The Effect of Capital Gains Taxation on Housing

Sales: Evidence from Taiwan^{*}

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Abstract

This paper uses a difference-in-differences framework to examine the impact of Taiwan's 2016 tax reform on the housing market. The empirical results show that the implementation of the capital gains tax reduced capital gains, rates of return, and the proportion of transactions with positive gains, indicating a lock-in effect for transactions with high potential gains. In contrast, between the announcement and implementation, capital gains increased as sellers with high potential gains tended to sell their properties before the implementation. Finally, at the time of the tax regime change, capital gains sharply declined, reflecting sellers' self-selection behavior: those with high gains sold before the reform, while those with lower gains waited until after 2016.

Keywords: Housing Prices, Capital Gains Taxation, Lock-in Effect

JEL Codes: H22, H24, G12, R38

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1 Introduction

Governments typically implement tax policies in housing markets for specific objectives. For instance, during the Great Recession, tax cuts may be utilized to stimulate the housing market (Best and Kleven, 2018). Conversely, in response to soaring housing prices, taxes can serve as tools to cool down the market activity (Agarwal et al., 2020). Among the various taxes impacting housing transactions, the property transfer tax and capital gains tax are particularly important, each serving distinct purposes and being applied under different circumstances. In this paper, we investigate the impact of capital gains taxation on housing markets by analyzing a tax reform implemented in Taiwan in 2016.

In Taiwan, the 2016 tax reform was announced on June 24, 2015, and implemented on January 1, 2016. This reform introduced three key elements: a capital gains tax based on transaction prices, differential tax rates determined by holding periods rather than comprehensive income, and tax-deductible transaction losses. Additionally, it includes a sunset clause that allows for the continued application of the original tax regime under specific conditions. This feature enables us to employ a difference-indifferences (DID) research design to investigate the impact of capital gains taxation on the housing market and compare outcomes with those unaffected by the reform.

To guide our empirical analysis, we develop a theoretical framework to help sellers decide whether to sell their properties before and after the tax reform. The model predicts that some transactions with high potential capital gains would be locked in under the new tax regime, while the reform could also encourage transactions with low or even negative capital gains to enter the market. Consequently, we expect overall pre-tax capital gains to decline after the tax reform. Additionally, as sellers can manipulate the timing of transactions around the tax regime switch at the end of 2015, the model indicates that this selection behavior will result in a dramatic increase in pre-tax capital gains right before the reform and a significant decrease immediately afterward.

To test our predictions, we construct a sample of repeated sales and employ a difference-in-differences (DID) approach to identify the effects of the tax reform. Specifically, we define our treatment group as transactions with holding periods of two years or less, which are subject to the new capital gains tax after 2016. In contrast, our control group comprises transactions with holding periods exceeding two years, which remain unaffected by the tax reform.

The empirical results indicate that the implementation of the capital gains tax led to reductions in capital gains, rates of return, and the proportion of transactions with positive gains, suggesting a lock-in effect for transactions with high potential gains. In contrast, between the announcement and implementation, capital gains increased as sellers with high potential gains tended to sell their properties before the reform. Specifically, the average capital gains prior to the announcement were 1.2 million NTD, and during the period between the announcement and implementation, they rose by approximately 0.3 million NTD. Following the implementation, capital gains dropped to a level that was 0.4 million NTD lower than the pre-announcement average.

This paper contributes to the literature in several ways. First, we provide evidence from Taiwan's tax reform to illustrate how sellers' behavior differs before and after both the announcement and implementation, which is not addressed in the existing literature on capital gains tax in the housing market. Most studies on capital gains tax have focused on financial assets (Reese Jr, 1998; Ivković, Poterba and Weisbenner, 2005; George and Hwang, 2007; Dai et al., 2008). In contrast, research on the housing market (Cunningham and Engelhardt, 2008; Shan, 2011; Biehl and Hoyt, 2014) has primarily highlighted increased mobility and sales following the Taxpayer Relief Act of 1997 (TRA97) in the United States. Our paper adds to this body of work by demonstrating the lock-in effect resulting from Taiwan's tax reform. The unique timing of the announcement and implementation allows us to observe distinct seller behaviors before and after the introduction of the capital gains tax, thereby offering new insights into the literature.

Second, in addition to demonstrating the lock-in effect caused by the capital gains tax, we examine the factors influencing this effect. Existing literature, such as Cunningham and Engelhardt (2008), highlights that certain groups, including divorced or widowed individuals and college-educated people, exhibit higher mobility in response to reduced capital gains taxes. We contribute to this understanding of heterogeneity by introducing additional selection factors, such as potential capital gains for sellers. This selection within the lock-in effect may further distort supply in the housing market, which could serve as an important consideration for policymakers.

