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WHERE HAVE ALL THE CHILDREN GONE? AN EMPIRICAL STUDY OF CHILD
ABANDONMENT AND ABDUCTION IN CHINA

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ABSTRACT

In the past 40 years, a large number of children have been abandoned by their families or have been abducted in China. We argue that the implementation of the one-child policy has significantly increased both child abandonment and child abduction and that, furthermore, the cultural preference for sons in China has shaped unique gender-based patterns whereby a majority of the children who are abandoned are girls and a majority of the children who are abducted are boys. We provide empirical evidence for the following findings: (1) Stricter one-child policy implementation leads to more child abandonment locally and more child abduction in neighboring regions; (2) A stronger son-preference bias in a given region intensifies both the local effects and spatial spillover effects of the region's one-child policy on child abandonment and abduction; and (3) With the gradual relaxation of the one-child policy after 2002, both child abandonment and child abduction have dropped significantly. This paper is the first to provide empirical evidence on the unintended consequences of the one-child policy in terms of child trafficking in China.

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1. Introduction

The problem of missing children has drawn continued attention in China over the past 40 years. Although without accurate reports, the estimated number of missing children in China ranges from tens of thousands in total till 2015[2] to tens of thousands a year[3]. Abandonment and abduction are two of the main reasons why children are separated from their families, and many of these children end up being trafficked into illegal adoptions. As a subcategory of human trafficking, the trafficking of children under the age of 14 has attracted widespread attention and concern due to the vulnerability of children and the long-lasting social and economic impact of these phenomena.[4] As families' economic situation has been shown to influence their decisions regarding such matters as childbirth and marriage in developing countries (Qian, 2008; Corno and Voena, 2019), poverty has been identified as one of the key reasons why children go missing or are trafficked (Dessy et al., 2005; Tamura, 2010). Yet, surprisingly, in the light of China's continuing rapid economic growth, the number of missing children has remained high. In this paper, we explore the institutional and cultural reasons behind this rampant problem.

While no accurate estimate of the number of missing children in China is available, it has generally been acknowledged to be a serious social problem (The State Council, 2011). This phenomenon differs in China from the problem of missing children in other countries in several ways. First, while most children who are trafficked in other countries have been abducted or stolen from their families (O'Connell Davidson, 2011), about half of the missing child cases in China are the result of child abandonment (Johnson, Huang and Wang, 1998; Shen, Antonopoulos and Papanicolaou, 2013; Li, Ren and Zhang, 2013; Xing, Chen and Xu, 2013). Second, whereas, globally, children who are trafficked often end up as child soldiers (Tiefenbrun, 2007), child laborers (Sanghera, 2018) or sexual slaves, most of the children who have gone missing in China end up in private or illegal adoptions (Liu, Larsen and Wyshak, 2004;

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[2] Legal Daily, The Ministry of Public Safety Retrieved 43,000 Abducted Women and Children in 2014, February 16, 2015, http://legal.people.com.cn/n/2015/0216/c188502-26574114.html

[3] Human Trafficking Research Organization, (2014), Human Trafficking in China by Michelle Lillie, https://humantraffickingsearch.org/human-trafficking-in-china/

[4] According to the International Labour Organization (ILO) and Walk Free Foundation, around 5.5 million children under 18 have been victims of child trafficking (ILO, 2017).

Zhang, 2006; Chen et al., 2015). Third, although poverty has been considered to be one of the main underlying reasons for the problem worldwide (Anderson and Ray, 2010), the upswing seen in child abandonment and child abduction in China during the 1980s and 1990s occurred during a period of economic prosperity. Throughout the long history of child abandonment and child abduction in China, many children have been abandoned or sent out for adoption by their own families in response to financial difficulties or because of a child's physical disability (Jiang and Sánchez-Barricarte, 2013). But starting in the 1980s, the abandonment of healthy children, especially healthy girls, more than doubled (Chen et al., 2015), and child abduction also increased dramatically during this period of rapid economic growth.

Obviously, then, the causes of this problem in China go beyond the parents' economic situation and involve not only the behaviors of child traffickers, but also the families' decisions to abandon a child (Dessy, Mbiekop and Pallage, 2005; Shen, Antonopoulos and Papanicolaou, 2013). To offer an explanation for the seemingly counter-intuitive increase in child abandonment and abduction during a period of economic prosperity, we turn to the one-child policy combined with the cultural preference for sons in China (Hesketh and Zhu, 2006; Almond and Edlund, 2008; Dahl and Moretti, 2008; Alesina et al., 2018). The economic logic is as follows: Under the one-child policy, families that exceeded the birth quota faced such punishments as financial penalties, deprivation of promotion opportunities and even potential job loss (Scharping, 2013; Howden and Zhou, 2014), making it very costly for parents to consider having a child beyond the quota. In a culture where sons are preferred over daughters, the attractiveness of either one of two alternative courses of action thus increases, with one option being the abandonment of a baby girl to give the parents an opportunity to have another child and the other being the purchase of a young boy by means of an illegal adoption of an abducted or trafficked child.

In line with this explanation, since the beginning of the 1980s, most of the children who have been abandoned have been girls (Xing, 2015), with Chen et al. (2015) estimating that around 1 out of every 25 girls born during the 1990s were abandoned. In contrast, most of the children who have been abducted

have been boys (Johnson, Huang and Wang, 1998; Li, Ren and Zhang, 2013; Xing, Chen and Xu, 2013; Tao, 2017). While there have been many studies exploring how families resort to pre-birth gender selection to achieve the desired gender ratio among children, research about families' decisions on post-birth gender selection has been limited. For pre-birth gender selection, the use of prenatal sex-diagnostic technology and sex-selective abortions are perceived to be a key reason causing the excessive male-female sex ratio at birth and the large number of "missing" unborn girls in cultures with strong son-preferences, such as India and China (Chen, Li and Meng, 2013; Jayachandran, 2017; Almond, Li and Zhang, 2019). However, families' gender discrimination behaviors may continue after child birth, through differential degree of neglect (Jayachandran and Kuziemko, 2011) and gender-biased resource allocation in health care and medical attention (Sen, 1990). In this paper, we explore an extreme type of post-birth gender selection behavior: child abandonment and abduction.

While the combination of the one-child policy and the cultural preference for boys in China has been referred to as the driving force for many family outcomes, including those relating to fertility, education, gender ratio, divorce, and migration (Zhang, 2017), this paper attempts to empirically test how the one-child policy and the cultural preference for sons have combined to influence the practices of child abandonment and child abduction in China. As far as we know, this is the first time that the link is being made between China's birth control policy and child trafficking.

The greatest challenge to be met by researchers attempting to undertake a study on missing children is the lack of data. Taking advantage of a recently developed database on family-reported missing persons maintained by the website of Baby Come Back Home (BCBH) (https://baobeihuijia.com/Index.aspx),[5] which is currently the largest online platform and non-governmental organization dedicated to locating missing children in China, we construct a record of missing child cases for different Chinese regions

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[5] The Baby Come Back Home (BCBH) website maintains two main databases on missing children. One contains reports filed by families looking for their children; the other contains reports filed by child victims looking for their biological families.

since 1950. Launched in 2007, the BCBH platform has become well known across the nation, as have the awareness campaign and special operations to combat child trafficking led by the Ministry of Public Security since 2009. Families looking for their missing children can provide basic information about them via a hotline service or online posts. All reports are verified by BCBH and then included in their database. As of June 2018, the database included 16,969 child abandonment reports and 24,175 child abduction reports. More than 90% of the reports concern children who went missing before 2010, and close to 80% of these children were lost before 2001. More than 95% of the reports were filed after 2011, and most of them were filed after 2015. These reports thus mainly deal with old cases, many of which occurred more than 15 years ago.

We explore the impacts of the one-child policy in terms of the problem of missing children using both regional and temporal variations in penalty fines and reported missing child cases at the level of local prefectures. Following Ebenstein (2010), Scharping (2013), and Huang, Lei and Sun (2016), we measure the stringency of the enforcement of the one-child policy at the provincial level using the ratio between the fine levied for the first unauthorized birth and the local average per capita annual income. Between 1980 and 2001, the average fine for each parent increased from the equivalent of 1.2 to 4.1 times that average annual income. As local provincial governments had full authority and ample flexibility in setting the level of local fines, there were substantial regional and temporal variations during the study period. We tested the null hypothesis that the average penalty did not vary across provinces as a function of local variables, such as the quality of transportation infrastructure and economic and fiscal conditions, and failed to reject it, which is consistent with our hypothesis of the strictly exogenous nature of the causal variable of interest.

To preview the results, we find that the size of the local fine is significantly and positively correlated with the number of self- or family-reported child abandonment cases between 1988 and 2001. On average, when the penalty fine increases by the same amount as local disposable income, the number of reported

child abandonment cases increased by 0.3, which accounts for about 14% of the reported child abandonment cases at the prefectural level. However, the positive impact is only significant for the abandonment of girls, while the abandonment of boys is not significantly affected by the level of the fine. The conclusion is that families are more likely to abandon girls in order to avoid having to pay the fines for exceeding the birth quota while still having the opportunity to have a second (potentially) male child, given the general population's preference for sons.

In contrast to the local effect of these fines on child abandonment, the stringency of the enforcement of the one-child policy mainly had an impact on the child abduction rate in neighboring regions. The number of children abducted in a given region was significantly influenced by the average level of the fine in neighboring provinces. When the average fine of a region's immediate neighbors increased by the same amount as the average income in those provinces, the number of children who were abducted in the region concerned increased by 0.93, which accounts for about 33% of total reported child abductions at the prefectural level. Unlike the situation with respect to child abandonment, the impact of the level of neighboring regions' fines on local self-reported child abduction cases was only significant for boys. The number of self-reported girl abduction cases did not correlate significantly with changes in the sizes of fines. This is also consistent with the gender composition pattern whereby most abandoned children were girls and most of the abducted children were boys. As the cultural preference for sons increased the demand for the adoption of boys because of birth quota restrictions, the market price for boys rose relative to the market price for girls. Thus, given similar costs for the abduction of children of either sex, it became more lucrative for traffickers to abduct boys.

While the general preference for sons shapes the contrasting gender patterns of child abandonment versus child abduction, the gender-preference bias also intensifies the impact of the one-child policy on child trafficking. Using the male-to-female ratio at birth as an indicator of local gender-preference bias,[6] we

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[6] The preference for male children has been shown to originate from agricultural practices (Alesina, Giuliano and Nunn, 2013 and 2018) and institutional arrangements concerning property rights (Bhalotra et al., 2019).

find the positive impact of these fines on child abandonment to be greater in regions with a stronger preference for sons. This is consistent with the hypothesis that families that prefer male heirs are more likely to abandon a previously born girl so that they can have the chance of giving birth to a boy in the future while remaining within the birth quota. The positive spillover impact of these fines on child abduction in neighboring regions is also found to be stronger if the gender-preference bias is greater, which is again in line with the argument that the birth control policy is an explanatory variable for child trafficking: An increase in the fines in a prefecture with a stronger gender bias leads to a greater increase in the number of children abducted from neighboring regions, and a stronger demand for boys in a region where birth control policies are more strictly enforced prompts traffickers to abduct more boys from neighboring regions.

To further explore the geographic range of the spillovers of the one-child policy on child trafficking, we study the impact of fines over different distances. In relation to a given prefecture, we divide all the prefectures in other provinces into four groups: prefectures located 0-300 km away, 300-600 km away, 600-900 km away and more than 900 km away.[7] When allowing for differing effects on prefectures at different distances, we find that child abandonment, mostly of girls, is significantly affected only by the level of local fines, not by fines in other regions, whereas child abduction, mostly of boys, is mainly affected by the size of fines in prefectures located between 300 km and 600 km from the original prefecture. This result is consistent with the previous finding that most children are trafficked to regions within 500 kilometers from the location of their abduction (Wang et al., 2018), since traffickers have to balance transportation costs with the possibility of being caught by parents or law enforcement officers.

Since a child's age is a key factor in the adoption decision, we also explore the differential impact of the one-child policy on the trafficking of children in different age groups. The majority of abandoned children

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7 The small number of prefectures located in the same province are excluded from the sample used for this estimation for two reasons: first, because their fines are the same as the local fine, which gives rise to a potential problem of collinearity; second, within-province coordination on fine collection and anti-trafficking is much smoother than cross-province efforts, making child abduction and trafficking within the same province very easy to detect and thus rare in China.

are newborns, and the abandonment of newborns also corresponds more closely with increases in fines than it does in the case of older children. This is probably because the decision to abandon a girl child is often made quite early on for two reasons: first, as the family's objective is to keep within the birth quota so that there is a chance of having a boy in the future, it is better to prevent people from learning about the birth; and, second, it would become harder to abandon the child as emotional attachment grows over time. By contrast, children in the 1-to-4 year age group become more vulnerable to abduction than children in other age groups when neighboring regions' enforcement of the one-child policy becomes stricter, but the stringency of neighboring provinces' enforcement of the one-child policy does not significantly affect the likelihood that either newborns or children older than 5 years of age will be abducted. While the reason for the fact that newborns are rarely abducted is straightforward ---infants are usually kept at home, giving traffickers little opportunity to steal them--- the reason for the rarity of abductees older than 5 years of age is that families generally prefer to adopt younger children, before they develop long-term memories. The results for rates of child abduction in different age groups are consistent with the observation that the price paid for an abducted boy tends to be higher for younger boys (Shen, Antonopoulos and Papanicolaou, 2013).

As a placebo test, we studied the period from 2002 to 2016 and failed to find an impact for fines on child abandonment and child abduction similar to the significant impact found to exist for the period from 1988 to 2001. Although the one-child policy in China was in place until 2016, when it was replaced by the current two-child policy, the enforcement of the policy was much more relaxed in the 2000s than in the 1990s, as evidenced by the decrease in the collection rate of fines (Shi, 2006; Gao and Lu, 2006). The lack of significant effects in the later period is thus consistent with our expectation.

Our results are robust to using the logarithm of the number of child abandonment and abduction cases. In addition, our results are robust when considering the left-censoring structure of child abandonment and child abduction, with missing observations taking the value of zero. Furthermore, our results are

robust to the exclusion of major prefectures that are perceived as top destinations for child trafficking and for the exclusion of minority autonomous regions that have less of a gender bias than the Han-dominated regions. The results also remain robust when including additional controls such as the local income level and the total number of children in the local prefecture, as well as linear and quadratic prefecture trends, which help control for prefecture-specific trends in Internet access, gender perception, and public awareness about the problem of missing children, among other factors.

