

Impact of property rights reform to support China's rural-urban integration: Evidence from the Chengdu national experiment

1. Introduction

While the rapid economic growth observed in China over the last decade is the result of many factors, a land tenure system that strictly separates rural from urban land and that allows expropriation of rural and its conversion to urban land in a way that provides large margins to local governments has significantly contributed to the associated expansion of industrial activity. At the same time, this dualism between rural and urban land and the ability of local governments to generate enormous amounts of revenue by expropriating land cheaply and selling it to developers at prices that are orders of magnitude higher than what is being paid in compensation has also contributed to inequality. Moreover, it also led to inefficient land use, bad loans secured with local governments' land banks, rural unrest, and -given China's limited agricultural land endowment- concerns about negative impacts on food security. The latter may arise either directly -by irreversibly converting land from agricultural to non-agricultural uses- or indirectly by reducing investment and efficiency-enhancing land transfers by farmers who fear expropriation with limited compensation. Most experts agree that this situation is not sustainable and that, to change it, simultaneous action in a number of areas is needed.

Cognizant of this challenge, a number of national experiments were conducted to explore the scope for alternative and potentially more sustainable arrangements. In this context, the city of Chengdu in Sichuan Province was selected by the central government as a "rural-urban Integration reform experiment zone" in 2008. Efforts undertaken in the context of the experiment are of interest as they involved systematic verification of all types of land assets, relaxation of the restrictions imposed by the *hukou* system of urban residency permits, and measures to improve land market functioning. They were expected to enhance tenure security and reduce transaction costs in land and labor markets so as to encourage land-related investment, enhance allocative efficiency, create jobs, and improve overall economic performance. But there was also concern that far-reaching reforms in this area would be costly to implement, give rise to disputes, or socially undesirable land transfers and migration.

As property rights and their links to rural-urban integration have recently been identified as a key reform areas by China's leadership, drawing the lessons from past reform experiments is important. Yet, beyond anecdotal accounts, few studies aim to assess either the magnitude of associated impacts or their incidence among different types of households. We use a survey of 529 neighboring villages that are separated from each other by the prefecture boundary to analyze reform effects on tenure security, land

use, and land market functioning. Noting that before the intervention counties on both sides of the border followed similar trends and that we can control for other government programs, the fact that the experiment was implemented in Chengdu prefecture but not in neighboring administrative units allows us to implement a difference-in-difference approach where reform effects are identified by comparing changes in the same village before and after the reform between villages inside and outside the prefecture boundary. Representative data from NBS' regular rural household survey for counties on both sides of the boundary allow us to assess reform impacts on household consumption and income, labor supply, incidence of land rental, crop choice, and productivity of agricultural land use. We use repeated cross-sectional data to compare household changes before vs. after the reform and inside vs. outside the boundary for identification, a choice justified by noting that sample households on both sides of the border followed parallel trends before the intervention and we can control for a range of time variant public programs, in particular pension and medical schemes as well as agricultural subsidies that may have been implemented differently on both sides.

Results suggest that about 3-4 years after it had been completed, rural-urban integration reform had helped to significantly increase tenure security by reducing the incidence of administrative reallocations and expropriation. This led to an increase in the share of arable agricultural land (compared to less intensive pastures) and the share of construction land devoted to economic activities rather than residential use while preserving the level of non-productive 'waste' land including forests. Reform-induced increases in levels of market-mediated transfers of construction land as well as formal and informal transfers of agricultural land are consistent with the notion that higher levels of tenure security created a basis for the operation of land markets that transferred land to better uses.

At the household level, the rural-urban integration reform experiment had led to significant consumption growth, estimated at 7.7%, especially for households with lower initial endowments of human and physical capital, and increments in net income of almost equal size. The magnitude of estimated annual consumption benefits is large; in excess of the cost of the entire intervention. A key reason for these shifts seems to be an increase in yields and profits from agriculture that coincides with increased diversification of output towards higher value crops: Agricultural yields increased by 55% and profits by 38%, due to more intensive input use, a shift in crop composition towards higher-value crops, and more active rental markets to transfer land from less to more productive users. This suggests removal of earlier threats of expropriation encouraged more effective use of highly productive peri-urban land to intensify agricultural production and, by doing so, increased job opportunities and resulted in changes of labor supply. People younger than 40 years old are found to shift from migration to agricultural activities while the older cohort shifted from farming to off-farm activities.

The paper is structured as follows. Section two provides context and discusses salient features of the Chengdu experiment. Section three introduces data sources and presents descriptive statistics on village and household outcomes complemented by information on nature and cost of land certification in sample villages. Section four discusses analytical methodology and econometric results. Section five concludes with implications for policy and future research.

2. Motivation and background

Between 2000 and 2010, rural-urban land conversion in China expanded at rates that are among the highest in East Asia. As such changes are not easily reversed, this poses vast challenges for China's development for decades to come. While piecemeal efforts to change this pattern had proved largely ineffective, the rural-urban integration the reform undertaken in Chengdu prefecture followed a more integrated approach that could hold broader lessons. We describe the nature of the reform and our analytical approach to evaluating their impacts.

2.1 The challenges of rural-urban land conversion in China

In the 2000-2010 period, the size of urban areas in China expanded enormously: use of satellite imagery to define 'urban' consistently across countries reveals that, with an average annual area expansion of 9.8% for Hangzhou, 8.1% for Shanghai, 6.1% for Chongqing, 5.9% for Chengdu, 4.5% for the Pearl River Delta and 4.0%, for Beijing, most Chinese cities expanded at a rate well in excess of the East Asian average of 2.8% (World Bank 2014).¹At the same time, and despite numerous measures to the contrary, rural-urban income inequality widened. While clear causality is difficult to establish, most experts agree that high rates of land conversion make a key contribution to this and, in addition, give rise to factor market distortions and often inefficient and unsustainable land use. This can largely be attributed to structural factors, most importantly the fact that, as rural land is owned by village collectives and not tradable, conversion of land from agricultural to non-agricultural use is possible only via acquisition by local governments. While farmers receive compensation for their agricultural land based on the value of land for agricultural production,² land acquired in this way can be transferred by local government at prices hundred times or more what was paid in compensation.

The scope for realizing such windfall gains made land acquisition a preferred means for funding local governments, with far-reaching implications for overall land supply, land prices, and the operation of land and other factor markets. Land lease fees accounted for an average of 60% of local budgetary revenues in 2003/04 (Su *et al.* 2013), a figure that has risen further as fiscal decentralization reduced alternative

¹ The average is for urban areas in East Asia with more than 5 million inhabitants in 2010 (World_Bank and DRC 2014).

² Farmers' residential land is often not expropriated, something that led to the spread of 'urban villages', i.e. unplanned neighborhoods that tend to provide shelter for migrants tend exert negative externalities on prices for neighboring properties (Song and Zenou 2009). It is estimated that 140-150 mn migrants are estimated to live in some 50,000 urban villages (Tan *et al.* 2011).

revenue sources for local governments (Wu *et al.* 2015).³ Revenue generated in this way provides a huge implicit subsidy to industrialization. (Ding and Lichtenberg 2011), with negative impacts on availability of land for residential and housing purposes (Peng and Thibodeau 2012).

This pattern of land development, which would be difficult to maintain without complementary restrictions in labor markets that in and of themselves may lead to considerable efficiency losses (Au and Henderson 2006b), by has several consequences. First, as local governments compete to attract industry, prices for industrial land in China have remained very low (World Bank and DRC, 2014). Supplying land to industry below its real value led to inefficient use of a valuable resource; in fact a nation-wide survey in 2003 suggests that 70% of land in China's Development zones was unused (Du and Peiser 2014). Meanwhile, residential land prices in Chinese cities increased dramatically, affecting affordability of housing for most of the population: in Beijing, real constant quality values for residential land rose by nearly 800% since 2003 with half of the increase having occurred during the 2008-10 period (Wu *et al.* 2012). Second, expropriations without what is perceived to be fair compensation contribute to conflict between farmers and government (Nitikin *et al.* 2012).⁴ They also undermine security of property rights, investment, land market functioning, and thus the efficiency of land use. Third, use of one-off land transfer revenue to finance recurrent local government expenditure is not viable in the long term and, in light of China's limited endowment with fertile land, will affect long-term food security. Local governments' high levels of collateralization of 'land banks', accumulation of bad debts, and 'land hoarding' all can lead to serious problems in the financial sector (Du and Peiser 2014).⁵

As land acquisition has increasingly become a focal point for legal disputes and rural unrest (Whiting 2011), efforts to find solutions focused on two areas. First, there have been calls to increase compensation paid to farmers and to make auctions rather than negotiation mandatory for all cases where land is made available for industry use. But determining an 'appropriate' level of compensation in a dynamic market is difficult. More importantly, local governments compete fiercely for industrial investment and auctions have been shown to be easily manipulated so that even their systematic use will not stop corruption (Cai *et al.* 2013). While these problems would be eliminated if direct rural-urban land transfers were allowed, few rural residents would be willing to give up their land unless an equivalent social safety net and source of income in old age was available (Ong 2014). Failure to capture the gains in land value from changing from rural to urban land use in a more sustainable way also undermines local governments' ability to provide social services. A tax on land or capital gains could help to do so but can only be implemented if

³ Total construction land in 2005 was estimated at about 17 million ha, about 64% of which in rural areas. A number of innovative, though not entirely legal models whereby villages brought this land directly to the market and reaping large profits from doing so (Su *et al.* 2013).

⁴ It is estimated that, during the 1987-2001 period alone, 40-50 million farmers lost half or more of their land to expropriation and that only about half of them obtained an urban residence permit (*hukou*) providing access to social services and education for their children (Tao and Xu 2007).

⁵ Land thus emerged as a key policy issue (Wong 2014) with multiple institutional challenges (Pan *et al.* 2015).

institutional preconditions are met, in particular if a proper cadastral database is in place (Nitikin *et al.* 2012).

This suggests that viable reforms would need to pursue a multi-pronged approach, including (i) registration of all rural land; (ii) a possibility for migrants to get an urban *hukou* that provides access to social services, especially if they give up part or all of their rural land rights; (iii) allowing rural collectives or individuals to enter into direct land transactions at freely negotiated prices, subject to compliance with planning standards; and (vi) taxation of land so as to generate the revenue to support urban welfare packages while also contributing to more efficient land use (Tao and Xu 2007). Several experiments were undertaken to explore available options. These include integration of construction and collective land markets in Shenzhen, land security development in Chongqing, urban fringe redevelopment in Beijing, land readjustment in Meitan, and the rural-urban integration in Chengdu to be studied here (World_Bank and DRC 2014). While some appear to have had positive effects, a more systematic evaluation of their impact on household welfare could help distil lessons to inform the potential nature and direction of future policy reforms in this area.

