Property Tax and Land Use:

Evidence from the reforms in the 1990s in Japan♦

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Abstract

This paper examines the effects of property tax reforms at the beginning of the 1990s in Japan through theoretical and empirical investigation. The objective of the reforms was to cease the preferential treatment for the urbanization promotion area (UPA) s' agricultural lands within designated cities in three metropolitan areas (Kanto, Kansai, and Chubu). This is done because the preferential treatment for agricultural land has been beset by many criticisms that it hinders the change into the residential use, which gives rise to the inefficiency of land use. We check this using the differences-in-difference approach (DID). Empirical results show that the share of the UPA's farmland, which should be converted into the residential use but preserved as farmland in most cases, decreased thanks to tax reforms that came into effect in FY 1992. However, DID estimation did not report the statistically significant results on housing supply after the reform.

Key words: Preferential treatment on property tax; Land use; Quasi-experiment
JEL classification: H22, R38

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1. Introduction

Public finance economists have reiterated property tax on land is neutral with respect to resource allocation. However, the reality is that its tax rate is different dependent on the use of land, which may affect the decision of landowners. Typical example is a preferential treatment on farmland. Indeed, many U.S. states give preferential property tax treatment to landlords for the preservation of land devoted to agricultural production, which contributes to keep farmland as it is.[1] This is why farmland conservation can be justified from various points of view: local and national food security, employment in the agricultural industry, efficient development of urban and rural land, and the protection of rural and environmental amenities (Lynch 2003)). Above all, as stated in Brueckner (2011), if urban sprawl generates the economic inefficiencies such as traffic congestion and air pollution, preferential treatment on farmland reins in the excessive urban expansion to the suburbs, which leads to solve the inefficiencies. However, when such preferential treatment is given to landlords in the center of the city, it impedes urbanization and gives rise to another type of economic inefficiencies. Indeed, Bruce (2000) points out the preferential treatment for

[1] For example, all 50 states in the U. S. adopted some form of use-value assessment for agricultural land, which treats agricultural land preferentially for property tax use. Moreover, the California Land Conservation Act of 1965 (the Williamson Act) allows landowners to receive property tax assessments which are much lower than normal for a 10-year renewable term if they agree to keep their land in agricultural production or open space.

agricultural land in metropolitan areas is not favorable because we lose the higher value of alternative uses (e.g., housing lot or office building) owing to the preferential treatment. He discussed this by referring to Japan as follows.

> Foreign visitors to Tokyo, Japan, are surprised to see farmers tending crops of broccoli and radishes amid high-rise office and apartment buildings … these are possibly the most expensive fruits and vegetables in the world … economists see the farms as an extreme example of economic inefficiency. (Bruce (2000))

If that is the case, the government should rescind it and urge owners to convert farmland into another use, and henceforth, urbanization is promoted. In this regard, the relationship between the reform of preferential property tax treatment on farmland and its effects on the land use is worthwhile investigating. Despite the importance of this, the effect of preferential property tax treatment amendment on the land use remains unexplored.

The purpose of this study is to examine the effects of a series of reforms with regard to preferential property tax treatment on the land use in the early 1990s in Japan. To do so, first we construct the theoretical model to explain this. After that, we perform difference-in-differences (DID) estimation before and after the reform. The property tax system in Japan have favorable characteristics to address this issue. First, unlike the

U.S., the government provides preferential treatment to farmland owners even in the metropolitan cities as well, as you can imagine from the argument in Bruce (2000). Second, as a part of effort to enhance housing supply in urban area, the government in Japan undertook fundamental reform of preferential property tax measure so that owners are induced farmland into residential lots. The details of the reform are illustrated in the Section 2. One is that the long-term agricultural operation system, which let many landlords keep the farmland as it is in designated cities[2], was revoked at the end of FY 1991 (March 1992). The other one is the amendment of the Production Green Land Law in September 1991. Under the revised Production Green Land Act, the farmland owners in designated cities are granted a preferential treatment whereas they are not allowed to convert farmland to other use for 30 years. In this regard, farmland owners in major cities had to face stricter rule as pointed out by Terai (2001), which is expected to induce landlords to change farmland into housing lots and thus encourage urbanization.

Using the three periods theoretical model over which land prices statistically evolve, we establish the hypotheses as follows; first, the property tax reform decreases

[2] The designated cities are major cities in three metropolitan areas including 23 wards in Tokyo, cities designated by ordinance whose population is over 50,000 (e.g., Osaka, Nagoya, and Yokohama, etc), and other cities that are classified into urbanized area and National Capital Region Development Act or suburban development else.

farmland in Urbanization promotion areas (UPA),[3] which supposedly be converted to housing lots; however, its effects on the supply of housing lots is ambiguous owing to the amendment of the Production Green Land Act. Our empirical results using the data before and after the reforms support this hypothesis. First, the share of farmland in UPA decreased in designated cities after a string of reforms in the 1990s This is supported by DID estimation as well as the observation of the data. Second, DID estimation did not report the statistically significant results on housing supply after the reform. Placebo tests over the periods from 1985 to 1986 show the coefficients regarding the policy change are not estimated to be statistically significant, suggesting that the results on UPA's farmland within designated cities reflect the effects of reforms. When it comes to the effects on the results of UPA's farmland, meanwhile, the results remain to be unchanged even in some other estimations implemented to check the robustness our results: adding other independent variables or lags and leads of dependent variables.

This paper is related to two types of literatures. First relevant body of literature comprises studies on the effects of preferential property tax treatment on the land use: Brueckner and Kim (2003), Lynch (2003), Song and Zenou (2006), (2009), Anderson et

[3] UPA is the area in which the local government is to promote urbanization.

al. (2015), and Wassmer (2016), etc. These papers address how preferential property tax treatment increases farmland in terms of keeping open space as well as solving the deficiency of farmland resources. However, our study is different from these previous works because we focus on preferential treatment on the farmland that should be in principle converted into residential use, which impedes the supply of housing lots and thus deters urbanization.

