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Migration Restrictions Can Create Gender Inequality: The Story of China's Left-Behind Children
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ABSTRACT

About 11% of the Chinese population are rural-urban migrants with a rural hukou that severely restricts their children's access to urban schools. As a result, 69 million children are left behind in rural areas. We use two regression-discontinuity designs - based on school enrollment age cutoffs and a 2014 policy change that more severely restricted migrants' access to schooling - to document that migrants become discontinuously more likely to leave middle-school-aged daughters (but not sons) behind in poor rural areas without either parent present exactly when schooling becomes expensive and restricted. The effect is larger when the daughter has a male sibling. Migrant parents send significantly less remittances back to daughters than sons. Although China's hukou mobility restrictions are not gender-specific in intent, they have larger adverse effects on girls. Rural residents adjacent to cities that experience shocks to labor demand after China's accession to the WTO are more likely to separate from children to take advantage of new opportunities in cities. Those workers earn much more and advance economically, but longitudinal data reveals that their children complete fewer years of schooling, remain poor, and have worse mental and physical health later in life.

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1 Introduction

People leaving rural areas to go work in urban factories has been integral to the development process. 11% of the Chinese population in the 2005 census – 145 million people – were rural-urban migrants. China imposes internal mobility restrictions that undermine parents' ability to migrate with their children. In particular, stringent *hukou* restrictions in many Chinese cities make it prohibitively expensive or even impossible for migrants to enroll their children in urban schools. As a result, 69 million Chinese children were left behind by migrant parents in 2015 (UNICEF, 2018). This paper tracks determinants and consequences of this massive societal disruption.

Beyond China, restrictions on migrants' access to services including schooling are also formalized in Vietnam through their similar *Hokhau* system (Cameron, 2012). Millions of internal migrants in India also find it difficult to access urban public services (Imbert and Papp, 2020). And the most typical international labor migrants – South, South-East Asians, and Africans working in East Asia and the Gulf – are discouraged or prevented from bringing families with them to work locations (Mobarak et al., forthcoming). As a result, millions of Filipino, Indian, Pakistani, Egyptian children are also growing up without a parent present.

Chinese migrants with a rural *hukou* are required to pay a large fee called *zanzhufei* to enroll their children in urban schools (Dang et al., 2020). *Zanzhufei* for junior middle school enrollment is about 10% of the average migrant's earnings – a big financial deterrent. Such constraints on migrant parents are becoming even more acute over time as cheaper schools specifically designated for migrant children are shut down in Beijing and other popular migration destinations (Yang, 2016).

We use variation in the stringency of *hukou* restrictions across Chinese cities interacted with discontinuous jumps in schooling costs as well as in new restrictions imposed on migrants to specific cities in 2014 to analyze how parents decide whether and when to migrate and leave their children behind in rural areas. Children must transition from primary to junior middle school at a certain age, and *Zanzhufei* for junior middle school is 53% larger than for primary school. This changes parents' incentives and ability to keep their children with them exactly when children transition to middle school.

We first employ a regression discontinuity research design based on the age cutoff for middle school entry, using data on children's exact date of birth from the 2010 Population Census. We find that parents near *hukou*-restrictive cities become discontinuously more likely to separate from daughters (but not from sons) when the cost of schooling increases. The change in schooling costs does not affect rural parents' decisions on whether to stay at home or migrate (not surprising – given the large wage premium in cities); it only affects the margin of whether to migrate *with or without children*. In a linear RD regression, the probability that daughters are left behind increases by 3.5 percentage points exactly when they reach the legal enrollment age for junior middle school *and* her parents originate near cities with restrictive *hukou* policy. There is no such effect for sons.

We again see that same effect on daughters when in 2014 the Chinese government urged "mega cities" - defined as those with a population of over five million in the city central district area - to rigidly control the population. This new "migrant population control policy" led to a tightening of *hukou* restrictions and shutting down on migrant schools in mega cities (Figure A1). We find that parents who had previously migrated to cities above the 5-million-population cutoff become 7 percentage points more likely to leave their middle-school-aged daughter behind after 2014, relative to parents who had previously migrated to cities below the mega-city population cutoff. That same discontinuity does not exist for boys. The effect is robust when we restrict attention to migrants who had made their destination choices before the 2014 policy was announced, which addresses concerns about endogenous destination choice in response to restrictions placed on children.

Thus, using multiple research designs with different data variation, we find that although China's policy of mobility restrictions is not gender-specific in its intent or design, it produces a gendered effect in which daughters of a certain age become more likely to be separated from their parents. And most girls are left behind without *either* parent present.

If migrating for work improves parents' earnings capacity, that could benefit children left behind even if parents are unable to spend time with them (Yang, 2008). The net effect on children depends whether the parents' time or money is more important for the child's human capital accumulation (Zhang et al., 2014). We therefore

add two pieces of analysis to better understand the lives of children left behind. First, we analyze migrant parents' remittance behavior, and find that migrants who leave daughters behind remit 9% less than migrants who leave sons behind. Girls therefore receive less parental time *as well as* less money compared to boys.

Second, we use a longitudinal survey that tracks rural children from Gansu province over 15 years to analyze the long run consequences of being left behind on later-life outcomes. This panel survey allows us to track into adulthood up to 2000 junior-middle-school-aged children growing up in rural area either with or without their parents. Since the parents' decision to migrate (leaving their child behind) is not random, we instead document the effects of city-specific labor demand shocks around 1999-2003 linked to China's entry into the WTO (Khanna et al., 2021; Facchini et al., 2019) on both short and long-run socioeconomic outcomes on parents and children in rural Gansu who lived near those cities.

We first see that the trade-related labor demand shocks in a city induced parents living in nearby rural Gansu prefectures to emigrate to cities to take up factory employment, separating from their children. This diversified the family's sources of livelihood away from agriculture as parents moved into skill-intensive occupations and industries in cities. The parents earn higher wages and the family's total consumption and food consumption increase.

Despite these large positive economic benefits of the new work opportunities for parents, when surveyors revisit the same children in 2015 who were school-aged around 2000 when those opportunities originally arose, we see that those children fared much worse later in life relative to kids in families in other parts of Gansu where those opportunities were not as easily accessible. Children whose families had a one standard deviation greater exposure to the 1999-2003 trade shock are over 10 percentage points more likely to appear in the bottom quintile of the income distribution of Gansu in 2015, are less educated, have 1.4% lower heights, and are significantly more likely to suffer from mental health problems. The enhanced migration opportunities for parents were evidently a curse for their children. The resulting separation from parents undermines children's human capital acquisition, and makes them poorer later in life.

Taken together, our results suggest that girls suffer disproportionately when strict mobility restrictions are imposed on migrant workers in a rapidly developing and

urbanizing society. When it is expensive for migrants to keep their children with them, they are more likely to separate from daughters than sons, and daughters receive less time, attention, and money from their parents. Separation undermines *all* children's human capital accumulation and hurts girls throughout their lives.

Other research has examined the effects of migration on children's educational outcomes (Zhang et al., 2014; Chen, 2013), but we are among the first to document the long-run consequences in adulthood, and the first – to the best of our knowledge – to document these gendered effects, and connect it to mobility restrictions. We add to the literature on the sources of gender disparities[1] by identifying a new mechanism by which gender disparities might emerge even if the underlying policy (of mobility restrictions) has no direct, explicit gender dimension. We also contribute to the literature on the adverse welfare effects of spatial immobility and add a gender dimension to the distributional consequences of migration.[2]

The remainder of this paper proceeds as follows. Section 2 describes the data and Section 3 discusses stylized facts about the *hukou* system and left-behind children in China. Section 4 provides RD estimates of how *hukou* restrictions result in school-aged girls being left behind, Section 5 analyses remittance behavior, Section 6 presents the long-term economic consequences on children of new migration opportunities for parents, and Section 7 discusses the potential mechanisms driving our empirical pattern. Section 8 concludes.

2 Institutional Background

2.1 Hukou Restrictions, Migration, and Children Left behind

In 1958, China formally instituted the *hukou* system to control internal migration. The system required that each person be classified as rural or urban and be assigned a locality of *hukou* registration, which is typically the person's location of birth. One's *hukou* registration determines one's entitlement to pursue many activities, and eligi-

[1] Beaman et al. (2012); Blau and Kahn (2017); Card et al. (2016); Goldin (2014); Goldin et al. (2021); Barth et al. (2017); Hannum et al. (2022); Qian (2008); Bhalotra et al. (2019); Dahl and Moretti (2008); Chetty et al. (2016).

[2] Bryan et al. (2014); Clemens et al. (2014); Gollin et al. (2014); McKenzie and Rapoport (2007); Facchini et al. (2019); Khanna et al. (2021); Kinnan et al. (2018); Imbert et al. (2022).

bility for state-provided goods and services in a specific place. All internal migration was subject to approval from local authorities at the destination. Thus, the red *hukou* book served as an internal passport that determines a person's rights to reside and work in specific locations within China. Children, regardless of age and gender, inherit their parents' *hukou* status, including any new urban *hukou* their parent may obtain.

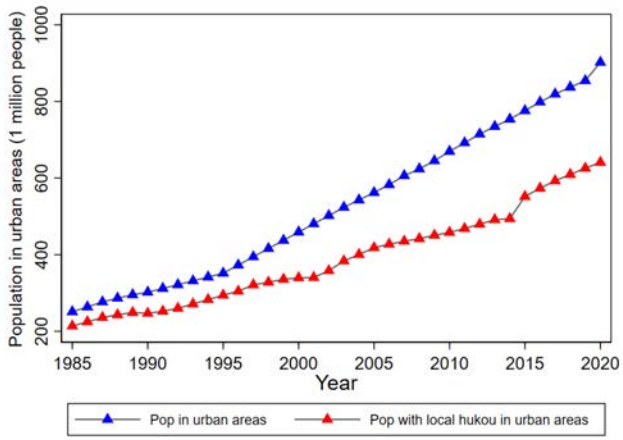
These mobility restrictions have been gradually relaxed since 1984. Chinese citizens can now migrate to cities, but cannot access many government-provided benefits at the destination without an urban *hukou*. Most importantly, it is difficult and expensive for the children of migrants to enter urban schools.

Economic growth in China triggered a dramatic increase in rural-urban migration. With an influx of rural migrants, the population of Chinese cities surged from 200 million in 1985 to 900 million in 2020 (Figure 1). Only a subset of those migrants were granted urban *hukou*, so the number of urban residents without urban *hukou* privileges also increased dramatically during this period. Obtaining an urban *hukou* requires levels of professional skills or educational attainment that are very difficult for the vast majority of rural migrants to attain (Khanna et al., 2021). The schooling restrictions have therefore led to large increases in the number of children left behind in rural areas without parents present. In 2018, approximately 69 million children in rural China were growing up without their parents (UNICEF, 2018).

The stringency of *hukou* regulations varies, with more developed cities with better amenities placing more restrictions on migrants. *Hukou* stringency therefore cannot be treated as exogenous, and inferring the effects of migration restrictions therefore requires a more sophisticated empirical strategy. Figure 2 illustrates that the stringency level of *hukou* restrictions is positively correlated with the share of rural migrants who leave their kids behind. There are many clear indications that left-behind rural children experience worse educational quality: teachers in rural schools have lower educational attainment (Table A2), are less professionally accomplished (Table A3), and have access to worse facilities (Table A4) than their counterparts in urban schools.

To keep their school-aged children with them in the city, migrant parents either have to pay an extra fee called *zanzhufei*, or send their children to "migrant schools"

Figure 1: More and More People Don't Have Local Urban *Hukou* as China Urbanizes



Note: The blue line denotes the population in urban areas, and the red line shows the population holding local urban *hukou* in urban areas. Data come from the *China Statistical Yearbook*.

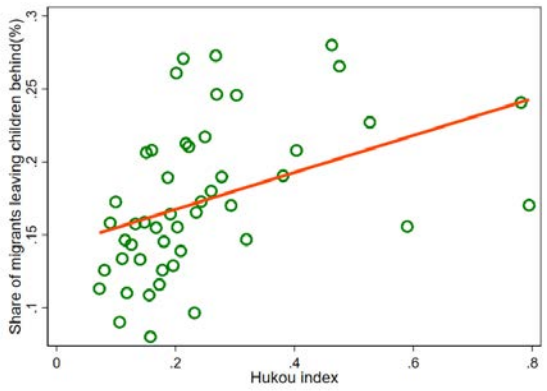
set up in cities specifically for poor migrant children without a local *hukou*. These schools are also of poorer quality than urban public schools.[3] Many cities closed migrant schools in recent years (Table A5), which forces parents to pay steeper *zanzhufei* if they want to keep their children with them. This can be cost-prohibitive for poor migrant households. The amount of *zanzhufei* is higher in cities that have more stringent *hukou* restrictions (Figure 3), which is why *hukou* policy stringency is a useful measure of the difficulty migrant parents face in keeping their children with them.

2.2 Junior Middle Schools More Restricted than Primary Schools

Education is compulsory in China. By law, parents must enroll their children in primary school if they turned six by September 1 in a given year and must enroll them in junior middle school if they turn 12 by that day. *Hukou* restrictions are a much bigger constraint on migrant families with junior middle school aged children relative to primary-school-age. Junior middle schools charge a substantially higher

[3]The majority of teachers in migrant schools do not have adequate credentials or experience to obtain jobs in city public schools. Migrant schools are often overcrowded and have worse infrastructure. They charge fees that are expensive for migrants, but much lower than *zanzhufei* charged by public schools for migrant students.

Figure 2: *Hukou* Index and the Share of Migrants Leaving Children Behind



Notes: This figure shows the relationship between the share of migrants leaving children behind and the stringency of *hukou* regulations in migrants' destination cities. Cities are grouped into fifty groups according to the quantile of the *hukou* index. The vertical axis denotes the mean value of the share of migrants leaving children behind and the horizontal axis denotes the mean value of the *hukou* index in each quantile. Data on left-behind children come from the *China Migrants Dynamic Survey (CMDS)*, and data on the *hukou* index come from Zhang et al. (2019).