2.2 The Chengdu experiment

Chengdu prefecture includes 20 counties/districts with a total area of 12,000 km² and a population of 11 million, of which 5 million are rural residents. In 2008, it was named as pilot area for the comprehensive reform under a Commission for Balanced Urban-Rural Growth (CBRUG). Three key changes were introduced (Li 2012). First, a participatory effort to title all land -including agricultural, construction, forest, and waste land- and to establish a registration system was implemented under the authority of administrative villages. The purpose was to establish clear and secure property rights as a basis for long-term contracts for agricultural or construction land.⁶ Second, the Chengdu Rural Property Rights Exchange was established as a platform for transactions of all types of rural property rights, including construction land quotas to allow more market-oriented and transparent mechanisms for price discovery. It also aimed to allow farmers and collectives to take the initiative in auctioning construction land quotas through competitive bidding and the role of Government to shift to that of a regulator and supervisor. Introduction of tradable development rights allows voluntary market-driven access to land for non-agricultural purposes in ways that can benefit local communities.⁷ Third, to encourage migration, *hukou* restrictions were eliminated and regulations to allow easier transfers of rural construction land were passed. At least in principle, this would allow migration without the fear of losing an essential social

⁶ Titles to homesteads were given on occupied land although the size of plots frequently exceeded legal norms or what was documented on past certificates. Use rights to collectively owned construction land, e.g. for rural enterprises, public interest, and other purposes, were also documented.

⁷ A fund to strengthen protection of farmland, replenished from fees from transfers of land use rights and charges on newly developed construction land, is used to cover farmers' contribution to old-age pension insurance and to provide subsidies for land protection.

safety net,⁸ or the sale of part of a migrant's land in her place of origin to finance start-up of small enterprises in urban areas.

The experiment attracted interest from policy makers, scholars and the media. Case studies point towards positive reform effects in terms of (i) higher levels of investment in high-value perennials and vegetables due to a reduced threat of expropriations and reallocations and confidence in the stability of land ownership triggered by award of formal documents; (ii) increased volume of land transactions for agricultural and construction land that are likely to enhance efficiency and an incipient markets for secondary transactions and land conversion; and (iii) job creation in agriculture and other industries and higher wages or incomes as gains from the reform is shared more broadly throughout the local economy. Although potentially very valuable to identify underlying mechanisms, such anecdotal evidence is often based on non-representative samples and lacks a clear counterfactual, does not allow quantification of benefits in a way that can be compared to the cost of the intervention. To provide these and, in doing so, draw out the implications of the experiment in a more systematic manner, more systematic survey evidence is needed.

3. Data

We use two data sets in our analysis. First, for the village-level analysis, we use data from a survey of villages along comparable stretches of the Chengdu prefecture border conducted by Development Research Center of the State Council (DRC) in May 2014. The sample comprises 529 villages; 288 inside and 241 outside the border. To illustrate the location of sample villages relative to the border and to Chengdu city, figure 1 plots coordinates of the centers for treatment and control villages. We note that, even after excluding the Western part of the prefecture that lacks comparability,⁹ our sample includes a high level of variability: villages in two pockets in the Northeast and South are located along expressways and thus easily accessed from the city center in less than 30 minutes. Sample villages towards the East and the West are in mountainous settings that are, with road distances of some 150 km to Chengdu city center and a travel time of 3-4 hours, economically more remote. With a mean distance of 1.9 km between the village center and the prefecture boundary, treatment and control villages are, however, very close to each other.

Information on village characteristics, incidence of land reallocations and expropriations, and land transfers, for years between 2004 and 2013 was obtained from formal village records. It is complemented with recall data on informal land transfers from current and previous village leaders. For Chengdu

⁸ This allows households to participate in rental without sending a signal that they do not need the land and make them subject to reallocation.

⁹ The Western part of Chengdu prefecture consists of a rapidly ascending mountain range that contains two large national parks and borders Qiang and Aba Tibetan autonomous prefectures. As this would compromise comparability, we decided not to survey any villages in these areas.

villages, administrative data collected in the course of land registration were added, allowing to understand the nature and the cost of the certification process.

Second, for the household-level analysis, we use data from the National Bureau of Statistics' regular household survey in 7 counties adjacent to the border of Chengdu prefecture (3 counties inside and 4 outside the boundary),¹⁰ as illustrated in figure 1. Ideally, we would have liked a sample to include data from the same households before and after the reform. The fact that NBS changed its panel of households in 2011 makes this impossible. The ability to use two representative panel data sets before (the 2005-06 panel data set) and after (the 2011-12 panel data set) the reform still allows us to control for time-invariant household characteristics within each panel data set.¹¹

Given the involvement of supervisors resident in the sample villages and the use of detailed logbooks to record consumption on a daily basis (Chen and Ravallion 1996), NBS data on consumption are considered of exceptionally high quality (Jalan and Ravallion 1999). Beyond information on consumption, the survey includes (less precise) data on income and individual members' labor supply to farm or off-farm activities, migration, income from different sources, and an account of agricultural output and inputs. We also have data on key village characteristics including total working age population, agricultural land, and distance to public health and education facilities to control for village level time-varying effects.

With 9-13 villages per county and a sample size of 10 households per village, the pre-reform sample comprises a total of 310 and 470 households inside and outside Chengdu, respectively.¹² The post-reform sample similarly includes 280 and 390 households inside and outside the prefecture boundary. After dropping some 5% of sample households who neither engaged in productive activities nor participated in labor markets due to old age or disability, we end up with a sample of 285 pre- and 259 post-reform households inside Chengdu and 453 and 382 households in neighboring counties (Meishan and Ziyang) in the pre-and post-reform sample, respectively.

3.1 Nature and cost of the certification process

A detailed description of the size of different types of land and the certification process for each of the 529 sample villages is provided in table 1. The average village area is 12,790 mu (8 km²). Certificates for collective construction land were issued to the village whereas those for contracted arable and forest land and residential land and actual structures were awarded to households.

¹⁰ The NBS sample is drawn from a fixed set of counties. We compare outcomes of NBS households in counties from both sides of the Chengdu prefecture border with three counties in Chengdu and four counties in Meishan and Ziyang.

¹¹ To avoid contamination as the reform was planned and implemented mainly between 2007 and 2009 and maintain a balanced sample from before and after the implementation, we use the 2005-06 panel data set and the 2012-12 panel data set to represent household outcomes before and after the reform, respectively.

¹² The number of selected villages was 9 for Jintang of Chengdu, 10 for Shuangliu of Chengdu, 12 for Qionglai of Chengdu, 13 for Dongpo of Meishan, 12 for Renshou of Meishan, 10 for Lezhi of Ziyang, and 12 for Jianyang of Ziyang.

Regarding implementation, we note that in more than 80% of cases, rules were made at the village level, either by the assembly (44%), economic organizations (23%), representatives (13%) or leaders (2%). Organization came more often from above (44% of township or above; 27% village leaders), and actual measurement was done by village representatives in 44% of cases.

In about 50% of villages, land registration gave rise to disputes and, where this was the case, an average of 11.1 disputes per village emerged. Disputes was most pervasive for arable and forest land (which attracted disputes in 45% and 31% of villages with 9.4 and 8.9 disputes, respectively) and least frequent with regard to collective and construction land (18.5% and 19.6% of villages with a mean of some 6 disputes). Even where disputes emerged, most of the cases encountered were resolved by village institutions: in villages with conflict, a total of 0.9 cases required intervention by institutions above the village.

After certification, contracts longer than 30 years were issued for all construction land and more than 95% of all other land use types with the exception of arable land (87%). Permanent land use contracts were given in close to 80% of cases overall, from 91% of residential and construction land to 84% of collective land, and some 58% and 59% of arable and forest land. Survey data point toward total cash cost of about Y 16 per mu of which close to half (43%) was contributed by the village and the remainder from outside. Villagers contributed close to 2,000 man-days of labor (about 3 days per household) and, with somewhat more than 10 person-months of labor by outsiders, contributions from above the village remained limited.

3.2 Descriptive statistics and pre-trend tests for the village-level analysis

Table 2 provides information on key characteristics separately for sample villages in the 2004-07 ‘before’ reform period (cols. 2 and 3 for villages outside and inside the Chengdu prefecture boundary, respectively) and the 2010-13 ‘after’ reform period (cols. 5 and 6 for villages outside and inside the boundary). To test for pre-reform trends in outcome variable Y_{it} , we use the 2004-07 sample to estimate $Y_{it} = \alpha + \beta_1 C_i + \beta_2 T_{it} + \beta_3 C_i T_{it} + \varepsilon_{it}$ where C_i is an indicator variable for location in Chengdu prefecture and T_{it} is a time trend while β_2 and $\beta_2 + \beta_3$ are estimates of the pre-reform trend for villages outside and inside Chengdu, respectively. As significance of β_3 implies rejection of the parallel trend assumption, we report the level of significance of β_3 in col. 7.

Of villages’ total land endowment, some 47% (44% vs. 50% outside and inside the border, respectively) was used for arable agriculture, 32% (38% vs. 28%) for ‘other’ agriculture, mostly pastures, 10% (8% vs. 11%) for residential or commercial purposes, and 11% (10% vs. 12%) remained unutilized. At 1.4 mu per capita, arable land endowments did not differ significantly between villages in- and outside the border. Residential land per capita was, with about 109 m² (101 m² outside and 115 m² inside), well above the 20-

30 m² norm for Sichuan (Han and Li 2009). Although more rigorous econometric analysis will be needed to assess whether these are true reform effects, we note that, in the post-reform period, the share of arable land increased inside but decreased outside the border while the opposite was observed for residential land. This is supported by an increase of almost 10 percentage points (from 1.40 to 1.53) in per capita arable land and an equivalent decrease (from 115 to 103 m²) inside Chengdu prefecture, compared to unchanged levels of arable land and significant increases in residential land endowments outside the boundary.

The incidence of land reallocation and expropriation was low: they were observed in 5% and 2% of villages overall, with higher rates inside (7.3% and 2.4%, respectively) vs. outside (2.5% and 0.7%) the boundary although reallocations in control villages involved larger areas and numbers of households. Interestingly, post-reform, the incidence of both reallocations and expropriations was higher outside as compared to inside the prefecture boundary (4.7% vs. 3.4% for reallocations and 6.3% vs. 5.6% for expropriations).