The remainder of this paper is organized as follows: Section 2 introduces the background of the Taiwanese tax reform. Section 3 provides a theoretical framework to guide the predictions. Section 4 presents the data, sample, and identification strategy. Section 5 describes the empirical models, main results, and robustness checks. Section 6 offers concluding remarks and future research.

2 Background

The 2016 tax reform in Taiwan was enacted on June 24, 2015¹, and implemented on January 1, 2016. It included a complex sunset clause, allowing for the continued application of the original tax regime under specific conditions. Compared to the original tax system, the new reform introduced two significant changes: the implementation of a capital gains tax and the integration of the tax base for house and land transactions. In the following subsections, we will describe the tax system prior to the reform and detail the 2016 Tax Reform along with the specifics of the sunset clause.

 $^{^{1}}$ This tax reform was based on the amendment to the Income Tax Act passed on June 24, 2015, commonly known in Taiwan as the House and Land Transaction Income Tax 1.0.

2.1 Tax System Before the Tax Reform

Before the 2016 tax reform, transactions involving houses and land in Taiwan were taxed separately based on their appraised values. Although a real estate transaction typically includes both the housing structure and the underlying land at a single market price, the seller was required to pay two separate taxes: the Land Value Increment Tax and the Housing Transaction Income Tax. For the Housing Transaction Income Tax, the transaction income could either be reported as gains from the sale if the seller voluntarily disclosed it or calculated as a proportion of the appraised value of the house. Typically, most transactions followed the latter method for calculating transaction income. Since the appraised values of houses are assessed using only the construction cost, they are often underestimated and lower than market prices². In addition, this housing transaction income is combined with the seller's other individual income and taxed annually based on the applicable tax rate. Therefore, before the tax reform, sellers typically did not need to pay much tax, even if they had large gains from the sale.

To address the shortcomings of the original tax system³, the government introduced a luxury tax in 2011⁴. The luxury tax applies to transactions where the holding period is less than two years, requiring sellers to pay 10% to 15% of the transaction price. Although the luxury tax is based on market prices, sellers were granted several exemptions⁵, so relatively few sellers paid the tax during this period.

 $^{^{2}}$ For example, in 2015, the average market price was 14 times higher than the appraised house values in our data.

³Using appraised values as the tax base has several drawbacks regarding effectiveness. For instance, land appraised values are fixed for the entire calendar year, providing opportunities for tax avoidance in short-term transactions.

⁴This tax is based on the "Specifically Selected Goods and Services Tax Act" of 2011.

⁵Exemptions applied to situations such as families owning only one house, involuntary turnover, properties acquired through inheritance or gift, or other non-speculative actions recognized by the tax authority.

2.2 The 2016 Tax Reform and Sunset Clause

The 2016 tax reform introduced a capital gains tax that combines the tax bases of land and house transactions and links them to market prices. Sellers are now subject to a single tax, the "House and Land Transaction Income Tax," which is calculated based on the difference between the selling price and the original purchase price. Tax rates vary according to the holding period: for properties held less than two years, the rate ranges from 35% to 45%, while for those held longer, the rate is between 10% and 20%. Additionally, for self-occupied residential properties held for more than six years, no tax is applied to capital gains up to NT\$4 million, with a 10% rate imposed only on gains exceeding that amount. Finally, transactions that result in losses are tax-deductible for up to three years.

The 2016 tax reform also abolished the luxury tax and established a complex sunset clause, allowing certain specific transactions to continue under the original tax regime. Figure 1 illustrates how transactions are subject to either the old or the new tax regime⁶. For any transactions with specific holding periods, we can pinpoint them on the plane shown in Figure 1. The x-axis represents the previous transaction (holding) dates, and the y-axis indicates the holding period for the current transaction. In this figure, negative 45-degree lines indicate transactions that share the same transaction date. For instance, the orange dashed line indicates transactions that occurred on January 1, 2016. In addition, the blue vertical dotted line divides the previous transaction dates into those before and after 2016, and the green horizontal solid line denotes the two-year holding period. According to the sunset clause, for properties owned before 2016 (to the left of the blue vertical dotted line), the old tax rules may still apply if the transaction occurred prior to 2016 (below the orange dashed line) or if the holding period exceeds two years (above the green horizontal solid line). Therefore, the plane can be divided into six tax regimes based on these

⁶We follow Chia-Hung Chen's thesis (https://hdl.handle.net/11296/7g974q) to categorise these transactions.

three lines. The shaded areas (Tax Regimes III, V, and VI) represent transactions subject to the new tax regime, while the unshaded areas (Tax Regimes I, II, and IV) indicate those under the old tax regime. Currently, some transactions still fall under the old tax regime (Tax Regime II), while others are subject to the new tax regime (Tax Regimes III and VI). Furthermore, the luxury tax applies to Tax Regime IV.