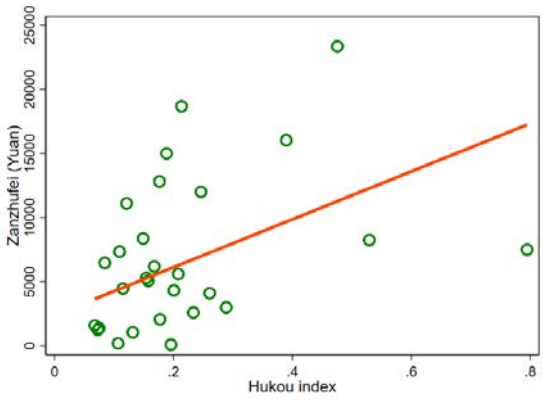
amount of *zanzhufei* than primary schools (Table A6). The number of available school seats is more limited in urban junior middle schools compared to primary schools.

Figure 4 shows that migrant workers are always more likely to leave middle-school-aged children behind compared to primary-school-aged children. They are also more likely to leave children of all ages behind when they migrate to cities with more stringent *hukou* restrictions. Guangzhou – a popular destination for migrant workers – offers an interesting case study on what happens to migrant children as they transition from primary to middle school age (Table A7). In 2012, about 53% of the children in migrant households studied in primary schools in Guangzhou, but only around 32% of junior middle school aged migrant children stayed in the city. Only 20% took the high school entrance exam.

2.3 The 2014 Migrant Population Control Policy in Mega-Cities

In July 2014, the State Council of China issued "Opinions on Promoting the *Hukou* System Reform", which urged mega-cities - categorized as those with a population of over five million in the city central district area - to "exercise strict control over

Figure 3: *Hukou* Restrictions and *Zanzhufei* (Extra School Fee) for Migrants' Children



Notes: In China, migrant children without a local *hukou* have to pay *zanzhufei* (an extra fee imposed specifically on them) in order to go to a local school. This figure shows the relationship between the amount of *zanzhufei* and the stringency of *hukou* regulations in migrants' destination cities. Cities are grouped into fifty groups according to the quantile of the *hukou* index. The vertical axis denotes the mean value of the amount of *zanzhufei* and the horizontal axis denotes the mean value of the *hukou* index in each quantile. Data on left-behind children come from the *China Migrants Dynamic Survey (CMDS)*, and data on the *hukou* index come from Zhang et al. (2019).

the population". Those mega-cities were required to set a population target by 2020, and local government performance would be evaluated against that target. As a result, in 2014 local governments in mega cities start strongly restricting the inflow of unskilled migrants by imposing even more stringent restrictions on school enrollment for migrant children. Conversely, the same "Opinion" led to a gradual relaxation of *hukou* restrictions in small and medium-sized cities. We will examine how the leave-behind decisions of migrant parents attached to mega-cities changed after 2014, relative to migrants attached to other cities.

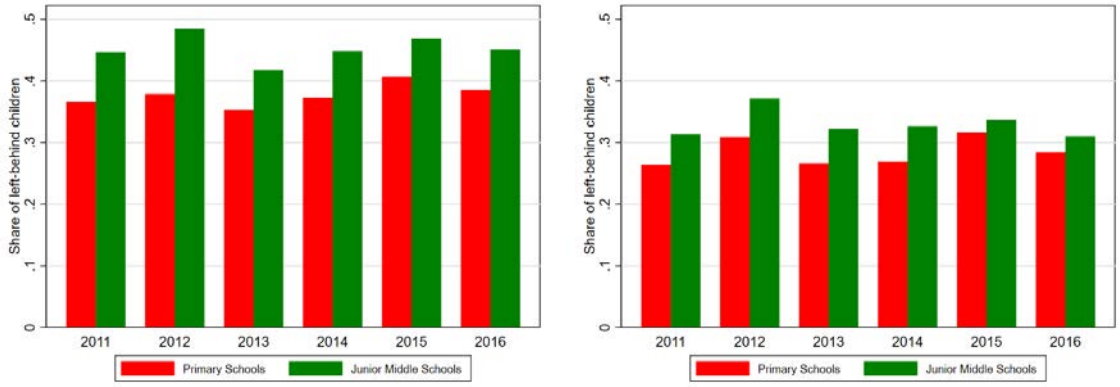
3 Data

3.1 Left Behind Children Data

We measure individual-level migration decisions using the 2010 Population Census of China.[4] China conducts its national population census every ten years, and the

[4]We use a 0.095 percent random sample drawn from the 2010 Census.

Figure 4: Share of Left-behind Children by School Age



(a) Highly restrictive cities

(b) Less restrictive cities

Notes: We divide cities into two groups based on the stringency of *hukou* restrictions. Highly restrictive cities are those in which the *hukou* index is above the national mean, and less restrictive cities are those in which the *hukou* index is below the national mean. *Hukou* index measures the stringency of *hukou* regulation and the difficulty for migrants to obtain local *hukou*. Data on left-behind children come from the *China Migrants Dynamic Survey (CMDS)*, and data on the *hukou* index come from Zhang et al. (2019).

2010 Population Census is the most recent decennial census with individual-level data available to researchers. The census records demographic characteristics of parents and their children, including age, gender, education, *hukou* type (rural or urban), *hukou* location, and current residential location. The full children sample includes 72,902 children in 54,596 rural households. We are able to employ a subsample of 20,831 children in our regression discontinuity design.

The census data allows us to characterize the three location choices rural parents can make: stay in the village with children, move to a city with children, or move to a city while children remain in the rural area. Following Facchini et al. (2019) and Khanna et al. (2021), we define migrants as those who move out from their *hukou* prefecture. Rural and urban areas within the same prefecture can be within commuting distance, so those moves would not necessarily correspond to children being separated from parents. 16.5% of the rural population in the 2010 census – 111 million people – had migrated from their *hukou* prefecture, up from 76 million (10.2% of the rural population) in 2005.

We supplement the census data with the China Migrants Dynamic Survey (CMDS), which is the largest nationally representative survey of China's migrant population. The CMDS sampling frame consists of migrants who have lived in cities for more than one month but have no local *hukou*. The survey records detailed socioeconomic information of migrant parents and their children, including age, gender, education, and residential location. It also includes information on remittances sent by parents, which we analyze in section 5.

We combine six waves of the CMDS survey from 2011 to 2016 to construct a pooled cross-sectional dataset. Unlike the census data, the timing of these surveys allows us to leverage the 2014 Migrant Population Control Policy for identification, and to control for city-and year- specific unobservables using fixed effects. Our CMDS analysis sample (migrants in cities where we can measure *hukou* restrictions) includes 171,859 children across 30 provinces, of whom 47,121 are junior middle school aged and 124,738 children are primary school aged.

3.2 Longitudinal Data on Children

The Gansu Survey of Children and Families (GSCF) is a longitudinal survey of rural children conducted by the University of Pennsylvania and the Gansu Bureau of Statistics in five waves in 2000, 2004, 2007, 2009 and 2015. The first wave surveyed a representative sample of 2,000 children aged 9–12 across 100 villages in Gansu Province. Subsequent waves track these rural children for 15 more years, which allows us to link their long-term socioeconomic outcomes during adulthood, including educational achievement, earnings, and migration status, with their childhood experience of being left behind by parents or not. We construct individual-level longitudinal panel data by combining GSCF 2000, 2004 and 2015. We restrict our analysis to the 1414 individuals who appear in the 2015 wave. These individuals were interviewed by phone if they were not physically present in Gansu. The survey attrition rate from 2000 to 2015 is not significantly different between those had above (26.1%) versus below (26.4%) median exposure to the trade shock, and that trade shock will be our source of identifying variation.

3.3 *Hukou* Restrictions Data

We use the *hukou* index constructed by Zhang et al. (2019) to measure the stringency of *hukou* regulations across Chinese cities. The main mechanisms by which migrants qualify for an urban *hukou* include tax payment and investment, home purchase, and employment.[5] The requirements associated with each mechanism differ by cities, and the composite *hukou* index measures the overall difficulty for adult migrants to obtain a local *hukou*. Because China experienced significant changes in the *hukou* policy in 2014,[6] Zhang et al. (2019) construct city-level *hukou* index specific for the periods of 2000–2013 and 2014–2016.

3.4 Data to Construct Trade Shocks

We leverage exogenous shocks to labor demand in nearby cities due to trade policy changes to identify the long-term consequences of parental separation from children in section 6. The raw data used to compute import demand in various cities are drawn from the International Trade Statistics Database of UN Comtrade. Appendix Table A1 reports summary statistics of the key variables used in the analysis.

4 Results on Leaving Children Behind

4.1 A Multinomial Logit Analysis of Parents' Migration Choices

Each parent i with a rural *hukou* for prefecture c have three $Choices_{ic}$ which we index by n (n=1,2,3): they can decide to (1) remain in the village with their children, or (2) migrate to a city leaving their children behind in the rural area, or (3) migrate with

[5]We ignore the family reunion channel in our index construction, because only a very small fraction of immigrants can obtain local *hukou* through this channel.

[6]China experienced two rounds of *hukou* reforms in the past two decades. First, in the early 2000s, many provinces abolished the quota system for rural to urban *hukou* transition. The state abolished the grain and oil permit system, thus separating the food supply from *hukou* registration. Although abolishing the quota system lowered the barrier for *hukou* transition, it was still very hard for internal migrants to obtain a local *hukou* in most Chinese cities during that period. Second, in 2014, following the issuance of "Opinions on Promoting the *Hukou* System Reform" and "Policies on the Reform of the *Hukou* System", small and medium-sized cities loosened restrictions while large cities strengthened them.

their children. We construct a multinominal logit model to analyze how the restrictiveness of *hukou* regulations in potential destination cities affect parents' propensity to choose n=1,2 or 3. The multinomial logit is the appropriate modeling framework to capture parents' simultaneous decisions on whether to migrate and whether to take children with them. We embed a regression discontinuity (RD) design with a difference-in-differences into the multinomial logit model, to examine whether parents' propensity to leave children behind shifts at the age cut-off for middle school entrance, given the increase in urban schooling cost when children enter junior middle school:

$$\begin{aligned} logV_{ic}(Choice = n) =& \psi_{0n} + \psi_{1n} SchoolAged_i \times Des\_Hukou_c \times Female_i + \\ & \psi_{2n} SchoolAged_i \times Des\_Hukou_c + \psi_{3n} SchoolAged_i \times \\ & Female_i + \psi_{4n} Des\_Hukou_c \times Female_i + \\ & \psi_{5n} SchoolAged_i + \psi_{6n} Des\_Hukou_c + \psi_{7n} Female_i + \\ & \psi_{8n} T_i \times SchoolAged_i + \psi_{9n} T_i + v_{icn} \end{aligned} \tag{1}$$

$SchoolAged_i$ is an indicator for whether child i is above the enrollment age for junior middle school, based on their exact date of birth relative to the September 1 school entry date. Des_Hukou_c denotes the stringency level of restrictions that rural migrants would face in cities near their origin location c, which is defined the inverse distance-weighted sum of the *hukou* index across potential destination cities, $\sum_d \left(\frac{1}{dist_{dc}} Hukou\ Index_d \right)$. We assign non-zero weights only to potential destination cities that are located within a 400 km radius of *hukou* location c, but our empirical results are not sensitive to this choice.

Our primary variable of interest is the triple interaction between $SchoolAged_{it}$, $Female_{it}$ and Des_Hukou_c, which examines whether there is any differential discontinuous shift in the probability of leaving children behind exactly at the junior middle school enrollment age ($T_j = 0$), in rural areas near cities with more restrictive *hukou* policies. The triple interaction with gender identifies whether this decision to separate from children varies by the gender of the child.

Table 1: Multinomial Logit Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Sample of Daughters		Sample of Sons		Full Sample	
Dependent Variable:	All in Rural	Separation	All in Rural	Separation	All in Rural	Separation
School-aged	-0.124	0.258	-0.101	-0.256	-0.134	-0.139
	(0.165)	(0.297)	(0.144)	(0.249)	(0.119)	(0.198)
School-aged × Standardized weighted *hukou* index	0.106	0.403***	0.0569	0.0185	0.0569	0.0185
	(0.0935)	(0.141)	(0.102)	(0.182)	(0.102)	(0.182)
School-aged × Standardized weighted *hukou* index × Female					0.0496	0.384**
					(0.132)	(0.193)
Observations	9,020	9,020	10,640	10,640	19,660	19,660
Age Bandwidth	2	2	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear	Linear	Linear

Notes: We estimate a mutinomial logit model. All in rural represents the choice of staying in the village with children. Separation represents the choice of migrating to cities and leaving children behind. We use the choice of migrating to cities with children as the base category. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Data come from 2010 Population Census. Robust standard errors clustered at the *hukou* prefecture level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Marginal Effects on the Probability of the 3 Choices

	(1)	(2)	(3)	(4)	(5)	(6)
	Sample of Daughters			Sample of Sons		
Dependent Variable:	All in Rural	Separation	All in City	All in Rural	Separation	All in City
School-aged	-0.0254	0.0167	0.00872	-0.00202	-0.00821	0.0102
	(0.0180)	(0.0127)	(0.0141)	(0.0172)	(0.0110)	(0.0132)
School-aged × Standardized weighted *hukou* index	-0.00346	0.0139**	-0.0105	0.00659	-0.00155	-0.00504
	(0.00993)	(0.00601)	(0.00804)	(0.0144)	(0.00935)	(0.00907)
Observations	9,020	9,020	9,020	10,640	10,640	10,640
Age Bandwidth	2	2	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear	Linear	Linear

Notes: We estimate the average marginal effects on the probability of parents' choices. All in rural represents the choice of staying in the village with children. Separation represents the choice of migrating to cities and leaving children behind. All in city represents the the choice of migrating to cities with children. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Data come from 2010 Population Census. Robust standard errors clustered at *hukou* prefecture level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The running variable T_i is the gap between the child's age and the middle school enrollment age cutoff, in years. Imbens and Lemieux (2008) and Gelman and Imbens (2019) suggest that a local linear regression using samples near the RD cutoff is likely to yield the most robust estimates. We use a local linear control function for the running variable T_i, and select two years as the bandwidth in our baseline specification. We conduct robustness checks with alternative bandwidths and control functions for T_i. Some migrant workers may send their children to junior middle school later than the compulsory enrollment age, so this framework is best interpreted as a fuzzy RD design.

