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Arrival of Young Talents: The Send-down Movement and Rural Education in China *

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Abstract

This paper studies human-capital spillovers and its persistence by exploiting a unique event in modern China—the send-down movement. From 1962 to 1979, the Chinese central government mandated the temporary resettlement of roughly 18 million urban youths to rural areas across the country. The movement's coercive features, together with strict restrictions on migration during that period, provide an ideal natural experiment to identify the causal impact of the better-educated sent-down youths (SDYs) on the less-educated local rural residents. Using a county-level dataset compiled from over 3,000 book-length local gazetteers and micro-level population censuses, we find that a greater exposure to SDYs significantly increased local residents' educational achievement. Our estimate shows that the unintended gain of rural education almost compensated the loss in urban China due to the educational disruption during the Cultural Revolution. The positive effect gradually declined as SDYs started to return to their urban homes in the late 1970s, but it never dropped to zero, indicating the persistence of human-capital spillovers. We also find suggestive evidence that the arrival of young talents reshapes the attitudes of local residents toward education.

Keywords: Send-down Movement, Rural Education, Human-capital Spillovers

JEL code: I25, J24, N35, O15, R23

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1 Introduction

The concept of human-capital spillovers plays an important role in the theory of economic growth (Lucas 1988) and in the design of education policies. Large public investment in education is rationalized by the positive externality of human capital, and its optimal amount is determined by social returns to human capital instead of private returns.

However, convincingly identifying human-capital spillovers encounters several econometric challenges. First, the location of human capital is generally subject to self-selection—people endogenously choose where to reside according to their different personal characteristics. Second, even if the human capital stock in a locality changes exogenously, spatial equilibrium makes it difficult to pin down the local impact, especially when internal migration is prevalent (Lange and Topel 2006). Third, a person in a locality can affect other people not only through human-capital spillovers, but also through the labor market. As shown in Ciccone and Peri (2006) and Iranzo and Peri (2009), the inflow of high-skill workers can increase the wage of low-skill workers even without raising their productivity if the two types of workers are not perfect substitutes.

Simultaneously solving these three challenges is no easy task. Rauch (1993)'s first attempt to estimate the human capital externalities used a Mincerian approach, which regressed individual outcomes (e.g., wage) on local-average human capital after controlling for private human capital, but he did not account for the endogenous location of human capital. Follow-up studies, including Acemoglu and Angrist (2001) and Moretti (2004), used different instrumental variables for state/city average human capital to overcome the endogeneity problem.[1] However, the issue of spatial equilibrium still exists. Acemoglu and Angrist (2001) conceded that a drawback to their approach is "that it does not necessarily eliminate bias from state-specific wage shocks if there is substantial interstate migration in response."[2]

We attempt to estimate human-capital spillovers and understand its persistence by exploiting a unique event in modern China—the send-down movement of the early 1960s to the late 1970s.[3]

[1] Acemoglu and Angrist (2001) applied variation in compulsory schooling laws in each state over time as an instrument for state-average years of education. Moretti (2004) used the (lagged) city demographic structure and the presence of a land-grant college in a city as instruments for the share of college graduates.

[2] The approach investigating the effect of state/city-average human capital implicitly treats each state/city as separate economies. This is a strong assumption if internal migration exists. Lange and Topel (2006) found, when replicating the work of Rauch (1993), Acemoglu and Angrist (2001), and Moretti (2004), that the association between aggregate wages and schooling declines substantially if spatial equilibrium is considered.

[3] The send-down movement is also known as "going up to the mountains and down to the villages" (*shangshan xiaxiang*), or the "rustication movement."

From 1962 to 1979, the central government mandated the temporary resettlement of roughly 18 million urban youth to rural areas. These urban youth, typically junior and senior high school graduates, were called "educated youth" or "sent-down youth" (which we will refer to as "SDY"). The villages to which SDYs were relocated were very poor rural areas in which most children barely completed primary school.[4] Moreover, the quality of education facilities in rural China was generally low. Therefore, the sent-down urban youths were well-educated compared with local rural residents.[5] After the decease of Mao in 1976, the movement quickly came to an end: most SDYs had returned to urban areas by the 1980s. The central question regarding human-capital spillovers is: how did the arrival of better-educated SDYs bring positive spillovers to poorly-educated rural residents? We are interested in the impact on rural residents who directly interacted with SDYs during the movement and in the persistent impact after SDYs returned to their urban homes after the movement's end.

The movement had three unique features that nicely solve the three identification challenges mentioned above. First, the resettlement was mandatory and was organized in a top-down manner.[6] Urban youths could neither choose whether nor where to go. If one refused to take part in the program, they could be accused of opposing the great strategy of Chairman Mao (Pan 2002), which would have resulted in severe consequences back then. Second, migration was highly restrictive in China at that time because of the household registration system (*hukou*). The 1958 codification of the household registration system decreed that all internal migration be subject to approval by the local government. Finally, China was a planned economy during the 1960s and 1970s. Therefore, there was no labor market during the send-down period. After the Chinese government initiated its market-oriented reform in the 1980s, the majority of SDYs had returned to the urban areas. Therefore, SDYs were unlikely to have affected the local residents through

[4]According to the 1990 China's Population Census, 38.4% of rural people born between 1946 and 1955 (the control group we will refer to in our later analysis) either received no schooling or did not complete primary school; 41.1% were primary school graduates; and only 4.0% pursued education beyond junior high school.

[5]In addition to recent graduates, the rustication program also included government cadres, professionals, workers, and jobless city dwellers (Pan 2003). Those people were also generally better educated when compared with rural residents.

[6]The mandatory feature of the movement does not necessarily imply random assignment. Strictly speaking, in this context, the word "mandatory" means that neither urban youths nor lower-level government could influence the flow of SDYs. The central government guided the cross-province relocation of educated youths and provincial governments had some discretion over the within-province arrangement. The county-level governments had little control over how many SDYs to receive because the quota was determined by the upper-level government; they could only decide which villages to send the SDYs within the county. However, the mandatory feature and the top-down organization do not rule out the possibility that upper-level government may have had some strategic considerations when assigning the SDYs. We will formally address this possibility in our later analysis.

the labor market.

To understand the human-capital spillovers from the better-educated SDYs to the less-educated locals, we manually compiled a county-level dataset from over 3,000 book-length local gazetteers on the number of SDYs received by each county. We combined the county-level data with the individual-level population census data to evaluate how rural children's exposure to those better-educated urban youth affected their educational attainment. Our identification stemmed from two sources. First, different counties received different numbers of SDYs during the movement. Second, within the same county, children of different cohorts were exposed differently depending on how their schooling years overlapped with the movement. Empirical results suggest that the arrival of SDYs significantly increased local rural children's years of schooling. According to our estimate, the spillovers of SDYs resulted in a 13.5 million increase in person-years of schooling in rural areas, compensating for almost the entire loss of education in cities as a negative consequence of the Cultural Revolution. The effect is larger among less-educated groups (girls and less-developed counties), suggesting that SDYs not only raised the overall level of rural education, but also reduced education inequality. The heterogeneous impacts also indicate that the human-capital spillovers are proportional to the knowledge gaps. After the movement's end, the SDYs gradually left the countryside and the spillovers declined but they never dropped to zero. This finding indicates that the temporary settlement of educated can have a long-lasting effect on the locality, suggesting the persistence of human-capital spillovers. Additionally, human-capital spillovers can take not only the form of knowledge transmission, but also those of values and culture diffusion. More exposed local incumbents have more internal locus of control (LOC) reflecting their belief that the outcomes of behavior are under their control (internal) as opposed to the control of the environment (external). More specifically, we find suggestive evidence that rural residents hold a more positive attitude toward education and are less likely to believe their fates are pre-determined by family background.

Our study speaks to two strands of literature. The first strand estimates human-capital spillovers and their persistence. Two recent studies most closely related to ours are Wantchekon, Klašnja, and Novta (2014) and Rocha, Ferraz, and Soares (2017). Wantchekon, Klašnja, and Novta (2014) tracked down the first students in regional schools in colonial Benin in the early twentieth century. They found large village-level human-capital externalities as the descendants of the uneducated in villages with schools performed better than those in villages without schools.

The exogenous shock in their study originated from the establishment of colonial schools. Rocha, Ferraz, and Soares (2017) studied the persistent effect of state-sponsored settlements located in the Brazilian state of São Paulo in the late nineteenth and early twentieth centuries, which attracted immigrants with higher levels of schooling. The authors found that the initial shock persisted all the way up to the year 2000; municipalities that had received state-sponsored settlement had higher average education and income. There are also studies estimating how the flow of scientists affects the productivity of their former colleagues (Waldinger 2012), students (Waldinger 2010), and incumbent scientists (Borjas and Doran 2012; Moser, Voena, and Waldinger 2014). The flows were driven by historical events, such as scientists who left Germany during the Nazi era (Waldinger 2010; Waldinger 2012; Moser, Voena, and Waldinger 2014) and the influx of Soviet mathematicians to the United States after its collapse (Borjas and Doran 2012). The findings are quite mixed, however.[7]

The resettlement program that our study focuses on is different from the existing literature of human-capital spillovers in several ways. First, the scale of the resettlement in China's send-down movement is simply remarkable and probably unprecedented in human history. About 18 million educated urban youth were sent down to villages across the country, and the rural children potentially benefiting from the human-capital spillovers brought by SDYs were about 245 million.[8] Second, the resettlement of SDYs was mandatory, as opposed to voluntary immigrants to Brazil (Rocha, Ferraz, and Soares 2017) and semi-voluntary scientists to the United States (Borjas and Doran 2012; Moser, Voena, and Waldinger 2014).[9] Furthermore, the main motivation for the send-down movement was not to target on rural education but to solve severe unemployment in urban China and SDYs were supposed to do farming in the countryside. Therefore, the improvement in rural education came as an unintended consequence of the movement. As a comparison, regional schools in colonial Benin were built for the purpose of education (Wantchekon, Klašnja, and Novta 2014) and the state-sponsored settlement policy in Brazil was designed to attract high-

[7] A strong positive spillover among scientists who directly collaborate with each other exists (Waldinger 2010) while the spillovers seem to be negligible or even negative among scientists not directly related (Borjas and Doran 2012; Waldinger 2012; Moser, Voena, and Waldinger 2014). The negative spillovers are often explained by the competition for limited academic resources.

[8] According to the 1982 China's Population Census, the population size of rural children born between 1956 and 1969 (the treatment group we will refer to in our later analysis) is 245 million.

[9] "Semi-voluntary" means that although the departure from the home country was involuntary, the destination country was still their decision. In contrast, during the send-down movement, the urban youths could not decide whether or where to go.

skill immigrants (Rocha, Ferraz, and Soares 2017). Third, the resettlement was temporary and most SDYs eventually returned to their urban homes. This unique feature helps us exclude the mechanical effect of the resettlement in changing the educational composition of rural residents and make a cleaner estimation of the persistent effect after SDYs left the countryside.

The second strand of literature focuses on China's send-down program. A large literature investigates how the send-down experience affected the long-term characteristics of SDYs themselves, including marriage (Song and Zheng 2016), education (Meng and Gregory 2002; Xie, Jiang, and Greenman 2008; Zhou 2014), income (Xie, Jiang, and Greenman 2008; Yang and Li 2011), inter vivos transfer (Li, Rosenzweig, and Zhang 2010), subjective wellbeing (Wang and Zhou 2017), political attitudes (Harmel and Yeh 2016), beliefs and values (Gong, Lu, and Xie 2015), financial behavior (Fan 2017), and entire life course (Zhou and Hou 1999). However, the impact of SDYs on the rural areas that accepted them, in which over 80% of the Chinese population lived during the 1960s, remains understudied. Kinnan, Wang, and Wang (2018) are among the first to explore the program's effect on destination regions. They found that temporary migration due to the program created lasting inter-province links, which resulted in increased access to migration decades after the program ended. Xing and Zhou (2018) provided evidence that SDYs became familiar to the residents living in their sent down regions. Henceforth, bilateral trust and trade between the source province and the destination province increased. Both Kinnan, Wang, and Wang (2018) and Xing and Zhou (2018) examined the inter-province flow of SDYs.

Our study contributes to the literature of send-down program in two ways. First and foremost, we uncovered the human-capital spillovers (as well as the persistence) from SDYs to poorly-educated rural locals, which is a new perspective. We found exposure to better-educated SDYs not only raised the overall level of rural education, but also reduced education inequality. The fact helps us to understand and evaluate the lasting impact of this historical event occurring fifty years ago on current human capital stock of rural people. Heckman and Yi (2014) and Heckman and Feng (2018) found that a large stock of medium-skill labor (with primary or secondary education) acquired before China's market-oriented reform had fueled its rapid economic growth in the past 40 years. Second, our data go further down to the county-level and also includes the intra-province flow of SDYs, which account for 92.1% of total SDYs (Table 1).

The remainder of this paper is organized as follows. Section 2 briefly reviews the relevant institutional background. In Section 3, we introduce the dataset used in this study and discuss

the econometric set-ups. Section 4 reports the main result: how exposure to SDYs affects the education attainment of rural residents. Section 5 discusses the effect on values and Section 6 presents the lasting impact of SDYs even after they left the countryside. Section 7 concludes.

2 Institutional Background

This section provides a brief overview of the send-down movement. We concentrate on the institutional details most relevant to SDYs' human-capital spillovers. The first subsection reviews the timeline of the movement. The remaining subsections answer two questions: where were SDYs sent? What did they do in rural China? These are important questions for understanding the exogeneity of the SDY flows and their possible spillovers in the destination counties.

