Do Parents Propagate Income Inequality among Children? Evidence from Chinese and Swedish Twins*

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Abstract

In this paper we provide comprehensive evidence on the role of parents in driving within–family income inequality by focusing on three important mechanisms through which parents may impact the children: investment in education, inter vivos transfers, and bequests. In particular, using data on parental investments in children's education in China and Sweden, we first show that parents invest the same amount of resources in twin children's education regardless of their initial ability differences. Second, using data on inter vivos transfers, we show that parents in China tend to reinforce income inequality among children with a 10% increase in a twin child's salary at the time of transfer increasing inter vivos transfers by 8.7%. We show that this reinforcing parental behavior is driven by an exchange motive where the child that gets a larger transfer tends to visit the parents more often and is more likely to reside with them, with the visits and living arrangements benefiting the parents and not the child. Swedish parents, on the other hand, tend to transfer equal amounts to both children. Third, we find that bequests tend to be divided equally between children both in China and Sweden. Fourth, we show that differences in parental attitudes towards within–family income inequality between parents in China and Sweden are *mainly* driven by cross–country differences in the level of parental education. The last item, in turn, demonstrates that other culture–/country–specific differences between Chinese and Swedish parents may be less important when it comes to estimating the role of parents in shaping income inequality among their children.

JEL Codes: D13, D31, D64, I24, J12, J13, O15.

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1 Introduction

Parental behavior shapes the propagation of income inequality. Yet our understanding of how parents invest in their children's development as a function of their own backgrounds, their children's abilities, and the underlying policy environment is still far from complete.

In this paper, we attempt to fill this gap in the literature by examining three important mechanisms through which parents may impact income inequality between the children: investment in their education, inter vivos transfers, and bequests. Specifically, focusing on twin children[1] due to the endogeneity of the number of children parents choose to have,[2] we first aim to identify through which mechanism(s) parents compensate/reinforce within–family income inequality. Second, we intend to shed light on potential motives behind this compensating/reinforcing parental attitudes. Third, we explore whether parental investment and transfer behaviors depend on parental country of residence by comparing our findings for families from China and Sweden. Fourth, we aim to identify some potential reasons behind the differences – if any – in parental behaviors between Chinese and Swedish parents.

Being able to identify the role of parents in driving within–family income inequality is crucial in advancing our understanding of intergenerational mobility and the design of optimal policy since it can shed light on how parents redistribute resources among family members in response to various policies aimed at reducing income inequality. However, because it requires an integrated analysis of children's initial abilities, parental educational investments, and monetary transfers between parents and children that span children's entire lives, our understanding of this propagation remains incomplete.

Access to five distinct datasets from two different countries – China and Sweden – enables us to provide comprehensive evidence on the role of parents in shaping income inequality among their children. In particular, data for our sample of Chinese families comes from the Chinese Child and Adult Twins Surveys.[3] These surveys were carried

[1] In Section 5 we additionally show that our twins estimates are generalizable to a larger population of siblings.

[2] It was also shown that differences in prenatal events may contribute to differences in children's outcomes (Almond and Currie 2011). Since twins are exposed to the same prenatal events, focusing on twins – compared to siblings – helps us overcome issues related to differences in children's prenatal events along with other factors that might differently affect siblings, but not twins.

[3] Rosenzweig and Zhang (2009) and Li et al. (2012) provide detailed information about the Chinese

out by the Urban Survey Unit of the National Bureau of Statistics in 2002 and contain information on twin children's birthweight, zygosity, parental investments in their education, inter vivos transfers from parents and in–laws, within–twin transfers, and bequests for children whose parents have passed away. They also include data on socioeconomic and demographic characteristics of twins and their parents. Altogether, in our Chinese sample we have information on parental investments in education for 2,240 twins and data on inter vivos transfers and bequests for 758 twins.

Data for our analysis using Swedish twins comes from three different administrative registries. In particular, data on zygosity, birthweight, APGAR scores, and polygenic scores of twins comes from a subset of the Swedish Twin Registry.[4] Data on socioeconomic and demographic characteristics of twins and their parents, on the other hand, comes from Statistics Sweden. Finally, information on parental investments, transfers, and bequests is taken from the Wealth Registry. In general, we have information on parental educational investments for 12,546 Swedish twins and data on inter vivos transfers and bequests for 1,504 twins.

Taking advantage of these datasets, we begin our analysis of within–family income inequality by estimating how parental investments depend on twin children's initial abilities – proxied by their birthweight. We use birthweight to proxy for individuals' initial abilities due to the following three reasons. First, birthweight has a significant causal effect on both short– and long–run outcomes of children.[5] Second, differences in birthweights of twins are exogenous to parents. Specifically, within–twin birthweight differences are a result of differences in their nutritional intake due to one twin being better positioned in the mother's womb (Almond et al. 2005; Black et al. 2007). Third, the estimates obtained using birthweight are consistent with alternative measures of individuals' initial abilities such as one–, five–, and ten–minute APGAR scores;[6] and polygenic scores.[7] Given this

Child Twins Survey and the Chinese Adult Twins Survey, respectively.

[4] Lichtenstein et al. (2002) provides a full summary of the Swedish Twin Registry.

[5] Tables A.3, A.6, B.5, and B.7 in Appendices show that twin children's birthweight has a significant causal impact on their grades and income in our sample of Chinese and Swedish twins. *See also* Black et al. (2007); Rosenzweig and Zhang (2013); Bharadwaj et al. (2018).

[6] APGAR scores are a composite index of a child's health at birth and take into account Activity (and muscle tone), Pulse (heart rate), Grimace (reflex irritability), Appearance (skin coloration), and Respiration (breathing rate and effort) (Black et al. 2007).

[7] Polygenic scores represent a weighted sum of individual genetic markers and essentially summarize a subset of the genetic factors that influence traits relevant for human capital accumulation (Papageorge

measure of children's initial abilities, as our measure of parental investments in Chinese twins' education we use both time and money investments into each twin child during the last year. Investments in Swedish twins, on the other hand, were defined using the total amount of parental deposits/transfers into each child's bank account before they finished compulsory schooling of 9 years.[8] Using these measures of parental investments in a family fixed–effects model, we find that parents do *not* invest differently in their children's education in either China or Sweden. Consistent with this investment behavior, we find that having a lower birthweight has a significant negative impact on children's academic achievement both in China and Sweden. We also show that parental tendency to invest similar amount of resources into the children is consistent with the existing literature and can be potentially explained by the non-exclusionary public good dimension of investments, given that twin children are in the same grade and are most likely in the same classroom (Bharadwaj et al. 2018).

One potential concern related to our analysis outlined above is that we are implicitly assuming that parental deposits into Swedish twin children's bank accounts are reflective of their investments into children's education. However, it is possible that we are only capturing a transfer of the study allowance from the Swedish government to each child that attends school full time. To address this concern, we first show that there is substantial heterogeneity in the amount of deposits that children receive year–over–year. Second, we demonstrate that annual deposits in our sample are significantly lower than the governmental study allowances that parents receive on behalf of their children. These patterns, therefore, indicate that parents are unlikely to be acting as conduits that transfer governmental allowance to their children and are instead making a *deliberate* decision on how much to transfer to each child every year. As such, we believe that our assumption of these deliberate transfer decisions being reflective of parental investment decisions is plausible.

Considering that parents invest the same amount of resources into twin children's education, we next explore whether the same pattern holds for exclusionary transfers –

and Thom 2020).

[8]It should be noted that our results for Swedish twins remain unchanged if we use the amount of parental transfers during last year, similar to the way it was done for Chinese twins, instead of using the total amount of parental investments into twin children before they finish compulsory schooling of 9 years, i.e., turn 16.

such as inter vivos transfers and bequests – from parents to their adult children. We begin our analysis by focusing on inter vivos transfers received by the sample of Chinese twins. In this case, transfers were identified using the second – after investments in education – most important reason for parental saving: wedding transfers to children to start a new family (Wei and Zhang 2011). These wedding transfers are sizable and, on average, are almost at the level of two annual salaries of the receiving child. Focusing on same–sex twins – due to data limitations – and instrumenting for differences in twins' salaries using the interaction between the within–twin differences in birthweight and household level variables like maternal age and education, we show that a 10% increase in a twin child's salary at the time of marriage *increases* inter vivos transfers from parents by around 8.7%. This finding indicates that parents in China tend to *reinforce* initial ability differences between their children using inter vivos transfers.

Given substantial income inequality reinforcing parental behavior, we subsequently explore some potential reasons behind it. One possibility is that parental transfer attitudes are driven by a competitive motive where parents aim to match wedding transfers from in–laws. By limiting the sample to twins for whom the amount of in–law transfers differed by more than 30%, we find that the reinforcing parental behavior is unlikely to be driven by differences in in–law transfers. It is also possible that parents are trying to maximize the overall welfare of the family: parents transfer more resources to the higher ability twin who subsequently helps his/her lower ability sibling and the parents. Using data on within–twin transfers and net transfers to parents[9] in the years following the wedding, we show that, although the twin that got a larger transfer from parents is more likely to help both his/her sibling and parents financially, these transfers compensate for only 20% of differences in the inter vivos transfers that children received. Another possibility is that an exchange motive is at play with parents making transfer decisions based on their expectation of which one of the twins will visit them or reside with them in the future. Considering that visits and joint residence might be benefiting the twin child, the parent, or both, we first show that these encounters and/or shared residence mainly benefit the parents. Then we show that parental expectation of a higher number

[9]These transfers are defined as the difference between transfers sent to parents and from parents in 2001.

of visits, likelihood of shared residence with children, and help from children does indeed explain the inequality reinforcing behavior by parents.

Recognizing the importance of bequests and the possibility that bequests can undo inequality amplification within children generated by inter vivos transfers, we proceed by limiting our sample to twin children for whom we have bequest information. Based on the bequest data for about a quarter of the sample, we find that, unlike inter vivos transfers, bequests tend to be divided equally among children – with less than 1% of twins receiving different bequest amounts.

To explore the role of transfer and bequest decisions by parents in Sweden, we impute within–family transfers from administrative registries measuring individuals' income and wealth. In particular, we focus on the year we observe the maximum amount of outflow of net assets[10] from parents and further confirm that the outflow from parents is highly correlated with a considerable inflow for children, accounting for taxes.[11] The latter helps us ensure that the outflow of net assets from parents is indeed driven by transfers to children and not by other type of parental spending such as home renovations. Using this measure of inter vivos transfers and instrumenting for children's income at the time of the transfer, analogous to the way it was done in the Chinese twins analysis, we then show that parental transfer amounts do *not* depend on differences in twin children's income. Further limiting the sample to twins who had at least one parent passing away and taking advantage of data on parental net assets at the time of death, we find that parents also tend to divide bequests equally among children. Overall, our analysis using Swedish twins suggests that parents make equal inter vivos and bequest transfers to their children, regardless of their initial ability differences.

Altogether, we find that Chinese parents reinforce income inequality between the children using inter vivos transfers. Swedish parents, on the other hand, tend to invest, transfer, and bequeath equal amounts to both children. Given considerable differences between Chinese and Swedish parents in their attitudes towards within–family income inequality, next we investigate possible reasons behind this difference. Accounting for differences in parental education levels between the countries with around two–thirds

[10]Net assets are defined as the difference between gross assets and total debt.

[11]Figure B.2 in Appendix B presents distributions of outflow from parents and inflow to children of net assets.

of parents in the Swedish sample having at least a high school diploma compared to about a third in the Chinese sample, we find that differences in parental attitudes can be *mainly* explained by differences in parental education levels in two countries. As such, our results suggest that other culture–/country–specific differences between Chinese and Swedish parents may be less important when considering redistributive effects of tax and transfer policies on families.

Finally, to assess generalizability of our twins estimates to a larger population of children, we utilize data for non–twin children from China and Sweden. Using this data, we then find suggestive evidence that twin children and their parents are similar to their non–twin counterparts in China and Sweden when it comes to both socioeconomic characteristics and transfer decisions.

Overall, in this paper we tried to capture all the important investment and transfer dynamics between parents and children that span children's entire lives. To our knowledge, we are the first paper to have information on *all* the significant aspects of parent–children interactions, given the unique datasets that are available to us. This advantage puts us in a better position to shed light on the role of parents in shaping income inequality among their children.

This paper relates to a number of different strands of existing literature, including work on the importance of family in fostering children's human capital,[12] and the extensive literature seeking to understand how parents make inter vivos transfer[13] and bequest decisions.[14] Among this vast amount of literature, there are two papers that are closest

[12] Yi et al. (2015), for example, using data on Chinese child twin pairs where one twin suffered a health shock at age 0–3, shows that parents make compensatory investments in children's health and reinforcing investments in their education. *See also* Becker and Tomes (1976); Behrman et al. (1982); Hanushek (1992); Behrman et al. (1994); Strauss et al. (2000); Rosenzweig and Zhang (2009); Bharadwaj et al. (2018).

[13] Halvorsen and Thoresen (2011), for instance, using data on inter vivos transfers from Norway shows that parents intend to divide transfers equally between the children. Li et al. (2010), on the other hand, using data on twins in China – who experienced the consequences of the forced mass rustication movement of the Cultural Revolution – shows that the child experiencing more rustication years received higher parental transfers despite having higher income. *See also* Cox (1987); Altonji et al. (1997); Dunn and Phillips (1997); McGarry and Schoeni (1995); McGarry (1999); Hochguertel and Ohlsson (2009); Brandt et al. (2015); McGarry (2016).

[14] Erixson and Ohlsson (2019), for example, using a population–wide dataset from Sweden covering data on bequests and inheritances shows that 86% of the parents who pass away with a positive estate, more than one child, and a will – that is a prerequisite for dividing an estate unequally – divide their estates equally among their children. *See also* Menchik (1980); Tomes (1981); Bernheim et al. (1986); Menchik (1988); Wilhelm (1996); McGarry (1999); Behrman and Rosenzweig (2004); Light and McGarry

to ours. The first one is Nordblom and Ohlsson (2011). The paper uses data from the 1998 wave of the "Household market and nonmarket activities" survey in Sweden that contains information on children's education, inter vivos transfers, and bequests, among others. Using the data, the authors show that children's level of educational attainment is positively correlated with probability of receiving inter vivos gifts and bequests from parents and that the latter increases in parental resources. Hence, the paper highlights the importance of accounting for unobserved heterogeneity between families when identifying how parents make transfer decisions. As such, in this paper we employ within–family analysis when estimating how parents make investment, inter vivos transfer, and bequest decisions.

