

# Rent-Tax Substitution and Its Impact on Firms: Evidence from Housing Purchase Limits Policy in China<sup>\*</sup>

Renjie Zhao <sup>†</sup>

Jiakai Zhang <sup>‡</sup>

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## Abstract

Using a novel source of quasi-experimental variation in the revenue of local governments from housing purchase limits policy (HPLP), we investigate the mechanism of “rent-tax substitution” in the period from 2008 to 2015. “Rent-tax substitution” refers to the substitute relationship between the tax revenue and land lease revenue (from renting land-use rights) of local governments in China. Our findings indicate that the implementation of the HPLP reduced land lease revenue and increased tax revenue. Overall, the HPLP decreased local governments’ total revenue. Specifically, in cities implementing HPLP, the proportion of land lease revenue in total revenue fell by 12.7%, while the proportion of tax revenue rose by 8.3%. We also examine how the HPLP affects firms. The results show that the HPLP increased the tax burden of local firms, particularly the burden arising from corporate income tax (CIT) and business tax (BT). Finally, the HPLP negatively influenced firms regarding investment, employment, and wages.

**JEL classification codes:** G18, H71, R52.

**Keywords:** *Housing purchase limits policy, Government revenue, Land lease revenue, Tax burden*

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<sup>†</sup>School of Public Economics and Administration, Shanghai University of Finance and Economics

<sup>‡</sup>**Corresponding Author:** Jiakai Zhang; Department of Economics, The Graduate Center, City University of New York, New York, NY 10016, USA. E-mail: [Jzhang6@gradcenter.cuny.edu](mailto:Jzhang6@gradcenter.cuny.edu)

# 1 Introduction

The sources of government revenue can be roughly categorized as tax revenue and nontax revenue.<sup>1</sup> Taxation is often regarded as the primary source of government revenue. However, tax revenue accounts for only less than 18% of GDP for more than half of developing countries, compared with 35% for developed countries (Gordon and Li, 2009). This lower fraction of GDP collected in the form of tax revenue among poorer countries is not a result of choosing lower statutory tax rates but rather of lower effective tax rates (ETRs). The taxation of local governments is generally constrained, and there are no sufficient incentives to enforce tax collection for local governments (Burgess and Stern, 1993), indicating that the source of nontax revenue is likely more important for the financing of local governments.

In China, since the creation of the land marketization contract in 1988, land lease revenue has become an essential type of nontax revenue of local governments by granting land-use rights for different purposes. Although urban land is owned by the state, developers and enterprises in need of urban land can still pay rents of land-use rights (land lease revenue) for a specified period from local governments.<sup>2</sup> Chinese

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<sup>1</sup>Residents in developing countries substantially contribute to the construction and maintenance of local public goods, not just through taxation (Ostrom, 1990). Olken and Singhal (2011) referred to this mechanism as “informal taxation”. Olken and Singhal (2011) distinguished informal taxation from nongovernmental organizations or bribe payments and referred to any “nonformal means utilized to finance the provision of public goods and services”, which was first mentioned by Prud’Homme (1992). Nontax revenue, in this paper, is close to the broad definition (all government income not from taxation) provided by Mourre and Reut (2019). We mainly focus on non-tax revenues arising from land lease transactions.

<sup>2</sup>There are two types of land ownership: state ownership and collective ownership. There is no private land ownership under Chinese law. According to China’s 1982 Constitution, all land in urban areas is owned by the state and is referred to as state-owned land. All agricultural land in rural areas is owned by rural collectives (Qun et al., 2015). In China, only land-use rights, not land ownership, are tradable. Land users pay land lease revenues when local governments grant land-use rights to them within a specified period, depending on the types of land use (70 years for residential land, 50 years for industrial land, 40 years for commercial land, and 50 years for comprehensive

local governments mainly rely on land lease revenue and other types of revenue related to land transactions. This type of fiscal revenue strategy is generally referred to as “land finance” (Qun et al., 2015). In general, this strategy can inspire local governments to reduce tax revenue by lowering tax enforcement to promote regional economic growth.<sup>3</sup> Chen (2017) nevertheless found that as Chinese local governments face highly intense fiscal pressure, their revenue loss will be largely and quickly offset by enhancing tax enforcement. Thus, there is likely a potential substitution relationship between tax revenue and land lease revenue (renting land-use rights) for local governments in China. We refer to this substitution relationship between these two primary revenues as the “rent-tax substitution” mechanism. This mechanism is identified in this paper by an exogenous policy variation to reveal whether local governments increase tax revenue through tougher tax enforcement in the presence of fiscal pressure.

This paper poses a simple question: Whether do local governments substitute tax revenue for lost lease revenue by increasing tax enforcement?<sup>4</sup> To address the question, we examine the impacts of the salient policy implemented by the Chinese central government, known as the housing purchase limits policy (HPLP).<sup>5</sup> We exploit the quasi-experimental setting brought about by the HPLP using a difference-in-land).

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<sup>3</sup>The institutional causes of “land finance” are shown in detail in [Section 2.1](#).

<sup>4</sup>For convenience, local governments are referred to as city governments if we do not specifically mention other types of local governments in this paper.

<sup>5</sup>The central government first implemented a general HPLP (“the Ten National Rule”) nationwide. Then, local governments had to implement their policies to restrict the amount of land and housing transactions due to an accountability mechanism of the central government, and these policies were gradually strengthened in the sampling period in some cities. The central government did not provide specific strategies for each city, but we believe that the central government led the implementation of the HPLP across Chinese cities. More details are shown in [Section 2.2](#).

differences (DiD) approach.<sup>6</sup>

Our econometric results show that the HPLP dramatically reduced land lease revenue for local governments. Due to fiscal pressure, local governments had to increase their tax revenue substantially. Overall, the HPLP decreased local governments' total revenue. Our findings show that the HPLP reduced the proportion of land lease revenue of total revenue by 12.7 percentage points while increasing the proportion of tax revenue by 8.3 percentage points. We also find that the HPLP mainly led to a higher tax burden for local firms located in the treated cities, particularly the burden arising from corporate income tax (CIT) and business tax (BT). Finally, we show that the HPLP negatively influenced local firms in some respects, such as investment, employment, and wages.

Our paper adds to the vast body of work on the nontax revenue of governments. Nontax revenue has been another primary revenue source for governments in both developed and developing countries. For example, [Mourre and Reut \(2019\)](#) found that nontax revenue in the EU, as a whole, accounted for approximately 12% of total revenue in 2014, which was equivalent to slightly more than 5% of its GDP. In China, land lease revenue, the most important source of nontax revenue, is approximately equivalent to 70% of tax revenue for local governments. Some previous studies have mentioned the importance of land revenue as nontax revenue for local governments in China ([Li et al., 2016](#); [Chen and Kung, 2016](#)). This paper would identify how local governments substitute tax revenues for nontax revenue using quasi-experimental settings for causal empirical evidence, thus illustrating the importance of nontax

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<sup>6</sup>We have two research targets of interest (the city and the firm), so two treated groups are composed of cities after the implementation of the HPLP and firms located in the treated cities. Nonimplementing cities and firms are in their own control group.

revenues (land lease revenues).

Many public finance studies have investigated the substitution of different types of taxes and the impacts on various aspects, such as economic growth and welfare.<sup>7</sup> This paper explores the specific impacts of substitution of tax and nontax revenues. China is a perfect laboratory for studying the substitution mechanism for local governments due to the implementation of HPLP. We provide explicit evidence that local firms would be significantly affected by the change in the structure of government tax and nontax revenue.

Finally, our study contributes to the literature on the analysis of the HPLP. Existing literature has examined the impact of the HPLP and other policies related to housing purchases and land restrictions in urban areas. For example, several previous studies have investigated the efficiency of the policy to stabilize the real estate market (Cao et al., 2015; Gong et al., 2016; Li et al., 2017; Jia et al., 2018). However, this paper mainly focuses on how the HPLP affects the revenue structure of local government and local firm activities in various aspects.<sup>8</sup>

The rest of the paper is organized as follows. Section 2 describes the incentives of land finance for local governments in China and provides details on the evolution

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<sup>7</sup>For example, Fullerton et al. (1983) examined the consequences in terms of welfare of changing the current income tax system to a progressive consumption tax in the US. More substantial gains occur if the further reform of capital income taxation accompanies this change. In Canada, several provinces replaced their retail sales taxes with value-added taxes (VATs). Smart and Bird (2009) estimated the effects of this tax substitution on business investment in the reforming provinces. Other examples come from countries in Asia. Hansen and Imrohoroglu (2018) studied the growth and welfare consequences of reducing income taxation in Japan, replaced by increasing consumption taxation. In the case of Chinese tax substitution, Liu and Mao (2019) found that the VAT reform in China, which was completed in 2009, that transformed the existing production-based VAT system to a consumption-based one by allowing for the deduction of the costs of purchasing capital goods when calculating the VAT bases reduced the user costs of capital and raised the investment and productivity of treated firms by 38.4% and 8.9%, respectively.

<sup>8</sup>Sun et al. (2021) may be one of few recent studies on the impacts of HPLP on non-real-estate outcomes.

of the HPLP. [Section 3](#) describes the data and the empirical method used. [Section 4](#) presents the main results, robustness checks, and potential mechanisms, and [Section 5](#) concludes the paper.

## 2 Institutional Background

### 2.1 Structure of Local Fiscal Revenue

In this section, we mainly describe the fiscal revenue structure of local governments and why local governments choose “land finance” in China.

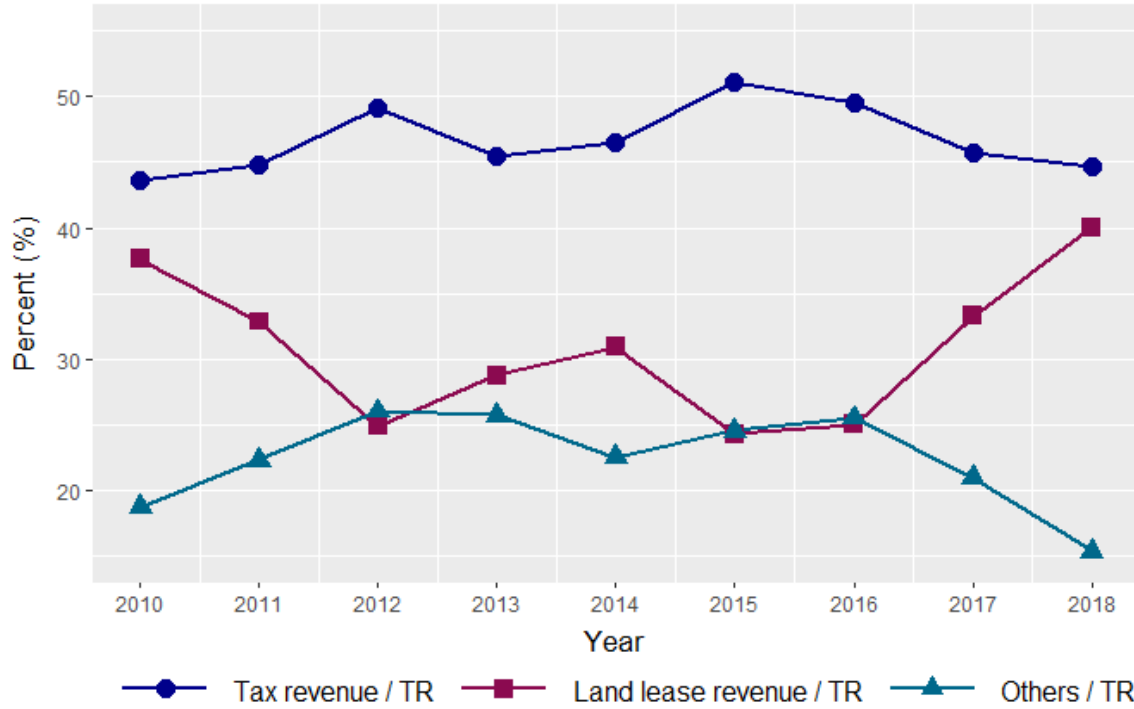
The revenue of local governments is primarily composed of three sources: tax revenue, land lease revenue, and others. [Figure 1](#) shows that 80% of the fiscal revenue of local governments comes from tax revenue and land lease revenue, which account for approximately 45% and 35% of total revenue on average, respectively. Thus, land lease revenue is the primary nontax revenue of local governments.<sup>9</sup>

There are two main reasons that local governments rely heavily on land lease revenue. First, the central government has chosen a clear tax assignment that favors itself to obtain more tax revenues since the tax-sharing reform in 1994. As a result, local governments became more motivated to acquire revenue from other sources to eliminate fiscal pressure ([Qun et al., 2015](#)). Second, local governments prefer revenue from land transactions, which can cause higher local economic growth in the short run to obtain more opportunities for promotion ([Li and Zhou, 2005](#)). Thus, land lease revenue has gradually become a more important fiscal revenue, particularly since the

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<sup>9</sup>Due to the lack of data on government fund revenue and state-owned capital revenue at the city level, Therefore, in this paper, we define the sum of tax revenue, land lease revenue, and nontax revenue in the public budget as local governments’ total revenue.

Figure 1: Sources of local revenues in China



*Notes:* The figure shows the sources of local government revenues. Tax revenue/TR represents the ratio of tax revenue to total revenue. Land lease revenue/TR represents the ratio of land lease revenue to total revenue. Others/TR represents the ratio of other revenues other than the tax and land lease revenues to total revenue.

*Source:* Authors' own calculations using data from the National Bureau of Statistics of China.