2.1 Send-Down Movement: A Brief History

The send-down movement began in 1953, reached its height during the Cultural Revolution (1966–1976), and ended only in 1980. Chairman Mao Zedong commented in December 1955 that "*All those intellectuals who can go to the countryside should go there happily. The countryside is a vast universe where there is plenty to be done.*" Before 1966, the program operated on a smaller-scale, and the participation was technically voluntary. Between 1962 and 1966, the rustication program sent an estimated 1.29 million urban youths to the countryside (Bernstein 1977).

With the outbreak of the Cultural Revolution in 1966, the movement entered a new stage in which over 16 million urban youths were mandatorily sent to the countryside against their will. Three motivations drove the massive send-down movement. First, students could not continue their education due to severe disruptions in educational institutions' operations, especially in the early years of the Cultural Revolution. All schools were shut down for two to three years at the beginning of the Cultural Revolution and college entrance exams were suspended for 11 years. Second, unemployment soared in the urban areas. China's economy suffered greatly: its industry output fell by 13.8% in 1967 and 4.2% in 1968. With the national-wide turmoil, fresh graduates found it almost impossible to find jobs in urban areas, which were previously assigned by the government. As a result, urban students who graduated during the years 1966–1968 had neither opportunities for continuing education nor employment. "Going up to the mountains and down to the villages" became their only option. The third motivation was to discharge the Red Guards

and to end chaos in urban areas. The Red Guards was formed by teenagers, most of whom were junior or senior high school students. The Red Guards were used as a political weapon to fight those opposed to Mao's policies during the first few years of the Cultural Revolution. However, the revolution spiraled out of control and turned into "red terror." To resolve the violence, Chairman Mao issued instructions to send millions of urban youth down to the countryside for "re-education." The large-scale send-down movement was made official in December 1968 when Chairman Mao stated in a speech that "*It is very necessary for the urban educated youth to go to the countryside to be re-educated by the poor farmers!*" (*People's Daily* 22 December 1968). Figure 1 shows that approximately 4.7 million urban youth were sent down in the three years from 1967 to 1969. After three years' intensive mobilization, the government allowed a larger proportion of urban graduates to enter the urban labor force. A second peak in the movement occurred in 1974, one year after the National Work Conference on Educated Youth, which re-emphasized the political importance of the movement.

There is ample anecdotal evidence that most SDYs at the time were reluctant to go. The reason is simple: the *hukou* system categorized people into urban or rural based on their parents' place of origin and directly tied social welfare to their *hukou* status. And, it has been well documented that urban *hukou* holders enjoyed significantly better social welfare (Bian 2002; Wu and Treiman 2004). However, they were overwhelmed by the severe social pressure on participating in the movement (Bernstein 1977; Unger 1979; Gold 1980; Chen and Cheng 1999; Zhou and Hou 1999). During that period, the movement was no longer just an economy issue of trying to alleviate the urban unemployment. It became more of a political issue. People belonging to the "red class"[10] wanted to show their loyalty to Mao, even if that meant rustication. Yet, youth in the "black classes" had no employment opportunity in urban areas and they also wanted to seize the opportunity to make a break from their parents' class (Pan 2003).

After Chairman Mao's death in September 1976, the ideological impetus to continue the program vanished gradually. In 1978, the new central leadership began to consider ending the program. The year 1978 also witnessed a sudden decline in sending-down rusticated youths (Figure 1). Meanwhile, large-scale protests from the SDYs began because they wanted to return home.

[10]During the Cultural Revolution, households were categorized according to their political identities. There were "five red classes" and "five black classes" (*wuhong wuhei*). Five red classes include: revolutionary cadre, revolutionary soldier, revolutionary martyr, worker, and poor & lower-middle peasant. Five black classes include: landlord & rich peasant, counter-revolutionaries, bad elements, rightists, and capitalists.

The protests started in Yunnan province in late 1978 and quickly spread to Xinjiang, Shanghai, and other places (Deng 1993). Eventually, in September 1980, the central government decided to discontinue the movement (Gu 2009). Most SDYs returned to urban areas afterward. Only approximately 5 percent of SDYs never returned home because they were married to local farmers or were assigned nonagricultural local jobs (Liu et al. 1995).

2.2 The Flow of the SDYs

Table 1 summarizes the total number of SDYs sent and accepted by each province. Most were reallocated within the province and only 7.9% (1.4 million) were sent outside the province. This implies that the inter-province flow of SDYs, which is highlighted in the studies of Kinnan, Wang, and Wang (2018) and Xing and Zhou (2018), account for only a small part of the movement. Among the 1.4 million inter-province SDYs, three municipalities—Beijing, Tianjin, and Shanghai—contributed 87.3% of the total (or 0.87 million). This fact signals that youths in more-developed urban areas were more likely to get involved in the rustication program and had a higher chance to be sent far away. One justification for such a design is that those cities were more urbanized and lacked the rural lands needed to absorb all urban youths in the locality.

Rusticated urban youths from the same places could be sent to vastly different places across the entire country. Some urban youths were sent to rural areas near their home city. But others, especially those from large cities, were sent to other provinces, sometimes thousands of kilometers away.[11] The destination of the SDYs was also partially related to military purposes because of China's intense foreign policy relationships with the Soviet Union, Mongolia, and Vietnam from the late 1960s to early 1970s. From Table 1, we see that the four border provinces—Inner Mongolia, Heilongjiang, Yunnan, and Xinjiang—received 0.75 million from the 1.42 million (53%) inter-province relocated SDYs. Many SDYs worked in army farms on the frontiers (Shi and He 1996). In addition to the border provinces, two other types of provinces also received many inter-province SDYs: (1) major grain-producing provinces (Anhui, Sichuan, Jiangsu, and Hunan) and (2) old liberated provinces (Shannxi and Jiangxi). The former secured the food need of the extra population and the latter served the purpose of political re-education. To the best of our

[11] For example, 0.72 million out of 1.26 million Shanghai SDYs were sent outside Shanghai. Among those SDYs, some were sent to provinces close to Shanghai (e.g., 150 thousand were sent to Anhui, a province about 300 kilometers away), while others were sent very far away, such as Yunnan (60 thousand, 4,000 kilometers away), Heilongjiang (170 thousand, 1,700 kilometers away), and Xinjiang (100 thousand, 3,900 kilometers away) (Gu 2009).

knowledge, improving education in rural China was not among the initiatives for relocating SDYs.

One important feature of the movement is that neither the urban youth nor the county-level government could determine the flow of SDYs.[12] Both the send-down quota and the destination counties of the urban youths were planned by the central or provincial government in a top-down manner (Bernstein 1977; Pan 2002). Therefore, coerciveness not only applied to the rusticated youth, but also to the counties that received them. At an early stage of the movement, the locals in the countryside often refused to accept those educated youths because they were viewed as a burden—the SDYs could not farm well but still consumed the farmer's food. This situation changed in 1968. In his 1968 speech, Chairman Mao highlighted the importance of "re-education" to the urban youth and emphasized that to the locals that "*the comrades in the countryside should welcome them.*" As a consequence, accepting the assigned SDYs became an important political task, making it difficult for local government to refuse.[13]

2.3 What did SDYs do in Rural China?

There were three major approaches to SDY resettlement: to rural villages (also known as *chadui*), to collective farms, and to state farms (see Figure 1). Rural villages absorbed most SDYs (12.8 million out of 17.7 million). Two million SDYs were sent to collective farms and 2.9 million were sent to state farms (Gu 2009). During that period, agricultural production in rural villages took the form of production teams (*shengchandui*). In the production teams, people earned "work points" according to their amount of farming work. The production team shared food and income according to the work points at the end of the year.

Life was hard for the SDYs because they grew up in urban areas and had never before worked as farmers. SDYs could barely earn enough work points to feed themselves because they lacked experience in the agricultural production. Chen and Cheng (1999) wrote that "*To many urban youth, including us, the send-down episode remains among the most difficult experiences in our lives—we suffered from a lack of material supplies, removal from our families, an unfamiliar*

[12] In the circumstance when not all middle school graduate needed to be sent down and a household had multiple age-eligible children, parents could choose which child to send, as described in Li, Rosenzweig, and Zhang (2010). Using a twin sample, they found that parents selected children with lower endowments. Such selection may have attenuated the human-capital spillovers in the countryside.

[13] Another change after 1968 was that the central government started to distribute a settlement allowance for each sent-down youth to their destinations. The purpose of the settlement allowance was to build residences for SDYs and to purchase their farming tools. However, the per-youth amount was small and could barely meet the needs of SDYs. It was unlikely that the allowance would have been spared to improve local education.

environment, harsh physical labor, and so on." In contrast, the SDYs were much better educated than rural residents.[14] Given such reality, SDYs started to be assigned more technical jobs instead of traditional farming jobs. According to a report published by the Office of Educated Youth (*zhiqingban*) under the State Council titled "Summary of the National Sent-Down-Youth from 1962 to 1972," approximately 11.7% of the SDYs were assigned more technical jobs from 1962 to 1972. The share grew steadily during the rustication movement. Liu (2009) documented that in Spring 1976, Huaide county in Jilin province reported that 7,000 SDYs were taking cultural or technical jobs, accounting for 70% of total SDYs in that county. Gu (2009) documented that in 1975, 32,421 SDYs in Jilin province worked as study counselors, agricultural technicians, bare-foot doctors, community school teachers, et al.. Moreover, many SDYs grew into local leaders. The Office of Educated Youth's 1981 report showed that in 1974, 4.3% of SDYs worked as cadres at various levels.

To summarize, the SDYs were not simply inferior manual labors working on farms. They bridged urban and rural areas by taking non-agricultural jobs, which at the time were less prevalent in rural China. They exerted externalities onto the local residents by bringing with them new techniques, knowledge, and ideologies from urban China. Kinnan, Wang, and Wang (2018)'s and Xing and Zhou (2018)'s studies confirm that the SDYs flow created long-lasting connections between SDY source and destination provinces. Moreover, the fact that many SDYs were originally expected to do farming but ended up in non-agricultural jobs supports our argument that improving education in rural China was an unintended consequence of the movement.

3 Data and Empirical Strategy

Understanding human-capital spillovers of the better-educated SDYs' flow on the poorly-educated local rural population requires two sets of information about the SDYs and the rural residents. From over 3,000 book-length local gazetteers, we constructed a unique county-level dataset on the number of received SDYs during the rustication movement. We then matched the county-level information on SDYs to various micro-level survey data. The main outcome variable came from

[14]Based on our calculation from the 2010 wave of China Family Panel Study (CFPS), 73.3% of SDYs had completed junior high education and 28.3% had completed senior high education by the time they were sent to the countryside. As a comparison, the numbers for the rural residents of the same cohort were only 23.2% and 4.0%, respectively.

the 1990 population census.

3.1 Local Gazetteers

Information on the number of received SDYs at the county level came from local gazetteers (*xianzhi*), book-length volumes of local history documenting the country's major events. Therefore, it is often regarded as a locality's "encyclopedia." Most local governments pay great attention to the compilation of local gazetteers and update them periodically because they are viewed as a type of local pride. Often, a committee composed of dozens of members will be in charge. The gazetteers we collected were mostly published in the 1990s and 2000s. We focused on information related to SDYs. For example, local gazetteers of Taihu county in Anhui province documented that

> "*From 1968 to 1977, we received 3,697 educated-youth from Shanghai, Hebei, Anqing, and urban areas within the county. Among them, 366 came from Shanghai, 1,596 were from Anqing, 1,498 were local, 237 were from Hefei and other places.*"

From above description, we collected the total number of SDYs received by each county from 1968 to 1977.[15] We divided the county-level received SDYs by its population in 1964, which was obtained from the second population census, to generate the density of SDYs. We chose 1964 because it was the only year in the 1960s in which county-level population was available. And, since 1964 came before the Cultural Revolution and the massive rustication program, the 1964 county-level population is unlikely to be reversely affected by the flow of SDYs.

We manually collected 3,153 gazetteers for all 2,868 county-level divisions in China.[16,17] We excluded 52 urban counties/districts in Beijing, Tianjin, and Shanghai and dropped 602 city-governed districts (*shixiaqu*) in other provinces because those districts were more developed areas and the source of rusticated urban youths. We were interested in the destination rural areas that received SDYs in this study. We found information on SDYs for 1,845 counties out of the

[15] Ideally, we wish to have the stock of SDYs in each year. Such details of documentation are not available. Therefore, we should interpret those numbers as the proxy for average stock in the locality from 1968 to 1977.

[16] Two reasons explain why the number of gazetteers exceeded that of counties. First, there may be multiple gazetteers for the same county on different topics. Second, some counties compiled one gazetteer during the 1990s and another during the 2000s.

[17] We cross-verified our data from the local gazetteers with seven volumes of "Sent-Down Movement Historical Data Collection" (Jin and Jin 2015). We noticed that Jin and Jin (2015) missed 171 counties in their compilation.

remaining 2,092 counties (88.2%).[18] Figure 2 illustrates the regional variation in the number of received SDYs in those counties.

Scholarly concerns may be raised regarding the accuracy of the numbers of SDYs in local gazetteers. We argue that the numbers are generally trustworthy for the following reasons. When the local gazetteers were compiled, the send-down movement was not a sensitive topic, as opposed to more politically sensitive topics, such as local fatalities during the Great Famine and victims during the Cultural Revolution.[19] Interestingly, there are no official statistics from the Chinese government about the fatalities for either the Great Famine or the Cultural Revolution. In contrast, numerous official documents about the send-down movement exist (see Gu (2009) for a comprehensive collection). More importantly, under Chairman Mao's instructions in December 1968 that "*the comrades in the countryside should welcome them,*" receiving those SDYs became an important political task. Therefore, the local government usually kept a good record of how many urban youth they received during the movement.

