

Do parental divorce and displacement decrease children's education? Evidence by using Taiwan administrative Data

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Abstract

This paper uses an unique data based on four administrative data sets of Taiwan, including birth registry, divorce registry, unemployment insurance payment records and college entrance test records, to estimate the various impacts of parental income shocks (induced by divorce and involuntary job loss) on children's education. Our identification strategy is employing family fixed-effect models to address the endogenous problems caused by unobserved family characteristics. We discover that parental divorce has adverse impact on children's outcome, but the impact of parental displacement is little. The detrimental effect of parental involuntary job loss is only investigated for boys. In addition, we suggest that cross-sectional estimations are mostly spurious and overstate the negative effect of parental income shock.

Key word: Divorce, displacement, within-family fixed-effect model, education.

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1 Introduction

It has been well emphasized that family income plays an important role on determining children's outcome. The established literature on intergenerational mobility showed that children's income as adults are highly correlated with their parent's income (Solon 1992, Zimmerman 1992). However, since it is difficult to measure the exogenous variation on family income, there has been still little evidence on the causal impact of parents' income on children's outcome. To tackle this issue, some recent studies have used shocks due to parental death (e.g. Gertler et al. 2004, Chen et al. 2009), divorce (e.g. Corak 2001, Lang and Zagorsky 2001) and job loss (e.g. Shea 2000, Oreopoulos et al. 2008, Stevens and Schaller 2010) to capture the exogenous change on family income, and tried to paint the picture of causal link between the those shocks and children's outcome.

This paper aims to use an unusual data constructed by linking several administrative data sets to investigate impacts of parental income shocks caused by parental divorce and displacement on children's educational attainment. Researchers from many fields have paid much attention on parental divorce. On one hand, parental divorce reduces family income substantially and persistently (Ducan and Hoffman 1985 ; Page and Stevens 2004). The reduction in family income may mainly explain the difference in children's outcome between ones from split families and others from intact families (MaLandhan and Sandefur 1994). On the other hand, the conflict which leads to parental dissolution also likely leads children to psychological adjustment problems that may potentially affect children's outcome as adults (Amato and Keith 1991; Bruce and Kim 1992). Therefore, children who were exposed to parental divorce may be deprived of key parental resources, and could more likely to have less educational attainment (Lang and Zagorsky 2001; Ermisch and Francesconi 2001; Gruber 2004). When those children grow up, they may be likely to have instable marriage (Corak 2001), earn lower income in labor market (Corak 2001), and have more health problems (Ermisch and Francesconi 2001).¹

¹Enormous amount of earlier literature found the adverse relationship between parental divorce and children's outcome. Many of these earlier studies are reviewed in Haveman and Wolf 1995.

Involuntary job loss is another important economic shock which many families could experience. The adverse impact of involuntary job loss on displaced workers' short- and long-run income have been well-documented (Ruhm 1991; Jacobson et al. 1993; Steven 1997; Rege et al. 2009).² In the recent decade, the economists turn to focus on the intergenerational effect of parental displacement on children's outcome. Children who experiencing parental displacement may suffer from less success in education, earnings as adults and other outcomes. For example, Oreopoulos et al. (2008) found that children with ever-displaced father have 9% lower earnings as adults; Stevens and Schaller (2010) and Rege et al. (2011) showed that a parent's involuntary job loss has profound detrimental impacts on children's school performance. Moreover, Lindo (2011) showed that paternal job loss reduces a child's birth weight significantly.

Though the parental divorce/ displacement may measure the exogenous variation in family income, it is still difficult to disentangle the causal effect on children's outcome from statistic correlation. Omitted factors, such as conflict or health problem, may jointly affect parental divorce/ displacement and children's outcome. In order to eliminate the omitted variables bias as much as possible, we exploit the family fixed-effect model to identify the effects of parental income shocks. The identification strategy involves observing gaps in college admission between siblings who are exposed to parental divorce/ displacement *before versus after* the age of 18. When looking at the parental displacement effect, we adopt involuntary job loss caused by firm closing which is less likely to be related personal characteristics.

This paper adds to the literature in three pathways. First, there is a burgeoning literature on the consequences of parental income shocks on children. However, most previous studies were based on the data in North America and Europe. This paper provides new evidence about parental income shock effect on educational outcome by using data of Taiwan. Given that the social and cultural environment in Asia is quite diverse from the West, our data provide an opportunity to know the consequence of the decrease in family resource on children's education in an

²Being exposed to job loss also has other detrimental impacts on adults, for example, it tends to increase the mortality (Sullivan and von Wachter 2009), and rise the propensity of marriage instability (Charles and Stephens 2004).

Asian country .

Second, our data is constructed by linking four national administrative data sets of Taiwan, including Birth registry, Divorce registry, Unemployment Insurance Payment records and College Entrance Test records. It covers about 1.1 million children, and provides rich information on children and parents. We can observe the date of divorce, the data and reason of involuntary job loss, whether a child attending to a college, and rich demographic variables for each family. Conditional on the large sample size which is rare seen in this line of literature, our estimates would be more precise.

Third, this paper compares effects of family income shocks due to parental divorce and involuntary job loss to the effect of shock due to unexpected parental death estimated by Chen et al. (2009) which was using the similar data base as ours. The comparison draws a complete picture on the consequences resulted in three kinds of family resource shock on children's college admission.

This paper finds that experiencing parental divorce reduce a child's possibility of entering a college by 1.3 percentage points, which is as much as 9 percent of the average college admission rate. In addition, children with low-educated parents suffer more from being exposed to parental divorce. In contrast, we find that the estimates of parental displacement effects are close to zero. The evidence of detrimental parental displacement only be discovered in boys. Furthermore, this paper also finds that the cross-sectional estimates of the effects are mostly spurious and confounded by unobserved family backgrounds.

