Housing Transfer Taxes and Household Mobility: Distortion on the Housing or Labour Market?*

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Abstract

We estimate the effect of the UK Stamp Duty Land Tax on household mobility using micro data. Exploiting a discontinuity in the tax schedule as a quasi-experimental setting, we isolate the impact of the stamp duty from other determinants of mobility. We compare homeowners with self-assessed house values on either sides of a cut-off value where the tax rate increases from 1 to 3 percent and find that a higher stamp duty strongly negatively affects their propensity to move. The 2 percentage-point increase in the stamp duty reduces the annual rate of mobility by between 2 and 3 percentage-points or about 30 percent. This adverse effect is confined to short-distance and non-job related moves, suggesting a distortion in the housing rather than the labour market. As a cross-validation check, we also analyse the distribution of actual transaction prices and find that the tax rate increase reduces the volume of sales by roughly 30 percent.

JEL classification: D23, H21, H27, J61, R21, R31, R38.

Key words: Stamp duty, housing transfer taxes, transaction costs, homeownership, household mobility.

1. Introduction

Most developed countries impose a tax – often labelled 'stamp duty' – on housing transactions. The stamp duty increases the transaction costs associated with the sale of a property and therefore increases the costs of moving for homeowners. This cost increase can be expected to negatively affect the propensity to move. Thus, the stamp duty is prone to have adverse effects on housing- and labour markets. Households may not live in the type of dwelling and the location that most closely match their preferences. Similarly, individuals may be less willing to accept new jobs that are not within commuting distance or they may decide to hold on to a current job that is a less good match than another available job further away. Given these potential adverse effects caused by mismatch in housing- and labour markets, the question of whether, and to what extent, the stamp duty reduces housing- and job-related household mobility is highly policy relevant.

The UK stamp duty – since 2003 termed Stamp Duty Land Tax (SDLT) but commonly referred to as 'stamp duty' – has long been criticized by economists as being inefficient. The Mirrlees Review (2011) highlights the fact that the British stamp duty system "creates a disincentive for people to move house" (p. 403) and the adverse consequences of this on the functioning of housing- and labour markets. To date, however, little is known about the *magnitude* of this disincentive effect on actual household mobility or the *nature of the affected moves* (short vs. long distance and housing- vs. job-related). The present study sheds light on these questions.

The UK provides an ideal setting to explore the impact of housing transfer taxes on mobility decisions. This is partly because the stamp duty liability is quite substantial, at least for more expensive housing (the top rate is currently 7 percent of the purchase price), and partly because the stamp duty liability jumps sharply at various cut-off values, providing various 'discontinuities' that can be exploited empirically. Our analysis focuses on a discontinuity where the stamp duty jumps particularly strongly. This discontinuity allows us to isolate the impact of the stamp duty from other determinants of mobility.

In our core analysis we use data from the British Household Panel Survey (BHPS) and compare homeowners with *self-assessed house values* on either side of the cut-off, while controlling for flexible but smooth functions of house values. We find that the stamp duty has a significant negative effect on household mobility and that this effect is confined to short-distance moves and to moves that are housing- rather than job-related. Our core estimates indicate that the 2 percentage-point increase in the stamp duty reduces the annual rate of mobility by between 2 and 3 percentage points. This is a very substantive effect given that in the UK about 5 percent of all owner-occupier households move each year.

To further assess the validity and quantitative significance of the response of households to the stamp duty, we turn our attention to a different dataset from the Land Registry that consists of *actual transaction prices*. Analysing the distribution of transaction prices of all housing sales in England and Wales, we find additional evidence of a strong behavioural response. We document bunching of observed transaction prices at the cut-offs where the tax

rate increases and, consistent with the results of our core analysis, we find that a 2 percentage point increase in the tax rate decreases the volume of sales by roughly 30 percent.

Two strands of the economics literature motivate our analysis. Firstly, we draw on literature that explores the effects of various housing market policies on residential mobility and the corresponding mismatch on housing markets. A policy that has received particular attention by economists is rent control. Munch and Svarer (2002), for example, demonstrate that rent control in Denmark severely reduces the tenancy mobility. Glaeser and Luttmer (2003) go one step further and argue that rent control, by hampering residential mobility, locks households into suboptimal dwellings, creating wasteful mismatch on the housing market (i.e., a mismatch between different kinds of dwellings and households with different housing needs). They document that in New York rent control indeed causes an economically meaningful fraction of apartments to be misallocated across demographic groups.