To provide further evidence on the quality of information related to SDYs, we made comparisons among three sources of data: our county-level data, national reports documented in Gu (2009) and estimates from the 2010 wave of the China Family Panel Study (CFPS).[20] Figure 3 compares the time series of nationally reported numbers and those of CFPS estimates. It is evident that CFPS cannot only match well the size of sent-down population, but also mimic the temporal fluctuations. This result lends credibility to national reports on the send-down movement. In Table 2, we compare our county-aggregation at the province level to those from a national report, which is documented in Gu (2009). The ratio varies from 60%–80% for most provinces. Three reasons can account for the gap. First, national statistics covers a longer time span than the county-aggregate (1962–1979 versus 1968–1977, respectively). If we consider the differential length in time span, the ratio becomes 72%–96%. Moreover, provinces that first started receiving SDYs would be more affected. For example, Heilongjiang and Xinjiang were among the first to receive SDYs because they were thinly populated areas with large unreclaimed arable land (Zhang

[18] When matching to the 1990 population census, we further lost 96 counties because of county merges or splits. In those scenarios, we could not uniquely link counties when the gazetteers were compiled to counties in the 1960s.

[19] The current President of China, Xi Jinping, is also a sent-down-youth. In 2017, he published a book titled "Xi Jinping's Seven Years as Educated Youth," suggesting the send-down movement is an open topic in China.

[20] CFPS provides sample weight, which can be interpreted as the number population each observation can represent, to allow for the national representativeness. Therefore, summing up the sample weight of the observations who report to be sent down yields an estimate for the number of SDYs.

1986). Second, the local gazetteers only cover SDYs received by the rural villages, which means that 2.9 million out of 17.7 million SDYs who were sent to state farms during the movement were not recorded in local gazetteers. State farms did not distribute evenly across the country. The largest army farm organization was the Xinjiang Production and Construction Army Group (*Xinjiang Jianshe Bingtuan*). We verified that the local gazetteers in Xinjiang province did not count those SDYs. Heilongjiang also had many state farms because of the intense relationship between China and the Soviet Union during the 1960s. The SDYs sent to state farms were separately recorded in the farm chronicles (*nongchangzhi*). These factors explain why the ratios are especially low in Xinjiang (42%) and Heilongjiang (26.5%). The third reason is that we excluded more-developed city-governed districts.

3.2 Population Census

We use the 1% sample from the 1990 China's Population Census (census 1990 hereafter) to evaluate how rural individuals' exposure to the SDYs affected their educational outcomes. As previously mentioned, most rural children finished primary education at best. Therefore, we define individuals' exposure according to whether their primary schooling years overlapped with the massive send-down movement. We focus on cohorts born between 1946 and 1969. Among them, we define the 1956–1969 cohorts as the treatment group and the 1946–1955 cohorts as the control group. Cohort 1956 was the first affected cohort because they were supposed to be at their fifth year of primary school in 1968, the year when the massive rustication movement began. Cohort 1969 is the last affected cohort because they started their primary education in 1976. Starting in 1977, the SDYs gradually returned to the urban areas. Three rationales make census 1990 suitable for this study. First, most affected cohorts should have completed their education by 1990. Earlier censuses do not satisfy this condition. An earlier population census took place in 1982. In that year, the youngest cohort in our analysis (born in 1969) was only aged 13, too young for an analysis of educational outcome. Second, using data in 1990 naturally rules out a mechanical effect that better-educated SDYs were categorized as rural residents during their sent-down period. By the year 1990, most SDYs had returned to their urban homes.[21] Third, migration was still limited in scope in 1990. Migration can threaten our identification if people

[21]It is true that approximately 5% of SDYs stayed in the countryside permanently (Liu et al. 1995). However, 5% of 18 million SDYs is a trivial number when compared with over 900 million rural population in 1990.

were not living in the same county when they were students. China's mass migration had not yet started in 1990. The migrant size grew rapidly during the 1990s because of the huge demand for unskilled labor as a result of the influx of foreign direct investment into China's coastal areas. The government also loosened its control over rural–urban migration during the 1990s (Meng 2014). The number of migrants in China rose from 22.6 million in 1990 to 78.8 million in 2000 (Fan 2008) and to a further 242.2 million in 2010 (National Bureau of Statistics of China 2011).

We coded our key dependent variable—years of education—according to the highest level of received education and the completion status. The completion status was very informative at that time. Before the enforcement of China's Compulsory Education Law in 1986, dropouts were prevalent in rural China. In our sample, 13.8% of those who attended primary school did not complete it. The rate is even higher for higher-level education. We assume that people received six years of education if they graduated from a primary school. If they dropped out of primary school, we coded the number to 3. We coded higher-level schooling years in a similar fashion.[22] We also used dummy variables indicating whether people completed primary/junior high education as alternative measures of educational outcomes.

We combined the census data with the county-level data on SDYs and excluded migrants who do not live in their *hukou* registration county/prefecture. Our key dependent variable (education) comes from the 1990 census, and the send-down movement took place in the 1960s and 1970s. Therefore, we implicitly presume people lived in the same county twenty years ago. This assumption is less likely to hold for the migrant sample. Note that the no-migrant restriction is much weaker for the rural sample in which the restriction only excludes 2.0% of the rural sample and 9.3% of the urban sample. Our final rural sample was 2,741,945 and the urban sample was 405,918 for cohorts 1956–1969. The rural sample is of primary interest, and the urban sample is for comparison purposes. Table 3 presents the summary statics of census 1990, which displays a huge rural–urban gap (column (1) versus column (2)) in educational attainment. The urban sample of our control cohorts (born between 1946 and 1955) on average received 8.9 years of schooling, but

[22]Note: this coding method is done to approximate the genuine years of education, which are difficult to compute precisely because of the historical shifts in China's education system. Prior to the outbreak of the Cultural Revolution in 1966, primary-secondary education generally took the form of 6-3-3, meaning six years of primary school, three years of junior high school, and three years of senior high school. The system was compressed to 5-2-2 during the Cultural Revolution and gradually restored to 6-3-3 after its end (Hannum 1999). In summary, if we observed a positive effect of SDYs on our imputed "years of education," we could interpret it as either a more advanced education level or higher probability of graduation.

their rural counterparts only receive 60% of that amount (5.4 years).

3.3 Empirical Strategy

Our identification strategy builds on two sources of variation. First, counties received different numbers of SDYs during the movement. Second, within the same county, children from different cohorts were exposed differently depending on how their schooling years overlapped with the movement. More specifically, our main estimating equation is the following (the control group is cohorts 1946–1955):

$$\text{Y_Edu}_{i,g,c,p} = \beta_0 + \beta_1 \%\text{SDY}_{c,p} \times I\left(1956 \leq g \leq 1969\right) + \beta_2 X_{i,g,c,p} + \lambda_c + \mu_{g,p} + \varepsilon_{i,g,c,p}, \qquad (1)$$

where $\text{Y_Edu}_{i,g,c,p}$ refers to the years of education of individual i of cohort g in county c of province p. $\%\text{SDY}_{c,p}$ is the density of received SDYs in county c during the movement, which is calculated as the ratio of received SDYs to the county population in 1964. $X_{i,g,c,p}$ is a vector of individual-level controls, including gender and ethnicity. λ_c are county fixed effects, which absorb all county-level characteristics invariant across time, for example, geography. $\mu_{g,p}$ are the province-cohort fixed effects, which allow different provinces to have different cohort trends. Standard errors are clustered at the county level.

The primary parameter of interest in this study is β_1 in front of $\%\text{SDY}_{c,p} \times I\left(1956 \leq g \leq 1969\right)$. Note that $\%\text{SDY}_{c,p}$ is included in the county fixed effects λ_c and $I\left(1956 \leq g \leq 1969\right)$ is included in the province-cohort fixed effects $\mu_{g,p}$. Therefore, equation (1) can be viewed as a difference-in-difference specification. By introducing province-cohort fixed effects, we not only make no assumption on the functional form of cohort trend, but also we allow the trend to be different across provinces.

Our estimation should be interpreted as a very conservative estimate of SDYs' human-capital spillovers for several reasons. First, we treated cohorts born between 1946 and 1955 as the control group. Even if they had passed the age of primary education, they could still have benefitted from those better-educated SDYs (e.g., went back to school if previously dropped out) or benefitted from their younger rural peers in the same village. We would underestimate the human-capital spillovers in this scenario. Second, our specification implicitly assumes that rural people who received their primary education from the 1960s to 1970s stayed in the same county when the 1990

population census took place. Although it is not a strong assumption given China's rigid household registration system,[23] it is true that the best-educated in rural areas are significantly more likely to migrate (Zhao 1997). Therefore, our specification is likely to miss those best-educated rural children who go beyond junior-high-school level and underestimates the human-capital spillovers.

4 Effect of SDYs on Rural Education

4.1 Main Results

Table 4 presents the main results of our paper. We separately report the rural sample and the urban sample. Ideally, we should divide our sample according to their *hukou* status in 1966. However, such information is not available in census 1990. Because the changes in *hukou* status are predominantly rural-to-urban, we can safely assume the rural sample in 1990 was also rural *hukou* in the 1960s. For completion purposes, we also report the results using the urban sample as a comparison.[24]

Table 4 column (1) shows that the SDYs have strong spillovers: local rural residents who were more exposed to SDYs ended up with more years of education. The coefficient is 2.884 and is positively significant. The average density of SDYs is 1.91% (191 SDYs per 10,000 locals). This implies that exposure to SDYs raises rural children's education by 0.055 years. The effect is not trivial, and the magnitude exceeds the effect of Compulsory Education Laws in the United States during the first half of the twentieth century.[25] Recall that the rustication movement was never targeted at improving the education in rural China, and our results only provide a lower-bound estimate. A different way of interpreting the magnitude is to compare it with the negative consequences of the Cultural Revolution in urban China. If we take the estimates from Meng and Zhao (2016), the Cultural Revolution decreased 13.8 million person-years of schooling

[23] According to the 1% sample from the 2000 China's Population Census, 86% of the rural people born between 1946 and 1969 lived in the same county as their birthplaces. Morover, 83.3% of these people (71.2% of the cohorts) did not move out of the township, a smaller administrative unit than a county. Those numbers should be even larger in 1990.

[24] It is tempting to use the urban sample as placebo tests. However, those results should be interpreted with caution. On one hand, those people might still be affected if they lived in rural areas during the rustication movement and the later moved to urban areas. On the other, we define cohorts born between 1946 and 1955 as the control group. However, urban cohorts could be the direct targets of the SDY movement and became affected.

[25] The estimates range from 0.025 to 0.05 (Angrist and Keueger 1991; Acemoglu and Angrist 2001; Lleras-Muney 2005).

in urban areas.[26,27] According to the 1982 population census, approximately 245 million of the rural population were affected by the arrival of SDYs according to our definition (cohorts 1956–1969). The spillovers of SDYs resulted in a 13.5 ($= 245 \times 0.055$) million increase in person-years of schooling in rural areas, compensating for almost the entire loss in urban China.

Table 4 columns (3) and (5) use completion of primary school/junior high school as alternative educational outcomes. Exposure to SDYs raises the probabilities of completing primary school by 0.71 ($= 0.371 \times 1.91\%$) percentage points and that of completing junior high school by 1.38 ($= 0.721 \times 1.91\%$) percentage points. Like our calculation above for years of education, those two numbers are not trivial if one considers that SDYs were affecting a much larger rural population. For every 100 SDYs accepted during the movement, the county would have 13.6 more primary school graduates and 26.4 more junior high graduates.[28] Columns (2), (4), and (6) present results using the urban sample; none show any sign of significance, confirming that SDYs only affected rural population in the destination counties.

Table A1 and A2 show that our main results are robust to a wide range of robustness checks, including (1) different bandwidth of treated cohorts, (2) allowing junior high school education to be affected by SDYs, (3) imposing stronger assumptions on migration, (4) excluding those who are likely to change their *hukou* status, and (5) possible measurement errors in number of received SDYs. Appendix A discusses the details.

Testing Common-trend Assumption

The most important assumption for a difference-in-difference specification is the common-trend assumption. Although we rule out all possible heterogenous trends at the province level by controlling for province-cohort dummies, we cannot eliminate the possibility heterogenous trends at the county level within the province exist. For example, less developed counties may have received more SDYs during the movement. Meanwhile, local education was improving faster, not

[26] Previous studies have generally reached a consensus that rural schooling was much less interrupted by the Cultural Revolution (Han 2000; Meng and Gregory 2002; Giles, Park, and Wang 2015; Meng and Zhao 2016).

[27] The number 13.8 million is calculated as follows. Meng and Zhao (2016) defined cohorts 1947–1963 as the affected group in urban areas. On average, their schooling years were interrupted for 2.87 years. They estimated that one year's interruption led to a 0.1 year reduction of completed years of schooling. Using census 1982, we estimate the size of urban population born between 1947 and 1963 at approximately 48.1 million. $48.1 \times 2.87 \times (-0.1) = -13.8$

[28] The calculation proceeds as follows. The total rural population belonging to our defined treatment group is approximately 245 million. During the movement, 12.8 million urban youths were sent to rural villages. $13.6 = \frac{0.71 \times 245}{12.8}, 26.4 = \frac{1.38 \times 245}{12.8}$

from more SDYs, but from law of convergence. To formally address this issue, we estimate the effects of SDYs on each cohort separately using the following equation (cohort 1941–1945 serves as the baseline):

$$\text{Y_Edu}_{i,g,c,p} = \beta_0 + \sum_{\gamma=1946}^{1969} \beta_{1,\gamma} \%\text{SDY}_{c,p} \times I\left(g = \gamma\right) + \beta_2 X_{i,g,c,p} + \lambda_c + \mu_{g,p} + \varepsilon_{i,g,c,p}. \quad (2)$$

Figure 4 Panel A plots the coefficient $\beta_{1,\gamma}$ for each cohort using census 1990. The dashed line shows the years of primary-school ages (7–12) that overlap with the period of massive send-down movement (years 1968–1977) for each cohort. The figure lends strong support to the common-trend assumption. The coefficients fluctuate around zero before cohort 1956, suggesting that after controlling for province-cohort dummies, there were no heterogenous cohort trends in education with regard to the share of SDYs prior to the rustication movement. The coefficients gradually become larger starting from cohort 1956 as later cohorts spent more primary-school years with SDYs. The effect then declines as the movement was ending and the SDYs were returning to their urban homes. This reversal also rules out the possibility that pre-existing heterogenous trends can explain our results—if such trends really exist, we should observe a steadily rising trend for those affected cohorts.

