245	0.022	0.043
	(0.225)	(0.151)	(0.260)	(0.612)	(0.088)	(0.076)
Any of Siblings Are Girls	-0.005	-0.074	0.016	-0.227	-0.031	-0.004
	(0.135)	(0.044)	(0.069)	(0.167)	(0.036)	(0.028)
Any of Siblings Are Boys	0.010	0.016	-0.009	0.054	0.008	0.033
	(0.060)	(0.081)	(0.130)	(0.310)	(0.044)	(0.040)
Number of Children	-0.027	-0.042	-0.049	-0.135	-0.022	-0.001
	(0.017)	(0.014)**	(0.025)	(0.056)*	(0.012)	(0.009)
Child is Male					0.083	0.159
					(0.046)	(0.039)**
Constant	0.352	0.598	0.923	15.313	0.635	0.144
	(0.081)**	(0.149)**	(0.280)**	(0.621)**	(0.080)**	(0.072)*
Observations	438	1018	437	1148	1643	1659
R-squared	0.007	0.030	0.018	0.018	0.010	0.023

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 12
Does Age at Adoption Affect Outcomes?

Here we compare the adoptees who are adopted at age < 1year to all other adoptees in the sample who are adopted at age 1-5. The latter group is

	(1) Child's Years of Education	(2) Child Four Year College Ranked by US News	(3) Log Child's Household Income	(4) Child Drinks (yes/no)	(5) Child Smokes (yes/no)	(6) Child's BMI
Adopted Age 1+ (ie 1-5)	0.412	0.085	0.093	-0.437	-0.300	0.780
	(1.009)	(0.193)	(0.392)	(0.242)	(0.200)	(2.101)
Mother's Years of Education	0.078			0.011	-0.002	-0.080
	(0.027)**			(0.007)	(0.006)	(0.055)
Adopted Age 1+ * Mother's Years Education	-0.070			-0.002	0.019	0.061
	(0.051)			(0.012)	(0.011)	(0.088)
Number of Children	-0.090	-0.026	-0.003	-0.010	0.005	0.141
	(0.046)*	(0.011)*	(0.021)	(0.011)	(0.009)	(0.084)
Adopted Age 1+ * Number of Children	-0.112	-0.026	-0.054	-0.024	-0.013	-0.306
	(0.080)	(0.017)	(0.032)	(0.018)	(0.015)	(0.130)*
Log Parent's Household Income	0.010	0.040	-0.059	0.004	0.004	-0.117
	(0.103)	(0.027)	(0.044)	(0.029)	(0.023)	(0.206)
Adopted Age 1+ * Log Family Income	0.153	-0.018	0.022	0.125	0.027	-0.188
	(0.192)	(0.045)	(0.092)	(0.048)**	(0.043)	(0.366)
Mother Has 4+ Years College		0.123	-0.072			
		(0.034)**	(0.056)			
Adopted Age 1+ * Mother Has 4+ Years College		-0.032	-0.102			
		(0.059)	(0.106)			
Mother's Drinks Per Day				0.100		
				(0.039)**		
Mother's BMI						0.005
						(0.025)
Adopted Age 1+ * Mother's BMI						-0.008
						(0.039)
Constant	13.984	0.288	3.721	0.406	0.222	24.213
	(0.511)**	(0.120)*	(0.191)**	(0.133)**	(0.113)*	(1.311)**
Mother Smokes					0.104	
					(0.069)	
Adopted Age 1+ * Mother Smokes					-0.092	
					(0.128)	
Adopted Age 1+ * Mother's Drinks Per Day				0.076		
				(0.075)		
Observations	1587	1391	1461	1555	1570	1474
R-squared	0.031	0.049	0.013	0.037	0.009	0.010

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Appendix 1
Cross Tab of Observations By Family Size and Adoption Status

This is done by reported total family size, for those observations that we have. We don't have all kids in all 7 person families.

	adopt		
Number of Children	0	1	Total
1	0	60	60
2	124	460	584
3	353	416	769
4	381	351	732
5	229	206	435
6	95	85	180
7	71	99	170
Total	1,253	1,677	2,930

Appendix 1A
Family Structure (Adoptees Versus Biological)

This does not match table above because we only know about the first 5 kids in the family. Showing this one may just add confusion.

Num		Num	Kids	Biological		
Kids Adopt	0	1	2	3	4	Total
1	94	255	446	307	197	1,299
2	357	159	265	223	0	1,004
3	150	56	167	0	0	373
4	102	59	0	0	0	161
5	93	0	0	0	0	93
Total	796	529	878	530	197	2,930

Appendix 2
Outcomes for Adoptees By Family Size

We think of adoptees as being randomly assigned to a certain family and look at how mean outcomes differ by number of children in the family.