Secondly, there is a long line of research starting from Oswald (1996) that explores whether high moving costs related to owner-occupied housing may have negative effects on owner-occupiers' labour market outcomes. Oswald (1996) argues that homeownership, by reducing mobility, may increase unemployment and provides cross-country evidence consistent with this conjecture. Subsequent studies (e.g., van Leuvensteijn and Koning, 2004; Munch *et al.*, 2006 and 2008; Battu *et al.*, 2008) that use individual-level panel data and more rigorous estimating techniques, by and large, confirm Oswald's conjecture that homeowners are less mobile. They rebut, however, the hypotheses that homeowners are more likely to become unemployed or have longer unemployment spells.[1] Coulson and Fisher (2009) explore a number of theoretical mechanisms that may affect the link between homeownership on the one hand and mobility and labour market outcomes on the other hand. They point out that different theoretical models can have very different predictions about the labour market at both micro and aggregate level. Their findings suggest that homeowners are less likely to be unemployed but they also have lower wages than renters. At the aggregate level, higher regional homeownership rates are associated with a greater probability of individual worker unemployment and higher wages. Finally, Ferreira *et al.* (2010 and 2011) point out that there may be an asymmetry in the mobility response of homeowners depending on whether they are in negative equity. Whereas their findings indicate that homeowners in negative equity are indeed less likely to move, other empirical studies (Schulhofer-Wohl, 2011; Coulson and Grieco, 2012) reach the conclusion that homeowners who are under water are slightly more likely to move than homeowners with positive equity.

[1] Van Leuvensteijn and Koning (2004) find no evidence that homeowners change jobs less than tenants. They conclude that the housing decision is driven by job commitment (and not the reverse) and that homeowners are less vulnerable to unemployment. Munch *et al.* (2006) point out that homeowners may set lower reservation wages for accepting jobs in the local labour market. Hence, they are more likely than renters to find jobs locally. Munch *et al.* (2008) have argued, from a search theoretic perspective, that homeowners should have a lower transition rate into new non-local jobs and therefore should stay longer in their jobs. Battu *et al.* (2008) suggest that there are differential effects across tenure types and that it matters whether the starting point is employment or unemployment. Their findings imply that homeownership is a constraint for the employed and public renting is more of a constraint for the unemployed.

The general lesson to be learned from these two strands of the literature is that policies that make households less mobile may harmfully affect the performance of housing- and labour markets.

Our study makes a contribution to these two strands of the literature by looking deeper into one of the mechanisms – barriers to mobility of owner-occupiers induced by housing transfer taxes – that may explain differences in mobility by tenure status.

Housing transfer taxes are an important part of moving costs and they are the most important component directly determined by policy makers. Despite this, little is known about their effect on mobility. On the theoretical side, Nordvik (2001) analyzes the mobility effects of the stamp duty in a theoretical dynamic life-cycle model of housing demand. He finds that a 2.5 percent stamp duty decreases the number of moves by the model household over the life cycle from three to one, implying a dead-weight loss of the stamp duty in the region of between 17 and 34 percent of the tax revenue.

On the empirical side, Dachis *et al.* (2012) utilize the introduction of real estate transfer taxes in Toronto to estimate their effect on the housing transaction volume and prices with a Differences–in-Differences approach comparing market outcomes across the boundary of the affected area.[2] They find that a 1.1 percent real estate transfer tax led to a 15 percent decrease in transactions in the first eight months after the introduction of the tax.

Van Ommeren and van Leuvensteijn (2005) provide indirect evidence on the mobility effects of the stamp duty using individual panel data for the Netherlands. They estimate a competing risks hazard model of moving to renting or owning with house values as an explanatory variable and use a theoretical model to infer the effect of transaction costs. Their results suggest that a 1 percentage-point increase in the value of transaction costs—as a percentage of the value of the residence—decreases residential mobility rates by at least 8 percent.