Persistence

A question that arises from the previous discussion is what happened after SDYs returned to urban areas? Would their impact simply vanish after they left the countryside? Using census 2000,[29] Figure 4 Panel B suggests it is not the case. The positive effect gradually declined as SDYs started returning to their urban homes in 1978. But the effect never dropped to zero, revealing the persistence of human-capital spillovers. Note that the persistence was too large to be explained by the 5% of SDYs who permanently stayed in rural areas. The magnitude of persistent effects after cohort 1970 is approximately 1/4–1/3 of the peak. We will present more related evidence in our later analysis and discuss the possible sources of persistence at the end of Section 6.

[29] Many of cohorts born after 1970 had not completed their education by 1990. Therefore, we use the census 2000 data in Figure 4 Panel B to estimate the effects of SDYs on those younger cohorts.

Heterogeneity

Table 5 estimates the heterogenous effect of SDYs on locals by gender (male versus female, with males receiving significantly more education[30]), and by levels of development (more-educated counties versus less-educated counties[31]). We found the spillovers are much larger on the less-educated groups: the effect on girls (less-educated counties) are more than twice that on boys (more-educated counties). Therefore, the send-down movement not only raised the overall education in rural China, but also reduced education inequality.

What can we learn from the observed heterogeneity? Our findings suggest that human-capital spillovers are positively related with the knowledge gap. This finding echoes Sacerdote (2001), who studied peer effects using randomly assigned roommates at Dartmouth College. He found that having a top student as a roommate benefitted bottom students more than middle students. The fact that rural girls gained more from the arrival of SDYs calls for greater attention. Distinct from the huge gender gap in education in rural villages, female SDYs were as well-educated as their male counterparts. They were 7 percentage points more likely to have completed junior high school (77.1% versus 70.1%) and only 3.5 percentage points less likely to have completed senior high school (26.4% versus 29.9%) by the time they were sent down.[32] The well-educated female SDYs might act as a role model for rural girls, signaling that they too can do as well as boys and collapsing gender stereotypes.

4.2 Possible Threats to Identification

This subsection discusses other competing stories that can also generate a positive association between SDYs and rural children's education. Note that our identification in equation (1) does not require the exogeneity of the flow of SDYs because county fixed effects would absorb any time-invariant local characteristics. Therefore, we focus on the confounding factors (1) whose local intensities are systematically correlated with the send-down movement and (2) affect the treatment and control cohorts in our main specification differently. Those factors fall into two categories: reverse causality (local government demand more SDYs to improve local education)

[30]The male sample in our reference group (1946–1955) on average received 6.49 years of education and female's schooling years are approximately two-thirds of that amount (4.22 years)

[31]We divided counties according to whether the average years of education of the reference group exceed six years. The reference group in more-educated counties have an average 6.35 years of education, as opposed to 4.61 years in less-educated counties.

[32]These numbers are from our calculation using the 2010 CFPS.

and missing variables (other events around the same period).

Endogeneity of the SDY flow

The first alternative story is reverse causality: it is not that SDYs improved local education but that local government, with greater attention to education, actively accepted more urban youth. In this scenario, the local education would have become better even without SDYs. However, this is unlikely to happen given our discussion in the background section. Both the quota and the destination counties of SDYs were determined by central or provincial-level government; county-level government had little control. Moreover, when upper-level government allocated the quota, improving rural education was not among its objectives.

In addition to the anecdotal evidence, we also present statistical evidence. The idea is that if the improvement in education is top to bottom, we should observe the government actively spending more on education. In contrast, if the improvement comes from the grass roots, we do not expect to see this phenomenon. To formally test the idea, we collected provincial-level information on fiscal expenditures on education and on the number of teachers from National Bureau of Statistics of China (2010).[33] We regressed the changes in those variables on the number of received SDYs as a share of population in 1964 at the provincial level from 1968 to 1979. Table 6 reports the results. Columns (1) and (2) show that provinces that received more SDYs did not experience higher growth in educational expenditures. This finding further reinforces our conjecture that the improvement in rural education was not among the initial targets and was an unintended consequence of the movement.

Cultural Revolution

Undoubtedly, the most important contemporaneous historical event with the rustication movement is the Cultural Revolution. All three main purposes of the mass send-down movement—to settle students who could not go to school, to relieve urban unemployment, and to discharge Red Guards—were the direct consequences of the Cultural Revolution. It is possible that a correlation exists between the local severity of the violence during the Cultural Revolution and the number of

[33] We could not find fiscal information at the county level from the local gazetteers. Therefore, we carried out the analysis at the more aggregated provincial level. If the educational expenditure increased for every county, we should have also been able to observe an increase at the aggregated provincial level.

received SDYs. For example, counties that experienced less violence during the revolution maintained better government function and thus kept a better education system and were also able to receive more SDYs. In that scenario, our findings could be interpreted as benefitting from less violence, not from more SDYs.

To control for the influence of the Cultural Revolution, we adopt the strategy of Bai and Wu (2017). We approximated the county-level severity of the Cultural Revolution with the numbers of victims, obtained from the "China Political Events Dataset, 1966-1971" (Walder 2017), as a share of county population in 1964. Walder (2017) also constructed his data from local gazetteers. We first defined cohorts 1954–1968 as the treated group because their years in primary school overlapped with the decade of the Cultural Revolution (1966–1976). Table 7 column (1) seemingly suggests that greater exposure to the revolution does not suppress educational achievement. However, after considering that most violent events and negative shocks to educational institutions took place in the first few years of the Cultural Revolution,[34,35] we redefine the treatment group according to whether they were in primary schools during the first three years of the revolution. Table 7 column (2) shows the expected result: the Cultural Revolution had negative consequences on education. Despite the Cultural Revolution's significant negative effects, the estimated effects of SDYs are identical to our baseline specification,[36] suggesting the robustness of our results against the inclusion of the Cultural Revolution.

Great Famine

In addition to the Cultural Revolution, another possible confounding historical event is China's Great Famine, which took place from 1959 to 1961 and caused estimated fatalities of 16.5 to 45 million (Meng, Qian, and Yared 2015). Our study covers cohorts born between 1946 and 1969. Therefore, some were exposed to this catastrophic event. A large literature discusses the

[34]Walder and Su (2003) collected information on violent events during the Cultural Revolution for 1,530 counties. While 836 armed battles were recorded in 1967 and 215 battles in 1968, there were only 26 battles in 1969 and zero afterward.

[35]At the beginning of the Cultural Revolution, all schools in urban China were closed for approximately two-three years. Schools were reopened in 1968–1969, and the standard school curriculum was gradually resumed in 1972 (Deng and Treiman 1997).

[36]When controlling for the local densities of the Cultural Revolution, we lose about 14% of the sample because 173 out of 1,749 counties that recorded the number of received SDYs did not record the number of victims during the Cultural Revolution. Table A3 describes the characteristics of those counties. Counties that do not contain information on the Cultural Revolution are relatively more developed. We have confirmed that dropping those 173 counties barely affects our main results.

negative long-term impact of the Great Famine on various socioeconomic outcomes, including health, education, earning, labor supply, and so forth (Chen and Zhou 2007; Meng and Qian 2009; Shi 2011). Moreover, it is possible that the local severity of the Great Famine is correlated with the number of accepted SDYs.

To control for the influence of the Great Famine, we constructed a county-level severity of the famine following the spirit of Meng, Qian, and Yared (2015)'s work, who used the birth cohort sizes of survivors observed in 1990 as the proxy for famine severity at the county level. We defined the local severity of the famine as the ratio of the cohort size of the famine cohort (1959–1961) over that of the non-famine cohort (1955–1957). Table 7 column (3) reports the estimation results, which additionally control for the interaction between local famine severity and a dummy variable indicating those born during the period 1956–1969. Consistent with the previous literature, we also find a strong negative impact of the Great Famine on education. However, the estimated impact of SDYs' arrival remains almost unchanged, suggesting our results are robust to the inclusion of the Great Famine. Column (4) simultaneously controlled for local severity of the Cultural Revolution and the Great Famine. The implication is identical.

4.3 Mechanisms

We probe the mechanisms of human-capital spillovers in this subsection. More specifically, how does the arrival of urban youth increase the education of rural children? We first highlight that better-educated SDYs can transmit their knowledge to the locals by direct instruction. Because the rusticated youth were among the best educated in rural villages, many became teachers and instructed rural children. Teaching is the most straightforward way of transmitting knowledge. This channel is analogous to the work of Hornung (2014), who analyzed the long-term effects of persecuted French Huguenots immigrating in 1685 on firm productivity in Prussia. At that time, face-to-face communication was virtually the only way of transferring technological knowledge, which took the form of Huguenot artisans instructing native apprentices and workers.

There is abundant anecdotal evidence that some SDYs worked as teachers in rural villages. Gu (2009) documented that SDYs worked as study counselors and teachers in non-state-funded schools in Jilin and Shaanxi provinces. Gu (2009) commented that

Working as teachers (or substitute teachers) in non-state-funded schools was an im-

portant experience of many educated youths. They dedicated themselves to the cause of education in rural China, especially in the remote areas.

The increase in the supply of teachers was timely and important if the political background during the Cultural Revolution is considered. China was suffering from a shortage of teachers during the Cultural Revolution because intellectuals were attacked and labeled as "bad classes" (Bernstein 1977; Walder 1989).

To formally test the hypothesis that the arrival of SDYs increases the supply of teachers in rural villages, we collected historical information on the number of teachers from local gazetteers. We found information for 657 counties out of 1,749 counties in our sample.[37] A subset has very detailed documentation, which allowed us to separate teachers into primary school teachers and secondary school teachers; into state-funded (*gongban*) school teachers and non-state-funded (*minban*) school teachers. We restrict our analysis to the period 1955–1977 and obtained 8,118 county-year observations with either numbers of primary school teachers or numbers of secondary teachers available. Note that the number of valid observations varies across counties. For example, in Guangxi province, the gazetteer of Nandan county only contains such information for 1976, while the gazetteer of Donglan county covers the entire 1955–1977 period. To estimate how the arrival of SDYs affects the number of local teachers during the period of the rustication movement, we adopt the following difference-in-difference strategy, which shares a similar spirit to our main specification:

$$\%\text{Teachers}_{t,c,p} = \beta_0 + \beta_1 \%\text{SDY}_{c,p} \times I\left(t \geq 1968\right) + \lambda_c + \mu_{t,p} + \varepsilon_{t,c,p}. \tag{3}$$

Here $\%\text{Teachers}_{t,c,p}$ represents the number of primary/secondary teachers of county c in province p in year t as a share of the county population in 1964. We not only control for county fixed effects λ_c, but also include provincial heterogeneous time trend $\mu_{t,p}$.

Table 8 reports the results of equation (3). Columns (1) and (4) indicate that the arrival of the SDYs significantly increased the number of local teachers. The share of primary school teachers in the population was 5.1‰ in 1967 and the share almost doubled in 1977 (9.6‰). The SDYs account for 20.5% of this increase.[38] The number is smaller for secondary school teachers (7.7%).

[37] Those counties have an average level of education (see Table A3).

[38] In the subsample that contains information on teachers, the density of SDYs is 22.0 per thousand locals. $\frac{0.042 \times 22.0‰}{9.6‰ - 5.1‰} = 20.5\%$

There is another important takeaway from Table 8. Columns (2), (3), (5), and (6) reveal that the increase in local teachers mostly occurred in non-state-funded schools, not state-funded schools. This result explains why in the last two columns of Table 6 we observe an increase in teachers but not in public educational expenditures. It also confirms that the positive human-capital spillovers from SDYs to rural residents cannot be explained by local government's endeavor to improve local education.

Analogous to our main specification, we are interested in knowing the effect of SDYs in each year separately for two purposes. First, it tests the common-trend assumption required for equation (3). Second, it helps us to understand the persistent effect after 1980. More specifically, we run the following equation that is similar to equation (2) (with 1955 as the baseline year):

$$\%\text{Teachers}_{t,c,p} = \beta_0 + \sum_{\gamma=1956}^{1985} \beta_{1,\gamma} \%\text{SDY}_{c,p} \times I\left(g = \gamma\right) + \lambda_c + \mu_{t,p} + \varepsilon_{t,c,p}. \tag{4}$$

Figure 5 plots the coefficient $\beta_{1,\gamma}$ for each year. There are three notable findings. First, SDYs had virtually no effect on the local supply of teachers before their arrival in 1968, ruling out the possibility of pre-existing trends. Second, the top two panels reveal that the positive correlation between the increase in number of teachers and that of received SDYs has gradually emerged since 1968. The remaining four panels show that this trend is mainly driven by non-stated-funded schools. Finally, with SDYs gradually returning to urban areas, the coefficients start to decline after 1980. But there is no indication that they would drop to zero, echoing the persistent effects we previously find for years of education (Figure 4). Again, this reversal in coefficients is entirely driven by non-state-funded schools.