Number of Children in Family	N	Graduate of US News Ranked College	P Value for Difference from Previous Row=0	Years of Education	Family Income ('000)
1	60	0.52		15.32	35.30
2	460	0.44	.28	14.91	42.04
3	416	0.44	.98	14.91	43.29
4	351	0.36	.04	14.63	40.39
5	206	0.37	.78	14.47	41.14
6	85	0.28	.21	14.60	44.09
7	99	0.19	.21	14.05	35.22

Appendix 2A
More Outcomes for Adoptees By Family Size

We think of adoptees as being randomly assigned to a certain family and look at how mean outcomes differ by number of children in the family.

Number of Children	N	Drinks? (0-1)	Overweight? (0-1)
1	60	0.58	0.29
2	460	0.60	0.21
3	416	0.62	0.21
4	351	0.59	0.26
5	206	0.54	0.29
6	85	0.48	0.24
7	99	0.47	0.22

Appendix 3
Outcomes for Biological Children By Family Size

Number of Children in Family	N	Graduate of US News Ranked College	P Value for Difference from Previous Row=0	Years of Education	Family Income ('000)
2	124	0.55		15.99	52.08
3	353	0.55	1.0	15.76	61.08
4	381	0.57	.63	15.74	65.34
5	229	0.45	.04	15.37	62.79
6	95	0.39	.46	15.19	58.24
7	71	0.46	.44	15.64	50.30

Figure 1: Histogram of Arrival Age for Adoptees

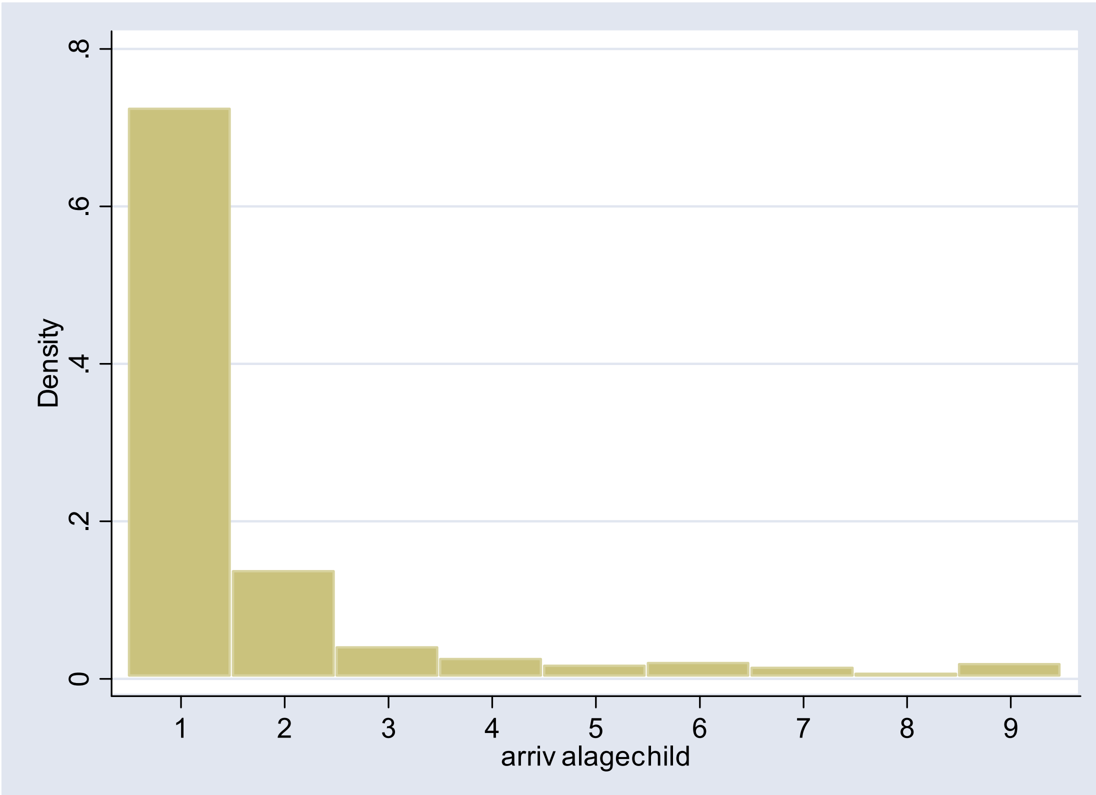

Figure 2: Comparison of Coefficient of Transmission from Parent to Child

Graph shows coefficient from a regression of child's outcome on mother's outcome for adoptees and non-adoptees in the sample.

