The tax elasticity of capital gains
Evidence from millions of housing sales

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SHORT VERSION

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Abstract

I assess the impact of capital gains taxes on real estate, exploiting quasi-experimental variation and detailed data on millions of housing sales in France. In the short-run, investors delay sales and bunch transactions after anniversary dates of their purchase to benefit from more generous holding period deductions. After a 2012 reform substantially increased capital gain taxes after intermediate holding durations, exempting primary homes, transaction volumes for more exposed dwellings rose sharply between the announcement and implementation of the tax hike (“anticipation”), and dropped durably afterwards, with a shift in the composition of sales towards lower-price appreciation units.

JEL codes: H26, H24, H31, R31, R38.

Keywords: housing markets, capital gains, tax avoidance.

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Rising home values in advanced economies have led to increased wealth-to-income ratios (Rognlie, 2016), and played a prominent role in the total return on real estate, over and above the actual – or imputed – rent on a home. Whether the windfall gains derived from soaring house prices can and should be taxed away and redistributed, however, depends on the response of property investors to housing capital gains taxes (henceforth, HCGT). On the one hand, existing housing in prime locations is an inelastic capital asset. Limited evasion possibilities due to well-registered property rights, the non-depreciating nature of the underlying land, the absence of mobility responses, and the limited scope for avoidance strategies given low liquidity: all these forces mute the behavioral response of housing investment, making its taxation likely less distortionary than other forms of capital. On the other hand, due to the realization-based nature of HCGT, owners have the option to escape taxation by simply not selling: this lock-in phenomenon is amplified relative to financial assets, given the possibility of directly consuming housing services or obtaining rental returns. Housing sales might then be peculiarly sensitive to increased capital gains tax burdens, potentially shifting their incidence onto buyers, leading to substantial distortions in portfolio, consumption, and maintenance decisions, and largely offsetting mechanical government revenue effects (Burman, Wallace, and Weiner, 1996).

Quantifying the response of housing owners to increased tax burdens on capital gains is therefore a crucial concern for the conduct of tax policy, the scoring of budget plans, and the analysis of portfolio adjustment behavior. In this paper, I estimate the sensitivity of housing markets to capital gains taxation, both in the short-and in the medium-run. I exploit quasi-experimental variation in tax rates and holding period deductions for real estate property in France, availing myself of static bunching approaches, as well as dynamic triple-differences methods. Using novel and exhaustive housing transactions data covering c. 4 million real estate property sales in France from 2010 to 2015, matched to the cadaster, I document two central findings.

First, property owners react to holding period deductions in the HCGT schedule, by delaying the sale of their assets in the short-run to wait for more favorable taxation parameters. Until 2011, all taxable real estate property in France benefited from a ten percent annual basis deduction, starting after five years. Because the deduction was not prorated for part-year holdings, it applied discontinuously on the anniversary date of a purchase, creating large unit-specific drops in average tax rates at holding duration thresholds. I document substantial bunching immediately after these anniversary dates by owners of taxable units. There is no such portfolio adjustment timing distortion among units not subjected to the HCGT or at placebo anniversary dates which do not reduce tax liabilities; and responses for taxable units are concentrated in locations that experienced substantial price increases in the past, demonstrating this regularity is driven by tax burdens, rather than exact holding period heuristics. In addition to showing the salience of the HCGT, re-timing responses, relative to a counterfactual smooth profile of holding choices absent notches, can be used to quantify the short-term reduced-form elasticity of sales volumes to HCGT: close to 5 percent of all taxable transactions are delayed in order for owners to reach a holding period milestone yielding a 3.15 percent statutory rate.

1The share of capital gains in housing returns has grown since the 1980s, as scarce land in highly sought-after locations, building regulations, and a secular drop in interest rates were accompanied by higher home prices and a diminished rental component of returns (Knoll, Schularick, and Steger, 2017; Jordà et al., 2019).

2Only second homes, rental, and vacant property were liable to HCGT, while one’s primary residence was tax-exempt.
Second, HCGT hikes lead owners to change their holding decisions, substantially anticipating sales before their implementation, and durably reducing transactions afterwards. A reform of the HCGT, announced in August 2011 and implemented in February 2012, sharply marked down the holding period deduction. While homes held for less than five years (full taxation after and before the reform) or more than thirty years (full exemption after and before) were left unaffected, tax hikes were hump-shaped in between, and of considerable magnitude: a home held for fifteen years was fully exempt until January 31st, 2012, but subjected to a 26 percent effective tax rate on cumulative capital gains starting the next day. A triple-differences estimation strategy shows that more exposed housing units (taxable residences with intermediate holding periods) display a sharp rise in transactions before the reform is implemented, durable and pronounced drops in relative sales probability afterwards, and a shift in the composition of sales from high- to low-price appreciation units, relative to unaffected units.

Empirical contributions estimating behavioral responses to the capital gains tax generally focus on the responsiveness of the sale of financial assets. Several studies identified significant short-run responses, and more muted long-term elasticities, exploiting the time-series of federal rates (Feldstein, Slemrod, and Yitzhaki, 1980), or panel variation in marginal tax rates across households (Ivković, Poterba, and Weisbenner, 2005) or states (Bogart and Gentry, 1995; Agersnap and Zidar, 2020). Dowd and McClelland (2019) provide evidence of short-term re-timing of stock sales to reach the one-year holding period required for long-term CGT treatment. Relative to past work, my estimates of the capital gains realization elasticity focus on a real rather than financial base, and rely on exhaustive administrative data covering the universe of transactions in France, as well as quasi-random variation in effective marginal tax rates across otherwise comparable housing units and investors, circumventing common endogeneity concerns.

Only a few studies examine the impact of capital gains taxation on housing markets. In the United States, HCGT for owner-occupiers was substantially revamped by the Taxpayer Relief Act of 1997 (TRA’97). Cunningham and Engelhardt (2008) find that the mobility of homeowners younger than 55 increased as the TRA’97 ended the preferential treatment of older households. Exploiting the newly created $500,000 exemption, Shan (2011) shows that sales in the Boston area increased among units with imputed gains below the exemption level. While these studies focus on primary residences, I am concerned with the impact of HCGT on non-owner occupied property investors, a wealthier set of taxpayers likely to exhibit different behavioral responses. Both of the aforementioned papers study a decrease in rates, while my setting considers both annual reductions and a large one-time increase in tax liability, an important distinction given evidence of substantial asymmetries in responses to tax increments and decrements (Benzarti et al., forthcoming). Finally, while past work relies on survey data or localized samples to study homeowner mobility, I examine the response of housing markets in exhaustive records of transactions not affected by sampling variation. Unlike prior research, my quasi-experimental strategy sharply distinguishes unaffected and treated units without requiring the imputation of

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3This overnight variation is large: it is 3 times the maximum year-on-year variation in capital gains tax rates in a panel of US states studied recently by Agersnap and Zidar (2020), and 26 times the standard deviation of tax variations in their data.