Informal land transactions were observed in 22% of villages (23% outside and 20% inside) and, where they occurred, transferred some 11% of arable village land (10% and 13% outside and inside), in 25% and 33% involving outsiders or contracts longer than 5 years, respectively, and contributing to some consolidation. Formal transfers were observed in 4% of villages (1.3% and 6.9% outside and inside, respectively) mostly with one partner only and in about 30% of cases (8% outside and 33% inside) mediated by local government. If they took place, they affected 7% of arable area, involved longer contract periods (77% between 6 and 30 years and 23% above 30 years) and involved a larger share of households (16% outside and 14% inside Chengdu prefecture) than informal transfers. The incidence of both types of transfers increased over time; informal transfers to 31.2% after the reform although the area affected changed much less (12% vs. 16% for informal and 6% vs. 10% for formal transactions).

Before the reform, transfers of construction were observed only in 1.4% of villages; 1.8% and 1.0% outside and inside the prefecture boundary, respectively. Where observed, they involved some 7% of construction land (2.3% outside and 10% inside). After reform, the incidence of transfers increased to 3.2% of villages (2.6% and 3.6% outside and inside the boundary), affecting 12.8% of construction land (7.8% and 15.3% outside and inside).

Results from tests for parallel trends pre-reform (col. 7) suggest that this hypothesis can be rejected at 10% or above for only 2 variables -incidence of expropriations and formal land transfers- out of 45. In both cases, trends for villages inside Chengdu are higher than for those outside. However, for the latter, the significance disappears if we consider only formal transfers that were not initiated by local government.

3.3 Descriptive statistics and pre-trend tests for the household-level analysis

Table 3 reports descriptive statistics on household characteristics, welfare, agricultural production, and time use for the pre- and post-reform periods inside and outside of Chengdu (cols. 1-4), estimated pre-reform trends (cols. 5 and 6), and a test of the significance of differences in such trends between households inside and outside the Chengdu border (col. 7).

We note that households in the treatment and control are comparable with respect to basic characteristics: they comprise 3-4 adults, had a head born in the late 1950s, education between junior high and high school, some 8% of female heads. At the same time, three sets of differences emerge. First, households in Chengdu had higher levels of assets, income, and consumption (Y16,063 and Y40,025, Y4,928 and Y8,549, and Y3,150 and Y6,078 in pre- and post-reform periods, respectively) than those outside (Y11,564 and Y29,752, Y3,770 and Y8,069, and Y2,668 and Y4,997). They also allocated labor differently across sectors, presumably due to proximity to urban income earning opportunities: with a time commitment of 43% and 50% in 2005/06, farming was the most important activity for households inside and outside Chengdu, followed by migration (18% and 23%, respectively, and local off-farm employment (14% and 10%). These shares changed significantly over time -to 30% and 40% for agriculture, 16% and 25% for migration, and 21% and 11% in local off-farm employment for treatment and control group, respectively. But the last column indicates pre-reform trends are not significantly different between the two, supporting our identification strategy.

With respect to agricultural production, households in Chengdu prefecture cultivated smaller areas (3.45 vs. 4.79 mu) in 2005/06 but spent more on inputs (456 vs. 368 Y/mu) and obtained higher monetary output per mu (1,880 vs. 1,254 Y/mu) and net revenues (1,406 vs. 957 Y/mu) than those outside. While pre-reform trends suggest a strongly declining trend in most of these variables inside compared to outside Chengdu, a glance at changes between pre-and post-reform period for those in the treatment and control suggests that reform may indeed have had a positive impact in a number of dimensions. For example, the area share of vegetables increased from 14% to 21% inside and 10% to 13% outside the boundary. But value of output and net revenue per mu actually decreased, suggesting that econometric analysis that controls for other factors will be needed.

The bottom panel of table 3 illustrates that the period coincided with expansion of subsidies for grain, seed, and other inputs. Yet, if anything, the absolute magnitude and growth rate of these was more pronounced outside as compared to inside the Chengdu border. Similarly, the rural pension and cooperative medical schemes were rolled out over the period but our data suggest that net receipts from these schemes were, if anything, lower to for households inside the prefecture boundary than outside.

As discussed in detail below, we cannot reject the hypothesis of no significant differences in pre-reform trends between households inside and outside the border for overall household welfare and the share of income derived from agriculture non-farm employment, migration, and local wages and, with one exception, individuals' time use, and agricultural yields and profits. Some significant pre-reform trends exist, however, with respect to use of agricultural inputs and crop choice. They point towards marked declines in agricultural assets (-18% in Chengdu vs. +35% in villages outside the prefecture boundary) and use of inputs (-38% vs. -16%). Output shares of wheat and other grains increased and those of oil crops decreased in Chengdu while the opposite was true for households in neighboring counties. Also, key interventions in place during the period of concern are a new rural pension scheme (Lei *et al.* 2013), cooperative medical scheme (Wagstaff *et al.* 2009), and agricultural subsidies (Huang *et al.* 2011; Meng 2012). While these are funded centrally, disbursements may vary by prefecture and we include information on the amounts received in such schemes, in addition for a wide range of household-level observables, in our regressions.

4. Econometric results

Our estimates from the village-level analysis point towards significant reform-effects on land markets. Reform-induced increases of tenure security: significant reductions of land reallocations and, to a lesser extent, expropriations seem to be a key driver. While the reform did not affect the amount of unused land, they triggered land transfers from 'other' to agricultural use and from residential to non-residential construction land. Large part of observed land use changes was mediated through land markets, suggesting that reform efforts to improve transferability of land and reduce the transaction costs of land markets operation did have an impact.

Our estimates from the household-level analysis also point towards higher rental market activity induced by the reform. In line with the investment effect traditionally documented by the property rights literature, the reform also increased more intensive input use and a shift of crop composition towards high-value crops. Agricultural yields and profits consequently increased by 55% and by 38%, respectively. Mainly contributed by income from farming, the reform is estimated to have led to a significant increase in per capita consumption by 7.7% that was most pronounced for less educated and less wealthy households, and an increment in net income of almost equal size. Finally, the reform also contributed to job creation with an increase in labor supply by males and a shift from migration to agricultural activities by the young and from farming to off-farm activities by the old.

4.1 Village-level analytical approach

To analyze village level impacts of the reform, we rely on a difference-in-difference approach whereby differences between pre- and post-reform periods in the same village are compared between villages located just inside Chengdu prefecture -and thus affected by the reform- and those located just outside - and thus unaffected. Although villages may have been different from each other already before the reform, use of village fixed effects implies that our strategy is valid as long as pre-reform trends of relevant outcome variables in treatment and control are parallel.

$$Y_{it} = \alpha + \beta_1 C_i R_t + \beta_2 X_{it} + \beta_3 \rho_{it} + \gamma_t + \delta_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the outcome of interest for village i in year t ; C_i is an indicator variable for villages inside of Chengdu; R_t is an indicator variable for the post-reform period (2010-13); X_{it} is a vector of time- varying village characteristics that includes total land areas, the population, the amount of agricultural subsidies, the share of households with access to new rural pension or new medical scheme, the distance to the nearest county road, the surface of the village road, and indicator variables for village-level infrastructure (primary schools and medical stations) in the village; ρ_{it} a vector of time- varying unobservables; γ_t is a year fixed effect; δ_i is a village fixed effect; and ε_{it} is an error term. β_s are parameters to be estimated. The parameter of main interest is β_1 , our estimate of the impact of certification on village-level outcomes.

Since the reform was implemented at the prefecture level rather than the village level, an econometric challenge to our identification is that the limited number of clusters in our sample leads to downward-bias of the variance matrix. To address this, we follow the literature (Cameron and Miller 2015) and report p-values from wild cluster bootstrap consistently for coefficients of interest (β_1) and take this into account consistently in interpreting results.

For a robustness check, we also include spatial fixed effects to control for time-varying changes in unobservables (e.g. local property booms) that may affect treatment and control located in close proximity from each other and construct neighborhoods denoted by j . To ensure we have at least one control for each treated village in the neighborhood and vice versa, we set the critical distance at 11km. Equation (1) is demeaned to obtain

$$\tilde{Y}_{ijt} = \beta_1 \tilde{C}_{ij} \tilde{R}_t + \beta_2 \tilde{X}_{ijt} + \beta_3 \tilde{\rho}_{ijt} + \tilde{\gamma}_t + \tilde{\varepsilon}_{ijt} \quad (2)$$

where variables with tilde are demeaned. To control for location-specific unobservables that affect villages on both sides of the border equally and thus introduce correlation between ρ_{ijt} and $C_{ij}R_{ijt}$, we introduce spatial fixed effects as follows:

$$\tilde{Y}_{ijt} - \frac{1}{n_j} \sum_{i' \in j} \tilde{Y}_{i'jt} = \beta_1 \left(\tilde{C}_{ij} \tilde{R}_t - \frac{1}{n_j} \sum_{i' \in j} \tilde{C}_{i'j} \tilde{R}_t \right) + \beta_2 \left(\tilde{X}_{ijt} - \frac{1}{n_j} \sum_{i' \in j} \tilde{X}_{i'jt} \right) + \beta_3 \left(\tilde{\rho}_{ijt} - \frac{1}{n_j} \sum_{i' \in j} \tilde{\rho}_{i'jt} \right)$$

$$+(\tilde{Y}_t - \frac{1}{n_j} \sum_{i' \in j} \tilde{Y}_t) + (\tilde{\varepsilon}_{ijt} - \frac{1}{n_j} \sum_{i' \in j} \tilde{\varepsilon}_{i'jt}) \quad (3)$$

where n_j represents the number of villages within a critical distance of village i . Standard errors are adjusted to deal with possible spatial correlation (Conley 2008).¹³

To check if our results might be due to structural differences other than the rural-urban integration reform, we perform a placebo test where equations (1) and (3) are estimated using a R_t corresponding to a putative reform in 2006-07. Estimates of β_j from this regression are reported throughout.

4.2 Village-level effects

In terms of presentation, tables 4-6 assess reform effects on land markets by reporting estimated reform effects on two sets of outcomes, namely (i) tenure security and changes in land use (tables 4 and 5); and (ii) market-mediated land transfers through a range of channels (table 6). Throughout, panel A reports estimated mean reform impacts, and panel B provides results from a putative placebo reform in 2006-07 to the test robustness of our estimates.¹⁴

We estimate that the reform led to a reduction of 5% in the incidence of land reallocations (cols. 1 and 2 without and with spatial fixed effects), thus contributing to stability of property rights that is likely to be a pre-condition for higher levels of land-related investment. Compared to a pre-reform average of 5.1% of villages being affected by reallocation, this is a quantitatively large effect. Equivalent regression for the incidence of land expropriation point towards a negative reform effect on the likelihood of any expropriation taking place with point estimates of 2%, but not robust to wild cluster bootstrap or spatial fixed effects. Again, in light of a pre-reform average of 1.6%, this effect is quantitatively large. Placebo tests suggest that, if anything, estimated reform impacts run counter to or even reverse strongly positive pre-reform trends in reallocation or insignificant ones for expropriation.