Discontinuities in transfer tax schedules have recently attracted increasing attention as a source of insight into how the tax affects market outcomes. Related to this paper, Best and Kleven (2013) utilize (i) the discontinuities in the UK schedule to study price responses and (ii) changes in the tax schedule over time to study the effect on the transaction volume. They find evidence of a strong negative price effect. In addition, they find that a temporary 1 percentage-point cut in the tax rate lead to a 20 percent increase in transactions. The bulk of this impact is explained by a long term reduction in sales rather than the timing of purchases. In a similar vein, Kopczuk and Munroe (2013) utilize the discontinuity in tax liability induced by the so called mansion tax in the US and find evidence that the incidence of this tax is on the seller. Davidoff and Leigh (2013) use data from Australia where the marginal tax rate rather than the average tax rate jumps at various cut-off prices. They use past local house prices and national house price inflation to construct an instrumental variable for the transfer tax rate. Their results indicate that a higher tax rate reduces turnover and that the incidence of the tax is on the seller.

[2] See also Dachis (2012) for follow-up work using a longer data period.

The contribution of our study to this existing literature is twofold. Firstly, we identify the *long-term (equilibrium) effects* of the stamp duty on *actual household mobility*. Secondly, we are able to distinguish between different types of moves. In particular, our analysis distinguishes between *short- and long-distance moves* and between *housing- and job-related moves*. This paper is to our knowledge the first quasi-experimental study that directly evaluates the effect of a real estate transfer tax on actual household mobility.

2. The UK stamp duty system and theoretical considerations

The stamp duty on real estate transactions was introduced in the UK during the 1950s. We focus on the current system of stamp duty on residential real estate transactions.[3] The stamp duty is paid by the buyer and is a percentage share of the purchase price of the house. The economic incidence, however, can be mainly expected to fall on the seller: In a setting with a uniform stamp duty for all properties and relatively inelastic supply, the stamp duty will be nearly fully (negatively) capitalised into house prices and the tax will be mainly borne by the seller.[4]

The defining feature of the UK stamp duty system is a progressive schedule where the tax rate for the whole purchase price goes up at certain thresholds. Table 1 reports the tax schedule that applies during our sample period: Houses sold for up to 125,000 are exempt from stamp duty, but from £125,000 upwards the tax rate rises in a stepwise manner from 1 to 5 percent.[5]

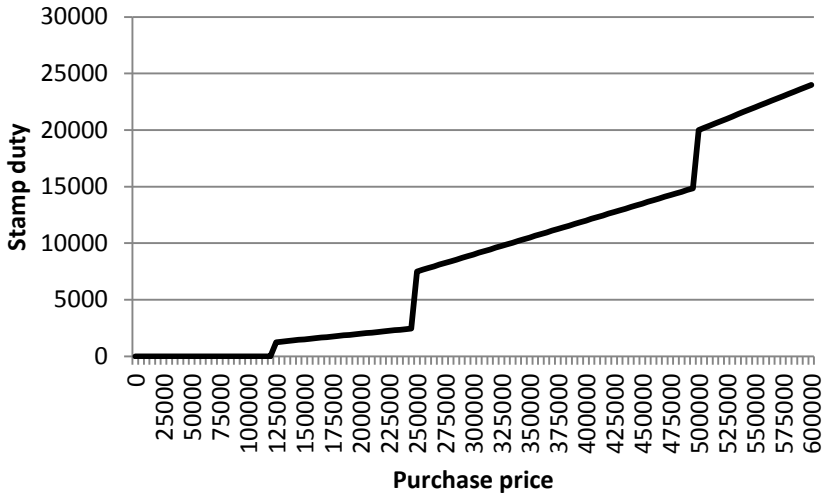
Figure 1 illustrates the relationship between the purchase price and stamp duty liabilities. Our empirical analysis focuses on the second cut-off at £250,000 where the tax rate increases from 1 to 3 percent. We do so for three reasons: (1) The cut-off is not affected by regional exemptions, (2) stamp duty payable increases significantly at the cut-off (from £2,500 to £7,500), and (3) our data is reasonably dense around the £250k cut-off. Significant variation in stamp duty liabilities and large sample size together make it possible to detect the effects of the stamp duty on mobility.

[3] The stamp duty also applies to other types of property transactions.

[4] Dachis *et al.* (2012) document roughly full capitalization of housing transaction taxes in the Toronto area and Davidoff and Leigh (2013) find evidence of strong capitalization in Australia. Hilber *et al.* (2011) find roughly full capitalisation of central government grants in England, implying that the stamp duty – another fiscal instrument – may also be roughly fully capitalised.