One important potential concern about our study is the possible under-reporting of child abandonment and abduction, as the actual number of missing children is most likely greater than what is indicated by our current statistics on self- and family-reported missing children. The under-reporting gap could be caused by limited access to information related to the campaign against child trafficking (including the existence of the BCBH platform), limited resources for use in looking for missing children, and the fact that the members of some families did not survive to 2007 (the launch year of the BCBH website) and so were unable to report cases of abduction. To address this potential problem, we first condition our analysis on prefecture fixed effects, year fixed effects and prefecture trends to take into account various cross-regional variations, temporal variations and prefecture-specific sources of under-reporting that vary linearly. Second, we limit the time frame to the window of 1988-2001 in order to obtain a relatively stable period for information access and awareness of child trafficking. By focusing on missing child cases that occurred many years ago, we believe that the cross-regional variations in the tendency toward under-reporting in our data is reduced substantially, since most of the barriers to information access and financial constraints on the search for missing children tend to be short-lived. Nevertheless, we investigate this issue further throughout the study and provide robustness checks for our main analysis.

Another concern is the misreporting of child abandonment as child abduction. Due to potential moral pressure, families may report child abandonment as child abduction, resulting in more under-reporting of child abandonment relative to child abduction. We will show, however, that this kind of reporting bias

does not affect the validity of our results, given our focus on the gender composition of child abandonment and abduction, since families are unlikely to misreport the gender of a missing child.

Yet another concern is the potential confounding effects of another policy: the Household Responsibility System (HRS) land reform, which started around the same time as the one-child policy in China. Almond, Li and Zhang (2019) argue that it is the income effect from land reform instead of the one-child policy that has led to more gender selective abortions and the excessive male-female ratio at birth in early 1980s in rural China. This concern is mitigated in the current study for two reasons: First, our paper focuses on the time period of 1988-2001, when the one-child policy became stricter than in the early 1980s, whereas the HRS land reform that began in 1978 had finished by 1984 throughout the country (Lin, 1992). Second, we find no significant differences in the effects of one-child policy penalty fines on missing children in rural versus urban regions during 1988-2001, which suggests that post-birth gender selection through child abandonment and abduction existed in both rural and urban regions universally. In fact, more than 70% of abandonment and abduction cases in our data occurred in urban areas, which should not have been significantly affected by the HRS land reform.

For similar reasons, another concern is mitigated in our study, i.e., the confounding effects of prenatal sex selection technologies. As the use of prenatal sex-diagnostic technology and sex-selective abortions had become widely spread throughout Chinese counties by 1990 (Chen, Li and Meng, 2013), there is very little variation in the availability of such technologies during much of our sample period to explain the patterns in missing children. Furthermore, to the extent that pre-natal sex selection technologies should be more financially accessible in non-rural regions (Almond, Li and Zhang, 2019), one should expect significant differences in the patterns of child abduction and abandonment if such technologies are an important explanation. The finding of no-significant differences between rural and non-rural regions thus provides support for the one-child policy as a separate explanation for the patterns in child abandonment and abduction. We will also present empirical results to further substantiate these

arguments in the estimation part of the paper.

To the best of our knowledge, this paper is the first empirical study to explore the institutional factors involved in child abandonment and abduction. By focusing on families' decisions on post-birth gender selection, our study thus supplements the current literature on pre-birth gender selection behaviors. And by studying another unintended consequence of the one-child policy in China, it also contributes to the general body of literature on the economics of crime and on population control policies (Edlund et al., 2013).

The rest of this analysis is organized as follows. In Section 2, we provide background information on child trafficking and the one-child policy in China and information on the method used to measure the enforcement level of the birth-control policy. Section 3 introduces our data on missing children and the potential under-reporting bias. Section 4 discusses our theoretical hypotheses and the empirical model used to relate the birth control policy to the number of missing children in China. Section 5 presents our results and robustness checks, while Section 6 concludes.

2. One-Child Policy and Penalty Fines

China's one-child policy was first introduced in 1979 and remained in place until 2016 (Ebenstein, 2010; Zhang, 2017), when it was replaced by a two-child policy. Under the one-child policy, most families were allowed to have only one child,[8] with both pre-birth authorization and after-birth penalties and rewards being the key instruments for ensuring the policy's effective implementation. Before a birth, a family was required to obtain a birth certificate (*Sheng Yu Fu Wu Zheng*), which was typically released after verification that the family was under the birth quota. If a family had an unauthorized birth, various penalties would apply, including fines, deprivation of promotion opportunities and/or potential demotion

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[8] A small number of families meeting certain conditions were allowed to have a second child; the specific conditions included being parents in rural areas with only a daughter and after a specified birth gap, membership of one of the parents in an ethnic minority group, etc.

of the parents. Families obeying the one-child policy were rewarded with certificates of merit, cash awards, favorable pension arrangements and the promise of priority status for the receipt of schooling and medical services (Wei and Zhang, 2014; Whyte, Feng and Cai, 2015). Families that had already used their birth quota were also encouraged to have birth control operations, such as intrauterine device (IUD) insertion and sterilization procedures.

Throughout much of this period, the central government gave provincial governments full authority and ample flexibility in the local implementation of the one-child policy. Starting in the early 1990s, the implementation outcome of the one-child policy was also used as a key indicator for the evaluation and promotion of local governmental officials (Huang, Lei and Sun, 2016). As a result, the strictness with which the one-child policy was enforced varied a great deal, potentially as a function of the differing political ambitions of the local leaders concerned.

Of all the various policy instruments in place, fines for parents who violated the birth quota requirement appear to have been the main punitive mechanism for enforcing the one-child policy. Like other specific enforcement measures for that policy, local regulations on family planning (*Ji Hua Sheng Yu Tiao Li*) drafted by provincial governments then stipulated the level of the fine in accordance with the general guidelines of the family planning law released by the central government. A typical provincial regulation explicitly specified the level of the fine for the first unauthorized birth to be paid by each parent and the types of families that would be subject to such fines. Multiple fines were levied on families that had more than one unauthorized birth.

Various types of fines have been used by local governments in China since the early 1980s, but they all fall into one of two main categories based on the mode of payment collection: either a certain percentage of the parent's wages is deducted each month for a specified period of time, or the fine is collected as a one-time lump-sum payment. While the monthly deductions have resulted in higher collection rates, they

depend on the employer's ability to collect the fines directly and are thus only applicable in the state sector. With the private sector playing an ever larger role in the Chinese economy, the second type of collection method has become more common as time goes by.

Under the one-child policy, the specific amount of the fine for birth control violations usually depended on the parent's income. For the direct deduction method, a region would specify a range of monthly percentages (henceforth referred to as Type 1 fines), whereas, for the lump-sum payment method, either a range would be set for the total payment amount (Type 2 fines) or a multiple of the parent's annual income or the average local annual income would be used to compute the total payment (Type 3 fines). While Type 1 fines were used in most regions to begin with, the other two types gradually came into greater use, with Type 3 fines ending up being the most widely used by the early 2000s.[9]

To facilitate a comparison across regions and over time, following Ebenstein (2010), we homogenize the various types of fines relative to local income to construct an *income-relative fine*. Specifically, for regions using Type 3 fines, we adopt the mean value of the range of the multiple as the income-relative fine, while the other two types of fines are converted as follows: For regions using Type 1 fines, the income-relative fine is calculated by discounting all future percentages of monthly fines at an annual rate of 2% to obtain their net present value at the start of the period during which the fine was to be levied; for regions using Type 2 fines, the mean value of the specified range of lump-sum fines is divided by the local region's average per capita disposable income to derive the income-relative fine. In Figure 1 we present the trend over time of the income-relative fine, which shows that the ratio has risen from 1.2 to more than 4.1 between 1980 and 2016, thereby placing a larger financial burden on the parents in average households as time went by.

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[9] A typical example of how the type of fine evolved over time is provided by the Province of Hebei, which used Type 1 fines in 1982-1988 and penalized parents for a first unauthorized birth by directly garnishing 10% of each parent's salary every month for 14 years. Starting in 1989 and continuing on until 2016, however, it switched to Type 3 fines, charging a lump-sum penalty amounting to 2.5 times the average local annual disposable income for each parent. Tibet, in contrast, maintained a fixed Type 2 fine of 3,000 RMB throughout the years from 1980 to 2006.

Throughout the period from 1980 to 2016, there were also substantial cross-regional and temporal variations in the income-relative fine, as provinces adjusted their local fine levels at different times. As shown in Figure 2, while most adjustments were made during the mid-1980s, the early 1990s and the early 2000s, when the central government released new guidelines for the one-child policy, the exact timing and magnitude of the adjustments were chosen by the provincial governments themselves.

Table 1 explores the determinants of the regional variability in the size of these fines, where standard errors are clustered at the provincial level.[10] Column 1 shows the estimated coefficients of the income-relative fine level for key local socioeconomic factors, including local GDP per capita, population density, wage level, and transportation availability, while controlling for province fixed effects and period effects. Although the income-relative fine is expressed in terms of the local income level, it is possible that richer regions imposed a stricter policy. However, we do not find evidence to support this hypothesis, with neither local income nor local wage levels significantly correlated with the income-relative fine level. Another potential driver of the fine is the local government's need to use it as a source of fiscal revenue, as the majority of the proceeds from these fines were kept by local governments rather than being shared with the central government. Column 2 shows that the income-relative fine level is also not significantly correlated with local fiscal revenue capacity or fiscal gap pressure. In this specification, however, the sample size is smaller due to missing information on the fiscal variables. None of the regressors are found to be significant at the conventional levels. As the one-child policy and the HRS land reform (1978-1984) began around the same time in China, we test whether local penalty fine level is correlated with the land reform speed in column 3. Using the proportion of production teams enrolled in the HRS as the measure of the speed of land reform in local provinces[11], we find that the HRS land reform did not significantly affect the level of penalty fines, implying that the one child policy and the HRS land reform were carried

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[10] As shown in the table, the number of clusters is around 30, which is the number of Chinese provinces.
[11] The percentage of production teams enrolled in the Household Responsibility System (HRS) in each Chinese province was collected from the Provincial Gazetteers of various years, with records of Anhui, Shaanxi, Inner Mongolia, Tibet and Xinjiang missing between 1981 and 1983.

out independently. This is in line with expectations, as the HRS land reform was largely completed in the whole nation by 1984 (Lin, 1992; Almond, Li and Zhang, 2019). In fact, the data we collected from the Provincial Gazetteers show that over 99% of production teams in all provinces had been enrolled in the HRS by 1984.

In addition to the level of the fine, another factor affecting how much financial pressure the fines placed on families is the fine collection rate. Before the 1990s, as fines in most regions were deducted directly from individual's salaries, the collection rate was close to 100%. When local governments switched from direct deductions to lump-sum fines, however, the difficulty of fine collection increased substantially. In response, the central government passed a stricter enforcement regulation in 1992 which helped to maintain the collection rate at relatively high levels during the 1990s. But toward the turn of the century, while the one-child policy remained on the books, increasing concern about potential labor shortages and about the birth rate falling to an excessively low level prompted the central government to draft the Law on Population and Family Planning in 2001 (henceforth the LPFP of 2001). For the first time, the law thus called for the protection of citizens' reproductive rights, in addition to laying down their family planning obligations, resulting in a dramatic decline in the fine collection rate (Yao, 2005; Shi, 2006).

Although there have been few academic case studies on the stringency of this policy's implementation in China, according to a field study by Shi (2006) in Tianmen, Hubei Province, the fine collection rate abruptly fell from more than 90% to close to 20% around 2002. Gao and Lu (2006) have also documented similar difficulties in collecting birth-related fines at the local level after the passage of the LPFP in 2001. The gradual relaxation of the one-child policy was also reflected in declines in abortions and birth-control operations, as shown in Figure 3. Thus, we believe that the passage of this law effectively marked the end of the strict enforcement of the one-child policy and that it is therefore appropriate to use these fines to measure the stringency of the policy only in the years prior to 2002.

3. Data and Potential Reporting Biases

We now turn to the data used in the analysis. While the focus of the discussion is on information regarding missing children and gender preferences, the availability of important control variables (i.e., crime rates) limits the time frame of our study to the years after 1988.

3.1 Data on missing children

As is also true of other underground activities, there is very little information available on child abandonment and abduction, and there are no official statistics or reports on the number of cases of child abandonment or abduction in China. Following Wang et al. (2018), we use information on self- or family-reported cases of missing children to measure child abandonment and abduction obtained from the website of Baby Come Back Home (BCBH), the largest non-governmental organization in China serving the community of missing persons. BCBH has also collaborated with the Ministry of Public Security of China to promote the sharing of information on missing children since the Ministry launched a special operation to counter child trafficking in April 2009.[12]

A missing person case can be logged onto the website either by a family that is looking for a missing person or by a missing person looking for his or her family. Unlike Wang et al. (2018), who use information provided by children looking for their families, we use only the first type of data, i.e., information supplied by families looking for their children, to build regional statistics for missing children. Our reason for doing so is, because all self-reported cases are based on recollection, missing children looking for their biological parents tend to have a vaguer memory of the location and the date of the incident and their age at the time that they went missing, as most children are quite young when abandoned or abducted and may have great difficulty providing accurate information when reporting the incident many years later.

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[12] Ministry of Public Security, 05/07/2009, Brief on the Anti-trafficking Special Action in China [http://www.mps.gov.cn/n2253534/n2253535/c4018254/content.html] (in Chinese).

Information on a missing person can be provided to BCBH either online or via a hotline. Volunteers are then assigned to follow up on the reports by cross-checking the information provided with the families and the local police force, thereby minimizing false reporting. After the accuracy of the information has been verified, reported cases are included in the database and listed in the forum section of the website for visitors to access and pass along.

Figure A1 in the online appendix provides a sample of the missing child reports maintained in the BCBH database. Each case report includes the name, gender, birth date, height of the child at the time he or she went missing, the location and date of the disappearance, and other descriptive information. BCBH classifies missing person reports according to whether the child was deserted or given up for adoption based on the detailed descriptions provided in each case. Then each case is labeled with the status of desertion/adoption or abduction.[13] In this paper, we define child abandonment as cases involving children who were either deserted or given up for adoption, i.e., cases in which families voluntarily surrendered the child. If a child was neither deserted nor given up for adoption, we classify the case as one of child abduction, i.e., cases in which the child was separated from the family involuntarily.[14] Before 1990, the majority of missing child cases were cases of child abandonment, while the majority were cases of child abduction after 1990 (see Figure A2).

Based on information given on the registration form, we geocode the longitude and latitude coordinates of the location where the child went missing.[15] Geocoded locations are then matched to the administrative boundaries of the relevant prefecture.[16] The age of the child when he or she went missing

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[13] The database is publicly available at https://www.baobeihuijia.com/so.aspx (in Chinese).

[14] Our categorization of child abduction is slightly broader than the legal definition of abduction, which refers to cases of children who are missing as a result of criminal action by traffickers. While there are occasional reports of parents losing a child by accident -- as, for example, when a child becomes lost in a crowd and then is not found -- such cases (cases that would not be correlated with the demand for illegal adoption, which constitutes the demand side of child abduction) are extremely rare.

[15] We use the *getpoint* service offered by Baidu Map at http://api.map.baidu.com/lbsapi/getpoint/index.html.