5 Effect on Values

Can the effect of SDYs be simply interpreted as the effect of additional teachers? We believe the answer is no. In addition to teaching the standard courses, the urban youth also shared their knowledge, ideology, technology, and stories based on their urban experience. Such communication could happen outside the classroom. Studies of Kinnan, Wang, and Wang (2018) and Xing and Zhou (2018) also suggest that the role of SDYs is much more complicated. For a concrete example, people living in urban areas generally put a greater emphasis on education. Such value may pass

from SDYs to rural residents. Exposure to new information can alter people's attitudes and behaviors. Jensen and Oster (2009) found that cable television, which brings new information about the outside world, alleviates discriminatory attitudes toward women in India. Because media coverage was extremely limited in rural China in the 1960s,[39] the SDYs from urban areas became important carriers of new information and may have induced changes in norms, values, or attitudes in the locality.

To formally test the hypothesis that human-capital spillovers could also take the form of values and culture diffusion, we use the 2010 wave of China Family Panel Study (CFPS), which was launched by the Institute of Social Science Survey of Peking University in China. The CFPS is a national representative survey covering 25 out of 34 provinces in China, and samples 162 counties. After excluding three municipalities (Beijing, Tianjin, and Shanghai) and city-governed districts, we were able to match 93 CFPS counties with our county-level dataset compiled from local gazetteers. Because CFPS covers a much smaller range of counties than the population census, our results in this section are more suggestive than conclusive. In the 2010 wave, the CFPS asked a wide range of questions about people's beliefs and values: for example, to what extent do they believe the statement "the higher level of education one receives, the higher the probability of his/her future success." The answers range from "1 = strongly disagree" to "5 = strongly agree." Following Chen, Lu, and Xie (2018), we took ten statements (see Table A4 for a complete description) to construct a measure of LOC, first proposed by Rotter (1966). LOC measures the extent to which people believe the outcome is under their control (internal) versus under the control of outside factors (external). The five internal statements are education, talent, effort, hard work, and intellect and the five external statement are family socioeconomic status, family wealth, family connection, luck, and connection. LOC has also been adopted as an important type of noncognitive skills (Heckman, Stixrud, and Urzua 2006; Heckman and Kautz 2014; Gong, Lu, and Xie 2015; Chen, Lu, and Xie 2018). Nevertheless, based on how LOC is constructed from the survey questions, this measure is also informative for people's values and attitudes toward factors, such as education, effort, luck, and family background.

We adopted the same empirical strategy as our analysis of educational outcomes. We restricted the rural sample to those born during the period 1946–1969 and defined cohorts 1956–1969 as

[39]The average TV ownership rate in China was only 19 televisions per 1,000 people in 1977 (Thomas 2003). The rate should be much lower in rural China during the period of the send-down movement.

the treatment group. The criteria for treatment is whether a person spent at least one year in primary school during the period of the send-down movement (1968–1977). This approach implicitly assumes that school age is an important period for children to form their values and LOC. Previous studies lend support to this hypothesis. Cobb-Clark and Schurer (2013) found that changes in LOC concentrates among the young or the very old and changes during adolescence are quite modest. Chen, Lu, and Xie (2018) showed that the exogenous increase in schooling as a result of the compulsory education laws can change people's LOC. More specifically, we evaluate how exposure to the better-educated SDYs affects local resident's values and LOC using the following equation:

$$\text{LOC}_{i,g,c,p} = \beta_0 + \beta_1 \%\text{SDY}_{c,p} \times I\left(1956 \leq g \leq 1969\right) + \beta_2 X_{i,g,c,p} + \lambda_c + \mu_{g,p} + \varepsilon_{i,g,c,p}. \quad (5)$$

Table 9 presents the results. Rural residents who were more affected by the movement had a more internal LOC (column (1)). They held a more positive attitude toward education (column (2)) and were less likely to believe their fates were pre-determined by family socioeconomic status and family wealth (columns (7) and (8)). Panel B additionally controls for education and income. Most coefficients become smaller, suggesting improved education is one channel by which SDYs changed values in rural areas. But a larger proportion of the effects remain even after we controlled for education and income. Therefore, interacting with SDYs may have had a direct impact on values and LOC.

6 Lasting Impacts of SDYs

The previous sections focused on the short-term effects of human-capital spillovers. Local incumbents who were more exposed to better-educated SDYs ended up with higher levels of education and have more internal LOC. Our analysis also indicates that spillovers can be long-lasting, with SDYs leaving the countryside after the movement ended, their impact declined but did not vanish (Figure 4 and 5). This section is devoted to further understanding the lasting impacts of SDYs.

6.1 Additional Evidence of Lasting Impacts

Seeking Higher Level Education

After rural children completed junior high school, would they continue to senior high school? The effect of SDYs on senior-high-level (and above) education has very different implications from those with low level education. On one hand, local senior high education should not be directly affected by the arrival of SDYs. Most SDYs were junior high or senior high graduates themselves and, therefore, were not sufficiently educated to serve as senior high school teachers. On the other hand, we defined treatment groups according to whether a person was attending primary school during 1968–1977. Therefore, many of our defined treatment groups received their senior high education after SDYs had left the countryside. The decision to attend senior high school conditional on the completion of junior high education is informative for assessing SDYs' lasting impacts.

Table 10 column (1) confirms that local junior high graduates are more likely to seek more-advanced education. The coefficient 0.366 can be interpreted as follows: if a county received 100 more SDYs during the movement, there would be 6.81 more graduates from senior high school.[40] This number is positive and further supports the existence of SDYs' persistent impact. However, the increase in senior high graduates is much smaller than that in primary graduates (13.6) and junior high graduates (26.4), as calculated in Section 4. This result confirms our conjecture that the movement had a larger impact on lower-level education (primary and junior high level) and its effect on higher-level education is mostly indirect.

Teacher as an Occupation

After SDY-teachers left the rural villages, who would fill their void? Figure 5 shows that starting in 1980, the correlation between the received number of SDYs and the number of local teachers began to decline but did not fall to zero, suggesting that SDYs' former positions in education were being filled. One possibility is that the local government hired more teachers.[41] Another

[40] The calculation proceeds as follows. The average density of SDYs is 1.91%. The movement raised the probability of senior high graduation conditional on junior high graduation by 0.7 percentage points. The size of the affected rural cohort is 245 million, of which 50.9% completed junior high education. Lastly, there were 12.8 million urban youth sent to rural villages between 1968 and 1977. $6.81 = \frac{0.70 \times 245 \times 0.509}{12.8}$

[41] One piece of suggestive evidence supporting this conjecture is the right panels of Figure 5. While the effect of SDYs on non-state-funded secondary school teachers started to decline in 1980, the effect on state-funded counterparts showed an upward trend.

possibility is that the SDYs' students were becoming teachers. Rural children's occupational choice upon graduation also partially reflects their attitude toward education. If people value education more, they should be more likely to choose education-related occupations.

Census 1990 provides detailed occupation codes, and we can define the dummy variables of teacher occupation accordingly. Table 10 column (2) estimates whether the arrival of educated youth encourages local children to choose teaching as their occupation. The results suggest a statistically significant effect. Column (3) additionally controls for schooling. The coefficients of the SDYs fall by approximately 40%, which is not surprising because people must be sufficiently educated to teach in schools. However, an important part of the effect remains, which suggests that the positive effect does not merely stem more qualified students as a result of more years of education.

Effect on the Second Generation

So far, we have shown that the arrival of SDYs has sizable spillovers onto the first generation. They received more years of schooling and held a more positive attitude toward education. The social value of human-capital spillovers would be much larger if the spillovers applied not only to the directly affected cohorts, but also to their offspring. There are abundant studies concerning the intergenerational transmission of human capital (Currie and Moretti 2003; Black, Devereux, and Salvanes 2005; Black and Devereux 2011). Two China-related studies, Huang, Guo, and Song (2016) and Meng and Zhao (2016), found evidence that the negative consequences of the Cultural Revolution passed onto the second generation.

To estimate SDYs' human-capital spillovers on the second generation, we used the 1‰ sample from the 2010 China's population census. Our approach was as follows. First, we constructed parent–children pairs by matching the household head (parent) and members who report their relationship to the head as son/daughter (child). Second, we restricted the sample to those children whose parents were born between 1946 and 1969. The children whose parents were born between 1956 and 1969 become the treatment group. Finally, we estimated the following equation:

$$\text{Y_Edu}_{i,g,c,p} = \beta_0 + \beta_1 \%\text{SDY}_{c,p} \times I\left(1956 \leq P_{i,g,c,p} \leq 1969\right) + \beta_2 X_{i,g,c,p} + \lambda_c + \mu_{g,p} + \varepsilon_{i,g,c,p}, \quad (6)$$

whereas $P_{i,g,c,p}$ represents parents' year of birth. The key difference from our main specification

(equation (1)) is that now we are interested in understanding how parents' exposure to the arrival of SDYs affect children's education.

Table 10 column (4) reports the estimation results.[42] We found evidence that the arrival of SDYs during the 1960s and 1970s still has had persistent spillovers to the second generation 40 years later. We also note that the coefficients in Table 10 using census 2010 exceed those in Table 4 using census 1990. Previous studies estimated a coefficient of intergenerational transition in education of about 0.6 (Huang, Guo, and Song 2016; Meng and Zhao 2016), which means that if parents receive one more year of education, children's school years would increase by 0.6. A first glance at our results seemingly suggests a coefficient exceeding 1. But we note that parents' exposure to the arrival of rusticated youths affect their children's educational outcome not only through parents' schooling years, but also through their values (Table 9) and through the supply of teachers (Table 10, columns (2) and (3)).

6.2 Sources of Persistent Effects

Given our findings so far, we can briefly discuss possible sources of the persistent effects after SDYs left the countryside. The first source is infrastructure. Duflo (2001) highlighted the importance of infrastructure in education using a school construction program in Indonesia. Many SDYs were among the founders of village schools. Even if SDYs left the village, schools stayed, and with others assuming their teaching positions. The persistent rise in number of teachers gives one concrete example of this channel. The second source is knowledge and information. Invisible capital, including knowledge, technology, information, and values, came along with the arrival of SDYs. This invisible capital would not simply vanish once the body of the SDYs left the villages. The persistent improved attitude toward education in the locality serves as one example. A third source is indirect spillovers. For rural residents who have no direct interaction with SDYs, they can still benefit from those who directly communicated with SDYs. For example, the directly affected cohorts may serve as teachers (Table 10, columns (2) and (3)) and become better parents (Table 10, column (4)). The indirect spillover channel shares a similar spirit to Wantchekon,

[42]There is one concern using census 2010: some children might still be attending school. For example, if a parent was born in 1969, and had his/her child at the age of 25, the child would be age 16 in 2010. But our estimation is still meaningful because we control for children's birth cohort fixed effects. At the age of 16, while some children are attending senior high school, others may decide not to seek further education after their graduation from junior high school. As a robustness check, we excluded the current student sample and obtained similar results.

Klašnja, and Novta (2014), who found that the second generation of villagers also benefited from the set of regional schools, regardless of their parents enrollment.

7 Conclusions

Understanding human-capital spillovers is challenging because it is difficult to identify. As such, we exploit China's send-down movement as a natural experiment. From 1962 to 1979, the government mandated the temporary resettlement of 17.7 million urban youth to rural areas, most of whom were reluctant but forced to go. The movement provides an excellent opportunity to examine human-capital spillovers by estimating how the arrival of those better-educated urban youth affected the less-educated rural incumbents. For this purpose, we compiled a unique county-level dataset on the flow of SDYs from over 3,000 book-length local gazetteers and matched it to the individual-level population census data.

We find that rural children who were more exposed to urban SDYs during their schooling ages accumulated more years of education. The spillovers of SDYs resulted in a 13.5 million increase in person-years of schooling in rural areas, compensating for almost the entire loss in urban China as a result of the Cultural Revolution. Less-educated groups (girls and children in less-developed counties) reaped larger benefits, suggesting that SDYs not only raised the overall level of rural education, but also reduced education inequality. The heterogeneous impacts also indicate that human-capital spillovers can be proportional to the knowledge gap. Neither the local government's endeavor to improve education nor other contemporaneous events (e.g., the Cultural Revolution, the Great Famine) can explain such an effect. Aside from knowledge transmission, there can also be spillovers of values. We find more exposed rural residents have more internal LOC: they hold a more positive attitude toward education and are less likely to believe their achievements are determined by family background. Another important finding regards the persistence of human capital spillovers. Most SDYs left rural villages when the rustication movement came to an end. Along with their departures, their local impacts diminished but did not vanish. We argue that infrastructure, invisible capital, and indirect spillovers from the directly affected cohorts may account for this persistence.

Even though our study examines an historical event from over a half century ago, it still contains important implications for the current policies. We list two policies here as examples:

China's College Volunteers to the West Program (*daxuesheng zhiyuan fuwu xibu jihua*) and the United States' international immigration policy. These two policies involve the migration of a group of better-educated people. The College Volunteers to the West Program encourages fresh college graduates to serve in Western China to help in the locality's development of education, health, technology, and economy. The program was initiated in 2003 and between 2003-2017 has involved approximately 270,000 students.[43] Unlike the send-down movement, the program is voluntary. Students serve for one to three years and thereafter receive preferential treatment during the admission process in graduate schools. The US international immigration policy also favors the well-educated. US Citizenship and Immigration Services (USCIS) sets different caps on H-1B visas, which allow US employers to employ foreign workers who hold a master's degree or higher from a US institution and those without such a degree. Therefore, graduates with master's degrees have a much higher chance of obtaining the H-1B visas. Our study helps us to understand the effect of education-biased policies on local residents. Of course, more delicate studies are necessary to evaluate their effectiveness.