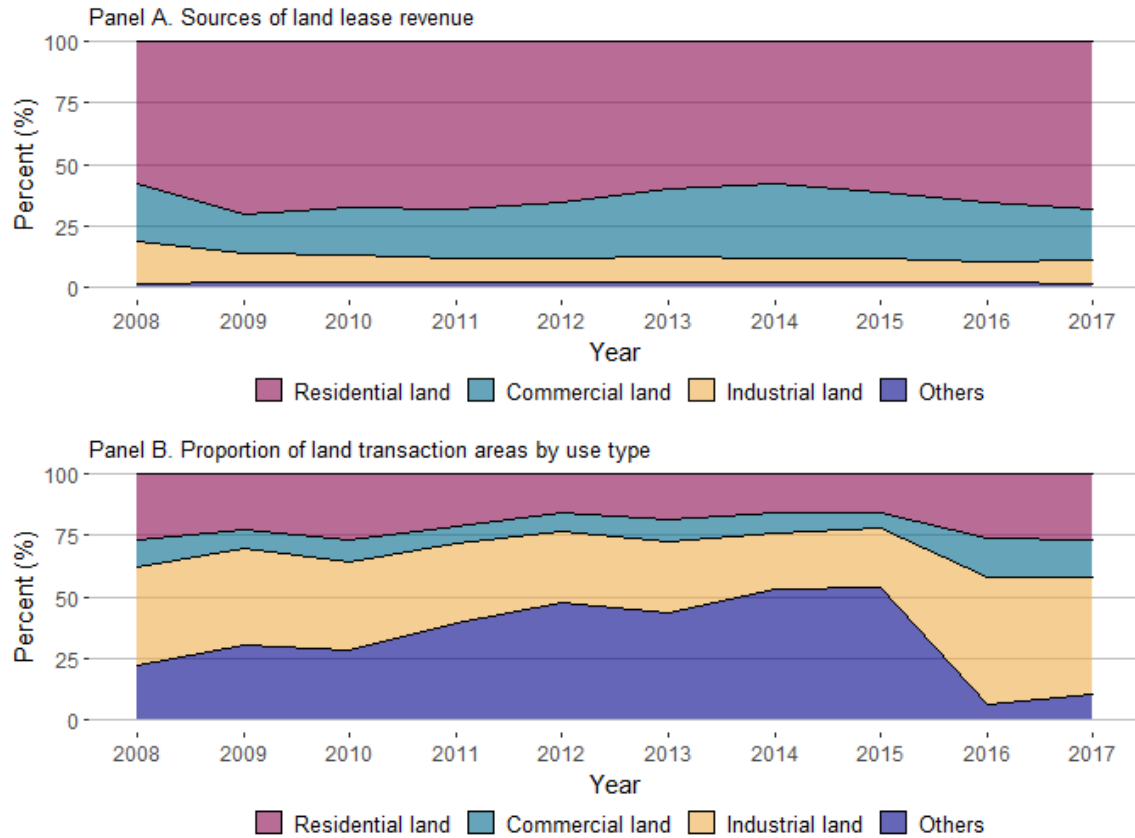
housing reform in 1998.<sup>10</sup>

The housing reform in 1998 terminated welfare-based housing allocation and established a market-based system of housing provision.<sup>11</sup> The quantity of land transferred for urban use increased at an average annual rate of 22.8% during the period from 1999 to 2007 (Man, 2011). As shown in panel A of Figure 2, the land lease revenue of local governments mainly comes from residential land transactions, which

<sup>10</sup>The land marketization and housing reform are shown in detail in Appendix A.

<sup>11</sup>China practiced a system to allocate public housing as a welfare benefit to urban dwellers (welfare housing), ensuring accommodation for all, though with a low per-capita living space. Before the housing reform, more than 80-90% of housing investment was from governments or state-owned enterprises (Chen et al., 2011).

Figure 2: The structure of the land transaction market in China



Notes: The figure depicts the structure of the land transaction market in China. Panel A presents the sources of land lease revenue by use type. Panel B presents the proportion of land transaction areas in the market by use type.

Source: Authors' own calculations using website data sources from the Chinese Land Transaction Monitoring System (<https://www.landchina.com/>).



accounts for more than 60% of total land lease revenue. Industrial land lease revenue accounted for less than 20% of total land lease revenue on average from 2008 to 2017. Panel B shows that the transaction areas of industrial land and residential land account for 40% and 25% of the total land transaction area, respectively. Thus, the price of the residential land transaction is much higher than the price of industrial land, according to simple calculations.<sup>12</sup>

## 2.2 Housing Purchase Limits Policy in China

Since the 1998 housing reform, the provision of welfare housing has been abolished through the transition to private property. The purchasing of housing has become a necessary requirement for each household. As a result, the dramatic increase in demand from urban residents has led to an excessively rapid rise in housing prices. In addition, the large income growth across Chinese cities also provides some assurance of the housing boom.<sup>13</sup> For instance, the annual growth rate of housing prices was approximately 15% on average in five major cities between 2004 and 2009 (see Figure 3). To stabilize housing prices and avert potential housing bubbles, the State Council of China issued a public announcement (“Ten National Rule”) that it had decided to take action to control prices on April 17, 2010.<sup>14</sup> Soon after this, Beijing was the first city to announce HPLP (“Twelve Beijing Rule”) on April 30, 2010, which indicates

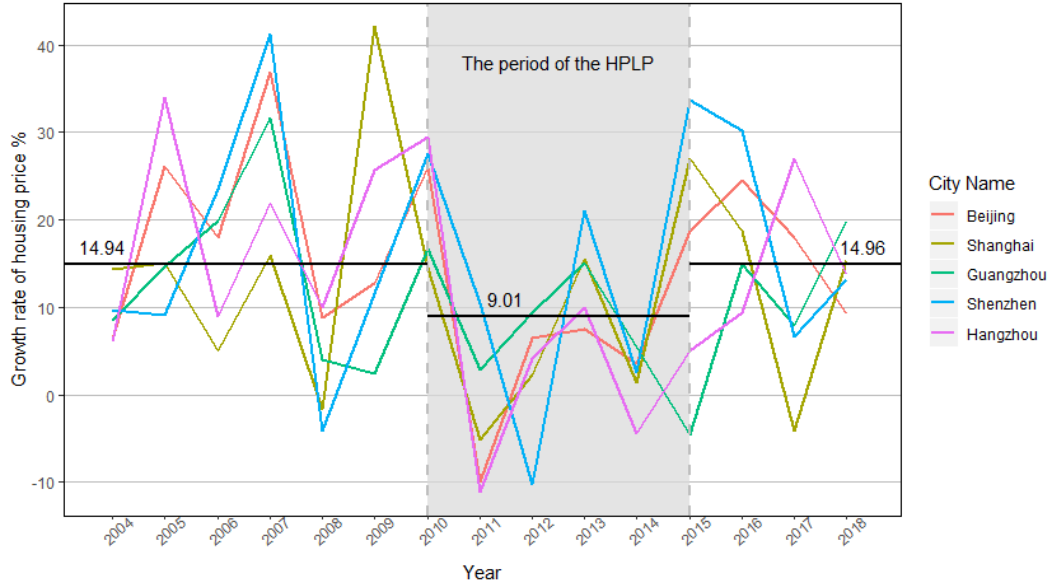
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<sup>12</sup>To attract more private investment, local governments tend to implement favorable policies for private firms, such as reducing taxes or providing more industrial land at a lower price for granting land-use rights. Therefore, although the industrial land transaction area accounts for a high proportion of total land area, the primary revenue from the land transaction does not come from the industrial land transactions.

<sup>13</sup>The demographic structure in urban areas and net urban migration also are possible explanatory factors regarding the increased housing prices (Chen and Wen, 2017; Fang et al., 2016).

<sup>14</sup>The State Council issued the “Notice of the State Council on Resolutely Curbing the Soaring of Housing Prices in Some Cities” (referred to as the “Ten National Rule”).

Figure 3: The growth rate of residential housing prices



*Notes:* The figure shows three different periods, including the years before the implementation of the HPLP, the years of the HPLP, and the years after cities began to loosen the restrictions on housing and land transactions. The number above every black horizontal line is the growth rate of the housing prices of five major cities, on average, in each period. The shaded area represents the period of the HPLP on which this paper mainly focuses.

*Source:* Authors' own calculations using data from the National Bureau of Statistics of China.

the official start of HPLP implementation in China. Then, some coastal cities, such as Shanghai, Shenzhen, Xiamen, Tianjin, Dalian, Guangzhou, and Fuzhou, also introduced detailed housing purchase limits policies. In 2011, the policy was even more widespread inland and was adopted by some smaller cities.<sup>15</sup> The HPLP effectively slowed the growth rate of housing prices and even reduced housing prices (Cao et al., 2015; Jia et al., 2018). The average growth rate of housing prices between 2010 and

<sup>15</sup>The “Eight National Rule” was issued (effective as of January 26, 2011), which promoted the implementation of the HPLP in more inland and small cities. The “Eight National Rule” of the real estate market was issued in the executive meeting of the State Council, mainly restricting the purchase of second homes. When purchasing a second home, households have to make a down payment amounting to no less than 60% of property value, with a loan interest rate at 1.1 times the basic rate.

2015 was lower than that before implementing the HPLP (see [Figure 3](#)). Forty-six cities initiated the implementation of the HPLP from May 2010 to November 2011. The timeline of the HPLP across cities is given in [Table 1](#). Due to various policy enforcement levels, including restricting housing purchase of households without local hukou or not, implementing the HPLP in all areas of the city or not, and other additional regulations, the implementation of policies varies across cities. However, the main principle of various policies is to stabilize housing prices and prevent potential housing bubbles ([Somerville et al., 2020](#)). The HPLP would affect the land lease revenue of local governments. Therefore, by taking advantage of the variation in local governments' revenue structure caused by the HPLP, we can explore the mechanism of "rent-tax substitution."

Table 1: Timeline of the implementation of the HPLP across cities in China.

Date	City	Year of enforcement used in the paper
April 30, 2010	Beijing	2010
October 1, 2010 to October 9, 2010	Shenzhen, Xiamen, Shanghai, Ningbo, Fuzhou, Hangzhou, Haikou, Nanjing, Tianjin, Wenzhou, Guangzhou, Sanya, Dalian	2011
January 5, 2011 to March 25, 2011	Zhengzhou, Taiyuan, Wuhan, Kunming, Jinan, Shijiazhuang, Hefei, Qingdao, Chengdu, Guiyang, Wuxi, Yinchuan, Nanchang, Harbin, Nanning, Xi'an, Shenyang, Suzhou, Changsha, Lanzhou, Zhoushan, Urumqi, Foshan, Jinhua, Hohhot, Shaoxing, Xuzhou, Changchun, Xining	2011
August 29, 2011 to November 1, 2011	Taizhou, Quzhou, Zhuhai	2012

*Notes:* The table shows the timeline of the implementation of the HPLP in forty-six cities. As mentioned in the paper, if the HPLP was implemented in the first half of the year, the policy would come into effect that year; otherwise, the policy would be regarded only as coming into effect in the next year.

*Source:* Authors' own compilation from relevant official documents (See [Table B.1](#)).

Since 2016, some cities began to relax the implementation of the HPLP, such as Guangzhou and Hangzhou. However, other cities continued implementing the HPLP and even provided more strategies to intervene in the housing market. For example, “price-capped” homes, as special types of commodity housing, have been approved for sale in some cities since 2016. According to the housing price cap set by the government, developers can bid for the land-use rights of “price-capped” homes through public auctions.<sup>16</sup> These policies probably affect empirical results in this paper, so this paper does not cover the years after 2015.

### 3 Data and Empirical Strategy

#### 3.1 Data

Our data on land transactions come from two different sources. First, the data on total land lease revenue at the city level are obtained from the Chinese Statistical Yearbook for Land and Resources (*Zhongguo Guotu Ziyuan Tongji Nianjian*). Second, we obtain data on the revenue, price, and area of different land types from the Chinese Land Transaction Monitoring System (<https://www.landchina.com/>) by web scraping, because the Chinese Statistical Yearbook for Land and Resources does not classify land lease revenue and transaction area by use type. We aggregate the

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<sup>16</sup>Compared to general commodity housing, price-capped homes cannot be sold in the first five years following their purchase. In general, if the five years plus two years of off-plan property and one year of obtaining a certificate of House Property Right have passed, then the owner can sell the housing after waiting at least those eight years. In Beijing, land transactions for general commodity housing stopped in October 2016. In the first half of 2019, there were 16,373 new residential transactions and a 103% increase over the same period in the previous year, of which 9,283 were “capped-price home” transactions, accounting for approximately 57% of new residential sales. For example, local governments also sold many lands used as “price-capped homes in other large cities, like Tianjin and Shenzhen.”

dataset to obtain the revenue, area, and price of different types of land at the city level. Moreover, other control variables at the city level are obtained from the Chinese City Statistical Yearbook and CEIC database.<sup>17</sup>

Our firm-level data come from the “National Tax Survey Database” (NTSD) and are jointly collected by the Ministry of Finance of China and the State Taxation Administration. In the data collection process, local financial and taxation authorities are responsible for the specific investigation to ensure the quality of data information, particularly the accuracy and completeness of the taxation of firms. The sample used includes approximately 700,000 surveyed firms (annually) from a broad range of industries and regions in China. Eighty percent of the sampled firms are key firms.<sup>18</sup> The remaining firms are randomly collected by the stratified sampling method. Stratification is carried out according to total sales, industry, and type of taxpayer. The overall tax receipts reported by the sampling firms account for 75% of the aggregate national tax revenue in 2014 (Fan and Liu, 2020).

The NTSD has the following advantages. First, the dataset contains various firms of different sizes, ages, and ownership levels for all sectors across all regions in China. Second, the dataset includes detailed information on the taxation and financing of firms, such as their tax identification number and affiliation. Third, the dataset contains over 400 financial indicators for almost all taxes in tax return transcripts, balance sheets, cash flow statements, and income statements. In general, the dataset

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<sup>17</sup>CEIC database (<https://www.ceicdata.com/en>) is provided by CEIC Data Company, Ltd, including World Trend database, Global database, and Premium databases which cover content from Brazil, Russia, India, Indonesia, and China. In addition, the China database provides over 3,26,000 time-series records on the macroeconomic, sector, industry, and regional data.

<sup>18</sup>Key firms refer to the firms of key tax sources. There are two types of key tax source firms. First, the firms brought into the key tax source of its locality, including provinces, cities, and counties, are governed by the local taxation bureau. Second, the firms brought into the key tax source of the country are governed by the state taxation bureau.

is superior to other primary Chinese firm-level datasets, such as those of the Annual Survey of Industrial Firms (ASIF), Chinese Private Enterprise Survey (CPES), and China Stock Market & Accounting Research (CSMAR), in terms of industry scope, sample size, firm type and timeframe (Liu and Mao, 2019).

In this paper, we use panel data of cities and firms in the period 2008-2015. The summary statistics of the variables are reported in Table B.2, and the definitions of the variables are provided in detail in Table B.3 (see Appendix B).

### 3.2 Empirical Strategy

To study whether the HPLP decreases the land lease revenue of local governments and whether the tax revenue of local governments increases, we conduct a DiD regression of the following form:

$$Y_{ipt} = \beta_0 + \beta_1 \text{HPLP}_{ipt} + (\mathbf{X}_{ip} \times \mu_{pt})' \phi + \lambda Z_{pt} + \delta_{ip} + \epsilon_{ipt} \quad (1)$$

where  $Y_{ipt}$  is the outcome variable of local governments in city  $i$ , province  $p$  and year  $t$ .<sup>19</sup> Specifically, we investigate how the HPLP affects the structure of local fiscal revenue, so  $Y_{ipt}$  represents the total revenue, land lease revenue, or tax revenue of local governments.  $\text{HPLP}_{ipt}$  is a dummy variable indicating the implementation of the HPLP for city  $i$  in province  $p$  and year  $t$ .  $\text{HPLP}_{ipt}$  equals zero for the years before HPLP implementation for a city in year  $t$  and one for the first year and all subsequent years of HPLP implementation.<sup>20</sup>  $X_{ip}$  denotes covariates (city-level characteristics)

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<sup>19</sup>Our estimation sample spans the period 2008-2015 and covers approximately 325 cities, including 46 treated cities implementing the HPLP.