4Agarwal et al. (2020) demonstrate that the “evasion gap” between reported prices and actual transaction values widened, in sales recorded by an intermediary in a large Chinese city, as a consequence of a CGT hike.
house prices in non-transaction periods, since it exploits discontinuous variation in holding period exemptions over time and across units. My contribution also demonstrates a pronounced household response to reaching a “no-tax” status, suggesting “tax-aversion” motives may play a role in the realizations elasticity. Finally, this paper also contributes to our broader understanding of how government policies affect housing market activity. A recent strand of literature exploits the impact of price notches in transfer tax schedules on sales (Best and Kleven, 2018; Besley, Meads, and Surico, 2014), price bargaining (Slemrod, Weber, and Shan, 2017), and market unraveling (Kopczuk and Munroe, 2015). Other papers study the role of subsidies for the purchase of new rental property by landlords (Levy, 2020), or targeted credits to first-time home-buyers (Carozzi, Hilber, and Yu, 2019; Berger, Turner, and Zwick, 2020). Unlike HCGT, transfer taxes and purchase subsidies fall upon the gross sale price, do not vary with the purchase basis or holding length, and apply independently of the use of the dwelling. Thus, their impact on market volume, prices and individual decisions, as well as their distributional consequences, differ substantially from the capital gains taxes which are the focus of this paper.

I describe the institutional setting of the French housing capital gains tax in section 1. I expose the short-term time-bunching response of housing markets to HCGT in section 2, before moving on to the medium-term lock-in effects using a triple-differences approach in 3. Section 4 discusses potential policy implications and concludes.

1 Institutional background and data

1.1 The taxation of housing capital gains in France

Capital gains taxes until 2011 In France, capital gains made on the sale of a primary residence are tax-exempt. Capital gains on all other real estate assets – rental property, vacant units, second homes, or land – are liable to income taxation and additional social contributions, due by the seller. Unlike other income taxes, HCGT rates are flat, not progressive; they are lower than top marginal wage income tax rates; no deduction for losses are allowed; and exemptions exist for homes owned for long enough. Adjusted capital gains (ACG) on real estate are defined as

\[
ACG = \frac{S - P - TC - IC}{\text{selling price} \ - \ \text{purchase price} \ - \ \text{purchase transaction costs} \ - \ \text{improvement costs}}
\]

A government-certified professional, the notary, whose intervention is required by law to supervise and register any housing transaction, is tasked with calculating the tax due, and paying the tax to the Treasury before remitting the remainder of the selling price to the seller. Transaction (TC) and improvement costs (IC) can be actual, documented expenses, or flat-rate deductions of 7.5 percent of the purchase price for transaction costs, and 15 percent for improvements.²

²In recent work, Chi, LaPoint, and Lin (2020) find evidence of bunching at duration notches in response to tax surcharges designed to discourage speculation in the Taiwanese housing market.

³For improvement costs, opting for this proportional reduction is only allowed if the holding period has been at least five years.
Until December 2010, the statutory tax rate on ACG was $\tau = 28.1\%$: 16 percent income tax, and 12.1 percent social contributions. However, the actual tax due decreased with the holding period. ACG were reduced by ten percent every additional year, starting from year 6; and an additional 1000€ could be subtracted. The tax due on a property with gains ACG and held for $h$ years was:

$$T(ACG, h) = \tau \times \max (0, \lambda(h) \times ACG - 1000)$$  \hspace{1cm} (1)

with

$$\lambda(h) = \begin{cases} 
1 & \text{if } h \leq 5 \\
\lambda(h - 1) - 0.1 & \text{if } 5 < h \leq 15 \\
0 & \text{if } h \geq 15 
\end{cases}$$

For example, ACG of 100,000 € on a house sold after ten years would be liable to a $13.77\%$ average tax; the same gains would be fully exempted after fifteen years. Moreover, because $h$ is the number of integer years from purchase to sale date, the effective tax rate dropped discontinuously by $0.1 \times \tau$, each year from $h = 6$ to $h = 15$, the day after the anniversary of the purchase date. Section 2 exploits these time discontinuities in average tax rates through a bunching approach.

The 2011-2012 reforms In January 2011, the statutory tax rate $\tau$ was increased by 3.2 percentage points to 31.3 percent. The rate was raised again in October 2011, to $\tau = 32.5\%$. More drastically, on August 25th, 2011, Prime Minister Fillon announced that housing capital gains would no longer benefit from the existing holding period deduction scheme $\lambda(h)$. His initial plan would replace it by a simpler – and considerably less generous – step-up of the basis by cumulative consumer price inflation since the purchase date, applicable immediately. After popular outcry and lengthy congressional deliberations, the reform was softened by the National Assembly on September 20th, 2011. First, it would only apply to sales made on or after February 1st, 2012, and not retroactively. Second, instead of an inflation indexation, a new holding period allowance schedule $\tilde{\lambda}(h)$ slowed down the rate of deduction. It still included no exemption for the first five years; but only a 2 percent annual deduction from year 6 to year 17; 4 percent a year for the subsequent seven years; and 8 percent annually from year 25 to year 30. Full exemption was therefore pushed back to thirty years of ownership, up from fifteen. The reform also scrapped the EUR 1,000 fixed deduction. The tax due after the reform would henceforth be computed as:

$$T(ACG, h) = \tau \times \max (0, \tilde{\lambda}(h) \times ACG)$$  \hspace{1cm} (2)

5 $\left[ 100,000 \times (1 - 0.1 \times (10 - 5)) - 1000 \right] \times (16 + 12.1) 
\approx 0.1377$

8 $h = \lfloor \text{Sale - Purchase} / 365 \rfloor$

9 The income tax rate was raised to 19 percent from 16 percent, and social contributions were increased to 12.3 percent, up from 12.1.