3 Theoretical Framework

In this section, we develop a theoretical framework specifically for sellers to guide predictions related to the tax reform. Given that houses are differentiated products with prices determined by the market, we assume that prices are exogenous to sellers. Each seller holds a house with a previous purchase price of P_0 , while the current market value of her house is P_1 . The opportunity cost of selling the house is denoted as V, and she must decide whether to sell her house or retain it.

Before the tax reform, the seller needs to pay a tax corresponding to her selling price, $\tau_B P_1$. Therefore, her utility can be written as

$$U_B = \begin{cases} P_1 - \tau_B P_1 & \text{if sell the house} \\ V & \text{if not sell the house.} \end{cases}$$

We assume that the tax is a certain proportion of the selling price, which holds true under the luxury tax. However, for transactions not subject to the luxury tax, this assumption also applies when the appraised values are proportional to the selling prices, and we can expect that τ_B is very small.

Following the 2016 tax reform, the major change was the introduction of a capital gains tax based on the difference between the selling price and the previous purchase price. As a result, the seller must pay a capital gains tax of $\tau_A(P_1 - P_0)$ when $P_1 \ge P_0$, but no tax payment is required when $P_1 < P_0$. Her utility can be written as

$$U_A = \begin{cases} P_1 - \tau_A (P_1 - P_0) & \text{if sell the house and } P_1 \ge P_0 \\ P_1 & \text{if sell the house and } P_1 < P_0 \\ V & \text{if not sell the house.} \end{cases}$$

To better match the facts in our case, we assume that $\tau_A > \tau_B$ in the following analysis.

Figure 2 illustrates the selling decision before and after the tax reform. The x-axis represents the previous purchase prices, and the y-axis represents the selling prices. Any point on this plane can represent a potential transaction made by a seller in the housing market. Since we focus solely on the supply side, we assume that each house offered by a seller will be purchased by a buyer. The opportunity cost V is assumed to be fixed in this figure. Before the tax reform, a seller would sell the house if $P_1 - \tau_B P_1 \ge V$. Therefore, the orange region (above the orange horizontal solid line) represents the possible realized transactions in the market. A transaction occurs if the selling prices are sufficiently high, and the decision to sell does not depend on the previous purchase price.

After the tax reform, sellers must pay the capital gains tax when $P_1 \ge P_0$. In this case, a seller would sell the house if $P_1 - \tau_A(P_1 - P_0) \ge V$, represented by the area above the red dashed line in Figure 2. In the other case, where $P_1 < P_0$, a transaction occurs if $P_1 \ge V$, shown as the area above the blue horizontal dashed line. Since sellers incur losses, they do not need to pay capital gains tax. Combining both the gains and losses cases, the blue-hatched area represents the possible realized transactions after the tax reform.

Comparing the possible realized transactions before and after the tax reform, Figure 2 illustrates two distinct areas outside the interaction regions. One area is the orange triangular region below the red dashed line, which represents transactions with potential high capital gains. Since the seller's net utility after paying the capital gains tax is lower than V, they choose not to sell under the new tax regime; however, they would sell the house under the old regime. In addition, the other area is the bluehatched region below the orange horizontal dashed line, which indicates transactions with potential low or even negative capital gains ($P_1 < P_0$). Since sellers either do not need to pay the capital gains tax or are required to pay only a small amount, these transactions occur under the new tax regime, but do not occur under the old regime. As a result, we expect that some transactions with potential high capital gains would be locked in under the new tax regime, and the new regime would also encourage some transactions with potential low or even negative capital gains to enter the market. Combining the changes in these two effects, the overall pre-tax capital gains are expected to decrease after the tax reform.