This paper proceeds as follows. Section 2 describes empirical strategy for identifying the impacts of parental income shocks on children's college enrollment. Section 3 lays out the data and sample statistics. Section 4 reports the empirical results for parental divorce and displacement. Section 5 discusses our findings, and compares the estimates of ours with the corresponding estimate of parental death effect obtained in Chen et al. (2009). Finally, Section 6 provides conclusions.

2 Identification

2.1 Related studies

The earlier studies identified parental divorce effect as the cross-sectional comparison of difference in children's outcome between those from single-parent families and those from intact families. Most of them found that growing in disrupt family is highly related to the less educational attainment and less success in later socio-economic status (Havemand and Wolfe 1995). After 1990s, researchers have doubted that the endogenous problem resulted by unobserved factors may contaminate the causal effect of divorce (Manski et al. 1992). The disadvantaged outcomes of children may be driven by some potential unobserved factors (such as conflict, mental stress and parental health problem), not parental dissolution per se.³ The investigation of causal parental displacement effect is also exposed to omitted variables problem. Recent studies have proposed some methods to address this problem.

The common method for removing endogenous problem is family fixed-effects model which identifies parental income shock effect as the comparison of the gap in children's outcome between siblings within the same family, usually referring to the same mother. The fixed unobservable family background factors are assumed to be shared by siblings. Therefore, comparing outcomes among siblings could potentially control for all time-invariant family background variables, including the observed and the unobserved. Recent studies of parental income shocks using family fixed-effects are (Ermish and Francesconi 2001; Bjorklund and Sundstrom 2006; Bjorklund et al. 2007; Francesconi et al. 2010, Lindo 2011).⁴

Besides, some studies use child fixed-effects model, which compares children's outcome before and after the occurrence of parental income shocks, to overcome the endogeneity (Painter and Levine 2000; Stevens and Schaller 2009). The concern of child fixed-effect model is that if sample are not randomly assigned, the lower

³For example, Ginther and Pollak (2004) found that the relationship between family structure and children's education weakens when more "observed" family background variables are controlled. It implies that some omitted family background may also affect parental divorce effect.

⁴Ermish and Francesconi (2001); Bjorklund and Sundstrom (2006); Bjorklund et al. (2007) and Francesconi et al. (2010) found that when employ the family fixed-effect model, the negative estimates of divorce effects are insignificant.

children’s outcome would not reflect parental income shock effect, but reflect the inferior family (poor or higher conflict) or fixed low ability of child.

Quasi-experimental method was applied in this line of literature. Because that parental death is less associated with unobserved factors of family background, researchers used parental death as the exogenous variation in parental absence and regarded parental death effects as the benchmarks for parental divorce effects (Corak 2001; Lang and Zogorsky 2001). In addition, policy change may offer the other type of exogenous variation in parental divorce. Gruber (2004) suggested that the increase in divorce caused by the relaxation of divorce law harms children’s education, and labor market outcomes as adults.

For some studies on parental displacement effect, researchers used the firm closure to measure the exogenous involuntary displacement. Relative to other reasons of involuntary job loss, firm closure is much less related to employer’s unobserved personal or family background characteristics. Using firm closure and classical liner model, some studies found that parental displacement has disadvantages on the next generation (Oreopoulos et al. 2008; Rege et al. 2011), but others cannot estimate the similar result (e.g. Rege et al. 2009).⁵

Finally, a number of research employ other strategies other than aforementioned ones, including instrumental method (Shea 2002), difference-in-difference method (Sanz-de-Galdeano 2007), simultaneous equation model (Steele et al. 2009), and propensity score matching method (Francesconi et al. 2010). Those methods are all aimed to remove the endogenous problem and try to investigate the causal effects of parental income loss.

2.2 Empirical Model

Our empirical strategy starts by using cross-sectional estimations which function as the benchmark. For a child i ,

$$Y_i = \beta_0 + \beta_1 d_i + F_i' \gamma + X_i' \delta + u_i, \quad (1)$$

⁵Rege et al. (2009) found little evidence on displacement shocks when restricting the involuntary job loss to firm closing. However, after they included the layoff in to treatment variable, the negative effect became stronger. Kalil and Ziol-Guest (2008) found fathers’ involuntary job loss including layoff are negatively correlated with children’s school performance as well.

where Y_i is a binary indicator for child's educational outcome, taking the value of one if the child attends a college at age 18; d_i is the treatment variable, measuring whether a child faced parental divorce/ displacement by age 18. We separate the cases of parental divorce and displacement. When looking at the divorce effect, the treatment group is those children who experienced parental divorce. In our data, we cannot observe parental separation; When looking at the displacement effects, we use the similar specifications with Page et al. (2009) for the identification of involuntary job loss: the treatment group initially includes children who were exposed to displaced families caused by firm closing or layoff, and then excluding children with parental displacement due to layoff. F_i measures the observable demographic and parental characteristics for a child i ; X_i measures children's individual characteristics; u_i is the error term.

There is a concern that the standard errors in cross-sectional regressions may be seriously contaminated in the existence of serial correlation of outcomes within a family. Therefore, we correct the standard errors by clustering on mother's identifiers. In addition, we further separate sample by gender to see if there is difference in the impacts of parental income shocks between girls and boys.