[43] http://xibu.youth.cn/

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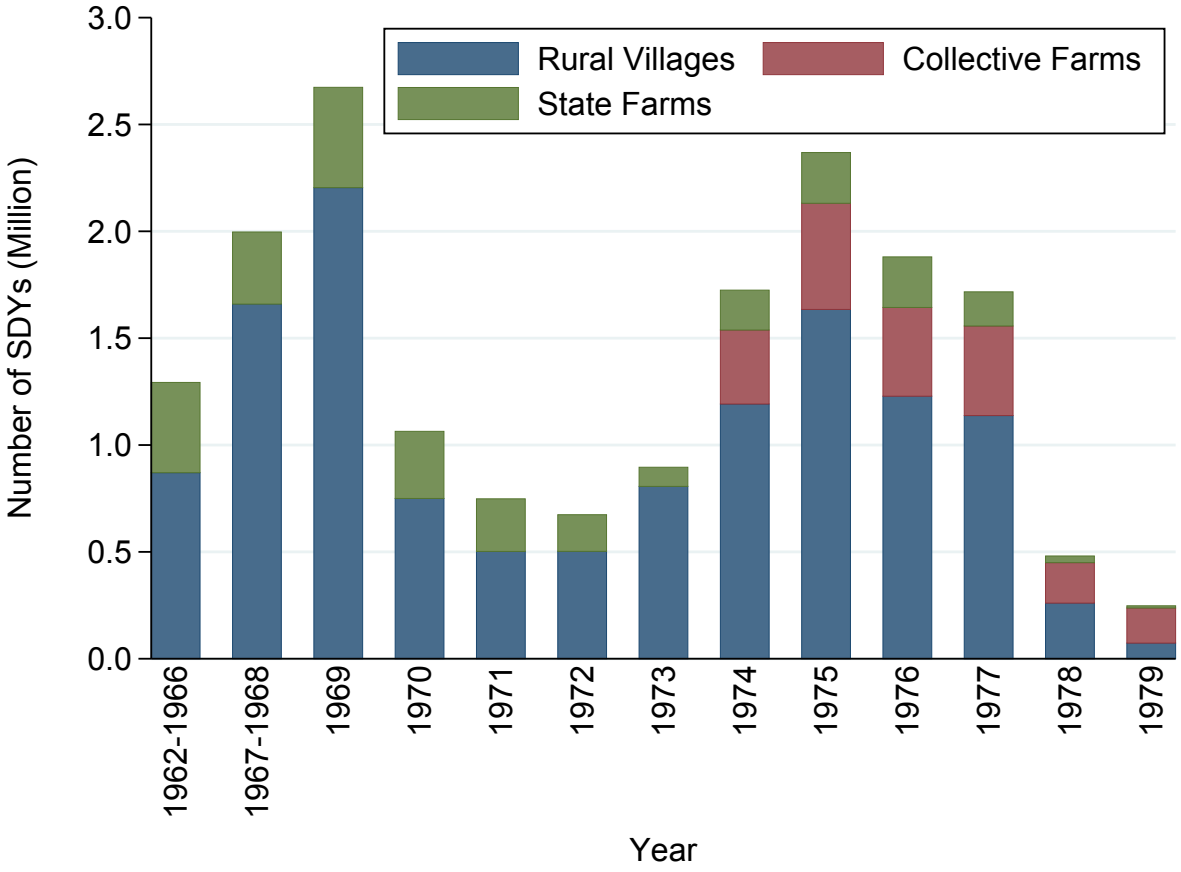
Figures

Figure 1: Number of Sent-Down-Youth by Resettlement, 1962–1979



Note: Data source is Gu (2009) "Chinese Educated City Youth: The Whole Story."

Figure 2: Number of Received Sent-Down-Youth in Each County

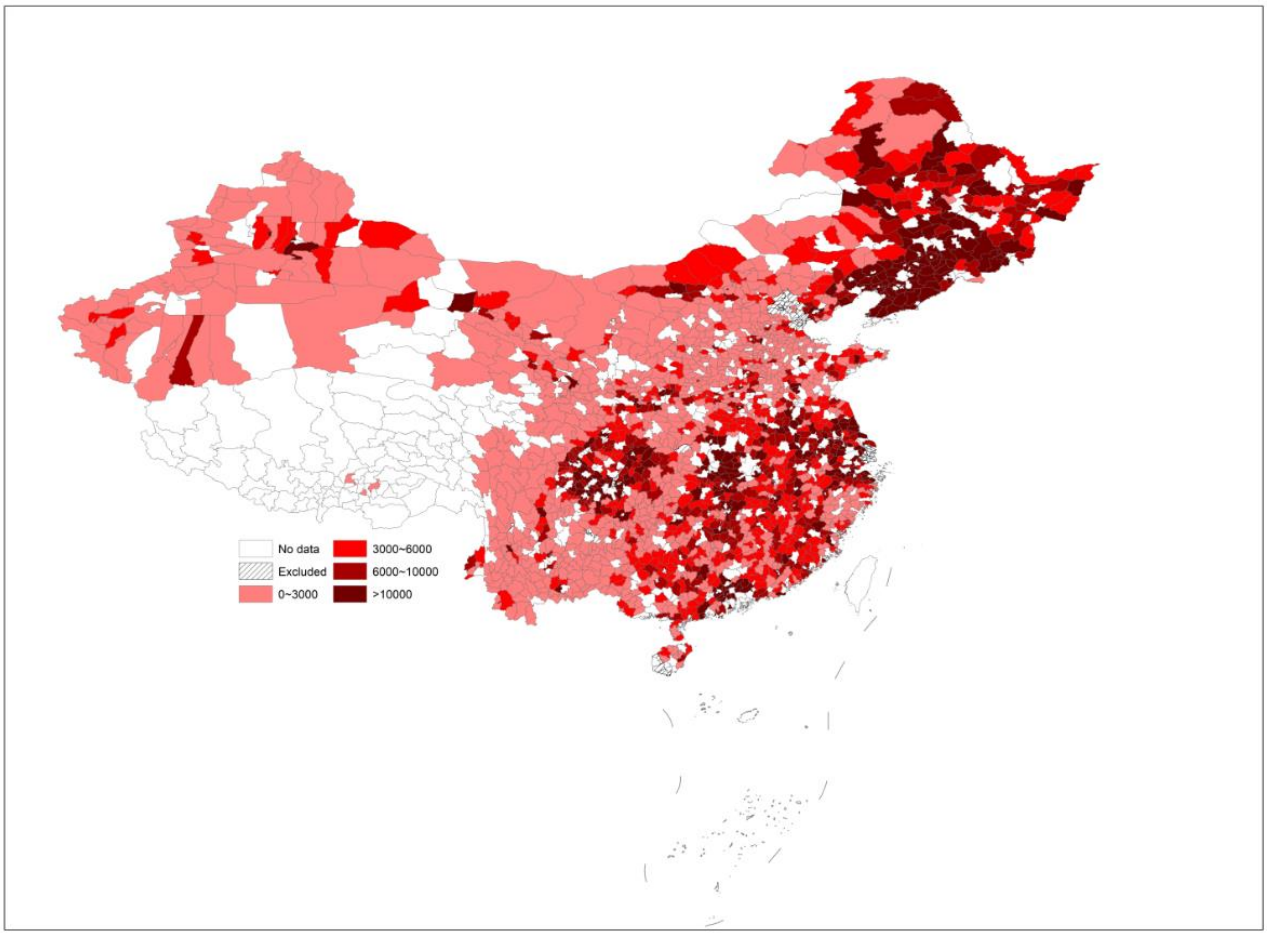
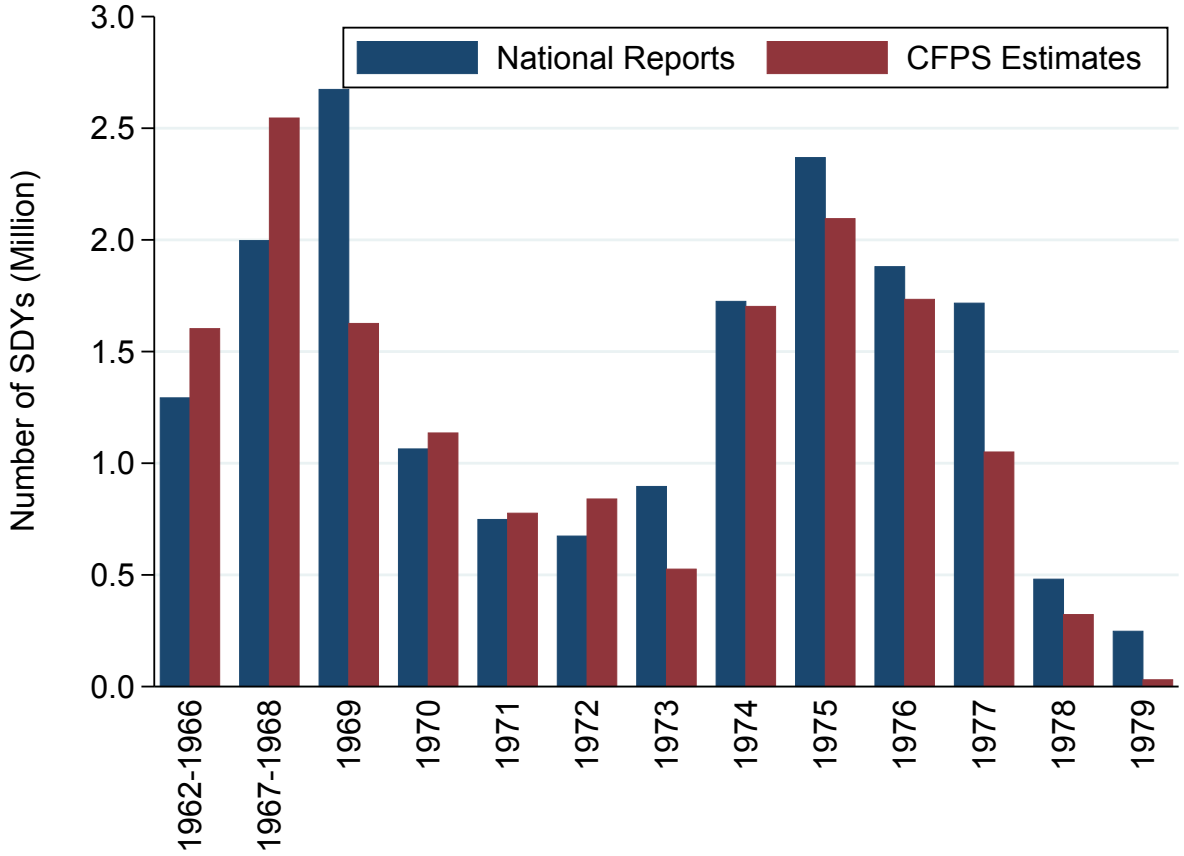
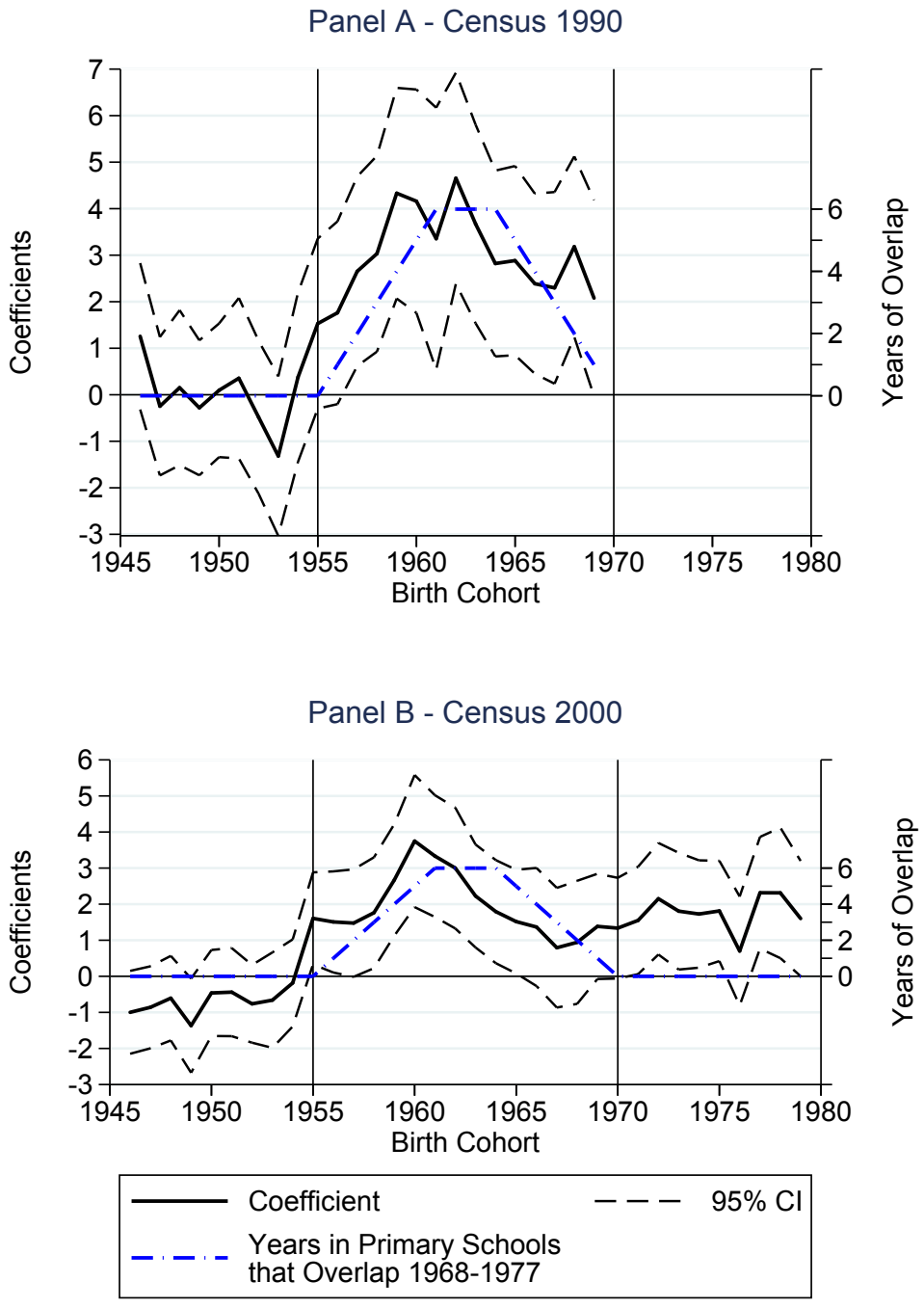