[16] For reports that lack detailed street locations of the incident, we use the geographic centroid of the reported prefecture for the latitude and longitude.

is calculated as the difference between the year of their disappearance and their year of birth. We focus on children who were younger than 14 years old at the time of their disappearance, since that is the age group identified in the official definition of child trafficking in China.

From the 41,144 cases of families looking for missing persons that had been registered by June 2018, we exclude cases in which information is missing on gender, birth year, year of disappearance or addresses that cannot be used to identify prefectures;[17] this leaves 40,825 cases, out of which 16,882 are child abandonment cases and 23,983 are child abduction cases, as shown in Table 2. When focusing on children under 14 years old when they disappeared, we obtain 38,173 reports on missing children, which account for more than 92% of all missing person reports. Around 44% of the reported cases are of children who are missing because they were abandoned, as reported by their families, whereas the remaining 56% of the cases concern families who are looking for children who were abducted or lost involuntarily. Figure 4 shows that more than 95% of these reports were filed after 2011, and the bulk of them were filed after 2015.

Based on our sample, child trafficking cases exhibit some geographic clustering patterns, as shown in Figure 5. The 8 provinces for which there are the most reports of child abandonment are Sichuan, Jiangsu, Anhui, Guangdong, Henan, Hubei, Shandong and Zhejiang, which account for 53% of all the child abandonment cases in our sample. But these 8 provinces are home to 47% of China's total population. Child abduction is even more geographically concentrated than child abandonment. The top 8 provinces reported as the location of child abductions are Guizhou, Sichuan, Guangdong, Henan, Yunnan, Hubei, Chongqing and Hunan, which account for 62% of reported child abductions in our sample but for only 38% of the total population. The destinations for trafficked children are also geographically concentrated, but in a different set of regions, which include Henan, Shandong, Hebei, Fujian, Jiangsu, Guangdong, Anhui and Sichuan. These regions are the destination for about 70% of trafficked children but account

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[17] Vague descriptions of the location of the disappearance are treated as missing information. Examples include "Our child got lost in front of our house", "Our child got lost on a train" and "Our child got lost in a market".

for only 47% of China's total population.[18]

As shown in Figure 6, the number of missing children included in the dataset maintained by BCBH also varied a great deal over time. While the number of lost children remained quite stable before 1978, except during the Great Famine of 1959-1962, the number of missing children increased dramatically after 1979. On average, there are 26 reports from families looking for lost children each year before 1957, but that number jumped to an average of 217 children each year between 1958 and 1962, peaking at 421 in 1960. The number of reports of missing children then gradually climbed from 81 in 1963 to 212 in 1978, but it rose sharply between 1979 and 1992, reaching more than 2,000 missing children each year during the early 1990s. Since the mid-1990s, there has been a steep and steady decline in the number of children reported missing, with that number stabilizing since 2004, with around 385 children missing each year until 2017. Overall, more than 90% of these children were lost before 2010, and close to 80% of the disappearances occurred before 2001, which is the year that the LPFP was passed and thus the last year for which the income-relative fine can be used to measure the one-child policy's enforcement.

While the location of child abandonment and child abduction incidents and the destinations of those children are both more likely to be the most populous regions, the predominant direction of child trafficking flows seems to be from inland and smaller provinces toward larger provinces on the coast. The increase in the number of missing children between 1958 and 1962 can be accounted for by the Great Famine, but the sharp spikes observed in the last two decades of the 20th century cannot be explained by economic hardship, given the country's impressive economic growth and the reduction in poverty achieved during that period. Thus, although the descriptive statistics reflect some preliminary patterns, a more rigorous examination is needed to provide a solid explanation for the patterns of missing child incidents in China.

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[18] It should be noted that the destination information may be more inaccurate as it is based on the recollections of the missing child many years after the incident.

The two types of missing child cases -- those involving child abandonment and those involving child abduction -- differ somewhat in their time trends and in their gender and age composition. While their numbers both peaked in the early 1990s and dropped afterward, the number of child abduction cases has remained higher than its pre-1978 level since 2010, but the number of child abandonment cases has nearly returned to its pre-1978 levels. The number of child abandonment cases has also fluctuated more, with around 40 reported child abandonment cases being registered each year in 2004-2017, compared to more than 1,050 cases per year in 1990-1991 (see Figure 6). Abandoned children also tend to be much younger than abducted children at the time of their disappearance. Children who are abandoned are more likely to be newborns, whereas children who are abducted tend to be older than that yet still under 5 years old (see Figure 7). The gender composition of these two groups of missing children also differs. More than 70% of all abandoned children are girls, whereas about 70% of trafficked children are boys (see Figure 8). This difference in gender composition was especially stark during the period between 1978 and 2002.

3.2 Data on gender preference

To study the variations in the number of missing children in China across regions and over time, we also collected key demographic and economic information at the prefecture level for the years between 1984 and 2016. One of the main factors that influences child trafficking is the strength of the preference for sons in the local culture. The most frequently used indicator for son preference is the sex ratio at birth (SRB) (see Ebenstein, 2010, and Chen et al., 2015). Because, under the one-child policy, Chinese families could resort to sex-selective abortions to increase the likelihood of having a son (Abrevaya, 2009; Chen et al., 2013; Oster, Chen and Yu, 2010), it is reasonable to infer that regions with higher boy-girl ratios among newborns tend to have a stronger cultural preference for boys[19]. In fact, whereas the average male-female ratio for newborns is around 103:100 globally, the sex ratio at birth has remained above 110:100 in the past few decades in China. The substantially larger number of newborn boys than girls suggests a strong gender bias toward sons; sex-selective abortions are considered to be the main reason for this

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[19] In addition to sex selective abortions, two other potential reasons leading to the excessive male-female ratio at birth are underreporting of female births (Cai and Lavely, 2003) and female infanticide (Wu, Viisainen and Hemminki, 2006).

distorted gender ratio (Hull, 1990).

Since the only basis for determining the gender composition of cohorts of newborns in Chinese regions is the population census, which is conducted every 10 years, we use the gender ratio of newborns in 2010, the most recent population census year, to represent the extent of the preference for a baby boy at the local level. This approach is justified by the fact that gender preferences are relatively stable over time.[20] And indeed, the mean male-female ratio for newborns in Chinese prefectures in 2010 was 116:100, which is much higher than it is in other countries and points to the important role of gender preferences in the nation's cultural tradition. But there is a great deal of variation across prefectures within China, with the male-female ratio ranging from 1.4 in Huangshi, Anhui Province, to 1.31 in Putian, Fujian Province, to 1.09 in Beijing, and 1.02 in numerous prefectures in Inner Mongolia.

As a stricter birth control policy translates into the payment of a higher fee for an additional birth, the preference for sons in Chinese culture may help shape the gender patterns of child trafficking, with a majority of abandoned children being girls and a majority of trafficked children being boys. Thus, regional variations in gender preferences may also result in heterogeneities in terms of the impacts of birth control fines on child trafficking. To investigate those heterogeneities, we use both the continuous variable of SRB and a discrete variable of a high-SRB group (with SRB$\geq$1.17, the national average SRB level as of 2010) to reflect regional variations in gender preference.

Given that child trafficking is an underground business, it should be affected by the cost of crime and the level of law enforcement in a given locality. We thus collected information on population density and the total number of suspects arrested at the provincial level, which is available only for the years after 1988 from the *China Statistical Yearbook*. Accordingly, our study focuses on the relationship between missing children and fines during the period 1988-2016, while the baseline analysis focuses on 1988-2001, given

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[20] As shown in Figure A3, the changes in the SRB between 2000 and 2010 indicate neither obvious convergence nor divergence at the prefecture level over that period. Using 2000 census data also yields similar estimates.

the high fine collection rate for that period.

3.3 Potential reporting bias

3.3.1 The problem of under-reporting

Due to the self-reporting feature of the database and the unethical nature of the activities involved, our data on child abandonment and abduction potentially suffer from a problem of under-reporting. As long as the likelihood of under-reporting is uncorrelated with the income-relative fine level, it will merely increase the measurement error in our dependent variable. The problem, however, is that the likelihood of under-reporting may be correlated with the causing fine variable of interest.

Specifically, under-reporting may occur for any of three reasons. First of all, under-reporting could be caused by information barriers or financial constraints faced by parents in searching for their children that prevent them from reporting their missing child to BCBH. Second, families need to have survived until 2007, the founding year of BCBH, in order to have been able to report their missing child on the BCBH website. Third, under-reporting may be a result of the family's lack of any intention to search for the child to begin with.

Of the three sources of under-reporting, the first should be of the greatest concern, as the degree of bias due to information access may be correlated with household income. For example, if a child who is abducted is from a well-off family, then the family may be more likely to report it. Note, however, that if that is the case, still there has to be a causal effect of the level of fines on abducting a child. Nevertheless, if the reporting bias exists, and it is function of income, in an extreme case, this behavior would generate a left-censored dataset. The same argument holds, mutatis mutandis, for abandoning children. Thus, we will check the robustness of our results by analyzing their consistency and by using a Tobit specification to deal with this potential source of bias.

By comparison, the other two types of potential under-reporting bias are relatively easier to address. As the second source of under-reporting has to do with survival bias, which can be affected by the survival rate of the parents, this bias will be greater for earlier cases. According to age-specific death rate data for China, the death rate of age cohorts younger than 60 is quite stable, while the rate for people older than 60 rises sharply. Therefore, the resultant under-reporting bias will be substantially more severe for cases that occurred before 1980, since the parents would be older than 60 by 2007. To address this potential concern, we will limit our sample to cases in which the disappearance happened after 1980. With life expectancy at 74.5 years in China in 2007 and the age-specific death rate of cohorts younger than 60 practically invariant with age, we argue that the problem of under-reporting due to the non-survival of parents will be largely mitigated by this strategy.

The third type of potential under-reporting bias will be very different in the case of child abandonment than in the case of child abduction. The likelihood that parents will decide to search for a missing child or not is influenced by the value of the child to the family and by the family's financial situation. The more valuable a child is to his or her family, the more likely it is that the parents will devote resources to a search for the child. As most abduction cases involve boys, we expect a large percentage of families to engage in a search for their abducted children, with the result that this type of under-reporting bias will be negligible in abduction cases. On the other hand, since child abandonment is a decision voluntarily made by the family, the likelihood of under-reporting will be much higher than it will be in the case of child abduction. Therefore, there will be a greater need to address the potential under-reporting of child abandonment cases in the empirical analysis. To the extent that this under-reporting is not correlated with the strictness of the one-child policy in place, it will not bias our estimates. This is likely, since a decision to search for a child who was abandoned would be the result of a change in life circumstances which, a priori, would not be correlated with the one-child policy. Even if we were to think that under-reporting is correlated with the severity of the one-child policy, the most likely case would be that the stricter the policy, the lower the rate of under-reporting, since, at the margin, the families that abandon a child would

tend to be relatively richer and, hence, more likely to be informed and have resources to search for the child later on in life.

To summarize, by focusing on the missing child cases that occurred between 1980 and 2001, the second type of under-reporting bias can be largely mitigated. In addition, for abduction cases, under-reporting due to a lack of willingness and effort on the part of the parents can be largely ruled out. However, under-reporting due to information and financial constraints remains a real concern, as these problems may correlate with income level, which, in turn, is the basis for determining the size of the fine -- the main policy variable of interest. We will provide robustness checks in our analysis to test the validity of our main findings.

3.3.2 Potential misreporting of abandonment as abduction

The dataset provides information on whether a reported case involves a child who was voluntarily given up or a child who was involuntarily separated from his or her family. We categorize the former as child abandonment and the latter as child abduction. In addition to the general issue of the under-reporting of lost or missing children, another potential problem with our data is that families may misreport an instance of child abandonment as child abduction, since child abandonment is still perceived as morally unethical despite how surprisingly prevalent it is in China. Misreporting a case of child abduction as child abandonment is very unlikely, however, so there is a potential upward bias in reported child abduction and an under-reporting problem for child abandonment.

Although families may misreport the reason why a child is missing, we believe that families would still accurately report other related information, such as the gender and birth year of the child and the year and location of the disappearance. As a result, the two types of biases caused by misreporting may be addressed by exploring the gender patterns of missing children.

Our current statistics show that most children who are abandoned are girls. If there is misreporting of children abandonment as children abduction, then some of the girls reported as having been abducted will actually have been abandoned. It is then possible to mitigate the impact of misreporting child abandonment cases as child abduction by focusing on the sample of abduction cases involving boys only. In this way, we prevent our results concerning the relationship between the abduction of boys and the one-child policy from being affected by a misreporting problem.

As for the impact of misreporting on child abandonment, as misreporting due to shame or fear of potential peer criticism is uncorrelated with the one-child policy, then, as in the case of under-reporting due to the lack of an intention to look for a missing child, it will merely increase the measurement error for child abandonment.

4. Theoretical Hypotheses and Empirical Model

4.1 Theoretical hypotheses

In traditional Chinese society, there is a preference for sons over daughters. In the absence of birth control policies, Chinese families would have the option of having more children until a child of the desired gender is born. Under the one-child policy, however, this option became much costlier, as hefty fines had to be paid by parents who had more than one child. This then increased the demand for the two alternatives to over-quota births, i.e., the abandonment of a first-born girl in order to retain the quota for another child, or the abduction of a boy.

Because it would give parents another opportunity to have their "first" child in the eyes of the government, the abandonment of girls became a substitute (however dreadful it may be) for giving birth to an additional child and having to pay a large fine. But more of an explanation is warranted as to why the abduction of a boy -- or, equivalently, the purchase of a boy who has been abducted by others -- could also serve as a substitute for additional births. Parents who felt it was extremely important to have a boy

but were unwilling to give up their existing child would have to pay fines for having an additional child regardless of whether they opted to have another child themselves or to resort to having a boy abducted. The key advantage of the latter option is that they are guaranteed to receive a child of the preferred gender, which is not the case if they choose to have another child of their own; hence the substitute value of boy abduction.

Thus, when the size of the fines increases, the price of having additional children rises accordingly, thereby fueling the demand for the substitute goods for additional births, i.e., the abandonment of girls or the abduction of boys. As long as the cost for the parents of abandoning a baby girl (essentially the traumatic emotional experience of separating from their own child) is not infinitely high, the supply of this substitute will be elastic and thus the stricter birth control policy will result in a larger number of baby girls being abandoned. Furthermore, in regions with a stronger-than-average preference for boys over girls, the supply of girl abandonment is more elastic. Thus, the same increase in birth control fines will lead to a bigger increase in the number of cases of abandonment of girls in these regions.

In the case of the abduction of boys, as long as there is uncertainty as to the gender of a future naturally born child, the increased fine and thus the higher price of additional births will drive up the demand for abducted boys. Additionally, in regions with a stronger-than-average preference for boys over girls, the same increase in birth control fines will lead to a bigger increase in the demand for abducted boys, since their gender (the desired one) is known. Thus, in parallel with the dynamic observed in the case of the abandonment of girls, the same increase in birth control fines will lead to a bigger increase in the number of abductions of boys in these regions.

