A Causal Analysis of the UK Property Transaction Tax Holidays During the COVID-19 Pandemic

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Abstract

This paper studies the effect the UK's property transaction holidays had on the volume of residential property sales during the COVID-19 pandemic and establish a causal relationship between the holiday and the volume of sales. The effects of the holiday are estimated using a unit-Fixed Effects model on Local Authority level property data from HM Land Registry. Differencing-in-differencing using OLS and Two-Fixed Effects models are then used to try and determine a causal relationship. The property transaction tax holidays are estimated to be positively correlated with the number of property sales within Local Authorities whilst the DiD models provide evidence of a causal relationship. These results provide further evidence on the effects of property transaction tax holidays as a policy tool during crises and contributes to a wider body of work on the effects of property transaction taxes on the housing market.

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Introduction

It is widely accepted that property transaction taxes have a sizeable impact on the functioning of property markets. As such, there is scope for governments to use these taxes as a policy tool to intervene in these markets. This has most recently been evidenced during the COVID-19 pandemic when the central and devolved administrations in the UK introduced a property transaction tax 'holiday' which significantly raised the threshold of the 0% rate of tax across the country. Buying property is often the most significant single purchase an individual will make in their life, so it is important to understand the impacts and the overall efficacy of such policy tools when they are used. This research paper aims to establish what effect the UK's property transaction holidays had on the volume of residential property sales and establish a causal relationship between the policy and this effect. This chapter will discuss how the UK transaction property tax system works, provide the context and background for why the tax holiday was implemented and then outline in more detail the objectives, methods, and limitations of this research.

UK Property Transaction Taxes

A property transaction tax, named 'Stamp Duty Land Tax (SDLT, or just 'Stamp Duty'), was introduced in the UK from 1st April 2006. This applied to all constituent countries in the UK. SDLT is an ad valorem tax charged on the value of a property when it is transferred from one owner to another. As it currently operates, there are a number of progressive rates and thresholds, with no SDLT paid on properties valued below £125,000. There are also several reliefs, such as for first-time buyers, and charges, for example on properties being bought as second homes. Given the geographic nature of property purchases, property transaction tax powers were amongst the first to be devolved to the Scottish and Welsh governments allowing these administrations control over setting the rates and thresholds. These powers were first devolved to Scotland in April 2015 when the Scottish government introduced the Land and Buildings Transaction Tax (LBTT). The Welsh government introduced the Land Transaction Tax (LTT) in April 2018. This means that currently there are three property transaction taxes active within the UK, SDLT covering England and Northern Ireland, LBTT in

Scotland and LTT in Wales. These all operate the same way, they differ only on the rates and thresholds set[1].

Since these taxes were initial introduced, the rates and thresholds have all slowly evolved. In addition to these more permanent changes, a Stamp Duty 'holiday' was introduced as a temporary policy during the 2007-08 Financial Crisis to support the property market. In this case, a tax 'holiday' is a temporary policy reducing the amount of tax due. This was the first and only instance of this policy tool being used in the UK until the 2020 COVID-19 pandemic.

COVID-19 Pandemic

The first cases of COVID-19 in the UK were identified in late January 2020. By March 2020, cases were rising exponentially and in response the Government announced a wide range of non-pharmaceutical interventions to help bring the number of infections under control. This included the first lockdown which legally came into force on 26 March 2020 and was gradually eased over the course of the spring and summer months. The lockdown forbade all non-essential travel in the UK. As a consequence of this intervention, the number of residential property sales fell significantly as people were unable to leave their homes. The real-estate company Zoopla reported in April 2020 that property sales had fallen 70% since the start of the lockdown (Zoopla, 2020).

As Stamp Duty holiday was announced as part of the UK governments Summer Economic Update, its second package of economic support for individuals and businesses, to support the residential property market and boost the post-lockdown recovery. This saw the 0% threshold of SDLT rise to £500,000 in England and Northern Ireland and would initially last until March 2021. The devolved administrations in Scotland and Wales subsequently announced holidays for their own property transaction taxes, raising their 0% thresholds to £250,000. The Office for Budget Responsibility (OBR) initially predicted that the Stamp Duty holiday would cost the exchequer £2.5 billion in tax revenue and that it would cause both residential property sales to rise alongside house prices (OBR, 2020).

[1] See Annex A for Table of rates and thresholds

Objectives

It is well established that property transaction taxes can have sizeable effects on property markets and there is a broad literature on the topic. The use of these taxes as policy tools during economic crises is far less researched. This is partly due to these tools being used far less frequently than other 'typical' fiscal policy levers. However, the UK has now reached for this policy lever during both it's most recent economic crises. It is therefore necessary to establish more evidence on the use and efficacy of such policies as these tax holidays become a potentially standard feature of the government's fiscal policy toolkit during crises. In addition, an unexplored aspect is how the holidays were implemented differently across the national and devolved administrations and if this has subsequently affected outcomes between regions of the UK.

This paper aims to answer two questions in relation to the property transaction tax holidays implemented during the COVID-19 pandemic. Firstly, determining what effect, if any, they had on the volume of residential property sales in the UK's four constituent countries. As such, this research focuses only on the period immediately leading up to the COVID-19 pandemic and up to the most recently released data. Secondly, this paper attempts to establish a causal relationship between the holidays and property sales. By taking advantage of the devolved set-up of the transaction tax system and a staggering of removals of the holidays, it is possible to use a difference-in-differences approach to isolate the treatment effect of the holiday and infer causality.

This study will add to a much wider body of work on the effects of property transaction taxes on property markets. More significantly, it will contribute to the currently light evidence on the use of property transaction taxes as a policy tool in economic crises in the UK. Finally, it takes a very early step in exploring the effects of property transaction tax devolution within the UK, a view which has thus far been lacking in the literature. this research cannot answer however, is question of the mechanism by which the transaction taxes causes any change. Additionally, caution must be taken if extrapolating any results beyond the UK given the unique set of circumstances and responses that were specific to this country.

Dissertation Outline

The paper is structured as follows; (1) the context and research topic are introduced, (2) a review of the existing literature for property transaction taxes and SDLT as a policy tool, (3) an explanation of the data and the three methodological approaches used for this research, (4) a presentation of the results, (5) a discussion on meaning of these results and suggestions for further research, and (6) a concluding section.

Literature Review

This paper will evaluate the effect of property transaction taxes holiday on property transactions in the UK during the COVID-19 pandemic, with a particular focus on these effects between England & Northern Ireland, Wales and Scotland, which all maintain their own transaction property tax regimes. There is a wide body of literature that discusses the possible determinants for property transactions with property transaction taxes, with SDLT having been identified as one of these determinants and having been shown to have a potent effect on the housing market. As a consequence, changes to property transaction tax rates and thresholds have been used to intervene and support the property market in times of economic crisis. This section will evaluate the current literature on the effect of property transaction taxes within this market and the use of such taxes as a policy intervention. Where possible, research based on the UK will be used, however the devolution of property tax powers will not be discussed due to the lack of published papers on devolved property transaction taxes.