Second, our research is related to some empirical studies of land or property tax in Japan. Following so-called "asset price bubbles" in the late 1980s to the early 1990s in Japan, there has been a lot of research done regarding this topic. These include: Kanemoto et al. (1987), Iwata et al. (1993), Yamazaki and Idee (1997), Terai (2001), and Kabeya and Itaba (2009). Above all, Terai (2001) estimates the effects of preferential property tax treatment on farmland in Tokyo metropolitan areas, and Kabeya and Itaba (2009) calculate the welfare loss caused by the preferential treatment. However, none of them did not address the change in the land use before and after the reforms by assuming them as a quasi-experiment.

The rest of this paper is organized as follows. Section 2 presents the institutional background of Japan's property tax system. Section 3 explains the data and discusses the assumptions to validate our DID estimation. Section 4 presents our theoretical

framework. Section 5 reports the empirical framework and results. Section 6 concludes.

2. Institutional Background

2.1. Japan's property tax system

Table 1 shows the outline of Japan's property tax system. Municipalities have the authority to impose property tax except 23 special wards in Tokyo, where the metropolitan government is in charge of property tax administration. The property tax covers land, houses and buildings, and depreciable business assets (tangible assets except land and buildings). Statutory tax rate is set as 1.4 %, and there is little room for municipalities to change the tax rate; an upper limit is 2.1%, and on top of that, there are not so many local governments that set the tax rate over 1.4 %.

Tax liability is determined upon ownership of the assets on the value as of January. This record becomes a basis of tax collection in next fiscal year (April to next March).

The property tax is levied annually based on the assessment value of aforementioned three taxable assets. Each municipality assess the value of taxable assets based on the unified formula, which is set by Ministry of Internal Affairs and Communications (hereafter MIAC). The assessed value of land is determined considering the return of each item.

Figures 1 and 2 depicts the share of the tax revenue of local governments (the sum of prefectures and municipalities) and municipalities. Property tax shares about 20 % of total tax revenue in local governments in Japan. Furthermore, when it comes to municipalities, the fraction of it amounts to 42 %. These figures imply that property tax is a principal item especially for municipalities.

2.2. Preferential treatment on farmland and reforms in the 1990s

According to Kitazato (2003), farmland yields lower return than housing lot. Given that tax base is assessed upon actual not the best use, therefore, the taxable value of farmland turns to be lower than that of housing lot. This is defined as "preferential treatment for farmland".

However, there is an exception; when it comes to the farmland of urbanization promotion areas (UPA) in designated cities, this should be taxed at the same as housing lots. Current City Planning Law, which was enacted in 1971, regarded UPA as the urban areas where even the existing farmland should be in principle converted to housing use from the viewpoint of urban planning.[4] In this regard, the UPA's farmland can be defined as the one that could be changed into housing lots.

Meanwhile, in designated cities, not all of UPA's farmland had been transformed into

[4] For more details, please see also Ishi (1991) and Ito (1994).

residential use, which might give rise to the inefficiency of land use. The long-term agricultural operation system had been enacted from FY 1982 to FY 1991, where tax burden was mitigated if farmers operate the land with a large size over 10 years. Such a lenient treatment for farmland in major cities was set owing to the special interest of farmers, as Ishi (1991) mentioned.

In a practical manner, many farmland owners took advantage of this system and escaped a higher tax burden by keeping their land in agricultural use. For example, Ishi (1991) wrote as follows.

In fact, there are many cases in the suburb of Tokyo where ordinary land is "disguised" as agricultural land by the planting trees, such as nut or persimmon.

Ishi (1991) attributed this phenomenon to the long-term agricultural operation system.

On the flip side, as addressed by Terai (2001) and Kabeya and Itaba (2009), two reforms were simultaneously executed in designated cities in order not just to decrease "disguised" farmland but to spur the development of housing lots there. The first refers to the reform that the long-term agricultural operation system was repealed at the end of FY 1991 (March 1992). Subsequently, the Production Green Land Law was rectified in September 1991. Under the amended Production Green Land Law, UPA's landlords

in designated cities face two options; one is to convert farmland into housing lots; the other is to preserve it as “production green land”. Provided that the landlords preserve their land as production green land for 30 years, their tax burden is mitigated because production green land is preferentially treated based on the same criteria as ordinary farmland.

In the meantime, inheritance tax is also levied on land, where farmland also is given a special treatment.

Figure 3 depicts the classification of farmland and property tax burden in Japan after the two reforms in the 1990s. Farmland is divided into two categories: ordinary farmland and UPA’s farmland. As stated earlier, the assessment on farmland is lower than that on housing lot and thus tax burden of farmland is lowered. When it comes to UPA’s farmland, owners in non-designated cities also get such preferential treatment. Regarding UPA’s farmland owners in designated cities, however, they can benefit only if they keep farmland as it is for 30 years. In this regard, after the 1990’s two reforms, UPA’s farmland owners in major cities have to abide by stricter rule.

3. Data and methodology

3.1. Data

All data on land area, property tax revenue, and property tax base come from the Brief Report on Value of Properties provided by MIAC. The sample periods are FY1992 and FY 1993, when reflect the results of survey before and after the tax reforms. Please recall that the collection of property tax between April to next March (fiscal year in Japan) is based on the information of January, when is the previous fiscal year. FY 1992's data (April 1992-March 1993) are calculated based on the information in January 1992. However, the long-term agricultural operation system had been still effective on that month since the act was rescinded in March 1992. Therefore, we should set the data on FY 1992 as "before" the reform. Likewise, FY 1993 is assumed as the period "after" the reform.

We focus on 501 cities included in the data for the periods from FY1985 to FY1995. We perform placebo test for the periods of FY1985-FY1986. We choose these periods to avoid the influence of asset price bubbles from 1986:12 to 1991:2. To address this, it may be fair to say that we choose the periods over FY1985-FY1986 as the ones for placebo test.

In Section 5, we also estimate the model by adding additional explanatory variables to

estimation equation: local government tax revenue per total local government revenue, agricultural income, population density, and the shipments. The data on local government tax revenue and total local government revenue comes from Statistics of the Final Accounts of Municipal Government, population data is from the Basic Resident Register. These data and land area data (total land area) are provided by MIAC. The data on agricultural income come from the Production Agricultural Income Statistics provided by Ministry of Agriculture, Forestry, and Fisheries. The data on shipments come from the Industry Statistics provided by Ministry of Economy, Trade, and Industry.

