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**Timothy Besley, Neil Meads, Paolo Surico**

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# The Incidence of Transaction Taxes: Evidence from a Stamp Duty Holiday*

Timothy Besley
*London School of Economics*

Neil Meads
*Bank of England*

Paolo Surico
*London Business School and CEPR*

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**Abstract**

This paper exploits the 2008-09 stamp duty holiday in the United Kingdom to estimate the incidence of a transaction tax on housing. We find that there was an average reduction in the post-tax sale price of around £900, out of an average tax reduction of about £1500. Under the new tax regime, the increase in transactions of properties affected by the stamp duty holiday was about 8%, though most of this effect was rapidly reversed after the policy was withdrawn. We calibrate these findings to a bargaining model and show this implies that about *sixty percent* of the surplus generated by the holiday accrued to buyers. Using this model, we also estimate an upper bound for the deadweight loss of the tax at around 4% of the revenue raised.

JEL classification: H22, R32.
Keywords: tax holiday, surplus incidence, surveyor's evaluation.

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# 1 Introduction

Transactions taxes, especially on real estate, are an important source of government revenues. A wide range of countries levy such taxes on property and proposals abound to extend their domain to a range of financial transactions.[1] One key question is who ends up paying it, the classical incidence question.[2] Although the tax is remitted by the buyer, we would expect it to be a part of the negotiation over the price.[3] In practice, the bargaining protocols associated with bargaining over real estate in this context are complex – see, for example, Merlo and Ortalo-Magne (2004). Following the extensive experimental literature on bargaining and experiments, see for example Roth (1995), we would expect some kind of surplus sharing. Indeed ultimatum games frequently lead to surplus sharing, especially among inexperienced bargainers.[4]

Another important issue is how the tax affects transactions as this determines the inefficiency created by the tax. While there is a sizeable literature on standard property taxes levied on owners or tenants, see for example Zodrow (2001), relatively little but growing attention has been paid to the incidence of transactions taxes on property.

As a form of taxation, stamp duties have a long history in the United

[1] The U.K. is not unusual in taxing property transactions. Such taxes exist in Australia, Denmark, France, Germany, the Netherlands, Japan and the U.S. (see for instance Oxley and Haffner, 2010). In the latter, taxes vary by state (see Federation of Tax Administrators, 2006).

[2] See Kotlikoff and Summers (1987) for a summary of the older tax incidence literature.

[3] Some U.S. states appear to have developed conventions on this, assigning tax payments fifty-fifty to buyers and sellers but this does not imply that this is the final incidence as buyers and sellers can still bargain in the shadow of this rule.

[4] In a wide-ranging meta-study, Engel (2011) finds that on average individuals give a little over 40% in the classic ultimatum game using a sample of over 600 laboratory studies.

Kingdom. Originally they were applied to transactions of vellum, parchment and paper in 1694 to pay for the war with France. Success saw the extension of items liable for stamp duty (despite the role of the 1765 Stamp Act in the movement for U.S. Independence) with housing transactions incorporated by 1808. Today Stamp Duty Land Tax (SDLT) is charged on land and property transactions in the United Kingdom with a varying rate and band structure related to the nominal value of those transactions. Stamp duties are also applied to transfers of shares in U.K. listed corporations.

This paper exploits a tax holiday in the UK to estimate both price and transaction effects of stamp duty. The tax holiday was granted in partial response to the global down turn in 2008. It cut stamp duty for a particular range of transactions prices as detailed below. It was worth approximately £1500 on the median transaction to which it applied. We use the stamp duty holiday to construct treatment and control groups by using two facts. First, the tax change was announced on the day immediately before its introduction, making its timing largely unanticipated.[5] Second, for a significant fraction of our dataset, we observe an independent valuation of the house by an approved mortgage surveyor which is demanded by lenders as a condition of granting a mortgage. This valuation reflects the resale value of the property in the event of default and we would not expect it to reflect the holiday: resale after default would almost certainly occur, if at all, after the tax holiday had ended. Thus, this independent valuation can be used to assign a property to the treatment group.

We estimate the average reduction in the post tax price of a house trans-

[5]Political leaks and media speculation may have led to some form of anticipation for which we control using an independent database on media citations among the most widely circulated British newspapers. We come back to this issue in section two.

acted during the holiday window to be around £900 and we show that this finding is robust to a variety of specifications and robustness checks. We also find that housing transactions in the relevant price window increased by around 8%. But this effect is estimated to be insignificant if we exclude the months immediately before and after the holiday end, thereby suggesting that the significant rise in purchases during the window was -at least partially- compensated by a significant fall afterwards. This suggests that most of the effect on volumes was due to a change in the timing of transactions.

To give these effects an economic interpretation, we present a simple bargaining model of house price determination. This allows us to decompose the effect of the tax holiday into a term which reflects the distribution of bargaining power between buyers and sellers and a selection term reflecting the fact that the tax affects which transactions take place during the tax holiday. We show how our estimated effects can be used to identify these components separately. This is because bargaining power does not affect whether a transaction happens. We find that buyers were able, on average, to capture about *sixty percent* of the tax saving during the holiday window. The model can also be used to give a back of the envelope sense of the welfare cost of raising revenues via levying stamp duty on housing transactions.

**Selected literature review.** A young but rapidly growing literature has looked at the effects of tax changes on housing transactions across geographical regions, over time and at different points of the sale price distribution. Van Ommeren and Van Leuvensteijn (2005) study the impact of transaction taxes in the Netherlands on residential mobility. Dachis, Duranton and Turner (2012) use a regression discontinuity design to identify the effects of Toronto's imposition of a Land Transfer Tax on the timing and

location of real estate purchases in early 2008. They estimate that the 1.1% tax generated a 15% decline in transaction volumes in the Toronto area, a decline in sale prices about equal to the tax and a welfare loss of about $1 for every $8 in tax revenue.

Another stream of research analyse the distortions on the house price distribution introduced by different aspects of the tax system in the United States and United Kingdom. Slemrod, Weber and Shan (2012) report evidence of manipulative sorting around the price notch, but not around the time notch, generated by a reform in Washington D.C. on residential real estate transfer taxes. Kopczuk and Munroe (2013) study the incidence of a tax on houses transacted above $1 million in the states of New York and New Jersey. Exploiting the discontinuity on the overall tax liability associated with the so-called 1% 'mansion tax' and the consequential bunching of transactions just below that threshold, they find that most of the surplus generated by the tax accrues to sellers. While sharing the emphasis on tax incidence, we look at a rather different segment of the market, namely houses transacted in the range £125,000-£175,000 and rely on a tax holiday as source of exogenous variation.

The paper most closely related to our analysis is Best and Kleven (2013) who exploit several discontinuities in the U.K. stamp duty system of tax liability to estimate the impact of a fiscal stimulus in the housing market on the aggregate economy. Using the universe of transactions available from the Land Registry office, they provide strong evidence of bunching just below the thresholds that trigger a higher rate on the whole sale price and estimate significant, but short-lived, effects of the 2008-09 tax holiday on real activity. Our analysis, in contrast, focuses on the incidence of the surplus generated by

the tax holiday (and the associated welfare gain) using an empirical strategy that, while controlling for notches and missing transactions in the distribution of sale prices, is based on surveyor's valuations.

# 2 Data and policy design

We use a dataset on mortgage transactions from the main financial regulator in the UK, the formerly Financial Services Authority (FSA), now Prudential Regulation Authority (PRA). It is compiled from mortgage lenders' returns which are submitted to the FSA/PRA for regulatory purposes. The dataset includes characteristics of the mortgage loan at origination such as the loan size, the date at which the mortgage is issued, the purchase price of mortgaged property and, for significant portion of the transactions, an independent surveyor valuation of the property. It also includes borrower characteristics such as the age of the main borrower, the total household income on which the mortgage advance is based, the previous tenure of the household. We also know the region in which the house was purchased.