Beyond encouraging higher levels of land-attached investment, tenure security is also a pre-condition for decentralized land transfers that can increase overall efficiency by better aligning land use with economic incentives (Besley and Ghatak 2010). To check if the Chengdu reform may have triggered such change, table 5 presents results from regressions of the share of land in a village under different uses, in particular (i) arable agriculture vs. other less directly productive uses; (ii) non-residential compared to residential construction land; and (iii) unutilized or so-called wasteland. Results point towards no appreciable impact on the share of unutilized or ‘waste’ land, allaying fears that the reform may have led to unsustainable

¹³ To implement this in practice, we use stata code suggested in the literature (Hsiang 2010).

¹⁴ We define two years to keep balanced samples before and after the placebo reform. For modules we have data between 2004 and 2013, the placebo reform is defined as 2006. For modules we have data in 2004, 2007, 2010 and 2013, the placebo reform is defined as 2007.

land expansion or deforestation but considerable changes within the agricultural and construction land categories.

For agricultural land, we find evidence of intensification of agricultural land use with a highly significant reform-induced increase of 2% in the share of land used for agriculture that is matched by a reform-induced decrease of almost equal magnitude (-2%) in the share of ‘other’ agricultural land. The placebo test illustrates that estimated reform impacts contrast with pre-reform trends (i.e. insignificant trend in terms of wild cluster bootstrap, or a significant increase for ‘other’ agricultural land for the estimation with spatial fixed effects), suggesting that, if anything, the reform reversed an earlier increase in ‘other’ agricultural land, helping to bring such land to more productive use.

A key goal of China’s land policy has been to create incentives for bringing unused residential land to more productive use although implementing this has not always been easy or uncontroversial (Huang *et al.* 2014). Our results suggest that the reform, by leading to a significant increase of some 1% compared to a pre-reform mean of 3.9% in the share of non-residential construction land (table 2), helped to move closer towards this goal. This is matched by a near-equivalent decrease (-0.9%) in the share of residential construction land,¹⁵ supporting the interpretation that it was creation of a more conducive environment for operation of land markets that allowed land freed up in this way to be formalized to allow its effective use in ways sanctioned by the law.

Although official records on actual land use are preferable to evidence on market-based transactions that may, for a range of reasons, not be formalized, data on transactions allow us to cross-check findings based on land use and ascertain if such changes are driven by market-based transactions. Results from doing so (table 6) suggest that, indeed, significant part of the land use change observed earlier can be attributed to land market activity, in three respects. First, we note a significant increase in market-mediated transfers of construction land, albeit from a very low level, with point estimate of 2% suggesting that reform helped to almost double the pre-existing level of such transfers. The contrast with insignificantly negative point estimates in placebo regressions suggests that estimates are unlikely to pick up pre-existing trends in Chengdu prefecture. Second, we find evidence of a significant reform-induced increase in formal transfers of agricultural land, with a point estimate of 7% or 5% for any transfer or transfers not mediated by the government (cols. 2 and 3), respectively, compared to a pre-reform level of 3% or 2%.

Finally, we find a significant reform effect for shorter-term land transfers in informal markets with an estimated increase in the incidence of land market activity of 7%, compared to a pre-reform mean of 21%, contrasting with an insignificant pre-reform trend according to the placebo. We can also run regressions

¹⁵ While placebo tests for the estimation with spatial fixed effects point towards some reduction of residential land in Chengdu even before the reform -though of much smaller magnitude than after the reform, no such trend is evident for non-residential construction land.

for the share of households participating in land markets. Results from doing so in table 6, cols. 5-7 suggest that reform led to a significant increase in the share of households who either rented in or out, with point estimates of around 1%, and affected mean shares of land transferred of 9% (lack of significance with spatial fixed effects). There is no evidence of significant pre-reform trends if other variables are controlled for, consistent with the notion of a reform-induced increase in the incidence of land market transactions.

4.3 Household-level analytical approach

Household-level effects are identified based on differences between (i) pre- and post-reform periods; and (ii) households located just inside Chengdu prefecture -and thus affected by the reform- and those located just outside -and thus unaffected. In the absence of one panel data set including both pre- and post-reform periods, the two rounds of panel data sets are at least representative for each period. In addition, we also control for time-invariant household characteristics within each panel data set by taking a difference. The basic equation of interest can be written as

$$\Delta Y_{ijt} = \beta_3 + \beta_4 C_{ij} + \beta_5 R_t + \beta_6 C_{ij} R_t + \beta_7 \Delta X_{ijt} + \beta_8 \Delta V_{ijt} + \Delta \varepsilon_{ijt} \quad (4)$$

where variables with delta are taken a difference. Y_{ijt} is the outcome of interest for household i in village j in year t ;¹⁶ C_{ij} is an indicator variable for households inside of Chengdu; R_t is an indicator variable for the post-reform period (2011-12); X_{ijt} is a vector of time-varying household characteristics including the number of children, adults and old people, highest education, the head's gender and age, and the amount from pension and medical schemes as well as crop subsidies received; V_{ijt} is a vector of time-varying village characteristics including total working age population, land area used for agriculture, distances to educational, health, and administrative institutions; and ε_{ijt} is an error term. β_s are parameters to be estimated. Our main interest is in β_6 , the estimated mean impact of the reform.

To explore whether effects vary with households' endowment of human capital and physical assets, we augment equation (4) by adding interaction terms between initial endowment and reform-related indicator variables as follows:

$$\Delta Y_{ijt} = \gamma_1 + \gamma_2 C_{ij} + \gamma_3 R_t + \gamma_4 E_{ijt-1} + \gamma_5 C_{ij} R_t + \gamma_6 E_{ijt-1} R_t + \gamma_7 C_{ij} E_{ijt-1} + \gamma_8 C_{ij} E_{ijt-1} R_t + \gamma_9 \Delta X_{ijt} + \gamma_{10} \Delta V_{ijt} + \Delta \varepsilon_{ijt} \quad (5)$$

where E_{ijt-1} denotes either an indicator variable that is one if the highest level of education for a family in the initial period is above the compulsory level of junior high school, or the standardized value of physical assets. γ_s are parameters to be estimated. The main parameters of interest are the mean reform

¹⁶ In some of our regressions, outcomes are at the individual rather than the household level. We do not include another subscript to avoid clutter.

effect, γ_5 , and its variation with pre-existing endowments, γ_8 . Again, to address the limited number of clusters, we follow the literature (Cameron and Miller 2015) and report p-values from wild cluster bootstrap consistently for coefficients of interest (β_6 and γ_8) and take this into account consistently in interpreting results.

4.4 Household-level effects

In terms of presentation, tables 7-9 assess reform effects on agricultural productivity, crop choice, and overall welfare, respectively. Throughout, panel A reports estimated mean reform impacts, panel B provides heterogeneous results in terms of initial education, and panel C illustrates heterogeneous results in terms of initial assets. As documented by the literature that increasing tenure security can promote land-related investments and land rental markets can enhance productivity by transferring land to more efficient uses or users, our village-level findings provide preconditions for testing household-level effects on investments and productivity. Moreover, if the reform increased productivity of land use and wages or changed certain activities' relative productivity, we would expect corresponding shifts in overall labor supply or time allocation across sectors.¹⁷ To test this hypothesis, table 10 reports reform effects on individuals' time use by gender.

Cols. 1 and 2 of table 7 point towards reform-induced increases of revenues from agricultural production by more than 50% or an increase in profits of 38% (panel A). Panel B suggests that such increases in yields and profits were particularly high for those with less than the required level of education. Panel C suggests that reform-induced increases in yield, but not profits, were particularly large for those with above-average levels of assets.

While we have information on one side (renting in) of the rental market only, the reform is estimated to have increased land market activity by 5.5%, beyond a secular increase of land rental activity of 2.5% (col. 3), a large increase compared to the initial level. Panel B points to insignificant variation with initial education while panel C suggests that reform effects on renting in were even more pronounced for those with higher levels of initial assets.¹⁸

Although significant differences in pre-reform trends of purchased input use and composition of output between households inside and outside Chengdu suggest that some 'catching up' may be involved, results in table 7 point towards a marked reform-induced substitution of purchased inputs for labor. As the effect of fertilizer and pesticides are felt beyond the current production cycle (Jacoby *et al.* 2002), this is consistent with the notion of reforms having reduced investment disincentives and thus provided greater

¹⁷ As we have information on time use at individual level, analyzing this aspect also allows us to obtain gender- and age-differentiated estimates of reform impacts, in line with evidence that such differences could be important (Wang 2014).

¹⁸ This contrasts to other studies (Deininger *et al.* 2014), reinforcing the notion that reform-induced increments in tenure security made investment in agriculture more attractive.

incentives to apply purchased inputs and adjust to rising wages (Ge and Yang 2014) and increase efficiency. The reform is estimated to have reduced per-mu intensities of fertilizer, pesticides, and seeds by 108%, 67%, and 39%, respectively, while reducing that of hired labor by 17%.¹⁹ Results in panel C suggest that, with the exception of seeds, changes in the intensity of input use were more pronounced for those with higher levels of assets.

In terms of the composition of agricultural output (table 8), the reform seems to have accelerated the trend of shifting area out of rice (-1.2%) and wheat (-1.3%). With point estimates of -3.4% for wheat, and -2.8% for rice, the estimated magnitude of reform-induced effects exceeds that of secular trends. Such declines were almost entirely compensated for by reform-induced increases in the area devoted to vegetables (+2.6%), oil crops (+3.4%), and corn (+2.1%). Panel C implies that after reform, those with more assets devote more land to high-value vegetables (a one standard deviation estimated to be associated with a 1% increase in vegetable area), possibly due to the more capital-intensive or risky nature of this crop.

The increasing profit in agriculture may shift the contribution of different sources to total income and affect total income and consumption. Cols. 1-4 of table 9 suggest that the reform led to a significant increase in the overall share of income from farming by 4.6% and a decrease in the income share of local wages by some 2.7% (panel A). Bootstrapped p-values imply that these effects are robust to clustering. By comparison, estimated impacts on the share of income from off-farm income or migration are insignificant. Size and significance of such impacts varied by initial levels of education and assets (panels B and C): in general the reform led to higher income shares from farming by those with lower initial education or assets -by 7.3% or 4.6%, respectively- but no changes by those with higher initial education or asset levels, consistent with the notion that reduction of expropriation threats led to more effective use of agricultural land that created jobs for the less-skilled.