10 Specifically, social contributions rose to 13.5 percent from 12.3.
\[
\tilde{\lambda}(h) = \begin{cases} 
1 & \text{if } h \leq 5 \\
\tilde{\lambda}(h-1) - 0.02 & \text{if } 5 < h \leq 17 \\
\tilde{\lambda}(h-1) - 0.04 & \text{if } 17 < h \leq 24 \\
\tilde{\lambda}(h-1) - 0.08 & \text{if } 24 < h \leq 30 \\
0 & \text{if } h \geq 30 
\end{cases}
\]

The plan implied sharp increases in tax liabilities for some households. Home prices rose by roughly 150 percent from 1997 to 2012.\(^{11}\) A typical home purchased for the French Franc equivalent of EUR 100,000 in mid-January 1997, selling for EUR 250,000 on January 31\(^{st}\), 2012, would have reached the fifteen years holding period and been fully exempt of HCGT. The very next day, on February 1\(^{st}\), 2012, the adjusted capital gains of EUR 127,500 on the same sale\(^{12}\) were subject to a tax liability of 33,150€\(^{13}\). Section 3 avails itself of this tri-dimensional difference in exposure, depending on whether the sale was recorded after or before the implementation of the reform, on the past holding period, and on the taxable nature of the dwelling.

1.2 Data description

I combine the universe of housing transactions for the entire country, with information from the cadaster on each housing unit in France. The detailed deeds data, combined by the French Treasury and Housing Ministry, record all housing and land transactions in France from 2010 to 2015, in the DV3F database, covering the overwhelming majority of housing transactions.\(^{14}\) I restrict the sample to sales of entire houses and apartments,\(^{15}\) representing c. 4.6 million real estate transactions from January 2010 to December 2015. I merge the transactions data with the French cadaster (Fichiers Fonciers), which includes precise property tax and history of ownership information on each unit. Matching each sale observed in the deeds data to the unit’s entry in the cadaster allows me to observe the exact date at which the unit was last purchased before the transaction of interest – and therefore to compute the precise holding period length \(h\).\(^{16}\) I also determine when a unit was in the ”fully-taxable” group (which includes rental and vacant property) or in the ”lower-tax-intensity” group (which includes untaxed owner-occupied homes, but also taxable second homes\(^{17}\)). Table 1 provides summary information about the analysis sample.

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\(^{11}\)Based on the nationwide index for existing home prices computed by INSEE, the national statistical institute, in a series made available at the following link. Price increases in high-demand locations were even larger: over the same period, they rose by c. 220 percent in the broader Paris region.

\(^{12}\)Selling price - Purchase price - 0.075 \times 100,000 - 0.15 \times 100,000 = 127,500

\(^{13}\)This effective tax rate (26% of 127,500 €) corresponds to the application of the 2 percent annual deduction for ten years after year 5: \(\tilde{\lambda}(h) \times \tau = (1 - 0.02 \times (15 - 5)) \times 0.325 = 0.26\).

\(^{14}\)The only exceptions to the almost universal coverage of arms-length transactions in the DV3F data are three French provinces (Bas-Rhin, Haut-Rhin, and Moselle) which do not follow the same reporting standards since the Franco-Prussian war of 1870, and are not included in the DV3F data. Homes in these departments represent c. 4 percent of the stock of overall c. 32 million housing units in France as of 2012.

\(^{15}\)I exclude garages, outbuildings, and commercial property, and focusing on residential housing units.

\(^{16}\)For 85 percent of homes sold in the sample period.

\(^{17}\)The data do not distinguish second homes from owner-occupied units in the latter group, making it a lower-intensity-treatment (rather than untreated) sub-sample. In online appendix E, I show that the results are robust to an alternative identification strategy exploiting the differential exposure of local housing markets depending on their initial share of non-owner occupied homes.
2 The short-run re-timing of housing capital gains

I first evidence the short-run response of transaction volumes using a bunching approach. As described in equation 1, statutory tax rates on housing capital gains decrease with the number \( h \) of years a property has been held for. Before the February 2012 reform, the holding period exclusion was increased by ten percent a year, starting year 6. At a 31.3 (resp. 32.5) percent statutory tax rate \( \tau \) from January to October 2011 (resp. October 2011 to January 2012), this entailed reductions in average tax rates of a magnitude of 3.13 (resp 3.25) percent of ACG for owners who reached the next holding year. Since \( h \) was evaluated in integer increments, and no apportionment was made for partial holding years, the calculation created large discontinuous drops in average tax rates after – and substantial incentives to delay sales until – each ”anniversary” of the purchase date, from year 6 to year 15. Owners could sell after \( t^* = t^{Purchase} + 365 \times (h + 1) \), delaying sales that would, absent notches, have occurred at \( t < t^* \). They were more likely to bunch (i.e. sell immediately after \( t^* \)) if their preferred counterfactual date in the absence of discontinuities, \( \tilde{t} \), was closer to \( t^* \), and if their indifference curves were relatively flat in the selling time choice. The estimated mass of owners opting to do so is indicative of the responsiveness of short-run holding decisions to capital gains taxes. I exploit these large notches (of \( \tau \times 0.1 \) percentage points) to evidence the short-term time-shifting of housing sales in response to HCGT.

Figure 1 graphically displays the behavioral re-timing response. Panel 1a summarizes the evolution of tax rates on capital gains for taxable units, depending on their holding period, due to the reform. It compares HCGT rates by holding duration from January 2010 to August 2011 (the pre-reform period), to post-reform rates. Discontinuous drops in statutory rates at anniversary dates from year 6 to 15 were reduced substantially by the slower holding period allowance schedule, going from 3.15 percent to 0.65 percent.

Panel 1b compares the distribution of holding period choices for taxable units in the pre-reform period (until September 2011) to their post-February 2012 pattern. Sales bunch at anniversary dates from year 6 to 15 in the period when notches were substantial: monthly sales counts exhibit a clear pattern with 12-month periodicity from year 6 to year 15. The number of transactions by holding duration bin rises sharply immediately after each tax-reducing anniversary date, with a corresponding missing mass before the notch. The largest proportional spike is noticeable for sales right after fifteen years (180 months), when a full exemption is acquired. However, bunching at holding period notches from years 6 to 15 almost entirely disappears in the period following the reform, consistent with muted incentives to bear the hassle and utility costs of delaying a sale once the notches are shrunk, and with the hypothesis that jumps in the frequency of sales after anniversary dates in the taxable group during the high-notch period is explained by discontinuous tax rate drops, and not by exact holding period heuristics. Only bunching at the 5-year holding duration mark is quantitatively substantial both before and after the reform, consistent with no change in the minimal holding duration to use the flat deduction for improvement costs.