Hukou policies in potential destination cities may be correlated with other city characteristics (e.g. population density, local industrial policy), so the main effect of Des_Hukou_c cannot be interpreted causally. Parents' decisions to separate from children may be related to child age and gender for a variety of reasons (e.g. safety considerations), so the coefficients on the running variable T_i and the main effect of $Female_i$ are not easily interpretable either. Controlling for those main effects, the triple interaction term at the school-age-RD cutoff identifies whether parents' decisions to migrate and to separate from children changes exactly when the cost of keeping children with them increases discontinuously - near *hukou*-restrictive cities, *and* whether that varies by the gender of the child.

Table 1 reports the coefficient estimates of the multinomial logit model, and Table 2 reports the corresponding marginal effects. Option 3 ("migrate to a city with children") is the omitted category against which RHS variables' effects on options 1 (don't migrate) and 2 (migrate without children) are compared. We first split the sample between boys and girls. The child's age, or its interaction with *hukou* policy restrictiveness has no effect on parents' decision to migrate versus stay in the rural area in either sample (columns 1 and 3). But the interaction has a significant effect on parents' propensity to separate from *daughters* as opposed to migrating *with* the child, as shown in column 2. Marginal effects computed in table 2 shows that daughters who cross the age threshold for middle school entry are 1.4 percentage points more likely to separate from parents for every one standard deviation increase in the stringency of *hukou* restrictions in nearby cities. This discontinuous jump in separation from daughters exactly when schooling becomes more expensive is sizable:

it represents a 24% jump in the probability of separation, because overall, 5.9% of primary-school-aged daughters with rural *hukou* are left behind in China.

There is no such effect on boys in Table 1 column 4. In contrast to daughters, elevated barriers to enter junior middle school do not induce rural parents to leave *sons* behind in their rural hometown, irrespective of the stringency of *hukou* restrictions in nearby cities. Columns 5 and 6 combine the boys' and girls' samples, and the triple interaction shows that the discontinuous jump in the probability of separation from daughters is indeed statistically larger than the corresponding effect on sons. When faced with restrictions on children's educational opportunities in cities, rural parents appear more willing to separate from daughters than from sons. Although China's *hukou* regulations are not gender-specific in intent, they create a gendered inequity.

Columns 1,3, and 5 in Table 1 show that changes in children's urban schooling access does not affect parents' decision on *whether* to migrate for work. This is not surprising, given the vast wage differences between rural and urban areas (Appendix Figure A2). Instead, the decision on whether to bring their children with them or not is the margin that adjusts as schooling costs change.[7]

4.2 Are Children Left Behind without *Either* Parent Present?

In Table 3 we study four choices for the household: Stay in the rural origin, migrate with children, one parent migrates leaving the child behind, or *both parents* migrate and leave the child behind. We find that about 60% of the discontinuous jump in the propensity to leave daughters behind when they turn middle-school age near *hukou*-restrictive cities are cases where the daughter is left behind *without either parent present* in the rural area. Such cases account for 0.8 of the 1.4 percentage point RD effect. This is relevant because the emotional toll and developmental burden on children are likely larger when both parents are absent (Zhang et al., 2014). Other descriptive data from China show that in such cases, grandparents are most often asked to take care of children left behind without either parent in rural areas.

[7]Table A8 shows that these results are robust to RD design variations in which we extend the bandwidth or use a quadratic control function for the running variable.

Table 3: Marginal Effects on the Probability that One versus Both Parents are Away

Dependent Variable:	All in Rural	One Parent is Away	Both Parents are Away	All in City
Panel A: Female				
School-aged × Standardized weighted *Hukou* index	-0.00342	0.00592	0.00800*	-0.0105
	(0.00997)	(0.00428)	(0.00483)	(0.00802)
Observations	9,020	9,020	9,020	9,020
Panel B: Male				
School-aged × Standardized weighted *Hukou* index	0.00718	0.00179	-0.00397	-0.00500
	(0.0139)	(0.00626)	(0.00456)	(0.00910)
Observations	10,640	10,640	10,640	10,640
Age Bandwidth	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear

Notes: We estimate the average marginal effects on the probability of parents' choices. All in rural represents the choice of staying in the village with children. One parent is away represents the choice of leaving children behind with one parent present. Two parents are away represents the choice of leaving children behind without either parent present. All in city represents the the choice of migrating to cities with children. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Data come from *2010 Population Census*. Robust standard errors clustered at the *hukou* prefecture level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.3 A Linear Regression-Discontinuity Model

The multinomial framework is necessary to study the simultaneous migration and child separation decisions, but the nonlinearity of the model is a drawback for the diff-in-diff, RD setup. Since the decision *whether* to migrate at all or not appears unaffected by the RD (Table 1), we now focus on studying just the child-separation decisions of those who choose to migrate. The advantage is that it allows us to use more detailed data from a much larger sample of migrants in the China Migrant Dynamic Survey (CMDS). And we can analyze the child-separation decision using a linear model, which is a better choices for an RD Diff-in-Diff setup:

$$\begin{aligned} Left\ behind_{ijt} =& \psi_0 + \psi_1 SchoolAged_{it} \times High\ Hukou_{jt} \times Female_{it} + \\ & \psi_2 SchoolAged_{it} \times High\ Hukou_{jt} + \psi_3 SchoolAged_{it} \times \\ & Female_{it} + \psi_4 High\ Hukou_{jt} \times Female_{it} + \psi_5 SchoolAged_{it} \\ & + \psi_6 Female_{it} + \psi_7 T_j \times SchoolAged_{it} + \psi_8 T_j + \xi_{jt} + \eta_m + v_{ijt} \end{aligned} \tag{2}$$

where $Left\ behind_{ijt}$ is an indicator for whether child i (whose parents work in city j and do not have a local *hukou* in their place of residence) are left behind in a rural

area in year t.[8] $High\ Hukou_{jt}$ is a binary variable that equals one if the stringency level of *hukou* restrictions in city j and year t is above the average city level. Our primary variable of interest is the interaction between $SchoolAged_{it}$, $High\ Hukou_{jt}$ and $Female_{it}$, which examines whether there is any differential gender-specific discontinuous shift in the probability of leaving children behind at the school enrollment age ($T_j = 0$) in cities with more restrictive *hukou* policies. We combine CMDS 2011-2016 to create an individual-level pooled cross-sectional dataset to estimate equation 2. Consistent with section 4.1, we use a local linear control function for the running variable T_j, and select two years as the bandwidth in our baseline specification.

In this linear model we can add city-by-year fixed effects ξ_{jt} to control for city-by-year characteristics such as industrial structure and economic development plans of local government that may be correlated with the city's *hukou* policies . We control for birth cohort fixed effects η_m to account for any changes in other policies (e.g. the One Child Policy) pertaining to child outcomes. Table A9 examines whether other variables change systematically at the RD cutoff. We do not see any discontinuities in the fraction of migrants who get a local urban *hukou*, parents' migration decisions, or incomes.[9]

4.4 Graphical and Regression Analysis of the Discontinuity

Figure 5 displays the shifts in the fraction of left-behind children at the age cutoff for middle school enrollment. Reflecting our triple difference research design, we show separate graphs for sons and daughters, and for cities where migrant parents face more or less stringent (above or below the mean value) *hukou* restrictions. Consistent with

[8]We exclude children whose parents migrate from rural to urban areas within the same prefecture-level region, as a rural and an urban area located within the same prefecture-level region are close, and can be within commutable distance.

[9]Other potential concerns with the RD strategy is that (a) parents change destinations or try harder to obtain a local *hukou* when their children reach middle school enrollment age. Table A9 directly tests for this and finds that parents' migration decisions or their probability of getting a local *hukou* do not meaningfully change at that school-age cutoff; (b) perhaps families disappear from our dataset entirely due to changes in their migration choices. To explore, we follow Cattaneo et al. (2020) and perform a data-driven manipulation test, in which we compare the density of observations around the RD cutoff. As reported in Table A10, we find no discontinuity in the sample distribution at the school-age cutoff for either male or female children. This mitigates concerns about "sorting" (e.g. changing *hukou* location) based on their child's school entry date.

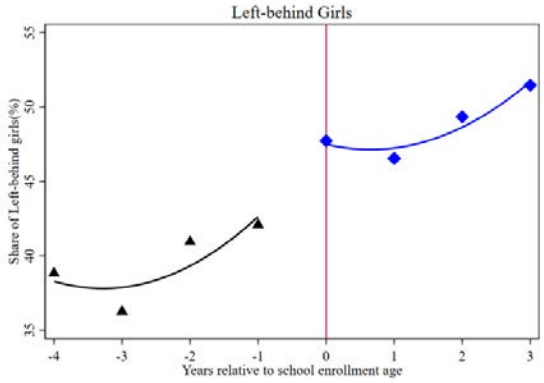
the multinomial logit results, there is a sharp increase in the share of left-behind girls just at the school enrollment age if their parents are in highly *hukou*-restricted cities (Figure 5a), whereas we do not observe any discontinuous changes at the enrollment age for boys in those highly *hukou*-restricted cities (Figure 5b). We also do not observe any discontinuity for either girls or boys in less *hukou*-restricted cities (Figures 5c and 5d). In addition, irrespective of child gender, the fraction of children that are left behind is much lower in less restricted cities than it is in highly restricted cities. As with the 2010 census data in section 4.1, the CMDS data also shows that migrant parents appear to leave their daughters rather than their sons in their rural hometown in response to strict *hukou* restrictions, whereas there is no obvious gender bias for parents in cities with relaxed *hukou* policies .

Table A11 shows the statistical significance and magnitude of these RD effects. The various columns control for city-by-year fixed effects, or a triple interaction between city-, year- and *hukou* province- fixed effects (to absorb any differences in attitudes towards boys' versus girls' education between migrants from different areas), or birth cohort fixed effects. Across all the specifications for daughters, the interaction of the above-enrollment-age indicator and the high-*hukou*-restriction indicator is statistically significant, and the coefficient implies that a girl becomes 3.2-3.5 percentage points more likely to be left behind exactly when she reaches the legal enrollment age for junior middle school and her parents work in a city with restrictive *hukou* policy.[10] 34% of girls in migrant households in China are left behind in rural areas, so the discontinuous jump at that age-cutoff represents a 10% increase at the mean. The coefficient on the above-enrollment-age dummy is close to zero, which suggests that the discontinuity does not exist for parents who migrated to cities with relatively relaxed *hukou* policies.

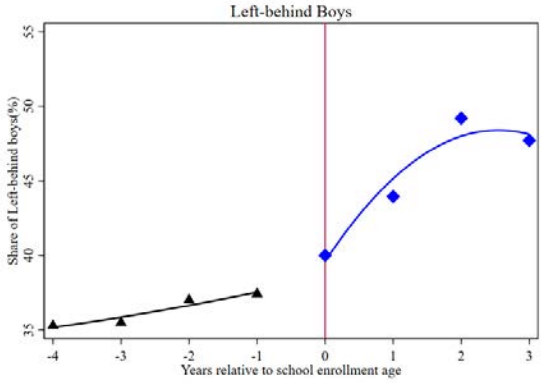
Across all specifications for sons, both the above-enrollment-age indicator and its interaction with the high-*hukou*-restriction indicator are statistically indistinguishable from zero. Table A13 formally demonstrates that the school-age discontinuity in restrictive *hukou* cities is statistically larger for girls than it is for boys.

[10]Table A12 shows that the results remain similar under RD design variations in which we extend the bandwidth or use a quadratic control function for the running variable.

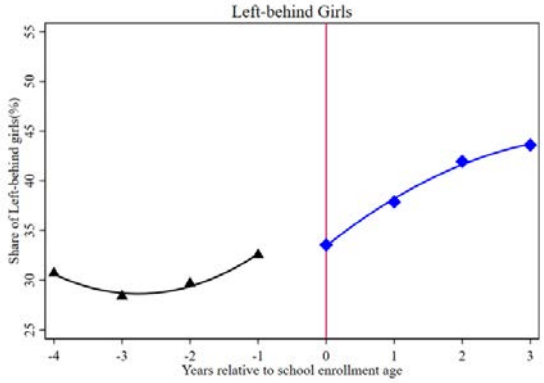
Figure 5: School Enrollment and Left-behind Children



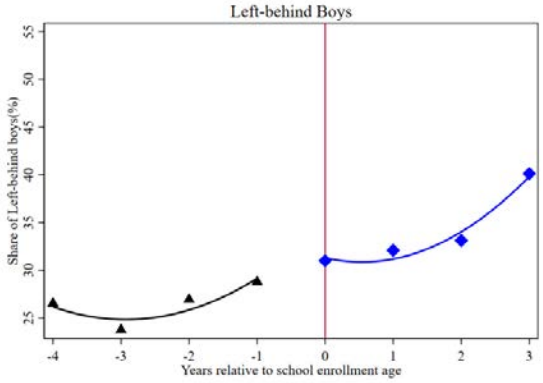
(a) Girls in *highly* restrictive cities



(b) Boys in *highly* restrictive cities



(c) Girls in *less* restrictive cities



(d) Boys in *less* restrictive cities

Notes: The vertical axis shows the share of children left behind in villages, for girls and boys, repectively. The horizontal axis shows the number of years relative to the junior middle school enrollment age. We divide cities into two groups based on the stringency of *hukou* restrictions. Highly restrictive cities are those in which the *hukou* index is above the national mean, and less restrictive cities are those in which the *hukou* index is below the national mean. Hukou index measures the stringency of *hukou regulation* and the difficulty for migrants to obtain local *hukou*. Data on left-behind children come from the *China Migrants Dynamic Survey (CMDS)*, and data on the *hukou* index come from Zhang et al. (2019).

4.5 Threats to Identification: One Child Policy

Given son preference in China and the availability of sex selection technology, there is a legitimate concern that child gender may itself reflect parental choices. Existing evidence suggests that sex selection is more common at higher birth orders, but that the gender ratio of *first-born* children in China matches biological expectations (Almond et al., 2019). We therefore re-run our regressions in Table A14 limiting the sample to first-born children only. The empirical patterns remain very similar, where daughters of parents in *hukou*-restrictive cities become 3.7-4.2 percentage points more likely to be left behind when they cross the age threshold for middle-school entry.