Property Transaction Taxes

Property transaction taxes are ad valorem taxes levied on the price of a house when a transaction occurs. This is in contrast to other property taxes that are recurrent and are often related to the provision of public services. Since the payment of the transaction tax is divorced from public service provision, buyers and sellers will not expect to see any benefit from paying the tax (John D. Benjamin, 1993). The negative welfare effects of these transaction costs can be demonstrated through a number of effects that it has on the market including sub-optimal housing consumption and a decrease in household mobility (Arthur O'Sullivan, 1995). Ommeren and Leuvensteijn showed in one study that a one percent rise in tax on the value of the house caused mobility rates to fall by at least eight percent in the Netherlands (Jos Van Ommeren, 2005). Another study shows that the negative welfare effects of transaction taxes are disproportionate compared to taxes on ownership of property (Arthur O'Sullivan, 1995). Given these issues, it is worth questioning why ad valorem transaction taxes are common across Europe and the OECD (Jos Van Ommeren, 2005). Whilst there is limited research in this area, one paper points to the negative externalities of moving house (such as disruption to neighbours both through physically moving and the loss of local social networks) (Arthur O'Sullivan, 1995) as a motive for imposing a transaction tax on property sales. Equally, the revenue raising motive for taxation is also a factor to consider here.

Stamp Duty Land Tax (SDLT), the UK, and now just English and Northern Irish property transaction tax was introduced 1 December 2003. Much of the literature on SDLT follows similar threads as the wider literature on property transaction taxes. As such, a study by Hilber and Lyytikainen has shown that a 2 percent rise in SDLT reduces the annual mobility rate by 2.6 percent which compared to their counterfactual model was a substantial fall of 37% (Christian A.L. Hilber, 2017) whilst another study shows that reactions to changes in SDLT are significant and fast (Michael Carlos Best, 2013). The same study also points to the further distortionary effects of SDLT in the property market caused by its progressive rates. This leads to bunching of house prices/ transaction values just below thresholds and holes just above. When changes occur the dynamic adjustment to bunching points and holes are exceptionally quick with new steady states becoming apparent three to four months after, or almost immediately where changes are anticipated (Michael Carlos Best, 2013).

Since property transaction tax powers were devolved to Scotland (in 2015) and Wales (in 2018), there is very little literature available of the effect of their respective transaction taxes on the property market. Nor is there significant research on the UK property market taking into account the varying levels of taxation on transactions between the national and devolved administrations.

Property Transaction Tax Policy Interventions in the Housing Market

As much of the previous literature has established, property transaction taxes have a significant impact on household property consumption and mobility rates. For countries who have already implemented these, there is therefore scope for governments to use changes to such taxes as an intervention to increase or decrease sales volumes. This paper will study the effect of the UK, Scottish and Welsh government interventions in their property markets with their respective transaction tax holidays during the COVID-19 pandemic. A similar policy was also implemented during the 2007-08 financial crisis. The literature on this is small but shows that the policy was effective at increasing property sales, with one study showing an 8% rise in activity after one year which was sustained into the second year (Michael Carlos Best, 2013). The same paper also finds the reversal effect once the holiday was removed was only 30-50%, suggesting a permanent effect, although it is worth noting other studies have found a complete reversal after the same policy (Timothy Besley, 2014) and reversals after similar stimulus programs (Atif Mian, 2012).

The literature on property transaction taxes is rich and convincingly points to these taxes having a significant impact on the performance of the housing market. Their effect on housing mobility makes it a potent tool for intervening in the market, although further research is needed into the effects of such interventions once the support has been removed. Equally, there is a glaring hole in research on the interactions between regions with different property tax regimes, particularly in the UK where devolved administrations have significant powers to set such taxes. Slightly aside, but interesting nonetheless is the preference for studying urban, as opposed to rural, property and housing markets in empirical studies, further research looking beyond these could complement this body of work.

Methodology

The purpose of this research is to determine two things; the effect of the property transaction tax holidays over the pandemic period in the UK and its constituent parts; and to identify a causal relationship between holidays and property transaction volumes. A quantitative approach is taken by employing three types of econometric models: unit-fixed effects, classic difference-in-differencing and two-way fixed effects under a difference-in-difference framework. These models are frequently used by applied economists to identify the effects and causal nature of policy treatments such as the tax holidays being studied here. The following section will discuss the data selection, each individual methodological approach, and modelling assumptions that need to be held for unbiased results.

Data Collection and Preparation

Data produced by HM Land Registry for the construction of its UK House Price Index (HPI) is used to conduct these analyses. HM Land Registry is the government department which is responsible for registering land ownership and property in England and Wales. UK HPI statistics are released monthly and include data for England, Wales, Scotland and Northern Ireland (Scottish data is supplied by the Land Registry of Scotland, Northern Irish data is supplied by Land Registers of Northern Ireland). These data record every property transaction in the UK (at the point of a transaction being completed) allowing analysis on a full population sample of sellers and buyers in the UK. The variables of interest for this paper are the volume of sales and average house prices. These are aggregated at the local authority level and monthly intervals. Northern Irish total sales volumes are calculated quarterly however for the purposes of this data they produce a monthly estimate by dividing quarterly figures by three (HM Land Registry, 2016). Only data from January 2020 to December 2021 is used for the purpose of these analyses. At the point of data collection, no other sources of Local Authority level data covering all countries of the UK were available. This was, in part, due to these analyses being conducted only shortly after the ending of the final property transaction tax holiday, so little data from this period had been published. Additionally, only a limited amount of Local Authority level data across all four countries is produced.

Before any analysis could take place, a number of steps were taken to prepare the data[2]. This involved dropping all variables that were not being used to conduct this analysis and regional and country level observations so that only Local Authority data remained. Sales volumes and average prices were log transformed to correct for skewness in the data ensuring normality within the data[3]. Finally, a series of dummy variables were generated. This included dummy variables indicating holiday periods, lockdown periods and post-treatment periods.

[2] See Annex B for Stata code
[3] See Annex C for data histograms

Determining Holiday Effects – Unit Fixed-Effects

A Unit Fixed-Effects models can be used to determine the effects of the property transaction tax holidays across the pandemic. Unit FE models remove the effect of time-invariant confounding variables. The benefits of this model are that it helps to reduce omitted variable bias (OVB) and the outputs are generalised across all units. For estimates and standard errors to be unbiased and consistent, the classic OLS assumptions for time-series must hold.

The coefficients for X_{igt} and $\boldsymbol{Z_{igt}}$ in this type of model are within-unit estimators. These tell us the average effect, generalised across all units i, that a one unit change in X has on Y across time (Jonathan Kropko, 2020). The model takes the following form:

$$Y_{igt} = \beta_0 + \beta_1 X_{igt} + \beta' \boldsymbol{Z_{igt}} + \alpha_i + u_{igt}; \qquad i = 1 \dots N, g = 1 \dots G\ t = 1 \dots T$$

Y_{igt} is the dependent variable, X_{igt} is the independent variable of interest, $\boldsymbol{Z_{igt}}$ is a vector of all other exogenous control variables, α_i is an unobservable unit-specific effect and u_{igt} is an error term. Subscripts i, g and t refer to what individual (e.g Local Authority), group (e.g. country) and time period (e.g. which month/year) an observation belongs to.