## 2.1 The 2008-09 stamp duty holiday

Following the onset of the global financial crisis in 2007-08, activity in the U.K. housing market and the economy more broadly slowed sharply. By the summer of 2008 economic surveys suggested that the economy would suffer a second successive quarter of falling output in 2008 Q3, entering a recession. In the residential housing market, house prices had declined by around 4% in 2008 Q2, and were around 9% down on a year earlier. As shown in Figure 1, indicators of activity had also declined substantially with the number of loan approvals falling by 70 in the year to June 2008.

The U.K. government decided to try to stimulate the housing market by cutting stamp duty land tax (SDLT) on housing transactions for lower value transactions. Figure 2 charts media speculation on the topic which reached fever pitch in late summer just before the government announced a change on $2^{nd}$ September 2008.

SDLT works on a 'slab' - band and varying rate structure - basis. The SDLT rate for the band within which a transaction value falls is imposed on the buyer and applies to the entire purchase price, including elements within lower bands.[6] With the marginal rate of SDLT applying to the entire purchase, discontinuities are generated around the thresholds to each band in the UK tax system. In the full FSA/PRA sample, around 25% of property transactions are between $£125,000$, the lower threshold above which SDLT was liable prior to $3^{rd}$ September 2008 and after $31^{st}$ December 2009, and $£175,000$, the lower threshold during the holiday period.

On $2^{nd}$ September 2008, the UK government announced a tax holiday, raising the lower threshold for SDLT liability from $£125,000$ to $£175,000$ with immediate effect: i.e. for transactions on or after $3^{rd}$ September 2008 and lasting until $3^{rd}$ September 2009. In the government 2009 budget (announced in April 2009), the holiday was extended to transactions completed before $31^{st}$ December 2009, and it was confirmed that the lower threshold would revert back to $£125,000$ from $1^{st}$ January 2010.[7] The tax relief offered

[6] The gap between taxes owned and taxes paid to Her Majesty Revenue and Customs (HMRC) on housing transactions is about 4-5% of the true tax liability, a value lower than the estimates for other UK taxes (Best and Kleven, 2013). This suggests that tax evasion is likely to be limited in this market.

[7] In the government March 2010 budget, the lower threshold for first time buyers was lifted to $£250,000$ until $24^{th}$ March 2012. To control for policy as well as non-policy factors affecting this segment of the market, we will add a dummy for first-time buyers in all specifications. The results below are robust to ending our sample in March 2010.

was 1% of the total purchase price. All higher SDLT rates and bands were left unchanged.[8]

Figures 1 and 3 suggest that the SDLT policy intervention may have had some success in boosting housing market activity during the holiday window (grey area) as well as in breaking the downward trend in UK house prices observed prior to its introduction. A formal econometric analysis, however, requires isolating the unanticipated effect of the tax change as well as controlling for macroeconomic conditions and regional developments. To this end, we will use, in section four, a simple theoretical framework to interpret the estimates of section three. The goal is to identify who benefited most from the 2008 stamp duty holiday as well as evaluate the impact of this policy change on housing market activity.

For the period that concerns us, the raw data covers over 1.1 million transactions for house purchases starting in March 2008 and finishing at the end of June 2010. This time span captures all transactions six months either side of the stamp duty holiday period. We choose a period of six months prior to the holiday window to minimize the impact of changes in the macroeconomic environment as well as to keep households in the treatment and control groups relatively homogeneous. Furthermore, we will augment our empirical specifications with household-specific demographics and macroeconomic variables as controls to assess the robustness of our findings.

The sample is restricted to observations where the mortgage is defined as being for house purchase, and where there is both a purchase price and

[8] As of 2013, there are six tax bands in the UK stamp duty system: (i) no tax liability for properties with sale price below £125,000, (ii) 1% between £125,000 and £249,999, (iii) 3% between £250,000 and £499,999, (iv) 4% between £500,000 and £999,999, (v) 5% between £1,000,000 and £1,999,999 and (vi) 7% above £2,000,000. As the relevant rate applies to the whole transaction price, the system implies that the tax liability changes discontinuously at each of the six sale price thresholds.

a surveyor price indicated. For the purposes of assessing the incidence of the stamp duty, we focus on purchasers whose houses were associated with a surveyor's valuation between £125,000 and £174,999. More specifically, we will compare the change in their post-tax transactions price associated with the SDLT holiday to the change in the transaction price for two groups which, according to the surveyor's valuation, are either in the £100,000-£124,999 or in the £175,000-£200,000 tax bracket throughout our sample, and therefore did not benefit from the tax holiday. By using the surveyor's valuation, we avoid selecting on our endogenous variable, the transaction price. By looking also at transactions in the segments of the housing market with sale prices immediately above and below the price range targeted by the fiscal intervention, we are able to control for seasonal and common factors that are likely to affect transactions on a range of relatively similar properties, at least as measured by their surveyor's valuation. These will naturally lead to a difference-in-difference interpretation of the estimates presented in this paper.

## 2.2 Summary Statistics

Our full sample spans the period March 2008 to June 2010, which will be further split into the holiday period, from $3^{rd}$ September 2008 to $31^{st}$ December 2009, and the non-holiday periods, from $1^{st}$ March 2008 to $2^{nd}$ September 2008 and $1^{st}$ January 2010 to $30^{th}$ June 2010. We focus on three groups of transacted houses with surveyor's valuation: (i) in the range [£100,000, £125,000), (ii) in the range [£125,000, £175,000) and (iii) in the range [£175,000, £200,000].

To minimize the impact of outliers, we also exclude transactions with

post-tax purchase price outside the range £100,000-£200,000 as well as transactions in the top 0.1 percentile of the distribution of percentage deviation between surveyor's valuation and purchase price.[9] Altogether, these restrictions give us a sample size of around 315,000 observations, which are summarized in Table 1 according to whether each of the three groups is observed during or outside the holiday period.

A number of interesting features emerges from the descriptive statistics in Table 1. First, there seems to be little systematic variation in the mean and standard deviation of surveyor's valuations in each group across the two periods. This is consistent with the idea that surveyors were ignoring the short term impact of the stamp duty holiday on transactions prices since, in the event of default, it would almost certainly be the case that the house would be sold beyond the stamp duty holiday window.

Second, in all groups, the average surveyor's valuation is very close to the average pre-tax purchase price. This result, however, may be driven from the fact that only in one quarter of the sample observations the surveyor's valuation differs from the purchase price. In Figure 4, we report the distribution of the difference between surveyor and purchase prices as a percentage of the purchase price outside of (top panel) and during (bottom panel) the holiday period, only for those transactions in which the two differ. For more than 80% of the distribution, surveyor valuations appear evenly distributed in the 10% neighborhood around the purchase price.

Third, the post-tax purchase price for transactions in the range [£125,000,

[9] The latter restriction drops further 315 observations with a surveyor's evaluation at least 50% higher than the purchase price and thus more likely to reflect special purchase conditions (if not measurement errors) and other non-policy factors that are outside the focus of this paper. Interestingly, we do not observe this type of outliers at the bottom of the distribution, which gives further weight to the special factors interpretation relative to measurement errors.

£175,000) occurred during the holiday period is, on average, about £550 *lower* than the average post-tax purchase price for the same group of transactions which occurred six months either way of the new policy regime. On the other hand, the average pre-tax purchase price for this group during the holiday period is about £300 *higher* than the average pre-tax price paid outside the holiday.

Fourth, in contrast to transactions with surveyor's valuations in the range [£125,000, £175,000), during the policy intervention the other two groups witnessed a joint drop of similar size for the average pre-tax and post-tax sale prices of about £500 (top panel) and £700 (bottom panel) respectively. Fifth, in all groups there seems to be sufficient variation in post-tax purchase price, whose conditional means are the focus of our empirical analysis.

Sixth, during the stamp duty holiday, the volume of house transactions per month in the range [£125,000, £175,000) increased, on average, by about 100 units at the regional level, corresponding to a 14% rise relative to the non-holiday period. This contrasts with the other two groups which experienced no significant increase over the policy intervention period. Using Figure 3, we can see that this corresponded to a 10% surge of the entire market (i.e. irrespective of the surveyor price). Our dataset is supplemented by a set of monthly macroeconomic data that will serve to control for regional conditions.