Some features of China's One Child Policy (OCP) may pose additional threats to causal inference from our regression discontinuity design (Qian, 2018; Rosenzweig and Zhang, 2009; Gao et al., 2022). First, in some provinces, the local government allows rural parents who have a second child only if their first-born is a girl. As a result, the gender of the child in our RD analysis may be systematically correlated with family size. In Table A15, we therefore re-run the RD regression controlling for the number of children (Panel A), and fixed effects for family size (Panel B). Our results remain robust, even when comparing between households with the exact same number of children.

Second, the penalties for violating OCP guidelines vary by province and by ethnicity.[11] Parents' gender preferences can also vary by province and ethnicity, which may create some accidental correlation where we mis-attribute OCP effects to migration restrictions. In Table A16, we control for triple interactions between parents' ethnicity fixed effects, cohort fixed effects, and parents' *hukou*-province fixed effects (which governs the OCP guidelines they are subjected to) to account for any potential confounding effect of the OCP. Our RD results do not change after including these controls.

[11] For example, the OCP restricted fertility for Han people between 1979 and 2016, but not for ethnic minorities. The financial penalties for violating the OCP varied across provinces.

4.6 Second RD: 2014 Mega-city Migrant Population Control Policy

Our use of cross-city variation in the stringency of *hukou* restrictions introduces a concern that unobserved educational preferences drives the choice of city that parents migrate to. We therefore use the 2014 "migrant population control policy" imposed on mega cities to construct a different RD research design to again test for gender biases in migrant parents' decisions on whether to leave their children behind. The CMDS data spanning 2011 to 2016 allows us to leverage this 2014 change in policy. This new policy forced local governments in mega-cities to impose new restrictions on migrants' access to local public services. Since "mega-cities" have a precise definition (population exceeding five million in the city central district), we construct the following RD specification based on that population threshold:

$$\begin{aligned} Left\ behind_{ijt} =& \alpha_0 + \alpha_1 School\ Age_{it} \times I(Pop > 5\ million)_j \times I(t > 2014) + \\ & \alpha_2 School\ Age_{it} \times I(Pop > 5\ million)_j + \alpha_3 School\ Age_{it} \\ & \times I(t > 2014) + \alpha_4 School\ Age_{it} + \xi_{jt} + \eta_n + v_{ijt} \end{aligned} \tag{3}$$

where $School\ Age_{it}$ is an indicator for children who have reached middle-school enrollment age by year t, $I\left(Pop > 5\ million\right)_j$ is an indicator for the mega-cities subjected to the new policy because their central district population at baseline exceeded 5 million, and $I\left(t > 2014\right)$ is an indicator for the post-treatment period. The running variable in this RD design is the city-specific difference between baseline city population and 5 million, which is absorbed by city-by-year fixed effects–ξ_{jt}. We restrict the sample to parents who made their migration destination choices before 2014, to mitigate any reverse causality concerns about parents choosing destinations based on concerns about children's access to urban schools. Given the pre-post policy variation, we do not need to use the variation in *Hukou* stringency at all.

Columns 1 and 3 of Table 4 show that for female children, the RD variable of interest – the triple interaction between having reached the junior middle school enrollment age; the indicator for cities with above-5-million population; and the indicator for post-2014 – is positive and significantly different from zero. In response to the new policy, parents who had migrated to mega-cities prior to 2014 become 7 percentage points more likely to leave daughters behind. The second row shows that

parents were not exhibiting that behavior before the policy went into effect. Columns 3-4 show that there is no such effect for boys in migrant households. All these coefficients jointly imply that new migration restrictions that increase the cost of raising children in the city pushes parents into discriminating against their daughters.

Table 4: An Alternative RD Design based on Population Controls in Mega Cities

	(1)	(2)	(3)	(4)
Dependent Variable: Indicator for leaving the child in rural hometown				
	Female	Male	Female	Male
School-aged ×I(Population>5 million) ×	0.0700***	-0.0429	0.0772**	-0.0314
I(Year>2014)	(0.0220)	(0.0363)	(0.0306)	(0.0267)
School-aged ×I(Population>5 million)	-0.00355	0.0186	-0.00946	0.00909
	(0.0222)	(0.0139)	(0.0197)	(0.0153)
School-aged × I(Year>2014)	-0.0495**	0.0342	-0.0491	0.0434
	(0.0214)	(0.0262)	(0.0291)	(0.0277)
School-aged	0.0314*	-0.0240	0.0453**	-0.0200
	(0.0173)	(0.0166)	(0.0172)	(0.0186)
Coeff diff p-value	0.000		0.000	
Observations	10,296	13,812	10,296	13,812
Adjusted R-squared	0.163	0.137	0.192	0.169
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Age Bandwidth	2	2	2	2
City Size Bandwidth	3	3	3	3

Notes: The age bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. "Coeff diff p-value" reports the p-value of a test of equality of the coefficient on "Above enrollment age ×I(Population>5 million) ×I(Year>2014)" between the female and male, using the Fisher's permutation test (following Cleary (1999), Brown et al. (2010) and Keys et al. (2010)). This bootstraps to calculate empirical p-values that estimate the likelihood of obtaining the observed differences in coefficient estimates if the true coefficients are, in fact, equal. The city size bandwidth is 3 million, and thus we only include cities with baseline population between 2 and 8 million in the city central district area. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

A potential concern with this second RD design is that parents anticipate the 2014 population control policy, and those with middle-school-aged kids choose to relocate from mega-cities. Table A17 tests this directly, and the RD (triple interaction) con-

dition does not predict relocation. Table A18 restricts the sample of migrant parents further to those who made destination choices before 2013 or 2012, and our results remain robust in these sub-samples.

5 Remittance Behavior

Leaving children behind in rural areas reduces the cost of raising children because parents can avoid paying extra urban school fees. Therefore, migrant parents could afford to compensate daughters for separating from them by sending remittances back to the rural area. Both parental time and money are useful for child development, so it's possible that this is, on net, beneficial for daughters. Table 5 examines the patterns of remittances sent back by migrant parents as a function of child gender. Remittance sent back is actually 9% *lower* when a daughter is left behind compared to a son being left behind. In panel C, we see that this gender difference gets even larger when the child reaches junior-middle-school age. In this sample, remittances are 13-16% lower for left-behind girls. Given the usual identification concerns about sex selection, Appendix Table A19 restricts this analysis sample to first-born children, where gender-ratio-at-birth follows biological norms (Almond et al., 2019). Estimated effects are even larger: middle-school-aged first-born daughters receive 15-17% less remittances from migrant parents than first-born sons. The result is also robust to controlling for family size fixed effects (column 5 of Table A19).

In summary, there is no evidence that daughters who (our previous analysis shows) are more likely to be left behind at that age are financially compensated by parents. Daughters receive less time and less money from their parents.

6 Long-term Effects of Leaving Children Behind

We now use longitudinal data to study the longer term consequences of being left-behind as a child on socio-economic outcomes in adulthood, observed 15 years later. We use data from the 2000, 2004, and 2015 rounds of the Gansu Survey of Children and Families (GSCF), which track a group of children born in 1988-1991 in rural Gansu into adulthood. We use information on the parents' location to identify chil-

Table 5: Remittance sent to rural children by gender

	(1)	(2)	(3)	(4)
	Dependent variable: IHS of the Amount of Remittance			
Panel A: Full Sample				
Female	-0.0872***	-0.0890***	-0.0928***	-0.0956***
	(0.0332)	(0.0332)	(0.0342)	(0.0341)
Observations	39,556	39,556	39,556	39,556
Adjusted R-squared	0.0778	0.0785	0.124	0.125
Panel B: Primary School Age				
Female	-0.0980*	-0.0971*	-0.0952*	-0.0925*
	(0.0530)	(0.0530)	(0.0558)	(0.0559)
Observations	14,460	14,460	14,460	14,460
Adjusted R-squared	0.0810	0.0814	0.133	0.133
Panel C: Junior Middle School Age				
Female	-0.134**	-0.135**	-0.165**	-0.164**
	(0.0653)	(0.0642)	(0.0702)	(0.0689)
Observations	8,018	8,018	8,018	8,018
Adjusted R-squared	0.0818	0.0816	0.113	0.112
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes
Cohort FE	No	Yes	No	Yes

Notes: The Inverse Hyperbolic Sine (IHS) transformation is applied to the amount of remittance. Panel A shows results for all children aged below 16, and panels B and C, respectively, show results for children at primary school age and junior middle school age. Data come from China Migrants Dynamic Survey (CMDS). We use the CMDS 2011 and 2012 to perform estimation as only the two waves of CMDS contain information about remittance. Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

dren who were either living with their parents, or were left behind when they were middle-school-age in 2000 or 2004.[12]

We will call a child i born in a rural area in prefecture c and middle-school-aged in survey year t (2000 or 2004) $Left\ behind_{ict}$ if that child was separated from at least one parent for more than six months in a survey year (2000 or 2004) during junior middle school age. Note an important difference in the structure of this data relative to datasets we used in our earlier analysis in section 4.1: in this panel dataset, left-

[12]Because the initial wave of GSCF in 2000 surveyed children aged 9–12, and the school age for junior middle school is 12-15 (if born before Sept 1) or 13-16 (born after Sept 1), the 2000 and 2004 survey waves offer us the opportunity to observe children separated from parents during middle school age.

behind children are those who have a parent who migrated but the child continues to live in a rural area, while parents of the "control group" are non-migrants. This is because the sampling frame for GSCF constitutes children who were present in rural Gansu in 2000 or 2004. 17% of the children in our Gansu sample were separated from one or both parents during childhood. Each parent's decision about whether to migrate is an endogenous choice, so we need some exogenous variation that governs parent's migration decisions to isolate the causal effect of being left behind.

6.1 Identification Strategy: Import Demand Shocks in Nearby Cities

The growth in China that induced this large-scale rural-urban migration was export-led. Not surprisingly, global import demand shocks for the products/industries that nearby cities specialize in can have large effects of parents' migration propensities from a rural region. Using UN Comtrade data on imports,[13] we construct an index called WID_{ct}, which measures each rural region's *exposure* to a world import demand shock (via their proximity to nearby industrial cities) in each year. The import demand shock experienced by each city is defined as the import demand for industry k weighted by the importance of that industry to destination city d, as measured by that city's pre-period (1997) export share of that industry ($\frac{EX_{k,d}}{\sum_j EX_{k,j}}$), prior to China's accession to the World Trade Organisation. Every city experiences these demand shocks, so each rural region's exposure is determined by their proximity to every "potential" migration destination. We therefore weight the city-specific demand shocks by the inverse of the distance from the migrant's birth location c to every urban destination d, to create the index for rural region c:

$$WID_{ct} = \sum_d \left(\frac{1}{dist_{dc}}\right) \left(\sum_k World\ IM_t\ \times \frac{EX_{k,d}}{\sum_j EX_{k,j}}\right) \tag{4}$$

This is akin to "shift-share" instruments common in the economics literature. But we do not run any IV regressions; we simply look at the reduced form effects of

[13]The International Trade Statistics Database of UN Comtrade contains detailed information on each world trade flow, including the corresponding importer, exporter, the Harmonized System (HS) 6-digit code, and total values. We calculate total imports for each HS 6-digit product at the world level and concord the HS level data to International Standard Industrial Classification industries.

greater trade exposure on Gansu families' choices and outcomes. We assign non-zero weights only to potential destination cities that are located within a 400 km radius of birthplace c.

Gansu is a large, geographically-spread province. As a result, the GSCF survey districts abut a variety of cities that experienced different intensities of import demand shocks: Xi'an, Chengdu, Xining. This creates sufficient variation: the range of exposure to world import demand shocks in our dataset exceeds four standard deviations.

6.2 What Trade-Induced Import Demand Shocks Identify

Positive import demand shocks in nearby cities can affect children growing up in rural Gansu through a variety of mechanisms beyond being left behind by migrant parents. It raises parents' wages. If the shock persists, it could create future economic opportunities for the children as they enter adulthood, and it could also thereby raise their perceived returns to education. All of this should *improve* the longer term education and economic outcomes for children who were born in rural areas close to cities that benefited from import demand shocks.

The two-step approach we take is to first document these beneficial direct effects on WID shocks on parents' lives, and only then investigate how their children fare in the longer term. We find that parents indeed migrate, and their economic conditions improve significantly. Despite those positive effects on the family, Gansu children are worse off in multiple dimensions later in life when they are exposed to WID shocks. Taken together, these results strongly suggest that exogenous shocks to migration opportunities benefit parents and families, but on net, children are worse off later in life. Parental separation is evidently very bad for children because they fare worse *despite* the economic opportunities created by shocks to import demand in nearby cities. Note that this strategy can only identify the net effect of trade opportunities, not specifically the effect of parental separation. We feel confident that we have identified the *direction* of the parental separation effect, because the net long-term effect of trade shocks on children is negative despite the positive economic benefits they confer. We also later check that this is not due to children dropping out to take advantage of factory job opportunities. We also only identify the effect on *all* children

- not on daughters specifically - because we trade shocks do not necessarily induce differential out-migration of the parents of sons versus daughters.

6.3 Effects of Import Demand Shocks on Parents

Migration Decisions: We match two cohorts of parents in GSCF whose children were junior-middle-school-age in 2000 and 2004, to trade demand shocks in 1999 and 2003 respectively. Given the two cohorts of data, we can control for fixed effects for the rural Gansu township, and identify this effect based on changes in exposure to the WID shock over time within the same rural hometown. Table 6 presents "upstream" results on parents' migration responses to the trade demand shocks in nearby destination cities. The dependent variable is an individual-level indicator for migrating to cities in columns 1 and 2, and a household-level indicator for whether at least one parent migrates and leave their children behind in columns 3 and 4. A one SD increase in the exposure to global import demand (as defined in equation 4) triggers a 22 percentage point increase in migration propensity, which corresponds to a 0.79 SD increase in this propensity. In columns 3 and 4, a one SD increase in WID raises the probability that at least one parent is away from the child by 40 percentage points. Trade shocks are indeed a powerful source of identification for the effects of new migration opportunities and parental separation.

Effects on Household Socio-economic Outcomes: We use three different data sources to track the effects of import demand shocks on parents and households: GSCF 2000/2004 and Population Census 2005 for contemporaneous and short-run outcomes, and GSCF 2015 for longer-term outcomes.