Implementing this in practice, the Unit FE model for determining holiday effects takes the following form[4]:

$$\log(salesvolumes)_{igt} = \beta_0 + \delta_0 holiday_{gt} + \beta_1 \log(avgprices)_{it} + \delta' lockdowns_t + u_{igt}$$

The model is run using data from between January 2020 and December 2021. Units, i, are the individual Local Authorities and t refers to individual months. The variable $lockdowns$ is a vector of variables indicating different lockdown periods. Lockdown 1 lasted from April 2020 to June 2020, Lockdown 2 occurred in November 2020 and Lockdown 3 from January 2021 to March 2021. The model is run four times: on the whole of the UK and then individually on England & NI, Scotland and Wales.

[4] See Annex D for Stata code

Causal Inference – Classic Difference-in-Differencing

Using a quasi-experimental design, a causal link can be determined between sales volumes and the introduction of the stamp duty holidays. Difference-in-Differencing (DiD) is one of the most commonly used methods to determine causal relationships by comparing the changes in the differences between treatment and control groups and between pre- and post-treatment periods. This allows the Average Treatment Effect (ATE) to be calculated.

An OLS regression model can be used on the following DiD set up (as shown below) with Y_{igt} being the dependent variable, P_t being a binary dummy variable indicating the pre- or post-treatment period, T_g being another binary variable indicating whether a group, g, belongs to the treatment or control group, $(P.T)_{gt}$ being an interaction variable (otherwise known as the DiD estimator), $\boldsymbol{Z_{igt}}$ representing all other exogenous control variables and u_{igt} being the error term (Marianne Bertrand, 2004). The data is arranged into two panels (T=2) with the first panel consisting of pre-treatment data and the second panel consisting of post-treatment data.

$$Y_{igt} = \beta_0 + \delta_0 P_t + \beta_1 T_g + \delta_1 (P.T)_{igt} + \beta' \boldsymbol{Z_{igt}} + u_{igt};\ i = 1 \ldots n; g = 1,2,3; t = 1,2$$

To implement the classic DiD model in practice, two dummy variables were generated; $scot$ which is equal to 1 if the local authority is Scottish and $treatmentperiod$ which is equal to 1 for all observations after March 2021 (i.e. all observations from after the LBTT holiday was removed in Scotland). Since the Stamp Duty holidays were eventually removed in England, NI and Wales, only data from July 2020 until July 2021 are used. The period from August 2021 to September 2021 are not used in the England & NI models because whilst the Stamp Duty holiday was active, a taper rate was introduced during these months lowering the threshold to £250,000. As this constitutes a second treatment, observations from these months have been excluded from the classic DiD models. A dummy variable indicating lockdown periods in the UK is also generated as a control variable. Finally, an interaction dummy variable is generated. This is the product of $treatmentperiod$ and $scotland$, the coefficient of which estimates the Average Treatment Effect of the removal of the LBTT holiday in Scotland. Using OLS, the following DiD model[5] can then be run:

$$\log(salesvolumes)_{igt} = \beta_0 + \beta_1 treatmentperiod_t + \beta_2 scotland_g + \beta_3 treatmentperiod * scot_{igt} + \beta_4 lockdown_t + u_{igt}$$

The stamp duty holidays across the UK were all introduced within the same month as each other. However, the removal of the stamp duty holiday was staggered over the course of 2021 allowing the set-up of a quasi-experiment where the treatment is this removal, rather than the introduction, of the policy. The Scottish LBTT holiday finished first on 31st March 2021 so becomes the treatment group whilst the rest of the UK (England & NI and Wales) act as control groups. With this data, three models can be run with the following control groups: England & NI only, Wales only and a combined England, NI and Wales.

Causal Inference – Difference-in-Difference using Two-Way Fixed Effects

An extension of the classic DiD set-up is to use a Two-Way Fixed Effects (TWFE) model. This approach removes the effects of time-invariant and unit-invariant confounders which helps to reduce omitted variable bias. Other benefits of this model are that it allows the use of panel data with T>2 and can be used when treatment implementation is staggered (i.e. a treatment is introduced at different times in different places). The standard model is shown below, α_i and α_t represent the unit- and time-fixed effects.

$$Y_{igt} = \beta_0 + \beta_1 X_{gt} + \beta' \boldsymbol{Z_{igt}} + \alpha_i + \alpha_t + u_{igt;} \quad i = 1 \dots n; g = 1 \dots G; t = 1 \dots T$$

Y_{igt} is the dependent variable, X_{gt} is a dummy variable indicating a treatment assigned at the group level, $\boldsymbol{Z_{igt}}$ is a vector of all other exogenous control variables, and u_{igt} is the error term.

[5] See Annex D for Stata code

To execute the TWFE model, a set of dummy variables are generated. Firstly, a binary variable $holidayoff$ so that it is equal to 1 for all observations when the stamp duty is not active and another binary variable $lockdown$ which is equal to 1 for all observations when a lockdown was in effect. Secondly, sets dummy variables $area$ and $time$ are created for each individual Local Authority and month. This model uses an extended time period (July 2020 to December 2021) can be used for this model compared to the classic DiD model. Using these, the following model can be used[6]:

$$\log(salesvolumes)_{igt} = \beta_0 + \delta_0 holidayoff_{gt} + \beta_1 \log(averageprices)_{igt} + \delta' lockdown_t + i.time_t + u_{igt}$$

The coefficient of $holidayoff$, δ_0, will be the ATE of the removal of the stamp duty holiday. $\delta' lockdown_t$ is a vector of lockdown variables and $i.time$ is a full set of dummy variables for each period t.

OLS Assumptions

To generate unbiased estimates and consistent standard errors (SEs), the standard OLS assumptions (for FE models, time-series OLS assumptions) should hold. Panel data often exhibits the effects of heteroskedasticity and autocorrelation/serial correlation, violating these assumptions. Whilst these issues do not affect the unbiasedness of estimators, they can cause inconsistent standard errors. To account for these issues, FE models are run with clustered robust-SEs whilst the classic DiD model is run with robust-SEs. SEs are clustered at the level of the individual Local Authorities.

Causal Inference Assumptions

In the DiD framework there are a number of additional assumptions that should be held to produce unbiased estimates which can be used for causal inference. The most important is the parallel trend assumption, which is the requirement that in the absence of the treatment, there would be no change in trends between treatment and control groups. Taking the means of the log of sales volumes in each

[6] See Annex D for Stata code

country and plotting these over the Stamp Duty holiday periods, it is possible to show that the parallel trend assumption holds.