Cross-sectional estimate of β_1 compares the gap in college admission between a child from a family with parental income shocks and one from a family without parental income shock. It has been considered non-causal interpretations for cross-sectional estimates, because that parental divorce/ displacement may be associated with unobservable family characteristics that influence children's educational outcome, not the income shocks per se. Although some literature regarded firm closing as an exogenous shock and used cross-sectional estimation (e.g. Page et al. 2009; Rege et al. 2011), we treat this with caution. Firm closures may likely occur in some specific industries, where the workers may have different characteristics from ones working in other industries. Therefore, the firm closure may be still not totally exogenous.

In order to take unobservable family background into account, we employed family fixed-effect estimations. Assuming that family structure only operates through a family-fixed effect, and all characteristics of family, no matter observed or unob-

served, do not vary over time within a family. The educational outcome for a child i in family j is:

$$Y_{ij} = \beta_0 + \beta_1 d_{ij} + F_j' \gamma + a_j + X_{ij}' \delta + u_{ij}, \quad (2)$$

where d_{ij} denotes the indicators that whether the child i in family j experienced parental divorce/displacement by age of 18; F_j refers to the observable characteristics of family background for siblings within the same family j , whereas a_j measures the unobservable family background; X_{ij} measures the individual characteristics that are different among siblings. The estimate of β_1 now measures the mean difference in college enrollment between siblings who are exposed to parental income shocks *before versus after* the age of 18.

In our data, parental divorce and displacement only can be observed up to 5 years, from 1998 to 2003, for each parent (see the description of next section). It implies that we estimate are the short-run effects of parental income shock. If the short-run effect is proved to be detrimental, parental income shocks are much likely to have more adverse impacts in the long run. Besides, impacts of parental income shocks may exhibit heterogeneity. This paper furthermore uses some specifications to look at the heterogenous effects by parental education and living places.

The causal interpretation of the estimations on parental income shock can only possibly be given to the fixed-effect analysis. This identification strategy for assessing the effects of parental income shocks can overcome most difficulties the earlier studies have faced. But strictly speaking, fixed-effect analysis may still not completely tackle the endogeneity of parental divorce/ displacement, because that some unobserved factors may not be time-invariant or sibling-invariant. For example, the elder siblings may spend a smaller part of their teenage years with stress induced by a bad parental relationship before actual divorce than younger siblings.

3 Data and sample statistics

3.1 Data

Our unique data is constructed by linking four administrative data sets of Taiwan, including Birth registry, Divorce registry, Unemployment Insurance Payment

records (UIP), and College Entrance Test records (CET). Starting from 1978, Birth registry covers more than 200 thousands new births per year, and records comprehensive variables for each child and his/her parent, such as birth date, birth place, birth order, birth type (singleton or multiple birth), birth weight, duration of pregnancy in weeks, parental age, and parental education.

Divorce registry starts at a later date, 1998, and includes each divorced person's identifier, birth date, marriage date and divorce date. UIP records also begins by year of 1998. It contains the identifier, date of losing job, the reason of losing job, and the period of receiving the insurance payment for each unemployed labor who has claimed the unemployment insurance payment. Only labors who are *involuntarily* unemployed are allowed to apply for the payment⁶. The reasons of involuntarily losing job cover a firm's closure (including relocation, suspension and bankruptcy) and layoff. The amount of unemployment insurance payment for a qualified unemployed labor is sixty percent of his/her insured income per month. However, the maximum period one can receive is 6 months (180 days)⁷. CET contains the information of high school, SAT scores (taken in February), college entrance tests scores (taken in July), whether entering a college, and the type of college (private or public colleges) for each test taker from 1996 to 2003.

This paper utilizes Birth registry as the base data set to merge with other three data sets. The process is as follow. Children born to the same mother are sorted by their birth date. And mothers whose first birth occurred between 1980 and 1985 are selected. Those selected mothers are traced more than 16 years. This design is aimed at getting the completed number of fertility for each mother and siblings' information for each child. In addition, mother's age of first birth is restricted to age of 16 to 50.

In order to construct within-family comparisons, we restrict analysis sample to children who have at least one sibling born during the period of 1980-1985. These cohorts are chosen in order to ensure that we can observe college-going behaviors of

⁶The other limitation of applying for the payment is that the unemployed labor has paid to the insurance company for more than one year.

⁷The unemployment insurance payment registry shows that 54 percent of the applicants are female, the average insured income per month is around 27,500, and the average length of receiving insurance is 150 days.

children at the age of 18, in the years from 1998 to 2003. The educational outcome variable is measured by whether the child is admitted to enroll college at 18, which is observed by linking the base data set to CET using children's personal identifiers.

Our treatment group consists of children whose parent experience divorce/ displacements before the child turned 18. We merge Birth-CET matched data set with Divorce registry and UIP records, using fathers' and mothers' personal identifiers. Parental displacement is initially defined as an involuntary job loss induced by a firm closures and layoff. Because that firm closing is much less likely to be related with unobserved family background, we focus on parental displacement only due to firm closing in subsequent model specifications. Although income reduction resulted from parental displacement might be attenuated by receiving temporary unemployment benefit in our data, families with displaced parent still face the mental stress and the uncertainty on future resources.

3.2 Sample and Statistics

Our analysis is based on a total of 1,154,072 children from 517,735 families with more than one child born between 1980 and 1985. Because of the comprehensive variables on family members and a considerably large sample size, this unique data can overcome most identification difficulties which the previous studies have faced. Our variables of interest are the indicators for whether a child was exposure to parental divorce/displacement before he (she) was eligible to take the college entrance test (at age 18). A large number of covariates for the child and parent are included in our analysis. Covariates for children's characteristics include gender, indicators for birth order, birth weight, and indicators for birth cohorts; covariates for parents cover number of fertilities, full set of indicators of parent's birth year, mother's age at first birth, living area, and parental education levels (junior high school, high school, professional and training school, academic college and above).