4.2 Empirical model

Taking advantage of regional and temporal variations in birth control policies, we will then empirically test the theoretical hypotheses outlined above. In particular, we will estimate the average effect of changes in *income-relative fines* on the number of cases of child abandonment and child abduction, along with

the heterogeneity of such effects due to differences in gender preferences across Chinese regions.

Although penalties for violating the one-child policy also included other measures, such as demotion, deprivation of promotion opportunities, restrictions on eligibility for the *hukou* family registration program and the loss of other social benefits, we focus on the fines as a measurement of the stringency of the one-child policy because it is the policy component for which the most information is readily available. We use the following empirical model to estimate the impacts of fines in terms of missing children.

$$Y_{it} = \alpha F_{it} + \beta X_{it} + \mu_i + \lambda_t + \rho_i t + \varepsilon_{it} \tag{2}$$

where the dependent variable, Y_{it}, is the quantity of child abandonment or abduction in prefecture i in year t, F_{it} is a vector of fine variables, including local fines and fines in other regions, while X_{it} is a set of control variables that includes local population density and total number of arrests in the local region, with the latter reflecting both the crime rate and the strength of the policing effort. Prefecture fixed effects are included to control for unobservable cross-prefecture variations that do not vary over time, such as regional variations in the preference for males, family size preferences and the local culture's level of tolerance of unethical activities. Year fixed effects are included to control for variations that are the same across prefectures, such as national trends in child trafficking and crime. Furthermore, prefecture-specific trends are included to control for time-varying factors that take a linear form at the prefectural level, such as regional anti-trafficking efforts, and local variations in media and transportation infrastructure. Clustered standard errors at the prefecture level are reported in all specifications.[21]

Because child abduction is an inter-regional, underground business, penalties in the form of fines may not only affect child trafficking in local regions but also child abduction in other regions. To better

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[21] The number of clusters in these estimates is around 300, which is how many Chinese prefectures there are.

distinguish the effects of the fines levied in different regions, we classify prefectures outside a given region based on distance in two different ways. First, other prefectures are classified according to their proximity to the local region. Four categories are used for this purpose: one for the prefectures located in provinces that are directly adjacent to the local region; one for the region's first-order neighboring provinces; those in the region's second-order neighboring provinces; and those in the region's higher-order neighboring provinces. Second, we classify all other prefectures based on their geographic distance from the local region into the following categories: those that are 0-300 km, 300-600 km, 600-900 km and further than 900 km away from the region. The size of the fine in each group of prefectures is then calculated as the population-weighted average fine of all prefectures in the group in order to reflect the relative stringency of the enforcement of the one-child policy in these different regions.

In order to identify how local gender preference affects the impact of the one-child policy on child trafficking, we include two types of interactions between the size of the fine and the sex ratio at birth (SRB) in the estimations: local fine and local SRB, and the average fine of neighboring regions and the average SRB of neighboring regions, as shown in Equation (3). Because child abandonment is mainly the result of decisions made by families in the local region, it is mainly affected by local gender perceptions. Moreover, because girls are more likely to be abandoned than boys, the increase in child abandonment should be higher for regions with a stronger preference for males. By comparison, the level of child abductions is mainly influenced by the gender preferences of the neighboring regions that are subject to a one-child quota because child traffickers tend to find destination households some distance away from the original location of the missing child in order to avoid being caught.

$$Y_{it} = \alpha F_{it} + \alpha_2 (F_{it} * SRB_{it}) + \beta X_{it} + \mu_i + \lambda_t + \rho_i t + \varepsilon_{it} \qquad (3)$$

We also explore the heterogeneities in the impacts of fines on the number of missing children using the interaction of fine variables with other regional demographic and economic characteristics, including the

urban population ratio, ratio of ethnic minorities, gender ratio of newborns, GDP per capita and the urbanization rate.

5. Results

5.1 Fines and child abandonment

We find that stricter enforcement of the one-child policy in a given region, as measured by larger fines for families that exceed the birth quota, leads to a significant increase in child abandonment in that region. Table 3 presents the estimated coefficients for fines and child abandonment using regression model (1) and data for 1988-2001, with the end of that time period having been chosen to ensure that the fine can be used to measure the enforcement level of the one-child policy. We show that, when the fine level increases by one unit or, in other words, the monetary penalty is increased by the equivalent of the per capita average annual local income, the number of reported cases of child abandonment increases by 0.3 in local prefectures. Given that the average number of reported cases of child abandonment is 2.15 per year at the prefectural level, such an increase in the fine corresponds to an increase of around 14% in reported cases of child abandonment.

The impact of the fines on child abandonment is significant only for girls, as shown in columns 2 and 3 of Table 3. The abandonment of boys is not significantly affected by the local fine, although the coefficient is positive in both cases. Given the restricted birth quota and the preference for sons in the Chinese culture, parents will have an incentive to abandon girls for the purpose of avoiding the fines and saving their birth quota for a potential boy in the future. And the more stringent the enforcement of the birth control policy, the more likely girls are to be abandoned by their families. The above results support our theoretical predictions.

The results show that larger fines lead to an increase in child abandonment only in the same local prefecture, whereas the coefficients for average fines in neighboring provinces relative to child

abandonment are not statistically significant. In other words, as expected, we do not observe spatial spillover effects of the fines on child abandonment in other regions, and the pattern is similar for the abandonment of both boys and girls. Because the main effect of larger fines is to increase the financial cost of violating the one-child policy, child abandonment, which is the result of a decision made by the parents of the abandoned child themselves, is only affected by the stringency of the local one-child policy and should not be affected by the stringency of its enforcement in other regions.

Among the control variables, neither population density nor law enforcement affect the number of reported child abandonment cases significantly, probably because child abandonment was not severely punished in China before 2001, although it was legally defined as a crime. This finding is also consistent with the voluntary nature of child abandonment, since this suggests that it is not correlated with typical crime/environmental factors, such as population density and the crime rate.

5.2 Fines and child abduction

Child abduction differs from child abandonment in China in two ways. First, the destination of children who are abducted tends to be more distant from the location of the abduction than the destination of abandoned children from the location of their abandonment, as child traffickers travel afar to avoid recognition by the parents and capture by the police. Second, most of the children who are abducted in China are boys, whereas most of the children who are abandoned are girls.

Table 4 presents the estimated coefficients for fines and child abductions. In contrast to the findings for child abandonment, and in line with the above discussion, the number of children who are abducted is significantly influenced by the size of the fine in nearby provinces but not by its size in the local region. When the population-weighted fine in neighboring provinces increases by one unit, there are 0.93 more reported cases of child abduction, which amounts to about 33% of the total number of cases of child abduction at the local prefecture level. Given that almost all provinces increased the stringency of their

enforcement of the one-child policy by raising local fines and that the policy compliance rate remained high between 1988 and 2001, the positive coefficient that we observe helps to explain the sharp increase in child abductions during that period in China.

As a majority of the children who are abducted are boys, we find that the size of the fines has a significant effect only on the number of boys who were abducted, as shown in columns 2 and 3. This is consistent with the theoretical argument that a stricter enforcement of the birth control policy would drive up the demand for boys, making it more lucrative for traffickers to abduct boys. Anecdotal evidence also indicates that the cost of adopting a boy is much higher than the cost of adopting a girl (Shen, Antonopoulos and Papanicolaou, 2013).

In contrast to the upward pressure exerted by fines on the abandonment of girls, the effect of fines in terms of the abduction of boys is significant only in nearby prefectures, i.e., prefectures located in the local region's first-order neighboring provinces, as shown in columns 2 and 3; we do not find similar patterns in the case of girls. This is in line with the expectation that child traffickers attempt to evade capture by taking the abducted children further away from the abduction site.

Among the control variables, the coefficient of population density is positive and the coefficient of arrests is negative, indicating that the probability that a child, especially a boy, will be abducted is higher in more densely populated regions and lower in regions where law enforcement is stringent. As it is crucial for offenders who abduct a child to avoid being apprehended, the cost of abducting a child can be expected to be lower in more densely populated regions and where law enforcement is laxer. These findings are thus in line with expectations, although neither population density nor the total number of arrests influences local levels of child abduction significantly

5.3 Spatial patterns of child abandonment and child abduction

We explore the geographic spread of the birth control policy's impact further in this section by using distance information instead of the designation of administrative provinces. This is particularly relevant for child abduction cases, as longer trafficking distances would increase the transportation cost and exposure risk for traffickers while reducing their risk of being discovered by the children's families or by police. Child traffickers therefore have an incentive to choose a destination located at an intermediate distance in order to minimize the total cost of their operation. And in fact, previous research on child abduction has found that children are primarily trafficked to neighboring provinces and places within 500 km from the location of the abduction (Wang et al., 2018).

To examine the geographic patterns empirically, for each local prefecture we assign all other prefectures to one of four groups based on their geographic distance from the local prefecture: those within 300 km, 300-600 km, or 600-900 km from the prefecture and those further than 900 km away from it. Then, for each prefecture group, we construct the average fine levied in all the prefectures in the group using their respective populations as weightings.

Table 5 presents the estimated coefficients of the population-weighted average fine in each distance group relative to child abandonment and child abduction. Consistently with the above results, child abandonment, which mostly involves girls, is positively influenced only by the size of the locally levied fine, whereas the coefficients for fines in all four groups of non-local prefectures are not significant for child abandonment. In contrast, child abduction is mainly influenced by the size of the fines levied in prefectures located between 300 and 600 km away, or from 3 to 6 hours' driving distance from the local prefecture, while the coefficients for the fines in the local prefecture and other groups of non-local prefectures are not significant. This confirms the previous finding that most children who are trafficked are taken to destinations within 500 km of their abduction site (Wang et al., 2018).

As larger fines increase the demand for child adoption and thus the value of children who are abducted,

the spatial spillover effects of fines on child abduction point to the widespread geographic impact of birth control policies on child trafficking.

5.4 Gender preferences, fines and missing children

As predicted in Section 4.1, gender preferences played an important role in determining the impacts of the one-child policy. We test these patterns empirically in this section. For child abandonment cases, as it is the local birth control policy that has significant effects, we include the interaction of the local fine and the male-female sex ratio at birth (SRB) in the local prefecture in the estimate in order to study the role of gender preferences. Column 1 in Table 6 gives the regression results, including the additional term based on the whole sample. As the coefficient of interaction of the local fine and the local SRB is positive and significant, the results indicate that the impact of the fines on child abandonment is significantly higher in regions with a stronger gender bias. As most of the children who are abandoned are girls, column 2 limits the sample to girls and obtains largely similar results, which suggests that prefectures in which the preference for boys is stronger are more likely to be the site of an increase in the abandonment of girls by families wishing to avoid paying the fine and to keep within the birth quota so that they can potentially have another baby in the future. Columns 3 and 4 use the discrete indicator for prefectures with high SRBs instead of the continuous SRB measure and produce qualitatively similar results.[22] Columns 5 to 8 include additional interactions of the fines and SRBs and exhibit the same results as those reported in columns 1 to 4.

In contrast to the situation with regard to child abandonment, the level of child abduction is significantly influenced by the size of the fine in neighboring provinces, and thus we include the interaction between the immediately neighboring regions' average fine and those regions' overall SRB in the estimation in order to study the impact of gender preferences. As shown in column 1 of Table 7, the coefficient for the interaction of the fines and SRBs in the neighboring regions is positive although only marginally

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[22] As expected, no significant effect of the interaction term is found for the sample of missing boys. The estimation results are not provided for this effect due to space limitations.

significant, indicating that a larger increase in the number of child abduction cases will be observed in a prefecture when birth control fines in its neighboring provinces are higher if those provinces also have a stronger gender bias toward boys. And in line with the fact that most abducted children are boys, column 2 shows that the above finding is applicable for the sample of missing boys. Using the discrete indicator for prefectures with high SRBs, columns 3 and 4 again display similar patterns. And similarly, columns 5 to 8 include additional interactions of fines and SRBs and exhibit the same results as those reported in columns 1 to 4.

5.5 Missing children in different age groups

Unlike what occurs in other countries, the main purpose of child trafficking in China is to put those children up for illegal adoption as a way of getting around the restrictions on the number of children that a family is allowed to have. This situation offers another dimension in which we can conduct additional tests for the argument that birth control policies have been part of the reason why children go missing in China. In particular, we explore the age patterns of the children involved in abandonment and abduction cases whose frequency has been impacted by changes in birth control policy.

While we focus on the intention to avoid fines for violating the one-child policy and to keep under the birth quota so that there will be a chance of having a boy in the future as the main reasons for the abandonment of girls, researchers have also documented cases in which some families abandon children with disabilities or severe diseases. If parents' decision to abandon a child is mainly driven by changes in the one-child policy, as in the former case, then families would abandon children at very early ages in order to avoid official checks. If the latter reason is the main one, then the age at abandonment will be spread over a wider range.

Panel A of Table 8 presents the estimated coefficients for fines and the number of abandoned children in five age groups: 0, 1, 2-4, 5-9 and 10-14. The results show that fines significantly and positively influence

child abandonment only for newborns (babies younger than 1 year of age), while the abandonment of children in any of the other age groups is not significantly affected by the size of the fines. This result also supports our argument that families abandon their (mainly girl) children to avoid fines in preparation for a future birth.

In contrast, we find that the stricter enforcement of the one-child policy mainly increased the number of abductions of children between 1 and 4 years old. Panel B of Table 8 shows that the number of 1-year-old children who were abducted would increase by 0.22 and the number of children between 2 and 4 years of age who were abducted would increase by 0.81 when neighboring provinces increased the average fine by 1. The level of that average fine in neighboring provinces did not, however, significantly impact the number of children who were abducted who were either younger than 1 or older than 5.

While younger children are preferred for illegal adoptions because of their limited early memory and attachment to their biological parents, newborns are usually kept indoors and are accompanied by adults almost all of the time, making them much less accessible to child traffickers. As a result, children between the ages of 1 and 4 are the primary target of child traffickers, since they are still malleable enough to form new memories with their adoptive families and also are engaged in more outdoor activities and are thus more accessible. These findings are therefore consistent with our argument concerning birth control policies' impact on the number of missing children.

5.6 Placebo test: missing children after 2002
Although the one-child policy was not officially abolished until 2016, when it was replaced by the two-child policy, the enforcement of the one-child policy was eased a great deal after the passage of the Law on Population and Family Planning (LPFP) in 2001 in response to mounting criticism of the harsh measures adopted by local officials to meet their birth control targets, including forced abortions performed in late-stage pregnancies. That law emphasizes that individuals' reproductive rights should be

respected and mandates civilized law enforcement responses to violations of the one-child policy. Local governments are also required to use economic incentives and other more civilized approaches in order to meet local birth control targets. As a result, the enforcement of the one-child policy was relaxed a great deal after 2002. Under the LPFP, forced abortions are no longer permitted, and fines for having an additional child can no longer be collected using force. Several researchers have documented a significant drop in the collection rate for these fines since the early 2000s (Shi, 2006, and Gao and Lu, 2006). The LPFP of 2001 has been regarded as the main reason for the gradually relaxation of the one-child policy.