Table 7, Panel A, columns 1 and 2, show that a one standard deviation increase in WID increases the likelihood that parents have off-farm income while their children are still school-aged (in 2000 or 2004) by 20 percentage points. This is a primary effect of those new import-demand induced migration opportunities: it allows rural parents to diversify away from agriculture.

In Panel B we match outcomes from the 2005 population census to WID constructed for 2004. Unlike GSCF, the census data contains information on wages, and on industry or occupation for parents. A one standard-deviation increase in WID

Table 6: Parents' Migration Responses to Trade Shock

	(1)	(2)	(3)	(4)
	Individual Out-migration (=1)		Household Level: A Parent Migrated	
Standardized WID	0.214***	0.215***	0.401***	0.399***
	(0.0264)	(0.0241)	(0.0441)	(0.0457)
Observations	2,712	2,712	1,379	1,379
Mean of Dep. Var.	0.0855	0.0855	0.173	0.173
SD of Dep. Var.	0.280	0.280	0.379	0.379
Individual Demographics	No	Yes	No	No
Household Controls	No	Yes	No	Yes
Township FE	Yes	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	No	No

Notes: We perform individual-level regressions in columns 1 and 2, and perform household-level regressions in columns 3 and 4. The dependent variable is an individual-level indicator for migrating to cities in columns 1 and 2, and a household-level indicator for whether at least one parent migrates and leave their children behind in columns 3 and 4. We combine two groups of parents whose children were at the age for junior middle school in 2000 and 2004, respectively, and leverage trade demand shocks occurred in 1999 and 2003 for the two groups of parents, respectively. Individual Demographics include an indicator for female, and education levels. Household controls include an indicator for whether a grandmother was alive and an indicator for whether a grandparent was living in the same place. Like Khanna et al. (2020), we control for import tariffs which may affect firm productivity. We add fixed effects for different age cohort of parents in columns 1 and 2. Robust standard errors clustered at the prefecture of birth level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

in nearby cities increases rural-*hukou*-holder parents' wages by 4.5%, which is an increase of 34 RMB per month. Parents also move into occupations and industries that are more skill-intensive.[14]

Panel A, columns 3-10 use the 2015 survey round of the GSCF to track the effects of trade shocks on the longer-term outcomes for parents and households. Even 10 years later, those parents continue to work in more skill-intensive industries (Columns 3 and 4). Those families enjoy significantly greater total consumption (Columns 5 and 6) and food consumption (Columns 7 and 8) in 2015. Positive trade shocks also significantly improve parents' long-run health status, as those parents are 12 percentage points more likely to report not having difficulty with their daily routine activities (Columns 9 and 10).

[14]We follow Ahsan and Chatterjee (2017) to define industry-specific skill intensity as $EI_{ind} = \sum_{f=1}^{L_{ind}} (\frac{\omega_f}{\sum_f^{L_{ind}} \omega_f}) \times e_f$; where e_f is individual $f's$ education category, ω_f is an individual's sampling weight, and L_{ind} is the total number of workers within an industry. We categorize a respondent's educational level into various rankings: not literate (=0), below primary school (=1), primary school(=2), middle school (=3), high school (=4), technical secondary school (=5), pre-college (=6), college (=7), master (=8) and PhD (=9). We define occupation-specific skill intensity in the same way.

6.4 Effects of Import Demand Shocks on Children

Table 8 reports effects of labor demand shocks in nearby cities when the Gansu children are school-aged (in 1999/2000 or 2003/2004) on their long-run outcomes observed in the 2015 round of GSCF.

Panel A focuses on educational attainment. A one SD increase in the exposure to world import demand during childhood *reduces* the probability of completing high school by 10-11 percentage points. This result is especially striking because anecdotally, a reason migrants often provide for leaving their children behind is for the child to prepare for the high-school entrance exam, for which the curriculum varies by provinces. A one SD increase in world import demand reduces schooling attainment by approximately 1.5 years (columns 3-4), which is equivalent to about a 10 percentage point decrease (columns 5-6).

Panel B tracks various later-life socioeconomic and labor outcomes. A one SD increase in world import demand in nearby cities increases the probability of remaining in agriculture by 8 percentage points (columns 1 and 2), and reduces the probability of obtaining an urban *hukou* in adulthood by 11 percentage points (columns 3 and 4). This is surprising in that the import demand shocks - to the extent that they are persistent - should, if anything, *increase* the opportunities those children have to migrate to urban areas. Instead of creating new opportunities, the family separation appears to be undermining inter-generational mobility in China. Indeed, those with one SD greater exposure to trade shocks when school-aged are 10-11 percentage points more likely to appear in the bottom quintile of the income distribution of Gansu in 2015 (columns 5 and 6).[15] They are also 9-10 percentage points less likely to have a significant other(columns 7 and 8).

Panel C tracks health outcomes. Rural children with one-standard greater exposure to world import demand shocks have 1.4% lower heights (columns 1 and 2), are significantly more likely to suffer from mental health problems (columns 3 and 4), and 4 percentage points more likely to be categorized as obese later in life (columns 5 and 6).

[15]We use data from China Family Panel Survey to construct the 2015 income distribution for people who were born in Gansu Province. Our dependent variable - "low income group" include those in the bottom quintile and those who report no income.

Table 7: The Effects on Parents

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: Outcomes Measured in the Gansu Survey of Children and Families(GSCF)									
	Having Off-farm Income (=1)		Industry-specific Skill Intensity		Annual Household Consumption (Chinese Yuan)		Annual Food Consumption (Chinese Yuan)		No difficulty to do daily routine activity (=1)	
Standardized WID	0.198***	0.197**	0.143**	0.0969*	4,857**	4,770**	544.8**	541.8**	0.118***	0.128***
	(0.0609)	(0.0614)	(0.0469)	(0.0466)	(1,919)	(1,913)	(178.3)	(176.8)	(0.0259)	(0.0261)
Observations	1,379	1,379	2,442	2,442	1,319	1,319	1,302	1,302	2,607	2,607
Mean of Dep. Var.	0.439	0.439	2.083	2.083	8841	8841	948	948	0.860	0.860
SD of Dep. Var.	0.496	0.496	0.356	0.356	10407	10407	1197	1197	0.347	0.347
Individual Demographics	No	No	No	Yes	No	No	No	No	No	Yes
Household Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Township FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	No	No	Yes	Yes	No	No	No	No	Yes	Yes

	Panel B: Outcomes Measured in Census Data							
	Monthly Wage		Log Monthly Wage		Occupation-specific Skill Intensity		Industry-specific Skill Intensity	
Standardized WID	33.87***	33.87***	0.0455**	0.0455**	0.0858*	0.0858*	0.0925*	0.0925*
	(12.04)	(12.04)	(0.0198)	(0.0198)	(0.0484)	(0.0484)	(0.0503)	(0.0503)
Observations	531,037	531,037	531,037	531,037	533,548	533,548	533,548	533,548
Mean of Dep. Var.	477.7	477.7	5.865	5.865	7.669	7.669	7.667	7.667
SD of Dep. Var.	402.7	402.7	0.787	0.787	1.394	1.394	1.379	1.379
Individual Demographics	No	Yes	No	Yes	No	Yes	No	Yes
Residential City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hukou Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: We perform individual-level regressions in Panel A columns 3, 4, 9, 10 and Panel B columns 1-8, and perform household-level regressions in Panel A columns 1,2, 5-8. In Panel A, we combine two groups of parents whose children were at the age for junior middle school in 2000 and 2004, respectively, and leverage trade demand shocks occurred in 1999 and 2003 for the two groups of parents, respectively. In Panel A columns 1 and 2, the dependent variable is an outcome observed in GSCF 2000 or 2004 (having off-farm income). In Panel A columns 3-10, dependent variables are long-term outcomes observed in GSCF 2015. In Panel B, we use population census 2005 to revisit the contemporaneous effects on parents, where the independent variable is the world import demand in 2004 and dependent variables are short-term outcomes in 2005. Individual Demographics include an indicator for female, and education levels. Household controls include an indicator for whether a grandmother was alive and an indicator for whether a grandparent was living in the same place when the child was school-aged. Like Khanna et al. (2020), we control for import tariffs which may affect firm productivity. In panel A, robust standard errors clustered at the prefecture of birth level are reported in parentheses. In panel B, robust standard errors clustered at the *hukou* prefecture level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: The Long-term Effects on Children

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Education Outcomes							
	High School and Above (=1)		Years of Schooling		IHS of Years of Schooling			
Standardized WID	-0.104**	-0.109**	-1.483***	-1.503***	-0.0944**	-0.0968*		
	(0.0413)	(0.0398))	(0.211)	(0.250)	(0.0375)	(0.0437		
Observations	1,335	1,335	1,335	1,335	1,335	1,335		
Mean of Dep. Var.	0.593	0.593	11.37	11.37	3.067	3.067		
SD of Dep. Var.	0.491	0.491	3.510	3.510	0.381	0.381		
	Panel B: Labor Outcomes							
	Agricultural Worker (=1)		Hold Urban *Hukou* (=1)		Low Income Group (=1)		Have a significant other (=1)	
Standardized WID	0.0726*	0.0843**	-0.116***	-0.113***	0.102*	0.115**	-0.105**	-0.0947*
	(0.0351)	(0.0330)	(0.0298)	(0.0328)	(0.0539)	(0.0426)	(0.0454)	(0.0477)
Observations	1,174	1,174	1,379	1,379	1,379	1,379	1,379	1,379
Mean of Dep. Var.	0.0860	0.0860	0.201	0.201	0.436	0.436	0.431	0.431
SD of Dep. Var.	0.281	0.281	0.401	0.401	0.496	0.496	0.495	0.495
	Panel C: Health Outcomes							
	Log Height		Psychological Index		Obesity (BMI>30) (=1)			
Standardized WID	-0.0143*	-0.0144***	0.312**	0.313**	0.0425***	0.0414***		
	(0.00779)	(0.00394)	(0.112)	(0.107)	(0.0112)	(0.0110)		
Observations	916	916	921	921	1,379	1,379		
Mean of Dep. Var.	5.127	5.127	0	0	0.0261	0.0261		
SD of Dep. Var.	0.0439	0.0439	1	1	0.160	0.160		
Individual Demographics	No	Yes	No	Yes	No	Yes	No	Yes
Household Controls	No	Yes	No	Yes	No	Yes	No	Yes
Township FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: We perform individual-level regressions in Panel A, Panel B and Panel C. We combine two groups of children who were at the age for junior middle school in 2000 and 2004, respectively, and we leverage trade demand shocks occurred in 1999 and 2003 for the two age groups of children, respectively. Dependent variables are children's long-run outcomes observed in GSCF 2015. In Panel B Columns 5 and 6, we divide the children in our sample into five groups based on their income in 2015; the low-income group includes those whose income is below the bottom quintile of 2015 income distribution for people who were born in Gansu and those who do not have any income. We use the CFPS data to construct the 2015 income distribution for people who were born in Gansu. Household controls include an indicator for whether a grandmother was alive and an indicator for whether a grandparent was living in the same place when the child was school-aged. Psychological index in Panel C columns 3 and 4: we construct an inverse-covariance weighted summary index of various psychological outcomes including depression, poor communication skills, pickiness, emotional instability and rudeness. Robust standard errors clustered at the prefecture of birth level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

6.5 We Likely Under-estimate the Costs of Leaving Children Behind

In summary, we document that trade shocks induced rural parents to migrate by raising labor demand in nearby cities. This improves parents' economic opportunities and increases household consumption, but it also induces parental separation. The net effect on children observed 11-15 years later (when they are aged 23-27) are very

negative. The separation from parents undermines their human capital acquisition, and makes them poorer, less urban, and less healthy later in life. Our WID-based identification strategy only allows us to report a *net* effect, which suggests that the pure effect of being left behind must be even more detrimental than what our regressions can estimate. One other possibility is that trade shocks induce children to drop out of school early to take factory jobs in cities, which in turn undermines their long-run human capital acquisition.[16] The GSCF 2009 survey wave records the age at which this longitudinal sample of children start working, and in Table A20 we find no evidence that trade shocks affect children's propensity to start working before the age of 15 or 16.

There are a few additional reasons why the analysis presented in this section might over- or under-estimate the consequences of the parental separation we documented in section 4. First, our longitudinal data compares the children separated from their parents to other children growing up with parents *in the rural area*. Parents trapped in rural areas earned 60% less than those who migrate, and our analysis shows that left-behind children fare even worse than this disadvantaged group. This is therefore a conservative estimate of the losses suffered by children who are sent back by migrant parents, relative to a counterfactual in which they would otherwise grow up with parents in the city, had the *hukou* restrictions not been so strict. Indeed, data from the China Family Panel Survey (CFPS) show that migrant children complete approximately one additional year of schooling relative to children who grow up with parents in the village.

Second, female out-migration rates were lower in Gansu province in 2000-2004 – the site of our longitudinal analysis – and 85% of the left-behind children have their mother present. In contrast, the nationally representative CMDS data reveals that 60% of left-behind children grow up without *either parent present*. Our longitudinal analysis with Gansu data therefore again provides a conservative estimate of the costs imposed on left-behind children across China.

Third, a possible mitigating factor is that we study Gansu residents who were children two decades ago, since we are interested in tracking long-term outcomes in

[16] À la Atkin (2016) for Mexico, although Heath and Mobarak (2015) finds the opposite effect where manufacturing growth led to *more* schooling investments in Bangladesh.

adulthood. Children left-behind today face a very different environment. With improvements in infrastructure and transportation networks, migrants parents can now return home to see their children more frequently. With the advent of mobile technologies, migrant parents can communicate with left-behind children more regularly. On the other hand, those same smart-phone technologies in the hands of unsupervised children may be more dangerous today for their emotional and cognitive development. It is possible to study short-run effects of parental absence on more recent cohorts of children using later rounds of CFPS data. Appendix Table A21 shows that world import demand shocks are associated with *worse* performance in academic test for school-aged children in 2014, and also with lower heights. In other words, more recent cohorts of left-behind children also appear to be on the same trajectory, even if we cannot yet observe their long-run outcomes.