[5] A new higher "mansion" tax rate of 7 percent (or 15 percent for corporate bodies) was introduced for properties over £2 million on 22 March 2012.

FIGURE 1
Purchase price and stamp duty



We focus on the current stamp duty system – the Stamp Duty Land Tax (SDLT), which replaced the old system in 2003. The SDLT was designed to crack down on tax evasion. In the old system it was possible to evade taxes by selling "fixtures and fittings" separately at excessive prices. In the current system, the sale of fixtures and fittings is declared together with the property and the Land Registry compares purchase prices with typical prices paid in the area to detect evasion.

The stamp duty drives a wedge between the price obtained by the seller and the price paid by the buyer and basic economic intuition suggests that these transaction costs will result in fewer housing transactions. Moreover, to the extent that households who consider moving need the sales proceeds for their next down-payment or do not want to become a landlord and rent out their existing home, we would expect that the stamp duty also reduces household mobility.[6]

When households make their mobility decisions they take into account the expected benefits of moving as well as the expected costs. The expected benefits will depend on the underlying motive for the move. Moves induced by employment related shocks can be expected to have a greater variance in expected benefits than moves induced by incremental housing-related motives. On the cost side, one cost component households will consider are the expected transaction costs induced by the stamp duty and these in turn depend on the expected sales price upon moving (i.e., the self-assessed house value).

[6] In addition to the effect on the mobility of homeowners, the stamp duty may also affect the propensity that households choose to become homeowners (and, possibly, the aggregate housing consumption over the life cycle). Households (especially those with a short expected duration) can be expected to become renters because the moving costs are high. The effect of the stamp duty on tenure choice is a question that should be explored in future work.

It is, however, not immediately clear how the owner's perceived house value and tax induced moving costs are related in the British stepwise tax schedule. We therefore use simple theoretical reasoning to analyse the likely effect of the stamp duty schedule on incentives to move for households with different self-assessed house values.

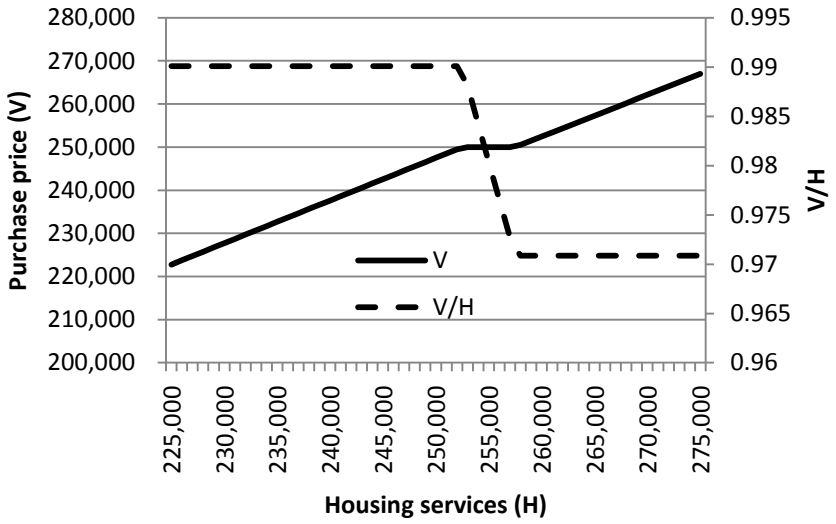
In our empirical analysis we essentially compare households reporting house values above the 250k cut-off with households with self-reported values below the cut-off. Specifically, we assume that dwellings produce a homogenous flow of housing services *H*. We consider a competitive housing market (for simplicity without search) where the buyers' willingness to pay for *one unit* of *H* is fixed and denoted by *P*. For illustrative purposes, let *P=1*. The purchase price of the dwelling is denoted by *V* and the stamp duty rate by *t*. In this setting, the stamp duty is capitalized into the purchase price *V*, and, hence, *V* is given by $V = PH/(1 + t) = H/(1 + t)$. We assume that, other things equal, a household's propensity to move depends negatively on the price per unit of housing services they receive upon sale $V/H = 1/(1 + t)$.

Figure 2 illustrates the relationship between housing services *H* provided by the dwelling (horizontal axis), price of the whole dwelling *V* (left vertical axis) and the seller's price per unit of housing services *V/H* (right vertical axis) in a UK type stepwise tax schedule with $t = 0.01$ up to $V=250$k and $t = 0.03$ for $V>250$k.