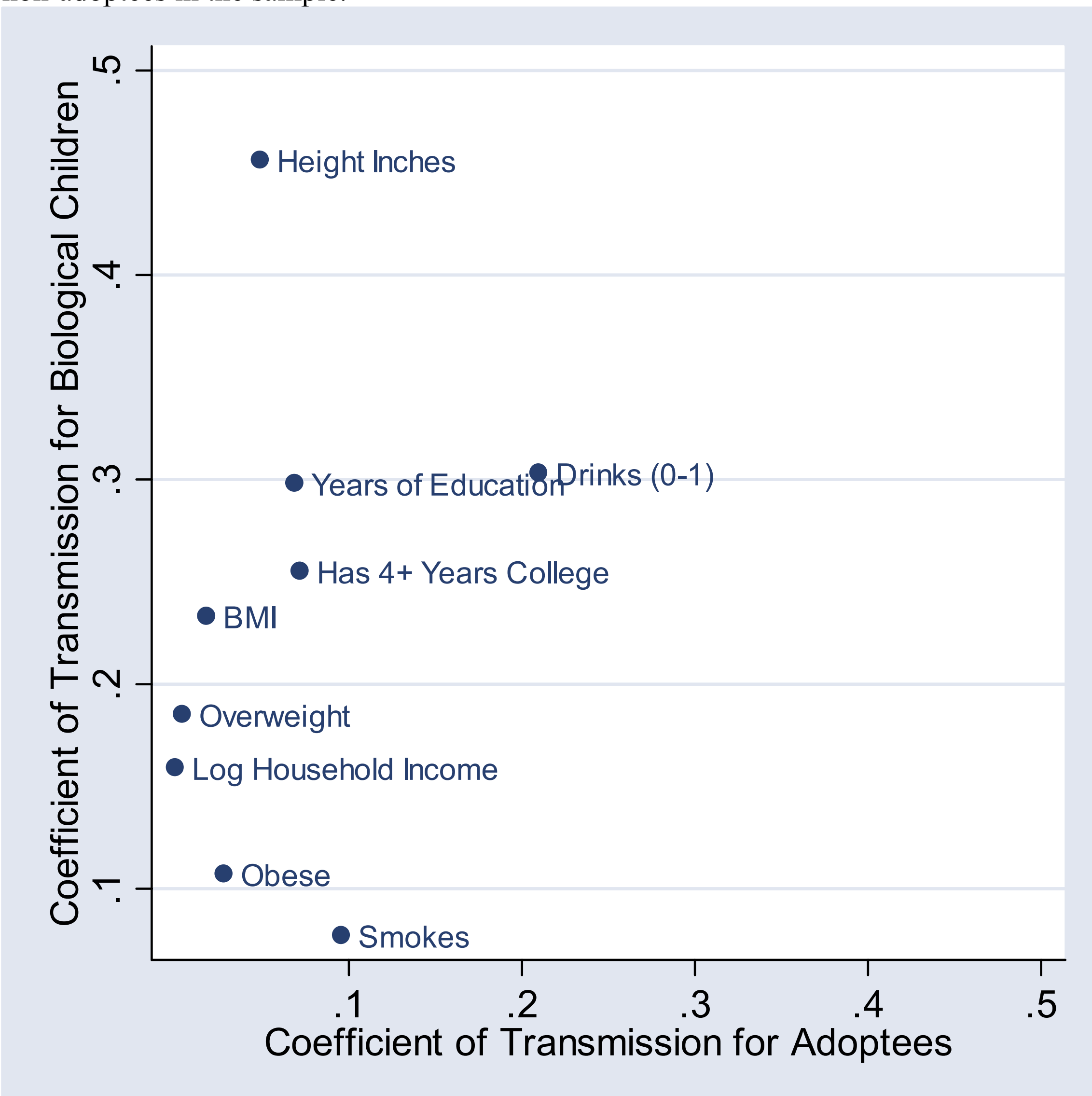

Figure 3: Comparison of Percent of Variation Explained By Parental Characteristics for Each of Child Outcomes

Graph shows R-squared from a regression of child's outcome on mother's and father's education, college status, smoking and drinking status, number of children, family income, height, weight, obesity and overweight status