6.6 Hukou Restrictions and the Gender Wage Gap

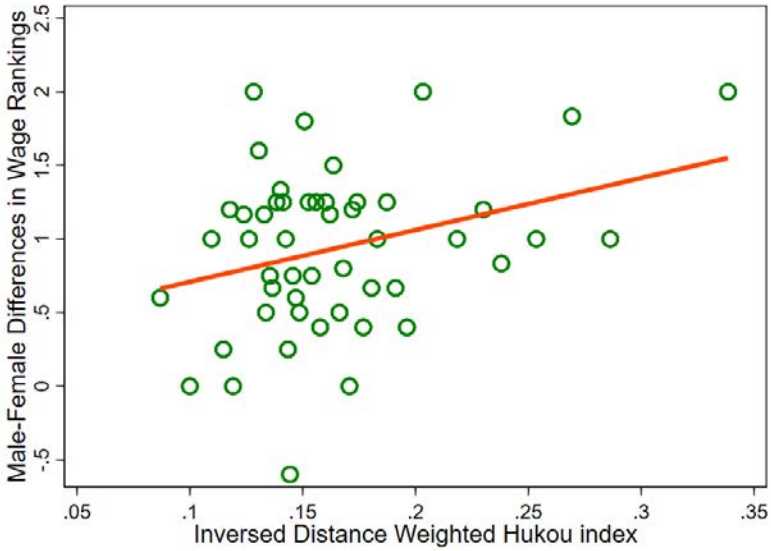
The World Import Demand shocks capture the general economic drivers of parental migration, so they cannot separately identify any differential effect of parental absence on sons versus daughters. In order to shed light on the gender-differentiated long-term consequences of parents' greater propensity to leave daughters behind, we can use data from China Labor-force Dynamic Survey (CLDS) to examine whether there are larger gender differences in adult labor market outcomes for individuals who originate in rural areas adjacent to cities with stricter *hukou* restrictions (where parents exhibited the bias against daughters).

Figure 6 correlates *hukou* policy restrictiveness in nearby cities on the horizontal axis with a "gender wage gap" measure on the vertical axis.[17] In rural locations near restrictive *hukou* cities, there is a greater gender wage gap in earnings later in life. This is a natural and sensible implication of the two sets of results we showed in sections 4 and 6: migrant parents are more likely to leave daughters behind when they face a restrictive *hukou* environment, and the children left behind fare worse later in life. The joint implication of these two facts is that we should observe larger gender

[17]The gender wage gap is measured as the difference in wage rankings between male and female workers who have the same rural area of origin. We divide individual wages into three terciles to measure wage rankings.

gaps in adult economic outcomes in rural areas adjacent to cities with restrictive *hukou* policies, which is exactly what Figure 6 shows.

Figure 6: *Hukou* Restrictions and Male-Female Wage Gaps



Notes: The figure illustrate how *hukou* restrictions in migrants' potential destination cities during individuals' childhood affect the gender gap in wages later in life. The horizontal axis denotes the inverse distance-weighted *hukou* index of potential destination cities (for migrants coming from a particular rural area of origin, i.e., rural area in a particular prefecture region) when these individuals were at junior middle school age. The vertical axis shows differences in wage rankings between male and female workers who have the same rural area of origin. We divide individual wages into three tertiles to measure wage rankings. Rural areas of origin are grouped into fifty groups according to the quantile of the inverse distance-weighted *hukou* index. Wage data come from the China Labor-force Dynamic Survey (CLDS), and data on the *hukou* index come from Zhang et al. (2019).

7 Mechanisms: Why are More Girls Left Behind?

In this section, we evaluate the underlying mechanisms through which *hukou* restrictions could lead to female children to be disproportionately more likely to be left behind. At least four potential mechanisms may be responsible for the empirical patterns we report. First, *hukou* restrictions exacerbate the effects of pre-existing son preference, and daughters bear the burden of the extra *zanzhufei* cost imposed on

migrant parents. Second, the rate of return to education may be lower for females than males, so this is a rational parental response to market conditions. Third, sons are relatively more productive in cities, so parents optimally choose to keep boys in cities and girls in rural areas. Fourth, sons are expected to support parents in their old age, so parents invest more in their sons. We examine implications of each of these mechanisms, and find clearest support for the first one: that the decision to send daughters back is related to son-biased preferences.

7.1 *Hukou* Restrictions Exacerbate Pre-existing Son Preference

We first assess whether our empirical pattern is driven by the interplay between parental son preference and *hukou* restrictions. Table 9 assigns girls (of migrant households) into two groups, based on whether they have male siblings who will compete with them for limited educational resources in cities. We find that our main RD empirical result – daughters being left behind when they reach middle-school-age in restricted *hukou* cities – is only evident for those with male siblings. The empirical patterns we document therefore appear related to unequal intra-household allocation of resources between boys and girls.

We construct another heterogeneity test to explore whether gender-biased social norms explain the empirical patterns we report. We re-estimate our RD specification from Table A11 and additionally interact our independent variable of interest – girls above enrollment age in restrictive *hukou* cities – with the indicator for whether the male-female ratio of second births in migrant parents' provinces of origin is above the national mean. The observed male-female ratio of second births is thought to capture the level of son preference prevalent in rural Chinese provinces, because that is when parents are more likely to practice sex selection (and not as much for first births)[18] Table 10 shows that this triple interaction term is significantly positive for the sample of female children, which implies that the main RD result we documented in Table A11 (middle-school-aged girls left behind when migrants are in restrictive-*hukou* cities) is

[18]To account for the confounding effects of current economic factors on gender ratio, we use the China Population Census 1990 (21 years prior to our sample period) to construct this interaction term. Almond et al. (2019) document that the sex ratio of second births measured using China Census 1990 reflects the son preference of parents, rather than differential potential earnings between male and female children.

significantly more pronounced for migrants who come from regions featuring son-biased sex ratios. The results are in accordance with the literature showing that, when people migrate, their beliefs and values on gender roles move with them, even though their external environment has changed (Alesina et al., 2013).

Table 9: Heterogeneity by Whether Having Male Siblings

	(1)	(2)	(3)	(4)
Dependent Variable: Indicator for leaving the child in rural hometown				
	Has male siblings		Doesn't have male siblings	
School-aged × Highly restricted cities (=1)	0.0372**	0.0365**	0.00585	0.00698
	(0.0171)	(0.0165)	(0.0295)	(0.0334)
School-aged	0.00525	0.00781	0.0174	0.0253
	(0.0219)	(0.0226)	(0.0348)	(0.0401)
Observations	18,353	18,353	6,106	6,106
Adjusted R-squared	0.174	0.213	0.161	0.211
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	No	Yes	No
City FE×Year FE×Hukou Province FE	No	Yes	No	Yes
Cohort FE	Yes	Yes	Yes	Yes
Age Bandwidth	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear

Notes: We use the sample of female children to estimate equation 2. Columns 1-2 show RD estimates for girls without male siblings, and columns 3-4 show RD estimates for girls with male siblings. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

7.2 Other Mechanisms

Differential Returns to Education or City Life? Men and women are likely to have heterogeneous returns to education, and one may expect that parents leave their female children in villages if females have a lower rate of return to education and therefore should be allocated less educational resources. In Table A22, we use individual-level data to perform Mincer wage regressions, and study whether the

Table 10: Heterogeneity by Baseline Sex Ratio in Original Provinces

	(1)	(2)	(3)	(4)
	Dependent variable: Indicator for leaving the child in rural hometown			
School-aged×Highly restricted cities (=1) ×	0.0680***	0.0664***	0.0820***	0.0812***
High Baseline Sex Ratio (=1)	(0.0222)	(0.0222)	(0.0169)	(0.0168)
Observations	31,066	31,066	31,066	31,066
Adjusted R-squared	0.101	0.102	0.206	0.207
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×Hukou Province FE	No	No	Yes	Yes
Cohort FE	No	Yes	No	Yes
Age Bandwidth	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear

Notes: The bandwidth is two years. We use RD sample that are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. High baseline sex ratio is an indicator for whether the male-female ratio of second births in migrant parents' *hukou* provinces is above the national mean level. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

returns to high school education differ between men and women.[19] Table A22 shows that girls actually have a *higher* rate of return to education - both among rural families and urban families, and among migrants.

A related possibility is that working in cities offers boys larger marginal returns compared to girls, and it is therefore economically rational for parents to give their sons greater exposure and access to cities. We use information on individual incomes in CLDS surveys to estimate gender-specific returns to migration for a sample of rural *hukou* in Table A23. The returns to working in cities is actually significantly larger for girls compared to boys.[20]

These correlations make it highly unlikely that the stronger propensity to leave

[19]We use individual-level pooled cross-sectional data by combining CLDS 2012, 2014, 2016 and 2018 to perform Mincer wage regression, because CLDS has a sample period similar to our baseline analysis and allows us to look at the pattern of gender-specific returns to education for people with different migration status and *hukou* types (rural or urban *hukou*).

[20]A concern with that test is endogenous selection into migration, or the "Roy sorting bias". We apply the Dahl (2002) selection correction procedure in Table A23 columns 5 and 6 to address this, and find that the returns to migration remains significantly larger for girls compared to boys.

daughters behind in rural areas (which undermines their educational attainment and future work opportunities in cities) stems from sons producing greater returns from education or from remaining in the city.

Sons are More Valuable for Old-Age Support? If sons (but not daughters) are expected to support elderly parents, migrants may rationally respond by keeping their sons with them, and leave daughters behind. To test this hypothesis, we use the CFPS data to create an indicator for whether the share of old people (aged 60 years or above) that are supported by their sons in the origin province is above the national mean. Table A24 shows that the effect of *hukou* restrictions on the propensity to separate from daughters is not meaningfully affected by the strength of the social norm that sons provide old-age support.

Girls are just different than boys? If parents fear that the uncertainties created by migrant restriction policies that cities have been adopting would have a more detrimental effect on girls, or that cities are more dangerous for girls, or that it is easier for grandparents to raise girls than boys in the rural hometown, then they may be more likely to leave daughters behind. Our identification strategy – where we show that parents' propensity to send daughters back from *hukou* restricted cities once they enter middle-school age – suggest that fixed differences between boys and girls are unlikely to explain the patterns we document. Parents do not always treat girls differently; only when and where their child becomes more expensive to keep.

In sum, the interaction between pre-existing son-biased preferences and migration restrictions provides the most credible, concise explanation for Chinese migrant parents' propensity to leave daughters behind when it becomes costly to keep their children with them in the city. Such son preference may itself be a result of historical gaps in earnings and productivity by gender. But current *hukou* policies serve to perpetuate and exacerbate those gender inequities.

8 Conclusion

Our analysis highlights an unintended consequence of imposing restrictions on people's mobility: it creates gender inequality, and daughters bear a disproportionate burden of the costs imposed on families.

As economic growth and industrial activities increase demand for unskilled workers in Chinese cities, adult migrant workers without a local *hukou* move to urban areas for work, but migration policies are designed to make it difficult for those parents to keep their children with them. That forces poor migrants into a difficult choice: is it worth the expense of keeping my child with me? If there is some pre-existing gender bias in the population, then the cost of the choices that migrants are forced into will be borne disproportionately by girls. We show that migrants are more likely to leave behind their daughters than their sons in poor rural areas. And this in turn perpetuates gender inequality inter-generationally, as left-behind children suffer later in life with worse educational attainment and lower socio-economic status.

Other studies have documented that mobility constraints trigger economic losses for adult workers and widen economic gaps between rural and urban people. We additionally highlight a distributional consequence that is gendered. Our work proposes a new mechanism whereby placing restrictions on migration can exacerbate gender inequity, even if the migration policy does not have an explicit gender dimension.

We already knew that improved access to economic opportunities for females and disadvantaged groups has significantly boosted economic growth in the United States (Duflo, 2012; Hsieh et al., 2019). A new corollary, given our results, is that migration restrictions can undermine long-term economic development in China and other developing countries. The story of China's "Left-Behind Children" highlights the possibility that both aggregate and distributional effects of mobility restrictions may be larger than development economists previously thought.

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Appendix

Table of Contents

A1 Summary Statistics of Key Variables

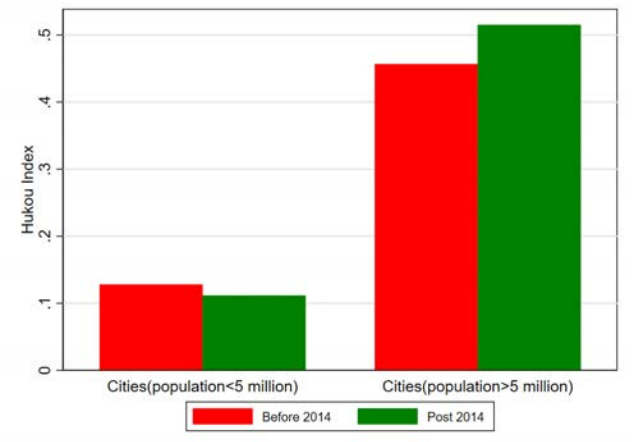
Table A1: Summary Statistics of Key Variables

Variable name	Mean	Std. dev
Panel A: Population Census		
Stay in Village with Children (=1)	0.831	0.374
Migrate and Leave Children Behind(=1)	0.067	0.250
Migrate and Bring Children to cities(=1)	0.101	0.302
Panel B: Migrant Sample in CMDS		
Leave Children Behind by Migrant Parents (=1)	0.343	0.475
Amount of Remittance (Chinese Yuan)	4755.343	7131.414
Age of Children	10.928	2.631
Birth Month of Children	6.662	3.487
Age of Father	36.52	5.300
Panel C: Children's Outcomes in GSCF		
High School and above (=1)	0.593	0.491
Years of Schooling	11.367	3.510
Agricultural Worker (=1)	0.086	0.281
Hold Urban *Hukou* (=1)	0.201	0.401
Low Income Group (=1)	0.436	0.496
Height (cm)	168.74	7.367
Standardized Psychological Index	0	1
Obesity (BMI>30)	0.0261	0.160

Notes: Table shows summary statistics for key variables. Data come from Population Census 2010 (Panel A), the China Migrants Dynamic Survey (CMDS) (Panel B), and the Gansu Survey of Children and Families (GSCF) (Panel C). In Panel C, we divide the children in our sample into two groups based on their income in 2015; the low-income group includes those whose income is below the bottom quintile of 2015 income distribution for people who were born in Gansu and those who do not have any income. We use the CFPS data to construct the 2015 income distribution for people who were born in Gansu. Standardized psychological index in Panel C: we construct an inverse-covariance weighted summary index of various psychological outcomes including depression, poor communication skills, pickiness, emotional instability and rudeness. We define migration status based on whether rural people move out from the prefecture-level region where they have local *hukou* (as in (Facchini et al., 2019; Khanna et al., 2021)).