With this tax schedule, a house with *H* just above the cut-off will sell for £250k because, due to the higher stamp duty, charging slightly above £250k would imply that the buyer is better off buying a house with slightly lower *H* and price £250k. As shown by the solid line, a seller will only be able to charge above £250k if the value of the services above the cut-off exceeds the *additional* stamp duty liabilities (£5,000).

FIGURE 2

Housing services, purchase price and price per unit for the seller



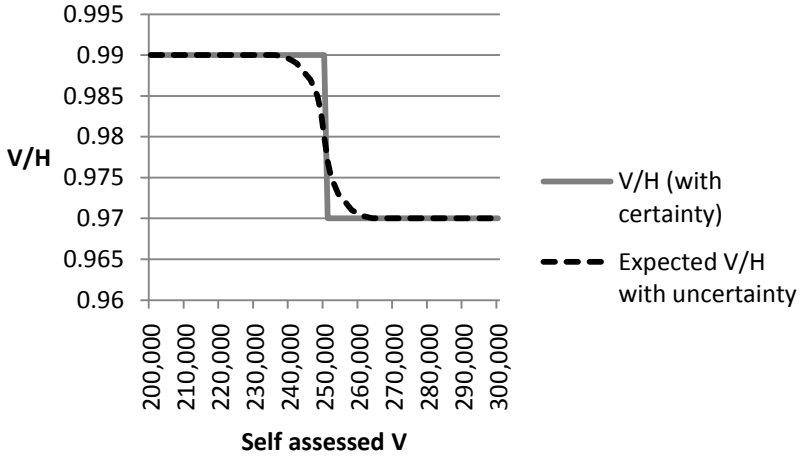
Now consider the relationship between the self-assessed house value *V* and the price per unit of *H* obtained by the seller. As a starting point, we assume that households think they know

with certainty (i) the value of their house and (ii) that the stamp duty is fully negatively capitalized into the sales price. In this simplified case, sellers with self-assessed house value (i.e., expected sales price) below £250k face a 'market price' (*V/H*) of £0.99 per unit of *H* and households reporting above £250k face a 'market price' of £0.97. Households reporting exactly £250k include those who would sell for £250k even in the absence of the tax rate notch (i.e., the jump from 1 to 3 percent) and those who would sell for £250k < $V \leq$ £255k in the absence of the notch but are unable to do so because of the notch. The latter group now receives £0.97$\leq$ *V/H* $\leq$ £0.99. We argue that the decrease in the price per unit of housing services, *V/H*, at the cut-off reduces the utility of moving compared with the utility of staying. Hence, we expect to see a drop in household mobility, when the perceived value of the house exceeds £250k.

With full certainty, *V/H* can be expected to drop sharply at £250k. This is illustrated by the solid line in Figure 3. In practice, however, households are likely to be uncertain about the true sales price of their house. We would expect that uncertainty will smooth out the relationship between the self-assessed price and *V/H*, as illustrated by the dashed line. Moreover, respondents may or may not include the amount charged for fixture and fittings and possible illegal side payments in their house value estimates. If avoidance components are included in the self-assessed value, households reporting a house value slightly above £250k may in fact face a *V/H* above £0.97, which would further smooth out the downward shift in *V/H* at the £250k cut-off, as illustrated in Figure 3. Uncertainty implies that, strictly speaking, there is no sharp discontinuity in the *V/H* at the £250k cut-off. However, at the scale we use in the empirical analysis, arguably, the discontinuity is sharp enough for regression discontinuity type empirical analysis to be informative of the causal effect of the stamp duty increase at the cut-off. Due to data limitations, and the fact that household mobility is difficult to model, we have to use data relatively far from the cut-off to get reasonably precise estimates. In our base specification, we use a sample where self-assessed house values vary between £175k and £325k (a 30 percent band around the £250k cut-off).