The basic summary statistics for our sample are shown in table 1a. The average college admission rate at the age of 18 is about 14 percent. About 2.4 percent of children experienced parental divorce before 18. And 2.2 percent of children have parent who lost their jobs due to firm closing or a layoff. Of the children with

displaced parent, more than 60 percent are caused by firm closing. Around 26 percent of mothers and fathers have more than a high school education, while 35 percent of fathers own the same level of education.

The comparisons in some statistics between treatment group and control group are listed in table 1b and 1c. The first column of table 1b presents means and standard deviations (in parenthesis) for control group of children with intact families. The second column are means and standard deviation for treatment group of children with divorced parent. In contrast to those from intact families, college enrollment rates drop by 6.3 percentage points for those who experienced parental divorce. Because the average college admission rate of youth at the age of 18 is about 14.1 percent, the reductions in admission rates are considerably large and statistically significant at the 5-percent level. In addition, we observe that divorced parents are more likely to be less-educated or reside in rural areas, and tend to have the first child at a younger age. On average, there is no significant gap on family size and birth weights between control group and treatment group.

Table 1c displays the comparisons between children without displaced parent (control group) and those with displaced parent (treatment group). We observe the mean of college enrollment rate for treatment group is higher than that for control group by 7-10 percentage points. Though the statistics is unconditional on children's and parent's characteristics, this finding seems different from the literature. Hence, we are specially interested in the results on regressing estimates conditional on the full covariates.

Control group mothers are more likely to have more than college education than treatment group mothers by approximate 0.5- 0.7 percentage points. However, fathers' education seems higher in treatment group than in control group. This pattern may be resulted from that parents who received the unemployment insurance tend to be higher-educated, suggested by a government survey. Council of Labor Affairs of Taiwan⁸ randomly sampled 8,700 from those who had ever received Unemployment Insurance Payment in the past 10 years in 2009. They were asked for some questions on personal characteristics, including their education level.

⁸Web site of this report is <http://statdb.cla.gov.tw/html/svy98/i0000089806020.htm>

The ratio of high-educated is very high— more than 85% of the participants have high school education or above.

4 Empirical Results

4.1 Cross-sectional Analysis

Cross-sectional estimations of parental divorce and displacement are reported in table 2 and table 3. We have to remark first that our cross-sectional estimators could be underestimated because that we cannot observe parental status of marriage and unemployment before 1998, the year which our divorce and unemployment data just started at.

The first column in table 2 for all sample shows that experiencing parental divorce is associated with a significantly lower probability of college admission by 7.5 percentage points relative to those from intact families, without controlling parental and demographic information. Observable family background captures about 40 percent of the difference in college enrollment rates between children with divorced parent and those with intact families: the effect of parental divorce declines to 4.6 percentage points after adding the full set of controls of family and parental characteristics, presented in the third column. This pattern is similar to the finding of Biblarz and Raftery (1999) and Ginther and Pollak (2004). Both of them showed that the relationship between parental divorce and children’s educational outcomes shrinks substantially after controlling for parental information including parental education and income.

Although not reported in the table 2, it is worth noting some sizeable differences in college admission rate across different characteristics of children. Boys are about 1.8 percentage points less likely to enter a college than girls; later-born children are 3.3 to 9 percentage points less likely to enter a college than first-born children; the endowment of children’s health, birth weight, also has powerful influence on children’s outcome— increasing one kg in birth weight raises the child’s likelihood of college admission by 2.3 to 2.7 percentage points.

Panel B and C show the parental impacts for girls and boys respectively. Facing

the shock of parental divorce, girls seems to have smaller detrimental effect than boys. In column (3), parental divorce significantly reduces 4.8 percentage points of possibility to enter a college for boys, and 4.4 percentage points for girls. However, the difference is not large in the magnitude.

Table 3 shows the cross sectional results for parental displacement effect. Column (1) to (4) list the effects resulted by firm closing and layoff. Panel A shows the estimates for all children. In contrast to the previous statistics that showed a 0.7 to 1 percentage point increase in admission rate among children who were exposed to parental displacement, the cross sectional estimates suggests that having displaced parent caused by firm closing or layoff is predict to decrease college admission rate by around 0.6 percentage points, unconditional on family background (column (1)). The estimate is downward shifting to 1.34 percentage points after taking account of all observed family characteristics (column (3)). When dividing the parental displacement effects into displaced mother and displaced father, we found that a displaced mother seems to have a bit stronger impact than a displaced father (-1.37 percentage points versus -1.00 percentage point). But the p-value of 0.44 suggests that null hypothesis for no difference in displaced impacts between mother and father is not rejected at significant level of 0.05.

Column (5) and (6) report effects of displacement caused by only firm closing. Column (5) in panel A shows that the detrimental impact of parental displacement caused by only firm closing (-0.94 percentage points) is smaller than caused by firm closing and layoff (-1.34 percentage points). This finding is similar with Page et al. (2009). This scenario may imply that parental layoff is more likely to be correlated with personal characteristic that results in inferior child educational outcome. In addition, effect of paternal displacement caused by only firm closing is worse than of maternal displacement for all children.

Results of panel B and and C show that girls perform better than boys when facing parental job loss, as similar with the results of parental divorce. The negative effect of having displaced parent for boys is almost double than for girls (column (3)). Interestingly, after excluding children who were exposed to parental displacements caused by layoff, girls are not significantly affected by having dis-

placed parent, neither placed mother nor father. However, having displaced parent (especially a displaced mother) have manifest detrimental influence on boys.