Cols. 5 and 6 point towards a reform-induced increase in households' per capita consumption and per capita income of 7.7% and 6.7%, respectively, robust to clustering (panel A). This implies estimated annual reform benefits of Y 70 to Y 95 per mu,²⁰ well above the Y 16 per mu it cost to implement the land certification program (table 1). In other words, estimated income gains even in one year are more than sufficient to pay for the cost of the program. Panels B and C suggests that effects of Chengdu's land reform on per capita consumption were pro-poor: income for households where the head's education was below junior high is estimated to have increased by 14.7% but those with more than this compulsory level of education are estimated to not have benefited at all. Similarly, the z-score for assets interacted with the

¹⁹ Reform-induced increases in supply of (young) own labor noted above are consistent with this reduced reliance on hired labor.

²⁰ With a mean cultivated area of 3.45 mu, the estimated benefit per mu in terms of consumption and income is $3,150 * 0.077 / 3.45$ and $4,928 * 0.067 / 3.45$, respectively. .

Chengdu dummy is negative and significant. It suggests the reform benefited those with lower assets but not those with above average wealth.

Finally, as we have individual level data on labor supply, we can use regressions for all individuals of working age (16-60 or 16-55 for males and females) in the sample to disaggregate estimated reform effects by gender.²¹ Doing so suggests that the reform led to an expansion of labor market opportunities and a significant increase in total labor supply by males -with the young (16-40 years old) focusing on agriculture and the old (41-60 years old) on off-farm work and similar shifts, though no change in aggregate labor supply, by females.

Results for males and females in the first two panels of table 10 imply that the reform led to an increase of overall annual labor supply of almost 0.4 months by males but not by females. Disaggregating by age suggests that young males spent more of their labor time in agriculture and less in off-farm (0.64 and 0.33 months, respectively), while the old worked more in off-farm self-employment (0.42 months). For females, the point estimate of changes in total labor supply is insignificant but we note a marginally significant (10% level) reduction in time spent migrating (0.44 months) by the young and a reduction of labor supply to agriculture (-0.55) that is only partly made up for by an increase (0.22) in time spent in off-farm activities. Aggregated over all individuals of working age to the household level (the last panel of table 10), the estimate for reform-induced changes in number of months worked is positive but insignificant. For the young, the significant reform-induced shift towards agriculture and away from off-farm and, to a lesser extent, migration, is confirmed.

5. Conclusion and policy implication

We assess the impact of a far-reaching factor market reform that was implemented in Chengdu prefecture through a ‘rural-urban integration’ experiment in 2008. We find that the reform significantly reduced the threat of reallocation or expropriation. This resulted in higher shares of agricultural and construction land being used for arable and economic purposes. Many of the reform-induced land use changes were mediated through land markets, suggesting that reform efforts to improve transferability of land and reduce the transaction costs of land markets operation were not without impact. Household-level evidence supports the effectiveness of the reform with three respects. First, the reform contributed to higher agricultural yields and profits through three channels, namely (i) greater rental market activity that transferred land to more productive producers; (ii) substitution of purchased inputs for labor; and (iii) a shift out of grains towards vegetables, corn, and oilseeds all of which offer higher levels of profitability. Second, the reform helped increase consumption and income, in particular for less educated and affluent households. Interestingly, estimated benefits exceed the cost of reform implementation. Finally, it

²¹ The age brackets of 16-60 years (or 55 for females) are in line with the age for participation in formal labor markets.

increased overall labor supply and contributed to a shift of labor by young males and females towards the agricultural sector, a move which, for females, coincided with a significant reduction of the time spent migrating.

All of these findings are consistent with the notion that, without the reform, tenure insecurity and transaction cost in factor markets undermined investment and functioning of land and labor markets, preventing high-value peri-urban land from being used most effectively, especially for the less affluent and educated. As China considers how to build on what has been achieved, pilot results point to important substantive lessons in terms of key elements of reform implementation and elements of what has been done in Chengdu reform are thus likely to form an integral part of any future reform package. While we can only estimate impacts of the entire reform package rather than individual components, careful design of future reforms, with an emphasis on evaluation right from the start could, could help to further enhance lessons for policy. Beyond China, there are many countries (e.g., Vietnam, Ethiopia, Nigeria, Tanzania) where a need for public sector intervention hampers the functioning of peri-urban land markets and negatively affects tenure security.

Figure 1: Location of sample villages and counties

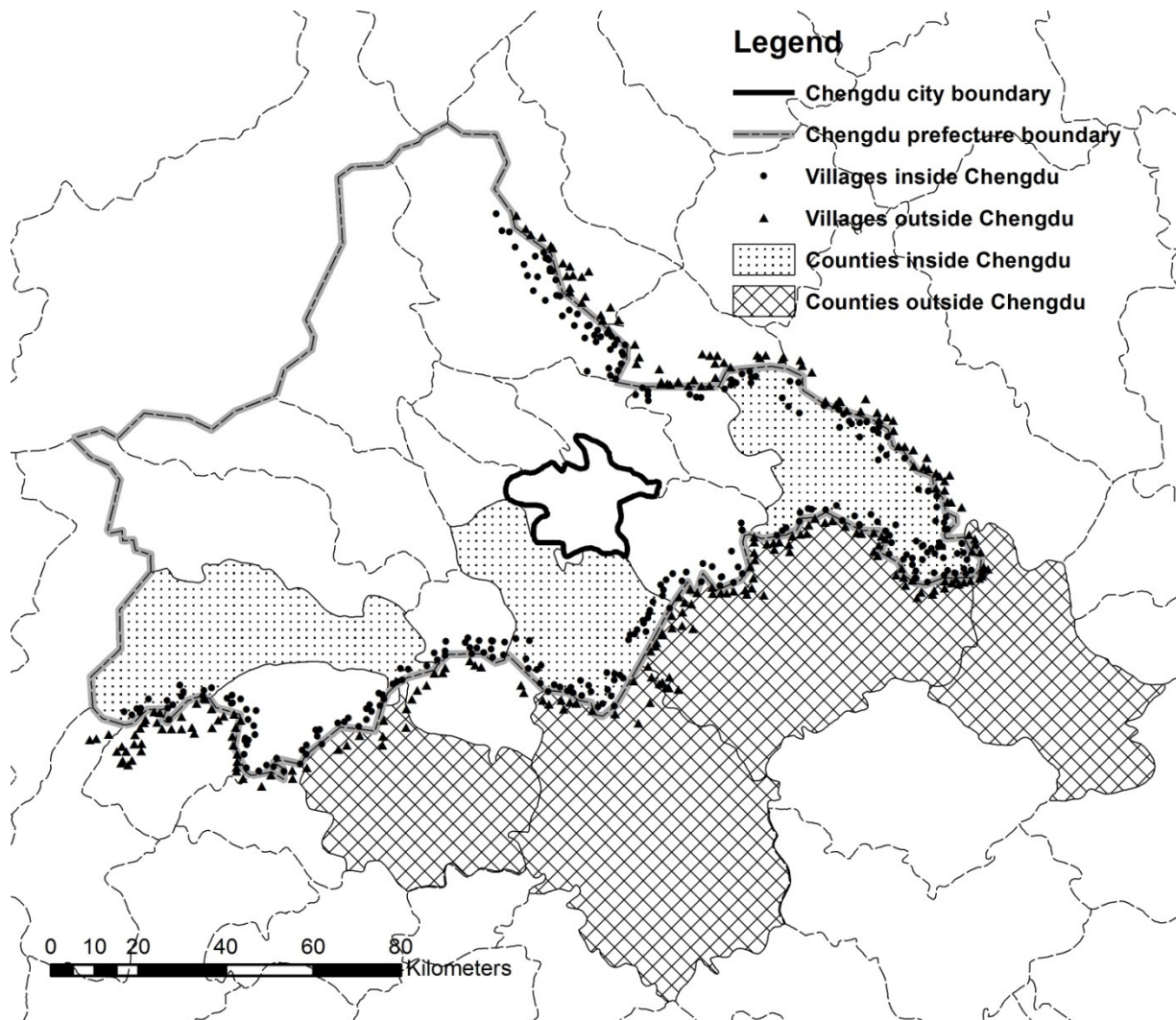


Table 1: Characteristics of the land certification process

	Total (1)	Land type					
		Collect. (2)	Arable (3)	Forest (4)	Constr. (5)	Residential (6)	Houses (7)
Main characteristics							
Total area	12,790	7,052	3,295	1,859	343	316	237
Titling complete	0.938	0.974	0.979	0.964	0.900	0.911	0.911
...if yes, months taken	5.011	4.157	4.455	5.961	5.080	5.330	5.711
No. of certificates issued	2,852	95	781	633	393	717	719
Area titled (mu)	9,033	5,861	3,159	1,695	306	267	219
Organization and implementation							
Rules made by village leaders	0.015	0.019	0.018	0.011	0.017	0.017	0.015
Rules made by village representatives	0.127	0.133	0.135	0.121	0.131	0.117	0.124
Rules made by village assembly	0.444	0.437	0.465	0.447	0.383	0.438	0.458
Rules made by village econ. Organizations	0.225	0.211	0.223	0.232	0.257	0.229	0.215
Rules made by township or above	0.188	0.200	0.160	0.189	0.211	0.200	0.189
Organization done by village leaders	0.271	0.264	0.276	0.220	0.176	0.270	0.278
Organization done by village representatives	0.047	0.048	0.046	0.079	0.049	0.045	0.043
Organization done by village assembly	0.129	0.117	0.141	0.126	0.126	0.139	0.141
Organization done by village econ. organizations	0.113	0.095	0.131	0.105	0.082	0.127	0.123
Organization done by township or above	0.439	0.476	0.406	0.471	0.566	0.418	0.415
Actual measurement done by village leaders	0.075	0.074	0.078	0.079	0.088	0.070	0.073
Actual measurement by village representatives	0.436	0.415	0.468	0.497	0.337	0.434	0.462
Actual measurement done by village assembly	0.041	0.029	0.039	0.026	0.050	0.029	0.047
Actual measurement by village econ. org.	0.289	0.265	0.309	0.330	0.337	0.307	0.298
Actual measurement done by township or above	0.159	0.217	0.106	0.068	0.188	0.160	0.120
Disputes							
Any disputes encountered	0.502	0.185	0.452	0.314	0.196	0.244	0.243
... if yes, no. of disputes	11.102	6.860	9.367	8.883	5.600	7.695	6.652
... disputes could not be resolved at village level	0.877	0.104	0.772	0.746	0.029	1.000	0.677
Results							
Contract now longer than 30 years	0.959	0.974	0.869	0.968	1.000	0.984	0.989
Contract now permanent	0.793	0.844	0.578	0.590	0.910	0.914	0.899
Resources required and costs							
Total labor from village (man-days)	1,918						
Total labor from outside (man-days)	269						
Total cost (Y/mu)	16.15						
Share of cost borne by village	0.431						

Source: Own computation from 2014 Chengdu village survey based on 529 villages.