If sellers can self-select the tax regime, Figure 3 illustrates a comparison of their utilities before and after the tax reform, assuming they are willing to sell their houses. When sellers incur gains $(P_1 \ge P_0)$, they would prefer the new tax regime with a capital gains tax if $P_1 - \tau_B P_1 < P_1 - \tau_A (P_1 - P_0)$. This condition is illustrated by a portion of the blue-hatched region located to the left of the 45-degree line $(P_1 = P_0)$. Conversely, when $P_1 - \tau_B P_1 \ge P_1 - \tau_A (P_1 - P_0)$, as shown by the area above the red solid line, sellers would prefer the old tax regime because they incur larger capital gains tax regime.

In contrast, when sellers incur loss $(P_1 < P_0)$, they would definitely prefer the new tax regime, as they would not need to pay any capital gains tax in this case. Overall, for transactions with potential low or even negative capital gains in the blue-hatched region, sellers are more likely to sell houses after the tax reform. In contrast, for transactions with potential high capital gains in the orange area, sellers will prefer to complete transactions before the tax reform. Since sellers can manipulate the timing of transactions around the tax regime switch at the end of 2015, we expect that their selection behavior will lead to a dramatic increase in pre-tax capital gains before the tax reform and a significant decrease immediately afterward.

To sum up, the theoretical framework yields two predictions. First, the new tax regime with capital gains tax is expected to discourage transactions with potential high capital gains while encouraging those with potential low or even negative capital gains. Second, around the time of the tax regime switch, we anticipate that sellers' selection behavior will result in bunching right before the new tax regime, with realized pre-tax capital gains being larger prior to the cutoff and lower thereafter.

4 Data and Identification Strategy

This research uses three datasets. The first dataset is the Real Estate Transaction Registration Database from Taiwan's Ministry of the Interior, which includes information on all real estate transactions in Taiwan since 2012, such as transaction dates, locations, prices, and housing characteristics. The second dataset is the Deed Tax data from the Fiscal Information Agency, containing transaction contract dates and anonymized buyer and seller IDs. The third dataset is the Luxury Tax data, which also includes contract dates and anonymized seller information.

Since the first dataset lacks buyer and seller information, we merge it with the second and third datasets using transaction dates (contract dates) and transaction locations to gain insights into buyer and seller identities. This allows us to link each current transaction with its corresponding previous transaction by identifying cases where the seller in the current transaction matches the buyer in the previous one. We construct a sample of repeated sales, excluding transactions that cannot be matched with previous transactions in the dataset. Within this repeated sales dataset, we can calculate the holding periods and pre-tax capital gains for each property transaction.

Our identification strategy employs on a difference-in-differences (DID) approach, based on the sunset clause of the 2016 tax reform. As shown in Figure 4, we mainly focus on transactions with previous transaction dates before 2016 (to the left of the blue vertical dotted line). Based on the holding period, we define the treatment group as those with holding periods of less than two years (Tax Regimes IV and V), while the control group consists of those with holding periods of more than two years (Tax Regimes I and II). Before 2016 (below the orange dashed line), both the treatment and control groups were subject to the old tax regime⁷. After 2016, the treatment group became subject to the capital gains tax. As a result, this identification strategy allows us to estimate the effects of the capital gains tax by comparing the treatment and control groups before and after 2016. To further address the potential issue of sellers manipulating the holding period between the treatment and control groups, we redefine these groups⁸ and conduct a robustness check in Section 5.3.

The final sample includes transactions from September 2014 to December 2017, with a total of 61,725 observations. Table 1 presents the summary statistics for both the treatment and control groups. The outcomes of interest include pre-tax capital gains (current transaction prices minus previous purchase prices), the rate of return (pre-tax capital gains divided by previous purchase prices)⁹, and a dummy variable indicating whether positive gains were realized. On average, the treatment group exhibits lower capital gains, rates of return, and proportions of positive gains.

In addition, Figure 5 shows the monthly average capital gains for both the treatment and control groups. The left gray dashed line marks the announcement month (July 2015), and the right dashed line indicates the implementation month (January 2016). Both the treatment and control groups (represented by the blue and green lines) experience a decline in average capital gains prior to 2016. After 2016, the control group (the maroon line) continues to decrease steadily, while the treatment group (the orange line) shows a dramatic drop in average capital gains. This finding

⁷Although Tax Regime IV includes the luxury tax, few sellers actually pay it due to various exemptions. Therefore, we also exclude these transactions from the dataset.

 $^{^8\}mathrm{We}$ would like to thank Tsung-Chih Lai for suggesting an alternative identification scheme to address this issue.