4.2 Family Fixed-effects Analysis

The family fixed-effect estimations present in table 4 and 5. The treatment group is the younger siblings who were exposed to parental divorce/ displacement by the age of 18, while the control group is the older siblings who were not exposed until the age of 18 or older. We identify the parental divorce/ displacement effect as the mean difference in college admission among siblings in a given family over period of 1998-2003 of college test-year.

Parental divorce impacts are listed in table 4. When we eliminate the unobserved sibling-invariant family background by using family fixed effect, parental divorce reduces college admission rate by 1.3 percentage points, though it is still statistically significant (in column (2)). It is around 30 percent of the cross-sectional estimates. This suggests that the negative relationship between parental divorce and children's educational outcome in cross-sectional comparison is more likely driven by omitted family background. Our finding is in line with some of previous studies using family fixed-effect estimations. For example, Ermisch and Francesconi (2001) found the evidence of adverse impact of parental separation on children's educational attainment in British. However, some previous studies found little evidence of parental divorce effects on children (Bjorklund and Sundstrom 2006; Bjorklund et al. 2007 ; San-de-Galdeano and Vuri 2007; Corak 2001 and Lang and Zagorsky 2000).

The adverse effect on children's educational outcome may be mediated by two channels: one is by the reduction of family income, the other is by mental stress induced by parental conflict. However, it is difficult to separate them out from the estimated effect.

Theories of intra-family allocation suggest that daughters generally suffer more from losing family resource than sons (Alderman and Gertler 1997), especially in areas which exhibit preferences for sons. If parents favor sons, the investments in sons are more likely to be protected after the shock of losing family resource

than are investments in daughters. In column (3) of Table 4 we add an interaction term between parental divorce and child's self-gender (indicator for a boy). The estimate of the interaction term shows that experiencing parental divorce lowers a boy's possibility of college admission by 0.35 percentage points relative to a girl, and the magnitude is very small and not significant. It suggests that there is no manifest difference in parental divorce effect between girls and boys. Therefore, we do not find evidence to support this hypothesis. This finding is consistent with Gertler et al. (2004), which found that daughters are not more likely to drop out than are sons.

We have so far analyzed the impact of parental income shocks for teenagers whose parents divorce/ lose job when they were aged 18. The impact of parental income shocks may be greater if the shock occurred when the child was younger. To look at whether the age at time of experiencing parental income shocks matters, we employ an interaction term between parental income shock and a time indicator, taking the value of one if the child experienced parental death when he/she was younger than the age of 15 (at junior high school or before). The estimate of this interaction term measures the difference in college admission between those who experienced shock *before* age 15 and those who lost their parents *after* age 15. The estimates in column (4) show little evidence of the difference in college admission rate among different timing of experiencing parental divorce.

Table 5 presents the fixed effect estimates for parental displacement. In contrast to cross-sectional estimates that displaced parent is associated with lower college admission rate, we find small but positive effect of parental displacement after accounting for family-fixed effects. Conditional on children's characteristics, the average admission rate increases by 0.62 percentage points if the displacement is caused by firm closing or layoff, and by 0.95 percentage points if the displacement is caused by only firm closing (column (2)). Although the estimates are not significant at significant level of 0.05, they are manifest at significant level of 0.10. As we separate out the displacement effect by maternal versus paternal displacement, we find that experiencing displaced mother has a positive impact on college college admission. Average college admission rate increases by 0.74- 1.6 percentage points

if children were with displaced mother (column (3)). However, the F-test result suggests that effect of maternal displacement is not different from that of paternal displacement.

The detrimental effect of parental displacement only occurs on boys when we exclude displacement due to layoff. Column (4) of table 5 displays the results for specification of adding an interaction term between parental displacement and child gender. It suggests that parental displacement due to firm closing reduces a boy's college admission significantly by 2.3 percentage points relative to a girl.

Column (5) of table 5 reports the results for the specification of interacting with timing of experiencing parental displacement. As similar with the results of parental divorce, we do not find the evidence that children who were exposed to parental displacement at younger age suffer more. The estimate of the interaction term is positive but insignificant.

In short, after controlling for observed and unobserved family background, we find that experiencing parental income shocks has small impact on children's college admission, contrary to the previous cross-sectional results. This suggests that cross-sectional estimates are spurious, caused mostly by unobserved backgrounds.

4.3 Other heterogeneity

Effects of parental income shocks may vary with parent's economic status. For example, Oreopoulos et al. (2008) found that children with displaced father have less earnings, especially for children whose family income was at the bottom of the income distribution. Owing to the absence of family income variables in our data, we use parental education as the proxy for parental income, and investigate the heterogeneous effects of parental income shock among low- and high-educated parents. Low education refers to junior high school or less, while high education indicates high school or above. In addition, we divide sample into two group by living area, and look at whether the effect for children living in urban differs from those living in rural. Urban area is defined as Taipei, Taichung, Tainan and Kaohsiung cities.

Table 6 presents the heterogeneous effects by mother's and father's education,

and living area. All estimates are investigated from family fixed-effect models which control for children's characteristics. Panel A reports the parental divorce effects. The average college admission rate is lower at rural area than urban (12% v.s 17%). Although having divorced parent cuts the average college admission rate more in magnitude in urban area than rural area, it accounts for larger percent effect in rural area.

There is a large gap in average college admission between low-educated parent and high-educated parent. For example, 9.5 percent of children with a low-educated mother enter a college, whereas more than 25 percent of children with a high-educated mother get the college admission. The average college admission rate decrease significantly by 1.04 percentage points for children with low-educated mother. And that reduction accounts for 11 percent of average college admission rate. While the reduction in average college admission induced by parental divorce take a smaller percent effect of 6.7% for children with high-educated mothers. The pattern is similar when we focus on the corresponding comparisons between children with low-educated and high-educated fathers. It suggests that children suffer more from parental divorce if they have lower-educated parent, especially having a low-educated mother.