Incidentally, although the Brief Report on Value of Properties includes the data on 23 wards in Tokyo, it is the aggregated data of 23 wards and never provide the data on each ward basis. Therefore, our data exclude the 23 wards in Tokyo.

3.2. Observation of Tax Reforms and the validity of DID estimation

Treatment group are designated cities in the three metropolitan areas (183 cities) following the arguments in Section 2. Regarding control group, we consider two cases. First, “Case 1” is the case that encompasses 206 cities whose population is over 50,000 as control group among rest of cities (318 cities). Recall that the number of population

of designated cities is over 50,000 from its definition. Following this, we single out cities whose population size is similar, and thus total number of cities in Case 1 amounts to 389. Further, we also limit 104 cities whose population is over 100,000 to check the robustness of the results. This is "Case 2," and total number of cities is 287.

Figures 4 and 5 show the average of ratio of UPA's farmland (UPA's farmland per total area) between the designated cities (treatment group) and the rest of cities (control group). After FY 1993, when the long-term agricultural operation was repealed and the amended Production Green Land Law came into force, the share of UPA's farmland had been dramatically dropped, while that of other cities were not changed before and after the reforms. According to figures, the two reforms concurrently implemented so as to solve the distortions caused by the preferential tax treatment for farmland use might be useful at three metropolitan areas.[5]

Following this, it is plausible that designated cities can be assumed as treatment group, and other cities are regarded as control group. Then, we examine the effects of tax reforms using difference-in-difference (DID) approach.

Meanwhile, we check several assumptions to implement DID approach. First, we

[5] Meanwhile, we also check "Ashenfelter' dip" to check whether or not landlords change the behavior before the reforms. For both cases, null hypothesis is not rejected.

discuss parallel trend assumption. As shown in Figure 4 and 5, the trajectory of UPA's farmland share are almost all the same between 1990 and 1991 (before the reforms). This is conspicuous in Case 2. Following this, parallel trend assumption is validated from the data observation. Second, as a whole, macroeconomic shocks contemporaneously affect all areas within a country. Therefore, common shocks assumption is not violated within our framework.

4. Theoretical foundation

We begin with developing theoretical illustration of how preferential tax treatment on production green land influences the use of land. Land may be used for either residential or agricultural purpose. The model contains three periods model over which land prices stochastically evolve. Consider owners of farmlands in the designated cites who decide timing of selling their lands. We assume that they possess different prospects for future land prices and tax policies. Their expectation may be then subjective rather than rational. Before the property tax reform, we suppose that there exists policy uncertainty at the second period regarding property tax on farmland. Given that the production green land is in place for 30 years, one period may refer to ten years and so it is plausible that land owners are not sure about the future tax. Thus, they may opt to sell land in

the first period if they expect higher property tax applied to their holding land afterward. The reform removes the uncertainty but instead clarify tax treatment of farmland in the urban promotion area. In the present context, production green land is government commitment to maintain preferential tax rate on farmland whereas it also asks landlords' commitment of not selling land for the first two periods. This corresponds to the institutional arrangement of the production green land with the mandate of 30 years cultivation as mentioned earlier. In the urban promotion area, the land owners can choose not to take preferential tax treatment although they have to pay higher tax according to land value of residential use. By doing so, they can exert selling option before the last period. Thus, there arises tradeoff between favorable tax treatment and option value of selling land.

Note that our focusing is on the selling decision of the representative land owner taking as given price dynamics and thus abstracting general equilibrium effect of property tax on land prices. The model is close to optimal timing of job search. In this regard, the present model deviates from the previous literature such as Brueckner (2001) and Brueckner and Kim (2003) that are based upon spatial setting. They consider how property tax on building improvement affects supply and demand for housing which in turn alters population density and thus city sprawl. Higher property tax on improvement

working as capital tax discourages housing supply in the center and lead to expansion of city fringe, i.e., city sprawl. Such distortive effect may be offset by lower tax on farmland as it decreases cost of holding farmland for owners and then undermines their incentive of converting it to housing use (Arnott(2005)). Wassmer (2016) makes overview on the theoretical finding as to how property tax and city sprawl interact. To the contrary, our model refrains from normative assessment but address incentive effect of differential tax treatment on land owners.

To be specific, denote by P_t market price of land corresponding to residential use at period t (=1, 2, 3) . P_1 is known, whereas prices in the subsequent periods involves uncertainty. Let $E[P_t|P_{t-1}]$ (t=2, 3) be the expected land price conditional on the one at the previous period. As addressed earlier, the expectation may be subjective and varies among the owners. Also note that we take evolution of P_t exogenous thus abstracting capitalization of property tax in land price. To clarify our theoretical hypothesis we suppose that in the last period, the landlord always opt to sell his land

(Assumption) $P_3 > R$ for all P_3

where R is return from farm land use. This implies that landlord seeks for timing of selling land rather than intending to cultivate land in his life. Write as $x_2\tau$ as an effective tax applied to farmland at period t=2 with $x_2 \leq 1$ where τ is property tax rate

on housing lots. We consider that the reform is undertaken at the first period and becomes effective afterward. Accordingly, no effective tax is charged at t=1. x_2 is stochastic before the property tax reform but becomes $x_2 = 1$ after the reform.

Designate j=H, A and G respectively, and farmland owners three options: (1) decision of selling and converting land to hosing at period 1, (2) holding as farm land in the urban promotion area, and (3) maintaining it as the production green land. There may be another option of lending land for the housing use to gain rent revenues. We include it in j=H interpreting P_t as present value of the rents. In the case of j=H, the payoff to the land owner is equal to $V_H = P_1$. If the owner opts for the Production green land after the reform, the owner commits to cultivate the land in the first two periods. At t=3, the preferential tax treatment is expired and the owner chooses to sell land at price of P_3 or to hold it as farmland paying property tax at the rate of τ according to price of residential use. Then his payoff is given by[6]

$$(1) \quad V_G = (1+\beta)R + \beta^2 E[E[P_3|P_2]|P_1]$$

[6] In the last term, we use iteration of expectation as $E[P_3|P_1] = E[E[P_3|P_2]|P_1]$

where β<1 is discount factor. The second term is expected price at t=3 from the first period perspective which is given as the function of the conditional expectation at t=2. For simplicity, we assume zero property tax on land of agricultural use. As we have assumed $P_3 > R$, the latter is always dominant. Alternatively, the owner can delay of selling decision although it may trigger high property tax payment afterward. Before the tax reform, given that x_2 is stochastic, the payoff from j=A is becmes

$$(2)\quad V_A = R + \beta E\left[Max[P_2, R - \tau x_2 P_2 + \beta E[P_3|P_2]|P_1\right]$$