<sup>20</sup>Since the implementation of the HPLP started in different months in 2010-2011 in these forty-six cities (see Table 1), if the implementation of the HPLP started in the first half of a year, then

in the initial year.<sup>21</sup>  $\mu_{pt}$  represents the year fixed effects. We follow [Lu and Yu \(2015\)](#) and [Lu et al. \(2019\)](#) to use all of the baseline characteristics interacted with year dummies ( $\mathbf{X}_{ip} \times \mu_{pt}$ ) in the DiD estimations to control for the presence of the pre-reform differences between the treatment and control groups. The covariates can shed light on how treated cities and untreated cities differed at the inception of the HPLP policy. Suppose the results with and without baseline controls are largely similar. In that case, that is taken as indicating that the DiD estimates are not severely biased by incomparability between the treatment and control groups ([Altonji et al., 2005](#)). The management and planning of land exhibit relatively large differences across provinces, so we use an interactive fixed effects model between province and time, denoted by  $Z_{pt}$ , to capture unobserved heterogeneity across provinces over time. We additionally include city fixed effects,  $\delta_{ip}$ , and idiosyncratic errors,  $\epsilon_{ipt}$ .

In order to explore whether local governments substitute tax revenue for lost lease revenue by increasing tax enforcement, thereby increasing the tax burden of firms, we consider the following specification:

$$ETR_{ijpt} = \beta_0 + \beta_1 HPLP_{ipt} + (\mathbf{X}_{ijp} \times \mu_{pt})' \phi + \lambda Z_{pt} + \delta_j + \epsilon_{ijpt} \quad (2)$$

where  $i$  denotes city  $i$ ,  $j$  denotes firm  $j$ ,  $p$  denotes province  $p$ , and  $t$  denotes year  $t$ .

$ETR_{ijpt}$  denotes the effective tax rate.<sup>22</sup> The dummy variable  $HPLP_{ipt}$  is the same

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$HPLP_{ipt}$  takes the value of 1 in that year. Otherwise,  $HPLP_{ipt}$  takes the value of 1 in the following year.

<sup>21</sup>The initial year for the treated and control cities is 2008. Variable definitions are shown in detail in [Table B.3](#).

<sup>22</sup>The concept of the effective tax rate (ETR) is a measure of the actual tax burden. Here,  $ETR_{ijpt}$  represents not only the total ETR (the ratio of total tax payable to the operating profit) but also the ETR of various taxes (for example, the effective CIT rate).

as in Equation (1).  $X_{ijp}$  denotes baseline firm characteristics in the initial year.<sup>23</sup>  $\mu_{pt}$  is year fixed effect. Additionally, we include interactive fixed effects between province and time, denoted by  $Z_{pt}$ , firm fixed effects  $\delta_j$ , and idiosyncratic errors  $\epsilon_{ijpt}$ .

All our identifications are based on the assumption that in the absence of the HPLP, control cities and firms have similar trends as those of the treated cities and firms. While we cannot directly test this assumption, we can check whether the time trends in control and treated groups were the same before HPLP implementation. To explore the validity of the assumption, we will follow an event-time specification to reconduct DiD analysis (Jacobson et al., 1993). We will replace the  $HPLP_{ipt}$  dummy variable with a series of time dummies, including those for the year before HPLP implementation, the first year of the HPLP being implemented, and all the subsequent years of the HPLP to re-estimate Equations (1) and (2). Thus, we consider the event-time specification for cities as follows:

$$y_{ipt} = \beta_0 + \beta_k \sum_{k=-3}^4 D_{t^*}^k + (\mathbf{X}_{ip} \times \mu_{pt})' \phi + \lambda Z_{pt} + \delta_{ip} + \epsilon_{ipt} \quad (3)$$

where  $D_{t^*}^k$  represents a series of event-time dummies that take the value of one when the beginning of HPLP implementation is  $k$  years away for a certain city.  $t^*$  represents the year when the HPLP is initially implemented in a city.  $D_{t^*}^k$  takes a value of one if  $t - t^* = k$ , with  $k = -3, -2, 0, 1, 2, 3, 4$ . We omit a time category, that is,  $k = -1$ . Therefore, the estimated coefficients,  $\beta_k$ , can be explained as the effects relative to the year before HPLP implementation. This estimation can provide evidence of preexisting trends. Moreover, we can investigate the dynamics of the impacts of the

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<sup>23</sup>The initial year for treated and control firms is not necessarily 2008. We use the year of the first appearance of each firm in the sample as the initial year.



HPLP by checking the year dummies after HPLP implementation.

The specification for firms is similar to the previous case:

$$f_{ijpt} = \beta_0 + \beta_k \sum_{k=-3}^4 D_{t*}^k + (\mathbf{X}_{ijp} \times \mu_{pt})' \phi + \lambda Z_{pt} + \delta_j + \epsilon_{ijpt} \quad (4)$$

where  $D_{t*}^k$  also represents the event dummies that take the value of one when the beginning of HPLP implementation is  $k$  years away for a certain firm.

## 4 Empirical Results

### 4.1 Impact on the Revenue Sources of Local Governments

In this section, we first examine the impact of the HPLP on the total revenue of local governments.<sup>24</sup> Table 2 presents the results of our baseline specification (1) (See Equation (1)), using the logarithm of total revenue as the dependent variable. We start the estimation by controlling for the city-specific fixed effects and year-specific fixed effects in column (1). It turns out that HPLP implementation is negatively and statistically significantly associated with total revenue. Column (2) adds the covariates interacted with the year dummies. The covariates are city-level characteristics in 2008, including the logarithm of per capita GDP, the share of the secondary industry in GDP, investment rate, degree of openness, degree of urbanization, and the logarithm of the population.<sup>25</sup> The coefficient of the HPLP is persistently negative and statistically significant at the 1% level. We also find that adding the covariates in the

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<sup>24</sup>As mentioned in Section 3.1, the total revenue of local governments is the sum of tax revenue, land lease revenue, and others.

<sup>25</sup>Variable definitions are shown in detail in Table B.3.

specification only reduces the impact of HPLP on total revenue by 17.18%, implying that the DiD estimates are not severely biased by incomparability between the treatment and control groups.<sup>26</sup> Column (3) includes the province-year fixed effects to capture heterogeneous unobservable impacts across provinces over time.<sup>27</sup> Quantitatively, column (3) indicates a semielasticity of total fiscal revenue with respect to the HPLP of -0.438, implying that relative to control cities, the HPLP led to a 35.47% decrease in the total revenue of treated cities.<sup>28</sup>

Tax revenue and land lease revenue are the overwhelming majority of revenue forms for Chinese local governments.<sup>29</sup> We examine whether the HPLP reduced the land lease revenue of local governments and how the local governments respond to the lost land lease revenue. Panels A and B of Table 3 report the results with and without controlling for baseline city characteristics (as illustrated in Table 2). Columns (1) and (2) show that the HPLP has opposite effects on the land lease revenue and tax revenue. The estimated coefficient of the HPLP is negative and statistically significant in column (1), which is consistent with our expectation of the reduction in land lease revenue caused by the HPLP. Quantitatively, column (1) in panel B implies that the

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<sup>26</sup>  $\frac{-0.352}{-0.425} - 1 = -17.18\%$

<sup>27</sup> “The Management of Income and Expenditure from the Assignment of the Right to Use State-Owned Land,” issued on December 31, 2006, mentioned that the authorities on the financing of provinces, autonomous regions, municipalities directly under the central government and municipalities under separate state planning in conjunction with same-level authorities on land and resources are responsible for enacting specific policies on the management of land assignment income and expenditure within their respective administrative regions and guiding their counterparts of cities and counties to do a good job in managing land assignment income and expenditure.

<sup>28</sup>  $100\% * (\exp(-0.438) - 1) = -35.47\%$

<sup>29</sup> Figure 1 shows that the sum of tax revenue and land lease revenue accounts for approximately 80% of total revenue on average. We also investigate how the HPLP affects local governments’ nontax revenue in the public budget in Table B.6. Although the impact of the HPLP on nontax revenue is positive and statistically significant, the proportion of nontax revenue is small, and the magnitude of the HPLP impact is not large, so this paper mainly focuses on the changes in tax revenue and land lease revenue.

Table 2: The impact of the HPLP on the total revenue of local governments

	ln(Total revenue)		
	(1)	(2)	(3)
HPLP	-0.425*** (0.055)	-0.352*** (0.081)	-0.438*** (0.102)
Covariates $\times$ year dummies	NO	YES	YES
City fixed effects	YES	YES	YES
Year fixed effects	YES	YES	NO
Province-year fixed effects	NO	NO	YES
$N$	2,602	2,602	2,602
R-squared	0.805	0.836	0.874

*Notes:* The dependent variable is indicated at the top of the columns. Additionally, the total revenue of local governments is defined as the sum of tax revenue, land lease revenue, and others. Column (1) starts the estimation by controlling for city and year fixed effects. Column (2) includes the interactions of covariates in the initial year with the year dummies. The covariates are city-level characteristics in the initial year, including the logarithm of per capita GDP, the share of the secondary industry in GDP, investment rate, degree of openness, degree of urbanization, and the logarithm of the population. Column (3) includes province-year interactive fixed effects in the specification. Standard errors are clustered at the city level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

HPLP led to a 51.95% decrease in land lease revenue of treated cities relative to control cities.<sup>30</sup> Column (2) shows that HPLP implementation is positively and statistically significantly associated with the tax revenue of local governments. Quantitatively, column (2) in panel B indicates that the HPLP led to a 28.06% increase in the tax revenue of treated cities relative to control cities.<sup>31</sup>

Moreover, we explore whether the HPLP affects each tax in different ways. The sum of CIT, BT, and VAT accounts for approximately 60% of total tax revenue for local governments.<sup>32</sup> In this paper, we examine the impacts of the HPLP on these

<sup>30</sup> $100\% * (\exp(-0.733) - 1) = -51.95\%$

<sup>31</sup> $100\% * (\exp(0.247) - 1) = 28.06\%$

<sup>32</sup>Local governments can obtain revenues from fourteen taxes, including value-added tax, business tax, corporate income tax, individual income tax, resource tax, city maintenance and construction tax, house property tax, stamp tax, urban land use tax, Land appreciation tax, tax on vehicles and

Table 3: The impact of the HPLP on land lease revenue and tax revenue

	ln(LLR) (1)	ln(Tax) (2)	ln(CIT) (3)	ln(BT) (4)	ln(VAT) (5)
<i>Panel A. Without covariates</i>					
HPLP	-0.732*** (0.161)	0.262*** (0.052)	0.328*** (0.060)	0.101** (0.042)	0.062 (0.046)
<i>N</i>	2,602	2,408	2,408	2,408	2,408
R-squared	0.760	0.870	0.767	0.852	0.672
<i>Panel B. With covariates</i>					
HPLP	-0.733*** (0.160)	0.247*** (0.050)	0.302*** (0.074)	0.175*** (0.054)	0.040 (0.059)
<i>N</i>	2,602	2,408	2,408	2,408	2,408
R-squared	0.775	0.882	0.785	0.864	0.686

*Notes:* The dependent variable is indicated at the top of each column. The dependent variables are the logarithm of land lease revenue, tax revenue, CIT revenue, BT revenue, and VAT revenue in columns (1)-(5), respectively. We control covariates including city-level characteristics in the initial year interacted with the year dummies in panel B. All columns in panels A and B include city fixed effects and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

three types of tax revenue. The results in columns (3)-(5) of [Table 3](#) show that the impacts of the HPLP on both CIT revenue and BT revenue are positive and statistically significant. However, the HPLP does not have significant effect on the VAT revenue.<sup>33</sup>

The revenue from residential land accounts for approximately 70% of land lease revenue of local governments on average, as shown in Panel A of [Figure 2](#). We conjecture that the decrease in land lease revenue results from a substantial decrease in residential land revenue because the HPLP restricts residential land transactions.

boat operation, farmland occupation tax, deed tax, and tobacco leaf tax. According to China Tax Yearbook. In 2016, the total tax revenue of local governments was 6469.169 billion yuan, and the sum of value-added tax, business tax, and corporate income tax was 3906.699 billion yuan, which takes account of approximately 60% of total tax revenue for local governments.

<sup>33</sup>The reasons will be discussed in detail in [Section 4.3](#)

Table 4: The impact of the HPLP on land lease revenue according to land-use type

	ln(RLR) (1)	ln(ILR) (2)	ln(PLR) (3)	ln(CLR) (4)
<i>Panel A. Without covariates</i>				
HPLP	-0.572*** (0.103)	-0.002 (0.083)	0.108 (0.228)	-0.257* (0.146)
<i>N</i>	2,588	2,582	2,582	2,578
R-squared	0.565	0.446	0.254	0.375
<i>Panel B. With covariates</i>				
HPLP	-0.676*** (0.137)	-0.056 (0.114)	0.190 (0.256)	-0.203* (0.123)
<i>N</i>	2,588	2,582	2,582	2,578
R-squared	0.581	0.466	0.280	0.399

*Notes:* The dependent variable is indicated at the top of each column. Additionally, the dependent variables are the logarithm of residential land revenue, industrial land revenue, public land revenue, and commercial land revenue, as shown in columns (1)-(4), respectively. We control covariates including city-level characteristics in the initial year interacted with the year dummies in panel B. All columns in panels A and B include city fixed effects and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

Therefore, we investigate the impacts of the HPLP on the revenue of different land types. The results in Table 4 show that only the impact of the HPLP on residential land revenue is negative and statistically significant at the 1% level. The estimated coefficients of the HPLP are not statistically significant in columns (2)-(3). It turns out that the decline in land lease revenue is not determined by the revenue of industrial land and public land because the target of the HPLP is to restrict speculative demand in the housing market. The impact of the HPLP on commercial land revenue is negative and statistically significant only at the 10% level, as shown in column (4). However, the magnitude of the effect on commercial land revenue is relatively small (-0.203), and the proportion of commercial land revenue (25%) is much lower than that of residential land revenue (70%). Hence, the decline in land lease revenue mainly

arises from the decreased residential land revenue.<sup>34</sup>

Table 5: The impact of the HPLP on the proportions of land lease revenue and tax revenue

	LLR/TR (1)	Tax/TR (2)	CIT/TR (3)	BT/TR (4)	VAT/TR (5)
<i>Panel A. Without covariates</i>					
HPLP	-0.098*** (0.013)	0.101*** (0.018)	0.055*** (0.011)	0.060*** (0.012)	0.017 (0.016)
<i>N</i>	2,602	2,402	2,402	2,401	2,402
R-squared	0.200	0.270	0.471	0.581	0.632
<i>Panel B. With covariates</i>					
HPLP	-0.127*** (0.015)	0.083*** (0.022)	0.061*** (0.019)	0.062*** (0.020)	0.014 (0.025)
<i>N</i>	2,588	2,402	2,402	2,401	2,402
R-squared	0.200	0.270	0.471	0.581	0.627

*Notes:* The dependent variable is indicated at the top of each column. The dependent variables are the proportions of land lease revenue, tax revenue, CIT revenue, BT revenue, and VAT revenue in the total revenue of local governments in columns (1)-(5), respectively. We control covariates including city-level characteristics in the initial year interacted with the year dummies in panel B. All columns in panels A and B include city fixed effects and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

To better quantify the results of the rent-tax substitution caused by the HPLP, we study how the HPLP affects the proportions of land lease revenue and tax revenue in total revenue. Specifically, the results in columns (1) and (2) show that the HPLP reduced the proportion of land lease revenue by 12.7 percentage points and increased the proportion of tax revenue by 8.3 percentage points. The results in Table 5 overall are consistent with the previous findings in Table 3.