## 2.3 Bunching

A key feature of stamp duty is that it creates a notch in the tax schedule. A number of recent contributions including Slemrod, Weber and Shan (2012), Kopczuk and Munroe (2013) and Best and Kleven (2013) show that the dis-

continuity imposed by the type of housing transaction tax changes considered in this paper generate (i) a notch in the sale distribution immediately before the thresholds that trigger an higher rate on the whole transaction price and (ii) a hole of missing transactions immediately after that. Indeed, Kopczuk and Munroe (2013) show on U.S. data that this bunching effect can extend into the sale price distribution as far as 10% of the threshold value.

In this section, we develop an analysis similar to Best and Kleven (2013) to show a similar pattern in our data. Figure 5 displays the density of property transactions occurred between £100,000 and £200,000 per each month of the holiday period and the two months either before or after that. These are evaluated at either the transaction price (solid red line) or the surveyor valuation (dashed blue line). While the two series tend to follow similar patterns over time and across distributions, they also tend to diverge occasionally, suggesting that surveyor valuations provide some independent information relative to transaction prices. On the other hand, the distributions of surveyor's valuations also display some form of bunching around the £125,000 threshold in the two months either side of the September 2008 start of the holiday as well as around the £175,000 threshold in the months immediately before the December 2009 end. Furthermore, the first two months after the holiday end in the bottom right corner of Figure 5 reveal a swift move of bunching from the just-below £175,000 notch associated with the old sale price threshold to the just-below £125,000 notch associated with the new sale price threshold. Interestingly, both towards the end of the holiday period and then immediately afterward in January 2010 there is also evidence of a hole, namely a drop in transactions immediately above the relevant threshold in the sale price distribution.

In the context of our analysis, bunching represents a serious concern as it may contaminate the composition of the treatment and control groups. To deal with this, we follow two incrementally conservative strategies. First, we restrict our sample only to transactions that did not occur in the £10,000 neighborhood of either the £125,000 or £175,000 thresholds. In other words, our baseline specifications run on three groups of transactions in the range: (i) [£100,000, £115,000), (ii) [£135,000, £165,000) and (iii) [£185,000, £200,000]. Second, we supplement the results from this baseline dataset with further restricted versions which additively remove the pairs of months for which we observe below-threshold bunching in line with the evidence in Figure 5. The latter strategy will guard against the possibility that bunching extended further than £10,000 from the threshold value into the sale price distribution.

# 3 Estimating the effect of a tax holiday

We now present the core results of the paper which estimate the impact of the stamp-duty holiday on prices and transactions. We begin with a sparse core specification to which we add sequentially national and regional characteristics to control for business cycle developments. We also assess the extent of any possible time-variation in the average effect of the stamp duty holiday on transaction prices and volumes.

## 3.1 Transaction prices

We consider the impact of the stamp duty holiday on the post-tax purchase price for transaction $i$ in month $s$ denoted by $P_{is}$, where $s$ incudes all months from March 2008 to June 2010 and $i$ incudes any transaction whose surveyor's

valuation lies in one of the three ranges [£100,000, £115,000), [£135,000, £165,000) or [£185,000, £200,000]. Fixed-effects for each price bracket are captured by two dummies for the first two ranges which we denote as $G_{js} \equiv \{G_{1s}, G_{2s}\}$. A common holiday period effect is absorbed by a dummy, $H_t$, which takes value of one if month $s$ belongs to the holiday period, $t$, from September 2008 to December 2009, and zero otherwise. The treatment dummy variable is the interaction between the dummy for the holiday period and the dummy for the transaction group with surveyor valuations in the range [£135,000, £165,000).

We use a difference-in-difference approach which compares the change in the transaction price due to the holiday period (relative to the non-holiday period) for the treatment group with the change in transaction prices for two other groups where surveyor valuations are close to (above or below) the range of sale prices targeted by the policy intervention. Specifically, we use as control groups properties priced in the [£100,000, £125,000) and [£175,000, £200,000] ranges where there was no tax change between March 2008 and June 2010. The identifying assumption is that these property price ranges faced similar economic shocks to those in the treatment range over the period in question.

To estimate the average price effect, we run different versions of the following basic regression:

$$\ln P_{is} = \beta_0 + \beta_1 * treatment_{ih} + \beta_2 G_{js} + \beta_3 H_t + \beta_4 D_{is} + \beta_5 R_{rs} + \eta_{is} \quad (1)$$

where $D_{is}$ refers to household-specific demographic characteristics, such as log age, squared log age and a dummy for whether the transaction involved a first-time buyer. The vector of regional factors, $R_{rs} \equiv [HP_{rs}, U_{rs}, Z_r]$, includes house price inflation based on the Halifax House Price Index, $HP_{rs}$,

the claimant count unemployment rate, $U_{rs}$, and a full set of region-specific dummies, $Z_r$. Standard errors are adjusted for intra-regional correlation.

Column (1) in Table 2 presents estimates for the baseline specification where we do not include national or regional controls. We find that the 1% stamp-duty reduction associated with the holiday period lowered the post-tax price by 0.53%. According to our estimates, this translates into a sale price change on the average transaction of around minus £830, a value in line with the figures in Table 1. Column (2) replaces the holiday period dummy with a full set of month fixed-effects. Column (3) adds controls for regional factors. These specifications lead to similar estimates for both the elasticity $\beta_1$, now around *minus* 0.58%, and the implied nominal price change, now about *minus* £860. All of the estimates in columns (1) through (3) are statistically indistinguishable from one another.

The remaining columns in Table 2 are sensitivity checks based on various sub-samples of the specification in column (3). Housing transactions typically take some time to be completed, often with some element of uncertainty around the completion date for the transaction. But the existence of the holiday (or rumors of it) could have lead to transactions being speeded up or delayed. To address the possibility that this affects our results, we exclude from the sample the two months before and after the beginning of the holiday. Transactions two months before the holiday are excluded to clean our results of any possible anticipation effect. We then remove transactions two months after the announcement to make sure our estimates are not contaminated by housing contracts that were already agreed before September 2008 but were completed only afterwards. We refer to this as the 'anticipation' and 'completion' sub-samples. The choice of a two month window is based on

the following reasoning. First, searching the FACTIVA electronic database of daily U.K. newspapers with major circulation suggested some possible anticipation of the policy change: as shown in Figure 2, we found the phrase 'stamp duty holidays' reported 4 times in July and 80 times in August 2008. Second, it is common practice in the U.K. mortgage market to complete a housing market transaction within 90 days of contract exchange with the typical lag being below 60 days. This suggests that a large proportion of transactions observed in the first months of the holiday period may have been agreed before the policy change announcement.

Column (4) shows the results using the 'anticipation' restricted sample and finds a slightly higher point estimate of minus 0.66% or minus £1000. On the other hand, column (5) reveals a smaller effect when we exclude the first two months of the holiday window, suggesting that buyers benefitted most in transactions agreed before the policy intervention but completed afterwards. In column (6) and (7), we exclude observations in the two month window before ('end notch') and after ('end hole') the deadline of $31^{st}$ December 2009. While both specifications reveal some variation relative to the richest baseline specification in column (3), these differences are not statistically significant. Finally, in column (8), we exclude the two months either side of both the holiday start and the holiday end dates. These restrictions are meant to purge further our treatment and control groups by removing any residual bunching effect not fully captured by the £10,000 exclusion restrictions around the £125,000 and £175,000 thresholds. Reassuringly, the estimates in column (8) are in line with the rest of the results.

Taken together, these results suggest a robust negative effect of the stamp duty holiday on house prices with an average magnitude of around *minus*

£900 across all specifications. In section four, we will discuss how these coefficients can be interpreted through the lens of a simple bargaining model to provide an estimate of the tax incidence.