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18This short-run response to a permanent change in statutory rates is close to what Gravelle (2010) labels the “transitory elasticity”.
19Given the 2 percent annual deduction after the reform, annual notches from year 6 to 17 were 0.65 percent (0.02 \times 0.325).
20The magnitude of the notch is the same when reaching year 15 or any year from 6 to 14; although annual spikes occur every year, there appears to be additional behavioral responsiveness to reaching tax-exempt status, beyond its monetary value.
21Waiting for the fifth anniversary implies a substantial drop in HCGT liability of up to \( \tau \times \lambda(h) \times 0.15 \times \text{Purchase price}, \) for taxpayers with no actual documented improvement costs. The magnitude of the notch, however, depends on the actual amount of incurred im-
Panel 1c zooms in on holding period choices for taxable properties in the large-notches period (Jan. 2010-Sep. 2011). It splits the sample into provinces, ranked by whether nominal price appreciation was above or below the median province over the preceding 15-year period in 2011. Sales of homes subject to HCGT exhibit more substantial bunching after anniversary dates in regions with high price appreciation, and more muted strategic re-timing of sales in localities with limited price gains, consistent with incentives to delay increasing with the absolute value of tax savings obtained.

Finally, Panel 1d explores the distribution of holding period choices for taxable units in the pre-reform period with more granularity. It pools together all sales of taxable homes that occur within 100 days of any “anniversary date” between year 6 and year 15 of the purchase date, and plots the counts of transactions in bins of one day. It also plots, as a counterfactual, all taxable sales within 100 days of a “placebo” anniversary date, occurring from year 2 to year 4 or from year 16 to year 22. The pooled notches provide stark evidence of manipulation: for sales occurring in years 6 to 15 after the purchase date, there is a clearly visible excess bunching of sales in days that immediately follow a “notch date”, a diffuse missing mass in the weeks preceding it, and a sharp discontinuity at the anniversary date with sales substantially higher in the 100 days following an anniversary than in the 100 days preceding it. On the contrary, no such re-timing evidence appears for sales around anniversary dates in years 2 to 4 and years 16 to 22, since these placebo anniversaries do not give rise to a lower tax liability.

Panel 1d helps quantify the extent of responsiveness to short-run permanent changes in HCGT. Defining \( n(j) \) as the number of days since the purchase of a home, observed holding choices for treated units (the number of homes sold \( n \) days away from a “notched” anniversary \( n^* \) of their purchase date, \( C(n) = |n(j) - n^* = n| \)) can be compared to the counterfactual distribution \( \hat{C}(n) = |n(j) - n^*\text{Placebo} = n| \) that would obtain in the absence of discontinuities in the budget set. This counterfactual is modelled after the distribution of sales around placebo anniversary dates in years 2 to 4 and years 16 to 22. The excess bunching mass of sales occurring within \( L_u = 20 \) days after the time notch, relative to the counterfactual “placebo anniversaries” distribution, is:

\[
B^* = \sum_{i=0}^{L_u} C(n) - \hat{C}(n)
\]

The behavioral response estimated in this way assumes no extensive margin reactions, a reasonable postulate given the focus on a short-term re-timing elasticity. I find that the excess mass of sales that are distorted by the 3.13 percent notches corresponds to around 17 times the counter-factual daily volume of taxable transactions, or 5 percent of annual transactions.

### 3 The medium-run lock-in effects of capital gains taxation

Turning to the dynamic, medium-term response of housing transactions to capital gains tax reforms, I exploit institutional features that created substantial heterogeneity in exposure to the February 2012 overhaul of

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__provement costs: to a taxpayer with receipts for documented expenses worth more than fifteen percent of the initial purchase price, the option for a flat adjustment is worthless and the local notch is zero.__
HCGT. The reform affected taxable units differently, depending on how long they had been the property of their owner. By slowing down the deduction schedule and pushing the full exemption up from fifteen to thirty years, tax hikes after February 1st, 2012 were hump-shaped in the holding period, peaking at fifteen years, at a 26 percent rate increase.\textsuperscript{22} There was no tax hike for homes held less than five years (fully taxable before and after the reform) and more than thirty years (fully exempt before and after), making these holding duration bins relevant untreated controls around the implementation period. Additionally, independently of their holding period, primary residences were fully exempt before and after February 2012. Only rental property, second and vacant homes, and constructible land, witnessed differential tax hikes by duration of ownership due to the reform.

Figure 2 visually evidences the gist and main findings of my triple-differences strategy to estimate the medium-term lock-in effect. Home sales are grouped into two categories:

- a \textit{high-tax increase} group, comprised of homes held for 13 to 17 years (facing tax increases ranging from 21 to 26 percentage points with the February 2012 reform)
- a \textit{no-tax increase} group, comprised of homes held for less than 5 or more than 30 years

Monthly transactions by tax hike intensity (normalized to the January 2010-July 2011 average count of monthly transactions within each class) are plotted separately for taxable (panel (a)) and mostly non-taxable (panel (b)) units, in figure 2.\textsuperscript{23}

The figure evidences five main results. First, both holding duration groups follow parallel trends prior to the announcement of the reform, both in the taxable and un-taxed categories. While the level of transaction counts in each holding period bin and tax status are different, as these correspond to groupings with distinct characteristics on average, dynamic patterns of transaction volumes are similar across categories until the announcement of the HCGT reform, even at high frequency. Second, after the announcement that the reform would not apply retroactively, and prior to its implementation (i.e. from September 2011 to January 2012), relative sales volumes for homes facing a larger future tax increase rise sharply among taxable properties. Sales of taxable units held for 13 to 17 years spike to around 500\% of their average pre-announcement monthly level in January 2012. Third, and correspondingly, we observe a missing mass of sales in the high-tax group in the months following the implementation of the reform. In the subsequent year, sales are c. 20 percent below trend for the group of highly taxed transactions among taxable dwellings. Fourth, these patterns are muted or completely absent in the placebo group of mostly untaxed properties, suggesting they are indeed driven by tax considerations, rather than factors affecting all homes bought at the same time in the past. While a small anticipation effect in the 13-17 year duration bin is visible in the un-taxed panel in February 2012, no substantial differences emerge in sales dynamics between the various holding period classes after the reform.

To estimate the causal impact of the added tax liability on sales volumes and values, I aggregate counts or

\textsuperscript{22} The new tax rate after fifteen years was \(0.26 = 0.325 \times (1 - 0.02 \times (15 - 5))\), up from zero taxation before. As shown in figure 1a, the differential was smaller for durations from 6 to 14 and 16 to 29 years.