Figure 1 – Average log sales volumes by country, July 2020-September2021

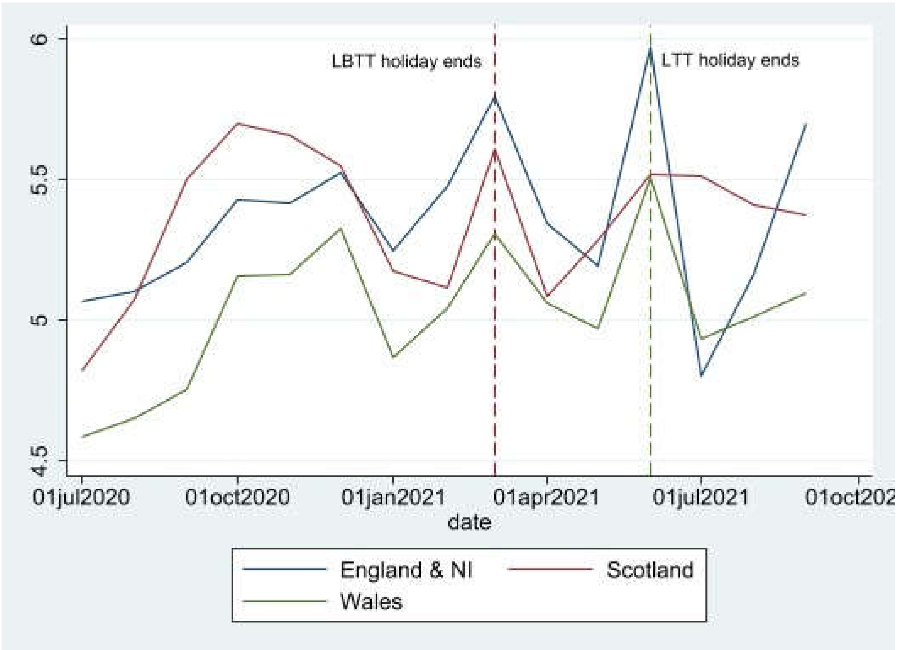


Figure 1 shows that before the LBTT holiday ended, the trends for England & NI, Scotland and Wales were largely the same. After the LBTT holiday ends, Scotland's trend diverges and no longer displays the significant peaks and troughs seen in the rest of the UK. Wales continues its LTT holiday until June 2021, after which we see a similar decoupling from the trend in England & NI which continues its SDLT holiday until September 2021. As such, we can assume that had Scotland not removed its holiday (i.e. implement its treatment), it would have continued to match the trend in the rest of the UK, as Wales did until its own property transaction tax holiday came to an end.

Another assumption which is required to allow us to perform causal inference is the Standard Unit Treatment Value Assignment (SUTVA) assumption. This has two parts; firstly, that outcomes for any unit are not influenced by treatments given to other units (i.e. there are no spillover effects), and secondly, that for each unit there are no other versions of a treatment leading to different potential outcomes. These ensure that the treatments are consistent and that there is no interference between units. On the first part, it can be assumed that this largely holds true. However, due to the different threshold levels between countries (£250,000 in Wales and Scotland, £500,000 in England & NI), there is the possibility for spillover effects at the boundaries between these as people make use of the more generous holiday in England & NI. Despite this, the scale of any spillover is likely to be small and contained to the border local authorities, particularly as the average distance moved by people in the UK is only around 9 miles, and almost two-thirds of moves are under 20 miles (Reallymoving, n.d.). For the second part of the SUTVA assumption, it can be presumed that this holds as there are no other policies in the UK applied to the transactions of residential properties and each local authority will only be affected by the one property transaction tax levied in their constituent country.

The final assumption that must be held to allow causal inference is the random allocation of the treatment. The allocation of the treatment was not completely random as the intervention was implemented based on geographic location (i.e. depended on which country a property sale occurred in) however the allocation of the treatment was completely independent of the result it may have on an individual. All three property transaction tax holidays were announced with an explicit end to the intervention on 31st March 2021. England & NI and Wales decided to extend their respective holidays at a later date whilst Scotland allowed their holiday to end as planned in March 2021. It is difficult to determine to what extent the decisions by the national and Welsh devolved government had on the Scottish government, particularly when political considerations are factored in. However, looking broadly at the situation, the implementation of the treatment (i.e. the removal of the LBTT holiday) was a continuation of the original policy as announced in July 2020 whereas the SDLT and LTT holiday extensions were deviations from that original timeline. Equally, affordability would not be an issue for the Scottish government as additional spending by the central government is factored into the devolved admirations grants (as calculated by the Barnett formula). This means Scotland would have received additional funding to continue the LBTT holiday should they have wished. This does, however, introduce the possibility that the Scottish government allowed the holiday to expire knowing that they would receive additional funding that could be allocated to other policies.

Results

Determining Holiday Effects

		UK	England & NI	Scotland	Wales
Obs = Groups=		8,952 373	7,656 319	768 32	528 22
δ_0 *Holiday*	Coefficient (SE†)	0.356 (0.008)	0.419 (0.005)	0.186 (0.022)	0.155 (0.015)
	t-stat	42.38*	80.71*	8.36*	10.56*
β_1 *Log(AvgPrice)*	Coefficient (SE†)	-0.195 (0.092)	-0.862 (0.064)	1.944 (0.260)	0.702 (0.111)
	t-stat	-2.11*	-13.49*	7.47*	6.35*
δ_1 *Lockdown 1*	Coefficient (SE†)	-0.481 (0.010)	-0.435 (0.008)	-0.753 (0.035)	-0.600 (0.034)
	t-stat	-47.97*	-51.45*	-21.76*	-17.72*
δ_2 *Lockdown 2*	Coefficient (SE†)	0.114 (0.007)	0.083 (0.006)	0.252 (0.019)	0.168 (0.027)
	t-stat	16.43*	13.15*	13.42*	6.24*
δ_3 *Lockdown 3*	Coefficient (SE†)	0.158 (0.008)	0.190 (0.008)	-0.114 (0.023)	0.053 (0.014)
	t-stat	19.30*	24.34*	-5.06*	3.76*

*Significant at 5% level ($|t_{stat}| > 1.960$). **Significant at 10% level ($|t_{stat}| > 1.645$). † robust Standard Errors

The coefficients reported here are within-unit estimators. As such, these indicate the average effect within-Local Authorities across time of a one unit change in the independent variable on the number of sales volumes. δ_0 is statistically significant across all models. The coefficient is positive showing a positive relationship between the holiday being active within a LA and the number of property sales. In England & NI, the average effect was highest with a 41.9% rise in the volume of property sales. The lowest increase was in Wales which saw the average effect within LA's being a 15.5% rise. The effect across the whole the UK was a rise of 35.6% rise in LAs with active property transaction tax holidays. Average prices were estimated to be statistically significant in all models although the direction of the effect varied. Average prices were shown to be negatively correlated with sales volumes for the UK and Eng & NI models whereas in Scotland and Wales they are positively correlated. The effects of the all the lockdowns across all four models are found to be statistically significant at the 5% level. These models estimate the effect of the first lockdown, δ_1, to be negative with LAs across the UK as a whole experiencing an average fall in property sales of 48.1%. The greatest fall was observed in Scotland with LAs experiencing an estimated fall of 75.3%. The subsequent lockdowns show the opposite effect, with coefficients for lockdowns 2 and 3, δ_2 and δ_3, being positive (with the exception of δ_3 in the Scotland only model). The average effect of lockdowns 2 and 3 within all LAs in the UK are increases of residential property sales of 11.4% and 15.8% respectively.