**Temporal heterogeneity.** We now look for evidence of time-variation in the effect of the tax change. In particular, we are interested in seeing whether the estimated price effect is influenced by strategic considerations as the tax holiday nears its end. To investigate this, we run a regression in which the dummy variable 'treatment' is replaced by a full set of interaction terms between the month fixed-effects during the holiday period and the group dummy for transactions with surveyor's valuation in the range [£135,000, £165,000). We also include interaction terms between the dummy for this group and the month fixed-effects outside the holiday period, but we have verified that our results are not sensitive to the inclusion of a single group-specific dummy for all non-holiday months.

The findings from this exercise are reported in Figure 6 in the form of horizontal lines spanning the 95% confidence band associated with the estimates of the monthly treatment effects. As we have already discussed, the first months of the holiday period are likely dominated by transactions whose purchase price was agreed prior to the government announcement but that were completed after the holiday began, thereby generating a windfall for the buyer. More generally, there is a slight tendency for the price effect to decline over time, especially towards the end of the holiday. But none of the monthly effects is statistically different from another, nor from the time-invariant price effect associated with the specification in column (3) and whose 95% confidence band is depicted by vertical red lines in Figure 6.

## 3.2 Transaction volumes

To examine the effect of the stamp-duty holiday on transactions volumes, we aggregate our data at the regional level, for each surveyor valuation bracket group and month. We then regress the log of the number of transactions $N_{rgs}$ in region $r$ for the surveyor valuation bracket group $g$ observed during month $s$ on the same type of dummies used in the price specification (1), including the interaction term between the dummy for the holiday period and the dummy for the transaction group with surveyor valuations in the range [£135,000, £165,000) for region $r$, which is denoted as $treatment_{rgs}$. We also include a full set of region-specific variables to yield:

$$\ln N_{rgs} = \gamma_{r0} + \gamma_1 * treatment_{rgh} + \gamma_2 G_{js} + \gamma_3 H_t + \beta_4 D_{rgs} + \gamma_5 Z_{rs} + \nu_{rs} \quad (2)$$

where $\gamma_2$ and $\gamma_3$ are vectors and $Z_{rs} \equiv [HP_{rs}, U_{rs}]$. The specification also include regional fixed effects, $\gamma_{r0}$. Standard errors are adjusted for intra-regional correlation.

The increase in housing transaction volumes associated with the SDLT holiday period is estimated to be, on average, around 8% per region in the most general specification with a full set of month fixed-effects in column (3) of Table 2. The estimates are slightly larger in the restricted samples that exclude the possibility of anticipation or completion effects. But the sharpest differences emerge in the last three columns. More specifically, the estimated elasticities in columns (6) and (7), associated with the restricted samples that drop either the two months before or after the 31 December 2009 deadline respectively, tend to be lower than in the previous columns. These restrictions are meant to evaluate the extent to which the activity boost generated by the housing fiscal stimulus was concentrated in the final months

of the holiday period and then swiftly reversed soon after the policy was withdrawn: the evidence suggests so. The latter finding becomes even more apparent in column (8) where the simultaneous exclusion of the two months either side of both holiday start and holiday end leads to an insignificant 2.6% volume increase. However, note that we also cannot reject the hypothesis that the effect in column (8) is the same as that in column (3).

**Temporal heterogeneity.** To investigate further the extent of time-variation in the volume effect, we run a regression that is similar to (2) but with the variable treatment being replaced by an interaction between month fixed-effects during the holiday period and the dummy for the group with surveyor valuations in the range £135,000 to £165,000. In keeping with the analysis for sale prices, we also include interaction terms between the monthly dummies for the non-holiday period and the dummy for the intermediate sale price group, though also here this is not crucial for our findings.

The results are displayed in Figure 7 and cover (in the same format of Figure 6) each holiday month. Unlike Figure 6, however, we also report January 2010 in Figure 7 since this is the first month after the stamp duty holiday was withdrawn.[10] Consistent with the findings in columns (6) and (7) of Table 2, December 2009 and January 2010 stand out as significant outliers, with elasticity point estimates of about +39% and −39% respectively. Moreover, November and December 2009 are the only two months characterized by significant volume effects within the holiday period. These findings suggest that the three months from November 2009 to January 2010 are the main drivers of the significant estimate of $\gamma_1$ in the time-invariant

[10] Unlike its volume counterpart, the estimated price effect for January 2010 is not statistically different from zero and therefore is not reported in Figure 6.

specification (2). The 95% confidence band for $\gamma_1$ based on column (3) of Table 2 are displayed as red vertical lines in Figure 7.

# 4 Interpretation and Welfare Analysis

The effects that we estimated above are reduced form impacts and it is unclear how to map them into anything of economic significance. In this section, we discuss how the reduced form results can be interpreted using a generalized Nash bargaining model. This approach suggests a natural way of estimating the welfare loss (excess burden) from the stamp duty.

While it might be tempting to infer the incidence of the stamp duty holiday directly from the estimates of equation (1), this is problematic. To see why, recall from Table 2 that housing transactions increased. And these are housing transactions that would not have taken place had the holiday not been in place. Thus, they are not a random sample of houses within the treatment window. This point emerges more clearly from the theoretical model that we present which also suggests a way of mapping the reduced form estimates in (1) and (2) into interpretable effects.

## 4.1 The Bargaining Model

Consider a world where a buyer and a seller are matched. The buyer's valuation of the seller's house is $V$. We denote the transaction price agreed by a buyer and seller as $p$. The stamp duty rate is $\tau \in \{0, t\}$. The seller's valuation of the house is $u$.

Suppose that buyer and seller bargain over the price and that the outcome is generated by a generalized Nash bargaining solution where $\alpha \in [0, 1]$ denotes the fraction of the net surplus that accrues to the buyer. Then, the

bargain struck will pick the price that maximizes:

$$W\left(p|\tau\right)=\left(V-\left(1+\tau\right)p\right)^{\alpha}\left(p-u\right)^{\left(1-\alpha\right)} \tag{3}$$

Maximizing (3) with respect to $p$ yields the following standard formula for the post-tax price:

$$P\equiv p\left(1+\tau\right)=\left(1-\alpha\right)V+\alpha u\left(1+\tau\right) \tag{4}$$

Now write the difference between buyer's and seller's valuation as

$$V-u=\varepsilon$$

This is a measure of the potential gain from trade, i.e. $\varepsilon$ is idiosyncratic variation which means that the buyer values the house more or less than the seller. Using this, (4) can be rewritten as:

$$P=u\left(1+\alpha\tau\right)+\left(1-\alpha\right)\varepsilon \tag{5}$$

We see from equation (5) that the tax term is multiplied by $\alpha$ which determines how far the tax increases the (gross) price.

Stamp duty prevents transactions that would otherwise be worthwhile from taking place. Trade takes place only if:

$$\varepsilon-u\tau>0 \tag{6}$$

i.e. the buyer values the house sufficiently more than the seller to overcome the need to pay a transaction cost in the form of a tax. Let $G\left(\cdot\right)$ be the distribution of $\varepsilon$ in the population of interest.

Now consider the impact of a tax holiday where we divide observations in the population of buyers and sellers into a treatment group, $T$, and a control group, $C$ where:

$$\tau=\begin{cases}0 & s\in T\\ t & s\in C\end{cases}$$

The effect on the price across the population of buyers and seller is

$$\begin{aligned} E\left(P:\tau=0\right)-E\left(P:\tau=t\right) &= \left[E\left\{u:\tau=0\right\}-E\left\{u:\tau=t\right\}\right] \\ &\quad -\alpha tE\left\{u:\tau=t\right\} \\ &\quad +\left(1-\alpha\right)\left\{E\left\{\varepsilon:\tau=0\right\}-E\left\{\varepsilon:\tau=t\right\}\right\} \end{aligned} \tag{7}$$

and the effect on transactions from tax holiday is given by

$$E\left\{G\left(ut\right)\right\}-G\left(0\right) \tag{8}$$

where expectations in both cases are taken with respect to $u$. Equations (7) and (8) are estimated in Table 2. An important observation is that only (7) depends on $\alpha$.