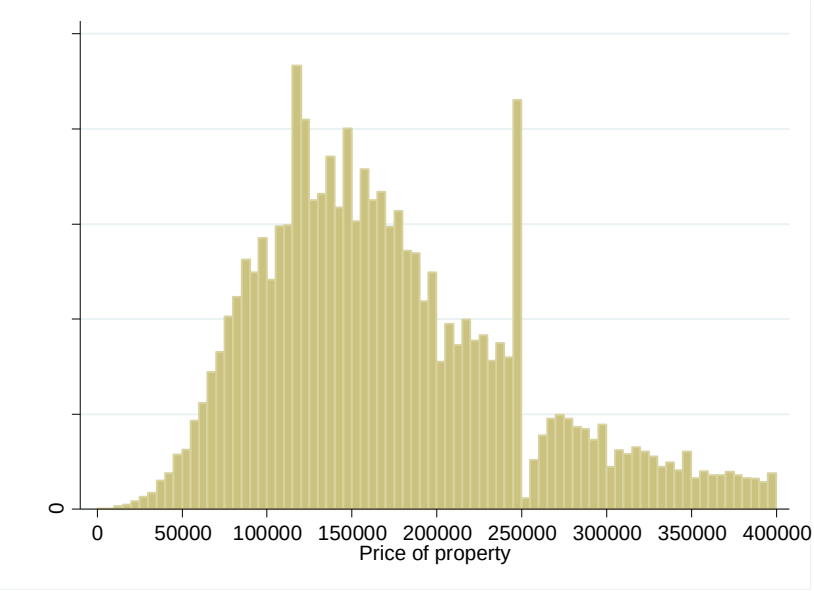
FIGURE 3

Seller's self-assessed house value and price per unit of housing services



Our theoretical analysis suggests that we should observe a pile-up in the transaction price distribution at £250k because houses that would sell for up to £255k absent of the tax rate notch will sell for £250k. This is indeed what is seen in Figure 4, which illustrates the distribution of actual transaction prices in the UK in 2006 from a data set obtained from the Land Registry. Our simplified theoretical analysis also implies that the price distribution right of the cut-off should move left and the distribution should continue smoothly after the cut-off. However, Figure 4 shows a dip in the distribution immediately right of the cut-off. Very few properties sell at £251k – £255k. The possibility to avoid taxes by selling fixtures and fittings separately at excessive prices is a possible explanation for this dip. Even though the SDLT system introduced in 2003 made such tax avoidance harder, it is likely that close to the cut-off people are more prone to engage in tax avoidance, even by unlawful means, because just above the cut-off, the expected benefits of trying to bring down the declared purchase price may exceed the cost associated with the risk of getting caught.[7]

FIGURE 4
Housing transaction prices in the UK in 2006



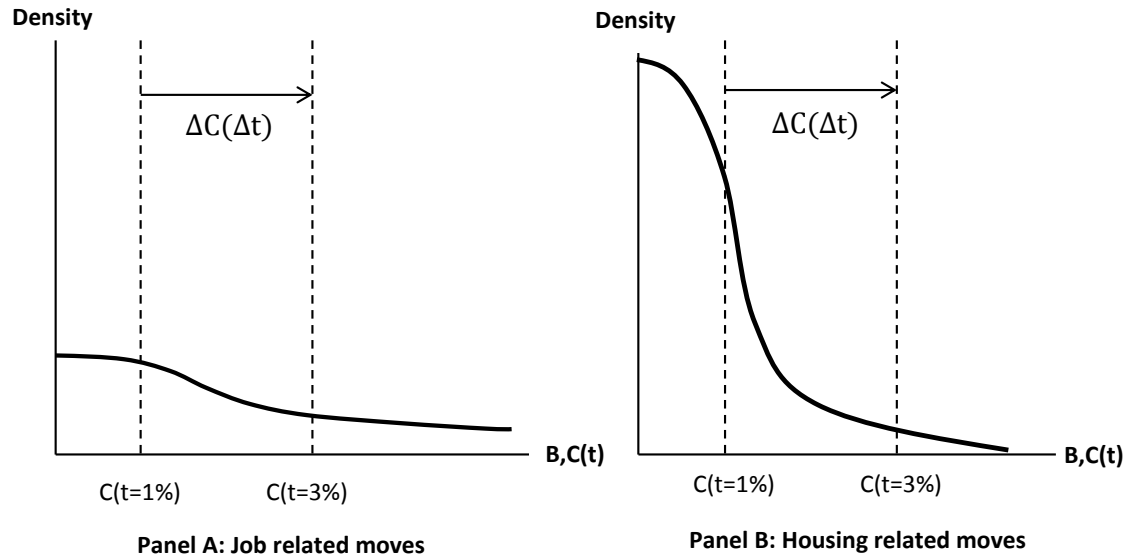
The above theoretical considerations yield a number of empirically testable predictions. Our main prediction (**Prediction 1**) follows directly from the above considerations: At the house