The validity of identification in Tables 2 to 4 is based on the assumption of a par-

<sup>34</sup>Table B.4 further explores the reasons for the decrease in land lease revenue. We examine the impacts of the HPLP on the different types of land transaction areas and prices. The results in columns (1) and (2) confirm a negative effect on residential land transaction areas in treated cities implementing the HPLP. Column (3) shows that the impacts of the HPLP on the prices of these three types of land are not statistically significant at the 1% level.

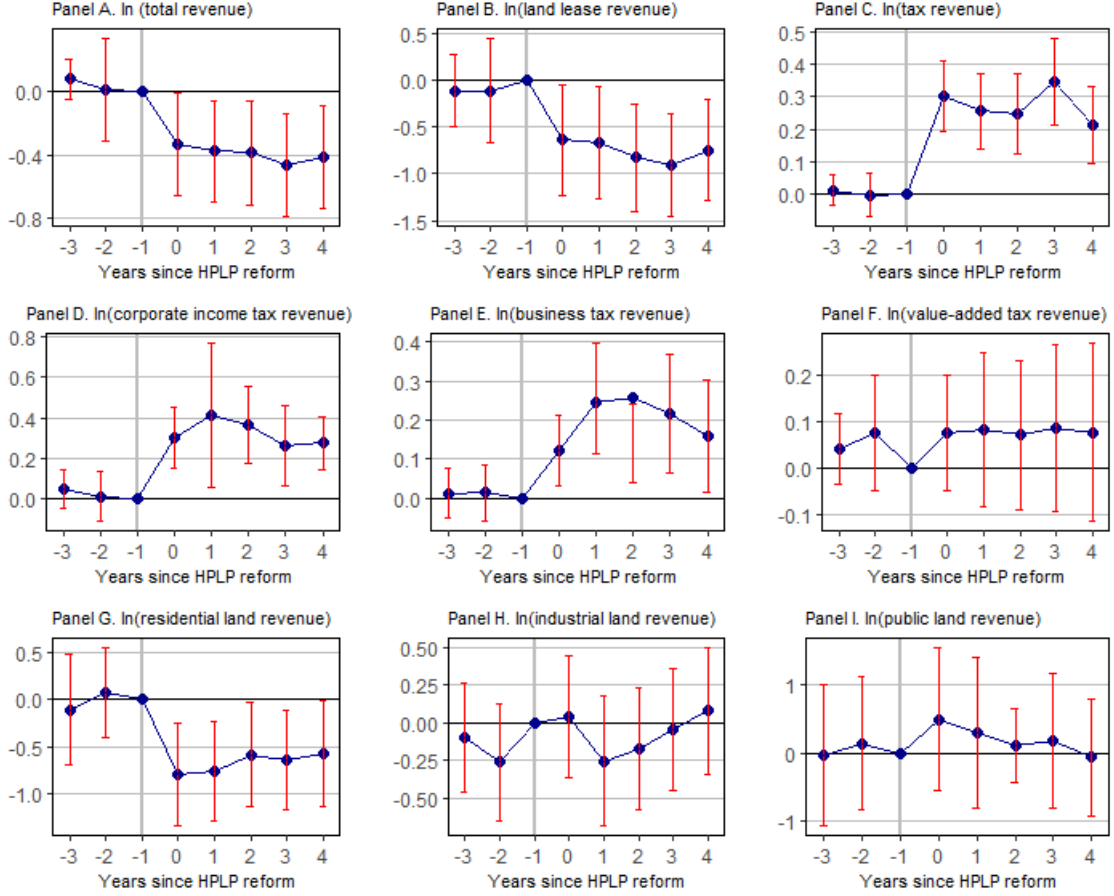


Figure 4: Event study estimates: Impacts of the HPLP on different fiscal revenues

*Notes:* The figure plots the event study estimates with corresponding 95% confidence intervals for the regressions of specification (3) (see Equation (3)). The dependent variable is indicated at the top of each figure. The horizontal axis shows the number of years since HPLP implementation. The coefficient for one year before HPLP implementation is normalized to zero. All estimated coefficients can be interpreted as impacts on the tax burden of firms compared to the year before HPLP implementation.

*Source:* Authors' own calculations.

allel pretrend for treated and control cities before HPLP implementation. Therefore, we conduct an event study by estimating specification (3) (see Equation (3)), where we replace the HPLP dummy with a series of yearwise dummies for a window of several periods around the start of the HPLP. Figure 4 plots the estimated coefficients on these dummies and shows the 95% confidence intervals, which are interpreted as

changes in the fiscal revenue of treated cities relative to control cities compared to the year prior to HPLP implementation. The point estimates show little to no pre-trend for total revenue, different land lease revenues, and different tax revenues before HPLP implementation. The significant change in these revenues started only after HPLP implementation. These results increase our confidence in the validity of our identification strategy.<sup>35</sup>

Table 6: Heterogeneous effect of HPLP enforcement on the revenue of local governments

	Group A (1)	Group B (2)	Group C (3)	Group D (4)
<i>Panel A: ln(LLR)</i>				
HPLP	-0.028 (0.171)	-0.339** (0.162)	-0.612*** (0.209)	-0.994*** (0.300)
<i>N</i>	2,290	2,458	2,522	2,498
R-squared	0.794	0.790	0.789	0.797
<i>Panel B ln(Tax)</i>				
HPLP	0.069 (0.058)	0.093** (0.047)	0.332** (0.130)	0.402*** (0.069)
<i>N</i>	2,112	2,280	2,344	2,320
R-squared	0.886	0.882	0.879	0.883

*Notes:* The dependent variables are  $\ln(\text{LLR})$  and  $\ln(\text{Tax})$  in panels A and B. There are four different treatment groups according to the level of HPLP enforcement (see Table B.5 for more details). Group A: cities implement only the HPLP, not involving hukou restriction and citywide implementation. Group B: HPLP implementation includes hukou restriction but not citywide implementation. Group C: the HPLP involves both hukou restriction and citywide implementation. Group D: the conditions of Group C plus more stringent regulations on the HPLP issued several times. In panel A, the coefficient of the HPLP represents the impact of the HPLP on land lease revenue for each treatment group relative to control cities. In panel B, the coefficient of the HPLP represents the impact of the HPLP on tax revenue for each treatment group relative to control cities. All columns include the interactions of city-level characteristics in the initial year with the year dummies, city fixed effects and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

<sup>35</sup>We also conduct an event study to check the validity of identification in Table 5 on the assumption of a parallel pretrend for treated and control cities before HPLP implementation (see Figure B.1).



As a step further, we explore the effect heterogeneity of HPLP enforcement on the land lease revenue and tax revenue of local governments in panels A and B of [Table 6](#), respectively. We divide the forty-six cities implementing the HPLP into four treatment groups based on the policy enforcement levels. We use these four treatment groups to identify the heterogeneous effect arising from policy enforcement. We expect the magnitude of HPLP impacts would gradually increase from group A to group D, relative to the control group. We perform regressions that are analogous to those in [Table 3](#) but using four different treatment groups in [Table 6](#). Policy enforcement of group A is the weakest in the four treatment groups shown in column (1). Column (2) presents the results using a treatment group from the cities implementing the HPLP, including hukou restriction. Column (3) studies the cities that have implemented the HPLP, including hukou restriction and citywide implementation. The treatment group in column (4) is a subgroup of column (3). Thus, the cities that have more frequently issued stringent regulations on the HPLP in column (3) would be used as treated cities in column (4). [Table 6](#) shows that the impacts of HPLP are statistically significant on the land lease revenues and tax revenues in panels A and B, respectively, except for group A in column (1). In addition, due to the intensification of policy enforcement in different treated cities, we find that the magnitudes of the impact of the HPLP on land lease revenue and tax revenues for local governments rise from columns (1) to (4).

## 4.2 Spillovers

One might be concerned that these DiD estimates could be biased due to spillovers from treated cities to non-treated ones. The two sets of exercises laid out in the

section are used to address that possibility.

Table 7: The impact of the HPLP on local fiscal revenue (excluding neighbors)

Panel A. Removing adjacent neighbors	ln(Total revenue) (1)	ln(LLR) (2)	ln(Tax) (3)	ln(CIT) (4)	ln(BT) (5)	ln(VAT) (6)
HPLP	-0.264*** (0.082)	-0.568** (0.229)	0.321*** (0.076)	0.269** (0.109)	0.102* (0.056)	-0.051 (0.073)
<i>N</i>	1,270	1,270	1,104	1,104	1,104	1,104
R-squared	0.867	0.753	0.897	0.797	0.870	0.745
Panel B. Removing two nearest neighbors						
HPLP	-0.243*** (0.072)	-0.551** (0.256)	0.308*** (0.068)	0.269** (0.109)	0.132** (0.062)	-0.049 (0.053)
<i>N</i>	2,104	2,104	1,940	1,940	1,940	1,940
R-squared	0.897	0.824	0.912	0.826	0.896	0.803
Panel C. Removing neighbors within 100 km						
HPLP	-0.286*** (0.070)	-0.551*** (0.175)	0.249*** (0.056)	0.289*** (0.096)	0.121*** (0.046)	-0.027 (0.056)
<i>N</i>	2,195	2,195	2,016	2,016	2,016	2,016
R-squared	0.874	0.772	0.878	0.784	0.866	0.693

*Notes:* The dependent variable is indicated at the top of the columns. In columns (1)-(6), the dependent variables are the logarithm of total revenue, land lease revenue, tax revenue, CIT revenue, BT revenue, and VAT revenue. Panels A, B, and C remove the adjacent neighbors, two nearest neighbors, and neighbors within 100 km of treated cities from the control group, respectively. All columns include the interactions of city-level characteristics in the initial year with the year dummies, city fixed effects and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

First, we check whether the main results are robust by excluding the control cities surrounding the treated cities. In spatial analysis, neighbors can be defined in many ways. We adopt three standard measures to define the geographic neighbors of treated cities in panels A, B, and C of Table 7. We start the estimation by excluding the adjacent neighbors of treated cities in the control group. However, adjacent neighbors only represent cities with a common border, so the distance between their centroids is not necessarily very short. Thus, we further examine the impacts of the HPLP on

local government's fiscal revenue, excluding the two nearest neighbors or neighbors within 100 kilometers in panels B and C.<sup>36</sup> The results of Table 7 are consistent with previous findings in Tables 2 and 3. Compared with baseline results, results of removing spillovers show that the magnitudes of HPLP impacts on the total revenue and land lease revenue fall by 34% and 23%, respectively, while the magnitude of the impact on tax revenue does not change significantly.

while the impact on taxation has not changed significantly.

Table 8: Spillover-robust difference-in-differences estimates

	ln(Total revenue) (1)	ln(LLR) (2)	ln(Tax) (3)	ln(CIT) (4)	ln(BT) (5)
HPLP	-0.362*** (0.041)	-0.525*** (0.019)	0.198*** (0.024)	0.203*** (0.029)	0.065* (0.038)
Close to treated [30-36) km	0.167** (0.079)		0.159* (0.086)	0.172** (0.79)	
Close to treated [36-42) km	0.136 (0.101)				
Close to treated [40-44) km		0.282** (0.126)			
Close to treated [30-40) km					0.325** (0.138)
<i>N</i>	2,602	2,602	2,408	2,408	2,408
R-squared	0.715	0.325	0.417	0.268	0.498
Optimal distance (km)	6	4	6	6	4
Maximum spillover distance (km)	42	44	42	36	40
RMSE bandwidth (h)	1.239	1.725	1.214	1.225	1.202

*Notes:* The dependent variable is indicated at the top of the columns. Optimal models are based on minimizing the RMSE criterion, with the optimal cross-validated RMSE displayed in the table. Spillover bins (h) are searched based on average distances from cities to the nearest treated border. The optimal bandwidth and maximum spillover distances in the optimal models are displayed in the table. All columns include the interactions of city-level characteristics in the initial year with the year dummies, city fixed effects, and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

Second, we follow the Clarke (2017) to propose a method for DiD estimation in the presence of spillovers. The spillover-robust DiD method allows for the spillovers of

<sup>36</sup>The geographic distance is calculated between the centroids of the two cities

treatments from treated clusters to non-treated clusters, with the only restriction being a quite flexible geographical dependence on propagation. Therefore, this method results in two classes of estimates: treatment effects and “close” to treatment effects. In [Table 8](#), we apply the proposed estimator to the impacts of the HPLP to determine the RMSE-optimal distance and identify the presence of spillovers.<sup>37</sup> Columns (1)-(5) present the impacts of the HPLP on a variety of types of local government revenue and display the estimated spillover impacts, which are identified using the proposed modeling strategy. The results on the impacts of the HPLP on various types of revenue of local governments are consistent with previous findings. In addition, the estimated spillover impacts of the HPLP are statistically significant and propagate up to approximately 40 km from treatment in columns (1)-(5).

### 4.3 Impact on Firm Tax Burden

We examined the mechanism of rent-tax substitution for local governments in [Section 4.1](#). When the HPLP was implemented, local governments had to increase their tax revenue to eliminate fiscal pressure. Our findings show that the HPLP increases CIT and BT revenues of local governments, but the impact of HPLP on VAT revenue is not significant. The burden of these three taxes directly falls on firms, so in this section, we would investigate how the HPLP affects the firms’ tax burdens.

Taking column (1) of [Table 9](#) as a benchmark, we start the estimation by controlling for the firm-specific fixed effects and year-specific fixed effects. It turns out that the HPLP is positively and statistically significantly associated with the tax burden of firms. Column (2) takes a further step to add covariates interacted with year

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<sup>37</sup>Each RMSE minimizing bandwidth, as well as the RMSE itself, is displayed in [Table 8](#).

Table 9: The impact of HPLP on tax burden of firms

	Tax burden			
	(1)	(2)	(3)	(4)
HPLP	0.199*** (0.0232)	0.224*** (0.0231)	0.237*** (0.0233)	0.186*** (0.0240)
Covariates $\times$ year dummies	NO	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	NO	NO
City-industry fixed effects	NO	NO	YES	YES
Province-year fixed effects	NO	NO	NO	YES
$N$	4,240,231	3,453,983	3,430,422	3,430,422
R-squared	0.411	0.518	0.483	0.415

*Notes:* The dependent variable is the tax burden measured by the ratio of taxes payable to the operating revenue of firms. Column (1) starts off the estimation by controlling for city and year fixed effects. Column (2) takes a further step to add firm-level characteristics interacted with year dummies. Column (3) adds the city-industry fixed effect. Column (4) adds the province-year fixed effect. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

dummies. Column (3) adds the city-industry fixed effect, and column (4) adds the province-year fixed effect. Quantitatively, column (4) indicates that the tax burden of treated firms approximately grew by 0.2 % compared with the control firms. On average, this translates into a 3.5% increase in the tax burden of firms.<sup>38</sup>

Furthermore, we consider the effect heterogeneity of the HPLP on firms. First, we explore the heterogeneous effects of the HPLP on the tax burdens of the CIT, VAT, and BT. Table 10 presents the different impacts of the HPLP on CIT, VAT, and BT burdens of the firms. We start the estimation by controlling firm-specific fixed effects and year-specific fixed effects in columns (1), (3), and (5), using different tax burdens of firms as the dependent variables. We further add the firm-level characteristics in the

<sup>38</sup> $0.186/5.321 \approx 0.035$ , where 5.321 is the sample mean of the tax burden of firms, as shown in Table B.2.