 $^{^{9}}$ We winsorise the rate of return at the 1st (-0.33) and 99th (1.67) quantiles to mitigate the influence of outliers.

is consistent with the predictions from the theoretical framework, which suggests that realized pre-tax capital gains would decline under the capital gains tax due to the lock-in effect from transactions with potential high capital gains.

5 Empirical Results

5.1 Empirical Models

Based on the DID approach outlined in Section 4, we specify the following regression model:

$$G_{imt} = \alpha \operatorname{Treat}_m + \beta_A \operatorname{Ann}_t + \beta_I \operatorname{Impl}_t + \gamma_A \operatorname{Treat}_m \times \operatorname{Ann}_t + \gamma_I \operatorname{Treat}_m \times \operatorname{Impl}_t + \theta_t + \mathbf{X}_i \mathbf{\Phi} + u_{imt},$$
(1)

where G_{imt} represents the outcome of interest for transaction *i* with holding period m at date *t*. Treat_m is a dummy for transactions with holding periods of 2 years or less (treatment group). Ann_t is a dummy for transactions occurring between June 24, 2015 (announcement) and December 31, 2015 (before implementation), while Impl_t is a dummy for transactions occurring after January 1, 2016 (implementation). θ_t captures year-month fixed effects, and \mathbf{X}_i includes housing characteristics and township fixed effects. Compared to the control group, the effect of the announcement on the outcome of interest is captured by γ_A , while the effect of implementing the capital gains tax is captured by γ_I .

To further check the parallel trends assumption, we also conduct the event-study framework based on the following regression:

$$G_{imt} = \alpha \operatorname{Treat}_{m} + \sum_{s \neq 2015M6} \beta_{s} \times \mathbf{1} \left[t - L = s \right] + \sum_{s \neq 2015M6} \gamma_{s} \operatorname{Treat}_{m} \times \mathbf{1} \left[t - L = s \right] + \theta_{t} + \mathbf{X}_{i} \mathbf{\Phi} + u_{imt},$$
(2)

where $\mathbf{1} [t - L = s]$ is an indicator variable representing the monthly time intervals relative to the policy implementation date, and $Treat_i \times \mathbf{1} [t - L = s]$ are the key interaction terms used to analyze the dynamic effects of the policy over time. Because the reform announcement was made near the end of June (June 24, 2015), we set the baseline level of the regression to June 2015, which is the closest monthly period preceding the announcement date. In the following analysis, we will plot a set of coefficients γ_s to illustrate the dynamic patterns before and after the announcement and implementation.

5.2 Main Results

We first present estimates from the event-study framework. Figure 6 shows changes in pre-tax capital gains over time. Prior to the announcement, there is no significant difference between the treatment and control groups, supporting the parallel trends assumption. After the reform announcement, the pre-tax capital gains in the treatment group increase relative to the control group, consistent with the theoretical prediction that sellers with potential high capital gains would prefer to sell houses under the old tax regime. However, there is a sharp decline immediately after the implementation of the new capital gains tax, reflecting sellers' selection behavior: those with high capital gains prefer to sell houses just before the reform, while those with low or negative capital gains choose to sell after 2016.

Furthermore, Figure 7 shows a similar pattern for the rate of return. Following the announcement, the rate of return continues to increase, peaking at 10 percentage points higher just before the end of 2015, then sharply dropping by 20 percentage points immediately after implementation. Compared to the pre-announcement level, the rate of return is approximately 10 percentage points lower after 2016, and this effect remains lower for about one year.

In addition, Figure 8 illustrates the change in the fraction of transactions with

positive gains. Prior to the announcement, the fraction of positive gains is very high, around 90%, so given the limited room, it only increases slightly after the announcement and before implementation. After the implementation, this fraction sharply declines by approximately 20 percentage points and remains low for an extended period, indicating a significant proportion of transactions with negative capital gains under the new tax regime.

Table 2 presents the DID estimation results from equation (1). From Column (1) to Column (5), we continue to add more controls, including month-by-year fixed effects, logarithms of housing areas, housing characteristics, and township fixed effects. From Column (5) in Panel A, compared to the capital gains prior to the announcement, there is an increase of approximately 0.29 million NTD during the period between the announcement and implementation. After the implementation, the capital gains drop to a level that is 0.35 million NTD lower than the pre-announcement level. Furthermore, the results in Panel B show a similar pattern: the rate of return increases by approximately 5 percentage points after the announcement and drops by around 11 percentage points following the implementation. In Panel C, the fraction of transactions with positive gains increases by only 1.23 percentage points after the implementation, this fraction drops by 16.8 percentage points below the pre-announcement level, due to the presence of transactions with negative gains.