Table 2: Key parameters for villages inside and outside the Chengdu prefecture boundary

	Before			After			Before Trend T test (7)
	Total (1)	Outside (2)	Inside (3)	Total (4)	Outside (5)	Inside (6)	
Land endowments							
Area of arable land per capita (mu)	1.410	1.425	1.400	1.485	1.420	1.532	
Area of residential land per capita (m ²)	109	101	115	105	109	103	
Share of arable land in total area	0.472	0.440	0.496	0.476	0.435	0.506	
Share of other agricultural land in total area	0.318	0.375	0.276	0.312	0.376	0.266	
Share of residential land in total area	0.057	0.049	0.063	0.054	0.052	0.055	
Share of other construction land in total area	0.039	0.033	0.044	0.049	0.037	0.057	
Share of unutilized land in total area	0.113	0.103	0.121	0.109	0.100	0.115	
Threats to tenure security							
Any reallocation	0.051	0.024	0.073	0.040	0.047	0.034	
... if yes, number of reallocations	1.140	1.261	1.107	1.369	1.311	1.436	
... if yes, area involved	0.083	0.184	0.061	0.134	0.063	0.199	
... if yes, share of households involved	0.176	0.324	0.133	0.181	0.126	0.248	
Any expropriation	0.017	0.007	0.025	0.059	0.063	0.056	**
... if yes, number of expropriations	1.222	1.286	1.207	1.560	1.984	1.156	
... if yes, area involved	0.080	0.020	0.085	0.065	0.058	0.071	
... if yes, share of households involved	0.145	0.085	0.158	0.145	0.176	0.117	
Informal transfers of arable land							
Any informal transfer of arable land	0.215	0.230	0.201	0.312	0.290	0.330	
... if yes, share of areas transferred	0.111	0.095	0.128	0.140	0.121	0.156	
... if yes, share of households renting out	0.100	0.081	0.120	0.144	0.118	0.163	
... if yes, share of household renting in	0.069	0.059	0.083	0.090	0.066	0.112	
... if yes, share of transfer period <=5 years	0.667	0.606	0.724	0.555	0.513	0.583	
...if yes, share with close kin	0.537	0.521	0.554	0.550	0.534	0.565	
... if yes, share with outsiders	0.254	0.249	0.264	0.325	0.331	0.314	
... if yes, share without rental	0.568	0.543	0.593	0.601	0.606	0.597	
Formal transfers of arable land							
Dummy: Any formal transfer	0.043	0.013	0.069	0.124	0.058	0.180	**
... if yes, # of formal transfers	1.391	1.077	1.444	1.441	1.232	1.498	
... if yes, share of area transferred	0.071	0.073	0.071	0.095	0.063	0.102	
... if yes, share of households involved	0.147	0.161	0.144	0.140	0.109	0.149	
... if yes, share not mediated by local government	0.707	0.923	0.671	0.677	0.732	0.662	
... if yes, share of transfer period <=5 years	0.000	0.000	0.000	0.066	0.154	0.042	
... if yes, share of transfer period 6-30 years	0.769	0.750	0.772	0.786	0.642	0.825	
... if yes, share of transfer period >30 years	0.231	0.250	0.228	0.148	0.204	0.133	
Formal transfers of construction land							
Dummy: Any transfer of construction land	0.014	0.018	0.010	0.032	0.026	0.036	
... if yes, # of construction land transfers	1.103	1.059	1.167	1.493	1.200	1.667	
... if yes, area transferred/constr. land area	0.062	0.023	0.098	0.128	0.078	0.153	
... if yes, share of transfer period >=30 years	0.586	0.647	0.500	0.644	0.660	0.634	

Source: Own computation from 2014 Chengdu village survey based on 529 villages. As explained in the text, the t-test is for the hypothesis of parallel trends pre-reform; stars indicate the confidence level with which this hypothesis can be rejected as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Outcomes of household inside and outside the Chengdu prefecture boundary

	Before		After		Before Trend		T test (7)
	Outside (1)	Inside (2)	Outside (3)	Inside (4)	Outside (5)	Inside (6)	
Household characteristics							
Household size adult equivalent	3.20	3.05	2.98	2.84	-0.008	0.026	
Highest education (level 3 = jun. high)	3.26	3.34	3.21	3.26	0.009	0.004	
Female head	0.08	0.07	0.08	0.08	-0.002	0.007	
Head's age	48.06	45.88	54.13	53.13	1.124	1.119	
Income and expenditure							
Consumption per capita	2,668	3,150	4,997	6,078	-0.025	-0.052	
Total assets per capita	11,564	16,063	29,752	40,025	0.070	0.031	
Net income per capita	3,770	4,928	8,069	8,549	-0.008	-0.029	
Share of income from crop agric.	0.35	0.32	0.28	0.24	-0.005	-0.023	
Share of income from other agric.	0.34	0.30	0.24	0.16	-0.054	-0.060	
Share of inc. from local wages	0.07	0.08	0.09	0.17	0.008	0.019	
Share of inc. from loc nfrm selfemp.	0.05	0.08	0.05	0.07	0.001	0.014	
Share of inc. from migration	0.16	0.20	0.25	0.23	0.048	0.042	
Share of inc. from other	0.03	0.03	0.10	0.13	0.002	0.009	
Renting in any land	0.08	0.00	0.04	0.04	-0.022	-0.007	
Time use							
Share of household time in farming	0.50	0.43	0.40	0.30	-0.018	-0.027	
Share of household time in local off-farm	0.10	0.14	0.11	0.21	0.003	0.017	
Share of household time in migration	0.23	0.18	0.25	0.16	0.026	0.028	
<i>Males 16-40 years old</i>							
Months for farming per member	3.13	3.08	1.06	1.71	-0.290	-0.334	
Months for local off-farm per member	1.16	1.83	1.31	2.42	-0.092	0.384	*
Months for migration per member	5.52	4.30	7.16	3.84	0.431	0.210	
<i>Males 41-60 years old</i>							
Months for farming per member	7.53	5.57	4.83	2.50	-0.304	-0.504	
Months for local off-farm per member	1.33	2.15	2.44	4.22	0.197	0.006	
Months for migration per member	1.04	1.55	2.14	2.37	0.267	0.482	
<i>Females 16-40 years old</i>							
Months for farming per member	4.92	4.63	2.70	3.46	-0.282	-0.586	
Months for local off-farm per member	0.85	1.69	0.80	1.27	-0.057	-0.080	
Months for migration per member	3.73	2.48	5.69	2.13	0.330	0.659	
<i>Females 41-55 years old</i>							
Months for farming per member	8.03	7.35	6.72	4.73	-0.040	-0.301	
Months for local off-farm per member	1.11	1.02	0.82	1.73	0.006	0.093	
Months for migration per member	0.48	0.26	1.28	0.84	0.174	0.208	
Agricultural production							
Cultivated area (mu)	4.79	3.45	5.18	3.99	0.201	0.111	
Value of output (yuan/mu)	1,254	1,880	1,471	1,578	-0.021	-0.111	*
Area share of wheat	0.45	0.39	0.40	0.32	-0.001	0.025	***
Area share of rice	0.10	0.07	0.05	0.03	0.015	0.020	
Area share of corn	0.14	0.21	0.14	0.16	0.011	0.001	*
Area share of other grain	0.10	0.06	0.12	0.06	-0.010	0.011	***
Area share of vegetable	0.10	0.14	0.13	0.21	-0.024	-0.031	
Area share of oil crops	0.12	0.13	0.16	0.21	0.010	-0.027	***
Agricultural assets (yuan/mu)	174.07	168.29	191.48	134.63	0.353	-0.183	***
Expenses on labor, seed, pesticide (yuan/mu)	283.10	456.04	368.23	392.65	-0.161	-0.377	***
Net revenue (yuan/mu)	957	1,406	1,091	1,168	0.142	0.079	
Other interventions							
Agricultural subsidy (yuan/mu)	13.08	21.01	85.48	68.00	-0.162	0.110	**
Contribution to rural pension (yuan)	0.00	0.00	361.16	620.85	0.000	0.000	
Rural pension income (yuan)	0.00	0.00	443.10	605.81	0.000	0.000	
Expense on cooperative medical scheme (yuan)	7.83	45.79	130.06	254.19	0.151	0.854	***
Medical expense paid by CMS (yuan)	2.80	5.16	79.43	85.53	0.036	-0.006	
Observations	906	570	764	518	453	285	

Note: Monetary values are deflated to 2005 by CPI for rural Sichuan. Educational levels are coded as 1=illiterate; 2=primary school; 3=junior high school; 4=high school or vocational school; 5=college and above. Column (7) denotes the significance in pre-reform trends between households inside and outside the prefecture boundary. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Impact of reform on threats to tenure security

	Any reallocation		Any expropriation	
	(1)	(2)	(3)	(4)
Panel A: Basis				
Chengdu*After	-0.055** (0.021)	-0.047** (0.023)	-0.025** (0.012)	-0.024 (0.020)
Bootstrapped p-value	0.080		0.114	
Observations	4,186	4,186	4,186	4,186
R-squared	0.277	0.011	0.226	0.004
Panel B: Placebo				
Chengdu*After	0.046*** (0.010)	0.048* (0.026)	0.016 (0.020)	0.007 (0.009)
Bootstrapped p-value	0.014		0.751	
Observations	2,095	2,095	2,095	2,095
R-squared	0.559	0.011	0.299	0.010
Spatial fixed effects	No	Yes	No	Yes

Notes: Village fixed effects and year fixed effects are included. Village time-variant characteristics are controlled for throughout but not reported. These include total area and population, share of the households with access to pension and health schemes as well as the amount of agricultural subsidy, distance to the nearest county road, surface of the village road, and indicator variables for primary schools and medical stations within the village. If spatial fixed effects are not included, standard errors are adjusted for correlations inside or outside of Chengdu. If spatial fixed effects are included, standard errors are adjusted for spatial correlation. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Impact of reform on shares of land used for different purposes