Table 10: Heterogeneous effect on tax burden: Tax type

	CIT		VAT		BT	
	(1)	(2)	(3)	(4)	(5)	(6)
HPLP	0.395*** (0.064)	0.590*** (0.067)	-0.117 (0.094)	0.130 (0.096)	0.078*** (0.005)	0.106*** (0.005)
Covariates $\times$ year dummies	NO	YES	NO	YES	NO	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	NO	YES	NO	YES	NO
City-industry fixed effects	NO	YES	NO	YES	NO	YES
Province-year fixed effects	NO	YES	NO	YES	NO	YES
$N$	3,153,606	3,124,071	1,244,322	1,225,700	2,187,690	2,162,429
R-squared	0.433	0.378	0.493	0.495	0.785	0.802

*Notes:* This table reports the heterogeneous effects of the HPLP on two different types of taxes. The dependent variable is indicated at the top of each column. Columns (1), (3), and (5) start the estimation by controlling for city and year fixed effects. Columns (2), (4), and (6) add firm-level characteristics in the initial year interacted with year dummies, city-industry fixed effects, and province-year fixed effects. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

initial year interacted with year dummies, city-industry fixed effects, and province-year fixed effects. The results in columns (1) and (2) of [Table 10](#) show that the impacts of the HPLP on CIT are persistently positive and statistically significant. Quantitatively, the estimated coefficient of the HPLP in column (2) is 0.59, implying that the CIT burden of treated firms is 0.59 percentage points higher than that of control firms. On average, this expresses a 4.5% increase in the CIT of firms.<sup>39</sup> The impact of the HPLP on VAT is not statistically significant, as shown in columns (3) and (4). In addition, the HPLP would increase firms' BT burden, as shown in columns (5) and (6). Column (6) indicates that the BT burden of treated firms is 0.106 percentage points higher than that of control firms, implying an 8% increase in

<sup>39</sup> $0.59/13.125 \approx 0.045$ , where 13.125 is the sample mean of CIT burden, as shown in [Table B.2](#).

the BT of firms.<sup>40</sup> Therefore, local governments enhance tax enforcement to offset the reduction in land lease revenue, which is significantly reflected in the strengthening of the collection of CIT and BT.

There are three possible reasons for heterogeneous effects on CIT, VAT, and BT. First, VAT is a type of tax that is assessed incrementally. It is levied on the price of a product or service at each stage of production, distribution, or sale to the end consumer. Sales transactions are taxed using the credit-invoice method in China, with the customer informed of the VAT on the transaction, and businesses may receive a credit for VAT paid on input materials and services. Moreover, the penalties for falsely issuing invoices are severe. Therefore, the VAT is more effective in facilitating tax enforcement (Pomeranz, 2015). Firms are more likely to evade business tax and corporate income tax by reducing the operating revenue or profits in China (Fisman and Wei, 2004; Cai and Liu, 2009; Fan et al., 2018). The “Golden Tax System Phase III,” the new tax management system, has been successfully up and running smoothly online in China after 2008. The “Golden Tax System Phase III” achieves nationwide online tax registration and full tax (fee) online declaration in China. All businesses must register with the tax authority and, through the Golden Tax system, invoices will be verified and given identifier codes. In addition, the tax bureau can assess “Big Data” of comprehensive tax by industries, taxes types, enterprise types, business models, business natures, and regions. Therefore, VAT evasion for firms is much more difficult than it was previously. Second, both VAT and CIT are shared taxes, indicating that the central government and local governments share these two tax revenues in specific ratios. However, the sharing ratios are different. The central

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<sup>40</sup> $0.106/1.332 \approx 0.080$ , where 1.332 is the sample mean of BT, as shown in Table B.2.

government collected 75% of VAT and 60% of CIT between 2008 and 2015. Therefore, when the same amount of tax is levied, the local government can get more revenue from corporate income tax than value-added tax through tougher tax enforcement.<sup>41</sup> Finally, CIT, VAT, and BT are not collected by the same department in China. The state taxation bureau collects the VAT from firms. The local taxation bureau collected the BT from firms. The department that collects the CIT from firms changed several times before 2010,<sup>42</sup> the most recent of which was announced in the “Notice on the collection and management of corporate income tax”, issued by the State Administration of Taxation on December 16, 2009.<sup>43</sup> The “Notice” provided a new strategy for the administration and collection of CIT from different firms.<sup>44</sup> Therefore, CIT is jointly collected by the state bureau and local taxation bureaus in China. Local taxation bureaus are affiliated with local governments, and local governments appoint the directors of local taxation bureaus. Therefore, local governments can intervene in the taxation of local taxation bureaus. We find that the impacts of the HPLP on the VAT are not statistically significant because there is a difference in tax effort between state and local taxation bureaus. State taxation bureaus affiliated with the central government can make more of an effort to collect VATs. Local taxation bureaus generally make less of an effort to collect tax. However, when facing fiscal pressure

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<sup>41</sup>For example, local governments levy an additional 1 yuan in the two taxes, which can increase VAT revenue by 0.25 yuan or CIT income by 0.4 yuan.

<sup>42</sup>Local taxation bureaus collected all CITs from firms before 2002. In 2002, “the corporate tax-sharing reform” transformed CIT from a local tax to a shared tax. From then on, if firms were established before 2002, then their CIT was still collected by local taxation bureaus. Otherwise, it was collected by state taxation bureaus.

<sup>43</sup>The full title of the “Notice” is “Notice on Adjustment of the Scope of Collection and Management of Newly Added Corporate Income Taxpayers”, which would come into force as of January 1, 2009.

<sup>44</sup>The details of adjustment of the “Notice” are that among the corporate income taxpayers newly established after 2009, the CITs from firms that pay the VAT will be governed by state taxation bureaus, while the CIT from firms that pay the BT will be governed by local taxation bureaus.



from HPLP implementation, local governments have to increase their enforcement of tax collection, particularly the collection of CIT and BT.

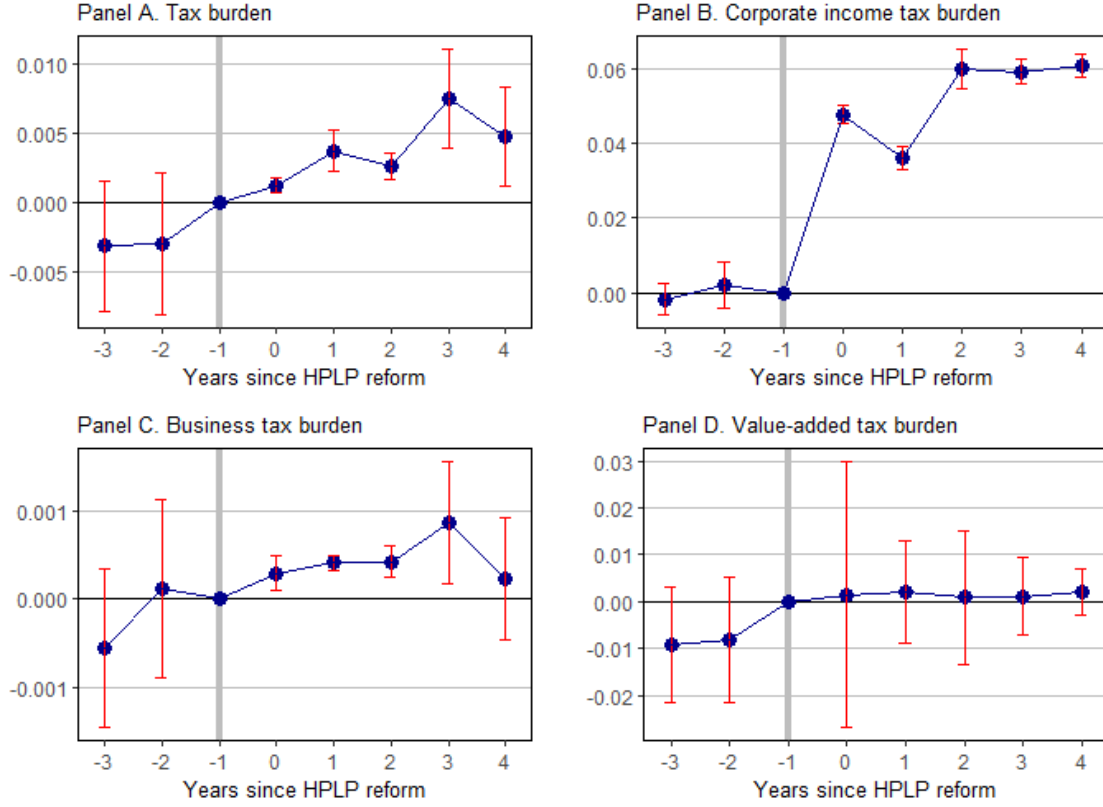


Figure 5: Event study estimates: Impacts of the HPLP on different tax burdens

*Notes:* The figure plots the event study estimates with corresponding 95% confidence intervals for the regressions of specification (4) (see Equation (4)). The dependent variables are the ratios of total taxes payable, CIT, BT, and VAT to the operating profit of firms. The horizontal axis shows the number of years since HPLP implementation. The coefficient for one year before HPLP implementation is normalized to zero. All estimated coefficients can be interpreted as impacts on the tax burden of firms compared to the year before HPLP implementation.

*Source:* Authors' own calculations.

The validity of our main results, as shown in Tables 9 and 10, relies on the assumption that there were no differential trends for treated and control firms in the pretreatment period. Figure 5 depicts the impacts of the HPLP on firms' different tax burdens on the basis of the year of HPLP implementation and shows that the

coefficients are not significant before the year of HPLP implementation. However, in panels A, C, and D, an upward trend exists, and there is a pre-trend that is larger than the change after the implementation of HPLP, even over three years. Thus, statistical significance is not a strong defense of pretreatment parallel trends, and the validity of identification may be uncertain.

Moreover, tougher tax enforcement caused by the HPLP could affect the tax evasion behavior of firms. The profit gap of firms between imputed profit and reported profit is related to tax evasion in China. We follow the approach of [Cai and Liu \(2009\)](#) to calculate the gap between firms' imputed profits (PRO) based on national income and their reported accounting profits (RPRO) to investigate the effect of the HPLP on tax evasion activities. We compute firm  $i$ 's corporate profit,  $PRO_{it}$ , in year  $t$  according to the national income accounting system as follows:

$$PRO_{it} = Y_{it} - MED_{it} - FC_{it} - WAGE_{it} - CURRD_{it} - VAT_{it} \quad (5)$$

where  $Y_{it}$  is a firm's gross output,  $MED_{it}$  measures its intermediate inputs including financial charges,  $FC_{it}$  is its financial charges (mainly interest payments),  $WAGE_{it}$  is its total wage bill,  $CURRD_{it}$  is the amount of its current depreciation, and  $VAT_{it}$  is the value-added tax burden. We define the intermediate inputs as the sum of manufacturing expenses, management expenses, and sales expenses after deducting the value-added of these three expenses, plus raw material expenses.<sup>45</sup> The imputed profit

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<sup>45</sup>The value added of manufacturing expenses, management expenses, and sales expenses includes wages, benefits, depreciation, labor insurance premiums, unemployment insurance premiums, medical insurance premiums, pension insurance premiums, real estate taxes, and others. Due to the lack of an indicator of intermediate inputs in the NTSD, we need to define the intermediate inputs of firms.

defined here can legitimately differ from a firm’s true accounting profit.<sup>46</sup> However, tax avoidance activities can alter the gap between imputed profit and reported profit. [Chen \(2017\)](#) shows that the profit gap declines once local governments have greater incentives to enforce taxation. HPLP implementation increased the tax revenue of local governments through tougher enforcement, so we expect that the HPLP will reduce the profit gap.

Table 11: The impact of the HPLP on the gap between imputed profit and reported profit

	(PRO -RPRO)/assets					
	Full sample	LTBs	STBs	Private firms	Foreign firms	SOEs
	(1)	(2)	(3)	(4)	(5)	(6)
HPLP	-0.034*** (0.003)	-0.045*** (0.005)	0.001 (0.006)	-0.042*** (0.004)	-0.016 (0.013)	-0.006 (0.005)
<i>N</i>	1,899,064	1,218,758	562,971	1,436,632	165,541	229,319
R-squared	0.521	0.541	0.552	0.524	0.523	0.526

*Notes:* The dependent variable is the ratio of the gap between imputed profit and reported profit to total assets. “STBs” indicates that state taxation bureaus collect the CIT from firms in column (2). “LTBs” indicates that local taxation bureaus collect the CIT from firms in column (3). Columns (4)-(6) report the heterogeneous effects on firms of different ownership. Each column includes firm-level characteristics in the initial year interacted with year dummies, firm fixed effects, city-industry fixed effects, and province-year interactive fixed effects. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

[Table 11](#) presents the impacts of the HPLP on tax avoidance activities, using the ratio of the profit gap to the total assets of firms. The results in the full sample in column (1) confirm the profit gap narrowing of firms in cities implementing the HPLP. In columns (2) and (3), we find that the impact on the tax avoidance of firms governed by local taxation bureaus is negative and statistically significant. However,

<sup>46</sup>The important reason for this is the differences in the revenue and expense recognition rules of the two systems ([Cai and Liu, 2009](#)).

the impact on firms governed by state taxation bureaus is not statistically significant. As previously mentioned, local taxation bureaus generally make less of an effort to collect taxes. Therefore, firms governed by local taxation bureaus are less likely to avoid paying taxes by underreporting their profits once local governments give higher incentives to enforce taxation. As shown in column (4), implementing the HPLP would reduce private firms' tax avoidance activities because foreign firms and SOEs exhibit relatively higher tax compliance than private firms.

As a further step, we explore the extent to which the impact of the HPLP on the CIT burden may vary across firms.<sup>47</sup> First, the heterogeneous effect on CIT arises from enforcement by different taxation bureaus. Local taxation bureaus collected all CITs from firms before 2002. Since then, according to “the corporate tax-sharing reform,” if firms were established before 2002, then CITs are still collected by local taxation bureaus. State taxation bureaus collect CITs from the remaining firms. Because local taxation bureaus are subordinate to local governments, the tax enforcement of the former is significantly affected by the latter. The heterogeneous effects of the HPLP on CIT burden arising from these two different departments (state taxation bureaus and local taxation bureaus) are shown in columns (1)-(2) of [Table 12](#). Column (1) reports that the impact of the HPLP on the CIT burden is positive but not statistically significant because local governments cannot interfere with the tax enforcement of state taxation bureaus. However, local governments can influence the tax enforcement of local tax bureaus, so the impact of the HPLP on the CIT burden is significantly positive in column (2).

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<sup>47</sup>The impact of the HPLP on the VAT burden is not statistically significant. Since May 1, 2016, BTs have been abolished, so the VAT and CIT are the two most essential burdens for firms. This paper focuses on the CIT burden of firms.