The second paper closely related to ours is French et al. (2017). In the paper, the authors use data on parental time and money investments into education as well as cash transfers – such as inter vivos transfers and bequests – from the National Child Development Study. Using this data, the paper shows that around 60% of the gap between the sons of low– and high–educated fathers is driven by parental investments in education, inter vivos transfers, and bequests with the rest being attributed to differences in children's initial abilities. The paper therefore highlights the importance of studying how parents make investment, inter vivos, and bequest decisions. Unlike French et al. (2017), in this paper we aim to identify how investments and transfers affect *within–family* and not between family income inequality. The latter helps us account for unobserved heterogeneity between families in their decision-making. Moreover, we are able to estimate the role of parents for families from two different countries.

The rest of the paper is organized as follows. Section 2 describes datasets used in the paper. Section 3 shows how differences in twin children's initial abilities affect parental investments in their education. Section 4 outlines the causal impact of differences in twin children's annual income on parents' inter vivos transfer and bequest decisions. Section 5 presents a set of robustness checks. Finally, Section 6 concludes. Additional materials can be found in Appendices.

(2004); Elinder et al. (2014); Horioka (2014).

2 Data and Sample Selection

2.1 *Data for Chinese Twins*

In this subsection, we present two datasets used to identify the role of parents in driving within–family income inequality in China. Specifically, we use the Chinese Child Twins Survey dataset for the analysis of parental investments in twin children's education. The Chinese Adult Twins Survey dataset, on the other hand, is used to estimate whether parents reinforce/compensate income inequality among their children via inter vivos transfers and bequests. Below we discuss each of these datasets in more detail.

2.1.1 *Data for Chinese Child Twins*

The Chinese Child Twins Survey (CCTS) was collected by the Urban Survey Unit of the National Bureau of Statistics in late 2002 and early 2003 in the city of Kunming in China.[15] The survey includes households residing in Kunming with twins who were between 6 and 18 years old and consists of 3,462 twin children. For each child in the sample, the dataset includes an extensive range of information on his/her education, schooling attainment, measures of health as well as a wide range of demographic and socioeconomic information at the household level. Most importantly for us, the dataset also contains both time and money investments into twin children's education and information on birthweight of twins, with the latter being used to proxy for children's initial abilities.

Given this initial sample of children, we further limit it to twins for whom we have data on parental investments in education for both twins. This leaves us with 2,484 twin children or 1,242 twin pairs. Parental investments in education in this case include both money and time investments. Money investments are reported by parents for each child and include: school tuition fees; boarding school fees; expenses on magazines, books, and stationery; expenses on home tutors and training classes.[16] Time investments, on the other hand, were reported by each twin child and contain time investments by parents, which are converted to monetary expenses using parental average hourly wage.

[15] Rosenzweig and Zhang (2009) provides a detailed description of the CCTS dataset.
[16] Our results do not change if the variable also includes clothing expenses.

Considering findings from Yi et al. (2015) that also uses the CCTS dataset and shows that early health shocks affect parental investments into children's education and health, we additionally limit the sample to pairs where neither twin suffered a health shock – such as calcium deficiency or heart disease – before turning three years old. The latter restriction helps us ensure that our findings are not driven by differences in the health of twin children and reduces our sample by less than 10%. Ultimately, our main sample consists of 1,120 twin pairs.

Table 1: Descriptive Statistics for Chinese Child Twin Children

	Lower Ability Twin		Higher Ability Twin	
	Mean	St. dev.	Mean	St. dev.
Birthweight (kg)	2.35	0.45	2.59	0.45
Health Investment	165	301	160	287
Money Investment into Education	893	931	893	914
Time Investment into Education	572	1,081	590	1,117
Male (Dummy)	0.46	0.50	0.48	0.50
Age	11.18	3.08	11.18	3.08
Mother's Age	36.67	4.78	36.67	4.78
Mother Han (Dummy)	0.88	0.33	0.88	0.33
Mother's Years of Education	8.36	3.85	8.36	3.85
Rural (Dummy)	0.54	0.50	0.54	0.50
Family Income	21,664	16,006	21,664	16,006
Observations	1,120		1,120	

Notes. The table above presents descriptive statistics for Chinese twin children in the CCTS dataset. All income and investment measures are presented in year 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table 1 above presents descriptive statistics for our sample of 1,120 Chinese twin children. Columns 1 and 2 of the Table contain information for twins with lower initial ability – proxied by their lower birthweight. Columns 3 and 4, on the other hand, include higher initial ability twins. The Table shows that the lower ability twins weighed around 2.35 kg at birth, with the birthweight difference between siblings averaging about 250 grams. Children, on average, were 11 years old in 2002 with mothers who were, on average, around 37 with 8 years of education. Slightly above half of the children in our sample are female. In terms of investments in education, parents spent around 893 yuan on each twin child annually. Accounting for the amount of *time* parents spent educating children,[17] we find that parents spent an additional 581 yuan on children's education. Altogether, parents invested around 1,474 yuan on children's education. As the annual

[17]Time investments into children's education were calculated as the product of the number of hours parents spent educating children and the average hourly parental wage.

parental income, defined as the sum of the mother's and father's labor and non-labor income, was a bit less than 22,000 yuan, this implies that parents on average spent 14% of their annual income on children's education. Moreover, the Table highlights that despite statistically significant differences in twin children's birthweight, differences in parental investments between children were *not* significant and were around 2%. Although in this paper we do not focus on parental investments in children's health, the Table also emphasizes that parental spending on children's health does not seem to depend on their initial abilities and that health investments are much smaller in magnitude and are at the level of around 10% of total educational investments.

2.1.2 *Data for Chinese Adult Twins*

Similar to the CCTS, the Chinese Adult Twins Survey (CATS) was carried out by the Urban Survey Unit of the National Bureau of Statistics in 2002 in the following five cities in China: Chengdu, Chongqing, Harbin, Hefei, and Wuhan.[18] The survey includes households in these five cities with *same–sex* twins who were between 18 and 65 years old and consists of 2,996 twin children. For each child in the sample, the dataset includes a wide range of demographic and socioeconomic information for the twin, his/her parents, and spouse and in–laws in case the twin got married. Most importantly for us, the survey includes data on twins' birthweight, parental wedding expenses, transfers to/from parents in 20002, and data on bequests for children whose parents have passed away.

Given this initial sample of children, we further limit it to twin pairs where neither twin was sent down to the country. This limitation stems from the results in Li et al. (2010) that also uses the CATS dataset and shows that factors like guilt can affect parental transfer behavior when only one of the twins experienced the consequences of the forced mass rustication movement of the Cultural Revolution. The latter restriction therefore helps us ensure that our findings are not driven by differences in which one of the twins got sent down to the country and leaves us with 1,912 twin children or 956 twin pairs.

We additionally limit the sample to twin pairs with non–missing information on their and their spouse's income at the time of the wedding, wedding expenses by parents and in–laws, and whether the twins reside with the parents. Limiting the sample to twins

[18] Li et al. (2012) provides a detailed description of the CATS dataset.

for whom we have information on parental wedding expenses is important because, as was mentioned in Section 1, wedding expenses were identified to be the second – after investments in education – most important reason for parental saving (Wei and Zhang 2011).[19] Hence, given their importance, in the paper we use wedding expenses to proxy for inter vivos transfers received by Chinese twins. Ultimately, our main sample consists of 758 twin children.

It should be noted that wedding expenses in the CATS dataset include both wedding *party* expenses as well as inter vivos transfers from parents to children to start a new family. Since differences in parental spending on a child's wedding party may not be representative of parental attitudes towards within–family income inequality, we first investigate how much of the wedding–related expenses can be attributed to the wedding party. Unfortunately, the CATS dataset does not contain information on the wedding party expenditure. As such, we take advantage of the Chinese Household Income Project (CHIP) dataset that was collected in 2002. This dataset includes data on wedding party related expenses, was collected the same year as the CATS dataset, and is representative of income distribution for both rural and urban areas of China. Given that the CHIP dataset is representative of the distribution of personal income in all of China whereas the CATS dataset covers only twins in five selected cities in China, in Table A.5 in Appendix A we show that the distribution of income in the CATS and CHIP datasets is not statistically different from one another. Considering the similarities in the demographic characteristics of individuals in the datasets, we next turn to comparing wedding expenses reported in the CATS dataset – that include both wedding party expenses and inter vivos transfers – and the CHIP dataset that consist of expenses related to the party alone. Table A.5 shows that less than 1.5% of the wedding–related expenditures reported in the CATS dataset are related to the wedding party with the rest being inter vivos transfers. Therefore, we interpret wedding expenses observed in our dataset as inter vivos transfers from parents to children to start a new family.

[19] This information in Wei and Zhang (2011) comes from the Chinese Household Income Project dataset that aims to measure and estimate the distribution of personal income in both rural and urban areas of China and was also collected in 2002. Shi (2009) provides a detailed description of this dataset.

Table 2: Descriptive Statistics for Chinese Adult Twin Children

	Lower Ability Twin		Higher Ability Twin	
	Mean	St. dev.	Mean	St. dev.
Birthweight (kg)	2.31	0.52	2.58	0.51
Male (Dummy)	0.51	0.50	0.51	0.50
At Least High School (Dummy)	0.62	0.49	0.65	0.48
Age at Marriage	25.10	3.05	25.44	3.07
Age in 2002	33.48	4.52	33.48	4.52
Salary in 2002	9,923	6,770	10,211	7,384
Spouse's Salary in 2002	9,521	8,161	9,556	7,211
Salary at the Time of Marriage	4,505	4,147	4,474	4,023
Spouse's Salary at the Time of Marriage	4,435	4,305	4,301	4,175
Parental Inter Vivos Transfers	7,821	10,097	8,607	11,576
Parents–in–Law Inter Vivos Transfers	7,051	9,754	7,839	10,573
Parental Net Transfers in 2002	419	1,033	373	958
Parents–in–Law Net Transfers in 2002	219	495	250	591
Parental Bequest Amount	907	4,475	1,184	5,268
Parent Has High School Educ. (Dummy)	0.37	0.48	0.36	0.48
Parent–in–Law Has High School Educ. (Dummy)	0.67	0.50	0.36	0.50
Reside with Parents (Dummy)	0.29	0.46	0.57	0.50
Reside with Parents-In-Law (Dummy)	0.14	0.35	0.15	0.36
Reside in the Same City as Parents (Dummy)	0.94	0.24	0.95	0.22
Reside in the Same City as Parents–in–Law (Dummy)	0.86	0.35	0.86	0.35
Observations	379		379	

Notes. All income, transfer, and bequest measures are given in 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table 2 above presents descriptive statistics for our sample of 758 adult twins. Columns 1 and 2 of the Table contain information for twins with lower initial ability – proxied by their lower birthweight. Columns 3 and 4, on the other hand, include higher initial ability twins. The Table shows that higher ability twins, on average, weighed around 270 grams more compared to their siblings. Additionally, the Table highlights that both sets of twins, on average, got married at the age of 25 and were around 33 years old when the survey was conducted. The Table also demonstrates that a higher ability twin tended to earn 3% more compared to his/her sibling. Although the difference between incomes of twins may seem small at around 3% compared to the difference in their birthweight of around 12%, it is consistent with the impact of birthweight on earnings. In particular, we find that a 10% increase in a child's birthweight – while controlling for that of the sibling – increases his/her income by 2%. Table 2 also shows that almost two thirds of the sample had at least a high school diploma by the time they got married. The twins were, on average, earning a similar income of 4,500 yuan at the time of marriage.[20] Parental

[20]It should be noted that the fact that twin children earn similar income at the time of parental

transfers, on the other hand, were nearly twice as large as the twins' salaries and were considerably different between twin siblings, with the higher ability twin receiving 10% more in transfers. The latter group also received 11% more in in–law transfers. Unlike inter vivos transfers for children's weddings, net transfers from parents in 2002[21] were much smaller and were in the magnitude of 5% of wedding transfers. The difference between these two types of transfers highlights two important points. First, it emphasizes the importance of focusing on inter vivos transfers to children to start a new family. Second, it shows that not accounting for subsequent net transfers from parents in the analysis may not significantly bias implications of this paper.

Table 2 also shows that twins that received larger transfer amounts were twice as likely to live with their parents, with the difference between siblings being statistically significant. Additionally, the Table highlights that both twins tended to reside in the same city as their parents. Finally, Table 2 shows that the higher ability twin tended to receive larger bequests, with the difference, although not statistically significant, being in the magnitude of 30%. Overall, the Table shows substantial differences in transfers received by children based on their initial abilities.

2.2 *Data for Swedish Twins*

In this subsection, we present datasets used to identify the role of parents in driving within–family income inequality in Sweden. Unlike survey datasets that were used for our Chinese twins analysis, data for our Swedish twins analysis comes from three different *administrative* registries. The first one is a subset of the Swedish Twin Registry.[22] This subset includes all genotyped twins born in Sweden between 1973 and 2005 and includes information at birth for each twin child such as birthweight; one-minute, five-minute, and

transfers does *not* imply that differences in twin children's birthweight have a negligible impact on their income. It is simply due to the fact that the higher ability twin, in our sample, tended to get married 2 years earlier than his/her siblings. As such, a proper estimation of the impact of birthweight on twin children's income is done by looking at the impact of birthweight on twin children's salary in 2002.

[21] It should be noted that this measure of inter vivos transfers was calculated as the difference between transfers from parents and transfers to parents in 2002.

[22] The reader is referred to Lichtenstein et al. (2002) for a full summary of the Swedish Twin Registry.

ten-minute APGAR scores;[23] and polygenic scores.[24] We complement this dataset with administrative data from Statistics Sweden that contains information on socioeconomic and demographic characteristics of twins and their biological parents. Finally, information on parental investments, transfers, and bequests is imputed from the Wealth Registry that contains data on financial assets, real assets, and debt of all twins and their parents for the period between 1999 and 2007. The focus on the 1999–2007 period stems from data availability; particularly, data on individuals' wealth was collected in Sweden starting from 1999 and continued only until 2008 due to the repeal of the wealth tax in Sweden in 2007. Overall, individually–linked data from the Swedish Twin Registry, Statistics Sweden, and the Wealth Registry comprise our main dataset for Swedish twins.

2.2.1 *Data for Swedish Child Twins*

For the analysis using Swedish child twins we further restrict the main dataset, described above, to twins who were born between 1983 and 2005 due to the following two reasons. First, we measure parental investments into twin children's education for children who are less than 17 years old since Swedish children are only required to stay in school until they finish compulsory schooling of 9 years.[25] Hence, differences in parental educational investments after children reach the age 17 may be stemming from differences in whether children continue their education and may not be representative of parental attitudes towards within–twin ability differences.[26] Second, the Swedish Wealth Registry covers only the 1999–2007 period. The combination of these two restrictions implies that the earliest cohort in our analysis was born in 1983. Since parents did not make educational investments into twins that were born in 2006 and 2007 in the data, the latest cohort in our analysis is the one born in 2005.