## 4.2 Calibration Method

The key assumption that allows us to make a structure interpretation of the coefficients is that:

**Assumption:** $E\left\{u|\tau=0\right\}=E\left\{u|\tau=t\right\}$

This says that sellers' valuations of houses available during the window do not change. This will allow us to attribute all changes in prices due to demand rather than supply side factors. Thus, the subsequent interpretation offered is only valid under this maintained hypothesis which can be thought of as an identifying assumption. Next observe that

$$\left\{E\left\{\varepsilon:\tau=0\right\}-E\left\{\varepsilon:\tau=t\right\}\right\}=E\left\{\int_{0}^{tu}\varepsilon dG\left(\varepsilon\right)\right\}$$

This reflects the fact that some transactions which were deterred by the stamp duty take place during the window. Our results on transactions

suggest that this term is positive and we can use the transactions coefficient to estimate the size of this effect.

We now have:

$$E\left(P:\tau=0\right)-E\left(P:\tau=t\right)=-t\alpha E\left\{u\right\}+\left(1-\alpha\right)E\left\{\int_{0}^{tu}\varepsilon dG\left(\varepsilon\right)\right\}. \quad (9)$$

The first term reflects surplus sharing and the second is the selection effect due to additional transactions taking place during the holiday period. To explain our method, we take the point estimate of (9) from column (3) of Table 2, *minus* 859, and use it as our benchmark. But we will also assess the robustness of the findings to looking across the 95% confidence intervals for these coefficients.

## 4.3 Bargaining Power

To estimate $\alpha$, we need to measure the second term in (9). We will do this by assuming that the distribution of the idiosyncratic valuation, $\varepsilon$, is normal with standard deviation $\sigma$. In this case:

$$E\left\{\int_{0}^{tu}\varepsilon\frac{dG\left(\varepsilon\right)}{G\left(tu\right)-G\left(0\right)}\right\}=\sigma E\left\{\frac{\phi\left(0\right)-\phi\left(\frac{tu}{\sigma}\right)}{\Phi\left(\frac{tu}{\sigma}\right)-\Phi\left(0\right)}\right\}$$

We can estimate $\sigma$ by evaluating this at the mean of $u$ and using (8). Observe then that from the most general specification in column 3 of Panel B in Table 2 with month fixed-effects, we have that:

$$\Phi\left(\frac{t\bar{u}}{\sigma}\right)-\Phi\left(0\right)=0.084$$

where $\bar{u}=E\left\{u\right\}$ is estimated as the average of the independent surveyor's valuation ($£149,197$) during the holiday period. This yields an estimate of

$$\sigma=\frac{t\bar{u}}{\Phi^{-1}\left(0.084+\Phi\left(0\right)\right)}=\frac{1492}{0.211}\cong 7077$$

It is then straightforward to compute the point estimate of the selection term in (9) as:

$$E\left\{\int_0^{tu} \varepsilon dG\left(\varepsilon\right)\right\} = 7077 \times 0.0088 \cong 62 \tag{10}$$

with the 95% confidence set ranging from £37 to £220.[11] Using the value in (10), our estimate of the average bargaining power of the buyer is then:

$$\hat{\alpha} = \frac{859 + 62}{1492 + 62} \cong 59.3\%$$

Moreover, the surplus share appears precisely estimated with a standard error of 11.1%. This says that the buyer captures close to two thirds of the value of the tax holiday, on average, after adjusting for the "selection" effect. We repeat this exercise for the whole range of estimated values in Panels A and B and report the outcomes in Panel C of Table 2. The point estimates of the share being captured by the buyer range from 55% to 68%. However, they are not statistically different from one another suggesting that an estimate $\alpha$ of around 60% is a reasonable interpretation of the results.

## 4.4 Welfare Effects

The bargaining model also allows us to estimate a back-of-envelope welfare cost associated with the stamp duty. To do this observe that total welfare of those who own or buy houses aggregated across the population is

$$W\left(t\right) = \bar{u} + \int_{\bar{u}\tau}^{\bar{\varepsilon}} \left[\varepsilon - tp\left(t\right)\right] dG\left(\varepsilon\right)$$

[11] In the 95% confidence interval, the estimates of $\sigma$ range from $\frac{1492}{0.36} = 4155$ to $\frac{1942}{0.06} = 25046$ and the estimated selection term $E\left\{\int_0^{\tau u} \varepsilon dG\left(\varepsilon\right)\right\}$ from $4155 \times 0.0088 = 37$ to $25046 \times 0.0088 = 220$.

where $p(t)$ solves (4) and $\bar{\varepsilon}$ is the highest individual valuation in the 1% tax bracket. The revenue raised is:

$$R(\tau) = \tau p(\tau) \left[ G(\bar{\varepsilon}) - G(\bar{u}\tau) \right].$$

Then define the cost of public funds, $\lambda$, associated with a stamp duty rate of $t$ from:

$$W(t) + \lambda R(t) - W(0) = 0$$

i.e. the shadow value of public spending that would be needed to justify levying a tax rate of $t$. In our case where $t = 1\%$, we have that

$$\lambda = 1 + \frac{\int_0^{\bar{u}t} \varepsilon dG(\varepsilon)}{R(t)} = 1 + \frac{62}{1492} \cong 1.04$$

So for every pound of tax revenue raised, there is a 4% welfare loss.[12] The range of estimates in the 95% confidence bands for the coefficient $\lambda$ is 1.02% to 1.15%.

For the purposes of this exercise, we have used the transaction effect from Table 2 column (3). But the fact that there is a large fall in transaction volumes post-holiday (Figure 7) may suggest that this short-run transactions effect may be an upper bound for considering the long-run deadweight loss. However, it would also be premature to conclude that a long-run elasticity of zero constitutes a more reasonable estimate given the amount of noise that the end of the window could bring to the timing of transactions. The main story should be that even the short-run effects that we estimate suggest a rather low elasticity and hence deadweight loss associated with the stamp duty. And recent efforts by the UK government to significantly increase

[12] Of course, we have only estimated the loss associated with the lowest stamp duty band and the effect could be larger or smaller for higher bands.

stamp duty rates on high value properties certainly seem predicated on such beliefs.[13]

# 5 Conclusions

This paper has looked at the incidence of a housing transaction tax in the U.K. exploiting the fact that the government offered a temporary unanticipated tax holiday to a particular segment of the market. With access to both the transactions price and the value of the house as reported by an independent valuer, we are able to construct a natural treatment group to identify the effect of the holiday.

The results provide consistent evidence that a reasonable account of the tax incidence is that the "surplus" created by the tax holiday accrued, on average, for about *sixty percent* to the buyers. We also found evidence that activity was boosted during the tax holiday window with a significant, though short-lived, increase of some 8% in transaction volumes for houses affected by the policy intervention.

While the context of our study is specific, it provides a benchmark study for other cases where transactions taxes are in place. As with any tax, there is a question of how far it deters transactions. The evidence from the stamp duty holiday in the UK finds a sizeable behavioral response in prices and quantities. This gives food for thought in debates to extend the domain of transactions taxes into other areas, not least in the area of financial transactions.

[13] The estimated transaction volume elasticities and hence welfare costs are a good deal lower than those in Dachis, Duranton and Turner (2012). This makes sense for cases where –like in their paper– the decision being studied is the choice of residential location as a function of taxes.