\textsuperscript{23} The always-taxable group (\(g = T\)) is comprised of c. 1.4 million sales of properties that are either vacant or rented at the time of the sale, and the “mostly-untaxed” group (\(g = U\)) includes c. 2.6 million owner-occupied (untaxed) and second homes (taxable).
(total value) of sales $y_{mgh} = \log N_{hmg}$ ($y_{mgh} = \log V_{hmg}$), occurring in month $m$ and taxable ($g = T$) or mostly untaxed ($g = U$) group, for duration bin $h$ (in months). I then attribute to each duration $h$ its percentage point tax hike generated by the February 2012 reform, $\Delta \tau(h)$, which is hump-shaped in holding length. Therefore, I can compare the differential post-reform drop in sales in a holding duration class experiencing a tax hike $\Delta \tau(h)$ one percentage point higher, in the fully-taxable group $g = T$ of rental and vacant property, relative to its differential post-reform evolution in the control group $g = U$ comprised of owner-occupied and second homes.\footnote{The inclusion of affected dwellings in the control group may, to some extent, bias estimated tax elasticities towards zero, so that estimated responses constitute lower bounds.} Defining $Post_m = \mathbb{1}(m \geq Feb.2012)$ as the indicator for whether a month occurs after the reform, and $X_m$ as a (potentially empty) vector of time-varying controls, the main estimating equation of the triple-differences strategy is:

$$y_{mgh} = \sum_t \alpha_t \mathbb{1}(m = t) + \sum_H \alpha_H \mathbb{1}(h = H) + \alpha_T \mathbb{1}(g = T) + \sum_H (\alpha_{post,H} Post_m + \alpha_{T,H}(g = T)) + \alpha_{Post,T}(g = T) \times Post_m$$

$$+ \sum_H \gamma_{T,H}(g = T) \times X_m \times \mathbb{1}(h = H) + \beta \times \mathbb{1}(g = T) \times Post_m \times \Delta \tau(h) + \epsilon_{mgh}$$

where the coefficient of interest is $\beta$, the effect on taxable transactions of being in a duration bin subjected to an additional percentage point of HCGT after the reform. The estimating equation includes month dummies, holding-period bin fixed effects, tax status dummies, and their relevant bilateral interactions.

Table 2 quantifies these effects. Panel A measures the results using the triple-differences framework outlined in equation 3, and defining the pre-period as all months until January 2012, and the post-period as all months from February 2012 to the relaxation of the HCGT in September 2013. Panel B estimates equation 3, but removes the effect driven by anticipated bunching of transactions before the implementation, excluding observations in the period ranging from the announcement to the implementation. Column 1 and 2 focus on the impact on the number of sales: column 1 includes only the baseline fixed-effects and their bilateral interactions, while column 2 adds time-varying controls (mortgage interest rates measured at monthly frequency) interacted with indicators by cell of holding period bin and taxable status. Column 3 and 4 provide the same specifications for the total value of sales in a tax group-holding duration-month cell, without or with time-varying controls. I find substantial effect, of the order of a 1 percent reduction in the number of transactions, and 1.3 percent reduction in their total value, in holding duration bins and taxable groups subjected to a one percentage point higher rate of capital gains taxation.

4 Concluding comments

Housing capital gains realizations are highly sensitive to taxation. In the short-run, investors re-time sales...
and hold properties for longer, bunching at turning points in the holding period allowance schedule, in order to benefit from large downward notches of up to 3.25 percentage points in their tax burden until 2011. In the medium-run, after the February 2012 tax increase, taxable dwellings (vacant and rental property) with intermediate holding periods (relative to longer and shorter durations) faced tax hikes of up to 26 percentage points relative to untaxed dwellings held for similar durations, or to taxable houses held for much shorter or longer time periods. The differential rise in capital gains taxation had large anticipation and lock-in effects on affected units, inducing substantial changes in tax revenue, and affecting aggregate housing sales and investment choices.

I provide novel experimental strategies to estimate the elasticity of capital gains realizations to taxation in a specific market, addressing the endogenous correlation of tax burdens and sales decisions by exploiting differences in pre-reform exposure across holding periods and taxable status. I evidence responses not only to statutory tax rate variation, but to the presence of holding period deductions, and to both permanent and temporary changes. This study is the first to explore the tax treatment of housing capital gains using nationwide, administrative and exhaustive data sources, limiting the risk of biased sample selection or attrition, ensuring the accuracy of price and quantity reporting, and allowing for a precise estimation of heterogeneous effects over time and across locations. Finally, I document a dynamic path of causal effects, including forward-looking anticipation behavior among investors and longer-term extensive margin drops in sales, helping to reconcile the large estimated short-run responses in the literature with more muted long-run elasticities.

My results suggest that alternative tools to redistribute housing wealth effects may have entail less foregone government revenue than realization-contingent taxation. Such instruments include annual property levies properly indexed to the time-varying value of local real estate, or retrospective accrual taxation, with an increasing path of statutory tax rates to reflect the time value of deferred taxes, while preserving taxpayer liquidity (Auerbach, 1991). In a time of secularly low interest rates, however, the lock-in effect of taxation on capital gains is less likely to be driven by the time-discounting value of deferring payment, and more by the possibility of evading taxes altogether, through bequests, gifts, incorporation, or simply the direct consumption of housing services and reduced maintenance efforts until death. Therefore, imputed rent taxation or appropriate land value taxes may be a more relevant tool for taxing latent housing gains, by making redistribution independent of taxpayer choices to sell or to hold onto their real estate investments.

Do housing transactions provide a good guide to the behavioral medium-run response of other asset sales, an important policy parameter for the scoring of capital gains tax reforms (Sarin et al., 2021)? Several factors could make housing investment sensitivity to capital gains taxes different from financial assets holdings. First, many CGT avoidance strategies available to a financial investor (short-sales of correlated assets, secured borrowing to obtain liquidity) are not feasible for an individual real estate owner, especially in the absence of loss deductions; this potentially renders housing investors less likely to avoid the burden of taxation. Second, a dwelling is a durable consumption good, and, unlike stocks or bonds, it is both a savings vehicle for households, and a source of direct housing consumption flows (Piazzesi, Schneider, and Tuzel, 2007). Thus, it effectively delivers non-tradable, generally un-taxed dividends, in addition to its expected financial returns (Chambers, Garriga,
and Schlagenhauf, 2009), potentially amplifying the lock-in effect. Third, idiosyncratic tastes of owners for individual housing units, due to local ties, household-specific amenities, or the non-separability between housing consumption and labor supply (Rupert and Wasmer, 2012), may imply that real estate investors are less elastic to variation in post-tax returns than investors in financial assets, for which such idiosyncratic preferences are close to nonexistent. Finally, housing markets are less liquid, and subject to larger search frictions, than trade in financial assets, possibly making idiosyncratic matches between sellers and buyers more relevant to transaction volumes than taxation schedules.