Panel B reports parental displacement effects caused by only firm closing. Experiencing parental job loss increase college admission rate by 1.4 percentage points (more than 11 percent of average admission rate) for children living in rural area. But the effect for children living in urban is close to zero. Also, the impact is relative large for children with a low-educated mother than that for children with a high-educated mother. The patten of heterogeneity on paternal education is somewhat strange. It shows that being exposed to parental displacement increases the college admission for children with high-educated father.

5 Discussion

In recent decades, the economists have made lots efforts on obtaining the causal relationship between family income and children's outcome, despite considerable studies on the statistic correlation between parental and children's income. Events

of parental death, divorce and displacement are undoubtedly the shocks which induce the variation in family income. It is right that those shocks may measure the exogenous change on family income. However, the overall effect of those shocks on children outcome cover impacts other than the effect mediated by income. It would be worth comparing that three impacts based on the similar data set. Owing to the data limitation, it is challenging to do this work. Fortunately, by using the similar data and empirical strategy, our results driven by parental divorce and displacement can compare to the corresponding results driven by parental death in Chen et al. (2009)⁹.

Table 7 reports the estimated coefficients produced in this study and corresponding estimates in Chen et al. (2009). It shows that, of three types parental income shocks, losing a mother unexpectedly has the most detrimental impact on children's education. Chen et al. (2009) found that losing a mother induces around 4.4 percentage points decrease in college admission rate, accounting for over than 30 percent of average college admission rate. Next, parental divorce also shapes children's education adversely. This paper finds that parental divorce decreases the probability that a child will entering a colleges by around 1.3 percentage points, as much as around 9 percent of average college admission; while the effects of parental displacement are either positive or close to zero, which implies that experiencing parental job loss has non-detrimental influence.

Despite shocking income, those events also shock mentality and psychology. Psychological problem caused by those events may be different from each other. The significant negative estimates in parental death and divorce suggest that the shocks which break the structure of families are more likely to worsen children education. The possible explanation for positive displacement effect would be that being exposed to parental displacement before the graduation of high school may stimulate the child to enter a college, in order to obtain a better job and give their family financial support in the future. In Taiwan, it has been widely believed that people can get better job with higher education.

⁹The data conducted in Chen et al. (2009) was based on birth registry, and matched to death registry and CET of Taiwan. The bigger sample size of theirs is because that children are selected from those born during 1978 to 1985.

Based on our findings, it is still hard to say that the detrimental effect of parental displacement on children's education does not exist. On the one hand, the educational outcome we use is the college-going behavior what is the later-step of education. The impact would be different if the displacement occurred in the early childhood. On the other hand, displaced parents in our data receive a temporary insurance benefit, which suggests that the short-run effect of being displaced may be diluted.

6 Conclusions

This paper utilize an unique data conducted by several administrative data sets of Taiwan to look at how do parental income shocks induced by parental divorce and displacement affect children's educational outcome. Our data can provide complete information on family structure and background that enable us to propose family-fixed analysis for addressing the endogenous problem. Our identification on the effect of shocks is the gap in college admission rate between sibling who are exposed to parental income shocks before versus after the age of 18. We find that children who were exposed to parental divorce is less likely to enter colleges than those who were not exposed to the same shock, especially for children from the families with low-educated parents. The evidence of detrimental parental displacement impact is little for all children. While we find that boys suffer from being exposed to displaced parent significantly. In addition, we suggest that cross-sectional estimations are mostly spurious and overstate the detrimental effect of parental income shocks.

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Table 1a : Summary statistics

	Mean	Deviation
Outcome: College admission rate	0.1401	(0.3471)
Divorced parent	0.0239	(0.1526)
Displaced parent (all displacements)	0.0216	(0.1452)
Displaced mother	0.0123	(0.1102)
Displaced father	0.0108	(0.1032)
Displaced parent (only firm closures)	0.0135	(0.1156)
Displaced mother	0.0078	(0.0877)
Displaced father	0.0068	(0.0825)
Children's controls		
Boys	0.5071	(0.5000)
Second-born birth	0.4420	(0.4966)
Third- and latter born birth	0.1945	(0.3958)
Birth weight (kg)	3.2486	(0.4686)
Birth year	1982	(1.5627)
Demographic controls		
Family size	2.9787	(0.8906)
Mother's age at first birth	23.2363	(3.2707)
Mother's birth year	1957	(3.4417)
Father's birth year	1954	(4.2458)
Living in urban	0.3139	(0.4641)
Parental education level		
Mother's education >HS	0.0505	(0.2189)
Mother's education =HS	0.2118	(0.4086)
Mother's education <HS	0.7377	(0.4424)
Father's education >HS	0.1077	(0.3100)
Father's education =HS	0.2468	(0.4312)
Father's education <HS	0.6455	(0.6455)
Number of children	1,154,072	

Note: We exclude mothers who gave birth less than 15 or later than 50 year-old. All children in our analysis were born between 1980 and 1985, and born in families with at least 2 kids. Urban area includes Taipei, Taichung, Tainan and Kaohsiung cities. Only 63 children experienced both parental divorce and displacement.