With j=A, the owner can keep option of selling land at t=2 if it exceeds expected return from further holding farm land. The tax reform determines $x_t = 1$ at t=2 and 3 for sure. The above payoff after the reform is written as:[7]

$$(3)\quad \begin{aligned}\hat{V}_A &= R + \beta E\left[Max[P_2, R - \tau P_2 + \beta E[P_3|P_2]|P_1\right] \\ &= V_G + \beta\left\{E\left[Max[0, P_2 - (R - \tau P_2 + \beta E[P_3|P_2]])|P_1\right] - \tau E[P_2|P_1]\right\}\end{aligned}$$

The second term refers to option value of selling land at period 2; such option is not allowed under j=G whereas the last term represents property tax burden given that tax

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[7] The last line of Eq. (3) comes from

$$\begin{aligned}\hat{V}_A &= R + \beta E\left[Max[P_2, R - \tau P_2 + \beta E[P_3|P_2]|P_1\right] \\ &= R + \beta E\left[Max[0, P_2 - (R - \tau P_2 + \beta E[P_3|P_2])|P_1\right] + \beta E\left[R - \tau P_2 + \beta E[P_3|P_2])|P_1\right] \\ &= R + \beta E\left[R + \beta E[P_3|P_2])|P_1\right] + \beta E\left[Max[0, P_2 - (R - \tau P_2 + \beta E[P_3|P_2])|P_1\right] - \beta E\left[\tau P_2|P_1\right]\end{aligned}$$

base is assessed based on residential use after the reform. Thus there exists tradeoff between the option and the tax burden at t=2. Such tradeoff does not occur before the reform. Indeed we have $V_A \geq \breve{V}_G$ where the right side is the payoff from the commitment to faming at t=2 as required by the Production green land and is defined by

(1') $\breve{V}_G = (1+\beta)R - \beta E[\tau x_2 | P_1] + \beta^2 E[E[P_3, | P_2] | P_1] (\geq V_G)$

The difference from Eq. (1) is that τ is replaced by $x_3\tau$ and the tax may be charged at t=2 before the reform.

To sum up, the following lemma establishes relationship among the payoffs.

[Lemma 1]

(i) $\hat{V}_A \leq V_A$

(ii) $V_A \geq \breve{V}_G$

(iii) $\hat{V}_A < V_G$ if $P_2 < R + \beta E[P_3 | P_2]$ for all P_2

The first statement of the lemma implies that option of j=A turns to be less attractive after the reform as high property tax is surely charged on farm land in the urban promotion area. The result is straightforward as Eq. (2) is declining with x_2 and the

reform let x_2 =1. Before the reform, j=A dominates commitment to holding farm land as addressed above; j=A adds option value of selling land at the earlier period whereas the government does not yet commit to preferential tax treatment for j=G.[8] At the post reform stage, on the other hand, insofar as $P_2 < R + \beta E[P_3|P_2]$ so that the second term in the last line of Eq. (3) takes zero[9], however, the landlord prefers to maintain farmland by t=3, so the production green land (j=G) becomes more favorable to holding farm land (j=A) due to the preferential tax treatment.

Before the reform, at t=1, owners choose between j=H and j=A, and the latter is favored if and only if $V_H = P_1 \le V_A$. In anticipation of land price increase and lower tax payment in the future, the owner opts to deter his selling decision. The property tax reform introducing the production green land whereas farm land is taxed according to the residential use after t=2 lowers the payoff from j=A, i.e., V_A and adds j=G yielding the payoff of V_G in the owner's choice. Table 2 provides configuration of relation among the payoffs before and after the reform. For instance, suppose $V_H \le V_A$ originally and $V_H \le \hat{V}_A < V_G$ at the ex post reform stage. Then the reform alters the choice of the owner from j=A to j=G. It may be the case that $V_H \le V_A$ but $V_H > Max[\hat{V}_A, V_G]$, implying that

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[8] Given that $V_G \ge \breve{V}_G$, this statement does not rule out the relation of $V_G > V_A$, which is so if $P_2 < R + \beta E[P_3|P_2]$ and x_2 is likely to take value of one so that $\hat{V}_A \approx V_A$.

[9] Note that $Max[0, P_2 - (R - \tau P_2 + \beta E[P_3|P_2]] = 0$

the owner prefers to sell land at t=1 after the reform. We can also have the relationship as $V_G > V_H > V_A$. This illustrates the circumstance that the owner change his choice from j=H, i.e., selling land at t=1 to j=G, i.e. holding it as the production green land. The owner may have been concerned about the future tax increase so decided to sell land at t=1, whereas the production green tax exempts him from paying high property tax.

(Table 2) Inserted

Given that different land owners may form different expectation, they would act differently in the table. However, the table reveals that overall the option of maintaining farmland in the urban promotion area become less likely to be selected, whereas effect of the reform on the decision of selling land at t=1 is ambiguous given that the Production green land is given as additional option. Indeed, aggregating the owners' decisions at the level of the urban promotion area, we can write supplies of agricultural land and housing as $A = E[Q(V_A - V_H, V_A - V_G)]$ and $H = E[F(V_H - V_A, V_H - V_G)]$ where Q and F the probabilities that land owner opts j=A and j=H, respectively. These probabilities increase with the payoff of the option relative to those of the others. In the above, for simplicity total land size is normalized to unity and the expectation is taken over the owners. The property tax reform alters the supplies as follows:

(4) $\Delta A = E[Q(\hat{V}_A - V_H, \hat{V}_A - V_G)] - E[Q(V_A - V_H, V_A - \breve{V}_G)]$ and

(5) $\Delta H = E[F(V_H - \hat{V}_A, V_H - V_G)] - E[F(V_H - V_A, V_H - \breve{V}_G)]$

Eq. (4) takes negative given that $\hat{V}_A \leq V_A$ and $V_G \geq \breve{V}_G$. It may be obvious since the tax reform raises the tax burden on holding agricultural land. On the other hand, Eq. (5) cannot be signed since the first variable in the equation augments whereas the second is lowered with $\breve{V}_G \leq V_G$. The choice of selling land at t=1 becomes more advantageous relative to holding it as agricultural land but the reform introducing the Production green land makes the commitment to cultivate until t=2 more attractive due to preferential tax treatment or the government commitment not to tax. Therefore, we can establish the following hypothesis that should be empirically confirmed:

(Hypothesis 1) The property tax reform decreases farmland in the urban promotion area at the time that the reform is conducted.