Without the effective collection of birth control fines, there is no link between the size of the fine and the number of missing children. Thus, the sample for the period after 2002 can be used as a placebo test of the argument linking the one-child policy and missing children. In order to explore the difference in the effect of the one-child policy before and after 2002, we specifically analyze the impact of the fines on child abandonment and child abduction in 2002-2016. Table 9 presents the estimated coefficients for the effects of fines on child abandonment and child abduction after 2002. As shown in the table, most of the fine variables do not significantly affect either child abandonment or child abduction. In other words, neither the rate of child abandonment nor the rate of child abduction changes significantly in response to changes in the size of the fine after 2002. Furthermore, the number of reported cases of children abandonment dropped dramatically, to around 46 cases per year on average during 2012-2015, suggesting that families became more likely to keep their unauthorized children after 2002.

Given that no obvious changes have occurred in gender preferences in the past two decades, the demand for male heirs appears to have remained more or less the same. Therefore, the different patterns observed before and after 2002 provide further support for the proposition that the strict enforcement of the one-child policy provides an explanation for the higher incidence of child abandonment and child abduction during the last two decades of the 20th century in China.

5.7 Robustness checks

In this section, we test the robustness of our main findings by conducting additional tests, whose results are shown in Table 10. To begin with, we replace the dependent variable used in the previous estimations, i.e., the total quantity of child abandonment and abduction, with the logarithm of child abandonment and abduction, so that the coefficients can be interpreted as the percentage change in the number of missing children. Column 1 of Table 10 shows that our results remain robust, indicating that the existence of fines significantly increases the incidence of child abandonment and abduction, whether measured in terms of absolute levels or percentage changes.

Another concern with regard to our main results is that zeros have been assigned to observations (prefecture-year pairs) in which there are no reports of missing children. As we mentioned above, this could be seen as a problem of data censoring, because zero values may represent either observations with no children missing or under-reporting in cases where there are children missing. As the measurement error of a failure to report child abandonment and abduction cases could be larger for prefectures that lack access to the Internet or where the population is unaware of the existence of online resources, it may be correlated with the policy variable of interest (the income-relative fine), thus potentially resulting in biased estimates. We address this potential problem by estimating a Tobit model that takes into account the left-censoring feature of child abandonment and child abduction measurements. We use the generalized panel Tobit model proposed by Honoré (1992) to estimate the coefficients of the fines and report the results in column 2. The coefficient of the fine for child abandonment remains robust and the coefficient of the fine for child abduction is positive and significant at the 89% confidence level, indicating that our findings are robust.

Since capital cities tend to have larger populations and larger population flows, there are more cases of missing children in those cities. To mitigate the potential influence of these outliers, we also exclude provincial capital cities from the sample; the results remain largely the same (as shown in column 3). As

the one-child policy was implemented less strictly in ethnic minority regions, in one specification we exclude the five autonomous provinces that have large ethnic minority populations[23] and obtain robust results (see column 4).

Our results are also largely robust to the inclusion of both linear and nonlinear prefectural trends (see column 5), as well as to the inclusion of additional control variables (see column 6), such as GDP per capita (in logarithms) and the number of children under 5 years of age in the prefecture. The results shown in these columns indicate that the coefficients of fine payment variables are quite similar to the main results given in Tables 3 and 4, despite the fact that the number of observations drops to 2,485 due to missing GDP information for some prefectures. Overall, the effects of the fines on child abandonment and child abduction remain robust.

As mentioned previously, there is a concern that there could be fewer reports of child abandonment than the actual number of cases due to the misreporting of child abandonment as child abduction. Considering the general pattern of the abandonment of girls and the abduction of boys, the misreporting of child abandonment as child abduction, if any, is likely to concern girls. Thus, we construct a pseudo abandonment variable as the sum of total abandonment plus girl abduction. As shown in column 7, our results remain robust, which implies that the misreporting problem is not severe.

A potential confounding factor affecting the patterns of missing children is the availability of prenatal sex selection technologies, as they may substitute for post-birth measures for selecting children of the preferred sex. We address this issue in column 8 of Table 10 by using the sample data for 1990-2001 instead of 1988-2001, as the diagnostic ultrasound technology had been introduced to practically all Chinese counties by 1990 (Chen, Li and Meng, 2013). Our results remain robust, indicating that penalty fine of the one-child policy have caused increases in child abandonment and abduction even when

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[23] These five regions are Inner Mongolia, Ningxia, Guangxi, Xinjiang and Tibet.

families already had access to pre-birth gender selection technologies. The results in column 8also help mitigate the problem of under-reporting of cases of missing children. Given that a potential source of under-reporting bias is cross-regional and temporal variations in the access to the BCBH platform and financial constraints of families in search of their missing children, focusing the analysis on a narrower time period should result in smaller temporal variations.

To further address the concern regarding how the access to sex-selective abortions in local families would affect the impact of fines on missing children, we explore the potential effects of the HRS land reform next. Because child abandonment and abduction are also family behaviors related to sex selection, the pre-birth sex selection might substitute for post-birth gender selection. Following Almond, Li and Zhang (2019)'s argument that rural families had relatively lower access to pre-birth sex selective abortions than urban families, we classify all reported cases into rural and non-rural categories based on the reported lost location. A case is classified as rural if the reported lost location has the keyword of "village" and non-rural otherwise. And more than 70% of child abandonment and abduction cases in our sample were reported in non-rural areas.

Table 11 lists the regression results of fines on child abandonment and abduction in rural and non-rural areas separately. It shows that the positive effects of local fine on child abandonment and positive impacts of neighbors' fine on child abduction are significant in both rural and non-rural regions, with the effects in non-rural areas slightly larger than rural areas but the difference statistically insignificant. This indicates that even though the non-rural areas may have better access to prenatal sex selection, families still resort to the post-birth sex selection approach of child abandonment and abduction to achieve the desired gender ratio among children. In addition, as non-rural regions are less likely to be affected by the HRS land reform, these results also help mitigate the confounding impact of the land reform on child abandonment and abduction, providing additional support for the independent effect of the one-child policy.

5.8 Checking data validity using the Great Famine (1959-1961)

As discussed earlier, the impact of the one-child policy on the number of missing children is mainly attributable to the additional financial burden for families of having to pay fines for having another child. Studies have also shown that the number of missing children has tended to increase during or after major natural disasters (Shen, Antonopoulos and Papanicolaou, 2013). One explanation is that severe disasters often lead to decreases in household income and food availability, driving up the cost of raising a child and hence the likelihood of abandonment. In addition, the amount of care that families give their children also tends to decrease in such situations due to the ensuing chaos. As a result, children are more likely to go missing either because they are abandoned or abducted.

If the reports of missing children in the BCBH database provide a representative sample of the actual number of missing children in Chinese regions over time, then we would expect there to have been a larger number of missing children during the Great Famine of 1959-1961, when many Chinese provinces experienced severe famines caused by crop failures, and a large part of the country saw its population shrink due to starvation and food-shortage-induced mortality (Meng, Qian and Yared, 2015).

We check for this pattern by studying the relationship between the number of missing children and the intensity of the impact of the Great Famine across Chinese regions. Table 12 presents the regression results for the impact of provincial death rates (Meng, Qian and Yared, 2015) on the number of missing child cases in each province using the BCBH data for 1950-1970. Column 1 shows that a higher death rate is significantly and positively correlated with the total number of children reported missing. According to Meng, Qian and Yared (2015), the death rate increased from 10.6 per 1,000 in 1957 to 15 per 1,000 in 1959 and then to 23 per 1,000 in 1960. Thus, our estimates imply that the total number of missing children increased by around 9.1 per 1,000 from 1957 to 1960, which accounts for 277% of the average annual level. Column 2 reflects a positive correlation for missing boys, while column 3 reports

a positive association for missing girls. Thus, for both boys and girls, there was a higher probability that they would be separated from their families during the famine years. Columns 4 and 5 further show that both child abandonment and child abduction were positively correlated with the severity of the Great Famine at the provincial level. Columns 6-10 present similar patterns when the death rate is replaced by the Great Famine dummy, which takes a value of 1 for the years from 1959 to 1961. These patterns thus help to corroborate the quality of the BCBH database.

6. Conclusion

Child trafficking has been a major underground economic activity globally. However, against a backdrop of rapid economic growth, China experienced a sharp increase in child abandonment and child abduction in the 1980s and 1990s. We argue that the combination of the one-child policy and the cultural preference for sons is the main explanation for the large numbers of child abandonment and child abduction cases reported during those years. The combination of these two factors has also shaped the unique gender composition of child trafficking in China, where most of the children who are abandoned are girls and most of the children who are abducted are boys.

Our empirical analysis relies on two sets of data: the self- and family-reported missing child cases filed on the website of Baby Come Back Home (BCBH), the largest online platform for posting information on missing children, are used to construct the dataset on missing child cases for each prefecture in all years from 1979 to 2018; and variations in the strictness of the one-child policy in local provinces are measured at the provincial level by the income-relative fine for the first unauthorized birth. Based on empirical case studies and statistics on birth control operations and fee collection rates, we then divide the period during which the one-child policy was in effect into two sub-periods: 1979-2001, when the policy was more strictly enforced, and 2002-2016, when it was applied less stringently. The availability of data on the key control variable of local arrests further limits the period of our analysis to the years after 1988.

During the stringent policy enforcement period, higher fines were found to be significantly correlated with increases in child abandonment. When the per parent fine amount increased by the amount of local average per capita annual income, the number of child abandonment cases increased by 0.3, which is equivalent to a 14% increase over the average number of abandonment cases. The impact of the fines in driving up the rate of child abandonment was confined to cases involving girls, which is consistent with the general preference for sons in China. Higher fines increased the number of cases of abandonment of girls in the local prefecture and had no spillover effects on other regions. In contrast, increases in fines led to a significant increase in child abductions in neighboring provinces; the impact of such increases was confined to abduction cases involving boys, with increases in those fines having no significant impact on the abduction of girls either in the local region or other regions. When the per parent fine amount increased by the amount local average annual per capita income, the number of children who were abducted from neighboring provinces increased by 0.93, which is equivalent to a 33% increase over the average level.

The cultural preference for sons heightens both the local impact of the fines on the abandonment of girls and the spillover effect on the abduction of boys. Child abandonment in regions with a stronger preference for sons increases more sharply in response to increases in the fines. By the same token, fine increases in regions with a stronger cultural bias towards sons trigger larger spillover effects on the abduction of boys in neighboring regions. Furthermore, we find that geographic distance explains much of the spatial spillover effects regarding the abduction of boys. While the impact spreads mainly to neighboring provinces, it nonetheless also tends to extend up to a distance of between 300 km and 600 km from the local prefecture. This is mainly due to nonlinear changes in the cost of child trafficking, with a higher probability of traffickers being apprehended if they cover a shorter distance with their victims and with traffickers facing higher transportation costs if they take their victims further away from the site of their abduction. Overall, we find that the impact of these fines on child abandonment is the largest in

the case of newborns while the spillover effect of the fines on child abduction is the strongest in the case of children from 1 to 4 years old.

During the period when the enforcement of the policy was more relaxed, on the other hand, we fail to find any significant impact for local fines on local child abandonment or any significant effect for neighboring regions' fines on child abduction in the local region. As in the case of other studies that have used self-reported data, however, the data currently available from the BCBH platform captures only a portion of the actual cases of child abandonment and abduction in China. We consider the three sources of under-reporting: financial or information constraints on families with missing children that limit their access to BCBH; the survival bias in terms of family members' ability to report such cases; and families' lack of an intention to search for their missing children. Because the latter two factors are more likely to be driven by region-specific trends in health care, a lack of awareness of child protection and social perceptions, they would not undermine our key results once we have included prefecture trends and year and prefecture fixed effects and have adjusted the sample period.

To address the concern about potential under-reporting, we use a panel Tobit model to account for the left-censoring structure of missing child reports and obtain similar results. The robustness checks show that our results are also robust when we adopt alternative measures of child trafficking, use a narrower time window, exclude major prefectures which are perceived as being top destinations for trafficked children, exclude minority autonomous regions which have a milder gender bias than the Han-dominated regions, include additional controls for such factors as the local income level and the number of children, control for non-linear tends, and address the potential problem of misreporting abandonment as abduction.

More importantly, our results are not confounded by two other policies that may also impact families' decisions regarding child abandonment and abduction, the implementation of the HRS land-reform policy and the availability of pre-natal sex-selection technologies. Although the HRS policy started at

about the same time as the one-child policy in China, the nation-wide land reform was completed by 1984. Thus, by using data from 1988-2001, our study focuses on a time period when the one-child policy was implemented independently from the land reform policy. Furthermore, we find that the positive effects of penalty fines on child abandonment and abduction are of similar size in both rural and non-rural areas, whereas the effects of land reform should only be observed in rural regions.

Similarly, as pre-natal sex-selection technologies had become widely available through Chinese counties by 1990 (Chen, Li and Meng, 2013), there was little variation in their availability in much of our sample period of 1988-2001, implying little explanatory power for such technologies in accounting for child abduction and abandonment. Furthermore, limiting the sample to 1990-2001 preserves our findings, and dividing the rural and non-rural regions (where the availability of pre-natal sex-selection technologies may differ) shows no significant difference in the results for the two subsamples.

To our knowledge, this is the first study to explore the institutional reasons behind missing child cases in China, where the combination of the one-child policy and a cultural preference for sons has shaped the unique gender pattern of child abandonment and child abduction practices. By focusing on families' decisions on child abandonment and abduction, or post-birth sex selection, our study supplements the current literature about prenatal sex selection family decisions, which lead to large number of missing women in India and China. In addition, it identifies an unintended consequence of the one-child policy, thereby contributing to the analysis of the impacts of the largest-ever fertility control policy in human history.

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7 Appendix

7.1 Tables

Table 1: Fines and Socioeconomic Factors

	(1) 1981-2001	(2) 1995-2001	(3) 1981-2001
ln real GDP	0.30	-0.63	0.080
	(0.60)	(0.65)	(0.71)
ln population density	1.57	-1.49	1.96
	(1.86)	(1.70)	(1.74)
Transportation	0.13	0.58	0.10
	(0.16)	(0.90)	(0.17)
ln wage level	0.33	-0.081	0.24
	(0.36)	(0.12)	(0.31)
Fiscal revenue/GDP		0.32	
		(0.52)	
Fiscal revenue/expenditure		-0.20	
		(0.27)	
Percentage of production teams enrolled in HRS			-0.29
			(0.51)
Observations	467	149	409
R-squared	0.599	0.911	0.608
provFE	Y	Y	Y
yearFE	Y	Y	Y
Number of clusters	27	25	22

Notes: All economic variables are in real values using 1980 price levels. Transportation is measured by the logarithm of total cargo transportation in local provinces each year. Column 2 has fewer observations due to missing values of fiscal variables. Column 3 controls for the percentage of production teams enrolled in the Household Responsibility System (HRS) in Chinese provinces, for which data was collected from the Provincial Gazetteers, with records of Anhui, Shaanxi, Inner Mongolia, Tibet and Xinjiang missing between 1981 and 1983. Standard errors clustered at the provincial level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2: Illustration of Sample Size

Total	All	Remove missing	U14	1988-2001	2002-2016	Other periods
Abandonment	16,969	16,882	16,761	9,037	852	5,303
Abduction	24,175	23,983	21,412	12,096	5,400	2,538
Sum	41,144	40,865	38,173	21,133	6,252	7,841

Notes: Column 2 removes reported cases with missing information on age, birth year, disappearance year or disappearance locations which cannot be identified at the prefecture level. "Other periods" corresponds to 1924-1987 and 2017-2018.