In summary, all results align with the event-study figures and theoretical predictions. Sellers with high potential capital gains tend to sell their properties before implementation or hold onto them afterward. This behavior leads to an observed increase in capital gains just before implementation, followed by a decline after. The effect of capital gains tax implementation aligns with the existing literature on the lock-in effect, and our analysis further highlights a selected group of transactions with potential high capital gains contributing to this lock-in effect.

5.3 Robustness Check

To address potential concerns about sample switching between the treatment and control groups, we use an alternative identification strategy, as shown in Figure 9. This approach further restricts the treatment group to transactions with a previous transaction date after 2014, while the control group includes only those with a previous transaction date before 2014. Because the policy announcement occurred after this date, there is no possibility of switching between the treatment and control groups. Furthermore, sellers cannot manipulate holding periods to switch groups. Thus, this identification strategy helps mitigate the issue of sample switching.

Figures 10, 11, and 12 present the results from the event-study framework for the three outcome variables under the alternative identification scheme, showing similar patterns to the main findings. Table 3 provides the estimated coefficients from the DID model, where we continue to observe a significant positive effect on capital gains between the announcement and implementation periods, followed by a negative effect after the implementation. As a result, the main findings remain robust, indicating that sample switching is unlikely to impact the results.

6 Conclusion

This paper employs a difference-in-differences framework to examine the effects of Taiwan's 2016 tax reform on the housing market. The findings indicate that the implementation of the capital gains tax led to reductions in capital gains, rates of return, and the proportion of transactions with positive gains, suggesting a lock-in effect for transactions with potentially high capital gains. Furthermore, in the period between the announcement and implementation, we observe the opposite effect: an increase in capital gains, indicating that sellers tend to sell properties before the reform if they anticipate higher gains. Finally, around the timing of the tax regime switch, a sharp decrease in capital gains reflects sellers' self-selection behavior. In future research, we will further investigate this tax reform in three ways. First, we will examine its effect on the sale probability of properties. Given the observed lock-in effect for certain transactions, we expect the sale probability to be lower for these properties. Second, we will analyze seller characteristics to understand who tends to hold onto properties rather than sell. For example, Cunningham and Engelhardt (2008) uses subgroup analysis to show that certain groups, such as divorced or widowed individuals and college-educated people, exhibit higher mobility in response to reduced capital gains taxes. In our case, examining seller information over time may help identify those most affected by the lock-in effect. Finally, we will conduct additional robustness checks to ensure the reliability of our findings and discuss the policy implications for the government.

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Figures



Figure 1: Tax Regimes before and after the 2016 Tax Reform

Notes: This figure illustrates the 2016 tax reform, including its complex sunset clause. All transactions can be pinpointed on the plane based on the previous transaction dates and the holding periods of the current transaction. The orange dashed line (a negative 45-degree line) represents transactions that occurred on January 1, 2016. The blue vertical dotted line marks the previous transaction date of January 1, 2016, and the green horizontal solid line indicates a two-year holding period. The direction of the red dashed line highlights the timing of the transaction. Shaded areas represent transactions subject to the new tax regime, while unshaded areas represent those under the old regime.



Figure 2: Selling Decision before and after the Tax Reform

Notes: This figure illustrates potential transactions before and after the tax reform within the theoretical model. The orange area above the red horizontal solid line indicates possible realized transactions prior to the tax reform. The blue-hatched area represents possible realized transactions following the tax reform.



Figure 3: Comparison of Utilities before and after the Tax Reform

Notes: This figure illustrates the comparison of sellers' utilities before and after the tax reform. The orange area represents transactions that yield higher utility before the tax reform, while the blue-hatched area indicates transactions that yield higher utility after the reform.



Figure 4: Difference-in-Differences: the Treatment and Control Groups

Notes: This figure illustrates the treatment and control groups along with their respective tax regimes before and after the reform. The treatment group is defined as transactions with a previous transaction date before 2016 and a holding period of less than two years, while the control group consists of transactions with a previous transaction date before 2016 and a holding period of more than two years.