Causal Inference – Classic Difference-In-Differencing

		Scotland, rUK (1)	Scotland, England & NI (2)	Scotland, Wales (3)
Obs =		4,476	4,212	648
β_3 *Treatmentperiod*scot*	Coefficient (SE†)	-0.203 (0.108)	-0.199 (0.108)	-0.247 (0.129)
	t-stat	-1.87**	-1.83**	-1.92**
β_1 *Treatment period*	Coefficient (SE†)	0.238 (0.025)	0.2308 (0.026)	0.212 (0.079)
	t-stat	9.49*	9.17*	2.67*
β_2 *Scot*	Coefficient (SE†)	-0.017 (0.056)	-0.075 (0.056)	0.417 (0.065)
	t-stat	-0.30	-1.33	6.46*
β_4 *Log(AveragePrice)*	Coefficient (SE†)	-0.073 (0.026)	-0.135 (0.026)	0.468 (0.118)
	t-stat	-2.83*	-5.20*	3.96*
β_5 *Lockdown*	Coefficient (SE†)	0.207 (0.022)	0.209 (0.022)	0.098 (0.069)
	t-stat	9.52*	9.37*	1.42

*Significant at 5% level ($|t_{stat}| > 1.960$). **Significant at 10% level ($|t_{stat}| > 1.645$). † robust Standard Errors

All models show that β_3, the average treatment effect of removing the LBTT holiday in Scotland, is negative showing there was a fall in the volume of property sales compared to the other countries which continued their property transaction tax holidays. The fall in property sales in the Scotland and Wales model (model 3) was 24.7% whereas in the Scotland, England & NI model (model 2) the fall was smaller at 20%. The coefficient β_3 is shown to be significant only at the 10% level for all models (although all are near the 5% threshold). β_1 shows the mean change in outcome in the control group between the pre-treatment and post-treatment periods. This variable is statistically significant at a 5% level in all three models which shows a rise in sales volumes of around 23% between periods in the control groups. β_2 shows the estimated mean difference between the control groups and the treatment group before the intervention in introduced. Models 1 and 2 are statistically insignificant. In contrast, model 3 shows a statistically significant difference, with sales volumes that are 41.7% higher in Wales than Scotland before the treatment is introduced. Log(averageprices) are shown to have both positive and negative effects and is statistically significant across all models. Model 3, with Wales as the control group, estimates the effect of a 1% rise in avg prices is a 46% rise in property sales. In contrast, models 1 and 2 show a negative relationship between avg prices and sales volumes. Finally, lockdowns are statistically significant in all three models (at either the 5% or 10% significance level). Lockdown measures display a positive effect on the volume of house sales ranging from a 10% increase (model 3) to a 20.5% increase (models 1 and 2).

Causal Inference – Difference-In-Differences using Two-Way Fixed Effects

		UK
Obs = Groups=		6,714 373
δ_0 *Holidayoff*	Coefficient (SE‡)	-0.105 (0.018)
	t-stat	-5.94*
β_1 *Log(AvgPrice)*	Coefficient (SE‡)	0.853 (0.245)
	t-stat	3.49*

*Significant at 5% level ($|t_{stat}| > 1.960$). **Significant at 10% level ($|t_{stat}| > 1.645$). ‡) clustered Standard Errors

δ_0 is the Average Treatment Effect of removing the holiday. This model estimates that the average effect for all Local Authorities in the UK of removing a property transaction tax holiday was a 10.5% fall in the residential property sales. Log of average prices is shown to be positively correlated with sales volumes and is statistically significant.

Discussion

The Unit FE model shows that there is a positive correlation between the property transaction tax holidays and the volume of residential property sales with the holiday coefficients for each model being statistically significant at a 5% level. The effect was greatest in England & NI which experienced an estimated 41.9% rise in property sales. In comparison, Local Authorities in Scotland and Wales only saw an average effect of 18.6% and 15.5% respectively. One likely reason for the significant difference in effect is that each holiday rose the 0% threshold by different amounts[7]. The threshold for SDLT in England and NI rose from £125,000 to £500,000 (a 400% increase). In contrast, the LBTT in Scotland

[7] See Annex A for table of rates and thresholds

rose by just over 170% and the LTT in Wales rose by almost 140%. Whilst all significant increases in their own right, the SDLT raise was significantly larger resulting in more direct savings on properties bought in England and Northern Ireland. This is likely to have had some effect on the magnitude of rises in sales caused by the holidays.

Results from the classic DiD model show that the removal of the LBTT holiday in Scotland led to a statistically significant (at a 10% level) decrease in the volume of sales compared to the rest of the UK (both in the combined model and the individual models). All three models showed an estimated fall in property sales of 20-25%. In addition to this, using the DiD framework with TWFE, similar results are found with the average effect to property sales when a tax holiday is removed being a fall of 10.5% within individual local authorities across the UK. The effect of the TWFE model is likely smaller than the classic DiD models because the FE model uses a slightly long time period (all models use data starting in July 2020, classic DiD models end July 2021 whilst TWFE ends December 2021). Immediately after the transaction tax holidays are removed, there is a substantial fall in property sales volumes which then recover over the next couple of months. The TWFE model being slightly longer means more of this recovery in property sales is incorporated into the model lowering the overall effect of the removal of the holidays.

As discussed in the methodology the parallel trend, SUTVA and random allocation assumptions are likely to be satisfied. This suggests that there is a causal link between the property transaction tax holidays and the changes in the number of sales volumes. The fact that this effect is consistently observed across all four models and with two methodological approaches further supports this result.

Whilst there is evidence of a causal link, it does not establish the exact mechanism by which the rise in property sales is induced. This paper does not seek to answer the question of how exactly the Stamp Duty holidays stimulate greater sales, however potential causes include housing purchases being shifted so as to benefit from the available tax reduction. For example, by looking at Figure 1 (3.5 Assumptions), we can observe that there are likely timing effects, with property sales being brought earlier so that they can be concluded before the expiration of the announced end-dates of the holidays. This explains the large peaks and subsequent troughs around the months of March 2021, June 2021 and September 2021. Another way the holidays could be increasing the volumes of property sales is by stimulating greater demand. The tax holidays lower the overall cost to buyers when acquiring a property which can cause demand to rise (although the benefit of this is likely split between buyers and sellers as property sellers adjust their prices to get a share of the tax cut). Depending on the price elasticity of demand this could cause a sizeable rise in property sales.

There has been some discussion within the literature on the persistency of the effects of property transaction tax holidays and similar policies after they have been removed (Michael Carlos Best, 2013). It may seem that these results suggest the effect is short-term, however the treatment period used in the classic DiD models were only three periods. Making any judgements on longer lasting effects is impossible with these data. However, the TWFE model, using a longer time period, does lend some support for the position that there is little effect of the property transaction tax holidays once the treatment is removed as far as the number of property sales is concerned.