(Hypothesis 2) The effect of the property tax reform on supply of housing lots at the time of the reform is ambiguous.

5. Empirical Framework and Results

This section establishes empirical methodology and results. In doing so, we give basic specification of the regression as follows.

$$(6) \quad L_{it} = \beta_0 + \beta_1 T_i + \beta_2 REFORM_t + \beta_3 (T_i \times REFORM_t) + \beta_4 C_{it} + \varepsilon_{it},$$

where L_{it} is the share of UPA's farmland per total land area, T_i takes 1 if it is the designated cities within three metropolitan areas and others 0, $REFORM_t$ is the dummy variable that identifies two reforms in the early 1990s, C_{it} is other control variable, and ε_{it} is disturbance. For L_{it}, we employ the data over the taxable minimum. If β_3 is estimated to be negative and significant, we interpret UPA's farmland was decreased thanks to tax reforms.

Furthermore, we also estimate Eq. (6) by using the share of housing lots per total land area instead of UPA's farmland share. We do this in order to check whether or not the reduced UPA's farmland was converted into housing lots.

For other control variable, we add the effective tax rate, local government tax revenue per total local government revenue, agricultural income, population density, and the

shipments.

Tables 3a and 3b report the estimation results of simple DID estimation. When it comes to the case that UPA's farmland ratio is used as a dependent variable, the coefficients of β_3 are estimated to be negative and significant for all cases. We confirm that UPA's farmland is reduced after the reforms. However, if we take housing lots ratio as a dependent variable, the coefficients of β_3 are not statistically significant. This implies that the reform impacts on the UPA's farm land and housing lots differently as suggested in the theoretical model.

We also perform placebo test for the case that UPA's farmland ratio is used as a dependent variable for1985 and 1986. As shown in Table 4, the coefficients of β_3 are estimated to be statistically insignificant, noting that there are no differences between designated cities and the rest of cities in these periods. Therefore, we can support the results shown in Tables 3a and 3b, and conclude that UPA's farmland surely changed after the reforms.

More than that, we also estimate Eq. (7) adding some other variables. First, we add some independent variables to control other factors related to land use and the municipal economies. Second, we add the lead and lag of L_{it}. To do so, we assume one-period lead and lag and two-periods lead and lags, respectively. Even if we perform these additional

estimation, as shown in Tables 5a and 5b we still confirm that the coefficients of β_3 (T*Reform) are estimated to be statistically significant. Thus, our empirical results are robust.

6. Conclusion

This paper examines how the property tax reforms conducted in the early 1990s in Japan affect land use using theoretical and empirical investigation. Both theoretical and empirical results show that tax reforms we address here reduced UPA's farmland of designated cities within three metropolitan areas. However, we cannot confirm that the not all of reduced UPA's farmland were converted into housing lots.

Policy implication drawing from our empirical findings is that whereas the reforms in the early 1990s in Japan were successful in reducing the farmland in designated cities that might give rise to economic inefficiency, not all of UPA's farmland had been translated into residential use, so the reform did not contribute to increase in housing supply. This also suggests that the amended Production Green Land Law might be a "loop hole" for the landlords in major cities, which let them keep the farmland as it was and thus the distortions caused by misuse of land cannot be perfectly removed. As a

matter of fact, the production green land skyrocketed from FY 1992 to FY 1993 as shown in Table 6, suggesting that some owners chose to preserve farmland as production green land for 30 years. In terms of urban planning, the government should preserve the farmland in mountainous regions and do estate development in urban part. However, in Japan, the critics often argue that whereas farmland remains in urban areas, the residential land in the peripheral part has been developed. In this regard our results also imply that the amendment of the Production Green Land Law was redundant from the viewpoint of urban planning, and had the law not been enacted for the convenience of special interest group (farmland owners), a lot more housing lot could have been provided for consumers.

One caveat of our estimation is that we cannot examine the effects on production green land. The data on production green land are included in "ordinary farmland" in the data provided by MIAC, but it is impossible for us to extract production green land from this data. Therefore, we cannot specify whether the landlords change the reduced UPA's farmland into either housing lots or production green land due to the data restriction.

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Figure 1. Share of tax revenue (prefectures and municipalities)

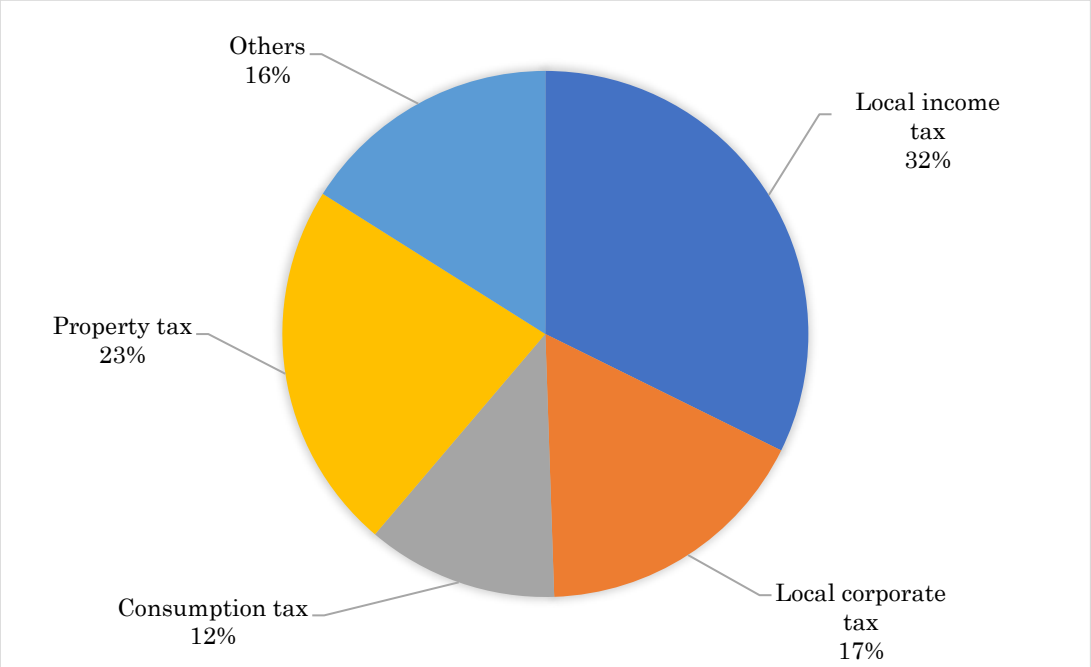


Figure 2. Share of tax revenue (municipalities)