[23] APGAR scores are a composite index of a child's health at birth and take into account Activity (and muscle tone), Pulse (heart rate), Grimace (reflex irritability), Appearance (skin coloration), and Respiration (breathing rate and effort). Each component is worth up to two points for a maximum of ten (Black et al. 2007).

[24] Polygenic scores represent a weighted sum of individual genetic markers and essentially summarize a subset of the genetic factors that influence traits relevant for human capital accumulation (Papageorge and Thom 2020).

[25] Children in Sweden, on average, go to school at the age of 7 and finish compulsory schooling at the age of 16.

[26] This age restriction also makes our Swedish sample similar to the Chinese one since the latter includes twin children who are between 6 and 18 years old.

Using data for twins born in 1983–2005, we then aim to identify how initial ability differences between twins – measured using birthweight; one–minute, five–minute, and ten–minute APGAR scores; and polygenic scores – affect parental investment decisions in their education. Education is free in Sweden and, unfortunately, we do not have detailed survey information on parental time and money investments into twin children's education. As such, we proxy for differences in parental investments using administrative data on total parental deposits/transfers into twin children's bank accounts before they finish compulsory schooling.

One potential concern related to using administrative data instead of survey data is that we are implicitly assuming that parental deposits into Swedish twin children's bank accounts are reflective of their investments into children's education. However, it is possible that we are only capturing a transfer of the study allowance from the Swedish government to each child that attends school full time. In this case, parents are mainly acting as conduits that pass the money from the government to the children. As such, parental transfers to children's bank accounts may *not* be indicative of parental investment decisions into their education. To shed light on the validity of this concern, in Figure B.1 in Appendix B we present average annual parental transfers for children between the ages of 0 and 16 and for whom we have data for all 9 years between 1999 and 2007. The Figure demonstrates that there is significant heterogeneity in the amount of transfers children receive year-over-year. Moreover, the Figure shows that annual transfers averaged around 4,100 SEK per year in our sample – an amount that is significantly lower than the governmental study allowance of 1250 SEK per month, i.e., 15,000 SEK per year in 2018 (Eurydice 2020). These patterns, therefore, indicate that parents are unlikely to be acting as conduits that transfer governmental allowance to their children and are instead making a *deliberate* decision on how much to transfer to each child every year. As such, we believe that our assumption of these deliberate transfer decisions being reflective of parental investment decisions is plausible.

Given our measures of children's initial abilities and parental investments in education, Table 3 below presents descriptive statistics for 12,546 twin children in our sample. Columns 1 and 2 of the Table contain information for the twins with lower initial ability – proxied by their birthweight. The Table shows that higher ability twins, on average,

weighed around 300 grams more compared to their siblings. The Table also shows that lower birthweight twins tended to be girls in the case of opposite–sex dizygotic twins. In general, children were around 6 years old and came from households where parental income – defined as the sum of maternal and paternal total income – was around 480,000 SEK in 2002. Parental net assets for the same year – defined as the sum of parental real estate and financial assets minus debt – were around 642,000 SEK. Mothers in the sample, on average, had at least a high school degree and were 37 years old in 2002. Parents also did not invest much in their children's education, with the investments averaging 28,000 SEK a year – less than 6% of parental income; this might be partially explained by the free nature of education in Sweden. The Table also shows that investments into twin children were not statistically significantly different from each other.

Table 3: Descriptive Statistics for Swedish Child Twin Children

	Lower Ability Twin		Higher Ability Twin	
	Mean	Stdev	Mean	Stdev
Birthweight (kg)	2.49	0.55	2.80	0.57
Investment into Education	27,876	42,722	27,975	42,633
Male (Dummy)	0.45	0.50	0.51	0.50
Age	5.92	4.26	5.92	4.26
Mother's Age	36.96	5.92	36.96	5.92
Mother's Years of Education	13.08	2.17	13.08	2.17
Family Income	481,526	184,411	481,526	184,411
Family Net Assets	641,508	1,113,358	641,508	1,113,358
Observations	6,273		6,273	

Notes. The table above presents descriptive statistics for all genotyped Swedish twin children in the Swedish Twin Registry who are less than 17 years old. All income, asset, and investment measures are presented in year 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

2.2.2 *Data for Swedish Adult Twins*

For the analysis using Swedish adult twins we restrict the main dataset to twins who were born between 1973 and 1989. Analogous to the case of child twins, this limitation is a result of two data restrictions. First, parental inter vivos transfers to twin children are measured for children who are more than 16 years old. Second, the Swedish Wealth Registry data covers only the 1999–2007 period.

Using data for twins born in the 1973–1989 period, we then aim to identify the role of parental inter vivos transfers in driving within–family income inequality. Similar to the case of parental investments into children's education, unfortunately, we do not have

data on within–family transfers. As such, to identify transfers from parents to adult children from administrative registries, we do the following. First, we use data on annual income and net assets – defined as the sum of real and financial assets less the amount of total debt owed – to determine how much of an increase in an individual's net assets for a particular year was a result of transfers from other individuals, including parents. Transfers in this case include both monetary and real estate transfers and also account for real estate price fluctuations at the municipality level since the latter can affect an individual's net assets even in the absence of transfers from relatives.[27] Second, we construct the transfer variable for each year between 2000 and 2007. Third, we limit the sample to the year we observe the maximum amount of outflow of net assets from parents. The latter restriction makes it easier for us to match outflows from parents to inflow to children and helps us abstract away from identifying all the transfer/non–transfer related expenses that individuals experience year–over–year. Additionally, focusing on the maximum transfers from parents instead of accounting for all the smaller transfers within the eight-year period brings our analysis closer to the one for the Chinese twins, since the latter uses a one–time transfer at the time of twin children's marriage. Fourth, we identify transfers that each child received the year parents experienced the largest outflow of net assets. Since it is possible that parents experienced a large outflow of net assets due to, for example, home renovations instead of transfers to children, in Figure B.2 in Appendix B we present distributions of an outflow of net assets experienced by parents and of an inflow observed in children. Similarity in the distributions shows that, accounting for taxes, the outflow of assets coincides almost perfectly with an inflow in children's assets for most of the distribution, with smaller transfers – those in the bottom 10% of the distribution – being the only exception. Given that we are indeed capturing support from parents, this is how we define inter vivos transfers from parents to children.

Table 4 below presents descriptive statistics for 1,504 twin children in our adult sample. Columns 1 and 2 of the Table contain information for twins with lower initial ability – proxied by their birthweight. The Table shows that the lower ability twins weighed around 2.44 kg at birth, with the birthweight difference between siblings averaging about

[27]For robustness, we also accounted for changes in an individual's total income from year to year. However, this did not change our results since total income does not vary much between years.

300 grams. The Table also shows that 38% of our sample is male. In general, the twins were around 22 years old in 2002 and received transfers from parents when they were around 21 years old. All twins and two thirds of the parents in the sample had at least a high school diploma. Additionally, the Table shows that there are differences in annual total income, with the lower ability twins earning around 2,300 SEK less than their siblings. Although the difference between incomes of twins may seem small at around 2% compared to the difference in their birthweight of around 12%, it is consistent with both findings in Black et al. (2007) for Norway and the impact of birthweight on children's income. Particularly, Table B.7 in Appendix B shows that differences in twin children's birthweight have a significant impact on their income with a 10% increase in a child's birthweight – while controlling for that of the sibling – leading to 1.3% increase in his/her income.

Table 4: Descriptive Statistics for Swedish Adult Twin Children

	Lower Ability Twin		Higher Ability Twin	
	Mean	Stdev	Mean	Stdev
Birthweight (kg)	2.44	0.52	2.74	0.52
Male (Dummy)	0.36	0.48	0.40	0.49
At Least High School (Dummy)	1.00	0.00	1.00	0.00
Age at the Time of Transfer	21.45	4.14	21.45	4.14
Age in 2002	21.82	3.97	21.82	3.97
Salary at the Time of Transfer	99,902	94,623	102,224	94,851
Parental Inter Vivos Transfers	60,460	136,730	55,161	128,830
Parental Bequest Amount	72,752	140,472	75,684	144,566
Parent Has High School Educ. (Dummy)	0.68	0.47	0.68	0.47
Reside with Parents (Dummy)	0.51	0.25	0.51	0.26
Reside in the Same Municipality as Parents (Dummy)	0.67	0.30	0.69	0.31
Observations	752		752	

Notes. The table above presents descriptive statistics for all genotyped Swedish twin children in the Swedish Twin Registry who are above 17 years old. All income and transfer measures were collected between 1999 and 2007 and are presented in year 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Parental inter vivos transfers seem to compensate for differences in income with the lower ability twin receiving a bit over 5,000 SEK more than the sibling. Additionally, the Table shows that parental bequest tend to be slightly larger than inter vivos transfers at around 74,000 SEK. The Table also indicates that although residing with parents is not very common in Sweden with only about half of twins doing so, around 70% of the children live in the same municipality as their parents. Overall, descriptive statistics show that parents in Sweden tend to compensate for within–twin salary differences using inter

vivos transfers, although the difference in transfers is not statistically significant.

Table 4 also shows that transfers and bequests are in the magnitude of 54–75% of the receiving child's annual income. Although the transfer amounts are smaller than the ones we observe in the Chinese sample, they are consistent with those observed in the literature for Sweden. In particular, using population–wide administrative data on bequests and inheritances during the 2002–2004 period in Sweden, Erixson and Ohlsson (2019) showed that bequests averaged around 60% of the receiving child's income. Hence, transfer variables that we constructed from the administrative registries seem to be consistent with the values obtained in the literature using *actual*, and not imputed, data on transfers from parents to children.

3 Parental Investments in Children's Education

3.1 *The Empirical Model and Its Identification*

In this section we want to estimate whether parental investments in twin children's education tend to compensate/reinforce initial ability differences between the twins. To do so, let $W_{i,\tau}$ be a birthweight of twin i in family τ and let $I_{i,\tau}$ represent parental investments in his/her education. As mentioned in Section 2, for Chinese twins $I_{i,\tau}$ includes both monetary expenses and time investments by parents into each twin child during 2002. For Swedish twins, on the other hand, it includes the total amount of parental deposits/transfers into each child's bank account before he/she finishes compulsory schooling of 9 years.[28] Moreover, let $\boldsymbol{X}_{i,\tau}$ consist of permanent characteristics of a child (birth year and gender). Additionally, let $\boldsymbol{X}_{\tau}^{P}$ and μ_{τ} represent observable (family income, mother's age and education) and unobservable parental characteristics, respectively. In the Chinese twins analysis, we also control for permanent characteristics of parents such as whether parents reside in a rural area and whether the mother is of a Han ethnicity whereas in the Swedish twins analysis we additionally include parental municipality fixed–effects. Finally, let $\xi_{i,\tau}$ reflect an idiosyncratic error term. Then parental

[28] It should be noted that our results remain unchanged if we use the total amount of parental transfers in 2002 instead.

investments in twin children's education, $I_{i,\tau}$, can be represented as:

$$I_{i,\tau} = \beta_1 W_{i,\tau} + \beta_2 \boldsymbol{X}_{i,\tau} + \beta_3 \boldsymbol{X}_{\tau}^{P} + \mu_{\tau} + \xi_{i,\tau} \tag{1}$$

where β_1 captures the impact of twin children's initial abilities, proxied by their birthweight, on parental investment decisions. The use of birthweight as a measure of individuals' initial abilities stems from the following three reasons. First, birthweight has a significant causal effect on both short– and long–run outcomes of children (Black et al. 2007; Bharadwaj et al. 2018). In particular, in Tables A.3, A.6, B.5, and B.7 in Appendices we show that twin children's birthweight has a significant causal impact on their grades and income in our sample of Chinese and Swedish twins. Second, differences in birthweights of twins are exogenous to parents. Specifically, birthweight differences between twins result from differences in their nutritional intake due to one twin being better positioned in the mother's womb (Almond et al. 2005; Black et al. 2007). Third, in Section 3.3 we show that the estimates obtained using birthweight are consistent with alternative measures of individuals' initial abilities such as one–, five–, and ten–minute APGAR scores; and polygenic scores. APGAR scores in this care represent a composite index of a child's health at birth and take into account Activity (and muscle tone), Pulse (heart rate), Grimace (reflex irritability), Appearance (skin coloration), and Respiration (breathing rate and effort) with each component being worth up to two points for a maximum of ten (Black et al. 2007). Polygenic scores, on the other hand, represent a weighted sum of individual genetic markers and essentially summarize a subset of the genetic factors that influence traits relevant for human capital accumulation (Papageorge and Thom 2020). It should also be noted that polygenic scores differ only for the sample of dizygotic twins since monozygotic twins have identical genes.

Equation (1) above also shows that in order to identify how parents make investment decisions, we need to account for unobserved parental characteristics such as parental preferences for children's ability/gender, among others. Ignoring unobserved parental characteristics, on the other hand, might lead to biased estimates. Therefore, in order to eliminate this source of bias and since cross–sibling effects are symmetric and equal, we

use the following within–twin fixed effect specification:

$$\triangle I_\tau = \beta_1 \triangle W_\tau + \beta_2 \triangle \boldsymbol{X}_\tau + \triangle \xi_\tau \tag{2}$$

where $\triangle$ is an operator forming within–twin differences and $\triangle \boldsymbol{X}_\tau$ captures differences in twin children's gender. β_1 helps us identify how differences in children's initial abilities affect parental investment decisions. The estimate of β_1 above can still be inconsistent if within–twin differences in birthweight, $\triangle W_\tau$, are correlated with $\triangle \xi_\tau$. The latter is more likely to be the case for dizygotic twins – who, on average, share only half of their genes – compared to monozygotic twins who share all of their genes. Since our sample contains both monozygotic and dizygotic twins, in subsequent subsections we show that we cannot reject the hypothesis that the relationship between birthweight and academic achievements of twins is the same for both types of twins. The latter, in turn, is also consistent with the literature that demonstrates that long–term outcomes of dizygotic twins are analogous to those of monozygotic twins (Black et al. 2007). Thus, we believe that the estimate of β_1 in equation (2) above is consistent.

Given this identification strategy, in the subsequent subsections we estimate the effect of differences in twin children's initial abilities on parents' investments in education for Chinese and Swedish twins.

3.2 *FE and OLS Estimates for Chinese Twins*

In this subsection we present our fixed–effect estimates of the impact of differences in twin children's initial abilities on parental investments in education for Chinese twins.

Table 5 below presents our FE and OLS estimates. Column 1 contains our FE estimates obtained using the identification strategy, given by equation (2). Our FE results demonstrate that parental investments in education *do not* depend either on differences in twin children's initial abilities or on the gender composition of the twins. In particular, column 1 shows that a twin with a birthweight between 2 and 2.5 kg, for example, receives only 1.3% *less* in investments compared to his/her sibling who weighs over 3 kg with the estimates not being statistically significant. Our OLS findings in column 2, on the other hand, are larger in magnitude and are of opposite sign compared to our FE estimates.