References


See notably Ngai and Tenreyro (2014) for clear evidence and a theory of frictional matching in housing markets.


Appendices

A Main figures

(a) Tax rates by holding period, pre and post-reform

(b) Treated units, pre and post-reform

(c) Treated units, pre-reform: by price appreciation

(d) Treated units, pre-reform: notches v. placebo

Figure 1: Bunching at time notches: taxable units. Panel (a) plots average tax rates for taxable dwellings by holding duration before and after the February 2012 reform: the red line corresponds to tax rates on adjusted capital gains from Jan.2010 to Sep.2011; the blue line is in February 2012. Notches in years 6 to 15 are reduced in magnitude by the February 2012 reform, given the slower pace of holding period allowances. Homes do not benefit from any holding period deduction below five years. The figure assumes a 250,000 EUR adjusted capital gains basis: the only variation between average and marginal rates on ACG comes from the negligible EUR 1,000 deduction abolished in February 2012. Panel (b) plots the total number of transactions (for taxable units only) by holding period choice, for sales in the pre-reform period (red line) when annual tax notches are high (3.15 p.p.), and sales in the post-reform period (blue line), when notches are small (0.65 p.p.). Panel (c) zooms in on sales of taxable units in the pre-reform period, and plots the total number of transactions by holding period choice, for provinces ranked by nominal price appreciation in the preceding decade: provinces with above median nominal price appreciation for the average home in the orange solid line, and below median in green dashed line. Panel (d) plots sales of taxable units in the pre-reform period occurring within 100 days of an anniversary date of their purchase, for anniversaries corresponding to notches (years 6 to 15, black dots) and anniversary dates without notches (years 2 to 4 and 16 to 22, light blue triangles).
(a) Treated units: rental and vacant property  

(b) Mostly untreated units: owner-occupied

Figure 2: **Normalized sales counts by holding period and taxable status: the lock-in effect.** Panel (a) plots the number of sales (normalized to their average in the bin from January 2010 to June 2011) of dwellings in two holding period bins (respectively, after 12 to 17 years, the most affected group; and after less than 5 or more than thirty years, the unaffected group), among the group of surely taxable dwellings (vacant and rental property). Panel (b) plots the total normalized number of transactions for the same two bins of holding period choices (12-17 years), for the partly-treated group comprised of dwellings either occupied by their owners (main residences, untaxed) or held as second homes (taxed).
### B Main tables

**Table 1: Summary statistics**

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<th></th>
<th>Mean</th>
<th>Std. dev</th>
<th>Median</th>
<th>p25</th>
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<td><strong>Full sample: 2010-2015</strong></td>
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<td>Home value (EUR)</td>
<td>210,302</td>
<td>456,545</td>
<td>158,000</td>
<td>100,000</td>
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<td>Price per square meter</td>
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<td>Square footage</td>
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<td>953.7</td>
<td>76</td>
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<td>Holding duration (months)</td>
<td>134</td>
<td>230</td>
<td>97</td>
<td>50</td>
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<table>
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<tr>
<th>Transactions</th>
<th>4,650,456</th>
<th>% with purchase date</th>
<th>51.2</th>
<th>% single-family</th>
<th>33.5</th>
<th>% in taxable group</th>
<th>49.4</th>
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<td><strong>Pre-reform: Jan. 2010-Sep. 2011</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>Home value (EUR)</td>
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<tr>
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<td>2254.0</td>
<td>1465.5</td>
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<tr>
<td>Square footage</td>
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<td>570.3</td>
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<td>51</td>
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<td>Holding duration (months)</td>
<td>131.5</td>
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<td>93</td>
<td>51</td>
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<th>% in taxable group</th>
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<td>Price per square meter</td>
<td>2,792.8</td>
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<td>Square footage</td>
<td>106.1</td>
<td>723.2</td>
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<tr>
<td>Holding duration (months)</td>
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<th>Transactions</th>
<th>314,118</th>
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<th>% single-family</th>
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<th>% in taxable group</th>
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<td>Home value (EUR)</td>
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<td>160,000</td>
<td>100,040</td>
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<td>Price per square meter</td>
<td>2,702.7</td>
<td>2,661.5</td>
<td>2,194.2</td>
<td>1,389.2</td>
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<tr>
<td>Square footage</td>
<td>105.2</td>
<td>1952.6</td>
<td>76</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Holding duration (months)</td>
<td>128</td>
<td>219</td>
<td>89</td>
<td>47</td>
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<th>Transactions</th>
<th>680,040</th>
<th>% with purchase date</th>
<th>84.7</th>
<th>% single-family</th>
<th>51.5</th>
<th>% in taxable group</th>
<th>32.6</th>
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</table>

The housing transactions data come from the DV3F database, a restricted-access repository of all housing transactions in France. Reading: during the pre-reform period (from January 2010 to September 2011, 49.4 percent of transactions correspond to single-family homes.
Table 2: The medium-term impact of HCGT on house sales


<table>
<thead>
<tr>
<th>Number of transactions (log)</th>
<th>Value of transactions (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>DDD coefficient ($\beta$)</td>
<td>-0.95</td>
</tr>
<tr>
<td>Standard error</td>
<td>(.24)</td>
</tr>
<tr>
<td>N</td>
<td>30,058</td>
</tr>
</tbody>
</table>

Set of controls: Baseline FE | FE+Time-varying | Baseline FE | FE+Time-varying


<table>
<thead>
<tr>
<th>Number of transactions (log)</th>
<th>Value of transactions (log)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>DDD coefficient ($\beta$)</td>
<td>-.72</td>
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<tr>
<td>Standard error</td>
<td>(.28)</td>
</tr>
<tr>
<td>N</td>
<td>25,895</td>
</tr>
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</table>