	Agricultural land		Construction land		Unutilized land (5)
	arable (1)	'other' (2)	non-residential (3)	residential (4)	
Without spatial fixed effects					
Panel A: Basis					
Chengdu*After	0.020*** (0.003)	-0.022*** (0.004)	0.018*** (0.003)	-0.009*** (0.001)	-0.007 (0.004)
Bootstrapped p-value	0.012	0.006	0.000	0.016	0.316
Observations	1,842	1,842	1,842	1,842	1,842
R-squared	0.949	0.968	0.831	0.966	0.916
Panel B: Placebo					
Chengdu*After	0.004*** (0.000)	0.006*** (0.001)	0.003*** (0.000)	-0.003*** (0.000)	-0.010*** (0.001)
Bootstrapped p-value	0.496	0.356	0.478	0.605	0.250
Observations	912	912	912	912	912
R-squared	0.980	0.981	0.962	0.987	0.965
With spatial fixed effects					
Panel A: Basis					
Chengdu*After	0.025*** (0.006)	-0.022*** (0.005)	0.012** (0.005)	-0.009*** (0.002)	-0.006 (0.004)
Observations	1,842	1,842	1,842	1,842	1,842
R-squared	0.110	0.025	0.040	0.083	0.207
Panel B: Placebo					
Chengdu*After	0.003 (0.003)	0.009* (0.005)	0.001 (0.002)	-0.002** (0.001)	-0.010** (0.004)
Observations	912	912	912	912	912
R-squared	0.266	0.092	0.037	0.137	0.183

Notes: Village fixed effects and year fixed effects are included. Village time-variant characteristics are controlled for throughout but not reported. These include total area and population, share of the households with access to pension and health schemes as well as the amount of agricultural subsidy, distance to the nearest county road, surface of the village road, and indicator variables for primary schools and medical stations within the village. If spatial fixed effects are not included, standard errors are adjusted for correlations inside or outside of Chengdu. If spatial fixed effects are included, standard errors are adjusted for spatial correlation. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Impact of reform on land transfers

	Construction		Agricultural				
	any rent	Formal		Informal			
		any rent	any rent not mediated by gov.	any rent	area %	rent out %	rent in %
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Without spatial fixed effects							
Panel A: Basis							
Chengdu*After	0.021*** (0.005)	0.075*** (0.011)	0.048*** (0.013)	0.073*** (0.014)	0.009** (0.003)	0.011*** (0.003)	0.009*** (0.001)
Bootstrapped p-value	0.002	0.000	0.000	0.014	0.054	0.066	0.000
Observations	4,186	4,186	4,186	2,094	2,040	2,080	1,944
R-squared	0.274	0.297	0.283	0.802	0.738	0.751	0.785
Panel B: Placebo							
Chengdu*After	-0.006 (0.008)	0.033** (0.011)	0.024** (0.007)	0.019** (0.005)	0.000 (0.001)	-0.001*** (0.000)	0.002*** (0.000)
Bootstrapped p-value	0.771	0.102	0.082	0.366	0.649	0.000	0.264
Observations	2,095	2,095	2,095	1,049	1,031	1,042	991
R-squared	0.351	0.482	0.469	0.936	0.883	0.924	0.914
With spatial fixed effects							
Panel A: Basis							
Chengdu*After	0.018** (0.008)	0.071*** (0.006)	0.049*** (0.009)	0.068*** (0.022)	0.007 (0.005)	0.010** (0.005)	0.008** (0.003)
Observations	4,186	4,186	4,186	2,094	2,040	2,080	1,944
R-squared	0.004	0.010	0.010	0.020	0.016	0.026	0.022
Panel B: Placebo							
Chengdu*After	-0.006 (0.007)	0.035*** (0.011)	0.026** (0.011)	0.006 (0.015)	-0.000 (0.003)	-0.003 (0.003)	0.001 (0.001)
Observations	2,095	2,095	2,095	1,049	1,031	1,042	991
R-squared	0.006	0.015	0.023	0.020	0.015	0.051	0.049

Notes: Village fixed effects and year fixed effects are included throughout. Village time-variant characteristics are controlled for throughout but not reported. These include total area and population, share of the population with access to pension and health schemes as well as agricultural subsidy, distance to the nearest county road, surface of the village road, and indicator variables for primary schools and medical stations within the village. If spatial fixed effects are not included, standard errors are adjusted for correlations inside or outside of Chengdu. If spatial fixed effects are included, standard errors are adjusted for spatial correlation. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Impact of reform on agricultural productivity

	Yield	Profit	Rent in	Labor	Purchased input use		
	(1)	(2)	(3)	(4)	Seed	Fertilizer	Pesticide
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Basis							
Chengdu	-0.106** (0.023)	-0.019 (0.053)	0.021** (0.005)	0.296*** (0.046)	-0.030* (0.009)	-0.650*** (0.011)	-0.375*** (0.029)
Post reform	-0.073 (0.048)	-0.231 (0.111)	0.025** (0.007)	0.026 (0.074)	-0.044 (0.027)	-0.205*** (0.023)	-0.257** (0.056)
Chengdu*post	0.548*** (0.073)	0.382* (0.128)	0.055*** (0.004)	-0.172* (0.065)	0.387*** (0.020)	1.077*** (0.028)	0.667*** (0.056)
Bootstrapped p-value	0.114	0.252	0.306	0.306	0.000	0.156	0.000
Observations	1,379	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.138	0.077	0.031	0.032	0.032	0.061	0.039
Panel B: Interaction with education							
Chengdu	-0.091** (0.029)	0.038 (0.050)	0.015 (0.009)	0.193* (0.062)	-0.105*** (0.017)	-0.574*** (0.013)	-0.445*** (0.034)
Post reform	-0.063 (0.056)	-0.271* (0.114)	0.005 (0.009)	0.082 (0.077)	-0.014 (0.037)	-0.046* (0.019)	-0.188** (0.057)
> Junior high educ.	0.089** (0.021)	0.072 (0.043)	-0.049*** (0.007)	0.095* (0.035)	-0.080** (0.017)	0.611*** (0.013)	0.114** (0.024)
Chengdu*post	0.583*** (0.085)	0.440** (0.137)	0.049** (0.009)	-0.168 (0.088)	0.332*** (0.040)	1.021*** (0.044)	0.742*** (0.071)
> Junior high educ.*post	-0.043 (0.029)	0.124** (0.031)	0.070*** (0.008)	-0.196*** (0.027)	-0.093* (0.031)	-0.542*** (0.018)	-0.252*** (0.036)
Chengdu*> junior high educ.	-0.059** (0.017)	-0.161*** (0.018)	0.025 (0.014)	0.236** (0.072)	0.208** (0.062)	-0.325*** (0.034)	0.149* (0.062)
Chengdu*> junior high educ.*post	-0.103* (0.038)	-0.223** (0.058)	0.011 (0.017)	0.103 (0.047)	0.221** (0.057)	0.275** (0.061)	-0.152 (0.075)
Bootstrapped p-value	0.220	0.114	0.639	0.382	0.108	0.156	0.260
Observations	1,379	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.140	0.080	0.035	0.034	0.034	0.074	0.043
Panel C: Interaction with assets							
Chengdu	-0.104** (0.022)	-0.028 (0.048)	0.022** (0.005)	0.310*** (0.039)	-0.045* (0.015)	-0.637*** (0.010)	-0.366*** (0.030)
Post reform	-0.080 (0.054)	-0.245 (0.118)	0.025** (0.007)	0.035 (0.070)	-0.051 (0.027)	-0.193*** (0.029)	-0.256** (0.058)
Z assets	0.074*** (0.005)	0.059** (0.011)	0.017*** (0.001)	0.041* (0.015)	-0.146*** (0.008)	0.039** (0.011)	-0.016 (0.009)
Chengdu*post	0.553*** (0.076)	0.396* (0.131)	0.054*** (0.004)	-0.187** (0.058)	0.404*** (0.015)	1.061*** (0.035)	0.666*** (0.059)
Z assets*post	-0.125*** (0.010)	-0.026* (0.011)	-0.026*** (0.002)	-0.036 (0.018)	0.149*** (0.009)	-0.113*** (0.017)	-0.148*** (0.009)
Chengdu*z assets	0.001 (0.008)	0.276*** (0.020)	-0.019** (0.004)	-0.342*** (0.028)	0.376*** (0.009)	-0.347*** (0.011)	-0.182*** (0.020)
Chengdu*z assets*post	0.320*** (0.009)	-0.014 (0.025)	0.027*** (0.003)	0.297*** (0.014)	-0.389*** (0.021)	0.227*** (0.038)	0.536*** (0.022)
Bootstrapped p-value	0.156	0.494	0.300	0.114	0.000	0.000	0.150
Observations	1,379	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.166	0.104	0.032	0.037	0.039	0.074	0.053

Note: Household characteristics include number of children, number of adults by age and gender, number of old people, family's highest education, female household head, head's age, agricultural subsidies received, contribution to rural pension, rural pension income, expense on cooperative medical scheme, and medical expense paid by cooperative medical scheme. Village characteristics include total labor, land area for agriculture, and indicator variables for remote village, suburban village, distance to county capital longer than 20 km, distance to primary school shorter than 2 km, distance to secondary school shorter than 2 km, and distance to medical station shorter than 2 km. Standard errors are adjusted for correlations inside or outside of Chengdu. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Impact of reform on crop choice