Figure 5: Average Capital Gains by the Tax Regimes

Notes: This figure presents the monthly average capital gains for the treatment and control groups. Tax Regimes IV and V represent the treatment groups, while Tax Regimes I and II serve as the control groups. The vertical dashed lines indicate the announcement and implementation of the reform, occurring in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 6: Event-Study Framework: Capital Gains

Notes: This figure shows the baseline event-study estimates γ_s in Equation (2) for capital gains (solid line) along with the 95% confidence intervals (dashed lines), which are based on robust standard errors clustered by holding periods. Capital gains are defined as the selling prices minus the previous purchase prices. The vertical dashed lines mark the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 7: Event-Study Framework: Rates of Return

Notes: This figure shows the baseline event-study estimates γ_s in Equation (2) for rates of return (solid line) and the 95% confidence intervals (dashed lines) based on the robust standard errors clustered at holding periods. The rates of return are defined as the capital gains divided by the previous purchasing prices. The vertical dashed lines mark the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 8: Event-Study Framework: Fraction of Transactions with Positive Gains Notes: This figure shows the baseline event-study estimates γ_s in Equation (2) for the fraction of transactions with positive gains (solid line) and the 95% confidence intervals (dashed lines) based on the robust standard errors clustered at holding periods. The vertical dashed lines mark the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 9: Alternative Identification Strategy: the Treatment and Control Groups Notes: This figure illustrates the treatment and control groups along with their respective tax regimes before and after the reform. The treatment group is defined as transactions with a previous transaction date between 2014 and 2016 and a holding period of less than two years, while the control group consists of transactions with a previous transaction date before 2014 and a holding period of more than two years.



Figure 10: Event-Study Framework: Capital Gains (Robust)

Notes: This figure shows the event-study estimates γ_s in Equation (2) based on the alternative identification strategy for capital gains (solid line) and the 95% confidence intervals (dashed lines) based on the robust standard errors clustered at holding periods. Capital gains are defined as the selling prices minus the previous purchasing prices. The vertical dashed lines indicate the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 11: Event-Study Framework: Rates of Return (Robust)

Notes: This figure shows the event-study estimates γ_s in Equation (2) based on the alternative identification strategy for rates of return (solid line) and the 95% confidence intervals (dashed lines) based on the robust standard errors clustered at holding periods. The rates of return are defined as the capital gains divided by the previous purchasing prices. The vertical dashed lines indicate the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.



Figure 12: Event-Study Framework: Fraction of Transactions with Positive Gains (Robust)

Notes: This figure shows the event-study DID estimates γ_s in Equation (2) based on the alternative identification strategy for the fraction of transactions with positive gains (solid line) and the 95% confidence intervals (dashed lines) based on the robust standard errors clustered at holding periods. The vertical dashed lines indicate the announcement and implementation of the reform in July 2015 (the closest month to June 24, 2015) and January 2016, respectively.

Tables

| | C | ontrol Group | Treatment Group | | | | | |
|-----------------------------------|---------|--------------------|-----------------|--------------------|--|--|--|--|
| Variables | Mean | Standard Deviation | Mean | Standard Deviation | | | | |
| Panel A: Outcomes of interest: | | | | | | | | |
| Capital gain | 984,592 | 2378,776 | 828,264.9 | 1665,913 | | | | |
| Rate of return | 0.2326 | 0.3234 | 0.2043 | 0.2941 | | | | |
| Positive gain or not | 0.8182 | 0.3857 | 0.8113 | 0.3913 | | | | |
| Panel B: Housing Characteristics: | | | | | | | | |
| Log(building area) | 4.6800 | 0.5857 | 4.7059 | 0.5130 | | | | |
| Housing age | 14.7685 | 10.9101 | 15.3337 | 11.5167 | | | | |
| Building type | 2.6505 | 1.6012 | 2.7710 | 1.6243 | | | | |
| Parking lot | 0.3396 | 0.4736 | 0.3177 | 0.4656 | | | | |
| Observations | 43,190 | | 18,535 | | | | | |

 Table 1: Summary Statistics

Notes: This table presents the summary statistics of three outcome variables and the housing characteristics for both treatment and control groups. Capital gains are defined as the selling price minus the previous purchasing price. Rate of return is the capital gains divided by the previous purchasing price. The fraction of positive gains is defined as the fraction of transactions having a non-zero positive capital gain. Building area is in squares meters. Housing ages are categorised into nine groups at 0, 1, 2, 5, 10, 20, 30, 40, and 105 years. Housing type is an index containing four types: houses, flats without a lift, flats with lifts, and apartment complexes that have more than seven floors. The rate of return is winsorised at the 1st (-0.33) and 99th (1.67) quantiles.