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Table 1: Descriptive statistics

| | MEAN | | STANDARD DEVIATION | |
|---|---|---|---|---|
| | 6 months before/after | holiday period | 6 months before/after | holiday period |
| PANEL A: £175,000≤SURVEYOR PRICE≤£200,000 | | | | |
| *surveyor price £* | 186,976 | 186,456 | 9,020 | 8,557 |
| *purchase price (pre-tax) £* | 186,680 | 186,175 | 8,955 | 9,359 |
| *purchase price (post-tax) £* | 188,385 | 187,990 | 9,070 | 9,556 |
| *monthly transactions per region* | 405 | 418 | 293 | 333 |
| observations: 35,451 (6m before/after); 41,629 (holiday period) | | | | |
| PANEL B: £125,000≤SURVEYOR PRICE<£175,000 | | | | |
| *surveyor price £* | 149,044 | 149,197 | 14,500 | 14,627 |
| *purchase price (pre-tax) £* | 149,032 | 149,337 | 15,110 | 15,174 |
| *purchase price (post-tax) £* | 149,892 | 149,357 | 15,569 | 15,216 |
| *monthly transactions per region* | 674 | 770 | 350 | 537 |
| observations: 72,570 (6m before/after); 98,274 (holiday period) | | | | |
| PANEL C: £100,000≤SURVEYOR PRICE<£125,000 | | | | |
| *surveyor price £* | 113,415 | 112,624 | 7,281 | 7,192 |
| *purchase price (pre-tax) £* | 113,672 | 112,982 | 7,825 | 7,819 |
| *purchase price (post-tax) £* | 113,680 | 112,982 | 7,852 | 7,822 |
| *monthly transactions per region* | 282 | 239 | 125 | 84 |
| observations: 30,281 (6m before/after); 37,459 (holiday period) | | | | |

Note: the holiday raised temporarily the lower threshold for the stamp duty tax liability from £125,000 to £175,000 on houses transacted between September 2008 and December 2009. The tax rate at/above the lower threshold stayed at 1% throughout.

Table 2: Estimates of the average price effect, average volume effect and surplus share

| column | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| specification | *baseline* | *macro* | *regional* | *anticipation* | *completion* | *end notch* | *end hole* | *bunching* |
| | | | | PANEL A: AVERAGE PRICE EFFECT (%) | | | | |
| *coefficient* $\beta_1$ | -0.56** | -0.57** | -0.58** | -0.66** | -0.55** | -0.61** | -0.55** | -0.64** |
| (s.e.) | (0.12) | (0.12) | (0.12) | (0.11) | (0.13) | (0.13) | (0.12) | (0.14) |
| *pound change* | -832.2** | -850.9** | -859.0** | -987.8** | -813.6** | -910.8** | -813.4** | -957.0** |
| (s.e.) | (179) | (176) | (172) | (167) | (173) | (192) | (181) | (202) |
| $R^2$ | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| obs | 181,675 | 181,675 | 181,675 | 168,323 | 170,362 | 163,879 | 173,281 | 130,820 |
| | | | | PANEL B: AVERAGE VOLUME EFFECT (%) | | | | |
| *coefficient* $\gamma_1$ | 6.17** | 8.23** | 8.35** | 9.99** | 9.27** | 5.67* | 3.98 | 2.62 |
| (s.e.) | (2.32) | (2.76) | (2.70) | (3.02) | (2.32) | (3.06) | (2.57) | (2.88) |
| $R^2$ | 0.02 | 0.17 | 0.27 | 0.28 | 0.27 | 0.25 | 0.26 | 0.24 |
| obs | 672 | 672 | 672 | 624 | 624 | 624 | 624 | 480 |
| | | | | PANEL C: BUYER'S SURPLUS SHARE (%) | | | | |
| *coefficient* $\alpha$ | 57.1** | 58.7** | 59.3** | 67.8** | 56.5** | 62.1** | 55.4** | 64.6** |
| (s.e.) | (11.7) | (11.3) | (11.1) | (10.7) | (11.1) | (12.5) | (12.0) | (13.4) |
| month fixed-effects | no | yes | yes | yes | yes | yes | yes | yes |

Note: Panel A (B) reports the estimated price (volume) effect using different versions of equation 1 (2). All specifications include age and squared age of the mortgagor, dummies for houses with surveyor value $\in$[100000,115000) and $\in$[135000,165000), a dummy for the holiday period, a dummy for being a first time buyer and a dummy for houses with surveyor value $\in$[135000,165000) transacted during the holiday period, whose coefficient is $\beta_1$ ($\gamma_1$). Column 2 adds month fixed-effects. Column 3 adds regional house price and claimant counts. Column 4 (5) excludes the two months before (after) the start of the stamp duty holiday. Column 6 (7) excludes the two months before (after) the end of the stamp duty holiday. Column 8 excludes the two months either way of both holiday start and end. All specifications in Panel B include regional fixed effects. **(*) denotes significant values at the 5% (10%) confidence level. Standard errors adjust for intra-regional correlation.

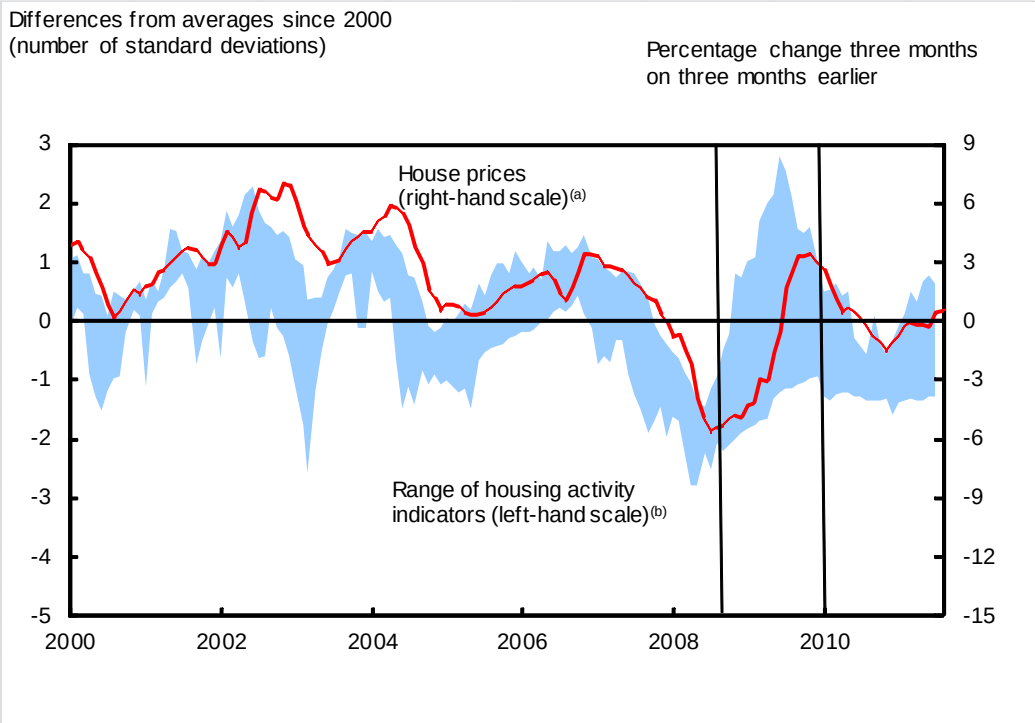


Figure 1: Residential property market activity and prices.

(a) Average of Halifax and Nationwide. The published Halifax index has been adjusted by the Bank of England to account for a change in the method of calculation. (b) The swathe includes: HBF site visits, HBF net reservations and RICs new buyer enquiries net balances; the RICs sales to stock ratio; and the number of loan approvals for house purchase. HBF data are seasonally adjusted by Bank staff.