Table 1b: Comparison on means across children with intact families and those with divorced parents

	Control (1)	Parental Divorce (2)	Diff=(2)-(1)
Outcome: College admission rat	0.142 (0.349)	0.079 (0.270)	-0.063 [0.000]
Male	0.507 (0.500)	0.512 (0.500)	0.005 [0.116]
Family size	2.980 (0.888)	2.979 (0.973)	0.000 [0.944]
Birth weight (kg)	3.249 (0.468)	3.243 (0.478)	-0.005 [0.066]
Mother's birth year	1957 (3.427)	1959 (3.435)	2.088 [0.000]
Father's birth year	1954 (4.235)	1955 (4.302)	1.685 [0.000]
Mother's age at first birth	23.273 (3.262)	21.717 (3.259)	-1.556 [0.000]
Mother's education>HS	0.051 (0.220)	0.034 (0.425)	-0.017 [0.000]
Father's education>HS	0.108 (0.479)	0.078 (0.002)	-0.031 [0.000]
Urban area	0.311 (0.464)	0.339 (0.473)	0.025 [0.000]
# of children	1,126,538	27,534	

Note: Standard deviation in (.) and p-value in [.].

Table 1c: Comparison on means across children with non-displaced and displaced parents

	Control	Displaced parents		Diff=(2)-(1)	Diff=(3)-(1)
		All displacements	Only closures		
		(1)	(2)		
Outcome: College admission rate	0.140 (0.347)	0.150 (0.357)	0.147 (0.363)	0.010 [0.000]	0.007 [0.0185]
Male	0.507 (0.500)	0.523 (0.499)	0.520 (0.499)	0.017 [0.000]	0.013 [0.001]
Family size	2.982 (0.892)	2.844 (0.836)	2.849 (0.829)	-0.138 [0.000]	-0.132 [0.000]
Birth weight (kg)	3.248 (0.468)	3.260 (0.480)	3.256 (0.471)	0.012 [0.001]	0.007 [0.0524]
Mother's birth year	1,957 (3.443)	1,957 (3.400)	1,957 (3.315)	0.370 [0.000]	0.202 [0.000]
Father's birth year	1,954 (4.253)	1,954 (3.883)	1,954 (3.809)	0.372 [0.000]	0.241 [0.000]
Mother's age at first birth	23.229 (3.272)	23.550 (3.204)	23.499 (3.147)	0.320 [0.000]	0.270 [0.000]
Mother's education>HS	0.051 (0.219)	0.044 (0.205)	0.045 (0.208)	-0.007 [0.000]	-0.005 [0.002]
Father's education>HS	0.107 (0.310)	0.121 (0.326)	0.117 (0.321)	0.013 [0.000]	0.009 [0.000]
Urban area	0.314 (0.464)	0.333 (0.471)	0.357 (0.479)	0.020 [0.000]	0.044 [0.000]
# of children	1,129,196	24,876	15,633		

Note: Standard deviation in (.) and p-value in [.].

Table 2 : Gross-sectional Analysis-- Effect of parental divorce on chil college admission

Outcome Variable=Indicator of college admission

	(1)	(2)	(3)
Panel A: All children			
Divorced parent	-0.0751** (0.0019)	-0.0436** (0.0019)	-0.0461** (0.0018)
Children's controls	X	X	X
Demographic controls		X	X
Parental education controls			X
R-square	0.0110	0.0525	0.096
Number of observations	1,154,072	1,154,072	1,154,072
Panel B: Girls			
Divorced parent	-0.0747** (0.0027)	-0.0419** (0.0027)	-0.0441** (0.0027)
Children's controls	X	X	X
Demographic controls		X	X
Parental education controls			X
R-square	0.0113	0.056	0.1027
Number of observations	568,899	568,899	568,899
Panel C: Boys			
Divorced parent	-0.0754** (0.0024)	-0.0452** (0.0023)	-0.0479** (0.0023)
Children's controls	X	X	X
Demographic controls		X	X
Parental education controls			X
R-square	0.0099	0.0486	0.0894
Number of observations	585,173	585,173	585,173

Note: We exclude children from families of parental displacement when looking at the parental divorce effect; vice versa for parental displacement effects. Children's control variables additionally include the full dummies of birth cohorts. Demographic variables include full indicators of family size, parent's birthyear, mother's age at first birth, parental education level and location counties. We control for full set of dummies for parental education, where the base group is education level of elementary or less. ** indicates p-value less than 5%; * indicates p-value less than 10%

Table 3: Cross-sectional Analysis-- Effect of parental displacement on child college admission

Outcome Variable=Indicator of college admission

	All displacements				Only closures	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All children						
Displaced parent	-0.0059** (0.0025)	-0.0137** (0.0024)	-0.0134** (0.0024)		-0.0094** (0.0035)	
Displaced mother				-0.0137** (0.0031)		-0.0035 (0.0047)
Displaced father				-0.0100** (0.0034)		-0.0105** (0.0048)
Children's controls	X	X	X	X	X	X
Demographic controls		X	X	X	X	X
parental education controls			X	X	X	X
R-square	0.0099	0.0521	0.0956	0.0956	0.0959	0.0959
p-value: displaced mother = displaced father				0.4408		0.3307
Number of children	1,154,072	1,154,072	1,154,072	1,154,072	1,129,820	1,129,820
Panel B: Girls						
Displaced parent	-0.0007 (0.0037)	-0.0096** (0.0036)	-0.0094** (0.0035)		-0.0042 (0.0052)	
Displaced mother				-0.0085* (0.0046)		0.0077 (0.0070)
Displaced father				-0.0080 (0.0050)		-0.0112 (0.0072)
Children's controls	X	X	X	X	X	X
Demographic controls		X	X	X	X	X
parental education controls			X	X	X	X
R-square	0.0103	0.0557	0.1023	0.1023	0.1025	0.1025
p-value: displaced mother = displaced father				0.9408		0.0737
Number of children	568,899	568,899	568,899	568,899	556,855	556,855
Panel C: Boys						
Displaced parent	-0.0105** (0.0033)	-0.0174** (0.0032)	-0.0171** (0.0031)		-0.0141** (0.0046)	
Displaced mother				-0.0185** (0.0040)		-0.0137** (0.0060)
Displaced father				-0.0120** (0.0045)		-0.0099 (0.0065)
Children's controls	X	X	X	X	X	X
Demographic controls		X	X	X	X	X
parental education controls			X	X	X	X
R-square	0.0087	0.0483	0.0890	0.0890	0.0894	0.0894
p-value: displaced mother = displaced father				0.3082		0.6898
Number of children	585,173	585,173	585,173	585,173	572,965	572,965

Note: Description of covariates is the same with table 3.