| | (1) | (2) | (3) | (4) | (5) | |
|-------------------------------------|----------------|-----------------|-------------|-------------|-------------|--|
| Panel A: Capital Gains | | | | | | |
| γ_A | 256,200*** | 260,838*** | 293,933*** | 282,674*** | 289,205*** | |
| | (54, 833) | (55, 550) | (54, 253) | (53, 674) | (53, 374) | |
| γ_I | -269,558*** | -357,879*** | -359,045*** | -374,007*** | -353,351*** | |
| | (45, 354) | (48, 183) | (46,783) | (47, 145) | (47, 526) | |
| Panel B: Rate of Return | | | | | | |
| γ_A | 0.0640*** | 0.0656*** | 0.0627*** | 0.0576*** | 0.0509*** | |
| | (0.0085) | (0.0086) | (0.0087) | (0.0082) | (0.0080) | |
| γ_I | -0.0628*** | -0.0761^{***} | -0.0760*** | -0.650*** | -0.0632*** | |
| | (0.0066) | (0.0069) | (0.0069) | (0.0067) | (0.0068) | |
| Panel C: Fraction of Positive Gains | | | | | | |
| γ_A | 0.0239*** | 0.0221*** | 0.0214*** | 0.0191** | 0.0123 | |
| | (0.0077) | (0.0078) | (0.0078) | (0.0078) | (0.0079) | |
| γ_I | -0.147^{***} | -0.171^{***} | -0.171*** | -0.171*** | -0.168*** | |
| | (0.0084) | (0.0086) | (0.0086) | (0.0086) | (0.0088) | |
| Observations | 61,725 | 61,725 | 61,725 | 61,725 | 61,725 | |
| Year-month Fixed Effects | - | Yes | Yes | Yes | Yes | |
| log Building Area | - | - | Yes | Yes | Yes | |
| Housing Characteristics | - | - | - | Yes | Yes | |
| Township Fixed Effects | - | - | - | - | Yes | |

Robust Standard Errors Clustered at Holding periods (Days)

Table 2: Regression Results for Differences-in-difference

Note: This table shows the baseline DID estimates of reform announcement γ_A and reform implementation γ_I based on Equation (1). Different fixed effects are added progressively from Columns (1) to (5). Inference is based on robust standard errors clustered on holding periods. *, ** and *** denote the significance level at 10%, 5%, and 1%, respectively.

| | (1) | (2) | (3) | (4) | (5) | |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|--|
| Panel A: Capital Gains | | | | | | |
| γ_A | 381,934*** | 374,279*** | 398,330*** | 388,783*** | 396,772*** | |
| | (56, 122) | (56, 395) | (55, 259) | (54,757) | (54, 376) | |
| γ_I | -312,394*** | -349,215*** | -351,990*** | -367,223*** | -339,695*** | |
| | (47, 430) | (49,625) | (48, 396) | (49, 395) | (49,854) | |
| Panel B: Rate of Return | | | | | | |
| γ_A | 0.0730*** | 0.0738*** | 0.0716*** | 0.0682*** | 0.0671*** | |
| | (0.0089) | (0.0090) | (0.0089) | (0.0086) | (0.0083) | |
| γ_I | -0.0814*** | -0.0856*** | -0.0853*** | -0.0754*** | -0.0704*** | |
| | (0.0070) | (0.0071) | (0.0072) | (0.0071) | (0.0071) | |
| Panel C: Fraction of Positive Gains | | | | | | |
| γ_A | 0.0285*** | 0.0261*** | 0.0255*** | 0.0250*** | 0.0234*** | |
| | (0.0082) | (0.0083) | (0.0083) | (0.0083) | (0.0084) | |
| γ_I | -0.178*** | -0.188*** | -0.188*** | -0.187*** | -0.182*** | |
| | (0.0086) | (0.0088) | (0.0088) | (0.0089) | (0.0089) | |
| Observations | 44,246 | 44,246 | 44,246 | 44,246 | 44,246 | |
| Year-month Fixed Effects | - | Yes | Yes | Yes | Yes | |
| log Building Area | - | - | Yes | Yes | Yes | |
| Housing Characteristics | - | - | - | Yes | Yes | |
| Township Fixed Effects | - | - | - | - | Yes | |

Robust Standard Errors Clustered at Holding periods (Days)

Table 3: Regression Results for Differences-in-difference (Robust)

Note: This table shows the alternative identified DID estimates of reform announcement γ_A and implementation γ_I based on Equation (1). Different fixed effects are added progressively from Columns (1) to (5). Inference is based on robust standard errors clustered on holding periods. *, ** and *** denote the significance level at 10%, 5%, and 1%, respectively.