Table 3: Fines and Child Abandonment (1988-2001)

	(1) All	(2) Boys	(3) Girls
Mean	2.15	0.47	1.68
Local fine	0.30***	0.042	0.26***
	(0.094)	(0.035)	(0.082)
Avg. fine in 1st-order	0.13	0.059	0.067
neighboring regions	(0.23)	(0.088)	(0.21)
ln density	-0.15	-0.0031	-0.15
	(0.23)	(0.095)	(0.20)
ln arrest	0.15	0.047	0.10
	(0.16)	(0.076)	(0.13)
Observations	3,461	3,461	3,461
R-squared	0.722	0.497	0.686
prefFE	Y	Y	Y
yearFE	Y	Y	Y
preftrend	Y	Y	Y
Number of clusters	276	276	276

Notes: The fine levels in neighboring provinces are the population-weighted average fines in corresponding neighboring provinces. Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Fines and Child Abduction (1988-2001)

	(1)	(2)	(3)
	All	Boys	Girls
Mean	2.80	2.05	0.75
Local fine	-0.0054	-0.036	0.031
	(0.21)	(0.22)	(0.046)
Avg. fine in 1st-order	0.93**	0.84**	0.089
neighboring regions	(0.39)	(0.36)	(0.089)
ln density	1.02	0.92	0.100
	(0.70)	(0.71)	(0.089)
ln arrest	-0.78	-0.70	-0.073
	(0.67)	(0.60)	(0.099)
Observations	3,461	3,461	3,461
R-squared	0.856	0.825	0.627
prefFE	Y	Y	Y
yearFE	Y	Y	Y
preftrend	Y	Y	Y
Number of clusters	276	276	276

Notes: The fine levels in neighboring provinces are the population-weighted average fines in corresponding neighboring provinces. Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Missing Children and Fines, by Distance

	(1)	(2)	(3)	(4)	(5)	(6)
	Abandonment			Abduction		
	All	Boys	Girls	All	Boys	Girls
Local fine	0.26**	0.010	0.25***	-0.039	-0.079	0.040
	(0.10)	(0.040)	(0.088)	(0.22)	(0.23)	(0.052)
Fine 0-300 km	0.079	0.047	0.033	-0.19	-0.15	-0.041
	(0.11)	(0.052)	(0.093)	(0.26)	(0.24)	(0.048)
Fine 300-600 km	-0.25	-0.13*	-0.12	0.78**	0.73*	0.049
	(0.19)	(0.077)	(0.17)	(0.39)	(0.39)	(0.100)
Fine 600-900 km	-0.23	-0.069	-0.16	0.35	0.31	0.035
	(0.20)	(0.089)	(0.18)	(0.34)	(0.31)	(0.11)
Fine over 900 km	-0.88	-0.81**	-0.070	-0.68	-1.07	0.39
	(0.75)	(0.32)	(0.68)	(1.24)	(1.08)	(0.39)
Observations	3,363	3,363	3,363	3,363	3,363	3,363
R-squared	0.722	0.501	0.685	0.857	0.827	0.627
prefFE	Y	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y	Y
preftrend	Y	Y	Y	Y	Y	Y
Number of clusters	264	264	264	264	264	264

Notes: Fines in regions falling within the distance ranges are all population-weighted fines for all regions in the range. All regressions control for the logarithm of population density and the logarithm of total arrests in local prefectures. Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6: Fines, SRBs and Child Abandonment

	(1) All	(2) Girls	(3) All	(4) Girls	(5) All	(6) Girls	(7) All	(8) Girls
Local fine	-2.82**	-2.31*	0.11	0.10	-2.77**	-2.27*	0.12	0.11
	(1.39)	(1.26)	(0.086)	(0.078)	(1.38)	(1.25)	(0.085)	(0.077)
Fine in 1st-order nbr	0.13	0.071	0.13	0.074	-11.5***	-8.80**	-0.31	-0.20
	(0.23)	(0.21)	(0.23)	(0.21)	(4.32)	(3.90)	(0.39)	(0.34)
Fine*SRB	2.69**	2.21**			2.65**	2.18*		
	(1.23)	(1.11)			(1.22)	(1.11)		
Fine in 1st-order nbr *SRB					9.86***	7.54**		
					(3.70)	(3.34)		
Fine*d(high SRB)			0.45**	0.37**			0.44**	0.36**
			(0.20)	(0.18)			(0.20)	(0.17)
Fine in 1st-order nbr* d(high SRB)							0.77*	0.48
							(0.43)	(0.37)
ln density	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.14	-0.14
	(0.23)	(0.20)	(0.23)	(0.20)	(0.23)	(0.20)	(0.22)	(0.20)
ln arrests	0.12	0.075	0.11	0.070	0.14	0.093	0.16	0.099
	(0.16)	(0.14)	(0.16)	(0.14)	(0.16)	(0.13)	(0.15)	(0.13)
Observations	3,461	3,461	3,461	3,461	3,461	3,461	3,461	3,461
R-squared	0.724	0.687	0.724	0.688	0.724	0.687	0.725	0.688
prefFE	Y	Y	Y	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y	Y	Y	Y
preftrend	Y	Y	Y	Y	Y	Y	Y	Y
Number of clusters	276	276	276	276	276	276	276	276

Notes: A prefecture is classified as having a strong preference for boys if the sex ratio at birth (SRB) in 2010 was no less than 1.17. Standard errors clustered at the prefecture level are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Fines, SRBs and Child Abduction

	(1) All	(2) Boys	(3) All	(4) Boys	(5) All	(6) Boys	(7) All	(8) Boys
Local fine	-0.0022	-0.033	0.00063	-0.029	-2.29*	-2.77**	-0.11	-0.15
	(0.21)	(0.22)	(0.21)	(0.22)	(1.34)	(1.28)	(0.19)	(0.29)
Fine in 1st-order nbr	-10.6	-9.68	0.55	0.39	-10.4	-9.43	0.56	0.40
	(6.97)	(6.16)	(0.42)	(0.38)	(6.90)	(6.10)	(0.43)	(0.29)
Fine*SRB					1.96*	2.35**		
					(1.19)	(1.13)		
Fine in 1st-order nbr *SRB	9.82	8.93*			9.65	8.73		
	(6.06)	(5.39)			(6.00)	(5.34)		
Fine*d(high SRB)							0.25	0.29
							(0.32)	(0.29)
Fine in 1st-order nbr* d(high SRB)			0.66	0.78**			0.65	0.77**
			(0.45)	(0.38)			(0.44)	(0.33)
ln density	1.02	0.92	1.03	0.94	1.02	0.92	1.03	0.93**
	(0.70)	(0.71)	(0.70)	(0.71)	(0.70)	(0.72)	(0.70)	(0.38)
ln arrests	-0.75	-0.68	-0.74	-0.66	-0.78	-0.71	-0.76	-0.68
	(0.68)	(0.61)	(0.67)	(0.60)	(0.67)	(0.61)	(0.67)	(0.50)
Observations	3,461	3,461	3,461	3,461	3,461	3,461	3,461	3,461
R-squared	0.857	0.825	0.857	0.826	0.856	0.825	0.857	0.826
prefFE	Y	Y	Y	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y	Y	Y	Y
preftrend	Y	Y	Y	Y	Y	Y	Y	Y
Number of clusters	276	276	276	276	276	276	276	276

Notes: A prefecture is classified as having a strong preference for boys if the sex ratio at birth (SRB) in 2010 was no less than 1.17. Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: Fines and Missing Children, by Age Group

	(1)	(2)	(3)	(4)	(5)
	0	1	2-4	5-9	10-14
A: Abandonment					
Mean	2.44	0.43	0.25	0.13	0.02
Local fine	0.40***	0.036	0.0035	0.024	-0.0021
	(0.11)	(0.045)	(0.027)	(0.026)	(0.0068)
Fine in 1st-order neighbor	0.14	0.12	0.050	0.0055	-0.0093
	(0.29)	(0.11)	(0.082)	(0.054)	(0.021)
Observations	2,264	2,264	2,264	2,264	2,264
R-squared	0.641	0.366	0.305	0.275	0.226
Number of clusters	265	265	265	265	265
B: Abduction					
Mean	0.21	0.30	1.9	1.36	0.44
Local fine	0.0075	0.070	0.14	-0.24	0.018
	(0.025)	(0.052)	(0.12)	(0.22)	(0.033)
Fine in 1st-order neighbor	0.057	0.22**	0.81**	0.27	-0.015
	(0.075)	(0.11)	(0.37)	(0.22)	(0.084)
Observations	2,284	2,284	2,284	2,284	2,284
R-squared	0.316	0.418	0.831	0.713	0.411
prefFE	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y
Preftrend	Y	Y	Y	Y	Y
Number of clusters	264	264	264	264	264

Notes: All regressions control for the logarithm of population density and the logarithm of arrests. Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9: Fines and Missing Children (2002-2016)

	(1)	(2)	(3)	(4)	(5)	(6)
	Abandonment			Abduction		
	All	Boys	Girls	All	Boys	Girls
Local fine	-0.0052	-0.015*	0.0094	-0.011	-0.032	0.021
	(0.014)	(0.0079)	(0.012)	(0.036)	(0.033)	(0.025)
Fine in 1st-order	-0.067	-0.045	-0.022	-0.12	-0.092	-0.026
neighbor	(0.051)	(0.029)	(0.044)	(0.16)	(0.14)	(0.094)
ln density	0.35	0.18	0.17	-2.23**	-1.94	-0.28
	(0.24)	(0.13)	(0.17)	(0.99)	(1.22)	(0.48)
ln arrest	0.072	0.022	0.049	0.21	0.070	0.14
	(0.048)	(0.024)	(0.039)	(0.14)	(0.094)	(0.097)
Observations	3,785	3,785	3,785	3,785	3,785	3,785
R-squared	0.385	0.256	0.337	0.752	0.702	0.520
prefFE	Y	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y	Y
preftrend	Y	Y	Y	Y	Y	Y
Number of clusters	287	287	287	287	287	287

Notes: Standard errors clustered at the prefecture level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 10: Robustness Checks

	(1) ln	(2) Tobit	(3) Remove capital	(4) Remove minority	(5) Nonlinear trend	(6) Other controls	(7) Expanded abandonment	(8) 1990- 2001
A: Abandonment								
Local fine	0.035*	0.36***	0.27***	0.39***	0.22*	0.25**	0.33***	0.22**
	(0.021)	(0.12)	(0.093)	(0.11)	(0.12)	(0.12)	(0.11)	(0.094)
Fine in 1st-order neighbor	-0.069	0.30	-0.11	0.18	0.0015	0.30	0.22	-0.066
	(0.049)	(0.42)	(0.20)	(0.25)	(0.25)	(0.32)	(0.24)	(0.23)
Observations	3,461	3,461	3,065	3,163	3,461	2,477	3,461	2,961
R-squared	0.682		0.674	0.723	0.760	0.747	0.769	0.746
B: Abduction								
Local fine	0.027	-0.27	-0.058	0.0037	0.31	-0.23		0.041
	(0.020)	(0.34)	(0.21)	(0.25)	(0.26)	(0.19)		(0.18)
Fine in 1st-order neighbor	0.14**	0.65	0.67**	1.06***	1.22***	1.30***		1.35***
	(0.056)	(0.55)	(0.32)	(0.40)	(0.35)	(0.30)		(0.40)
Observations	3,461	3,461	3,065	3,163	3,461	2,477		2,961
R-squared	0.754		0.787	0.858	0.898	0.873		0.821
prefFE	Y	Y	Y	Y	Y	Y	Y	Y
yearFE	Y	Y	Y	Y	Y	Y	Y	Y
preftrend	Y		Y	Y	Y	Y	Y	Y
Number of clusters	276		246	250	276	271	276	276

Notes: Column 5 includes both linear and quadratic year trends for each prefecture. Column 6 includes controls for children under five years of age and a logarithm of GDP per capita in local prefectures. The dependent variable in column 7 is the total of abandoned children plus abducted girls. Standard errors are in parentheses. We cluster errors at the prefecture level in all columns except column 2.   *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11: Fine and Missing Children in Rural and Nonrual Regions (1988-2001)

	(1)	(2)	(3)	(4)
	Abandonment		Abduction	
	Rural	Nonrural	Rural	Nonrural
Mean	0.56	1.59	0.84	1.95
Local fine	0.14***	0.17**	0.052	-0.063
	(0.035)	(0.077)	(0.051)	(0.20)
Fine in 1st-order neighbor	0.035	0.081	0.38**	0.56**
	(0.086)	(0.20)	(0.16)	(0.26)
lndensity	-0.13	-0.018	0.18	0.83
	(0.11)	(0.15)	(0.13)	(0.63)
lnarrest	0.077	0.065	0.10	-0.88
	(0.060)	(0.14)	(0.14)	(0.70)
Observations	3,461	3,461	3,461	3,461
R-squared	0.509	0.685	0.683	0.838
prefFE	Y	Y	Y	Y
yearFE	Y	Y	Y	Y
preftrend	Y	Y	Y	Y
Number of clusters	276	276	276	276

Notes: The dependent variables are children abandonment and children abduction in rural and nonrural regions in China. An abandonment or abduction cases is identified as rural if the reported lost location is identified to a location in a rural village, and non rural otherwise. We cluster errors at the prefecture level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11: The Great Famine and Missing Children (1950-1970)

	(1) All missing	(2) Boys	(3) Girls	(4) Abandoned	(5) Abducted	(6) All missing	(7) Boys	(8) Girls	(9) Abandoned	(10) Abducted
Mean	3.28	1.74	1.54	2.15	1.12	3.28	1.74	1.54	2.15	1.12
Death rate	0.70*	0.40*	0.29*	0.29	0.41*					
	(0.38)	(0.22)	(0.16)	(0.17)	(0.20)					
D(famine 1959-1961)						7.75***	4.06**	3.69***	3.64**	4.11***
						(2.79)	(1.55)	(1.28)	(1.39)	(1.45)
Observations	546	546	546	546	546	546	546	546	546	546
R-squared	0.394	0.388	0.352	0.388	0.386	0.334	0.306	0.33	0.375	0.276
provFE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Notes: The death rate data for the provinces are from Meng, Qian and Yared (2015). The famine dummy variable takes a value of 1 for the years from 1959 to 1961. Standard errors clustered at the provincial level are shown in parentheses. The number of clusters is 29. *** p<0.01, ** p<0.05, * p<0.1