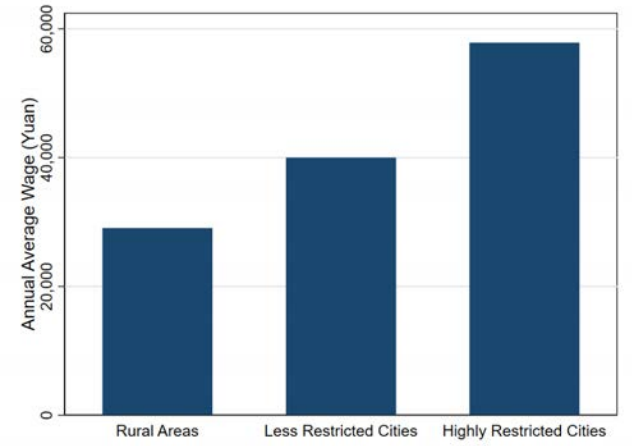
A2 Important Facts about Context and Educational System

Figure A1: 2014 Population Control Policy and *Hukou* Restrictions



Notes: We divide cities into two groups based on whether baseline population in the city central district area is above 5 million. The *hukou* index come from Zhang et al. (2019).

Figure A2: Wage Gains from Moving to Cites



Notes: We divide cities into two groups based on the stringency of *hukou* restrictions. Highly restricted cities are those in which the *hukou* index is above the national mean, and less restricted cities are those in which the *hukou* index is below the national mean. Wage data come form China Labor-force Dynamic Survey (CLDS). The *hukou* index come from Zhang et al. (2019).

Table A2: The Share of Teachers by Education Levels

	Master or above	College	Pre-college	High school	Below high school
Panel A: Junior middle school					
Urban	0.031	0.830	0.135	0.003	0.000
Rural	0.004	0.657	0.328	0.011	0.000
Panel B: Primary school					
Urban	0.010	0.570	0.374	0.045	0.000
Rural	0.001	0.249	0.552	0.195	0.003

Notes: Data come from the Educational Statistics Yearbook of China 2013.

Table A3: The Share of Teachers by Professional Titles

	Special Grade (Excellent)	Level-1	Level-2	Level-3	No title
Panel A: Junior middle school					
Urban	0.218	0.436	0.270	0.009	0.068
Rural	0.114	0.405	0.372	0.026	0.083
Panel B: Primary school					
Urban	0.578	0.302	0.022	0.003	0.095
Rural	0.508	0.360	0.041	0.002	0.089

Notes: Professional titles are designated to teachers based on their professionalism and progressive nature. The special grade teacher is the highest professional title, followed by Level-1 teacher, and then by Level-2 and Level-3 teacher. Data come from the Educational Statistics Yearbook of China 2013.

Table A4: Education Facilities per Student

	Num of multi-media classrooms	Asset value of education equipment
Panel A: Junior Middle School		
Urban	0.053	0.511
Rural	0.036	0.358
Panel B: Primary School		
Urban	0.081	0.653
Rural	0.036	0.293

Notes: Data come from the Educational Statistics Yearbook of China 2013.

Table A5: Beijing Closed Migrant Schools in Recent Years

Year	Number of migrant children in Beijing (10,000)	Share of migrant children in migrant schools	Number of Migrant Schools
2006	37.5	34.7	300
2007	40.0	36.5	268
2008	40.0	34.0	228
2010	43.4	—	—
2011	47.8	27.2	176
2012	41.9	—	158
2013	52.9	24.2	130
2014	51.1	18.2	127

Notes: Data come from the Annual Report on Education for China's Migrant Children (2016).

Table A6: Migrant Households' Spending on Education

	Primary school	Junior middle school
Zanzhufei specific for migrant children	1432.005	2198.48
Total education expenditure (excluding *zanzhufei*)	1444.093	2339.375

Notes: In China, migrant children without a local *hukou* have to pay $zanzhufei$ (an extra fee specifically imposed on them) in order to go to a local school. Data come from the Chinese Household Income Project Survey (CHIPS) 2007 and 2008.

Table A7: Migrant Children in Guangzhou Disappear as They Enter Junior Middle School

		2008	2012	2015
Primary school	Num of migrant children	376963	434473	458216
	Share of migrant children	43.69%	52.82%	48.86%
Junior middle school	Num of migrant children	86089	121426	127815
	Share of migrant children	21.09%	32.51%	37.97%
High school Entrance Exam	Num of migrant children	—	23762	31969
	Share of migrant children	—	20.06%	28.87%

Notes: Only a small fraction of migrant children without a local *hukou* are eligible to take local high-school entrance exams. Every year, the Guangzhou government sets a quota for the number of migrant children who can take local high-school entrance exams. Data come from the Annual Report on Education for China's Migrant Children (2016).

A3 Additional Results on First RD Design

Table A8: Average Marginal Effects: Alternative RD Controls and Different Bandwidths

	(1)	(2)	(3)	(4)	(5)	(6)
		Female			Male	
Dependent Variable:	All in Rural	Separation	All in City	All in Rural	Separation	All in City
Panel A: Quadratic Control+2-year Bandwidth						
School-aged	-0.0204	0.0143	0.00608	0.000807	-0.0101	0.00927
	(0.0167)	(0.0111)	(0.0135)	(0.0151)	(0.00946)	(0.0117)
School-aged × Standardized weighted *hukou* index	-0.00346	0.0139**	-0.0105	0.00659	-0.00155	-0.00504
	(0.00993)	(0.00601)	(0.00804)	(0.0144)	(0.00935)	(0.00907)
Observations	9,020	9,020	9,020	10,640	10,640	10,640
Panel B: Quadratic Control+3-year Bandwidth						
School-aged	-0.0132	0.0115	0.00162	-0.0102	-0.00376	0.0140
	(0.0126)	(0.00754)	(0.0104)	(0.0123)	(0.00767)	(0.00998)
School-aged × Standardized weighted *hukou* index	-0.00789	0.0133**	-0.00538	0.00452	0.00265	-0.00717
	(0.00756)	(0.00528)	(0.00604)	(0.00936)	(0.00682)	(0.00609)
Observations	13,764	13,764	13,764	16,278	16,278	16,278
Panel C: Local Linear Control+3-year Bandwidth						
School-aged	-0.0154	0.0134	0.00200	-0.0128	-0.00116	0.0140
	(0.0135)	(0.00878)	(0.0104)	(0.0127)	(0.00800)	(0.0105)
School-aged × Standardized weighted *hukou* index	-0.00789	0.0133**	-0.00538	0.00452	0.00265	-0.00717
	(0.00756)	(0.00528)	(0.00604)	(0.00936)	(0.00682)	(0.00609)
Observations	13,764	13,764	13,764	16,278	16,278	16,278

Notes: We estimate the average marginal effects on the probability of parents' choices. All in rural represents the choice of staying in the village with children. Separation represents the choice of migrating to cities and leaving children behind. All in city represents the the choice of migrating to cities with children. Data come from 2010 Population Census. Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Summary Statistics of Observables for Below and Above the Age Cutoff

	(1) Below age cutoff	(2) Above age cutoff	(3) Diff. in means	(4) RD Estimates
Panel A: Boys				
Household *hukou* transfer (=1)	0.006	0.003	-0.003	-0.010
	(0.078)	(0.054)	[0.003]	[0.007]
Father migrates (=1)	0.014	0.009	-0.005	-0.027
	(0.117)	(0.092)	[0.009]	[0.035]
Mother migrates (=1)	0.018	0.018	-0.000	-0.008
	(0.135)	(0.133)	[0.010]	[0.039]
Father income	37,288.474	30,975.676	-6,312.798*	-6,720.214
	(23,504.601)	(23,217.771)	[3,253.024]	[13,079.839]
Mother income	21,312.289	21,306.623	-5.666	8,199.975
	(14,738.911)	(17,566.470)	[2,327.219]	[10,131.891]
Panel B: Girls				
Household *hukou* transfer (=1)	0.003	0.002	-0.001	0.006
	(0.052)	(0.041)	[0.002]	[0.008]
Father migrates (=1)	0.009	0.010	0.001	0.000
	(0.096)	(0.101)	[0.008]	[0.032]
Mother migrates (=1)	0.023	0.031	0.008	-0.037
	(0.149)	(0.173)	[0.013]	[0.052]
Father income	35,217.738	35,613.582	395.844	-7,051.000
	(22,727.107)	(23,917.980)	[3,333.514]	[11,393.291]
Mother income	21,669.966	19,778.509	-1,891.457	-9,579.064
	(15,597.513)	(15,566.202)	[2,430.097]	[8,001.999]

Notes: Household *hukou* transfer is an indicator for whether a particular household transfers their *hukou* location. Father migrates and Mother migrates are indicators for whether father and mother, respectively, move away from their *hukou* city. Columns 1 and 2 report the sample mean and standard deviation for children whose ages are above and below the age cutoff, respectively. Column 3 reports the raw difference between these sample means. Note that this statistic shows a simple difference between all children aged 6-15, which is not necessarily a discontinuous difference at the RD cutoff. In column 4, we use our RD sample to investigate whether there is such a discontinuous difference. We use local linear regression to obtain RD estimates for the observables and report the standard errors in brackets. In columns 1 and 2, standard deviations are reported in parentheses. In columns 3 and 4, standard errors are reported in brackets. Data come from China Family Panel Survey (CFPS) *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Data Manipulation Test

	(1) All	(2) Female	(3) Male
T-stat	0.3518	-0.3835	0.7948
P-value	(0.7250)	(0.7014)	(0.4267)

Notes: This table reports the density test at the cutoff of school enrollment age using the method proposed by Cattaneo et al. (2020). T-statistics of the RD density test and corresponding p-values in parentheses are reported. Data come from China Migrants Dynamic Survey (CMDS).

Table A11: School Enrollment Age and left-behind Children

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Indicator for leaving the child in rural hometown							
	Female	Male	Female	Male	Female	Male	Female	Male
School-aged × Highly restricted cities (=1) (ρ_1)	0.0324**	0.00331	0.0330**	0.00444	0.0349**	0.00871	0.0354**	0.00984
	(0.0145)	(0.0150)	(0.0144)	(0.0148)	(0.0145)	(0.0170)	(0.0144)	(0.0167)
School-aged (ρ_2)	-0.00451	0.000905	-0.00545	0.00125	-0.00375	0.000643	-0.00644	0.000597
	(0.0158)	(0.0136)	(0.0159)	(0.0134)	(0.0176)	(0.0153)	(0.0178)	(0.0152)
P-value of $\rho_1 + \rho_2$	0.0341	0.679	0.0397	0.576	0.0149	0.400	0.0271	0.360
Coeff diff p-value	0.00		0.00		0.00		0.00	
Observations	31,071	40,854	31,071	40,854	31,071	40,854	31,071	40,854
Adjusted R-squared	0.172	0.146	0.173	0.147	0.206	0.184	0.207	0.184
Mean of Dep. Var.	0.35	0.34	0.35	0.34	0.35	0.34	0.35	0.34
Household Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	Yes	Yes	No	No	No	No
City FE×Year FE×*Hukou* Province FE	No	No	No	No	Yes	Yes	Yes	Yes
Cohort FE	No	No	Yes	Yes	No	No	Yes	Yes
Age Bandwidth	2	2	2	2	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear

Notes: This table shows the results of estimating equation 2. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. "Coeff diff p-value" reports the p-value of a test of equality of the coefficient on "School-aged × Highly restricted cities (=1)" between the female and male, using the Fisher's permutation test (following Cleary (1999), Brown et al. (2010) and Keys et al. (2010)). This bootstraps to calculate empirical p-values that estimate the likelihood of obtaining the observed differences in coefficient estimates if the true coefficients are, in fact, equal. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Alternative RD Control and Different Bandwidth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Indicator for leaving the child in rural hometown							
	Female	Male	Female	Male	Female	Male	Female	Male
Panel A: Quadratic Control+2-year Bandwidth								
School-aged × Highly restricted cities (=1)	0.0324**	0.00331	0.0330**	0.00444	0.0349**	0.00871	0.0354**	0.00984
	(0.0145)	(0.0150)	(0.0144)	(0.0148)	(0.0145)	(0.0170)	(0.0144)	(0.0167)
Observations	31,071	40,854	31,071	40,854	31,071	40,854	31,071	40,854
Adjusted R-squared	0.172	0.146	0.173	0.147	0.206	0.184	0.207	0.184
Panel B: Quadratic Control+3-year Bandwidth								
School-aged × Highly restricted cities (=1)	0.0261*	0.0161	0.0269*	0.0167	0.0268*	0.0187	0.0274*	0.0193
	(0.0146)	(0.0148)	(0.0144)	(0.0145)	(0.0144)	(0.0159)	(0.0142)	(0.0154)
Observations	47,040	61,572	47,040	61,572	47,040	61,572	47,040	61,572
Adjusted R-squared	0.176	0.152	0.177	0.152	0.208	0.187	0.209	0.188
Panel C: Local Linear Control+3-year Bandwidth								
School-aged × Highly restricted cities (=1)	0.0261*	0.0162	0.0269*	0.0168	0.0268*	0.0188	0.0274*	0.0193
	(0.0146)	(0.0149)	(0.0144)	(0.0145)	(0.0144)	(0.0159)	(0.0142)	(0.0154)
Observations	47,040	61,572	47,040	61,572	47,040	61,572	47,040	61,572
Adjusted R-squared	0.176	0.152	0.177	0.152	0.208	0.187	0.209	0.188
Household Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	Yes	Yes	No	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	No	No	Yes	No	Yes	Yes
Cohort FE	No	No	Yes	Yes	No	Yes	Yes	Yes