Specifically, our findings indicate that a twin with a birthweight of 2–2.5 kg, for example, receives 7.7% *more* in parental investments compared to his/her sibling who weighs over 3 kg. Although our OLS results seem to indicate that parents tend to compensate for initial ability differences between the twins, the effects are not statistically significant. The difference in signs and magnitudes between the FE and OLS findings indicates a significant endogeneity bias that is present in the OLS estimates and prompts the use of FE models.

Table 5: The Effect of Differences in Chinese Twin Children's Initial Abilities on Parental Investments in Education

	FE	OLS
Birthweight (dummy): <2	-0.016	0.045
	(0.044)	(0.062)
Birthweight (dummy): 2-2.5	-0.013	0.077
	(0.039)	(0.057)
Birthweight (dummy): 2.5-3	-0.001	0.034
	(0.035)	(0.057)
Male (Dummy)	-0.018	-0.014
	(0.020)	(0.030)
Observations	2,222	2,222
Adjusted R^2	0.932	0.359

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on parental investments in their education. Column 2 additionally controls for maternal age, level of education, whether she is of Han ethnicity, household income and whether the family resides in a rural area. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

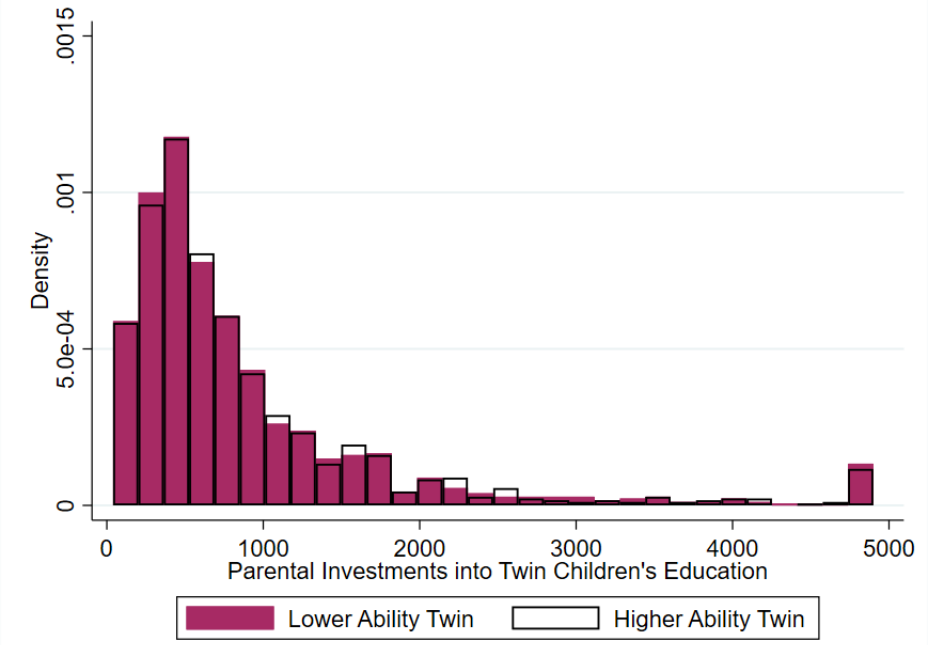
The small impact of within–twin differences in birthweight is additionally confirmed by Figure 1 below that presents the histogram of parental investments in twin children by their initial abilities. The histogram indicates that parental investments into twins are almost identical and do not seem to depend on initial abilities of the children.

To identify whether our findings of equal investments by parents are driven by parents' tendencies to *report* similar investments into education of both children, in Table A.1 in Appendix A we use parental *time* investments[29] that were reported by *each child* – and not by the parents – as our dependent variable. Analogous to Table 5 above, Table A.1 shows that within–twin differences in birthweight do *not* have a significant impact on parental time investments. Unlike Table 5, however, Table A.1 indicates a slightly compensating behavior by the parents. In particular, our FE estimates in column 1 show that a twin

[29] As mentioned in Section 2, time investments contain time investments by parents that are converted to monetary expenses using parental average hourly wage.

weighing 2–2.5 kg receives around 1.2% *more* in investments compared to his/her sibling weighing over 3 kg. Altogether, we find that differences in twin children's initial abilities do not have a significant impact on parental educational investment decisions.

Figure 1: Distribution of Parental Investments in Chinese Twin Children's Education



Notes: The figure above presents the distribution of annual parental investments in twin children's education by their initial abilities. All investment measures are presented in levels and year 2002 prices.

We also explore whether parental tendency to invest equal amounts into both children's education is driven by a group of parents with high/low household income or high/low maternal education. Focusing on households with below average income and those where mothers do not have a high school degree in Table A.2 in Appendix A, we find that households with lower levels of education tend to reinforce within–twin differences a bit more compared to the full sample. However, we cannot reject that the estimates are the same between these two groups. These findings then suggest that equal investments by parents is *not* driven by a certain group of parents.

If parents have invested similar amount of resources into the education of both children, we would also expect to observe a persistent effect of birthweight on twin children's academic achievement. Indeed, in Table A.3 in Appendix A we show that a twin weighing 2–2.5 kg has a mathematics score that is around 0.22 of a standard deviation *lower* than his/her sibling who weighs over 3 kg with the results being statistically significant at 5%.

To verify the consistency of our estimates, we additionally present our findings of the impact of twin children's birthweight on their test scores for the sample of dizygotic twins. Table A.4 in Appendix A demonstrates the results and shows that although the impact of birthweight on the mathematics scores of dizygotic twins is larger at 0.32 for twins weighing 2–2.5 kg, for instance, we cannot reject that it is the same for both dizygotic and monozygotic twins. Thus, we believe that our results are consistent.

Overall, we find that differences in parental investments into twin children's education neither reinforce nor compensate for initial ability differences in twins.

3.3 *FE and OLS Estimates for Swedish Twins*

Analogous to the previous subsection, this subsection identifies how differences in twin children's initial abilities affect parental investments into twin children's education for Swedish twins.

Table 6: The Effect of Differences in Twin Children's Initial Abilities on Parental Investments in Education

	FE	FE	FE	FE	FE
Birthweight (dummy): <2	-0.042				
	(0.047)				
Birthweight (dummy): 2-2.5	-0.033				
	(0.032)				
Birthweight (dummy): 2.5-3	-0.028				
	(0.025)				
Birthweight (kg)		0.092			
		(0.066)			
One-Minute APGAR Score			-0.002		
			(0.006)		
Five-Minute APGAR Score				-0.017**	
				(0.009)	
Ten-Minute APGAR Score					-0.001
					(0.012)
Male (Dummy)	0.012	0.010	0.014	0.014	0.014
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Observations	12,494	12,494	12,494	12,494	12,494
Adjusted R^2	0.977	0.977	0.977	0.977	0.977

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight and one–, five–, and ten–minute APGAR scores, on parental investments in their education. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table 6 above presents our FE estimates using different measures of children's initial abilities such as birthweight and one–, five–, and ten–minute APGAR scores. Specifically, column 1 of the Table shows that a very low birthweight twin, defined as having a

birthweight of less than 2 kg, who has a sibling who weighs over 3 kg tends to receive 4.2% *less* in parental educational investments. Similarly, column 2 shows that a twin that weighs 10% more than his/her sibling, on average, receives 0.9% *more* in investments. The Table also indicates that the small and insignificant impact of birthweight differences on parental investments remains unchanged when we consider other proxies for children's initial abilities such as one– and ten–minute APGAR scores. In contrast, column 4 demonstrates a statistically significant compensating behavior by parents with a one point *increase* in a twin's five–minute APGAR score *decreasing* parental transfers by 0.02%. Since within–twin differences in APGAR sores can be at most 10,[30] column 4 suggests a within–twin difference in parental investments of at most 0.2%. Altogether, our estimates in Table 6 seem to suggest that parents tend to invest similar resources into both children. Moreover, the Table highlights that the findings are consistent across various measures of children's initial abilities such as birthweight and APGAR scores.

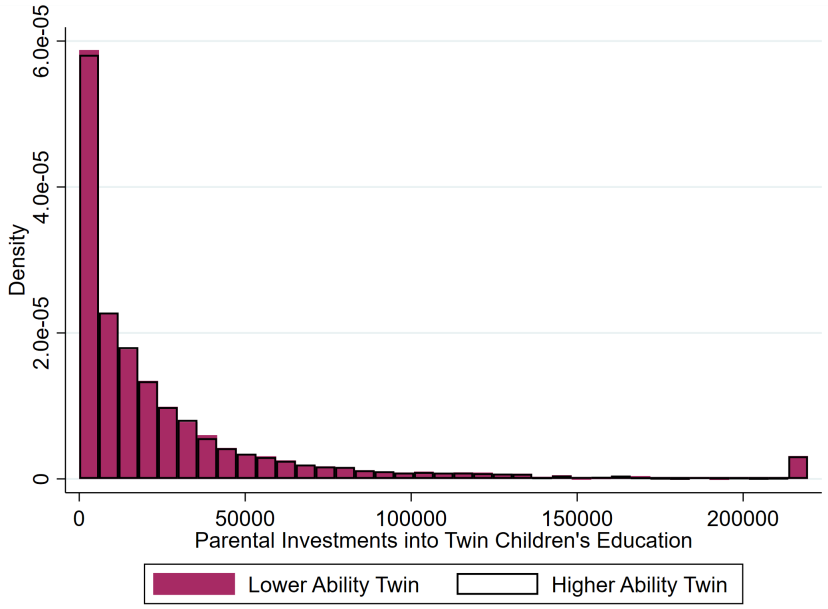
To identify whether our estimates in Table 6 above are consistent with another measure of initial ability, in Table B.1 in Appendix B we limit the main sample to twins for whom we have data on their polygenic scores. The Table shows that parents tend to slightly reinforce within–twin differences with a 1 standard deviation increase in a twin child's polygenic scores increasing parental investments by 3.5%. Columns 1 and 2 of the Table demonstrate that an analogous pattern holds when we focus on within–twin differences in birthweight. In particular, we find that a 10% increase in a twin child's birthweight increases investments in his/her education by 2.1%. In Table B.2 in Appendix B we demonstrate that differences in parental attitudes between Tables 6 and B.1 are driven by differences in the characteristics of the main sample and the polygenic score sample. Specifically, it shows that parents in the latter sample tend to have lower income and lower level of education, with both estimates being statistically significant. In the rest of the paper we show that this reinforcing behavior by parents with lower level of income and education is consistent with our analyses later in this section and of parental inter vivos transfer behaviors. Overall, Table B.1 shows that our findings of parental educational investments are consistent regardless of whether we use birthweight or polygenic scores as our measure of initial ability.

[30] APGAR scores range between 0 and 10.

OLS estimates of the impact of within–twin differences in children's initial abilities on parental educational investments are given in Table B.3 in Appendix B. The Table shows that Swedish parents tend to compensate for initial ability differences between their children with a 10% *increase* in a twin child's birthweight – while keeping his/her sibling's birthweight constant – *decreasing* parental investments by almost 4.4%. Similarly, we find that an increase in a one–minute APGAR score of a child by 1 point (out of 10 possible) *decreases* parental investment amount by around 0.06%. Overall, OLS findings highlight mitigating behavior on the side of Swedish parents. Differences between the FE and OLS estimates thus suggest that there is a significant within–family heterogeneity in parental investments and prompt the use of within–family estimates in our analysis.

In line with our results in Table 6 above, Figure 2 below highlights similarity in the distribution of parental investments by twin children's initial abilities and seems to suggest that investments do not depend on within–twin differences in initial abilities.

Figure 2: Distribution of Parental Investments into Swedish Twin Children's Education



Notes: The figure above presents the distribution of annual parental investments into twin children's education by their initial abilities. All investment measures are presented in levels and year 2002 prices.

To ensure that our estimates are not driven by a specific group of parents, in Table B.4 in Appendix B we present our FE estimates separately for families with below average income and those with mothers who do not have a high school degree. Similar to Table 6 above, the Table shows that both low income and low education households tend to

slightly reinforce within–twin differences in initial abilities. Specifically, we find that a twin with a 2.5–3 kg birthweight receives 0.06% less in parental investments compared to his/her sibling who weighs over 3 kg, with the result being statistically significant at 10%. Thus, although we cannot reject that the estimates do not differ between these groups and the rest of the population, the results for below average income and low level of education households seem to suggest a slightly more reinforcing parental behavior.

Since Swedish parents tend to, on average, invest similar amount of resources in their children's education, analogous to our findings for Chinese twins, we also find a persistent impact of birthweight on children's grades in our Swedish sample. In particular, Table B.5 in Appendix B shows that being born with a weight in the 2.5–3 kg range and having a sibling who weighs over 3 kg results in a twin receiving 0.29 of a standard deviation *lower* grades after ninth grade. Moreover, the Table shows that a one point increase in one–minute and five–minute APGAR scores increases children's standardized grades by around 0.06 and 0.09 of a standard deviation, respectively. To verify consistency of these estimates, in Table B.6 in Appendix B we present our findings of the impact of twin children's birthweight on their standardized grades for the sample of dizygotic twins. The Table shows that, although the impact of birthweight on the mathematics scores of dizygotic twins is larger at 0.32 for twins weighing 2–2.5 kg, for instance, we cannot reject that it is the same for both dizygotic and monozygotic twins. Thus, we believe that our results are consistent. Altogether, our findings suggest that parental investments in twin children education *do not* depend on their initial ability differences.

To conclude, in this section we find that differences in parental investments in twin children's education neither reinforce nor compensate for initial ability differences in twins in either China or Sweden. As in Bharadwaj et al. (2018), this phenomenon can be potentially explained by the public good dimension of the investment where it is difficult to actively prohibit the other twin from being tutored when the parent is tutoring one twin, implying that even if parents wish to invest differentially they are unable to do so.