7.2 Figures
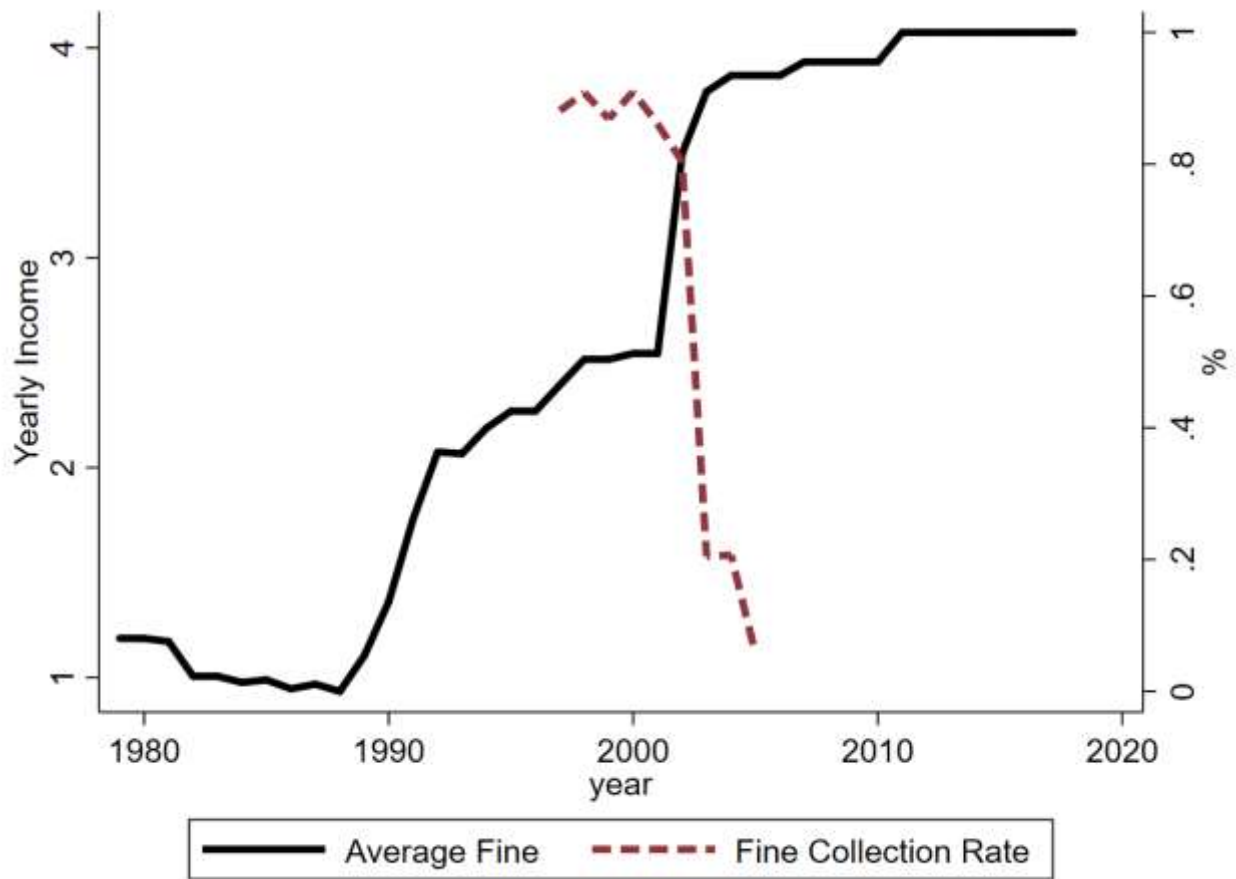
Figure 1: Trend in Fines for the First Unauthorized Birth and Fine Collection Rates

Notes: The solid line plots the average per parent fine in the unit of yearly income for the first unauthorized birth for all provinces. The dotted line shows the fine collection rate in Tianmen, Hubei province (Shi, 2006).
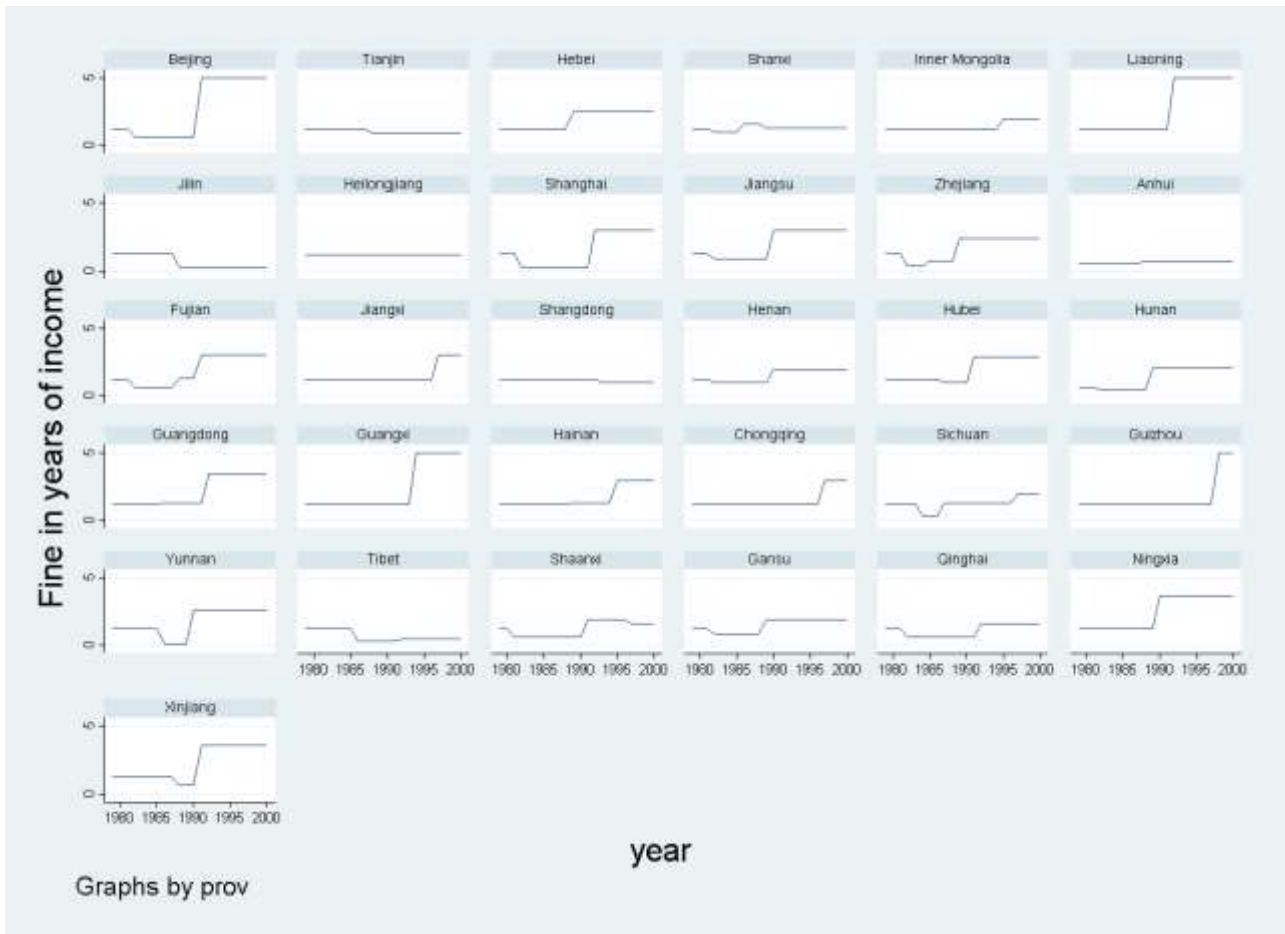
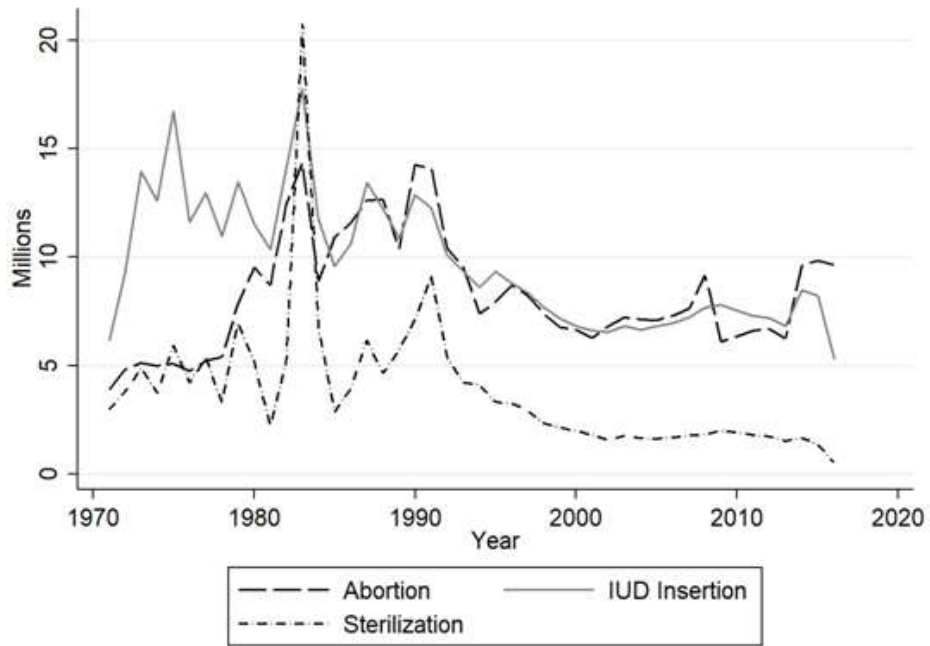Figure 2: Variations in Fines, by Province (1980-2001)

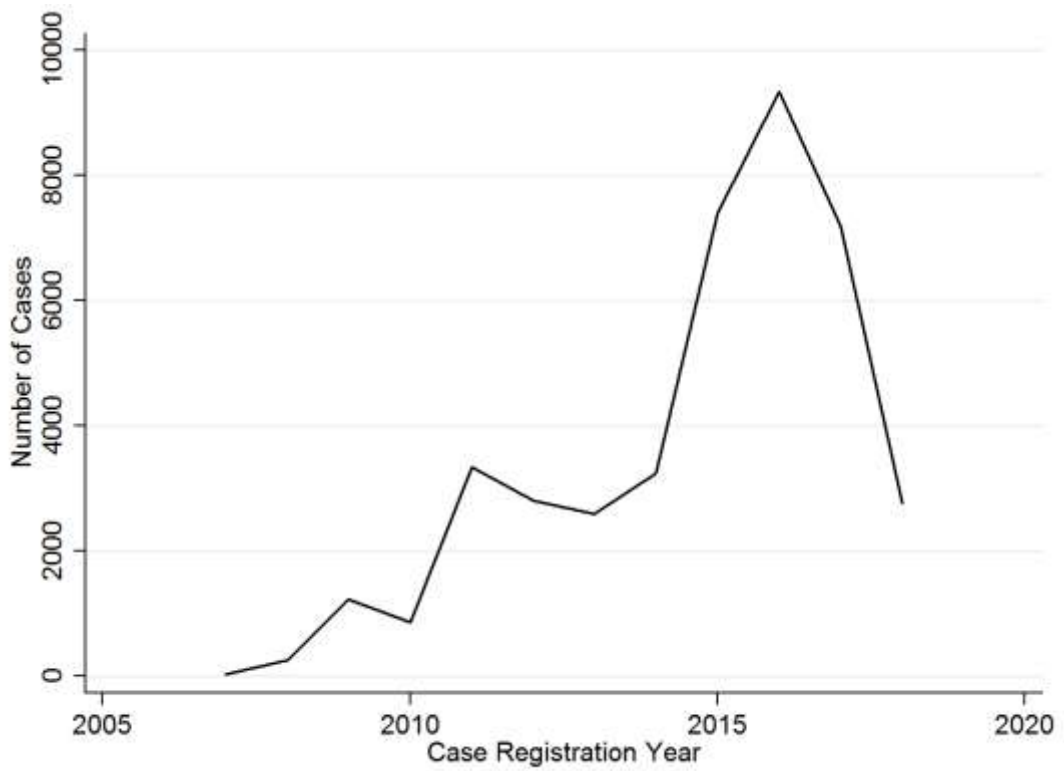Figure 3: Number of Birth-Control Operations in China: 1971-2016