Figure 3: Number of Sent-Down-Youth Estimated from CFPS 2010



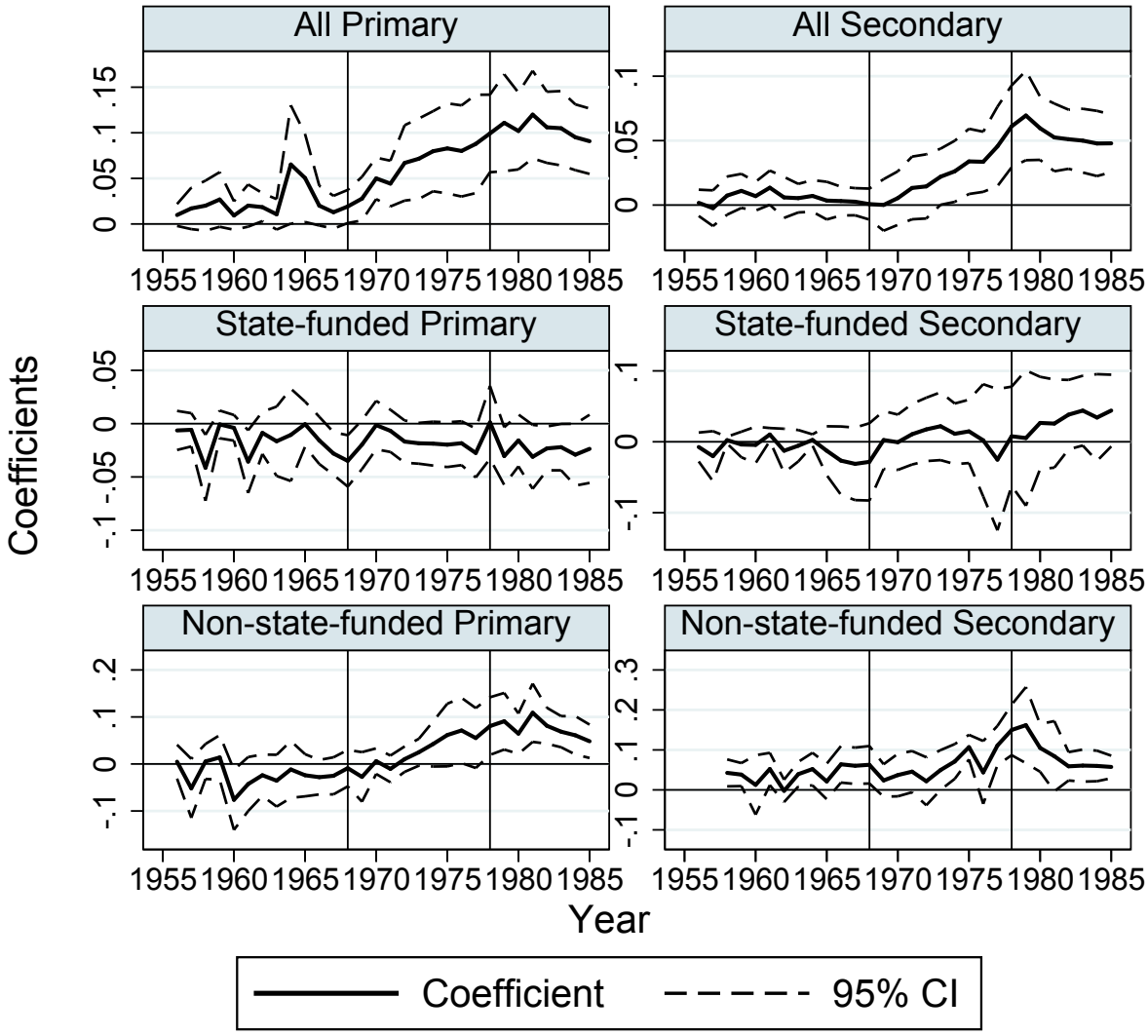
Note: authors' estimation based on CFPS 2010.

Figure 4: Effect of SDYs on the Educational Attainment of Different Cohorts



Note: the left y axis represents the coefficients from equation (2), which captures the effect of SDYs densities on different cohorts.

Figure 5: Effect of SDYs on Local Supply of Teachers in Different Years



Note: y axis represents the coefficients from equation (4), which captures the effect of SDYs densities on number of teachers in different years.

Tables

Table 1: Total Number of Sent and Received SDYs in Each Province, 1962–1979

Province	SDY Sent (Thousand)			SDY Received (Thousand)		
	Total	Inside	Outside	Total	Inside	Outside
Beijing	636.3	384.2	252.1	384.2	384.2	0.0
Tianjin	465.1	193.6	271.5	193.6	193.6	0.0
Hebei	384.4	377.8	6.6	510.5	377.8	132.7
Shanxi	264.3	264.3	0.0	312.9	264.3	48.6
Inner Mongolia	193.8	193.8	0.0	299.3	193.8	105.5
Liaoning	2013.4	2013.4	0.0	2018.0	2013.4	4.6
Jilin	991.4	991.4	0.0	1052.6	991.4	61.2
Heilongjiang	1519.2	1519.2	0.0	1922.2	1519.2	403.0
Shanghai	1259.2	532.3	719.9	532.3	532.3	0.0
Jiangsu	828.4	810.2	18.2	861.2	810.2	51.0
Zhejiang	646.2	563.9	82.3	595.9	563.9	32.0
Anhui	576.5	576.5	0.0	725.5	576.5	149.0
Fujian	372.3	372.3	0.0	372.3	372.3	0.0
Jiangxi	504.5	504.5	0.0	622.5	504.5	118.0
Shandong	512.9	492.7	20.2	492.7	492.7	0.0
Henan	673.0	673.0	0.0	673.0	673.0	0.0
Hubei	886.6	878.6	8.0	878.6	878.6	0.0
Hunan	635.8	635.8	0.0	635.8	635.8	0.0
Guangdong	973.2	973.2	0.0	973.2	973.2	0.0
Guangxi	434.8	434.8	0.0	434.8	434.8	0.0
Sichuan	1472.4	1427.4	45.0	1427.4	1427.4	0.0
Guizhou	213.5	213.5	0.0	224.1	213.5	10.6
Yunnan	232.5	232.5	0.0	339.1	232.5	106.6
Tibet	3.4	3.4	0.0	3.4	3.4	0.0
Shaanxi	463.1	463.1	0.0	490.3	463.1	27.2
Gansu	245.2	245.2	0.0	264.3	245.2	19.1
Qinghai	43.6	43.6	0.0	51.0	43.6	7.4
Ningxia	49.2	49.2	0.0	57.5	49.2	8.3
Xinjiang	277.6	277.6	0.0	416.6	277.6	139.0
Total	17771.8	16341.0	1423.8	17764.8	16341.0	1423.8

Note: Data source is Gu (2009) "Chinese Educated City Youth: The Whole Story."

Table 2: Comparing the Number of Received SDYs from County-aggregate and from National Report in Each Province

Province	SDY Received (Thousand)		
	County Aggregate 1968–1977	National Report 1962–1979	Ratio (%)
Hebei	297.2	510.5	58.2
Shanxi	144.9	312.9	46.3
Inner Mongolia	329.1	299.3	110.0
Liaoning	1405.1	2018.0	69.6
Jilin	659.6	1052.6	62.7
Heilongjiang	529.6	1922.2	27.6
Jiangsu	599.0	861.2	69.6
Zhejiang	438.7	595.9	73.6
Anhui	511.6	725.5	70.5
Fujian	334.5	372.3	89.8
Jiangxi	402.7	622.5	64.7
Shandong	400.3	492.7	81.3
Henan	481.6	673.0	71.6
Hubei	686.2	878.6	78.1
Hunan	583.0	635.8	91.7
Guangdong	574.8	973.2	59.1
Guangxi	293.6	434.8	67.5
Sichuan	1294.5	1427.4	90.7
Guizhou	157.6	224.1	70.3
Yunnan	187.8	339.1	55.4
Shaanxi	376.9	490.3	76.9
Gansu	168.0	264.3	63.5
Qinghai	32.2	51.0	63.1
Ningxia	21.3	57.5	37.1
Xinjiang	175.1	416.6	42.0
Total	11084.7	16651.3	66.6

Note: the county aggregate numbers are computed based on authors' collection of data from local gazetteers. Numbers from national report are the same as those in Table 1.

Table 3: Summary Statistics of the 1% Sample from China's 1990 Population Census

Cohort	Reference Group (1946–1955)		Treatment Group (1956–1969)	
Hukou	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)
Years of Education	5.368	8.868	7.188	10.507
	(3.367)	(3.180)	(3.103)	(2.511)
Complete Primary School	0.616	0.910	0.799	0.972
	(0.486)	(0.286)	(0.401)	(0.165)
Complete Junior High	0.205	0.668	0.454	0.903
	(0.404)	(0.471)	(0.498)	(0.296)
Male = 1	0.507	0.593	0.505	0.567
	(0.500)	(0.491)	(0.500)	(0.496)
Han Ethnic = 1	0.923	0.929	0.914	0.923
	(0.266)	(0.257)	(0.280)	(0.266)
Age	39.031	39.215	26.639	27.014
	(2.823)	(2.862)	(4.003)	(3.954)
Observations	948,331	143,900	1,793,615	262,089

Table 4: The Effect of SDYs on the Educational Attainment of Local Children (census 1990)

Dependent Variables	Years of Education		Complete Primary		Complete Junior High	
Sample	Rural	Urban	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Total received SDYs	2.884***	-0.149	0.371***	-0.0503	0.721***	-0.125
*Affected Cohort (1956–1969)	(0.728)	(0.556)	(0.106)	(0.0596)	(0.131)	(0.109)
Male	1.876***	0.667***	0.201***	0.0321***	0.203***	0.0548***
	(0.0285)	(0.0258)	(0.00362)	(0.00232)	(0.00284)	(0.00322)
Han Ethnic	0.138**	-0.00936	0.0200***	0.00839	0.00566	0.0163*
	(0.0555)	(0.0804)	(0.00760)	(0.00529)	(0.00677)	(0.00870)
Observations	2,741,945	405,918	2,741,945	405,918	2,741,945	405,918
R-squared	0.292	0.221	0.255	0.105	0.210	0.197
County FE	✓	✓	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Share of total/inflow/local SDYs is computed by dividing the number of total/inflow/local SDYs by the county population in 1964.

Table 5: Heterogeneous Effect of SDYs (census 1990)

Dependent Variables	Years of Education			
Sub-sample	Male	Female	Less-Educated Counties	More-Educated Counties
	(1)	(2)	(3)	(4)
Share of Total received SDYs	1.757***	4.112***	6.090***	2.731***
*Affected Cohort (1956–1969)	(0.646)	(1.012)	(2.037)	(0.715)
Observations	1,385,946	1,355,995	1,557,173	1,184,766
R-squared	0.195	0.315	0.295	0.198
Mean Education of Reference Group	6.489	4.216	4.612	6.352
Individual Controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓

Note: Only rural sample is used. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Ethnicity and gender are controlled in all regressions. More/less-urbanized counties are defined as whether the share of urban population in the county exceeds 6%. Share of total/inflow/local SDYs is computed by dividing the number of total/inflow/local SDYs by the county population in 1964.

Table 6: SDYs and the Growth of Educational Expenditures at the Province Level

Dependent Variables	Δ Edu. Expenditures as a Share of GDP	Δ Edu. Expenditures as a Share of Fiscal Expenditures	Δ Primary Teachers per ten thousand	Δ Secondary Teachers per ten thousand
	(1)	(2)	(3)	(4)
Share of Total received SDYs	0.007	-0.027	0.962	20.783**
	(0.007)	(0.045)	(23.133)	(8.928)
Δ Share of Non-agricultural Population	0.023	0.409**	55.597	65.496
	(0.034)	(0.207)	(90.238)	(41.547)
Δ Share of Secondary Industry in GDP	-0.011**	-0.122***	10.074	-6.529
	(0.005)	(0.032)	(15.588)	(6.679)
Δ Share of Tertiary Industry in GDP	0.002	-0.158	-6.001	-11.874
	(0.016)	(0.124)	(37.583)	(19.701)
Δ GDP per capita	-0.114***	-0.207***	-29.664	-3.261
	(0.014)	(0.078)	(34.203)	(14.962)
Observations	226	226	183	196
R-squared	0.727	0.798	0.137	0.532
Year FE	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors are in the bracket.