4 Parental Inter Vivos Transfers and Bequests

4.1 *The Empirical Model and Its Identification*

In this section we investigate whether parental inter vivos transfers compensate or reinforce income inequality among twin children. To do so, let $Y_{i,\tau}$ be an annual salary of twin i in family τ at the time of the transfer and let $T_{i,\tau}$ represent inter vivos transfers from parents to children. As mentioned in Section 2, in the case of Chinese twins, parental transfers were identified using wedding transfers to children to start a new family. For Swedish twins, on the other hand, transfers were measured using inflow of net assets – including both cash and real estate – to children during the year parents experienced the largest outflow of net assets. Moreover, let $X_{i,\tau}$ consist of permanent characteristics of a child (gender and birth year). Additionally, let X^P_τ and μ_τ represent observable (mother's birth year, parents' city/municipality of residence) and unobservable parental characteristics, respectively. For the sample of Chinese twins, we additionally present our estimates with and without $T^S_{i,\tau}$ – that represents the amount of wedding transfers from in–laws. The latter is included in the estimation to identify if and how transfers from in–laws affect parental transfer amounts. Finally, let $\eta_{i,\tau}$ reflect unobservable child characteristics and an error term. Then parental inter vivos transfers to children can be represented as:

$$T_{i,\tau} = \alpha_1 Y_{i,\tau} + \alpha_2 \boldsymbol{X}_{i,\tau} + \alpha_4 \boldsymbol{X}^P_\tau + \mu_\tau + \eta_{i,\tau} \tag{3}$$

where α_1 captures the impact of twin children's income on parental inter vivos transfers. Considering that unobservable parental characteristics – such as differences in their preferences for within–family income inequality – might bias our estimates, we focus on within–twin differences in parental transfers:

$$\triangle T_\tau = \alpha_1 \triangle Y_\tau + \alpha_2 \triangle \boldsymbol{X}_{i,\tau} + \triangle \eta_\tau \tag{4}$$

where $\triangle$ is an operator forming within–twin differences and $\triangle \boldsymbol{X}_{i,\tau}$ captures differences

in Swedish twin children's gender.[31] It should be noted that although family fixed–effects help us control for unobserved family characteristics, they do so at the expense of far greater measurement error. Specifically, the fixed–effects estimates in equation (4) above can be substantially downward biased since the correlation between the self-reported income of twins increases the attenuation caused by the measurement error (Ashenfelter and Krueger 1994).[32] Therefore, to get consistent estimates of the impact of twin children's income on parental transfers, we instrument for within–twin differences in income using the interaction between household level variables (such as maternal age, A_τ^m, and maternal level of education, S_τ^m) and within–twin variation in initial abilities, $\triangle W_\tau$. The use of these instruments is motivated by the following two reasons. First, similar to Yi et al. (2015), we let our theoretical analysis guide us in choosing these instruments. In particular, both maternal age and education are included in equation (3), but are excluded from equation (4). Moreover, Bharadwaj et al. (2018), using administrative data from Sweden, shows that the impact of birthweight on twin children's income between the ages of 25 and 33 varies with maternal age and education.[33] Second, within–twin differences in birthweight have a significant causal effect on both short– and long–run outcomes of children and are exogenous to parents (Black et al. 2007). Given our instrument, the second–stage of the instrumental variables approach can be represented as:

$$\triangle T_{i,\tau} = \beta_1 \triangle \hat{Y}_\tau + \beta_2 \triangle \boldsymbol{X}_{i,\tau} + \triangle \xi_\tau \tag{5}$$

where the first–stage is identified as:

$$\triangle \hat{Y}_\tau = \left(\gamma_1 + \gamma_2 A_\tau^m + \gamma_3 S_\tau^p\right) \times \triangle W_\tau + \zeta_\tau \tag{6}$$

[31] As was mentioned in Section 2, our sample of Chinese adult twins consists of only same–sex twins due to data limitations.

[32] It should be noted that this is less of a concern in our analysis of the impact of within–twin differences in initial abilities on parental investments in education since birthweights of twins were reported by the parents. Income of twin children at the time of transfer, on the other hand, was reported by each twin child.

[33] Given this finding, in Table B.10 in Appendix B we verify that the impact of birthweight varies with maternal age and education using Swedish data available to us. The results indicate significant heterogeneity in our sample with younger and less educated mothers reinforcing the impact of initial ability differences between children on their income.

Given this identification strategy, in subsequent subsections we describe our empirical method used to estimate the effect of differences in twin children's income on parents' inter vivos transfers. It should be also noted that we use the identification strategy, defined above, to estimate how within–twin differences in annual income at the time a parent has passed away affect parental bequest decisions in China and Sweden.

4.2 *IV and OLS Estimates for Inter Vivos Transfers by Chinese Parents*

In this subsection we present our estimates of the causal effect of within–twin differences in Chinese twin children's annual income on inter vivos transfers from parents using the empirical model outlined in the previous subsection.

Table 7: The Effect of Differences in Chinese Twin Children's Income at the Time of Transfer on Parental Inter Vivos Transfers

	IV		OLS	
	(1)	(2)	(3)	(4)
Twin Salary	0.867***	0.894***	0.091*	0.128**
	(0.327)	(0.321)	(0.035)	(0.028)
Parents–in–Law Inter Vivos Transfers		0.186***		0.419***
		(0.040)		(0.051)
Observations	750	750	750	750

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 3 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table 7 above presents our IV and OLS results. Columns 1 and 2 contain our IV estimates obtained using the identification strategy, given by equation (5). Our IV estimates indicate a large, positive, and significant *causal* effect of within–twin differences in income at the time of transfer on parental transfer decisions. In particular, Column 1 shows that a 10% increase in a twin child's salary – while keeping the sibling's salary constant – increases parental inter vivos transfers to him/her by almost 8.7%. Column 2 demonstrates that this estimate increases to 8.9% when we also control for inter vivos transfers from in–laws. It also highlights that an increase in in–law transfers by 10% increases parental transfers to children by additional 2%. Altogether, our IV estimates indicate that parents tend to reinforce within–twin differences in income. Our OLS estimates given in columns 3 and 4, on the other hand, highlight a dampened effect of

children's income on parental transfers. Specifically, they show that a 10% increase in twin children's salary increases parental transfers by less than 1.3%. As was mentioned in the previous subsection, the OLS estimates might differ from the IV ones due to a measurement error and since the former does not account for unobserved parental and child characteristics. The difference between the IV and OLS estimates suggests that the OLS estimates *understate* the substantial positive impact of children's income on parental transfer amounts.

In Table A.6 in Appendix A we examine validity of our instrument for within–twin differences in income and find that twin children's birthweight has a substantial positive impact on their income at the time of transfer. Specifically, we show that being very low birthweight, i.e., weighing less than 2 kg, for instance, decreases a child's income by around 40% compared to having a birthweight of over 3 kg with the result being statistically significant at 5%. In sum, a positive relationship between twin children's initial abilities and their income combined with a strong positive relationship between their income and parental transfers indicate that parents tend to *reinforce* initial ability differences between twin children through inter vivos transfers.

Overall, in this subsection we have established that parents tend to reinforce income inequality among their adult children via inter vivos transfers.

4.2.1 Potential Reasons Behind Reinforcing Inter Vivos Transfers by Chinese Parents

In this subsection we explore a few possible reasons behind within–family income inequality reinforcing parental inter vivos transfers. First, it is possible that twins with higher income tend to live in cities with higher cost of living and thus may need more support from their parents. To identify whether this reason is the driving force behind reinforcing parental transfer decisions, in Table A.7 in Appendix A we limit our main sample to pairs where both twins reside in the same city as their parents.[34] The Table indicates that a 10% increase in twin children's salary increases inter vivos transfers from parents by 8.9% compared to the estimate of 8.7% for the whole sample. Similarity between the

[34]It should be noted that less than 10% of twin pairs in the sample have a twin that resides in a different city than their parents.

estimates for the sample of twins that live in the same city as their parents and the full sample demonstrates that differences in the cities that twin children reside in are unlikely to be substantially affecting parental transfer decisions.

Second, it is possible that our results are driven by a sample of twins with sizeable differences in their initial abilities. To identify whether this is the case, in Table A.8 in Appendix A we first show that twins for whom the difference in their birthweight is above the mean, i.e., above 270 grams, are not statistically significantly different from the rest of the sample in terms of characteristics, with the only exceptions being their birthweight and decision to reside with the parents. Then, focusing on this sample of twins with above average differences in their initial abilities in Table A.9 in Appendix A, we show that a 10% increase in a twin child's income at the time of transfer increases parental transfers by 7.1%. Since the estimate for this group of twins is slightly smaller than our estimate for the whole sample, it is unlikely that our results are driven by this group of twins.

Third, it is possible that parental reinforcing behavior is driven by a competitive motive. Specifically, since we use wedding transfers from parents to children as our measure of inter vivos transfers, it is probable that parents make transfer decisions based on the wedding transfers their children receive from in–laws. This is especially important since the correlation between wedding transfers from parents and in–laws is 56% in our sample. If a competitive motive is a crucial mechanism, limiting the sample to twin pairs for whom within–twin difference in in–law transfers varied substantially should also increase the within–twin difference in inter vivos transfers from parents. As such, in Table A.10 in Appendix A we limit the sample to twin pairs for whom the amount of in–law transfers differed by more than 30%.[35] The Table shows that the impact of within–twin differences in income is substantially smaller at 5.6% for this group of twins compared to the estimate of 8.7% for the full sample. Differences between the estimates reported in Tables 7 and A.10 highlight that, if anything, parental transfers are more reinforcing for twins who received similar amount of in–law transfers. Altogether, differences in in–law transfers received by children do not seem to explain differences in parental inter vivos

[35] Around 60% of twin pairs in the sample experienced a within–twin difference in in–law transfers of more than 30%.

transfers.

Fourth, it is possible that twin children's age at marriage, and not income, is what matters most for parental transfer decisions. For instance, since it takes parents years to save for children's weddings, the twin that gets married first may be more likely to receive a larger transfer from the parents regardless of his/her income. Table A.11 in Appendix A indeed shows that a higher ability twin, weighing over 3 kg, tends to get married 2 years earlier than his/her lower ability sibling, weighing less than 2 kg at birth. To identify whether and how twin children's age at marriage affects parental transfers, in Table A.12 in Appendix we limit the sample of twins to those for whom within–twin difference in age at marriage differed by more than 3 years.[36] The Table shows that a 10% increase in twin children's income increases parental transfers by around 8.1% for this group of twins with the estimate being statistically significant at 5%. The latter is only about 10% smaller than the estimate of 8.7% for the entire sample. Similarity between the estimates for the entire sample and the sample of twins that got married more than 3 years apart indicates that age at marriage cannot fully explain the reinforcing parental behavior.

Fifth, it is possible that parents are reinforcing income inequality among their children to increase the overall welfare of the family and then redistribute resources among the members. To identify whether this is the case, in Table A.13 in Appendix A we explore whether the higher ability twin – that received larger transfers from parents – subsequently compensates his/her lower ability twin using within–twin transfers. The Table shows that the higher ability twin tends to send 0.4% more in monetary transfers to his/her twin sibling, with the effect being statistically significant at 1%, in response to receiving 10% more in wedding transfers from parents. Analogously, in Table A.14 in Appendix A we find that the higher ability twin additionally sends 1.6% to his/her parents in monetary transfers.[37] Altogether, the Tables show that the child that got larger transfers from parents is more likely to give back to both the twin sibling and parents. However, these subsequent transfers from the higher ability twin compensate

[36] Only around 17% of twin pairs in the sample had a within–twin difference in age at marriage of more than 3 years.

[37] These transfers are defined as the difference between transfers sent to parents and from parents in 2002.

for only 20% of differences in the inter vivos transfers that twin children received. Thus, maximizing the overall welfare of the family does not seem to be the main driving force behind reinforcing parental inter vivos transfers.

Sixth, the reinforcing behavior might be driven by an exchange motive. In particular, transfer decisions might be driven by parental expectations of which one of the twins will visit them more or is more likely to reside with them in the future. Hence, in line with Bernheim et al. (1985), in Table A.15 in Appendix A we investigate whether the amount of transfers to twin children depends on parental expectations of children's visits and the probability of sharing a residence. Table A.15 shows that an increase in the number of visits by 100 – while keeping the number of sibling's visits constant – increases parental transfers by 87%. Similarly, column 2 indicates that parents transfer 1.5 times more to the twin child that is most likely to reside with them. Although the estimates seem to suggest an exchange motive behind reinforcing parental transfer decisions, they do not indicate who benefits from the visits and shared residence. In particular, living with parents might be benefiting the child since, for example, he/she does not need to rent an apartment and can instead reside in the parental home. On the other hand, it is also possible that the shared residence benefits the parents because the child can take care of the elderly parents and help around the house. To identify how the living/visiting arrangements should be interpreted, we take advantage of another question from the CATS dataset that specifically asks whether it is the children that take care of the parents during the time they spend together.[38] Column 3 of Table A.15 presents findings from an answer to this question and shows that parental transfers do *increase* with parental expectations of help from children. Column 4 of the Table indicates that transfers increase even more if parents expect children to support them after grandchildren turn 3, i.e., after grandchildren start kindergarten and twin children return to work full–time. These findings, combined with the finding in Table A.14 of monetary transfers from children in response to inter vivos transfers from parents, suggest that parental transfer decisions are *mainly* driven by an exchange motive where larger transfers are associated with a higher number of visits, likelihood of shared residence with children, and help from children. This finding is

[38]Specifically, the question asked was: "Regarding the time spent by your parents and you on helping or taking care of each other, who spent more time to help the other?"

also consistent with the previous literature that highlights the prevalence of an exchange motive in parent–child interactions in China (Lee and Xiao 1998; Yin 2010; Almås et al. 2020).

4.3 *IV and OLS Estimates for Bequests by Chinese Parents*

In this subsection we explore whether and how parental bequest decisions depend on within–twin differences in Chinese twin children's annual income at the time parents have passed away. It should be noted that our analysis focusing on parental bequest decisions should be interpreted with caution since all individuals in our sample have at least one parent alive at the time the survey was conducted. In particular, only around a quarter of the sample has one parent that has passed away.[39] Hence, our identification of how parents make bequest decisions comes from this more limited sample.

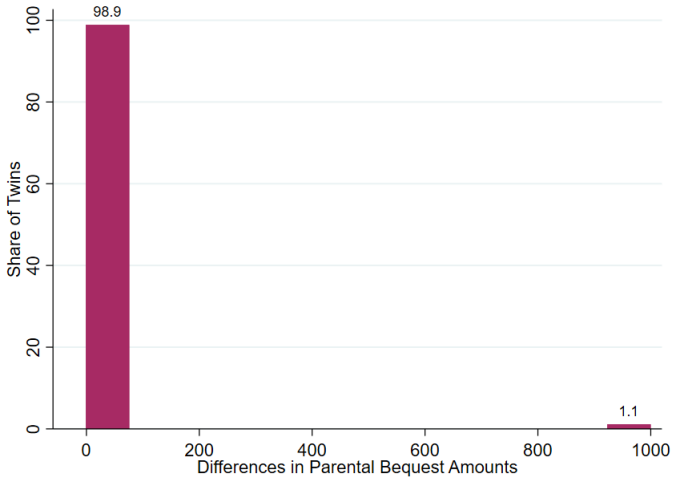
Table A.16 in Appendix A presents descriptive statistics for our bequest sample. The Table shows that, similar to the rest of the population, within–twin difference in birthweight of twins in this sample was around 230 grams with the lower ability twin weighing around 2.3 kg. The Table also highlights that although twins in the bequest sample, on average, tended to receive smaller amount of inter vivos transfers, the within–twin difference in the transfers was similar to that of the main sample at around 7%. Moreover, analogous to the main sample, the Table demonstrates that the higher ability twin was almost twice as likely to reside with the parents compared to his/her sibling. In general, the Table shows that within–twin differences in socioeconomic characteristics in the bequest sample were not that different from the rest of the sample.