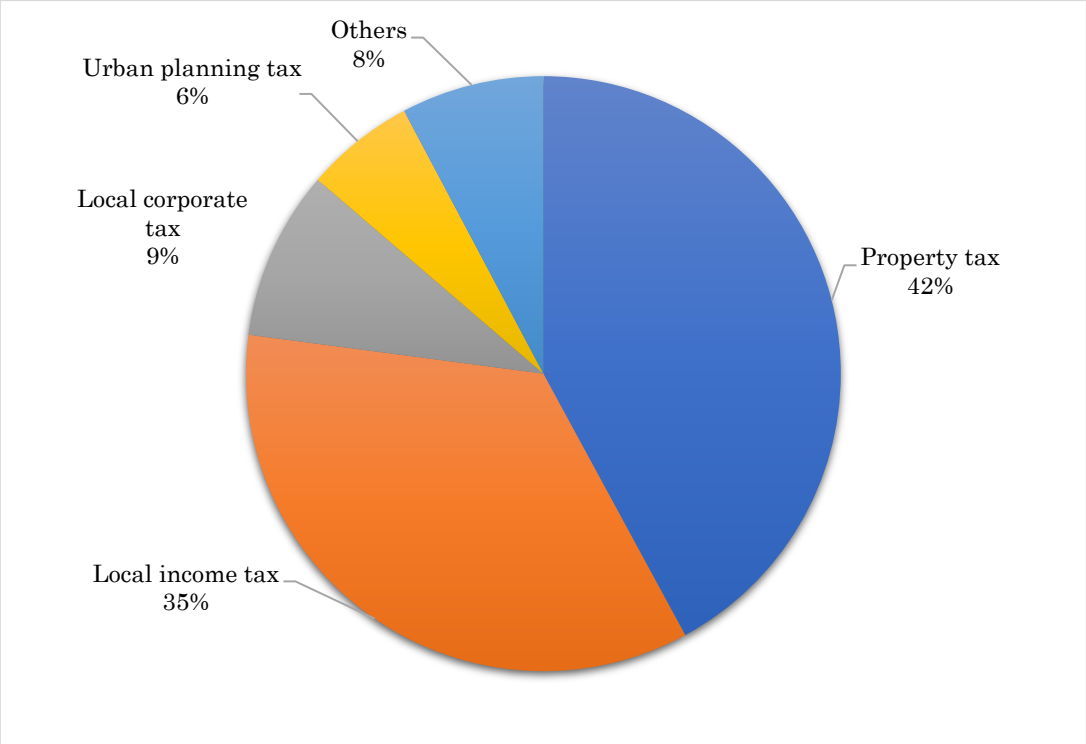
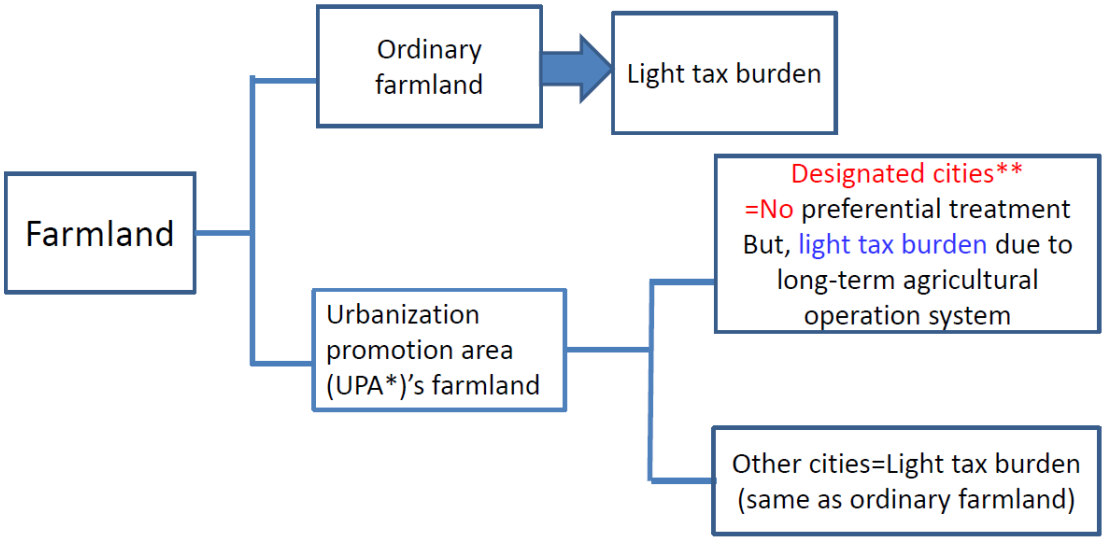


Figure 3. The classification of farmland and property tax burden in Japan (before and after the reforms)

(Before the reforms)



(After the reforms)