	Share of area planted with					
	Wheat (1)	Rice (2)	Corn (3)	Oth. grain (4)	Vegetable (5)	Oil crops (6)
Panel A: Basis						
Chengdu	0.029** (0.006)	0.007*** (0.001)	-0.009** (0.002)	0.020*** (0.002)	-0.007 (0.005)	-0.044*** (0.005)
Post reform	-0.013* (0.004)	-0.012*** (0.000)	-0.013* (0.005)	0.010 (0.008)	0.019 (0.008)	0.009 (0.007)
Chengdu*post	-0.034*** (0.004)	-0.028*** (0.003)	0.021** (0.005)	-0.025** (0.004)	0.026** (0.005)	0.034*** (0.004)
Bootstrapped p-value	0.000	0.228	0.130	0.098	0.130	0.000
Observations	1,369	1,369	1,369	1,369	1,369	1,369
R-squared	0.103	0.072	0.030	0.064	0.049	0.054
Panel B: Interaction with education						
Chengdu	0.026** (0.007)	0.006 (0.003)	-0.006 (0.003)	0.022*** (0.003)	-0.017** (0.004)	-0.032*** (0.005)
Post reform	-0.009 (0.004)	-0.010*** (0.000)	-0.010 (0.006)	0.012 (0.008)	0.017 (0.008)	0.001 (0.006)
> Junior high educ.	0.006*** (0.001)	-0.001 (0.002)	0.006*** (0.001)	-0.004 (0.003)	-0.004 (0.003)	0.004 (0.002)
Chengdu*post	-0.045*** (0.005)	-0.035*** (0.003)	0.017* (0.006)	-0.030*** (0.005)	0.057*** (0.006)	0.030*** (0.005)
> Junior high educ.*post	-0.012*** (0.001)	-0.005** (0.001)	-0.009*** (0.001)	-0.006** (0.002)	0.000 (0.001)	0.028*** (0.001)
Chengdu*> junior high educ.	0.008 (0.004)	0.001 (0.006)	-0.008* (0.003)	-0.004 (0.008)	0.025** (0.005)	-0.030*** (0.003)
Chengdu*> junior high educ.*post	0.039*** (0.004)	0.022*** (0.004)	0.012* (0.004)	0.016 (0.007)	-0.092*** (0.004)	0.006 (0.004)
Bootstrapped p-value	0.228	0.118	0.160	0.204	0.000	0.472
Observations	1,369	1,369	1,369	1,369	1,369	1,369
R-squared	0.108	0.075	0.031	0.065	0.058	0.058
Panel C: Interaction with assets						
Chengdu	0.030** (0.006)	0.007*** (0.001)	-0.009** (0.002)	0.021*** (0.002)	-0.007 (0.005)	-0.044*** (0.005)
Post reform	-0.013** (0.004)	-0.011*** (0.000)	-0.013* (0.006)	0.010 (0.008)	0.019 (0.008)	0.009 (0.007)
Z assets	0.010*** (0.001)	-0.000 (0.001)	-0.007*** (0.000)	0.002* (0.001)	-0.004*** (0.000)	0.000 (0.002)
Chengdu*post	-0.035*** (0.004)	-0.027*** (0.003)	0.020** (0.005)	-0.025** (0.004)	0.028** (0.005)	0.034*** (0.004)
Z assets*post	-0.006** (0.002)	0.004** (0.001)	0.011*** (0.001)	-0.006** (0.002)	-0.002 (0.002)	-0.003 (0.002)
Chengdu*z assets	-0.007 (0.004)	-0.003* (0.001)	0.011*** (0.001)	-0.007** (0.001)	0.012** (0.002)	-0.005 (0.002)
Chengdu*z assets*post	-0.003 (0.008)	0.027*** (0.002)	-0.033*** (0.003)	0.002 (0.004)	0.012** (0.003)	-0.002 (0.009)
Bootstrapped p-value	0.883	0.160	0.100	1.000	0.098	1.000
Observations	1,369	1,369	1,369	1,369	1,369	1,369
R-squared	0.105	0.080	0.035	0.066	0.051	0.055

Note: Household characteristics include number of children, number of adults by age and gender, number of old people, family's highest education, female household head, head's age, agricultural subsidies received, contribution to rural pension, rural pension income, expense on cooperative medical scheme, and medical expense paid by cooperative medical scheme. Village characteristics include total labor, land area for agriculture, and indicator variables for remote village, suburban village, distance to county capital longer than 20 km, distance to primary school shorter than 2 km, distance to secondary school shorter than 2 km, and distance to medical station shorter than 2 km. Standard errors are adjusted for correlations inside or outside of Chengdu. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Impact of reform on overall welfare

	Income from				Total	
	Farming (1)	Local wage (2)	Off farm (3)	Migration (4)	Cons.. (5)	Income (6)
Panel A: Basis						
Chengdu	-0.022*** (0.004)	0.015*** (0.001)	0.015*** (0.001)	-0.011* (0.004)	-0.038*** (0.002)	-0.078*** (0.012)
Post reform	-0.001 (0.004)	0.000 (0.004)	-0.013*** (0.002)	-0.022* (0.009)	0.132*** (0.012)	-0.006 (0.033)
Chengdu*post	0.046*** (0.004)	-0.027** (0.005)	-0.002 (0.004)	-0.002 (0.007)	0.077*** (0.007)	0.067** (0.018)
Bootstrapped p-value	0.000	0.156	0.675	0.587	0.000	0.114
Observations	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.034	0.035	0.030	0.077	0.136	0.104
Panel B: Interaction with education						
Chengdu	-0.039*** (0.005)	0.026*** (0.003)	0.014*** (0.001)	-0.023* (0.007)	-0.076*** (0.010)	-0.052*** (0.008)
Post reform	-0.002 (0.004)	0.002 (0.004)	-0.014*** (0.002)	-0.016 (0.009)	0.096*** (0.016)	-0.030 (0.036)
> Junior high educ.	0.019*** (0.002)	-0.008* (0.003)	-0.002* (0.001)	0.013** (0.003)	-0.037** (0.008)	-0.044*** (0.008)
Chengdu*post	0.073*** (0.006)	-0.054*** (0.007)	-0.003 (0.004)	0.015 (0.012)	0.147*** (0.010)	0.056* (0.022)
> Junior high educ.*post	-0.002 (0.002)	-0.000 (0.002)	0.006** (0.001)	-0.025*** (0.003)	0.107*** (0.011)	0.084*** (0.014)
Chengdu*> junior high educ.	0.038*** (0.004)	-0.025** (0.005)	0.001 (0.004)	0.027* (0.010)	0.099** (0.025)	-0.055*** (0.009)
Chengdu*> junior high educ.*post	-0.067*** (0.004)	0.076*** (0.004)	0.004 (0.005)	-0.042** (0.013)	-0.205*** (0.031)	0.002 (0.017)
Bootstrapped p-value	0.156	0.000	0.482	0.416	0.156	1.000
Observations	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.042	0.042	0.030	0.081	0.138	0.107
Panel C: Interaction with assets						
Chengdu	-0.022*** (0.003)	0.015*** (0.001)	0.015*** (0.001)	-0.011* (0.004)	-0.041*** (0.003)	-0.079*** (0.012)
Post reform	-0.001 (0.004)	-0.000 (0.004)	-0.013*** (0.002)	-0.022 (0.009)	0.132*** (0.012)	-0.006 (0.033)
Z assets	0.014*** (0.001)	0.003** (0.001)	-0.003* (0.001)	-0.008** (0.002)	-0.045*** (0.005)	-0.040*** (0.002)
Chengdu*post	0.046*** (0.004)	-0.027** (0.005)	-0.001 (0.004)	-0.003 (0.007)	0.080*** (0.006)	0.069** (0.018)
Z assets*post	-0.012*** (0.001)	-0.010*** (0.001)	0.000 (0.001)	-0.000 (0.002)	0.030*** (0.005)	0.035*** (0.002)
Chengdu*z assets	0.006* (0.002)	-0.007*** (0.000)	0.001 (0.002)	-0.012** (0.003)	0.062*** (0.009)	0.035** (0.007)
Chengdu*z assets*post	-0.011** (0.003)	0.029*** (0.003)	0.005 (0.002)	0.001 (0.007)	-0.095*** (0.010)	-0.044** (0.011)
Bootstrapped p-value	0.000	0.000	0.408	0.905	0.000	0.266
Observations	1,379	1,379	1,379	1,379	1,379	1,379
R-squared	0.040	0.039	0.030	0.082	0.141	0.107

Note: Household characteristics include number of children, number of adults by age and gender, number of old people, family's highest education, female household head, head's age, agricultural subsidies received, contribution to rural pension, rural pension income, expense on cooperative medical scheme, and medical expense paid by cooperative medical scheme. Village characteristics include total labor, land area for agriculture, and indicator variables for remote village, suburban village, distance to county capital longer than 20 km, distance to primary school shorter than 2 km, distance to secondary school shorter than 2 km, and distance to medical station shorter than 2 km. Standard errors are adjusted for correlations inside or outside of Chengdu. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Impact of reform on time use

	Total	Young (16-40)			Old (40-60)		
	(1)	Farming (2)	Off farm (3)	Migration (4)	Farming (5)	Off farm (6)	Migration (7)
				Males only			
Chengdu	0.172 (0.089)	-0.100 (0.067)	0.619** (0.109)	-0.226 (0.123)	-0.161 (0.137)	-0.092 (0.080)	0.028 (0.151)
Post reform	0.103 (0.156)	0.333 (0.302)	-0.147 (0.079)	0.317 (0.244)	0.389* (0.153)	0.011 (0.150)	-0.504** (0.134)
Chengdu*post	0.389*** (0.039)	0.646** (0.127)	-0.332*** (0.045)	0.092 (0.061)	0.082 (0.179)	0.415** (0.109)	0.335 (0.206)
Bootstrapped p-value	0.268	0.258	0.146	0.148	0.651	0.000	0.424
Observations	1,242	748	748	748	765	765	765
R-squared	0.272	0.079	0.031	0.079	0.040	0.060	0.078
				Females only			
Chengdu	0.144** (0.025)	0.112 (0.114)	-0.019 (0.036)	0.021 (0.123)	-0.159* (0.055)	0.120 (0.069)	0.039 (0.078)
Post reform	0.898 (0.473)	0.403 (0.515)	0.182** (0.045)	0.370 (0.163)	0.789 (0.514)	0.208 (0.208)	-0.419 (0.241)
Chengdu*post	-0.232 (0.148)	0.315 (0.149)	0.040 (0.109)	-0.435* (0.144)	-0.548** (0.128)	0.221*** (0.035)	0.182 (0.089)
Bootstrapped p-value	0.256	0.202	0.909	0.202	0.102	0.102	0.374
Observations	1,101	688	688	688	527	527	527
R-squared	0.311	0.132	0.063	0.099	0.086	0.067	0.024
				Entire sample			
Chengdu	0.372** (0.079)	0.095 (0.130)	0.528*** (0.086)	-0.117 (0.159)	-0.275 (0.122)	0.076 (0.178)	0.003 (0.188)
Post reform	0.837 (0.541)	0.585 (0.541)	-0.058 (0.086)	0.342 (0.296)	1.110* (0.402)	0.265 (0.248)	-1.015** (0.189)
Chengdu*post	0.269 (0.141)	0.964*** (0.085)	-0.438*** (0.054)	-0.258* (0.106)	-0.116 (0.206)	0.292 (0.201)	0.556 (0.283)
Bootstrapped p-value	0.278	0.136	0.000	0.000	0.783	0.358	0.356
Observations	1,283	974	974	974	812	812	812
R-squared	0.335	0.235	0.044	0.098	0.311	0.084	0.114

Note: Dependent variable is no. of months worked. Household characteristics that are controlled for throughout include number of children, number of adults by age and gender, number of old people, family's highest education, female household head, head's age, agricultural subsidies received, contribution to rural pension, rural pension income, expense on cooperative medical scheme, and medical expense paid by cooperative medical scheme. Village characteristics include total labor, land area for agriculture, and indicator variables for remote village, suburban village, distance to county capital longer than 20 km, distance to primary school shorter than 2 km, distance to secondary school shorter than 2 km, and distance to medical station shorter than 2 km. Average level of education and gender composition for the specific group are also controlled for. Standard errors are adjusted for correlations inside or outside of Chengdu. *** p<0.01, ** p<0.05, * p<0.1.

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