Notes: This table shows the results of estimating equation 2. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Triple Difference Regressions

	(1)	(2)	(3)	(4)
	Dependent variable: Indicator for leaving the child in rural hometown			
Female × School-aged × Highly restricted cities (=1)	0.0282*	0.0279*	0.0282*	0.0279*
	(0.0152)	(0.0151)	(0.0152)	(0.0151)
Observations	71,925	71,925	71,925	71,925
Adjusted R-squared	0.157	0.158	0.157	0.158
Household Control	Yes	Yes	Yes	Yes
City FE × Year FE	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	No	Yes
Age Bandwidth	2	2	2	2
Control function for the running variable	Linear	Linear	Quadratic	Quadratic

Notes: The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A14: Estimates using the Sample of First-born Children

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Indicator for leaving the child in rural hometown							
	Female	Male	Female	Male	Female	Male	Female	Male
School-aged × Highly restricted cities (=1)	0.0366**	0.00864	0.0374**	0.00974	0.0413**	0.0131	0.0418**	0.0141
	(0.0155)	(0.0159)	(0.0154)	(0.0158)	(0.0170)	(0.0188)	(0.0170)	(0.0185)
Observations	27,370	34,234	27,370	34,234	27,370	34,234	27,370	34,234
Adjusted R-squared	0.172	0.141	0.173	0.142	0.203	0.175	0.203	0.176
Mean of Dep. Var.	0.36	0.35	0.36	0.35	0.36	0.35	0.36	0.35
Household Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	Yes	Yes	No	No	No	No
City FE×Year FE×*Hukou* Province FE	No	No	No	No	Yes	Yes	Yes	Yes
Cohort FE	No	No	Yes	Yes	No	No	Yes	Yes
Age Bandwidth	2	2	2	2	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear

Notes: This table shows the results of estimating equation 2 using the sample of first-born children. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A15: Controlling for the Number of Children

	(1)	(2)	(3)	(4)
Dependent Variable: Indicator for leaving the child in rural hometown				
	Female	Male	Female	Male
Panel A: Control for the number of children				
School-aged × Highly restricted cities (=1)	0.0329**	0.00444	0.0359**	0.00984
	(0.0142)	(0.0148)	(0.0141)	(0.0167)
School-aged	-0.00463	0.00125	-0.00635	0.000597
	(0.0156)	(0.0134)	(0.0174)	(0.0152)
Observations	31,071	40,854	31,071	40,854
Adjusted R-squared	0.175	0.147	0.210	0.184
Panel B: Control for FE for the number of children				
School-aged × Highly restricted cities (=1)	0.0331**	0.00473	0.0359**	0.0107
	(0.0141)	(0.0148)	(0.0141)	(0.0169)
School-aged	-0.00468	0.00134	-0.00637	0.000901
	(0.0156)	(0.0133)	(0.0175)	(0.0152)
Observations	31,071	40,854	31,071	40,854
Adjusted R-squared	0.175	0.148	0.210	0.187
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes

Notes: The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. We control for the number of children in panel A, and fixed effects for the number of children in panel B. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

Table A16: Controlling for the Effect of the OCP

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Indicator for leaving the child in rural hometown					
	Female	Male	Female	Male	Female	Male
School-aged × Highly restricted cities (=1)	0.0338**	0.00713	0.0342**	0.00889	0.0341**	0.00724
	(0.0154)	(0.0147)	(0.0154)	(0.0142)	(0.0159)	(0.0144)
Observations	33,041	43,470	32,498	42,616	32,498	42,616
Adjusted R-squared	0.210	0.181	0.208	0.180	0.218	0.188
Household Control	Yes	Yes	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Father Race FE×Year FE×Father *Hukou* Province FE	Yes	Yes	No	No	Yes	Yes
Mother Race FE×Year FE×Mother *Hukou* Province FE	No	No	Yes	Yes	Yes	Yes
Age Bandwidth	2	2	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear	Linear	Linear

Notes: This table shows the results of estimating equation 2. The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

A4 Additional Results of Mega-city RD Design

Table A17: Migration Responses to 2014 Mega City Population Controls

	(1)	(2)	(3)
Dependent Variable: Change city location Indicator			
I(Population>5 million) × I(Year>2014)	-0.00128		
× Having a school-aged child (=1)	(0.00168)		
I(Population>5 million) × I(Year>2014)		-0.00271	
×Having a school-aged daughter (=1)		(0.00327)	
I(Population>5 million) × I(Year>2014)			0.000151
×Having a school-aged son (=1)			(0.000647)
Observations	12,312	12,312	12,312
Adjusted R-squared	0.389	0.389	0.389
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
City Size Bandwidth	3	3	3

Notes: We employ individual longitudinal panel data from 2011 to 2016 constructed using China Labor-force Dynamic Survey. The dependent variable is an indicator for whether a particular migrant parent changed city location between year t and $t-1$. I(Population>5 million) is an indicator for whether the migrant parent was in a mega city in year $t-1$. I(Year>2014) is an indicator for the post-treatment period. Having a school-aged child (=1) is an indicator for whether the parent had a child who had reached the middle-school age in year $t-1$. We control for the interactions between any two of the three indicators (in the triple interaction term) as well as the three indicators. The city size bandwidth is 3 million. We only include cities with baseline population within 2 million and 8 million. Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

Table A18: Different Coming years

	(1)	(2)	(3)	(4)
Dependent Variable: Indicator for leaving the child in rural hometown				
	Female	Male	Female	Male
Panel A: Came before 2014				
School-aged ×I(Population>5 million) ×	0.0700***	-0.0429	0.0772**	-0.0314
I(Year>2014)	(0.0220)	(0.0363)	(0.0306)	(0.0267)
Observations	10,296	13,812	10,296	13,812
Adjusted R-squared	0.163	0.137	0.192	0.169
Panel B: Came before 2013				
School-aged ×I(Population>5 million) ×	0.0913***	-0.0641	0.0966***	-0.0496
I(Year>2014)	(0.0298)	(0.0387)	(0.0332)	(0.0304)
Observations	9,629	12,815	9,629	12,815
Adjusted R-squared	0.163	0.135	0.193	0.170
Panel C: Came before 2012				
School-aged ×I(Population>5 million) ×	0.0661**	-0.0689	0.0696**	-0.0569
I(Year>2014)	(0.0254)	(0.0426)	(0.0286)	(0.0329)
Observations	8,626	11,466	8,626	11,466
Adjusted R-squared	0.158	0.130	0.187	0.166
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Age Bandwidth	2	2	2	2
City Size Bandwidth	3	3	3	3

Notes: The age bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. The city size bandwidth is 3 million. We only include cities with baseline population within 2 million and 8 million. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We use a local linear control function for the running variable. Data come from China Migrants Dynamic Survey (CMDS). Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

A5 Additional Results on Remittance Behaviour

Table A19: Differential Remittance by the Gender of First-born Children

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: IHS of the Amount of Remittance				
Panel A: Full Sample					
Female	-0.134***	-0.134***	-0.154***	-0.154***	-0.140***
	(0.0375)	(0.0374)	(0.0419)	(0.0417)	(0.0419)
Observations	30,365	30,365	30,365	30,365	30,365
Adjusted R-squared	0.0692	0.0698	0.0918	0.0926	0.0926
Panel B: Primary School Age					
Female	-0.110*	-0.111*	-0.112	-0.111	-0.0833
	(0.0637)	(0.0637)	(0.0694)	(0.0692)	(0.0732)
Observations	11,175	11,175	11,175	11,175	11,175
Adjusted R-squared	0.0694	0.0693	0.0938	0.0938	0.0937
Panel C: Junior Middle School Age					
Female	-0.152**	-0.154**	-0.170**	-0.170**	-0.188**
	(0.0684)	(0.0678)	(0.0715)	(0.0708)	(0.0737)
Observations	7,646	7,646	7,646	7,646	7,646
Adjusted R-squared	0.0786	0.0783	0.101	0.100	0.101
Household Control	Yes	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes	Yes
Cohort FE	No	Yes	No	Yes	Yes
Num. of children FE	No	No	No	No	Yes

Notes: We use the sample of first-born children. The Inverse Hyperbolic Sine (IHS) transformation is applied to the amount of remittance. Panel A shows results for all first-born children aged below 16, and panels B and C, respectively, show results for first-born children at primary school age and junior middle school age. We use the CMDS 2011 and 2012 to perform estimation as only the two waves of CMDS contain information about remittance. Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

A6 Additional Results on Long-term Consequences

Table A20: Effects on the Age of First Job

	(1)	(2)	(3)	(4)
	Age Below 16		Age Below 15	
Standardized WID	-0.0195	-0.0195	-0.0238	-0.0238
	(0.0542)	(0.0542)	(0.0275)	(0.0275)
Observations	1,379	1,379	1,379	1,379
Adjusted R-squared	0.0429	0.0429	0.0301	0.0301
Mean of Dep. Var.	0.126	0.126	0.0544	0.0544
SD of Dep. Var.	0.332	0.332	0.227	0.227
Household Control	No	Yes	No	Yes
Township FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: The dependent variable is, respectively, whether a particular individual had the first job below age 16 in columns 1-2, and below age 15 in columns 3-4. Data on the age of first job come from GSCF 2009. We leverage the exposure to world import demand shock during the age of junior middle school for each individual. Household controls include an indicator for whether a grandmother was alive and an indicator for whether a grandparent was living in the same place when the child was school-aged. Robust standard errors clustered at the birth prefecture level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

Table A21: Effects on Children Born Recently

	(1)	(2)	(3)	(4)
	Log Height		Ranking in Test	
Standardized WID	-0.00854*	-0.0100**	-0.0302*	-0.0352*
	(0.00503)	(0.00456)	(0.0170)	(0.0199)
Observations	2,072	2,072	1,239	1,239
Adjusted R-squared	0.494	0.486	0.234	0.221
Mean of Dep. Var.	0.297	0.297	2.844	2.844
SD of Dep. Var	0.179	0.179	1.405	1.405
Birth Province FE	Yes	No	Yes	No
Cohort FE	Yes	No	Yes	No
Birth Province × Cohort FE	No	Yes	No	Yes

Notes: Data come from China Family Panel Survey (CFPS). We use the sample of children at school age. We divide children's scores in vocabulary test and maths test into 5 rankings based on score quintiles (1=bottom 20%, 5= top 20%); the dependent variable in columns 3 and 4 is the average ranking of their scores in vocabulary test and maths test. Robust standard errors clustered at the birth prefecture level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.

A7 Tests of Alternative Mechanisms (from Section 7)

Table A22: Differential Returns to Education by Gender

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Log individual income				
	Full Sample	Rural *hukou* holders	Urban *hukou* holders	Migrants	Locals
High school (=1)	0.217***	0.110***	0.300***	0.251***	0.195***
	(0.0142)	(0.0185)	(0.0301)	(0.0243)	(0.0178)
High school (=1) × Female (=1)	0.185***	0.118***	0.121***	0.148***	0.205***
	(0.0196)	(0.0264)	(0.0403)	(0.0329)	(0.0249)
Observations	30,021	21,860	8,161	9,740	19,842
Adjusted R-squared	0.381	0.360	0.297	0.378	0.354
City FE × Year FE	Yes	Yes	Yes	Yes	Yes

Notes: We use individual-level pooled cross-sectional data by combining CLDS 2012, 2014, 2016 and 2018. We control for an indicator for female, an indicator for rural *hukou*, age and age-squared. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A23: Differential Returns to Migrating to Cities by Gender

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Log individual income					
Migrate to Cities (=1)	0.242***	0.236***	0.224***	0.217***	0.224***	0.217***
	(0.0276)	(0.0276)	(0.0288)	(0.0289)	(0.0288)	(0.0289)
Migrate to Cities (=1) × Female (=1)	0.113***	0.117***	0.111***	0.116***	0.110***	0.115***
	(0.0298)	(0.0298)	(0.0301)	(0.0301)	(0.0301)	(0.0301)
Observations	16,046	16,046	16,046	16,046	16,046	16,046
Adjusted R-squared	0.364	0.367	0.366	0.369	0.367	0.369
City FE × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	No	Yes	No	Yes
Hukou Location FE	No	No	Yes	Yes	Yes	Yes
Dahl Correction	No	No	No	No	Yes	Yes

Notes: We use individual-level pooled cross-sectional data by combining CLDS 2012, 2014, 2016 and 2018 and restrict the sample to rural *hukou* holders. We control for an indicator for female, an indicator for high school and above, age and age-squared. To address the endogeneity of migration choices, we apply the Dahl (2002) semi-parametric selection correction approach in columns 5 and 6. We divide individuals into groups based on *hukou* regions, gender and education levels at baseline. Then, we define baseline selection probability ω_i as the fraction of the population in individual i's cell that chooses to live in a particular destination city. Finally, we augment the Mincer equation by adding a quadratic function of ω_i. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A24: Heterogeneity by the Norm that Aged Parents Are Supported by Sons

	(1)	(2)	(3)	(4)
Dependent Variable: Indicator for leaving the child in rural hometown				
School-aged × Highly restricted cities (=1)	0.000356	-0.00104	-0.0150	-0.0172
×Strong norm that the aged are supported by sons (=1)	(0.0214)	(0.0216)	(0.0227)	(0.0229)
Observations	29,336	29,336	29,336	29,336
Adjusted R-squared	0.162	0.163	0.191	0.192
Household Control	Yes	Yes	Yes	Yes
City FE×Year FE	Yes	Yes	No	No
City FE×Year FE×*Hukou* Province FE	No	No	Yes	Yes
Cohort FE	No	Yes	No	Yes
Age Bandwidth	2	2	2	2
Control function for the running variable	Linear	Linear	Linear	Linear

Notes: The bandwidth is two years. We use a RD sample of children who are two years older or younger than the enrollment age of junior middle school. Household controls include father's age and age-squared, an indicator for whether household income is above the median value among the migrant population in the city and an indicator for whether household consumption is above the median value among the migrant population in the city. We create an indicator for whether the share of people aged 60 years or above that are supported by their sons in a particular origin province is above the national mean. We use a local linear control function for the running variable. Robust standard errors clustered at the city level are reported in parentheses. *** significant at 1%; **significant at 5%; * significant at 10%.