Table 12: Heterogeneous effect on CIT burden: Firm heterogeneity

	CIT				
	STBs (1)	LTBs (2)	Private firms (3)	Foreign firms (4)	SOEs (5)
HPLP	0.061 (0.095)	1.091*** (0.141)	0.747*** (0.081)	0.238 (0.255)	0.223 (0.157)
<i>N</i>	1,591,960	1,450,273	1,776,632	535,541	629,319
R-squared	0.456	0.508	0.524	0.523	0.526

*Notes:* This table reports the heterogeneous effects of the HPLP on the CIT burden of firms. Columns (1) and (2) indicate the different government departments that collect CITs from firms. “STBs” indicates that state taxation bureaus collect CITs from firms in column (1). “LTBs” indicates that local taxation bureaus collect CITs from firms in column (2). Columns (3)-(5) report the heterogeneous effects on firms with various ownership types. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

Second, the effect heterogeneity is possibly related to the ownership of firms. As indicated in columns (3)-(5) of [Table 12](#), the impacts of the HPLP on the CITs for private firms are positive and statistically significant at the 1% level. However, the impacts of the HPLP on CITs for foreign firms and SOEs are not statistically significant because foreign firms and SOEs exhibit relatively higher tax compliance than private firms, so local governments cannot strengthen the tax enforcement for foreign firms and SOEs. In general, local governments are willing to lower tax enforcement for private firms without fiscal pressure because of the flexible mobility of private firms. Therefore, facing fiscal pressure, local governments strengthen only the enforcement of CITs for private firms rather than for foreign firms and SOEs. As a result, HPLP implementation has mainly increased the burden of CIT for private firms.

Finally, we investigate the heterogeneous effect of HPLP enforcement on the CIT

Table 13: Heterogeneous effect on CIT burden: Policy enforcement

	CIT			
	Group A (1)	Group B (2)	Group C (3)	Group D (4)
HPLP	0.061 (0.138)	0.3178** (0.1338)	3.401*** (0.063)	3.767*** (0.082)
<i>N</i>	2,038,963	2,609,888	3,053,729	2,915,704
R-squared	0.456	0.427	0.513	0.536

*Notes:* The dependent variable is the CIT burden of firms. There are four different treatment groups. Group A: the cities implement only the HPLP, not involving hukou restriction and citywide implementation. Group B: HPLP implementation includes hukou restriction but not citywide implementation. Group C: the HPLP involves both hukou restriction and citywide implementation. Group D: the conditions of Group C plus more stringent regulations on the HPLP issued several times. If firms are in treated cities, then they serve as the treatment group at the firm level. The coefficients of the HPLP represent the impacts of the HPLP on each firm-level treatment group relative to control firms. All columns include firm-level characteristics in the initial year interacted with year dummies, firm fixed effects, year fixed effects, and province-year fixed effects. Standard errors are clustered at the firm level for all regressions (in Parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

burden of firms. We expect that the impact of the HPLP on the CIT burden of firms is positive and that the magnitude of the impact for different treatment groups relative to the control group will increase along with the increase in the intensification of HPLP enforcement. We define four different treated cities according to their levels of HPLP enforcement, which is similar to the work in [Section 4.1](#).<sup>48</sup> In addition, we use the local firms located in the defined treated cities that are included in four various treatment groups. As seen in column (1) of [Table 13](#), the coefficient of the HPLP is positive but not significant for the treated firms in group A relative to control firms. Along the same lines as the previous estimation in panel B of [Table 6](#), we find that

<sup>48</sup>More details are shown in [Table B.5](#).

the magnitudes of the HPLP impacts on the CIT burden for firms gradually increase from column (1) to column (4) because of the differences in HPLP enforcement.

#### 4.4 Firms Respond to the HPLP

Table 14: The impact of the HPLP on investment rate

	Investment rate		
	(1)	(2)	(3)
	Full sample	Large firm	Small firm
HPLP	-2.133*** (0.024)	-0.173** (0.075)	-2.549*** (0.026)
$N$	2,538,523	369,821	2,118,233
R-squared	0.437	0.459	0.452

*Notes:* The dependent variable is the investment rate measured by the ratio of real investment to lagged real capital stock. Column (1) starts the estimation using the full sample. In columns (2) and (3), we split the sample into the groups of large firms and small firms, based on the asset scale, the number of employees, operating income, and other firm indicators of the industries. All columns include firm-level characteristics in the initial year interacted with year dummies, firm fixed effects, year fixed effects, and province-year fixed effects. Standard errors are clustered at the firm level for all regressions (in Parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

In this section, we investigate how the HPLP influences firms in various aspects, including investment, employment, and wages. Table 14 presents the impacts of the HPLP on the investment incentive of firms, using the investment rate as the dependent variable.<sup>49</sup> Column (1) shows that the impact of the HPLP on investment in the full sample is significantly negative at the 1% level. Quantitatively, the estimated coefficient of the HPLP indicates that HPLP implementation reduces investment rates

<sup>49</sup>Investment rate=new fixed investment/lagged capital stock (capital stock at the end of last year).

by 2.133%. On average, this translates into an 18.55% decrease in the investment rate of firms.<sup>50</sup> In columns (2) and (3), we examined the heterogeneous effects of HPLP on the investment rate of firms of different sizes.<sup>51</sup> The results show that the impacts of the HPLP on the investment rate of small firms are much greater than that of large firms.

Table 15: The impact of the HPLP on employment

	Employment		
	(1) Full sample	(2) Large firm	(3) Small firm
HPLP	-0.087*** (0.000)	-0.024** (0.014)	-0.109*** (0.000)
<i>N</i>	3,354,049	407,200	2,871,355
R-squared	0.858	0.669	0.754

*Notes:* The dependent variable is employment measured by the logarithm of the number of employees. Column (1) starts the estimation using the full sample. In columns (2) and (3), we split the sample into the groups of large firms and small firms, based on the asset scale, the number of employees, operating income, and other firm indicators of the industries. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

In Table 15, we replace the dependent variable with the logarithm of the number of employees. We examine the impact of the HPLP on the employment of firms.<sup>52</sup>

<sup>50</sup> $2.133/11.5 \approx 0.1855$ , where 11.5 is the sample mean of the investment rate, as shown in Table B.2.

<sup>51</sup>The division of the size of firms involved is based on the asset scale, the number of employees, operating income, and other firm indicators. We follow the classification standards of the firm size in various industries published by the National Bureau of Statistics of China to define the large, medium, and small firms.

<sup>52</sup>Sun et al. (2021) found that housing purchase restrictions significantly discourage migrant students from accepting job offers in Beijing by 6.0 percentage points. There are two potential reasons graduates would value homeownership: to gain a comparative advantage in the marriage market and invest in the housing market. Therefore, intervention in the housing market could affect the decisions of employees.



Column (1) using the full sample show that the estimated coefficient of the HPLP is -0.087, implying that the HPLP reduced employment by 8.33%.<sup>53</sup> In addition, we split the sample into two groups based on the asset scale, the number of employees, operating income, and other firm indicators of the industries to examine the effect heterogeneity of the HPLP arising from the size of firms. Results in columns (2) and (3) show that the impacts of the HPLP on the employment of small firms are much greater than that of large firms.

Table 16: The impact of the HPLP on average wage

	Wage		
	(1)	(2)	(3)
	Full sample	Large firm	Small firm
HPLP	-0.081*** (0.005)	-0.557*** (0.014)	-0.012** (0.005)
<i>N</i>	3,101,811	317,357	2,651,485
R-squared	0.582	0.595	0.589

*Notes:* The dependent variable is wage measured by the ratio of total wages to the number of employees for each firm (the average wage of employees in each firm). Column (1) starts the estimation using the full sample. In columns (2) and (3), we split the sample into the groups of large firms and small firms, based on the asset scale, the number of employees, operating income, and other firm indicators of the industries. Standard errors are clustered at the firm level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

Finally, we would explore the impact of the HPLP on employee wages.<sup>54</sup> Column (1) of Table 16 shows that the implementation of the HPLP reduced the average wage of firms. Quantitatively, the estimated coefficient of the HPLP is -0.081 in column (1), implying that the HPLP decreased the average wage of treated firms by 7.78

<sup>53</sup> $100\% * (\exp(-0.087) - 1) = -8.33\%$

<sup>54</sup>The measure of wage represents the average wage that employees can obtain per year in each firm.

percent.<sup>55</sup> In columns (2) and (3), we find that the impacts of the HPLP on the employment of small firms are much less than that of large firms.

## 5 Conclusion

Although tax revenue and land lease revenue are the two pillars of local finance in China, many previous empirical findings have investigated that Chinese local governments generally loosen the tax collection enforcement and rely more on the land lease revenue. In contrast, the number of empirical studies concerning how tax revenue and land lease revenue can be substituted is relatively small. Therefore, this paper exploits the implementation of the housing purchase limits policy in China as a natural “fiscal squeeze” experiment in which local governments were forced to raise taxation from firms to fill the lost revenues from the land market.

The paper makes several contributions to understanding the substitution of tax revenue and nontax revenue (land lease revenue) and examining the extent to which local governments lower tax enforcement in developing countries through the lens of China. First, we find that the HPLP caused an immediate decrease in land lease revenue and decreased tax revenue for local governments. Moreover, the HPLP reduced the total revenue of treated cities. Quantitatively, the proportion of land lease revenue in total revenue decreased by 12.7%, while the proportion of tax revenue in total revenue increased by 8.3% in cities implementing the HPLP. Second, we find that the increased tax revenue of local governments arises from the revenues from CIT and BT rather than the VAT due to differences in tax enforcement. These results are verified across many robustness tests and sensitivity analyses.

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<sup>55</sup> $100\% * (\exp(-0.081) - 1) = 7.78\%$

Furthermore, this paper uses a large and unique firm-level dataset from 2008 to 2015 to study whether the HPLP has large and heterogeneous effects on firms' tax burden. Our findings show that the HPLP increased the tax burden of firms, particularly that arising from the CIT and BT governed by local taxation bureaus. We further validate that both firms governed by local taxation bureaus and private firms experience a relatively higher tax burden from HPLP implementation.

Finally, we explore how the company responded to HPLP. The results show that the impact of HPLP on investment, employment, and wages of firms is statistically significant and negative. In addition, we also find that the HPLP has a greater impact on the investment and employment of small firms than on large firms, but the effect of HPLP on average wage of small firms is less than that of large firms.

Our analysis explains only the effect of the HPLP on firms in terms of influencing the tax burden. Future research could further investigate the unexplained effects of the HPLP on different firm aspects. For example, [Jayamaha \(2020\)](#) examined the extent to which land-use restrictions, through their impact on housing prices, act as a barrier to labor mobility. In addition, [Hsieh and Moretti \(2019\)](#) quantified the amount of spatial misallocation of labor across US cities and its aggregate costs. The misallocation coming from high-productivity cities restricts the new housing supply, leading to limitations for workers who have access to such high productivity. Future research would contribute to the literature by modeling housing prices and labor mobility in China to explain the effects of the HPLP more comprehensively.

## References

- Altonji, J. G., Elder, T. E., and Taber, C. R. (2005). Selection on observed and unobserved variables: Assessing the effectiveness of catholic schools. *Journal of political economy*, 113(1):151–184.
- Auerbach, A. J. (2002). Taxation and corporate financial policy. In *Handbook of public economics*, volume 3, pages 1251–1292. Elsevier.
- Brandt, L. and Rawski, T. G. (2008). *China’s great economic transformation*. Cambridge university press.
- Burgess, R. and Stern, N. (1993). Taxation and development. *Journal of economic literature*, 31(2):762–830.
- Cai, H. and Liu, Q. (2009). Competition and corporate tax avoidance: Evidence from Chinese industrial firms. *The Economic Journal*, 119(537):764–795.
- Cao, J., Huang, B., and Lai, R. N. (2015). On the effectiveness of housing purchase restriction policy in China: A difference in difference approach. *Working Paper*.
- Chen, J., Guo, F., and Wu, Y. (2011). One decade of urban housing reform in China: Urban housing price dynamics and the role of migration and urbanization, 1995–2005. *Habitat International*, 35(1):1–8.
- Chen, K. and Wen, Y. (2017). The great housing boom of China. *American Economic Journal: Macroeconomics*, 9(2):73–114.
- Chen, S. X. (2017). The effect of a fiscal squeeze on tax enforcement: Evidence from a natural experiment in China. *Journal of Public Economics*, 147:62–76.

- Chen, T. and Kung, J.-S. (2016). Do land revenue windfalls create a political resource curse? Evidence from China. *Journal of Development Economics*, 123:86–106.
- Clarke, D. (2017). Estimating Difference-in-Differences in the Presence of Spillovers. Technical report, University Library of Munich, Germany.
- Deng, Y. and Liu, P. (2009). Mortgage prepayment and default behavior with embedded forward contract risks in China’s housing market. *The Journal of Real Estate Finance and Economics*, 38(3):214–240.
- Ding, C. (2003). Land policy reform in China: Assessment and prospects. *Land use policy*, 20(2):109–120.
- Djankov, S., Ganser, T., McLiesh, C., Ramalho, R., and Shleifer, A. (2010). The effect of corporate taxes on investment and entrepreneurship. *American Economic Journal: Macroeconomics*, 2(3):31–64.
- Drucker, J., Funderburg, R., Merriman, D., and Weber, R. (2020). Do local governments use business tax incentives to compensate for high business property taxes? *Regional Science and Urban Economics*, 81:103498.
- Fan, H., Liu, Y., Qian, N., and Wen, J. (2018). Computerizing VAT Invoices in China. Technical report, National Bureau of Economic Research.
- Fan, Z. and Liu, Y. (2020). Tax compliance and investment incentives: Firm responses to accelerated depreciation in China. *Journal of Economic Behavior & Organization*, 176:1–17.

- Fang, H., Gu, Q., Xiong, W., and Zhou, L.-A. (2016). Demystifying the Chinese housing boom. *NBER macroeconomics annual*, 30(1):105–166.
- Feng, W. (2003). Housing improvement and distribution in urban China: Initial evidence from China’s 2000 census. *China Review*, pages 121–143.
- Fisman, R. and Wei, S.-J. (2004). Tax rates and tax evasion: Evidence from “missing imports” in China. *Journal of political Economy*, 112(2):471–496.
- Fullerton, D., Shoven, J. B., and Whalley, J. (1983). Replacing the US income tax with a progressive consumption tax: A sequenced general equilibrium approach. *Journal of Public Economics*, 20(1):3–23.
- Glaeser, E. and Gyourko, J. (2018). The economic implications of housing supply. *Journal of Economic Perspectives*, 32(1):3–30.
- Glaeser, E., Huang, W., Ma, Y., and Shleifer, A. (2017). A real estate boom with Chinese characteristics. *Journal of Economic Perspectives*, 31(1):93–116.
- Gong, Y., Hu, J., and Boelhouwer, P. J. (2016). Spatial interrelations of Chinese housing markets: Spatial causality, convergence and diffusion. *Regional Science and Urban Economics*, 59:103–117.
- Gordon, R. and Li, W. (2009). Tax structures in developing countries: Many puzzles and a possible explanation. *Journal of Public Economics*, 93(7-8):855–866.
- Han, L. and Kung, J. K.-S. (2015). Fiscal incentives and policy choices of local governments: Evidence from China. *Journal of Development Economics*, 116:89–104.