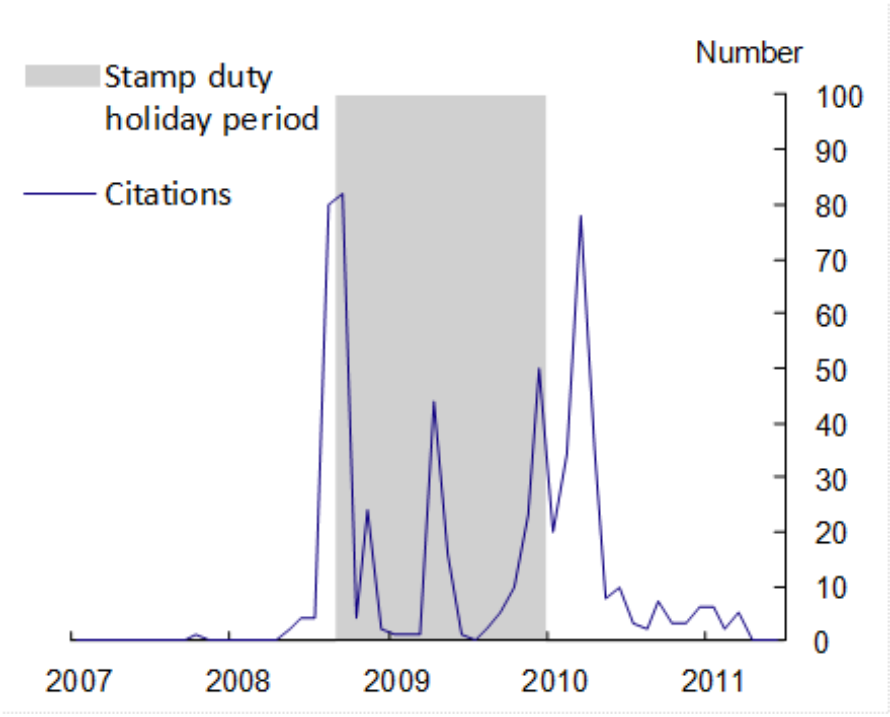


Figure 2: Media citations of 'stamp duty holiday'[(a)]

Source: Factiva. (a) Media citations from The Financial Times, The Guardian, The Observer, The Daily Telegraph, The Sunday Telegraph, The Independent, The Independent on Sunday, The Times, The Sunday Times and The Mail on Sunday.

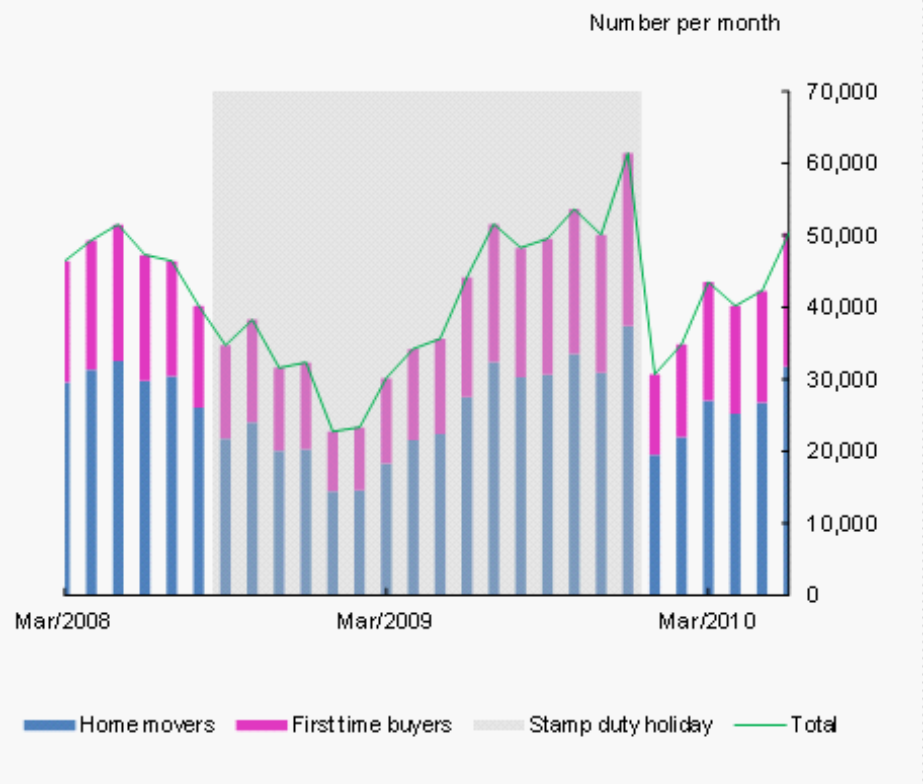


Figure 3: Property transactions per month.

Source: The Financial Services Authority (Product sales database) and Bank of England calculations.

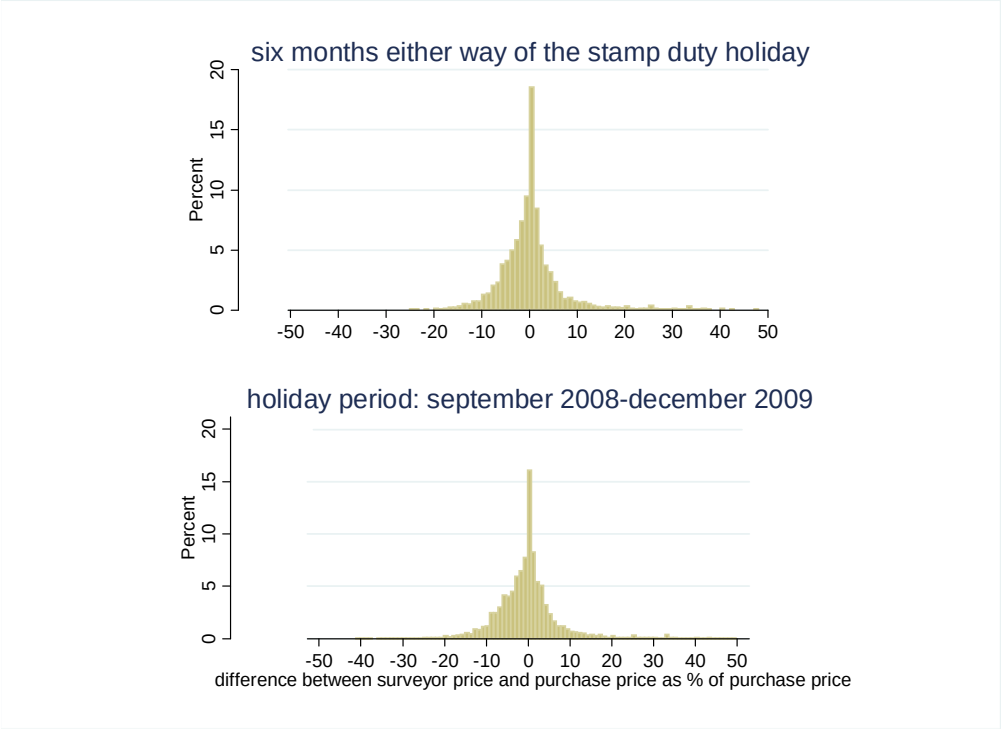


Figure 4: Density function of the difference between surveyor price and purchase price as % of purchase price.