[7] Our theoretical considerations abstract from the fact that sellers may not only care about the sales price but also about the property's expected time on the market, which signifies an opportunity cost to them. Properties that offer housing services close to H=257,500 but can only be sold for £250k can be expected to have a shorter time on the market than properties that offer housing services H only slightly above 252,500 and that can also be sold for £250k. This effect may thus in principle further reduce the sharpness of the discontinuity in V/H at the £250k cut-off. During our sample period, however, the median time on the market was quite short (see: http://www.hometrack.co.uk/our-insight/monthly-national-house-price-survey/time -to-sell-over-three-months-across-a-third-of-the-country; last accessed on 29/5/2012). Moreover, property sales in the UK are time-consuming mainly due to a complicated legal procedure that takes roughly 12 weeks irrespective of the 'attractiveness' of the asking price (see e.g., http://www.home.co.uk/guides/buying/; last accessed on 29/5/2012). Hence, the discontinuity in V/H at the cut-off can be expected to persist even when endogenous time on the market is taken into account.

value cut-off of £250k, as a consequence of the stamp duty tax notch, household mobility should decrease.

We would expect that the magnitude of this adverse effect depends on household specific circumstances. Homeowners who face gradual changes in their life-cycle circumstances, which move them away incrementally from their optimal locations and housing consumptions, may be more strongly discouraged from moving, as a consequence of the stamp duty, than homeowners who face more momentous – typically employment related – mobility shocks. Generally, we would expect that the variance of the expected benefit associated with a longer distance or employment related move is greater than the variance of the expected benefit associated with a shorter distance or housing related move. The corresponding empirical predictions are that at the house value cut-off of £250k, as a consequence of the stamp duty tax notch, the adverse effect on household mobility should be greater for shorter-distance moves than for longer-distance moves (**Prediction 2**) and for housing related as opposed to job related moves (**Prediction 3**). The theoretical argument for this prediction is illustrated in Figure 5. Households relocate when the benefits (*B*) exceed the costs (*C*) of moving. The curve shows the density function of the benefits of moving. An increase in the stamp duty rate from 1 to 3 percent reduces the mobility by the area between *C(t=1%)* and *C(t=3%)*. This area is bigger in panel B than in panel A because the benefits associated with housing related moves have a shorter tail than job related moves.

FIGURE 5
Job versus housing related moves



Finally, we would expect that an increase in transaction costs results in an overall reduction in observed sales right of the cut-off (**Prediction 4**).[8] In the empirical analysis that follows we turn to the data to test Predictions 1 to 4.

[8] Consistent with this theoretical conjecture, in Figure 4 the distribution right of the cut-off seems depressed even further away from the apparent bunching region, suggesting that the tax reduces the volume of sales.

3. Empirical analysis

Our empirical analysis consists of two parts. In Section 3.1 we use household level data from the BHPS to analyse the effect of the tax on overall household mobility and on different types of moves (Predictions 1 to 3). In Section 3.2 we then turn to housing transaction data from the Land Registry to estimate the effect of the stamp duty on the volume of transactions (Prediction 4).

3.1. Impact on household mobility

3.1.1. BHPS data

The data used in this section is derived from the BHPS. The BHPS follows roughly 10,000 households over time. The survey began in 1991 and the last year available is 2008.[9] The surveys for each wave are conducted between September and March. We define our 'year' variable as the year when data collection started.