Figure 4: Number of Cases Registered on the Baby Come Back Home Website, by Year
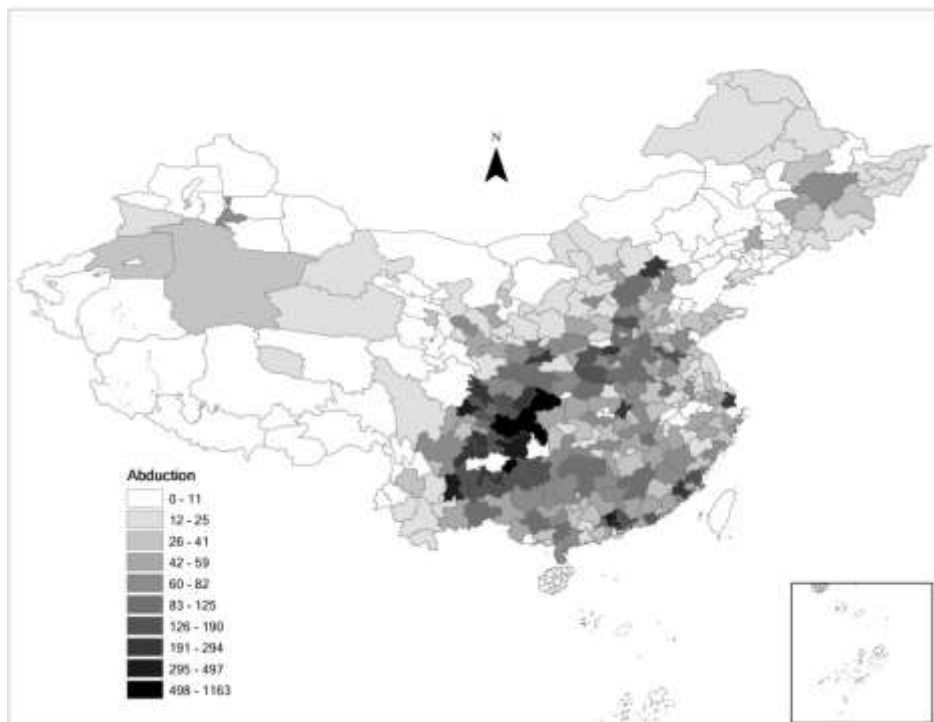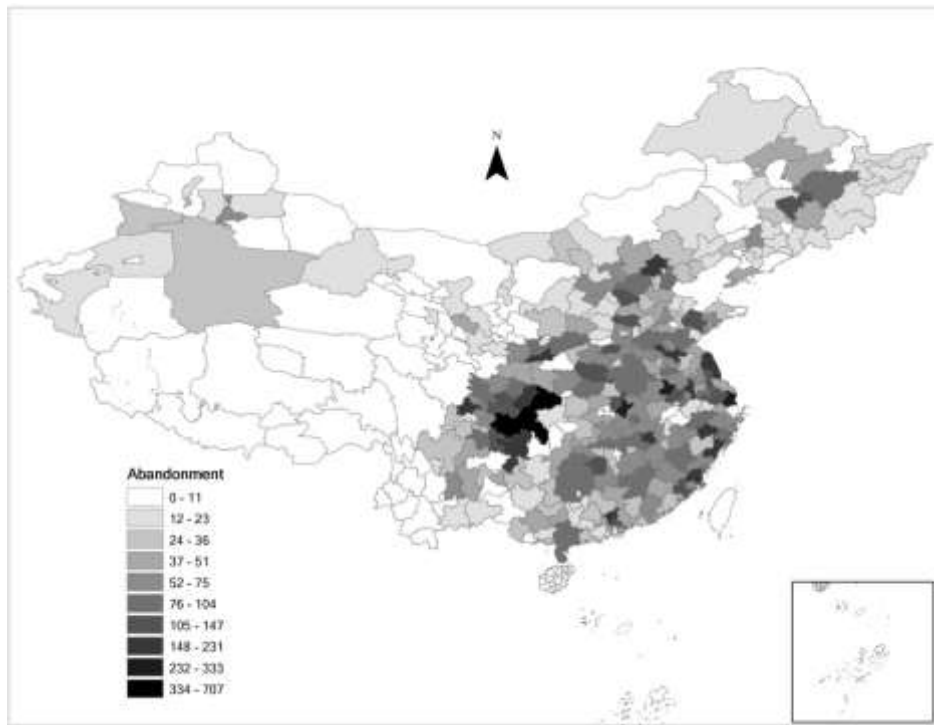
Figure 5: Map of Self-reported Child Abandonment and Abduction in China
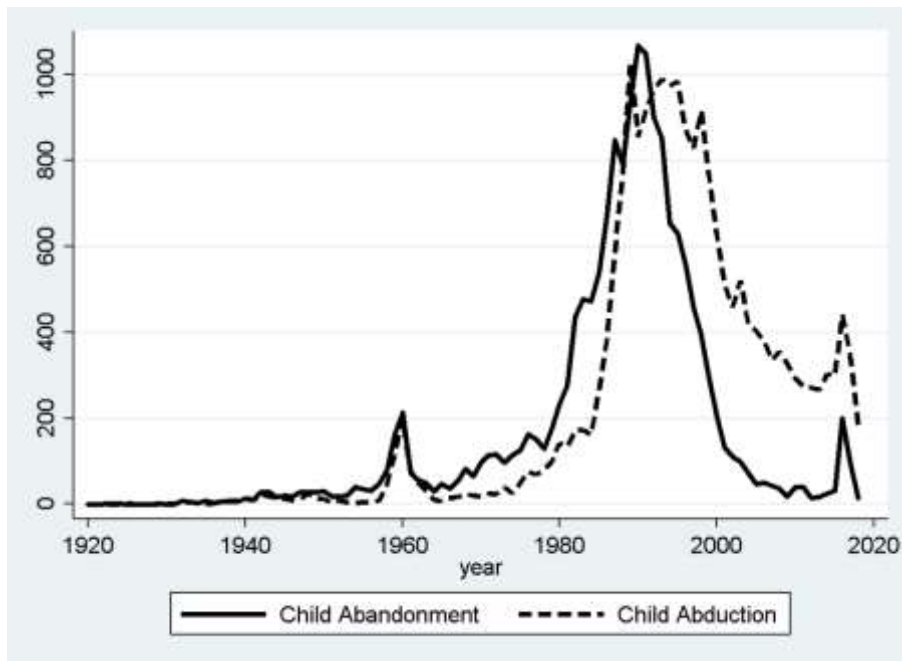
Figure 6: Trend of Self-reported Missing Children in China

Notes: All data are from self-reports of families looking for missing children on the website of Baby Come Back Home by June 2018.
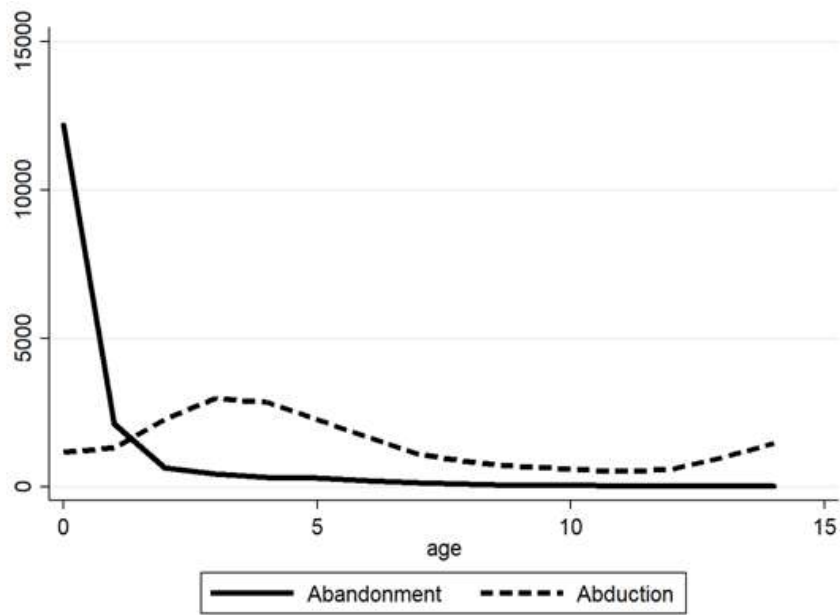
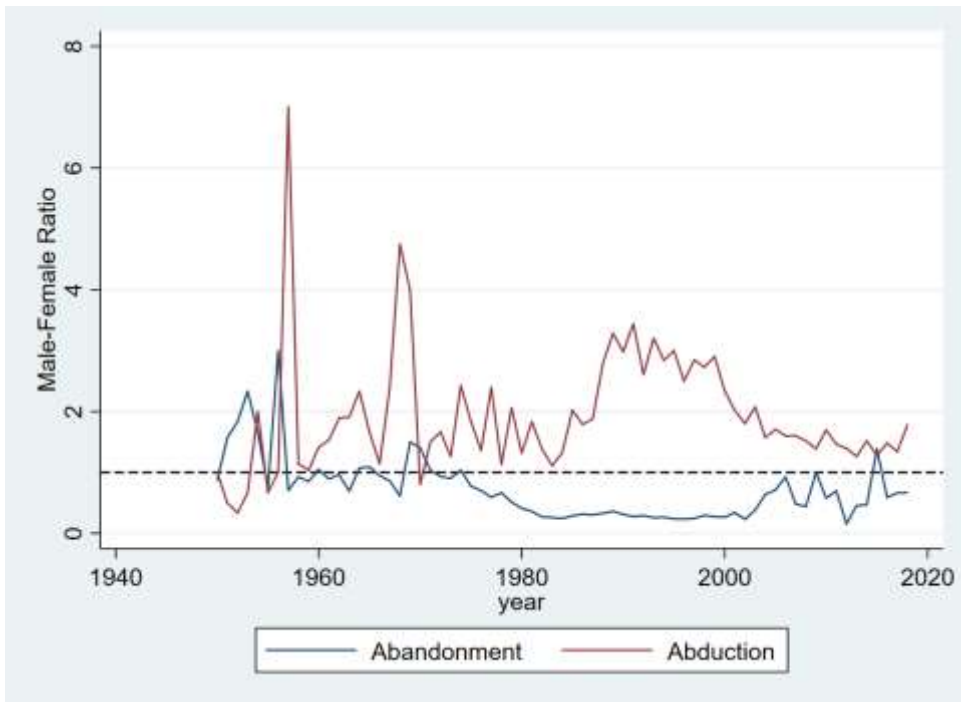Figure 7: Self-reported Child Abandonment and Child Abduction, by Age

Figure 8: Gender Ratio of Self-reported Missing Children, by Year

Online Appendix

Table A1: Child Abandonment, Fine and Heterogeneities (1988-2001)

	(1)	(2)	(3)
Local fine	0.27***	0.25*	0.036
	(0.092)	(0.14)	(0.81)
Fine in 1st-order neighbor	0.11	0.11	0.30
	(0.23)	(0.23)	(0.32)
Local fine* D(capital city)	0.26		
	(0.34)		
Local fine * urban pop rate		0.15	
		(0.30)	
Local fine *ln per capita GDP			0.039
			(0.097)
Observations	3,461	3,461	2,745
R-squared	0.721	0.721	0.734
prefFE	Y	Y	Y
yearFE	Y	Y	Y
preftrend	Y	Y	Y

Notes: The dependent variable is total children abandonment during 1988-2001. All regressions control for the logarithm of population density and the logarithm of arrests. Standard errors are in parentheses. We cluster errors at the prefecture level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

— Type: family looking for child   寻亲类别： 家寻宝贝

— ID:18081   寻亲编号： 18081

— Name: 姓　名： 曾温

— Gender: Male   性　别： 男

— Birth Date: 1988/07/06   出生日期： 1988年07月06日

— Height when lost: about 80cm   失踪时身高： 80厘米左右

— Lost Date: 1991/2/20   失踪时间： 1991年02月20日

— Residence of the lost person   失踪人所在地：

— Lost location: Guangdong Chaoshan   失踪地点： 广东潮汕地区

— Descriptions: 寻亲者特征描述： 额头上的头发偏个偏，头发有点卷，左脚大拇指有点上翘。5周岁脑袋头有点齐，圆脸，走时穿的时候衣绵裤。

— Other info   其他资料： （玲珑跟进）

— Registration date   注册时间： 2010/5/23 22:18:40

— Follow-up volunteer   跟进志愿者： 玲珑

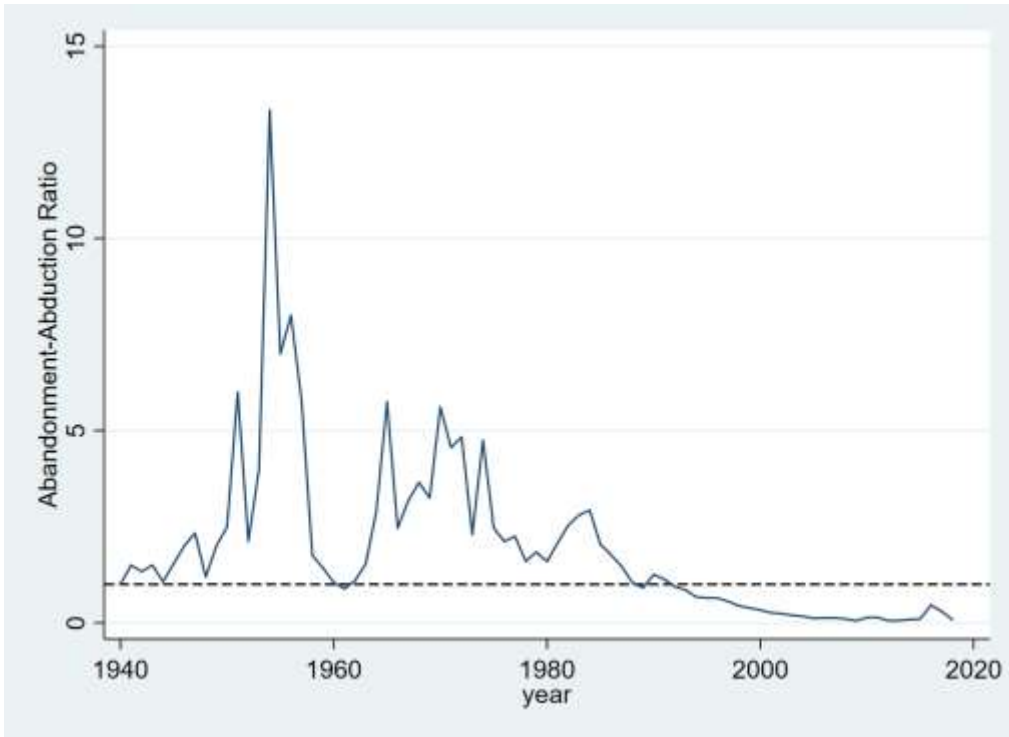Figure A1: Example of Missing Child Case Reported to BCBH

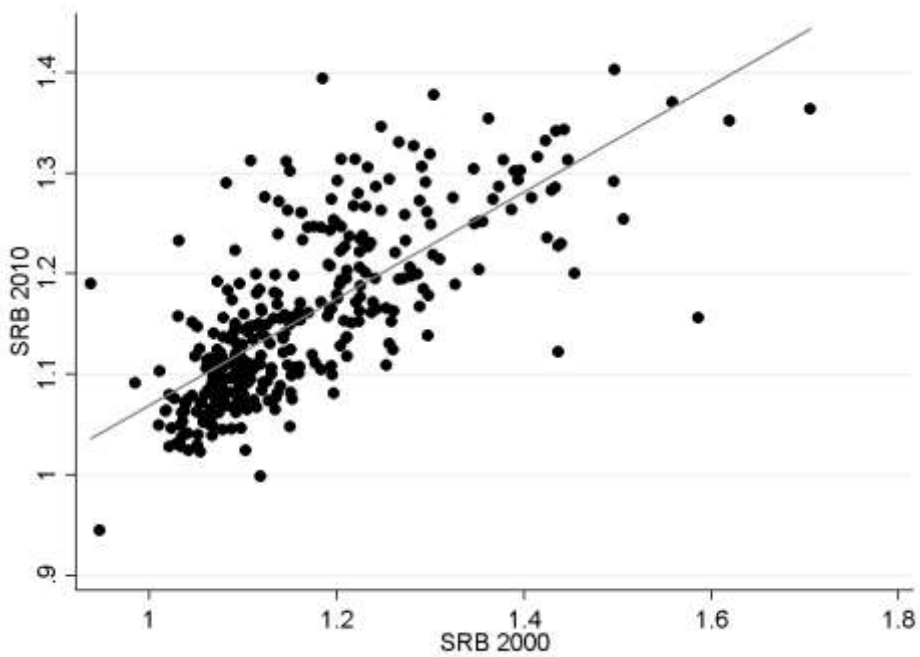Figure A2: Ratio of Abandonment/Abduction Based on Self-reported Cases of Missing Children

Figure A3: Sex Ratio at Birth in Chinese Prefectures: 2000-2010