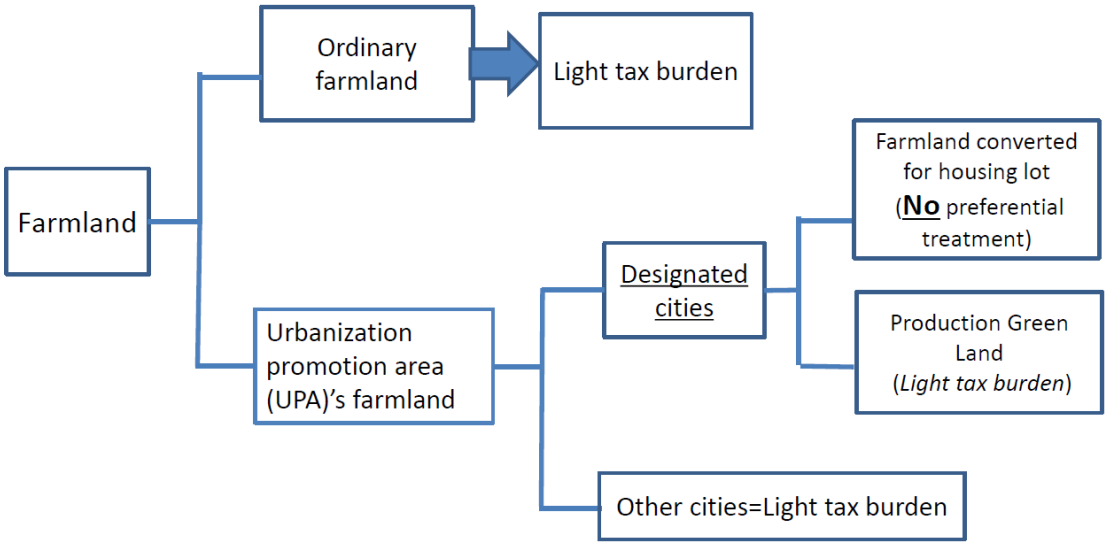


Figure 4. The average of the UPA's farmland ratio (Case1)

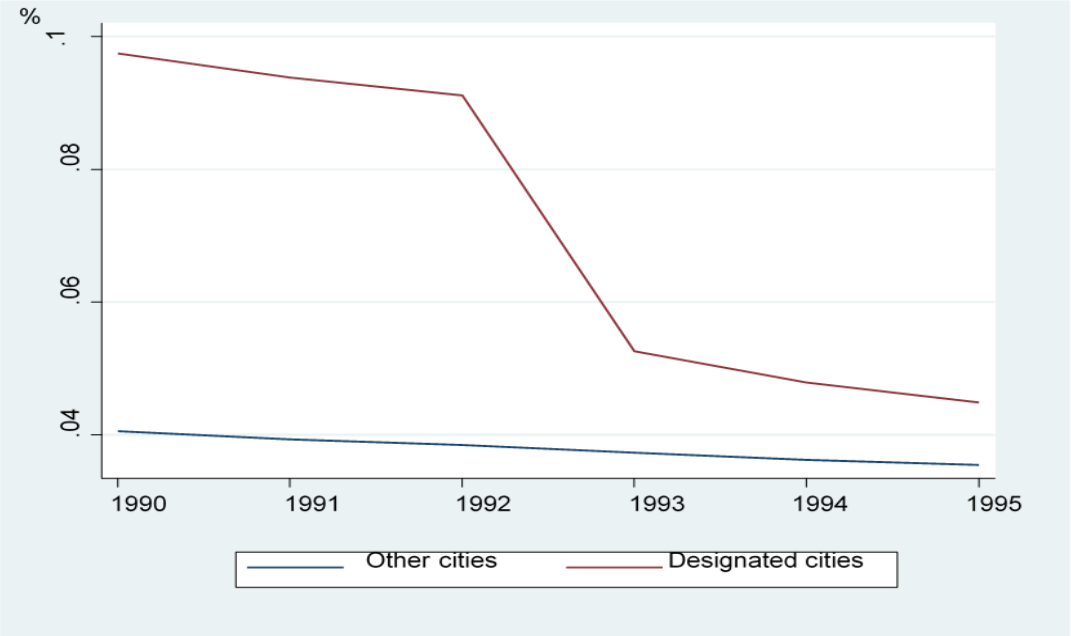


Figure 5. The average of the UPA's farmland ratio (Case2)

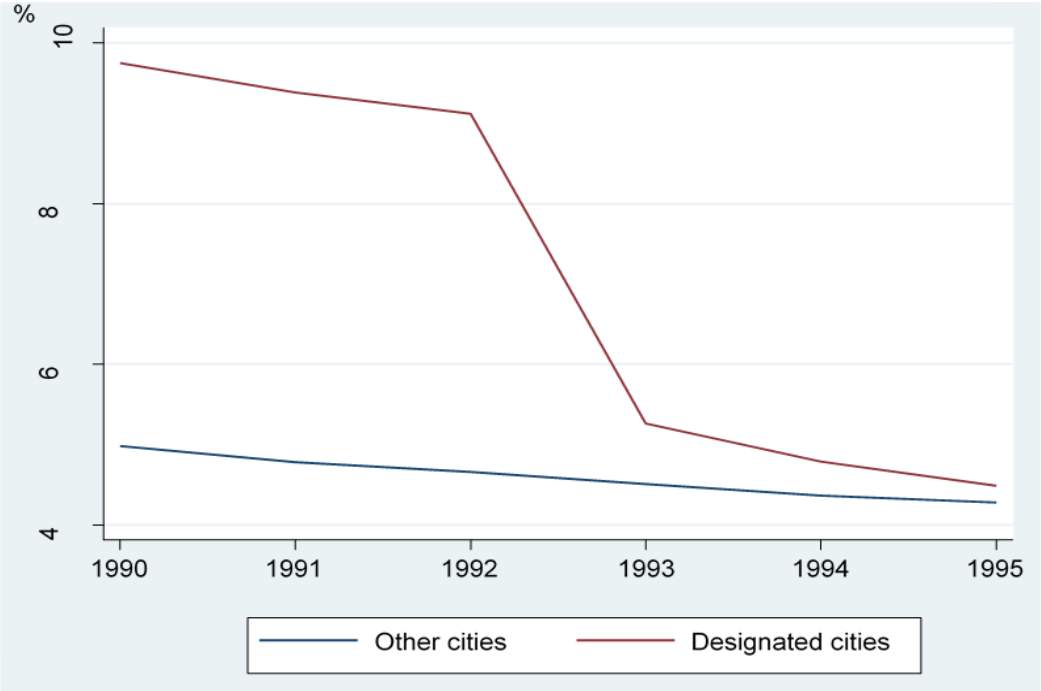


Table 1. The outline of property tax system in Japan

Tax authority	Municipalities (cities, towns, and villages) assess, levy, and collect the tax*
Taxable assets	1. Land
	2. Houses and buildings
	3. Depreciable business assets
Taxpayer	Owners of each taxable asset
The evaluation of tax base	Value (fair market value) as of January 1
Tax rate	Statuatory tax rate: 1.4 %
	(Maximum tax rate): 2.1 %

＊Regarding Tokyo special wards area, Tokyo metropolitan government is in charge of the tax administration.