- Hansen, G. and İmrohoroğlu, S. (2018). Replacing income taxation with consumption taxation in Japan. *Journal of the Japanese and International Economies*, 48:15–28.
- Herkenhoff, K. F., Ohanian, L. E., and Prescott, E. C. (2018). Tarnishing the golden and empire states: Land-use restrictions and the US economic slowdown. *Journal of Monetary Economics*, 93:89–109.
- Holm-Hadulla, F. (2020). Fiscal equalization and the tax structure. *Regional Science and Urban Economics*, 81:103519.
- Hsieh, C.-T. and Moretti, E. (2019). Housing constraints and spatial misallocation. *American Economic Journal: Macroeconomics*, 11(2):1–39.
- Hu, C.-Z. (1990). On the Development, Methodology and Management of Land Value Appraisal System. *Beijing: State Land Administration Internal Report*.
- Jacobson, L. S., LaLonde, R. J., and Sullivan, D. G. (1993). Earnings losses of displaced workers. *The American Economic Review*, pages 685–709.
- Jayamaha, D. (2020). Land-Use Restrictions: Implications for House Prices, Inequality, and Mobility Inequality, and Mobility. *Working paper*.
- Jia, S., Wang, Y., and Fan, G.-Z. (2018). Home-purchase limits and housing prices: Evidence from China. *The Journal of Real Estate Finance and Economics*, 56(3):386–409.
- Jiang, D., Chen, J. J., and Isaac, D. (1998). The effect of foreign investment on the real estate industry in China. *Urban Studies*, 35(11):2101–2110.

- Li, H. and Zhou, L.-A. (2005). Political turnover and economic performance: The incentive role of personnel control in China. *Journal of Public Economics*, 89(9-10):1743–1762.
- Li, P., Lu, Y., and Wang, J. (2016). Does flattening government improve economic performance? Evidence from China. *Journal of Development Economics*, 123:18–37.
- Li, V. J., Cheng, A. W. W., and Cheong, T. S. (2017). Home purchase restriction and housing price: A distribution dynamics analysis. *Regional Science and Urban Economics*, 67:1–10.
- Liu, T., Cao, G., Yan, Y., and Wang, R. Y. (2016). Urban land marketization in China: Central policy, local initiative, and market mechanism. *Land Use Policy*, 57:265–276.
- Liu, Y. and Mao, J. (2019). How do tax incentives affect investment and productivity? Firm-level evidence from China. *American Economic Journal: Economic Policy*, 11(3):261–91.
- Lu, Y., Wang, J., and Zhu, L. (2019). Place-based policies, creation, and agglomeration economies: Evidence from China’s economic zone program. *American Economic Journal: Economic Policy*, 11(3):325–60.
- Lu, Y. and Yu, L. (2015). Trade liberalization and markup dispersion: Evidence from China’s WTO accession. *American Economic Journal: Applied Economics*, 7(4):221–53.



- Man, J. Y. (2011). *China's housing reform and outcomes*. Lincoln Institute of Land Policy Cambridge, MA.
- Moon, T. S. (2019). Capital Gains Taxes and Real Corporate Investment. *Job Market Paper, Princeton University*.
- Mourre, G. and Reut, A. (2019). Non-tax revenue in the European Union: A source of fiscal risk? *International Tax and Public Finance*, 26(1):198–223.
- Ohrn, E. (2018). The Effect of corporate taxation on investment and financial policy: Evidence from the DPAD. *American Economic Journal: Economic Policy*, 10(2):272–301.
- Olken, B. A. and Singhal, M. (2011). Informal taxation. *American Economic Journal: Applied Economics*, 3(4):1–28.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.
- Ping Wang, Y. and Murie, A. (1996). The process of commercialisation of urban housing in China. *Urban Studies*, 33(6):971–989.
- Pomeranz, D. (2015). No taxation without information: Deterrence and self-enforcement in the value added tax. *American Economic Review*, 105(8):2539–69.
- Prud'Homme, R. (1992). Informal local taxation in developing countries. *Environment and planning c: government and policy*, 10(1):1–17.
- Qun, W., Yongle, L., and Siqu, Y. (2015). The incentives of China's urban land finance. *Land Use Policy*, 42:432–442.

- Shen, C., Jin, J., and Zou, H.-f. (2012). Fiscal decentralization in China: History, impact, challenges and next steps. *Annals of economics and finance*, 13(1):1–51.
- Smart, M. and Bird, R. M. (2009). The impact on investment of replacing a retail sales tax with a value-added tax: Evidence from Canadian experience. *National Tax Journal*, pages 591–609.
- Smith, S. J. (2012). *International encyclopedia of housing and home*, volume 7. Elsevier.
- Somerville, T., Wang, L., and Yang, Y. (2020). Using purchase restrictions to cool housing markets: A within-market analysis. *Journal of Urban Economics*, 115:103189.
- Sun, W., Zhang, S., Lin, C., and Zheng, S. (2021). How do home purchase restrictions affect elite Chinese graduate students’ job search behavior? *Regional Science and Urban Economics*, 87:103644.
- Valletta, W. (2001). The land administration law of China of 1998 and its impacts on urban development. In *Proceedings of the 2001 World Congress of Urban Planning, Shanghai, China*, pages 11–15.
- Yagan, D. (2015). Capital tax reform and the real economy: The effects of the 2003 dividend tax cut. *American Economic Review*, 105(12):3531–63.
- Zhang, L., Hui, E. C.-m., and Wen, H. (2015). Housing price–volume dynamics under the regulation policy: Difference between Chinese coastal and inland cities. *Habitat International*, 47:29–40.

## Appendix A. Land Reform and Housing Development

In China, all land in urban areas is still owned by the state. The Chinese constitution prohibited any organization or individual from appropriating, buying, selling or leasing land or otherwise engaging in the transfer of land by unlawful means during the period between the 1949 founding of the People's Republic of China and the 1978 Chinese economic reform (Glaeser et al., 2017). Companies, organizations, and individuals were allowed only to acquire nontransferable land-use rights from Chinese governments through non-market-oriented land allocation. During this period, the housing was allocated through a working unit-employee linkage, and the size and location of dwellings were determined by the size of households and length of employment, as well as other factors. Most urban residents relied on the government or the public institutions that employed them to provide housing; therefore, the consequences of such a socialist housing system were a housing shortage, insufficient investment, unequal distribution, and poor living conditions (Ping Wang and Murie, 1996). In 1978, the per capita residential area in urban areas was 3.6 square meters, which was even lower than that in 1949.<sup>56</sup>

Since the 1978 economic reform, the surge in foreign business has challenged the land-use tenure systems, as the demand for access to land has increased (Jiang et al., 1998). The old land system conflicted with the target of the 1978 economic reform that introduced the market system to improve the efficiency of land allocations and correct government failure in the land market. In the early 1980s, China established

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<sup>56</sup>Per capita living space in most Chinese cities was less than 5 square meters. Between 1952 and 1978, per capita floor space in urban China declined from 4.5 to 3.6 square meters (Feng, 2003).

special economic zones (SEZs) that could use an economic management system to conduct business to attract foreign direct investment (Ding, 2003).<sup>57</sup> In 1986, the land administration bureau that is responsible for land development, the implementation of land laws, and other land administrative issues was established, and land administration laws were passed, which means that private organizations and individuals could legally access state-owned land. Importantly, the Chinese constitution was amended to allow for land transactions, and this change set the legal stage for the privatization of housing in China (Fang et al., 2016).

The State Council announced the “Provisional Regulations of the People’s Republic of China on Assigning and Transferring the Urban State-owned Land-use Right” in 1991, which allows land users to assign, transfer, rent, and mortgage land-use rights (Valletta, 2001). In these regulations, there are two kinds of land transactions, including land-use rights and the transfer of land-use rights (Hu, 1990). Local governments sell land-use rights to buyers through auctions, tender or other ways as representatives of the state. The price of land-use rights is determined by different factors, such as land-use price, land-use type, location, and land-use density. The housing reform started in the early 1980s and gained momentum in 1994 when employees who worked in the state sector were allowed to purchase the property rights of their apartments at subsidized prices. However, the overall reform was slow and piecemeal until the Chinese constitution was amended to allow for land transactions.<sup>58</sup> A national law defined the concepts of “economically affordable houses” and “commodity houses”.<sup>59</sup>

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<sup>57</sup>Between 1980 and 1984, China established SEZs in Shantou, Shenzhen, and Zhuhai in Guangdong Province and Xiamen in Fujian Province and designated the entire island province of Hainan an SEZ. In 1984, China opened 14 other coastal cities to overseas investment.

<sup>58</sup>1998 Land Administration Law, Articles 11, 12 and 13.

<sup>59</sup>Commodity houses refer to private houses on the leased land developed by development companies. Affordable houses refer to a specific type of government-subsidized owner-occupied housing,

The price of commodity houses sold or rented was determined by the housing market. These series of actions enhanced the growth of land transactions and the privatization of housing, which led to a dramatic rise in housing prices. Then, the HPLP was implemented nationwide to cool the real estate market.

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which is based on income or other qualifications ([Smith, 2012](#)).

## Appendix B. Supplementary Figures and Tables

Table B.1: Local government decrees issued on the implementation of HPLP

City	File name	File code	Release date
Beijing	Notice of Implementation of Beijing Municipal Government on implementing the State Council's document on Resolutely Curbing the Soaring of Housing Prices in Some Cities.	Jingzhengfa[2010]13	04/30/2010
Xiamen	Opinions of Xiamen City on Implementing the Real Estate Macro-Control Policies of Five Ministries and Commissions including the Ministry of Housing and Urban-Rural Development to promote the sustainable and healthy development of the city's real estate industry.	Xiaguotufang[2010]279	09/30/2010
Shanghai	Several Opinions of Shanghai Municipal Government on Further Strengthening the Regulation and Control of the Real Estate Market in the Municipality and Accelerating the Promotion of Housing Security Work.	Hufufa[2010]34	10/07/2010
Ningbo	Notice of the General Office of Ningbo Municipal Government on Further Implementing the State Council's Document on Resolutely Curbing the Excessive Rise of House Prices.	Yongzhengbanfa[2010]230	10/09/2010
Fuzhou	Supplementary Notice of the General Office of the Fuzhou Municipal Government on Further Implementing the Spirit of the State Council's Documents and Resolutely Curbing the Excessive Rise of House Prices.	Rongzhengban[2010]199	10/10/2010
Hangzhou	Implementation Opinions of Hangzhou Municipal Government on Further Strengthening the Regulation and Control of the Real Estate Market in Our City and Accelerating the Construction of Affordable Housing.	Hangzhenghan[2010]232	10/11/2010
Haikou	Opinions of the General Office of the Haikou Municipal Government on Implementing the Policy of Promoting the Stable and Healthy Development of the Real Estate Market.	Haifuban[2010]184	10/12/2010
Nanjing	Opinions of the Nanjing Municipal Government on implementing the macro-control policies of the Ministry of Housing and Urban-Rural Development and other ministries and commissions to promote the sustainable and healthy development of the city's real estate market.	Ningzhengfa[2010]196	10/12/2010

Wenzhou	Supplementary opinions on further strengthening the regulation of the real estate market and housing security in the city.	Wenzhengban[2010]91	10/12/2010
Tianjin	Notice on Further Implementing the Spirit of the State Council's Real Estate Macro-Control and Promoting the Sustainable and Healthy Development of the City's Real Estate Market.	Jingzhengfa[2010]38	10/13/2010
Guangzhou	Notice on Strictly Implementing the Policy of Restricting the Purchase of Commercial Housing in the City.	Huiguofangzi[2010]1313	10/12/2010
Shenzhen	Notice of Implementation of Shenzhen Municipal Government on further implementing the State Council's document on Resolutely Curbing the Soaring of Housing Prices in Some Cities.	Shenfuban[2010]36	10/20/2010
Jinhua	Implementation Opinions of Jinhua Municipal Government on Further Strengthening Regulation and Control of the Real Estate Market and Speeding up the Construction of Affordable Housing.	Jinzhengfa[2010]90	12/09/2010
Taiyuan	Several Opinions of the Taiyuan Municipal Government on Further Implementing Real Estate Macro-Control Policies to Promote the Stable and Healthy Development of the Real Estate Market.	Bingzhengfa[2011]1	01/11/2011
Jinan	Notice of the Jinan Municipal Government on Further Implementing Real Estate Control Policies to Promote the Healthy and Stable Development of the Real Estate Market.	Jizhengfa[2011]3	01/21/2011
Changchun	Implementation Opinions of Changchun Municipal Government on Further Implementing Real Estate Macro-Control Policies to Promote the Sustainable and Healthy Development of the City's Real Estate Market.	Changfufa[2011]7	01/28/2011
Qingdao	Opinions of the General Office of the Qingdao Municipal Government on Further Doing a Good Job in Real Estate Market Regulation and Promoting the Stable and Healthy Development of the Real Estate Market.	Qingzhengbanfa[2011]8	01/28/2011
Guiyang	Notice on the Implementation Opinions on Further Doing a Good Job in Real Estate Market Regulation.	Zhufufa[2011]14	02/11/2011
Chengdu	Opinions of the General Office of the Qingdao Municipal Government on Further Doing a Good	Chengfangfa[2011]7	02/15/2011



	Job in Real Estate Market Regulation and Promoting the Stable and Healthy Development of the Real Estate Market		
Harbin	Notice of the General Office of the Harbin Municipal People's Government on Further Doing a Good Job in the Regulation and Control of the Real Estate Market in the City.	Hazhengbanfa[2011]4	02/18/2011
Wuhan	Opinions of the General Office of the Wuhan Municipal Government on Implementing the Notice of the General Office of the State Council on Further Doing a Good Job in Real Estate Market Regulation and Relevant Issues.	Wuzhengban[2011]27	02/18/2011
Shijiazhuang	Notice of Shijiazhuang on Further Doing a Good Job in the City's Real Estate Market Regulation.	Shizhengbanfa[2011]7	02/19/2011
Nanchang	Opinions of Nanchang City on the Notice of the General Office of the State Council on Further Doing a Good Job in Real Estate Market Regulation and Relevant Issues.	Hongfutingfa[2011]17	02/20/2011
Wuxi	Notice of the Wuxi Municipal Government Office on Implementing the State Council's Real Estate Control Policies to Further Promote the Stable and Healthy Development of the City's Real Estate Market.	Xizhengbanfa[2011]38	02/20/2011
Yinchuan	Opinions of Yinchuan City on the Notice of the General Office of the State Council on Further Doing a Good Job in Real Estate Market Regulation and Relevant Issues.	Yinzhengbanfa[2010]24	02/22/2011
Dalian	Opinions of the General Office of Dalian Municipal Government on Further Strengthening the Regulation and Control of the Real Estate Market.	Dazhengbanfa[2011]22	02/25/2011
Kunming	Opinions of the General Office of the Kunming Municipal Government on Further Doing a Good Job in the Regulation and Control of the Real Estate Market.	Kunzhengban[2011]24	02/25/2011
Shenyang	Notice of the General Office of the Shenyang Municipal Government of on Further Doing a Good Job in the Regulation and Control of the Real Estate Market.	Shenzhengbanfa[2011]11	02/25/2011
Xining	Notice of Xining Municipal Government on Implementing the State Council's Policy on Real Estate Market Regulation and Other Issues Related to Issues.	Ningzheng[2011]27	02/25/2011