Table 4: Family Fixed-effects analysis -- Effect of parental divorce on child college admission

Outcome Variable=Indicator of college admission				
	(1)	(2)	(3)	(4)
Divorced parent	-0.0018 (0.0041)	-0.0130** (0.0042)	-0.0112** (0.0049)	-0.0126** (0.0042)
<i>Interaction terms</i>				
Divorce x boy			-0.0035 (0.0050)	
Divorce x child<15 at time of parental divorce				-0.0065 (0.0058)
Children's covariates		X	X	X
Number of children	1,154,072	1,154,072	1,154,072	1,154,072
Number of families	517,735	517,735	517,735	517,735

Note: Descriptions of observations and covariates are the same with Table 2.

Table 5: Family Fixed-effects analysis -- Effect of parental displacement on child college admission

Outcome Variable=Indicator of college admission	(1)	(2)	(3)	(4)	(5)
Panel A: All displacements					
Displaced parent	0.0171** (0.0032)	0.0062* (0.0033)		0.0112** (0.0043)	0.0059* (0.0033)
Displaced mother			0.0074* (0.0043)		
Displaced father			0.0059 (0.0046)		
<i>Interaction terms</i>					
Displaced parent x boy				-0.0096* (0.0051)	
Displaced parent x child<15 at time of parental displacement					0.0153 (0.0116)
p-value: displaced mother = displaced father			0.8264		
Children's covariates		X	X	X	X
Number of children	1,154,072	1,154,072	1,154,072	1,154,072	1,154,072
Number of families	517,735	517,735	517,735	517,735	517,735
Panel B: Only closures					
Displaced parent	0.0207** (0.0048)	0.0095* (0.0049)		0.0217** (0.0063)	0.0091* (0.0048)
Displaced mother			0.0163** (0.0065)		
Displaced father			0.0051 (0.0067)		
<i>Interaction terms</i>					
Displaced parent x boy				-0.0231** (0.0077)	
Displaced parent x child<15 at time of parental displacement					0.0336 (0.0192)
p-value: displaced mother = displaced father			0.2695		
Children's covariates		X	X	X	X
Number of children	1,129,820	1,129,820	1,129,820	1,129,820	1,129,820
Number of families	507,414	507,414	507,414	507,414	507,414

Note: Descriptions of observations and covariates are the same with Table 2.

Table 6: Other Heterogenous effects of parental income shocks

Outcome Variable=Indicator of college admission

	Rural area	Urban area	Low- educated mothers	High- educated mothers	Low- educated fathers	High- educated fathers
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Parental divorce effects</i>						
Mean College admission rate	0.1247	0.1738	0.0951	0.2675	0.0855	0.2396
Divorced parent	-0.0118** (0.0052)	-0.0160* (0.0081)	-0.0104** (0.0043)	-0.0179 (0.0119)	-0.0094** (0.0043)	-0.0217** (0.0099)
Percent effect (%)	9.46	9.21	10.94	6.69	10.99	9.06
Family FE	X	X	X	X	X	X
Number of children	791,779	362,293	852,663	301,409	744,920	409,152
Number of families	346,035	171,979	374,877	143,137	326,436	191,578
<i>Panel B: Parental displacement effects (only closures)</i>						
Mean College admission rate	0.1249	0.1736	0.0951	0.2681	0.0856	0.2403
Displaced parent	0.0140** (0.0065)	0.0036 (0.0090)	0.0092* (0.0051)	0.0074 (0.0121)	-0.0011 (0.0054)	0.0213** (0.0104)
Percent effect (%)	11.21	2.07	9.67	2.76	1.29	8.86
Family FE	X	X	X	X	X	X
Number of children	774,744	355,076	835,550	294,270	730,950	398,870
Number of families	338,869	168,763	367,730	139,902	320,602	187,030

Note: Descriptions of observations and covariates are the same with Table 2.

Table 7: Comparisons among three types of parental income shock effects

Outcome Variable=Indicator of college admission

	Divorce	Displacement (only closures)		Unexpected Death (Chen, Chen and Liu, 2009)	
	(1)	(2)	(3)	(4)	(5)
Mean college admission rate	0.141	0.141	0.141	0.140	0.140
	Parental divorce:	Parental displacement:	Displaced mother:	Parental death:	Mother died:
	-0.0130** (0.0042)	0.0095* (0.0049)	0.0163** (0.0065)	-0.0134 (0.0088)	-0.0442** (0.0220)
Percent effect (%)	9.22	6.74	11.56	9.57	31.58
			Displaced father:		Father died:
			0.0051 (0.0067)		-0.0034 (0.0093)
Percent effect (%)			3.62		2.43
Family FE	X	X	X	X	X
Number of childre	1,154,072	1,154,072	1,154,072	1,481,003	1,481,003
Number of familie	517,735	517,735	517,735	621,113	621,113

Note: Chidren selected in Chen et al. (2009) are those born between 1978 and 1985.