Set of controls: Baseline FE | FE+Time-varying | Baseline FE | FE+Time-varying

This table presents the medium-term lock-in results for the period from January 2013 until the loosening of the holding period allowance schedule in September 2013, restricting the sample to units held for less than 60 years. Robust standard errors are in parentheses, clustered at the treatment level, i.e., at the holding duration years bin level. Baseline FE include month fixed effects, holding duration group (in months) dummy fixed effects, and taxable status fixed effects, as well as the interaction of a post-reform indicator with taxable status and with holding duration dummies. Time-varying controls include the interaction of taxable status-holding duration cell dummies with monthly housing mortgage rates. Columns 1 and 2 focus on the impact of capital gains taxes on the log total number of transactions in a holding duration bin x taxable status x month cell; columns 3 and 4 measure the impact on the log total value of sales in a cell. Panels A and B estimate the triple-differences equation 3, using only the differential variation in tax rates $\Delta \tau(h)$ entailed by the February 2012 reform: panel A uses the full pre-reform period sample; panel B excludes the anticipation period immediately following the announcement and preceding the implementation of the February 2012 reform.
Figure 3: **Distribution of sales: polynomial counterfactual.** Figure 3 plots the distribution of sales (in the pre-reform period Jan. 2010-Sep. 2011) by holding period bins as well as a counterfactual distribution constructed using the traditional polynomial fit approach of the bunching literature. The polynomial fit is a 9th order polynomial in the number of days since the purchase date, fitted when excluding ten days after and thirty days before every anniversary date corresponding to a notch.
Figure 4: Price of transacted units with duration from 12 to 17 years. Figure 4 plots the log median price per square meter of homes with a holding duration from 12 to 17 years, for transactions occurring in the period surrounding the February 2012 reform. Panel (a) plots the price for units in the taxable group experiencing a large tax increase (holding durations from 13 to 17 years), while panel (b) plots the median price per day for units with similar durations in the non-taxable group. An upwards trend before the reform, and a large downwards discontinuity at the time of the reform, appears only in the group experiencing the large tax increase, indicative of a shift in the composition of sales towards dwellings having experienced lower price appreciation in the past as a consequence of the reform.
Figure 5: **Notary form to declare housing capital gains.** Figure 5 is an example of the form notaries have to fill out in order to declare housing capital gains. They are tasked with computing the value of the sale, the purchase basis, and the holding period adjustment $\lambda(h)$ separately for income taxes and social contributions.
D Aggregate evidence on house sales

In this appendix, I provide evidence that aggregate home sales respond dynamically to incentives built into the capital gains tax on housing. Until December 2010, ACG on the sale of non-tax-exempt property faced a \( \tau = 28.1\% \) statutory tax rate. The rate included a 16 percent income tax, and 12.1 percent social contributions. In January 2011, the income tax rate was raised by three p.p. to 19 percent from 16 percent, and social contributions were increased by 0.2 p.p. to 12.3 percent, up from 12.1, pushing the statutory tax rate \( \tau \) up by 3.2 percentage points (p.p.), leading to a full tax rate of 31.3 percent. In October 2011, the social contribution rate was raised to 13.5 percent from 12.3, yielding a full 1.2 percent increase in the total tax rate.

On February 1st, 2012, the new holding period allowance schedule \( \tilde{\lambda}(h) \) described in section 1 slowed down the rate of deduction for HCGT. On July 1st, 2012, the total statutory tax rate was raised for the third time in 18 months, to \( \tau = 34.5\% \). On January 1st, 2013, the newly elected Socialist government, in order to increase the progressivity of housing capital gains taxes, implemented an additional surtax on large capital gains, with rates reaching up to 6 percent. Therefore, top marginal tax rates now reached 40.5 percent for large nominal gains on homes sold less than five years after being purchased. Finally, on September 1st, 2013, HCGT burdens were decreased through two specific measures. First, a faster holding period allowance schedule was put in place; second, the government created a one-year long 25 percent additional deduction off the basis, explicitly aimed at stimulating housing markets.

I provide two separate pieces of aggregate evidence on the responsiveness of households to the capital gains tax reforms. First, Figure 6 measures the total number of home sales by transaction date in the period of interest. While sales are close to 3000 per day on average, and exhibit some weekly frequency seasonality, the data evidence spikes immediately before expected reforms that increased the capital gains tax burden, either by increasing rates (in January 2011, October 2011, July 2012, and January 2013) or by reducing the generosity of holding period exemptions (in February 2012); sustained evidence of missing sales immediately after these policy changes; and large spikes after expected reforms that reduce the capital gains tax bill (in September 2013), as owners delay sales to benefit from more generous treatments. This response immediately before capital gains tax increases and shortly after tax reductions, indicates the salience of the levy for owners of real estate, and is suggestive of a degree of ability to shift transactions inter-temporally in order to benefit from more favorable tax schedules.

26 Specifically, the rate of social contributions increased to 15.5 percent from 13.5 percent.
27 The progressive tax applied to a basis \( B \) equal to the adjusted capital gains after subtracting the holding period deduction (\( ACG \), started at a 2 percent rate for \( B \) above 50,000€, and reached a 6 percent top average tax rate for \( B \geq 260,000€ \). Marginal tax rates were much higher on some small intervals for \( B \), however, due to their non-monotonic nature which involved both concave and convex kinks.
28 The holding period deduction was altered separately for the income tax and for social contributions. For the 19 percent statutory income tax rate, the holding period deduction was raised to 6 percent a year from year 6 to 21, and 4 percent for year 22, reaching full exemption after 22 years; the holding period deduction for the 15.5 percent social contributions component was changed to 1.65 percent per year from year 6 to year 21, 1.6 percent for year 22, and 9 percent per year for years 23 to 30, maintaining the thirty year duration required for a full exemption.
29 The additional “exceptional deduction” of 25 percent off the ACG applied to sales made from September 1st, 2013 to August 31st, 2014, and reduced both the income tax and the social contributions by this factor.
More generous λ Surtax introduced Rate τ increased
Less generous λ Rate τ increased Rate τ increased

0 5000 10000 15000
Number of transactions
01jan2011 01jan2012 01jan2013 01jan2014
Number of transactions by day

Figure 6: Daily housing sales, 2010-2014 Daily number of housing sales in France. Dotted vertical lines represent modifications of the capital gains tax schedule, on January 1st, 2011 (rate increase); October 1st, 2011 (rate increase); February 1st, 2012 (holding period exemption made less generous); July 1st, 2012 (rate increase); January 1st, 2013 (progressive surtax introduced); and September 1st, 2013 (holding period exemption made more generous).