Given similarity in the within–twin characteristics between the bequest sample and the main sample, in Figure 3 below we present the distribution of within–twin differences in the amount of parental bequests the twin children received. The Figure shows that parental bequests tended to be divided equally among children with around 99% of twins receiving equal bequests. Within–twin differences in the rest of the sample highlight a slightly reinforcing parental behavior with the higher ability twin receiving 1,000 SEK more in bequests compared to his/her sibling. The latter is equivalent to around 10% of

[39] To be more specific, 180 out of 758 twin children have a parent that has passed away.

the average annual salary of receiving children in 2002.[40]

Figure 3: Distribution of Within–Twin Differences in Chinese Parents' Bequest Amounts



Notes: The figure above presents the distribution of within–twin differences in parental bequest amounts. Bequest amounts are presented in levels and year 2002 prices.

Table A.17 in Appendix A presents our IV and OLS estimates. In particular, analogous to Figure 3 above, the Table shows that a 10% increase in a twin child's salary – while keeping the sibling's salary constant – increases parental bequests by less than 1%, with the result not being statistically significant. Altogether, we conclude that, consistent with the literature on bequests in China (Horioka 2014), bequests in our sample tend to be divided equally among children regardless of their levels of initial ability.

4.4 *IV and OLS Estimates for Inter Vivos Transfers by Swedish Parents*

In this subsection we present our estimates of the causal effect of differences in Swedish twin children's annual income on inter vivos transfers from parents using the empirical model outlined in Section 4.1.

Table 8 below presents our IV and OLS results. Column 1 contains our IV estimates obtained using the identification strategy, given by equation (5). Our IV estimates indicate that within–twin differences in income have a negligible impact on parental inter vivos transfer decisions. Specifically, we find that a 10% increase in a twin child's salary – while keeping the sibling's salary constant – increases parental inter vivos transfers by

[40] Average salary of twin children in the sample was 9,277 yuan in 2002.

around 2.2%, with the effect being not statistically significant. OLS estimates given in Column 2, on the other hand, demonstrate a strong positive relationship between differences in twin children's income and the amount of inter vivos transfers. In particular, the Table shows that a 10% increase in a twin child's income increases parental inter vivos transfers by 13%. Differences between our OLS and IV estimates highlight the significant bias that is present in the OLS estimates. Altogether, the results in Table 8 suggest that parents in Sweden tend to transfer equal amounts to both children regardless of their initial ability differences.

Table 8: The Effect of Differences in Swedish Twin Children's Income at the Time of Transfer on Parental Inter Vivos Transfers

	IV	OLS
Total Income at the Time of Transfer	0.219	1.307***
	(0.699)	(0.110)
Male (Dummy)		0.546***
		(0.195)
Observations	1,504	1,504

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers. All income and transfer measures were collected between 1999 and 2007 and are given in logs. Column 2 additionally controls for maternal age, maternal education, children's age, child's gender, and municipality fixed-effects. Within-twin differences in salary in Column 1 were instrumented using household level variables – such as maternal age and education – interacted with the within-twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

In Table B.7 in Appendix B we examine validity of our instrument for within–twin differences in income and find that twin children's birthweight has a significant positive impact on their income at the time of transfer. Specifically, we show that a 10% increase in a twin child's birthweight increases his/her income at the time of transfer by around 1.3%, with the result being statistically significant at 5%. The latter is also consistent with the findings in Black et al. (2007) and Bharadwaj et al. (2018) for Norwegian and Swedish twins, respectively.

Overall, in this subsection we have established that parents in Sweden neither reinforce nor compensate for income inequality among their adult children via inter vivos transfers.

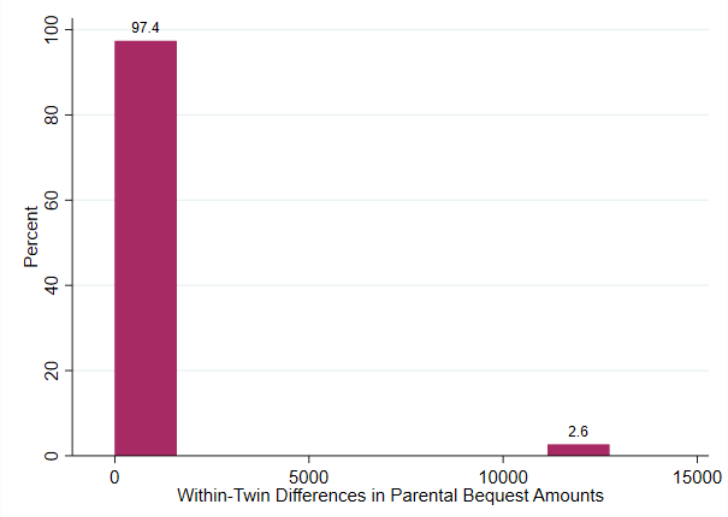
4.5 *IV and OLS Estimates for Bequests by Swedish Parents*

In this subsection we investigate whether and how parental bequest decisions depend on within–twin differences in Swedish twin children's annual income at the time parents have passed away. It should be noted that, like our analysis of bequests in the Chinese

sample, our analysis of bequests in Sweden should be interpreted with caution since all but 2 individuals in our sample have at least one parent alive in 2007. In particular, only around 5% of the sample has one parent that has passed away before 2007.[41] Hence, our identification of bequest decisions comes from this more limited sample.

Table B.8 in Appendix B presents descriptive statistics for our bequest sample. The Table shows that, similar to the rest of the population, within–twin difference in birthweight of twins in this sample was around 300 grams with the lower ability twin weighing around 2.34 kg. Additionally, analogous to the main sample, we find that the higher ability twin tended to earn 5% more than his/her lower ability sibling. Moreover, the Table shows that the higher ability twin tended to receive 3,000 SEK more in bequests with the bequests averaging around 75,000 SEK. The Table also highlights that the difference between twins in the amount of bequests received was not statistically significant. In general, the Table shows that within–twin differences in socioeconomic characteristics in the bequest sample were not that different from the rest of the sample.

Figure 4: Distribution of Within–Twin Differences in Swedish Parents' Bequest Amounts



Notes: The figure above presents the distribution of within–twin differences in parental bequest amounts. Bequests are presented in levels and year 2002 prices.

Given similarity in the within–twin characteristics between the bequest sample and the main sample, in Figure 4 above we present the distribution of within–twin differ-

[41] To be more specific, 76 out of 1,504 twin children have a parent that has passed away. It should also be noted that, as was mentioned in Section 2.2, we are focusing on the period before 2007 due to wealth data availability.

ences in the amount of parental bequests the twin children received. The Figure shows that parental bequests tended to be divided equally among children for 97.4% of twins. Bequests received by the remaining 2.6% of twins tended to be slightly reinforcing with the difference being around 13,000 SEK – that is around 10% of twin children's salary in 2002.[42]

Table B.9 in Appendix B presents our IV and OLS estimates. In line with Figure 4 above, the Table shows that twin children's income does not have a significant impact on parental bequest amounts. Specifically, we find that a 10% increase in a twin child's salary – while keeping the sibling's salary constant – increases parental bequests by less than 2%. Altogether, consistent with the literature on bequests in Sweden (Elinder et al. 2014; Erixson and Ohlsson 2019), we conclude that bequests in our sample tend to be divided equally among children regardless of initial ability differences.

4.6 Potential Reasons for Differences between Chinese and Swedish Parents' Inter Vivos Transfer Behaviors

In our analysis utilizing the sample of Chinese twins we found that parents tend to reinforce income inequality among their children using inter vivos transfers. Swedish parents, on the other hand, tended to invest and transfer similar amounts to both children. As such, in this subsection we explore some potential reasons behind these differences in parental attitudes towards within–family income inequality in our sample of Chinese and Swedish families.

To identify why parental transfer behaviors might differ between our Chinese and Swedish samples, we start off by examining Tables 2 and 4 in Section 2 – which provide descriptive statistics for adult twins and their parents in China and Sweden. Closer assessment of the Tables reveals substantial differences in parental education between the two groups. In particular, we find that only about one–third of parents in the Chinese sample have a high school diploma compared to around two–thirds in the Swedish sample. Considering significant differences in parental education and their intergenerational effect, we therefore explore whether these differences can explain differences in parental attitudes. To do so, we begin by dividing the Chinese sample into two groups based on

[42] Average salary of twin children in the sample was around 127,000 SEK in 2002.

whether at least one of the twin children's parents has a high school diploma in Table 9 below.

Table 9: The Effect of Differences in Twin Children's Salary on Parental Inter Vivos Transfers By Level of Parental Education

	Without High School		*With High School*	
	IV	OLS	IV	OLS
Twin Salary	0.903**	0.112*	0.310	0.032
	(0.396)	(0.049)	(0.350)	(0.105)
Twin is Male		0.641**		0.880**
		(0.216)		(0.281)
Observations	476	476	276	276

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers by parental level of education. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 2 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 3 were instrumented using household level variables – such as maternal age – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table 9 shows that there are indeed significant differences in parental transfer behaviors by parental education levels. Specifically, the Table highlights that parents who did *not* graduate from high school tend to drive the income inequality reinforcing behavior observed in the Chinese sample with this group of parents transferring three times more to their higher ability child compared to the rest of the sample.

Table 10: The Effect of Differences in Twin Children's Salary at the Time of the Transfer on Parental Inter Vivos Transfers By Level of Parental Education

	Without High School		*With High School*	
	IV	OLS	IV	OLS
Total Income at the Time of Transfer	0.798	1.575***	-0.117	1.195***
	(0.997)	(0.195)	(0.655)	(0.133)
Male (Dummy)		0.388		0.509**
		(0.369)		(0.229)
Observations	480	480	1,024	1,024

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers. All income and transfer measures were collected between 1999 and 2007 and are given in logs. Columns 2 and 4 additionally control for maternal age, child's birth year, child's gender, and municipality fixed–effects. Within–twin differences in income in Columns 1 and 3 were instrumented using household level variables – such as maternal age – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Given significant differences in parental attitudes by parental education in the Chinese sample, in Table 10 above we present our estimates, grouped by parental education, for Swedish twins. Similar to our findings for Chinese twins, we find that Swedish parents without a high school degree tend to reinforce income inequality among their children

with a 10% increase in a twin child's salary increasing inter vivos transfers from parents by 8%. Highly educated parents, on the other hand, tend to slightly compensate for within–twin differences in income. Hence, although not statistically significant, the results for Swedish parents also depict differences in parental attitudes by parental education.

Similarities in parental attitudes towards within–family income inequality, once cross–country differences in the levels of parental education are taken into account, between parents in China and Sweden given in Tables 9 and 10 above therefore seem to indicate that other country–/culture–specific factors may be less important when considering the role of parents in driving within–family income inequality. Overall, the results in this subsection suggest that between–country differences in parental attitudes towards within–family income inequality can be *mainly* explained by differences in parental education levels in the countries.

5 Robustness Analysis

This section discusses a number of robustness checks, supporting the validity of our main results.

Generalizability of the lessons from twin children.–In this paper we have explored parental attitudes towards within–family income inequality using data for Chinese and Swedish twins. To assess the generalizability of the estimates that were obtained from this selected group of children, we examine two possible reasons why the external validity of twins results may be limited: twin children and their parents may be different from other parents and children; parents may invest differently in their twin children compared to non–twin ones.

To identify whether and how twin children in China differ from their non–twin counterparts, we use socioeconomic data for non–twin children that was collected by the Urban Survey Unit of the National Bureau of Statistics as part of the CATS dataset. Using this dataset, in Table A.18 in Appendix A we present descriptive statistics for both twin and non–twin children. The Table shows that twin children do not differ significantly from non–twin children when it comes to their salaries, spouses' salaries, transfers from both parents and in-laws, the amount of bequests received, and in their levels of education.

Additionally, the Table demonstrates that the similarity between groups extends to parents of twin and non–twin children. The Table also shows that, unlike twins, non–twin children are about 8% less likely to reside in the same city as their parents. This, however, can be explained by a larger share of females in the general population compared to our twin sample. Taken together, we view the descriptive statistics presented in Table A.18 as suggestive evidence in support of the external validity of our findings based on Chinese twins.

To asses generalizability of the estimates based on Swedish twins, in Table B.11 in Appendix B we display the socioeconomic characteristics of twins along with a population–wide sample of non–twin children – who are born in the same period as the twins. Table B.11 shows that twin children tend to earn less and have a higher share of females in the sample compared to the rest of the population. Unfortunately, using our Swedish sample, we cannot estimate whether parents tend to transfer similar amounts to their twin non–twin children. The latter restriction is a result of wealth data being available only for twin children. Table B.11 also shows that parents of non–twin children tend to be more educated with 84% having at least a high school degree compared to 68% in the twin sample. Differences in parental attitudes towards within–family income inequality by parental level of education, combined with a larger share of highly educated parents in the general population, indicate that our findings for twin children represent a lower bound of parental transfer and investment behaviors.

Difference in behaviors of parents in urban and rural areas of China.– It is possible that differences in parental attitudes between parents in China and Sweden is not driven by differences in the level of parental education, but is instead driven by another factor correlated with education. For instance, parental education might be capturing the impact of parental residence in rural as opposed to urban area. However, it is unlikely that differences in parental attitudes between parents in rural and urban areas can explain the results outlined in the paper since the data for parental transfers comes from only urban areas of China.

6 Concluding Remarks

In this paper we explore the role of parents as well as mechanisms through which they affect within–family income inequality. We also examine whether parental attitudes differ between parents in China and Sweden. Specifically, using data on parental investments into children's education, we first show that parents in both China and Sweden tend to invest the same amount of resources into twin children's education regardless of their initial ability differences. This pattern is consistent with the previous literature and can be explained by non–exclusionary public good dimension of parental investments. Second, we identify whether a similar pattern holds when we look at exclusionary goods such as parental inter vivos transfers. Considering that, in China, the biggest inter vivos transfer takes place at the time of children's marriage, we subsequently show that transfers tend to reinforce income inequality between children with a 10% increase in a twin child's income – while keeping the sibling's income constant – increasing parental transfers by 8.7%. We demonstrate that this reinforcing parental behavior, in turn, is driven by an exchange motive wherein the child that gets a larger transfer tends to visit the parents more often and is more likely to reside with the parents, with the visits and the living arrangements benefiting the parents and not the child. In Sweden, on the other hand, we find that parents tend to transfer similar amounts to both twins. Third, we show that bequests tend to be divided equally in both samples. Overall, using data on parental investments and transfer decisions in China and Sweden, we show that parents in China tend to reinforce income inequality among their children via inter vivos transfers. Parents in Sweden, on the other hand, tend to invest and transfer similar amounts to both children.