The first lockdown, lasting from April to June 2020, is shown to have a substantial effect on the number of house sales during that period. The estimates show a 40-70% decline in sales volumes of residential properties. This supports evidence from the time showing a serious slow down in the property market and justifies the governments rationale for intervening in the property market. Interestingly, the subsequent lockdowns (Lockdown 2 in November 2020 and Lockdown 3 from January to March 2021) had a positive effect on the number of property sales, with the exception of in Scotland during Lockdown 3. The average effect within Local Authorities across the UK during lockdowns 2 and 3 were 11.4% and 15.8% rises in property transactions, respectively. These lockdowns were active simultaneously to the transaction tax holidays. This could suggest that lockdowns implemented once a holiday is active compounds the overall effect of the treatment. One possible reason for this could be that the lockdowns may initiate a change in preferences in consumers leading to more individuals looking to move houses. With a significant number of individuals unable to travel and forced to Work from Home (WfH), there has been a loosening in the requirement for residential properties to be located within a reasonable travel distance of their working places. Therefore, repeated lockdowns (and Working from Home orders) may be causing preferences to change for these individuals leading to an increase in the number of people looking to move property. Additionally, lockdowns free up individuals' time allowing more people to search for homes and reducing the time to find properties. One of the constraints on the speed at which properties can be bought and sold is how quickly a match can be made between a buyer and an available property for purchase. By freeing up an individual's time, this reduces the constraint they face on the time they can spend searching for properties, thus increasing the residential sales velocity and allowing more sales to be concluded in each period. There is scope to study these effects further to complement the existing literature on consumer preferences and constraining factors on the residential property market.

The lack of control variables used in the models for this research poses a potential issue for the validity of these results. Omitting relevant variables can cause bias in the estimates of the coefficients. The unit and two-way FE models remove the effect of time-invariant confounding variables (for unit and two-way FE models) and unit-invariant confounding variables (two-way FE model only) reducing the effect of omitted variable bias. However, it does nothing to control for time or unit variant variables which could cause biased estimates. For example, there are likely a number of macro-dynamic effects that are unrelated to the holiday that will affect property sales (e.g. savings rates, completed property constructions etc). This research could be taken further in future as more related data is published, allowing for a greater number of control variables to be included in these models reducing the effects of bias in the estimates produced.

Another potential issue that may introduce bias is endogeneity within the model. The variable $\log(avgprice)$ could be endogenous to the model in two ways. Firstly, there may be a reverse-causal relationship between itself and the volume of property sales which violates the strict exogeneity assumption required for time-series OLS estimation. Economic theory suggests that the price of residential properties will affect the quantity demanded, whilst inversely it is reasonable to assume that the quantity of property sales within an area are used to calculate future prices. Secondly,

$\log(avgprice)$ is likely related to the treatment – the property transaction tax holidays. Taxes such as these have been shown to have an effect on property prices by causing bunching around rate thresholds as buyers seek to minimise their tax costs (Michael Carlos Best, 2013). As such, this breaks the no multicollinearity assumption of OLS estimation. Despite this, the $\log(avgprice)$ is kept in the models estimated in the paper. As noted above, the models lack controls for time-varying variables and $\log(avgprice)$ was one of the very few available to use as a control. Equally, the economic theory does support its inclusion in the model in spite of the issue of reverse-causality. Finally, when running the models with and without the variable, there were small changes in the magnitude of the coefficients for holiday and none so large to change the level of statistical significance. Within the wider literature on OLS and panel data methods, several approaches have been suggested for correcting for endogeneity caused by both reverse-causality and multicollinearity (Lars Leszczensky, 2019) (Wissam Abdallah, 2015). As such there is opportunity for this research to be taken further, correcting for issues of endogeneity.

Conclusion

The purpose of this research is to establish what effect the property transaction tax holidays had on the volume of residential property sales in the UK and its constituent countries. In addition to this, the aim is to determine a causal relationship between the transaction tax holidays and property sales in the UK. The results show that the SDLT, LBTT and LTT holidays were all positively correlated with the number of property sales in each country. The magnitude of the effect likely relates to the size of the increase in 0% rates with England & NI experiencing a much greater increase in sales volumes due to its more generous increase in threshold compared to Scotland and Wales. The quasi-experimental approaches undertaken for this research support the finding that the holidays are related to higher house sales compared to when the holidays are removed. In addition to this, due to several key assumptions holding within these models, most importantly the parallel trend assumption, there is evidence that there is a causal relationship between the holidays and the volume of property sales. Whilst steps were taken to limit the effect of biased estimates due to omitted variables in the models, the lack of control variables raises some questions to the validity of these results. As more data is published for the time period studied here, there may be opportunities for further research on this topic. The mechanisms by which the property transaction tax holidays induce greater sales volumes is not determined by this study and would also benefit from further study to better understand how these policies work. Nevertheless, these results will be useful evidence for policy makers when assessing the effect of the holidays during the COVID-19 pandemic and will complement the surrounding literature on the use of property transaction taxes as a policy tool in property markets during periods of 'crisis'. Equally, it contributes to a wide body of work showing the effects that property transaction taxes have on property sales in general

Annexes

Annex A – Table of Rates and Thresholds

Table 1 - Rates and thresholds before and after transaction tax holidays

	SDLT (Eng, NI)		LBTT (Scot)		LTT (Wales)	
	Threshold	Rate	Threshold	Rate	Threshold	Rate
Band 0	£125,000	0.0%	£145,000	0.0%	£180,000	0.0%
Band 1	£250,000	2.0%	£250,000	2.0%	£250,000	3.5%
Band 2	£925,000	5.0%	£325,000	5.0%	£400,000	5.0%
Band 3	£1,500,000	10.0%	£750,000	10.0%	£750,000	7.5%
Band 4	>£1,500,000	12.0%	>£750,000	12.0%	£1,500,000	10.0%
Band 5					>£1,500,000	12.0%

Table 2 – Rates and thresholds during transaction tax holidays

	SDLT (Eng, NI)			
	Start	Finish	Start	Finish
	08/07/2020	30/06/2021	01/07/2021	30/09/2021
	Threshold	Rate	Threshold (Taper)	Rate (Taper)
Band 0	£500,000	0.0%	250,000	0
Band 1	£925,000	5.0%	£925,000	5.0%
Band 2	£1,500,000	10.0%	£1,500,000	10.0%
Band 3	>£1,500,000	12.0%	>£1,500,000	12.0%
Band 4				

	LBTT (Scot)		LTT (Wales)	
	Start	Finish	Start	Finish
	15/07/2020	31/03/2021	27/07/2020	30/06/2021
	Threshold	Rate	Threshold	Rate
Band 0	£250,000	0.0%	£250,000	0.0%
Band 1	£325,000	5.0%	£400,000	5.0%
Band 2	£750,000	10.0%	£750,000	7.5%
Band 3	>£750,000	12.0%	£1,500,000	10.0%
Band 4			>£1,500,000	12.0%