Table 2. Pay offs before and after the reforms

After the reform / Before the reform	$V_H \le \hat{V}_A$		$V_H > \hat{V}_A$	
	$Max[V_H, V_G] \le \hat{V}_A$	$\hat{V}_A < V_G$	$V_H > Max[\hat{V}_A, V_G]$	$V_H < V_G$
$V_H \le V_A$	From j=A to j=A	From j=A to j=G	From j=A to j=H	From j=A to j=G
$V_H > V_A$			From j=H to j=H	From j=H to j=G

Table 3a. Simple DID results (Case 1). Sample periods=1992-1993, NOB=778

Dependent variable	ufarm (ratio)	house (ratio)
DID esimate	-0.038 ***	0.004
(T*Reform)	(0.006)	(0.024)
R2	0.22	0.36
N. of treated municipalities	183	183
N. of control municipalities	206	206

Note: "Ufarm" stands for UPA's farmland, and "house" means housing lots. Robust standard errors are in parenthesis.

Table 3b. Simple DID results (Case 2). Sample periods=1992-1993, NOB=574

Dependent variable	ufarm (ratio)	house (ratio)
DID esimate	-0.038 ***	0.003
(T*Reform)	(0.008)	(0.031)
R2	0.18	0.26
N. of treated municipalities	183	183
N. of control municipalities	104	104

Note: "Ufarm" stands for UPA's farmland, and "house" means housing lots. Robust standard errors are in parenthesis.

Table 4. Placebo test for UPA's farmland ratio. Sample periods=1985-1986, NOB=778 (Case 1), 574 (Case 2)

	Case1	Case2
DID esimate	-0.001	-0.0001
(T*Reform)	(0.008)	(0.011)
R2	0.25	0.16
N. of treated municipalities	183	183
N. of control municipalities	206	104

Table 5a. Robustness check for Case 1. Dependent variable=UPA's farmland ratio.

Sample periods=1992-1993, NOB=778.

T*Reform	-0.038 ***	-0.025 ***	-0.026 ***	-0.035 ***	-0.035 ***
	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
Treatment	0.016 ***	0.005 ***	0.004 ***	0.018 ***	0.019 ***
	(0.004)	(0.001)	(0.0007)	(0.003)	(0.002)
Reform	-0.0001	0.00006	-0.0004	0.00002	0.0001
	(0.002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
L-1		0.590 ***	0.592 ***	0.340	0.329
		(0.098)	(0.105)	(0.299)	(0.297)
L-2				0.136	0.151
				(0.210)	(0.204)
L+1		0.405 ***	0.410 ***	0.822 **	0.853 **
		(0.104)	(0.104)	(0.376)	(0.338)
L+2				-0.272	-0.302
				(0.262)	(0.229)
taxrate	-0.00007 ***		0.0000009 ***		-0.00002
	(0.00001)		(0.0000004)		(0.00005)
ltaxratio	0.026 *		0.006 **		0.001
	(0.015)		(0.003)		(0.005)
ln(agri income)	0.001		0.0001		0.0002
	(0.001)		(0.0003)		(0.0006)
ln (pop density)	0.031 ***		-0.0008		-0.0006
	(0.002)		(0.001)		(0.001)
ln (ship value)	-0.003 *		0.0004		-0.0002
	(0.002)		(0.0004)		(0.0006)
const	-0.129 ***	0.0018 ***	-0.003	0.0007	0.006
	(0.021)	(0.0002)	(0.006)	(0.0008)	(0.008)
R2	0.521	0.941	0.942	0.906	0.906
N. of treated municipalities	183	183	183	183	183
N. of control municipalities	206	206	206	206	206

Note: Robust standard errors are in parenthesis.

Table 5b. Robustness check for Case 2. Dependent variable=UPA's farmland ratio.

Sample periods=1992-1993, NOB=574.

T*Reform	-0.038 ***	-0.026 ***	-0.034 ***	-0.035 ***	-0.035 ***
	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
Treatment	0.017 ***	0.004 ***	0.003 ***	0.017 ***	0.018 ***
	(0.005)	(0.001)	(0.0008)	(0.003)	(0.002)
Reform	-0.0006	0.0001	-0.0007	0.00006	0.0001
	(0.003)	(0.0003)	(0.0005)	(0.0004)	(0.0004)
L-1		0.591 ***	0.594 ***	0.329	0.317
		(0.098)	(0.103)	(0.331)	(0.328)
L-2				0.142	0.156
				(0.245)	(0.238)
L+1		0.398 ***	0.409 ***	0.903 **	0.94 **
		(0.106)	(0.104)	(0.460)	(0.405)
L+2				-0.340	-0.367
				(0.340)	(0.295)
taxrate	-0.0003 ***		0.0002		0.0001
	(0.0001)		(0.00002)		(0.0002)
ltaxratio	0.024		0.0008		-0.0006
	(0.019)		(0.006)		(0.006)
ln(agri income)	0.003 *		0.00001		0.0002
	(0.002)		(0.0007)		(0.0007)
ln (pop density)	0.032 ***		-0.0005		-0.0008
	(0.003)		(0.001)		(0.001)
ln (ship value)	-0.005 **		0.0004		-0.0003
	(0.002)		(0.0005)		(0.0007)
const	-0.146 ***	0.0026 ***	-0.006	0.0005	0.008
	(0.026)	(0.0003)	(0.007)	(0.0015)	(0.011)
R2	0.447	0.924	0.876	0.877	0.878
N. of treated municipalities	183	183	183	183	183
N. of control municipalities	104	104	104	104	104

Table 6. The movement of farmland and production green land

	The UPA's farmland except production green land	Production green land
1992	14.85	0.07
1993	12.81	1.52
1994	12.23	1.54
1995	11.83	1.55
1996	11.37	1.56
1997	10.92	1.56
1998	10.56	1.55
1999	10.29	1.55
2000	10.05	1.54