Given differences in parental attitudes towards within–family income inequality between parents in China and Sweden, we provide one potential reason behind this difference. In particular, considering substantial differences in the level of parental education between the samples with around two–thirds of Swedish parents having a high school diploma compared to only one–third in the Chinese sample, we show that differences in parental attitudes can be mainly explained by differences in parental education levels in these countries. Finally, using data for both twin and non–twin children, we show that the estimates obtained from twin children can be generalized to a wider population of

children and their parents in China and Sweden.

Overall, to the best of our knowledge, this is the first paper to provide a *comprehensive* view of the role of parents in driving within–family income inequality. Understanding the role of parents is vital to understanding intergenerational transmission of income and sheds light on how parents respond to policies aimed at reducing income inequality and how they allocate resources among their children. Our findings for Chinese sample indicate that parents are one important mechanism that reinforces income inequality among children. As such, one implication of the paper is that measures of inequality that fail to consider resource allocation within the household may be underestimating income inequality in China. Our estimates for Sweden, on the other hand, indicate that household resources tend to be divided equally. Hence, parental behavior may have limited impact on the level of inequality in Sweden. In general, our paper shows that accounting for parental responses is important in evaluation of various policies aimed at reducing inequality as well as in measurement of the level of inequality in the country. Moreover, we show that parental response to these policies may not be uniform across countries, with factors such as the level of parental education in the target population affecting parental attitudes towards within–family income inequality.

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Appendix A. Results for Chinese Twins

Table A.1: The Effect of Differences in Twin Children's Initial Abilities on Parental *Time* Investments in Education

	FE	OLS
Birthweight (dummy): <2	0.269	0.261
	(0.227)	(0.266)
Birthweight (dummy): 2-2.5	0.012	0.218
	(0.201)	(0.245)
Birthweight (dummy): 2.5-3	0.204	0.429*
	(0.180)	(0.248)
Male (Dummy)	0.109	-0.308**
	(0.100)	(0.130)
Observations	2,084	2,084
Adjusted R^2	0.878	0.177

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on parental investments in their education. Column 2 additionally controls for maternal age, level of education, whether she is of Han ethnicity, household income and whether the family resides in a rural area. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.2: The Effect of Differences in Twin Children's Initial Abilities on Parental Investments in Education by Family Income and Education

	Low Income Households		Low Education Households	
	FE	OLS	FE	OLS
Birth weight (dummy): <2	-0.020	0.038	-0.018	0.018
	(0.062)	(0.077)	(0.051)	(0.068)
Birth weight (dummy): 2-2.5	-0.007	0.038	-0.012	0.050
	(0.055)	(0.071)	(0.044)	(0.062)
Birth weight (dummy): 2.5-3	0.009	0.020	-0.002	-0.019
	(0.050)	(0.073)	(0.039)	(0.063)
Male (Dummy)	-0.004	0.079**	-0.011	0.016
	(0.027)	(0.038)	(0.021)	(0.034)
Observations	1,388	1,388	1,728	1,728
Adjusted R^2	0.908	0.319	0.926	0.314

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on parental investments in their education by family income and education. Columns 1 and 2 present results for low income households, defined as households with below average income. Columns 3 and 4, on the other hand, present results for low education households, defined as households with mothers who do not have a high school degree. Columns 2 and 4 additionally control for maternal age, level of education, whether she is of Han ethnicity, household income and whether the family resides in a rural area. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.3: The Effect of Differences in Twin Children's Initial Abilities on Standardized Math Scores

	FE	OLS
Birthweight (dummy): <2	-0.201	-0.147*
	(0.126)	(0.086)
Birthweight (dummy): 2-2.5	-0.217**	-0.140*
	(0.109)	(0.079)
Birthweight (dummy): 2.5-3	-0.222**	-0.108
	(0.098)	(0.080)
Male (Dummy)	-0.045	-0.058
	(0.056)	(0.042)
Observations	2,100	2,100
Adjusted R^2	0.598	0.073

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on their standardized math test scores. Column 2 additionally controls for maternal age, level of education, whether she is of Han ethnicity, household income and whether the family resides in a rural area. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.4: The Effect of Differences in Twin Children's Initial Abilities on Standardized Math Scores of Dizygotic Twins

	FE	OLS
Birthweight (dummy): <2	-0.282*	-0.185*
	(0.159)	(0.108)
Birthweight (dummy): 2-2.5	-0.323**	-0.157
	(0.137)	(0.098)
Birthweight (dummy): 2.5-3	-0.244**	-0.124
	(0.123)	(0.100)
Male (Dummy)	-0.052	0.001
	(0.060)	(0.053)
Observations	1,419	1,419
Adjusted R^2	0.564	0.081

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on their standardized math test scores for the sample of dizygotic twins. Column 2 additionally controls for maternal age, level of education, whether she is of Han ethnicity, household income and whether the family resides in a rural area. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.5: Descriptive Statistics for Individuals in the CATS and CHIP Datasets

	CATS Dataset		CHIP Dataset	
	Mean	St. dev.	Mean	St. dev.
Age in 2002	33.48	4.52	33.27	3.56
Salary in 2002	10,070.67	7,090.42	10,430.48	7,773.68
Parental Wedding Expenses	8,213.76	10,861.85	112.44	373.47
Observations	758		3,579	

Notes. The table above presents descriptive statistics for Chinese children in the CATS and CHIP datasets. All income and expense measures are presented in year 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table A.6: The Effect of Differences in Twin Children's Initial Abilities on Their Income at the Time of Transfer

	FE
Birthweight (dummy): <2	-0.371**
	(0.107)
Birthweight (dummy): 2-2.5	-0.091
	(0.147)
Birthweight (dummy): 2.5-3	-0.137
	(0.226)
Observations	758
Adjusted R^2	0.437

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on their income at the time of marriage. All income and transfer measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.7: The Effect of Differences in Twin Children's Income at the Time of Transfer on Parental Inter Vivos Transfers for Twins Residing in the Same City as Parents

	IV		OLS	
	(1)	(2)	(3)	(4)
Twin Salary	0.890***	0.890***	0.104**	0.135***
	(0.327)	(0.321)	(0.036)	(0.023)
Parents–in–Law Inter Vivos Transfers		0.160***		0.369***
		(0.042)		(0.019)
Observations	347	347	694	694

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers for twin children where both twins reside in the same city as parents. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 3 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.8: Descriptive Statistics for Chinese Adult Twin Children by Their Birthweight Differences

	All Twins		Twins > Avg. △ in BW	
	Mean	St. dev.	Mean	St. dev.
Birthweight (kg)	2.45	0.53	2.43	0.52
Male (Dummy)	0.51	0.50	0.48	0.50
Age at Marriage	25.27	3.06	24.95	2.86
At Least High School (Dummy)	0.64	0.48	0.62	0.49
Age in 2002	33.48	4.52	33.62	4.73
Salary at the Time of Marriage	4,490	4,083	4,224	4,180
Spouse's Salary at the Time of Marriage	4,368	4,238	4,047	4,033
Parental Inter Vivos Transfers	8,214	10,862	6,693	8,146
Parents–in–Law Inter Vivos Transfers	7,445	10,173	6,948	9,305
Parental Transfers in 2002	396.10	996.14	487.82	1190.18
Parents–in–Law Transfers in 2002	234.50	544.19	251.73	566.45
Parent Has High School Educ. (Dummy)	0.37	0.48	0.36	0.48
Parent–in–Law Has High School Educ. (Dummy)	0.50	0.51	0.33	0.52
Reside with Parents (Dummy)	0.43	0.50	0.44	0.50
Reside with Parents-In-Law (Dummy)	0.15	0.35	0.15	0.35
Reside in the Same City as Parents (Dummy)	0.94	0.23	0.95	0.23
Reside in the Same City as Parents-In-Law (Dummy)	0.86	0.35	0.87	0.34
Parental Bequest Amount	1,045	4,874	417	2,309
Observations	758		292	

Notes. All income, transfer, and bequest measures are given in 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table A.9: The Effect of Differences in Twin Children's Income at the Time of Marriage on Parental Inter Vivos Transfers for Twin Pairs with Above Average Birthweight Differences

	IV		OLS	
	(1)	(2)	(3)	(4)
Twin Salary	0.710***	0.693***	0.021	0.062*
	(0.274)	(0.261)	(0.086)	(0.023)
Parents–in–Law Inter Vivos Transfers		0.217***		0.417**
		(0.061)		(0.100)
Observations	145	145	290	290

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers for twin pairs with above average birthweight differences. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 3 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.10: The Effect of Differences in Twin Children's Income at the Time of Marriage on Parental Inter Vivos Transfers for Twin Pairs with Difference in In–Law Transfers of More than 30%

	IV		OLS	
	(1)	(2)	(3)	(4)
Twin Salary	0.539*	0.589**	0.136*	0.150*
	(0.276)	(0.267)	(0.056)	(0.056)
Parents–in–Law Inter Vivos Transfers		0.188***		0.301***
		(0.040)		(0.054)
Observations	219	219	438	438

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers for twin pairs with difference in in–law transfers of more than 30%. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 3 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.11: The Effect of Differences in Twin Children's Initial Abilities on Their Age at Marriage

	FE
Birthweight (dummy): <2	2.071**
	(0.502)
Birthweight (dummy): 2-2.5	1.847**
	(0.409)
Birthweight (dummy): 2.5-3	1.119*
	(0.435)
Observations	379

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on their age at marriage. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.12: The Effect of Differences in Twin Children's Income at the Time of Marriage on Parental Inter Vivos Transfers for Twin Pairs with Difference in Age at Marriage of More than 3 Years

	IV		OLS	
	(1)	(2)	(3)	(4)
Twin Salary	0.808**	0.789**	0.273*	0.367**
	(0.320)	(0.315)	(0.102)	(0.101)
Parents–in–Law Inter Vivos Transfers		0.101		0.401***
		(0.107)		(0.077)
Observations	64	64	128	128

Notes. The table above presents the effect of differences in twin children's annual income on parental inter vivos transfers for twin pairs with difference in–law transfers of more than 30%. All income and transfer measures were collected at the time of a twin child's wedding and are given in logs. Columns 3 and 4 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin differences in income in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.13: The Effect of Differences in Parental Inter Vivos Transfers on Subsequent Within–Twin Transfers

	FE	OLS
Parental Inter Vivos Transfers	0.040***	0.188**
	(0.006)	(0.043)
Observations	730	730
Adjusted R^2	0.747	0.109

Notes. The table above presents the effect of differences in parental inter vivos transfers on subsequent within–twin transfers. Parental inter vivos transfers were collected at the time of a twin child's wedding whereas within–twin transfers were collected in 2001. All transfer measures are given in logs. Columns 2 additionally controls for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.14: The Effect of Differences in Parental Inter Vivos Transfers on Subsequent Transfers to Parents

	FE	OLS
Parental Inter Vivos Transfers	0.155**	0.101***
	(0.044)	(0.019)
Observations	522	522
Adjusted R^2	0.594	0.050

Notes. The table above presents the effect of differences in parental inter vivos transfers on subsequent net transfers to parents – defined as the difference between transfers to and from parents. Parental inter vivos transfers were collected at the time of a twin child's wedding whereas net transfers to parents were collected in 2001. All transfer measures are given in logs. Columns 2 additionally controls for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.15: The Effect of Differences in Twin Children's Visits and Co–Residence on Parental Inter Vivos Transfers

	All Twins			Twins with Children over 3
	IV	IV	FE	FE
△ Number of Visits to Parents in 2001 (in 100)	0.87**			
	(0.40)			
△ Residence with Parents in 2001 (Dummy)		1.51*		
		(0.90)		
△ Twin Spent More Time Helping the Parents			0.38*	0.72**
			(0.21)	(0.34)
Observations	366	366	366	123

Notes. The table above presents the effect of differences in twin children's visits and co–residence on parental inter vivos transfers. All transfer measures were collected at the time of a twin child's wedding and are given in logs. Within–twin differences in visits and co–residence in Columns 1 and 2 were instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Column 3 presents family FE instead of the 2SLS since the model rejects that the "time spent helping parents" is an endogenous variable. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table A.16: Descriptive Statistics for Chinese Adult Twin Children for Whom We Have Data on Parental Bequests

	Lower Ability Twin		Higher Ability Twin	
	Mean	St. dev.	Mean	St. dev.
Birthweight (kg)	2.27	0.47	2.50	0.48
Male (Dummy)	0.57	0.50	0.57	0.50
At Least High School (Dummy)	0.52	0.50	0.62	0.49
Age at Marriage	25.07	3.44	25.31	3.23
Age in 2002	35.90	3.49	35.90	3.49
Salary at the Time of Marriage	2,904	3,263	3,219	3,297
Spouse's Salary at the Time of Marriage	2,482	2,488	2,826	2,930
Parental Inter Vivos Transfers	5,359	7,697	5,732	9,481
Parents–in–Law Inter Vivos Transfers	4,850	7,839	4,213	5,316
Parental Bequest Amount	948	4,570	1,223	5,352
Parent Has High School Educ. (Dummy)	0.21	0.41	0.20	0.40
Parent–in–Law Has High School Educ. (Dummy)	0.67	0.58	0.33	0.58
Reside with Parents (Dummy)	0.30	0.46	0.54	0.50
Reside with Parents-In-Law (Dummy)	0.12	0.33	0.11	0.32
Reside in the Same City as Parents (Dummy)	0.97	0.18	0.94	0.23
Reside in the Same City as Parents–in–Law (Dummy)	0.87	0.34	0.82	0.38
Observations	90		90	

Notes. All income, transfer, and bequest measures are given in 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table A.17: The Effect of Differences in Chinese Twin Children's Income on Parental Bequests

	IV	OLS
Twin Salary	0.088	0.101
	(0.120)	(0.077)
Male (Dummy)		0.245
		(0.528)
Observations	88	176

Notes. The table above presents the effect of differences in twin children's annual income on parental bequest amounts. All income and bequest measures were collected at the time a parent has passed away and are given in logs. Column 2 additionally control for maternal age, parental level of education, child's age, child's gender, and city fixed effects. Within–twin difference in salary in Column 2 was instrumented using household level variables – such as maternal age and education – interacted with the within–twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