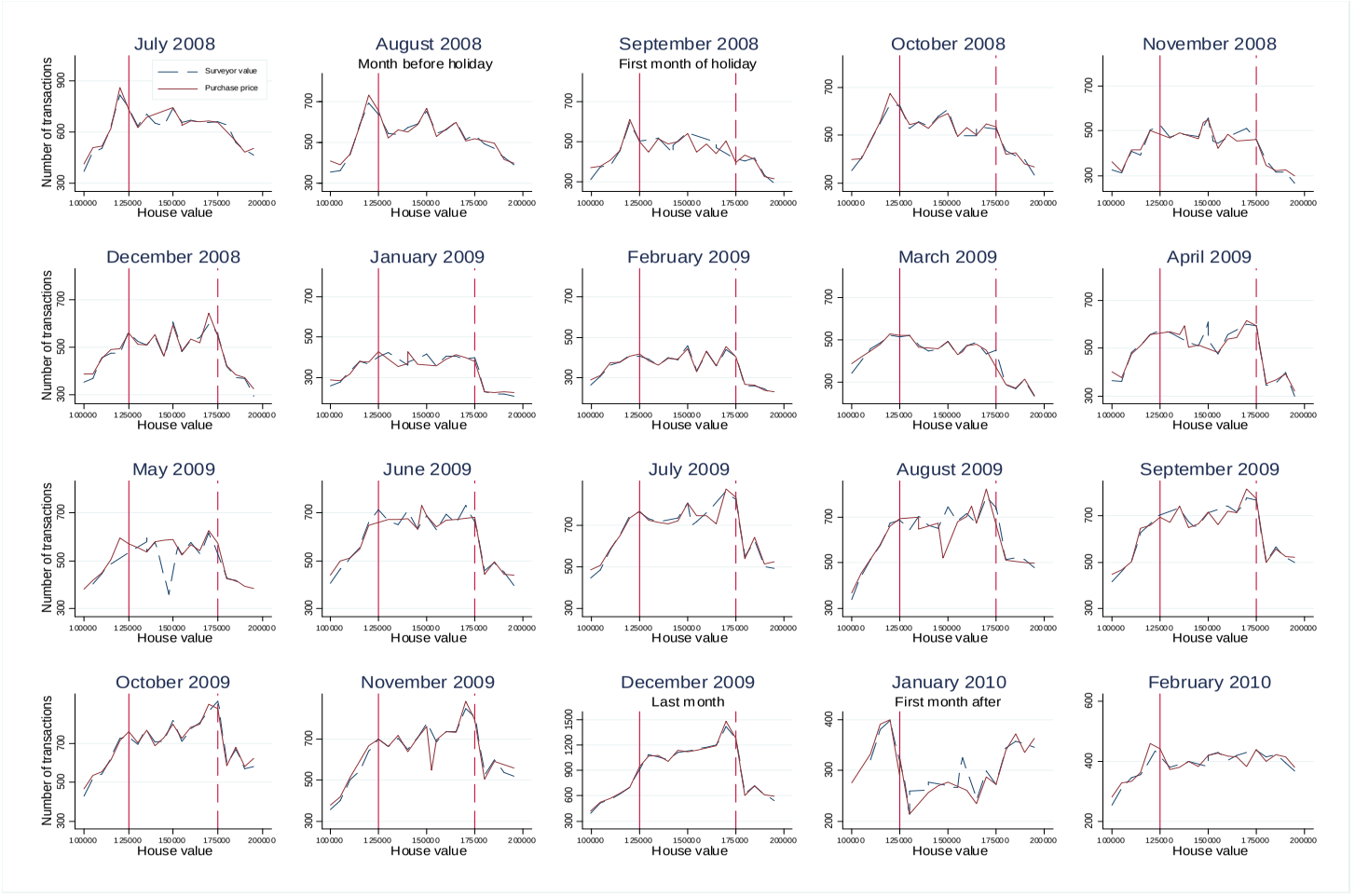


Figure 5: Density of housing transactions per month for sale prices between £100,000 and £200,000. Dashed blue line (red solid line) refers to the density based on surveyor value (purchase price).

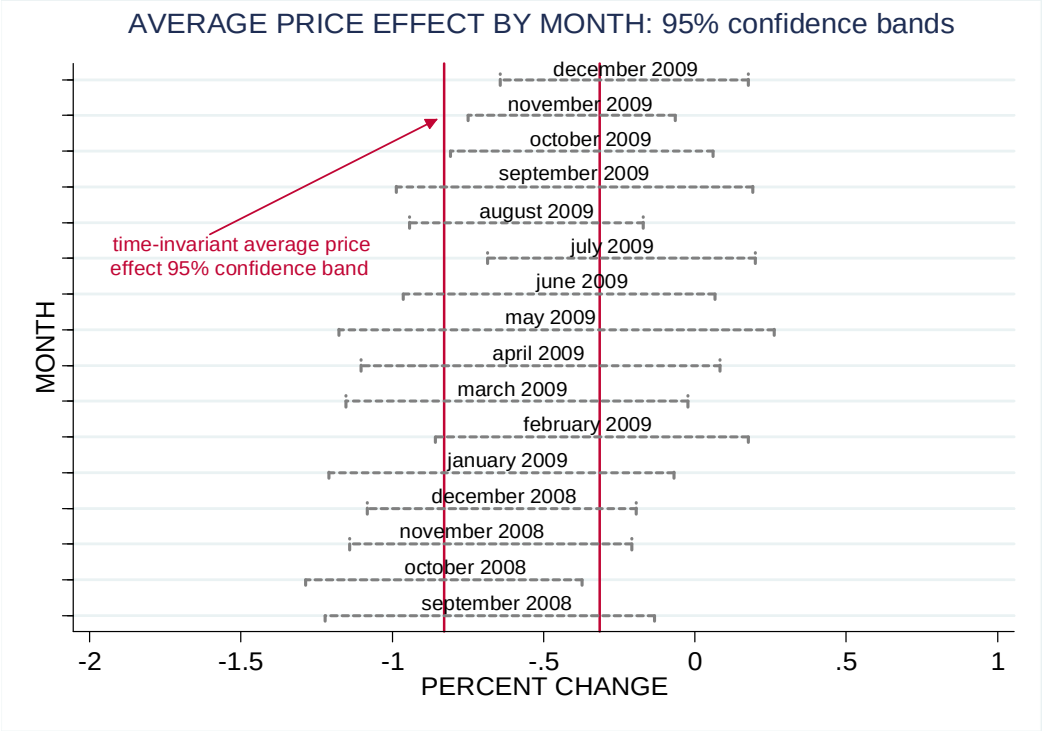


Figure 6: Average Price Effect by Month: 95% confidence bands.

Credible sets for the average price difference by month (in $\%s$) are obtained from an estimated model with regional controls, month fixed-effects for the full sample and month-fixed effects specific to the treatment group. Horizontal axes refer to the month-specific percent price change for the treatment group during the holiday period. The vertical lines correspond to the 95% credible set for the average price effect of the holiday period using regional controls and month-fixed effects (column 3 in Table 2).

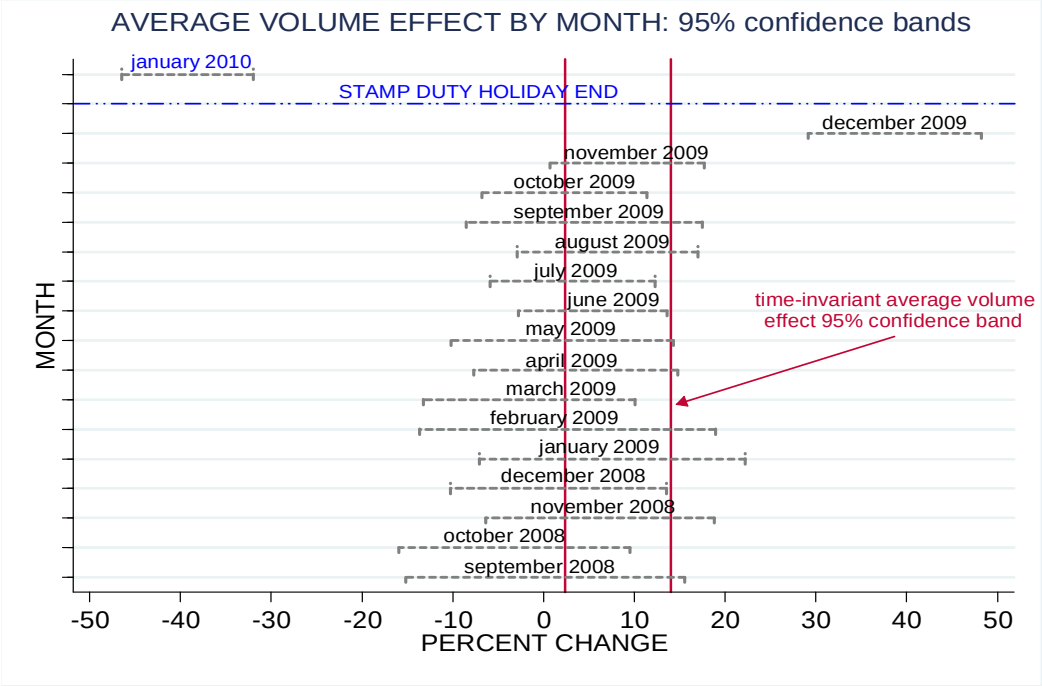


Figure 7: Average Price Effect by Month: 95% confidence bands

Credible sets for the average volume difference by month (in $\%s$) are obtained from an estimated model with regional controls, month fixed-effects for the full sample and month-fixed effects specific to the treatment group. Horizontal axes refer to the month-specific volume percent change for the treatment group during the holiday period. The vertical lines correspond to the 95% credible set for the average volume effect of the holiday period using regional controls and month-fixed effects (column 3 in Table 2).