Table 7: The Cultural Revolution and the Great Famine as Confounding Events (census 1990)

Dependent Variables	Years of Education			
	(1)	(2)	(3)	(4)
Share of Total received SDYs	3.041***	3.056***	2.814***	2.981***
*Affected Cohort (1956–1969)	(0.770)	(0.767)	(0.717)	(0.761)
Local severity of **Cultural Revolution**	0.150			
*Affected Cohort (1954–1968)	(0.455)			
Local severity of **Cultural Revolution**		-0.774**		-0.776**
*Affected Cohort (1954–1961)		(0.315)		(0.312)
Local severity of **Great Famine**			-0.515***	-0.550***
*Affected Cohort (1956–1969)			(0.0880)	(0.0924)
Observations	2,349,094	2,349,094	2,741,903	2,349,052
R-squared	0.294	0.294	0.293	0.295
Information on Cultural Revolution	✓	✓		✓
Individual Controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Individual controls include gender and ethnicity. Share of total SDYs is computed by dividing the number of total SDYs by the county population in 1964. Local severity of Cultural Revolution is proxied by dividing the number of victims by the county population in 1964. The data source is Walder (2017). Local severity of the Great Famine is proxied by the ratio of 1959–1961 cohort size over 1955–1957 cohort size.

Table 8: SDYs and Number of Teachers, 1955–1977

Dependent Variables	Share of Primary School Teachers			Share of Secondary School Teachers		
School Types	All	Stata-funded	Non-state-funded	All	Stata-funded	Non-state-funded
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Total received SDYs	0.042***	0.002	0.057**	0.014***	0.013	0.022*
*Post 1968	(0.009)	(0.009)	(0.024)	(0.005)	(0.020)	(0.012)
Observations	6,554	1,845	1,588	6,306	1,256	568
R-squared	0.840	0.834	0.883	0.803	0.745	0.821
Number of Counties	487	151	140	489	105	85
County FE	✓	✓	✓	✓	✓	✓
Province-year FE	✓	✓	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. We collect both county-level information on number of teachers and county-level information on number of SDYs from local gazetteers. Share of total/inflow/local SDYs is computed from dividing the number of total/inflow/local SDYs by the county population in 1964. Share of primary/secondary school teachers is computed by dividing the number of primary/secondary school teachers by the county population in 1964.

Table 9: The Effect of SDYs on Local Incumbents' Locus of Control (CFPS 2010)

Dependent Variables		Do you agree with following statements? 1 = strongly disagree, 5 = strongly agree									
		Internal Locus of Control					External Locus of Control				
	LOC Index	Education	Talent	Effort	Hard Work	Intellect	Family SES	Family Wealth	Family Connection	Luck	Connection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A											
Share of Total received SDYs	18.920**	3.262	-1.672	0.818	-0.365	-0.463	-3.940*	-6.415***	-2.243	-1.759	-2.291
*Affected Cohort (1956–1969)	(9.045)	(2.794)	(3.165)	(1.998)	(1.143)	(1.401)	(2.281)	(2.257)	(2.652)	(3.115)	(2.555)
Observations	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596
R-squared	0.183	0.142	0.141	0.156	0.168	0.156	0.160	0.171	0.156	0.158	0.134
Panel B											
Share of Total received SDYs	16.762*	3.271	-1.017	0.685	-0.505	-0.425	-3.396	-5.455**	-2.009	-1.189	-2.034
*Affected Cohort (1956–1969)	(9.022)	(2.824)	(3.136)	(2.024)	(1.128)	(1.421)	(2.327)	(2.266)	(2.638)	(3.076)	(2.570)
Years of Education	0.102***	-0.001	-0.032***	0.006*	0.007*	-0.002	-0.026***	-0.045***	-0.011**	-0.027***	-0.013***
	(0.014)	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
log(income)	0.050	0.004	-0.006	0.010	-0.000	-0.001	-0.008	-0.022	-0.006	-0.008	0.006
	(0.043)	(0.010)	(0.011)	(0.007)	(0.008)	(0.009)	(0.014)	(0.016)	(0.012)	(0.012)	(0.012)
Observations	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596	4,596
R-squared	0.192	0.142	0.152	0.157	0.169	0.156	0.166	0.190	0.157	0.166	0.136
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Only rural sample is used. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Individual controls include gender and ethnicity. Share of total SDYs is computed from dividing the number of total SDYs by the county population in 1964.

LOC Index: Following Chen, Lu, and Xie (2018), we define this variable as the summation of ten z-scores (external locus-of-control statements take negative values). The higher the score, the more internal the individual. Table A4 presents the ten questions for generating this index.

Table 10: The Lasting Effect of SDYs

Dependent Variables	Go Beyond Junior High (conditional on Junior High Graduate)	Teacher as an Occupation		Second Genderation's Years of Education
Data	Census 1990	Census 1990		Census 2010
	(1)	(2)	(3)	(4)
Share of Total received SDYs	0.366***	0.0331***	0.0200*	4.199***
*Affected Cohort (1956–1969)	(0.0797)	(0.00995)	(0.0106)	(0.862)
Years of Education			0.00455***	
			(8.42e-05)	
Observations	1,132,825	2,741,945	2,741,945	98,962
R-squared	0.071	0.005	0.024	0.545
Individual Controls	✓	✓	✓	✓
County FE	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓

Note: Only rural sample is used. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Individual controls include gender and ethnicity. Share of total SDYs is computed by dividing the number of total SDYs by the county population in 1964. See Section 6.1 for the detailed construction of data that combine two generations (columns (4)).

Appendix A: Robustness Check

This appendix is devoted to discussing the robustness of our main findings, which is reported in Table 4.

Different Bandwidth of Cohorts

Our main specification focuses on cohorts born between 1946 and 1969, and cohorts 1956–1969 are defined as the treatment group. That is, our bandwidth of treatment cohort is 14 years. The rationale of such choice is that cohort 1956 was receiving their last year of primary education at the beginning of the massive rustication movement while cohort 1969 had just started their primary school when the movement came to an end. This approach assumes a standard procedure of school attendance: children started primary school at the age of six and spent six years in primary school. However, the compliance may be incomplete. Table A1 replicates the results from Table 4 using different bandwidths (10 years, 7 years, and 4 years). In terms of statistical significance, Table A1 yields exactly the same results regardless of the choice of bandwidth. In terms of the magnitude of the coefficients, the results also match the findings from Figure 4, which displays a reversed-U-shaped pattern. Exclusion of the last few SDY-affected cohorts (bandwidth = 10, 7 years) makes the coefficients larger because those cohorts were exposed to SDYs only for several years at the start of primary education. Following the same logic, only focusing on the first few affected cohorts (bandwidth = 4 years) makes the coefficients smaller.

Allow SDYs to Affect Junior High Education

Currently, we define exposure to the SDYs according to whether rural children's years in primary school overlaps with the massive send-down movement. The justification is based on the fact that most rural children in China during that period received at most primary-level education. Still, about one-fourth went to junior high school. If we allow the flow of SDYs not only to affect primary school, but also junior high school, the treatment cohorts would be extended by three years (1953–1969). Table A2 columns (1) and (2) reports the result using this alternative definition of exposure. The coefficients stay positively significant but become smaller, which should be expected because a smaller share of rural residents would attend junior high school.

Stronger Assumption on Migration

Our empirical analysis combines the census 1990 with the historical data on the SDYs flow during the period 1968–1977. One implicit assumption is that people live in the same county at those two points in time. Although China's population census in 2000 suggests that 86% of the sample in this study lived in the same county as their birthplace, we cannot rule out the possibility that the remaining small proportion has an important influence on our results. In our main analysis, we exclude the sample whose residence county differs from their registration county/prefecture. In this appendix, we impose an even stronger assumption: people resided in the current locality on July 1st, 1985.[44] If migration is a real issue, the extra restriction should have an important influence on our results. Table A2 columns (3) and (4) gives almost identical results as those

[44]This approximates our ideal experiment, which is to exclude those whose current residence county differs from their birth county. Unluckily, such information is not available in census 1990.

in Table 4. With the additional assumption, we lose less than 1.0% of the sample. This is not surprising because migration in China was still of limited scope before 1990.

hukou Changes from Rural to Urban

Similar to the concerns about migration, we may also be concerned with the changes of *hukou* from rural to urban because our analysis focuses on the rural sample. However, China's household registration system means that people cannot change their *hukou* status at will. They must first satisfy certain requirements. One way for rural residents to change to urban *hukou* is becoming sufficiently well-educated. Graduates from technical secondary schools, colleges, and universities satisfy this requirement. Thus, junior high graduates and regular senior high graduates are ineligible. Table A2 columns (5) and (6) exclude the sample of sufficiently educated to change their *hukou* status and yield identical results, suggesting that the limited impact of rural-to-urban *hukou* switches. This results arose because the overall level of education in rural China was still quite low and few rural children could reach the required level of education.

Measurement Errors in Numbers of Received SDYs

One final issue is measurement error in our key independent variable—numbers of received SDYs in each county. We take those numbers from local gazetteers and therefore implicitly assume that the records are accurate. However, measurement errors and recall biases are inevitable in historical documents. To evaluate the possible consequences of measurement errors, we use the following idea: if the compilers of local gazetteers did not have any specific records and had to "guess" the numbers, those numbers are more likely to end with zero. Those counties should account for 10% of the sample if the last digit is randomly distributed. The share is 18% in our data, suggesting the existence of measurement error. Table A2 columns (7) and (8) drop those counties whose numbers of received SDYs end with zero. The impact of SDYs actually becomes larger in this case. It is a classic econometric result that measurement errors make the coefficients underestimated. Therefore, the true magnitude of human-capital spillovers should be even larger if historical documentation can be more accurate.

Table A1: Robustness Check with Different Cohort Bandwidth (census 1990)

Dependent Variables	Years of Education					
	Rural			Urban		
	N=10	N=7	N=4	N=10	N=7	N=4
	(1)	(2)	(3)	(4)	(5)	(6)
Share of Total received SDYs	2.982***	3.253***	2.982***	-0.0385	0.345	0.483
*Affected Cohort (1956–1956+N)	(0.729)	(0.733)	(0.731)	(0.533)	(0.517)	(0.507)
Observations	2,403,047	1,939,652	1,487,689	363,023	303,138	232,013
R-squared	0.298	0.305	0.292	0.221	0.223	0.206
Individual Controls	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Individual controls include gender and ethnicity. Reference cohorts are those born between the year 1956-N and 1956. Share of total/inflow/local SDYs is computed from dividing the number of total/inflow/local SDYs by the county population in 1964.

Table A2: Other Robustness Checks (census 1990)

Dependent Variables	Years of Education							
Robustness	Junior High Affected		Stayed in the County/Prefecture for at Least Five Years		Exclude Graduates from Technical Secondary School/from College		Exclude Counties whose Last Digit of SDY number is Zero	
Sample	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share of Total received SDYs	2.471***	-0.230	2.820***	0.0606	2.850***	0.207	3.637***	0.151
*Affected Cohort	(0.740)	(0.693)	(0.743)	(0.584)	(0.735)	(0.525)	(0.849)	(0.805)
Observations	2,928,447	438,518	2,903,158	403,387	2,922,643	363,213	2,426,621	362,359
R-squared	0.301	0.225	0.302	0.204	0.301	0.259	0.304	0.229
Individual Controls	✓	✓	✓	✓	✓	✓	✓	✓
County FE	✓	✓	✓	✓	✓	✓	✓	✓
Province-cohort FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the county level. Individual controls include gender and ethnicity. Share of total/inflow/local SDYs is computed by dividing the number of total/inflow/local SDYs by county population in 1964. In columns (1) and (2), the treatment group is cohorts 1953–1969 and the reference group is cohorts 1938–1952. Both groups are extended by three cohorts because we allow junior high education to be affected. In columns (3) and (4), the treatment group is cohorts 1956–1969 and the reference group is cohorts 1944–1955. Migrants are defined as those who do not hold a local *hukou* in the county.

Table A3: Possible Selections in County-level Information Availability

	Total	Information on Victims during Cultural Revolution?		Information on Number of Teachers?	
		Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)
Years of Education	5.094	5.026	5.715***	5.032	5.197
	(1.504)	(1.515)	(1.249)	(1.513)	(1.486)
Share of Primary Graduates	0.574	0.566	0.643***	0.559	0.599*
	(0.226)	(0.228)	(0.192)	(0.226)	(0.224)
Share of Junior Graduates	0.192	0.188	0.223***	0.187	0.201
	(0.122)	(0.120)	(0.135)	(0.125)	(0.117)
Share of Total received SDYs	0.022	0.022	0.024	0.022	0.024
	(0.028)	(0.028)	(0.024)	(0.026)	(0.031)
Number of Counties	1749	1576	173	1092	657

Note: */**/*** represent whether the two types of counties differ significantly at level 10%/5%/1% after controlling for provincial fixed effects.

Table A4: Questions for Generating the LOC Index

Variables	Survey Questions: How much do you agree with the following statement: 1 (strongly disagree)–5(strongly agree)
Internal Local of Control	
Education	The higher level of education one receives, the higher the probability of his/her future success.
Talent	The most important factor affecting one's future success is his/her talent.
Effort	The most important factor affecting one's future success is his/her effort.
Hard Work	In today's society, hard work is rewarded.
Intellect	In today's society, intellect is rewarded.
External Local of Control	
Family Socioeconomic Status	The higher a family's social status is, the greater the child's future achievement will be; the lower a family's social status is, the smaller the child's future achievement will be.
Family Wealth	A child from a rich family has a better chance of succeeding in the future; a child from a poor family has a worse chance of succeeding in the future.
Family Connection	The most important factor affecting one's future success is whether his/her family has "connection."
Luck	The most important factor affecting one's future success is his/her luck.
Connection	In today's society, having social connections is more important than having individual capability.