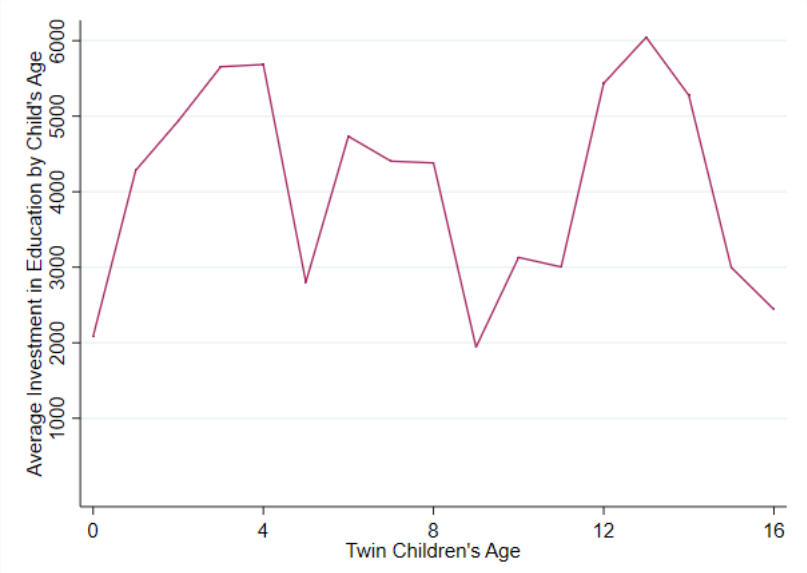
Table A.18: Descriptive Statistics for Swedish Adult Twin and Non–Twin Children

	Twin Sample		Non–Twin Sample	
	Mean	Stdev	Mean	Stdev
Male (Dummy)	0.51	0.50	0.29	0.46
Salary at the Time of Marriage	4,374	3,772	4,422	2,826
Spouse's Salary at the Time of Transfer	4,238	3,838	4,188	3,090
Parental Inter Vivos Transfers	7,842	9,433	8,339	9,740
Parents–in–Law Inter Vivos Transfers	7,216	9,263	7,489	9,592
Parental Bequest Amount	827	3,347	1,380	4,450
Parent Has High School Educ. (Dummy)	0.36	0.48	0.37	0.48
Reside with Parents (Dummy)	0.45	0.50	0.26	0.44
Reside in the Same City as Parents (Dummy)	0.94	0.23	0.86	0.34
Observations	764		320	

Notes. All income, transfer, and bequest measures are given in 2002 prices. Numbers highlighted in red are statistically different between the twin and non–twin sample at 1% level of significance.

Appendix B. Results for Swedish Twins

Figure B.1: Average Parental Investments in Twin Children's Education by Their Age



Notes: The figure above presents average parental investments in twin children's education by children's age. All investment measures are presented in levels and year 2002 prices.

Table B.1: The Effect of Differences in Twin Children's Initial Abilities on Parental Investments in Education for Twins with Polygenic Scores

	FE	FE	FE
Birthweight (dummy): <2	-0.055		
	(0.067)		
Birthweight (dummy): 2-2.5	-0.086**		
	(0.044)		
Birthweight (dummy): 2.5-3	-0.036		
	(0.033)		
Birthweight (kg)		0.210**	
		(0.091)	
Polygenic Score			0.035**
			(0.018)
Male (Dummy)	0.010	0.006	0.016
	(0.024)	(0.024)	(0.024)
Observations	7,000	7,000	7,000
Adjusted R^2	0.974	0.974	0.974

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight and polygenic scores, on parental investments in their education for the sample of twins for whom we have data on polygenic scores. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.2: Descriptive Statistics for Swedish Child Twin Children with and without Polygenic Scores

	Twins Without Polygenic Scores		Twins with Polygenic Scores	
	Mean	Stdev	Mean	Stdev
Birthweight (kg)	2.71	0.56	2.55	0.59
Investment into Education	29,352	44,385	26,145	40,374
Male (Dummy)	0.50	0.50	0.45	0.50
Age	5.45	4.03	6.49	4.47
Mother's Age	37.25	5.58	36.62	6.29
Mother's Years of Education	13.20	2.18	12.94	2.15
Family Income	487,412	181,545	474,311	187,611
Family Net Assets	692,384	1,159,934	579,034	1,049,980
Observations	6,966		5,580	

Notes. The table above presents descriptive statistics for Swedish twin children in the Swedish Twin Registry who are less than 17 years old. All income, asset, and investment measures are presented in year 2002 prices.

Table B.3: The Effect of Differences in Twin Children's Initial Abilities on Parental Investments in Education

	OLS	OLS	OLS	OLS	OLS
Birthweight (dummy): <2	0.330*				
	(0.169)				
Birthweight (dummy): 2-2.5	0.251*				
	(0.135)				
Birthweight (dummy): 2.5-3	0.119				
	(0.111)				
Log(Birthweight) (kg)		-0.439**			
		(0.209)			
One-Minute APGAR Score			-0.062**		
			(0.028)		
Five-Minute APGAR Score				-0.034	
				(0.040)	
Ten-Minute APGAR Score					-0.048
					(0.055)
Male (Dummy)	0.147*	0.145*	0.130	0.132	0.133
	(0.085)	(0.086)	(0.085)	(0.085)	(0.085)
Observations	10,156	10,156	10,156	10,156	10,156
Adjusted R^2	0.105	0.105	0.105	0.104	0.104

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight and one–, five–, and ten–minute APGAR scores, on parental investments in their education. The table additionally controls for maternal age, level of education, household income, twin-children's age, and municipality fixed–effects. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.4: The Effect of Differences in Twin Children's Initial Abilities on Parental Investments in Education by Family Income and Education

	Low Income Households		Low Education Households	
	FE	FE	FE	FE
Birthweight (dummy): <2		-0.020		-0.081
		(0.073)		(0.077)
Birthweight (dummy): 2-2.5		-0.077		0.018
		(0.050)		(0.053)
Birthweight (dummy): 2.5-3		-0.065*		0.023
		(0.039)		(0.040)
Log(Birthweight) (kg)	0.127		0.131	
	(0.101)		(0.108)	
Male (Dummy)	0.066*	0.069**	-0.013	-0.010
	(0.034)	(0.034)	(0.037)	(0.037)
Observations	5,864	5,864	3,546	3,546
Adjusted R^2	0.975	0.975	0.984	0.984

Notes. The table above presents the effect of differences in twin children's initial abilities, proxied by their birthweight, on parental investments in their education by family income and education. Columns 1 and 2 present results for low income households, defined as households with below average income. Columns 3 and 4, on the other hand, present results for low education households, defined as households with mothers who do not have a high school degree. All income and investment measures are presented in year 2002 prices and are given in logs. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.5: The Effect of Differences in Twin Children's Initial Abilities on Their Grades After Ninth Grade

	FE	FE	FE	FE	FE
Birthweight (dummy): <2	-0.099**				
	(0.047)				
Birthweight (dummy): 2-2.5	-0.047				
	(0.032)				
Birthweight (dummy): 2.5-3	-0.049**				
	(0.025)				
Log(Birthweight) (kg)		0.276***			
		(0.066)			
One-Minute APGAR Score			-0.002		
			(0.006)		
Five-Minute APGAR Score				-0.005	
				(0.009)	
Ten-Minute APGAR Score					-0.021*
					(0.012)
Male (Dummy)	-0.340***	-0.348***	-0.334***	-0.334***	-0.333***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Observations	6,828	6,828	6,828	6,828	6,828
Adjusted R^2	0.757	0.758	0.756	0.756	0.757

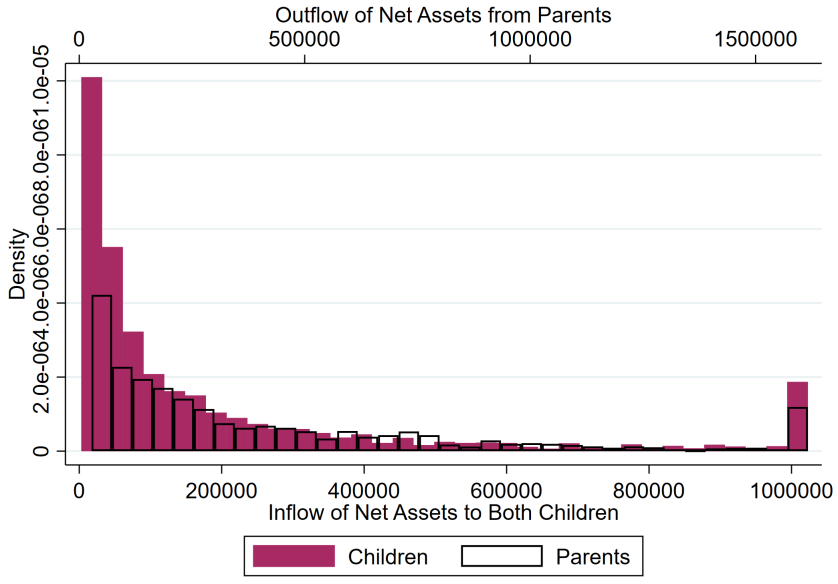
Notes. The table above presents the effect of differences in twin children's initial abilities on differences in their standardized grades after ninth grade. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.6: The Effect of Differences in Twin Children's Initial Abilities on Their Grades After Ninth Grade for Dizygotic Twins

	FE	FE	FE	FE	FE
Birthweight (dummy): <2	-0.170**				
	(0.081)				
Birthweight (dummy): 2-2.5	-0.056				
	(0.052)				
Birthweight (dummy): 2.5-3	-0.083**				
	(0.039)				
Log(Birthweight) (kg)		0.328***			
		(0.108)			
One-Minute APGAR Score			-0.007		
			(0.009)		
Five-Minute APGAR Score				-0.011	
				(0.016)	
Ten-Minute APGAR Score					-0.033*
					(0.019)
Male (Dummy)	-0.345***	-0.352***	-0.335***	-0.335***	-0.334***
	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)
Observations	3,670	3,670	3,670	3,670	3,670
Adjusted R^2	0.626	0.627	0.625	0.625	0.626

Notes. The table above presents the effect of differences in twin children's initial abilities on differences in their standardized grades after ninth grade for the sample of dizygotic twins. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Figure B.2: Distribution of Outflow of Parental Net Assets and Inflow to Children's Net Assets



Notes: The figure above presents the distribution of outflow of parental net assets and inflow to children's net assets for the year parents experienced the maximum outflow of net assets between 1999 and 2007. All net asset measures are presented in levels and year 2002 prices.

Table B.7: The Effect of Differences in Twin Children's Birthweight on Differences in Their Salary at the Time of Inter Vivos Transfers

	Net Income	Total Income
Log(Birthweight)	0.105**	0.126**
	(0.043)	(0.056)
Male (Dummy)	0.113***	0.088**
	(0.028)	(0.037)
Observations	1,504	1,504

Notes. The table above presents the effect of differences in twin children's birthweight on differences in their annual net and gross incomes. All income measures were collected between 1999 and 2007, are given in logs, and are presented in year 2002 prices. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.8: Descriptive Statistics for Swedish Adult Twin Children for Whom We Have Data on Parental Bequests

	Lower Ability Twin		Higher Ability Twin	
	Mean	Stdev	Mean	Stdev
Birthweight (kg)	2.34	0.56	2.61	0.54
Male (Dummy)	0.29	0.46	0.32	0.47
Age at the Time of Transfer	24.58	5.09	24.58	5.09
Age in 2002	24.00	3.63	24.00	3.63
Salary at the Time of Transfer	123,736	86,977	130,699	83,586
Parental Bequests	73,768	145,482	76,699	149,419
Parent Has High School Educ. (Dummy)	0.58	0.50	0.58	0.50
Reside with Parents (Dummy)	0.61	0.30	0.64	0.31
Reside in the Same Municipality as Parents (Dummy)	0.86	0.23	0.88	0.23
Observations	38		38	

Notes. The table above presents descriptive statistics for all genotyped Swedish twin children in the Swedish Twin Registry who are above 17 years old and for whom we have data on parental bequests. All income and transfer measures were collected between 1999 and 2007 and are presented in year 2002 prices. Numbers highlighted in red are statistically different between twins at 1% level of significance.

Table B.9: The Effect of Differences in Swedish Twin Children's Income on Parental Bequests

	IV	OLS
Total Income at the Time of Transfer	-0.197	0.565
	(1.003)	(0.372)
Male (Dummy)		-0.262
		(0.763)
Observations	76	76

Notes. The table above presents the effect of differences in twin children's annual income on parental bequest amounts. All income and bequest measures were collected between 1999 and 2007 and are given in logs. Column 2 additionally controls for maternal age, maternal education, children's age, child's gender, and municipality fixed-effects. Within-twin differences in salary in Column 1 were instrumented using household level variables – such as maternal age and education – interacted with the within-twin variation in birthweight. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.10: The Effect of Differences in Twin Children's Birthweight on Differences in Their Salary at the Time of Inter Vivos Transfers by Maternal Age at Birth and Level of Education

	All	Without High School	With High School	Mother Age ≤ 30	Mother Age > 30
Log(Birthweight)	0.148**	0.199**	0.095	0.156*	0.139
	(0.068)	(0.097)	(0.095)	(0.085)	(0.107)
Male (Dummy)	0.176***	0.211***	0.147***	0.207***	0.150***
	(0.027)	(0.040)	(0.036)	(0.036)	(0.040)
Observations	4,288	1,926	2,362	2,260	2,028
Adjusted R^2	0.433	0.425	0.439	0.498	0.370

Notes. The table above presents the effect of differences in twin children's birthweight on differences in their annual net and gross incomes. All income measures were collected between 1999 and 2007, are given in logs, and are presented in year 2002 prices. Standard errors are in parenthesis. *, **, and *** mean statistically different from zero at 10, 5, and 1% levels of significance.

Table B.11: Descriptive Statistics for Swedish Adult Twin and Non–Twin Children

	Twin Sample		Non–Twin Sample	
	Mean	Stdev	Mean	Stdev
Male (Dummy)	0.38	0.49	0.51	0.50
At Least High School (Dummy)	1.00	0.00	1.00	0.00
Age in 2002	21.81	3.97	20.97	4.95
Salary in 2002	76,902	88,144	115,641	92,893
Parent Has High School Educ. (Dummy)	0.68	0.47	0.84	0.37
Observations	1,506		2,431,048	

Notes. The table above presents descriptive statistics for all genotyped Swedish twin children in the Swedish Twin Registry who are above 17 years old and for all non–twin children in Sweden. All income and transfer measures were collected between 1999 and 2007 and are presented in year 2002 prices. Numbers highlighted in red are statistically different between the twin and non–twin sample at 1% level of significance.