The behavior of sales of real estate property in the period immediately surrounding the February 2012 reform, provides suggestive aggregate evidence of its impact. The timing of sales fluctuations closely follows expected tax burdens. Between the policy announcement, in August 2011, and its actual vote, at the end of September 2011, sales dropped, since the policy was widely thought to apply from the announcement date (see section 1). After the September 2011 parliamentary vote clarified that the reform would only be implemented for sales made after February 1st, 2012, a substantial spike in nationwide sales is observed, peaking in January 2012, consistent with the hypothesis that forward-looking sellers anticipated sales in order to benefit from the existing regime while still eligible. Finally, sales show an immediate and durable downwards break from trend after the policy starting date, in February 2012. The total value of monthly transactions drops sharply, by roughly 25%, relative to the earlier time period, and stayed low throughout the subsequent years, an aggregate pattern of transaction volumes suggestive of a large lock-in effect of the HCGT reform on housing sales. The magnitude of these swings in transaction volumes is economically large: the difference between the January 2012 peak and the February 2012 trough corresponds to c. EUR 15 billion. Nevertheless, seasonal fluctuations, and simultaneous aggregate shocks to housing demand (changing refinancing rates, variation in borrowing constraints, regulatory reforms, and income shocks due to the euro area crisis) or supply (evolving construction rules, the targeted implementation of rent controls, or tax subsidies to new housing supply) may have occurred concurrently and could have triggered the observed dynamics. To causally quantify the short- and medium-run capital gain realization elasticity, I avail myself in the main text of legal aspects of the HCGT reform.

30 The policy was announced on August 24th, 2011, and was initially due to apply to all sales, starting immediately. The September 20th, 2011 vote stated that the amended policy would apply only to sales realized on or after February 1st, 2012, and not retroactively.

31 For scale purposes, this represents c. 0.75 percent of French Gross Domestic Product.
reform that created sharp distinction in tax burdens across comparable units and over time.

As a second piece of evidence, the overhaul of the holding period exemption drew considerable attention from the public. Figure 7 plots Google Trends’ index of searches for “housing capital gains” ("plus-value immobilière") in France. It suggests that discussions of the reform were salient for French taxpayers and homeowners. There was a sharp rise in searches for the topic, of c. five times the usual search volume, with a differential spike starting in August 2011 – when the announcement was made, and ending after February 2012, when the new tax schedule was implemented.32.

![Figure 7: Google searches for housing capital gain](image)

**Figure 7: Google searches for housing capital gain** The figure plots the Google Trends publicly available index of monthly searches for “housing capital gains” (plus-values immobilières) in France. The index is normalized to 100 for its maximal value over the period. The dotted line represents the August 2011 policy announcement for the capital gains tax reform by Prime Minister Francois Fillon; the dashed line is the implementation of the policy in January 2012.

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32Hoopes, Reck, and Slemrod (2015) show in the United States that search volumes evidenced by Google Trends are an accurate proxy of taxpayer search for information; they also show that these volumes exhibit sharp spikes around major tax reform announcements and implementation starting dates, in addition to regular seasonality around tax filing periods.
Local housing markets effects

In the main text, I focus on the different tax treatment of homes with unequal holding periods, and its impact on unit-level inwards shifts of the supply curve. While this framework allows me to uncover the impact on transactions of more affected dwellings, an alternative question of interest, however, is the local housing market incidence of the capital gains tax. I identify the market-level impact of higher housing capital gains tax rates by exploiting the differential treatment of non-owner occupied homes, relying on variation in the share of non-primary residences across local housing markets at the granular municipality level, to proxy for pre-reform exposure.

I define my main measure of exposure at the local housing market level as the share $s_{c,0} = \frac{\text{Affected units}}{\text{Total units}}$ of second homes, rental property, and vacant dwellings in total housing units, as of January 1st, 2012,33, in a locality $c$, obtained from the Census and Housing survey.

In this methodology, the identification assumption states that any non-tax, time-varying determinants of local housing market outcomes around the policy period (conditional on controls and location fixed effects) are uncorrelated with the local share of homes subject to the policy change. Any post-announcement differential dynamics are triggered by the higher exposure of these regions to the increased capital gains tax. Under that assumption, the vector of estimates for parameters of interest $\hat{\beta}_j$ (scaled by the exposure measure) correspond to the causal impact of the change in tax rates on the probability that a treated home is sold. I evidence strikingly parallel high-frequency trends before the reform between more and less treated locations, suggesting that differences in dynamics in the period immediately surrounding the reform are not driven by other unobserved local trends correlated with the exposure measure (i.e. the initial share of treated dwellings.)

The destination of homes (rental property, second homes, vacant, or owner-occupied housing) is not predetermined and can change overtime. The measure is conceptually akin to a pre-policy exposure design, similar to Berger, Turner, and Zwick (2020), who study the impact of the First-Time Homebuyer Credit in the US, by analyzing the differential dynamics of sales in ZIP codes with a larger historical share of first-time homebuyers prior to the policy, arguing that specific amenities and features of these neighbourhoods make them properly suited for a specific segment of buyers in the housing market. In results available on demand, I verify that the results are robust to alternative definitions of the share of treated homes (e.g. using only second homes), and to a strategy instrumenting the share of treated homes by an index of natural amenities (distance to the sea, average temperature) and touristic appeal (number of hotel rooms per inhabitant) proxying for the likelihood that homes in a location are second homes rather than owner-occupied residences.

33In robustness checks, I also use the share $\tilde{s}_{c,0}$ as of January 1st, 2007, as well as only the share $s_{c,0}^{\text{second}}$ of second homes; all three measures are highly correlated and make no qualitative difference to the results.
Figure 8: **Value of housing sales in high- and low- secondary residence share provinces** Monthly tax basis (total value) of housing sales for existing homes for the top and bottom deciles of *departements* ranked by the share of secondary residences. The total value of sales is normalized to equal one for the average monthly sales in the period from January 2006 to January 2009. Vertical lines correspond to the same events as Figure 2.

I aggregate France’s c. 36,000 municipalities into deciles of exposure (re-weighted to have equal population). I compute the number of transactions in each decile of exposure at monthly frequency. Figure 8 provides evidence of a differential effect of the policy at the province level, depending on initial exposure. It compares the number of monthly transactions in two groups of locations. The first category is comprised of the top decile of municipalities, when ranked by the share of non-owner-occupied homes; the second group to the bottom decile. Sales counts are normalized so that the January 2010-July 2011 average count of monthly transactions is indexed to one in each group. As in the main identification strategy, the figure visually evidences a substantial anticipation effect in more affected cities, with a sharper time bunching of sales before the policy starting date; and a more pronounced drop in sales after the start of the policy in the locations with the largest share of treated homes.