Annex B – Data Preparation Stata Code

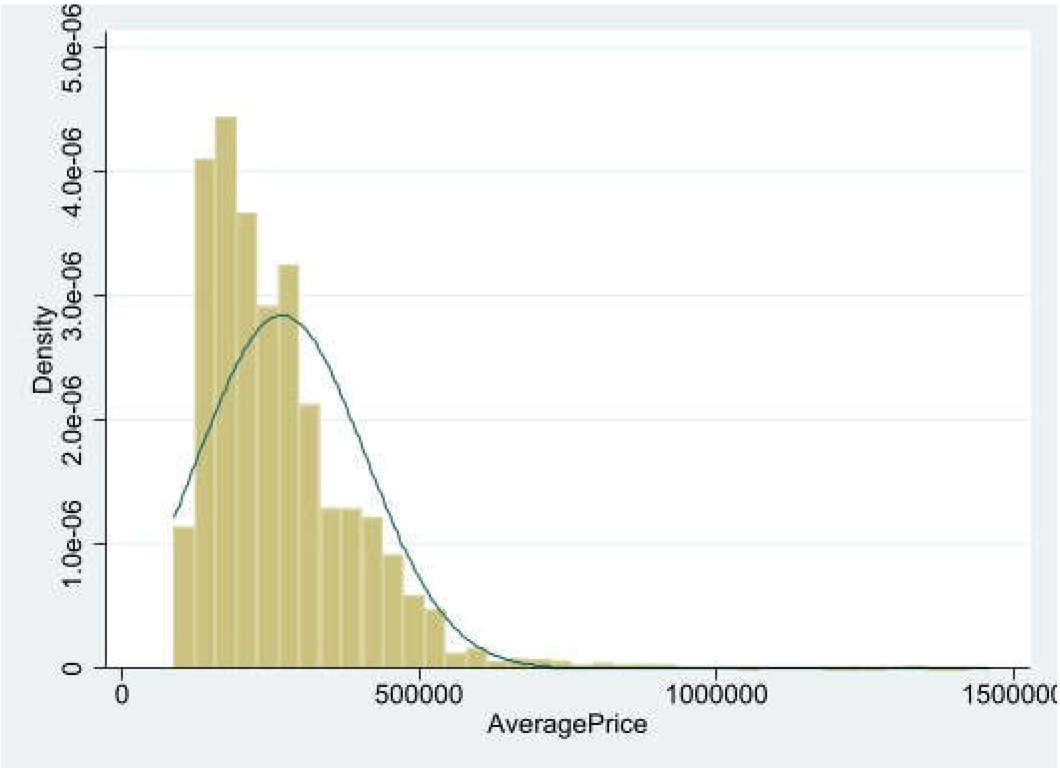
```
//* Data Preparation *//


* Removing unnecessary variables and log transformations *
keep date regionname areacode averageprice salesvolume
gen lavgprice=log(averageprice)
gen lsalesvol=log(salesvolume)

* Removing regional/country/national level data *
drop if strpos(areacode,"E1")>0
drop if strpos(areacode,"E9")>0
drop if strpos(areacode,"K")>0
drop if strpos(areacode,"W92")>0
drop if strpos(areacode,"S92")>0
drop if strpos(areacode,"N92")>0

* Generating new date variable from string *
gen date2 = date(date, "DM20Y")
format date2 %td
gen monthlydate = mofd(date2)
format monthlydate %tm

*Generating new area variable from string *
encode areacode, generate(area)

* Generating country dummy variables *
gen eng=1 if strpos(areacode,"E")>0
replace eng=0 if eng==.
gen wales=1 if strpos(areacode,"W")>0
replace wales=0 if wales==.
```

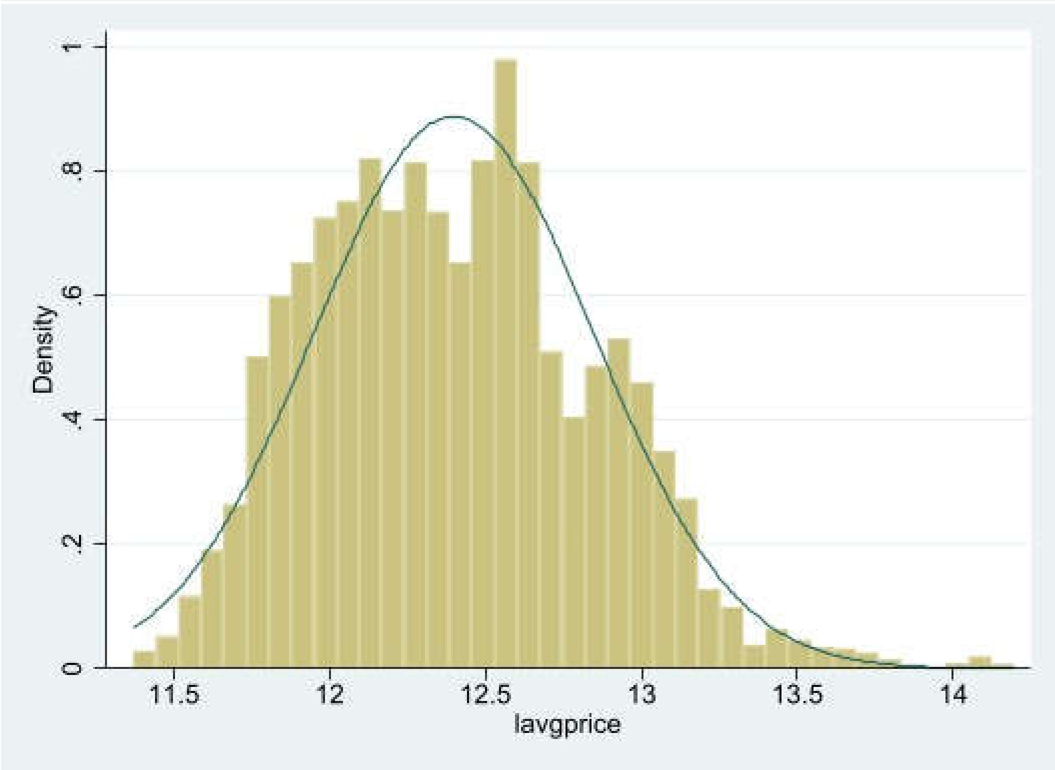
```
gen scot=1 if strpos(areacode,"S")>0
replace scot=0 if scot==.
gen ni=1 if strpos(areacode,"N")>0
replace ni=0 if ni==.
gen country=0
replace country=1 if scot==1
replace country=2 if wales==1
* engni=0 scot=1 wales=2

* Generating holiday dummy variables *
gen engnihol=0 if strpos(areacode, "E")>0 | strpos(areacode, "N")>0
replace engnihol=1 if date2>=td(01jul2020) & date2<=td(01sep2021) & strpos(areacode, "E")>0
replace engnihol=1 if date2>=td(01jul2020) & date2<=td(01sep2021) & strpos(areacode, "N")>0

gen waleshol=0 if strpos(areacode, "W")>0
replace waleshol=1 if date2>=td(01jul2020) & date2<=td(01jun2021) & strpos(areacode, "W")>0

gen scothol=0 if strpos(areacode, "S")>0
replace scothol=1 if date2>=td(01jul2020) & date2<=td(01mar2021) & strpos(areacode, "S")>0

gen holiday=0
replace holiday=1 if strpos(areacode, "E")>0 & date2>=td(01jul2020) & date2<=td(01sep2021) | strpos(areacode, "N")>0 & date2>=td(01jul2020) & date2<=td(01sep2021) | date2>=td(01jul2020) & date2<=td(01jun2021) & strpos(areacode, "W")>0 | date2>=td(01jul2020) & date2<=td(01mar2021) & strpos(areacode, "S")>0
```

```

* Generating lockdown dummy variables *
gen lockdown=0
replace lockdown=1 if date2>=td(01Apr2020) & date2<=td(01jun2020) | date2==td(01nov2020) | date2>=td(01jan2021) & date2<=td(01mar2021)
gen lockdownsplit=0
replace lockdownsplit=1 if date2>=td(01Apr2020) & date2<=td(01jun2020)
replace lockdownsplit=2 if date2==td(01nov2020)
replace lockdownsplit=3 if date2>=td(01jan2021) & date2<=td(01mar2021)
```