Urumqi	Notice of the General Office of the Urumqi Municipal Government on the Implementation Opinions on Further Doing a Good Job in Real Estate Market Regulation.	Wuzhengban[2011]51	02/28/2011
Lanzhou	Opinions of the Lanzhou Municipal Government on Further Strengthening the Regulation and Control of the Real Estate Market and Speeding up the Construction of Affordable Housing Projects.	Ganzhengfa[2011]28	03/01/2011
Suzhou	Notice of the Suzhou Municipal Government on Implementing the Notice of the General Office of the State Council on Further Doing a Good Job in the Regulation and Control of the Real Estate Market.	Sufu[2011]38	03/02/2011
Sanya	Notice of the Sanya Municipal Government on Implementing the Spirit of the Documents of the General Office of the State Council and Further Strengthening the Regulation and Control of the City's Real Estate Market.	Sanfu[2011]31	03/03/2011
Changsha	Notice of the General Office of the Changsha Municipal Government on Further Strengthening the Management of the Real Estate Market.	Changzhengbanfa[2011]10	03/04/2011
Zhoushan	Notice of the Zhoushan Municipal Government on Further Doing a Good Job in the Regulation and Control of the Real Estate Market.	Zhouzhengfa[2011]16	03/09/2011
Xi'an	Notice of the General Office of the Xi'an Municipal Government on Relevant Issues Concerning Further Strengthening the Regulation and Control of the Real Estate Market.	Shizhengbanfa[2011]26	03/10/2011
Foshan	Notice of the Office of the Foshan Municipal Government on Implementing the State Council's Real Estate Control Policies to Further Promote the Stable and Healthy Development of City's Real Estate Market.	Fofuban[2011]28	03/18/2011
Hefei	Notice of the General Office of the Hefei Municipal Government on Further Strengthening the Regulation and Control of the Real Estate Market.	Hezhengban[2011]6	03/24/2011
Nanning	Notice of the General Office of the Nanning Municipal Government on Further Doing a Good Job in the Regulation and Control of the Real Estate Market.	Nanfuban[2011]61	03/24/2011

Zhengzhou	Notice of Zhengzhou Municipal Government on Further Stabilizing Housing Prices in the City.	Zhengzheng[2011]16	03/25/2011
Shaoxing	Implementation Opinions of the Office of the Shaoxing Municipal Government earnestly implementing and further improving the regulation and control of the real estate market in the urban areas	Shaozhengbanfa[2011]59	04/08/2011
Hohhot	Implementation Opinions of the Hohhot Municipal Government on Further Implementing the Real Estate Macro-Control Policies to Promote the Sustainable and Healthy Development of the City's Real Estate Market.	Huzhengfa[2011]10	04/13/2011
Xuzhou	Notice of the Xuzhou Municipal Government on Issues Concerning the Implementation of the Policy on Restrictions on the Purchase of Ordinary Commercial Housing.	Xuzhengfa[2011]50	04/16/2011
Taizhou	Notice of the Taizhou City Government Office on Further Implementing the Regulation and Control of the Real Estate Market.	Zhengtaizhengban[2011]119	08/25/2011
Quzhou	Several Opinions of the Quzhou Municipal Government on Further Strengthening the Regulation and Control of the Urban Real Estate Market.	Quzhengfa[2011]70	09/05/2011
Zhuhai	Notice of Zhuhai Municipal Government Office on Deepening the Regulation and Control of the Real Estate Market.	Zhufuban[2011]45	10/31/2011

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*Notes:* Government decrees issued by all forty-six cities implementing the HPLP over 20010–2011 are listed in the table. Most decrees are from Municipal government websites. The release date refers to the time when the decrees were released. Thus it is not necessarily the date of HPLP enforcement.

Table B.2: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
<b><i>City-level Dependent Variables</i></b>					
ln(Total revenue)	2,602	13.513	1.427	8.652	18.725
ln(LLR)	2,602	11.232	1.975	3.168	17.124
ln(Tax)	2,408	13.136	1.218	10.356	17.922
ln(CIT)	2,408	10.892	1.465	6.764	16.795
ln(VAT)	2,408	11.363	1.192	6.176	16.692
ln(BT)	2,408	11.883	1.237	8.049	16.441
LLR/TR	2,602	0.252	0.148	0.962	0.076
Tax/TR	2,406	0.614	0.119	0.941	0.149
<b><i>Firm-level Dependent Variables</i></b>					
Tax burden	4,240,231	5.321	12.815	0	82.241
CIT	3,153,606	13.125	16.524	0	95.706
VAT	1,244,322	16.113	20.185	0	97.365
BT	3,274,585	1.332	2.465	0	17.513
Investment rate	2,549,734	11.5	22.6	0	100
Employment	3,424,036	3.658	1.572	0.397	7.857
Wage	3,261,475	1.782	1.305	0	6.271
<b><i>Variable of interest</i></b>					
HPLP	2,608	0.088	0.088	0	1
<b><i>City-level control variables</i></b>					
ln per capita GDP in 2008	326	10.078	1.087	3.737	14.574
Share of secondary Industry in 2008	326	48.804	12.674	15.5	90.971
Degree of openness in 2008	312	25.064	41.151	0.828	85.245
Degree of urbanization in 2008	305	44.856	15.404	12.254	95.252
ln population in 2008	326	5.822	0.887	2.975	9.247
<b><i>Firm-level control variables</i></b>					
Debt-to-assets ratio in the initial year	3,130,344	0.632	0.465	0.002	2.135
Age in the initial year	3,012,455	1.921	0.733	0	3.359
Size in the initial year	3,129,540	9.242	2.849	0	12.986
Tax refund rate in the initial year	3,105,225	0.006	0.025	0	0.173
Nontax burden in the initial year	1,805,187	0.006	0.010	0	0.125

*Notes:* The year of the first appearance of each firm in the sample as the initial year of firm-level control variables. For definitions of these variables, see [Table B.3](#).

Table B.3: Variable Definitions

Variable	Definition
$\ln(\text{Total revenue})$	Logarithm of the total revenue of local governments (total revenue is defined as the sum of public budgetary revenue and land lease revenue )
HPLP	Dummy for the housing purchase limits policy (1 if the policy is implemented in the city; 0 otherwise)
$\ln(\text{LLR})$	Logarithm of land lease revenue of local governments
$\ln(\text{Tax})$	Logarithm of total tax revenue of local governments
$\ln(\text{CIT})$	Logarithm of corporate income tax revenue of local governments
$\ln(\text{VAT})$	Logarithm of value-added tax revenue of local governments
$\ln(\text{BT})$	Logarithm of business tax revenue of local governments
$\text{LLR}/\text{TR}$	The proportion of land lease revenue in total revenue
$\text{Tax}/\text{TR}$	The proportion of total in total revenue
$\ln$ per capita GDP	Logarithm of the GDP per capita
Share of secondary industry	Value-added of secondary industry as a percentage of GDP
Investment rate	Investment in fixed asset as a percentage of GDP
Degree of openness	The sum of import and export as a percentage of GDP
Degree of urbanization	The share of non-agricultural population in the total population
$\ln$ population	Logarithm of total population
Tax burden (%)	The ratio of taxes payable to operating revenue of firms
CIT (%)	The ratio of corporate income tax to operating profit of firms
VAT (%)	The ratio of value added tax to industrial value-added of firms
BT (%)	The ratio of business tax to operating profit of firms
Debt-to-assets ratio	The total amount of liabilities relative to the total amount of assets
Age	Logarithm of the firm's age
Size	Logarithm of number of employees in the end of year
Tax refund rate	The share of total amount of tax refund to operating revenue
Nontax burden	(Administrative and institutional fees+ late fees of tax + others)/operating revenue
Investment rate (%)	The ratio of real investment to lagged real capital stock
Wage	The ratio of total wages to the number of employees. (The average wage of employees in each firm)
Employment	Logarithm of the number of employees

Table B.4: The impact of HPLP on land transaction area and price by use type

	ln(Land transaction area) (1)	Ratio of the land transaction area (2)	ln(Price of the land) (3)
Panel A. Residential land			
HPLP	-0.343*** (0.130)	-0.080*** (0.025)	0.086 (0.106)
<i>N</i>	2,180	2,503	2,588
R-squared	0.459	0.203	0.403
Panel B. Industrial land			
HPLP	-0.141 (0.148)	0.009 (0.036)	0.003 (0.111)
<i>N</i>	2,499	2,499	2,497
R-squared	0.447	0.209	0.264
Panel C. Commercial land			
HPLP	-0.024 (0.184)	0.010 (0.014)	-0.084 (0.142)
<i>N</i>	2,508	2,508	2,443
R-squared	0.451	0.177	0.98

*Notes:* The dependent variable is indicated at the top of each column. The dependent variables are the logarithm of land transaction areas, the ratio of the land transaction area to the total transaction area, the logarithm of price of the land in columns (1)-(3), respectively. Panels A, B, and C shows the impact of the HPLP on the land transaction area and price by the land usages, including residential land, industrial land, and commercial land. All columns include the interactions of city-level characteristics in the initial year with the year dummies, city fixed effects, and province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions in parentheses. Levels of significance: \*10%, \*\*5%, \*\*\*1%.

Table B.5: Effect heterogeneity of HPLP enforcement

Treatment Group	Name of city
Group A	Hohhot, Urumqi, Yinchuan, Taiyuan, Zhoushan, Changsha
Group B	Hangzhou, Fuzhou, Guangzhou, Xining, Shijiazhuang, Jinan, Qingdao, Xuzhou, Wuxi, Suzhou, Chengdu, Shaoxing, Nanchang, Guiyang, Kunming, Nanning, Hangzhou, Zhuhai
Group C	Beijing, Tianjin, Shanghai, Nanjing, Dalian, Ningbo, Xiamen, Lanzhou, Xi'an, Shenzhen, Haikou, Sanya, Harbin, Changchun, Taizhou, Zhengzhou, Hefei, Wuhan, Jinhua, Wenzhou, Foshan
Group D	Beijing, Shanghai, Lanzhou, Tianjin, Shenzhen, Haikou, Zhengzhou, Hefei, Wuhan, Wenzhou

*Notes:* We define four different treatment groups according to levels of enforcement of the HPLP. Group A: the cities only implement the HPLP not involving Hukou restriction and citywide. Group B: implementation of the HPLP includes Hukou restriction but not citywide. Group C: implementation of the HPLP involves both Hukou restriction and citywide. The group D: the conditions of the third one plus more stringent regulations on the HPLP issued several times. Group D is a subgroup of Group C based on their definitions. The Hukou restriction in the HPLP generally means that the people without Hukou of the city they live would lose more opportunities to purchase the housing in this city.

*Source:* Authors' compilation from relevant official documents,

Table B.6: The impact of HPLP on nontax revenue

	ln(nontax revenue)		
	Full sample	Removing the neighbors within 100 km	Removing the adjacent neighbors
	(1)	(2)	(3)
HPLP	0.224*** (0.072)	0.124** (0.061)	0.175* (0.089)
<i>N</i>	2,364	2,102	1,098
R-squared	0.820	0.825	0.815

*Notes:* The dependent variable is indicated on the top of the columns. The dependent variable is the logarithm of nontax revenue. Columns (1) uses full samples. Columns (2) removes the neighbors within 100 km of treated cities from the control group. Columns (3) removes the adjacent neighbors of treated cities from the control group. All columns include city-specific fixed effects, the interactions city-level characteristics in the initial year with year dummies, treatment trend, the province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.



Table B.7: The impact of the HPLP on public budgetary expenditure

	ln(Public budgetary expenditure)		
	Full sample	Removing the neighbors within 100 km	Removing the adjacent neighbors
	(1)	(2)	(3)
HPLP	0.224*** (0.072)	0.124** (0.061)	0.175* (0.089)
<i>N</i>	2,602	2,200	1,272
R-squared	0.899	0.897	0.883

*Notes:* The dependent variable is indicated on the top of the columns. The dependent variable is the logarithm of public budgetary expenditure. Columns (1) uses full samples. Columns (2) removes the neighbors within 100 km of treated cities from the control group. Columns (3) removes the adjacent neighbors of treated cities from the control group. All columns include city-specific fixed effects, the interactions city-level characteristics in the initial year with year dummies, treatment trend, the province-year interactive fixed effects. Standard errors are clustered at the city level for all regressions (in parentheses). Levels of significance: \*10%, \*\*5%, and \*\*\*1%.

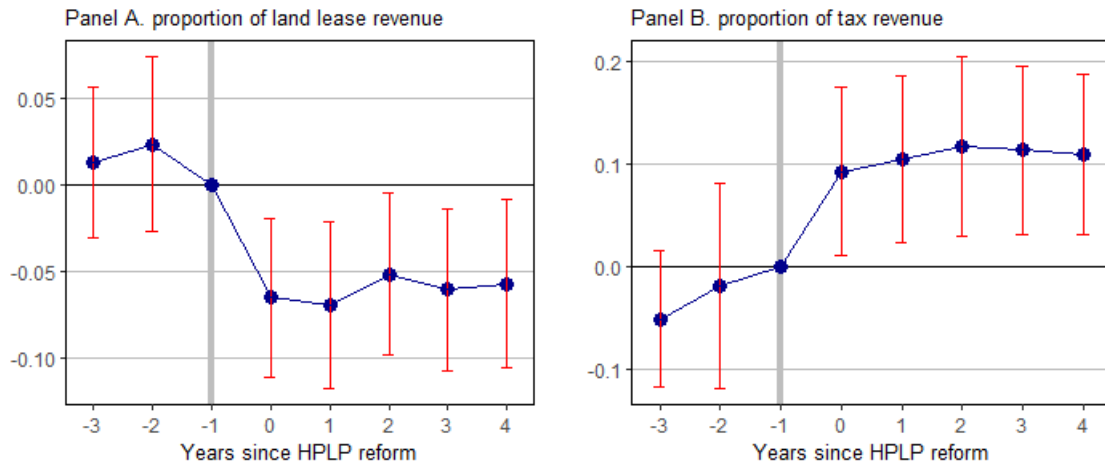


Figure B.1: Event study estimates: Impacts of the HPLP on proportions of land lease revenue and tax revenue

*Notes:* The figure plots the event study estimates with corresponding 95 % confidence intervals for regressions of specifications (3) (see Equation (3)). The dependent variable is indicated on the top of each figure. The horizontal axis shows the number of years since HPLP implementation. The coefficient for one year before HPLP implementation is normalized to zero. All estimated coefficients can be interpreted as impacts on the proportions of land lease revenue and tax revenue compared to the year before the HPLP implementation.

*Source:* Authors' own calculations.