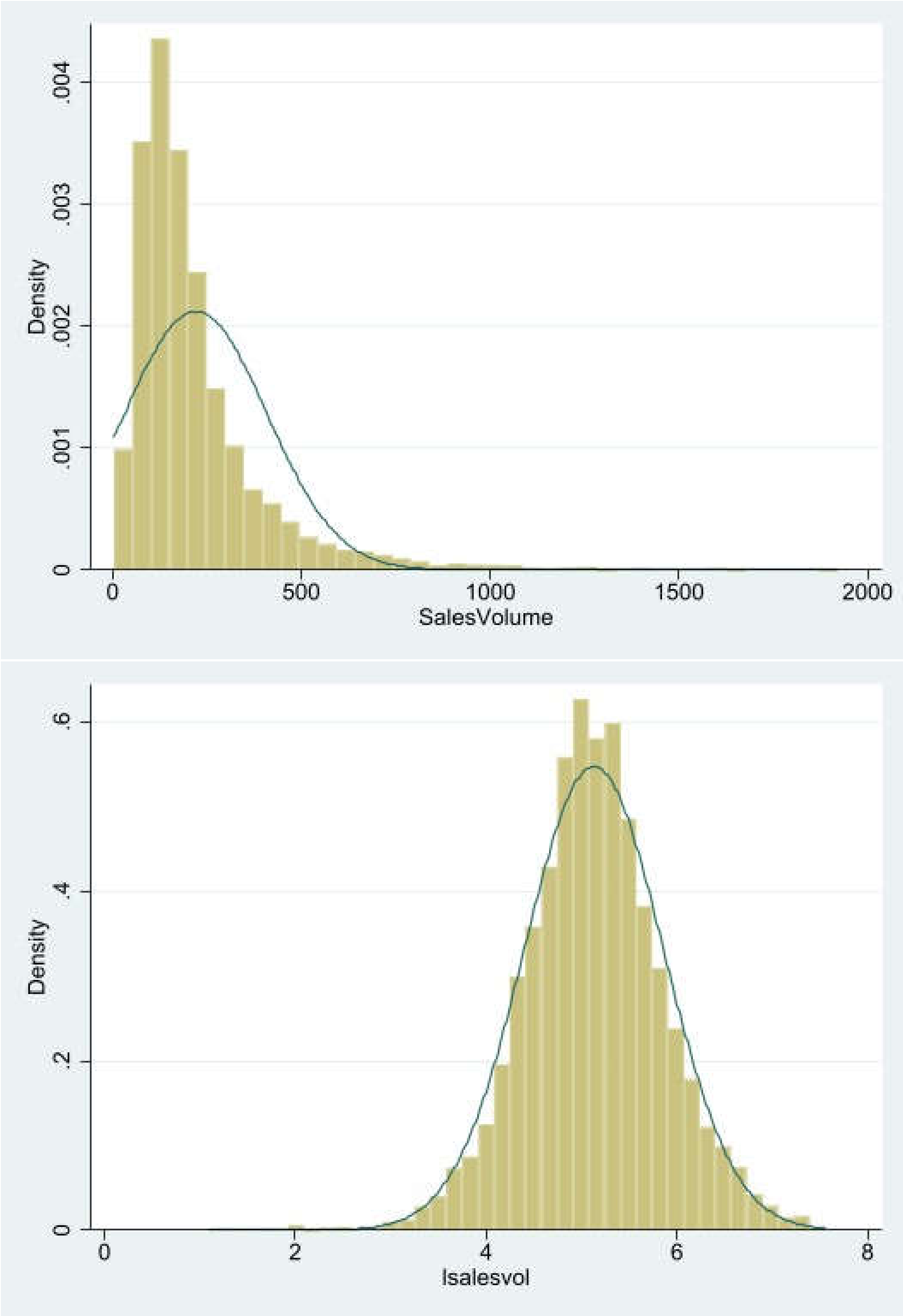
Annex C – Data Histograms

Graph 1 & 2 – Average and log average prices, Jan 2020 – Dec 2021





Graph 3 & 4 – Sales volumes and log sales volumes, Jan 2020 – Dec 2021



Annex D– Modelling Stata Code

Image 1 – Unit FE model code

```
//* Unit FE Model do *//

log using UnitFE.log, replace

drop if date2<=td(01dec2019) | date2>=td(01jan2022)

* UK *
xtreg lsalesvol holiday lavgprice i.lockdownsplit, i(area) cl(area) fe

* Eng & NI *
xtreg lsalesvol holiday lavgprice i.lockdownsplit if eng==1 | ni==1, i(area) cl(area) fe

* Scotland *
xtreg lsalesvol holiday lavgprice i.lockdownsplit if scot==1, i(area) cl(area) fe

* Wales *
xtreg lsalesvol holiday lavgprice i.lockdownsplit if wales==1, i(area) cl(area) fe

log close
```

Image 2 – Classic DiD model code

```
//* DiD Model do *//

log using DiDregressionsfinal.log, replace

drop if date2<=td(01jun2020) | date2>=td(01jul2021)

gen treatmentperiod=0
replace treatment=1 if date2>=td(01apr2021)

* Scotland & England NI Wales *
reg lsalesvol scot##treatmentperiod lavgprice lockdown, robust

* Scotland & Wales *
reg lsalesvol scot##treatmentperiod lavgprice lockdown if scot==1 | wales==1, robust

* Scotland & England NI *
reg lsalesvol scot##treatmentperiod lavgprice lockdown if scot==1 | eng==1 | ni==1, robust

log close
```

Image 3 – Two-Way FE model code

```
//* TWFE Model do *//

log using twfixedeffectsfinal.log, replace

drop if date2<=td(01jun2020) | date2>=td(01jan2022)

gen holidayoff=0
replace holidayoff=1 if holiday!=1

* UK *
xtreg lsalesvol holidayoff lavgprice i.lockdownsplit i.monthlydate, i(area) cl(area) fe

log close
```

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