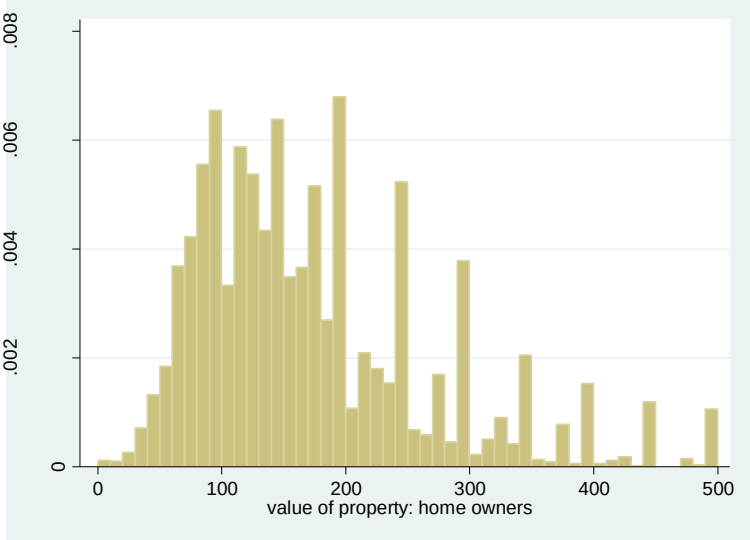
In addition to a rich set of household characteristics, the dataset includes the owner-occupiers' assessments of the value of their homes and information on whether the household moved in the subsequent year, making it an ideal dataset to study the impact of the stamp duty on household mobility. The exact question on which the self-assessed house value is based is: "About how much would you expect to get for your home if you sold it today?" If the household gives a range, the interviewer will report the lowest figure in that range.

We limit the sample to the post 2002 period when the SDLT system with stricter control on tax avoidance came into effect. In the estimations, we further limit the sample to owner-occupiers with self-assessed house values within 20 to 40 percent bands around the £250k cut-off where the stamp duty tax rate jumps from 1 to 3 percent. A further limitation is that the mobility status of the last wave (2008) is not known. Thus, the estimation sample consists of data from 2003 to 2007. Finally, we are concerned that recent movers may bias our results. Because many houses sell at and just below £250k, recent movers are disproportionately represented just below the cut-off. To the extent that the *recent mover* status affects mobility, this may bias our estimates. Moreover, recent movers may be problematic for our research design in the sense that they can precisely choose the value of their house. Their ability to "precisely manipulate" the assignment variable can invalidate the Regression Discontinuity (RD) design. Due to these issues, we exclude households that moved into their current dwelling between year *t-1* and *t*.

Figure 6 shows the distribution of self-assessed house values. Overall, people tend to report round values divisible by £50k. There is a clear spike at £250k, but this spike does not stand out from the other round values. The spike is clearly much more pronounced in the transaction price distribution in Figure 4. The fact that there is no abnormal pile-up at the cut-off supports the validity of the RD design.

[9] The BHPS was subsequently replaced by the *Understanding Society* survey and there was a break in the panel.

FIGURE 6
Distribution of self-assessed house values (excluding recent movers)



Treatment variable

Our treatment variable is a dummy variable that equals one if the self-assessed house value of household *i* in year *t*-1 exceeds £250k, $Treat_{it\text{-}1}$ = D(*House value*$_{it\text{-}1}$ > 250k). Based on the discussion in Section 2, we argue that the likelihood of being affected by the 3 percent tax rate rather than the 1 percent rate increases drastically at, or in the vicinity, of this point. The self-assessed value may not be an accurate measure of the actual value when a house is sold. However, the self-assessed value is arguably more relevant for our purposes as households' expectations regarding stamp duty payable upon sale are likely based on the self-assessed house value.

Outcome variable

Our outcome variable measures actual moves between the interview date and the subsequent interview. The variable move gets the value one if the BHPS records classify the household as a mover household in *t*. We lose some observations due to attrition from the panel between *t*-1 and *t* but we were able to recover the value of the moving indicator for some non-respondent households by utilizing information in the sample record files of the BHPS. In addition to the overall mobility, we study different types of mobility separately by using information on the distance of move and main reasons of moving.

We argue that a direct measure of household mobility is preferable to measures of housing transactions, used in previous studies, when the interest is on the potential adverse impact of the stamp duty on the functioning of housing- and labour markets. As already noted in the introduction, the effect of the stamp duty on transactions may differ from the effect on mobility for two reasons: (i) some housing transactions are carried out by investors rather than owner-occupiers, and (ii) some mover households can circumvent the stamp duty by renting out their previous house rather than selling it. In the latter case, the stamp duty leads

to a distortion in a household's investment portfolio but may affect mobility to a lesser extent. In our data about 20 percent of owner-occupiers who moved appear to have rented out their previous unit.[10]

Control variables

Exploring the data suggests that households that report round house values divisible by £50k (£100k, £150k etc.) have a lower propensity to move. One might be concerned that households intending to stay do not follow the market as closely and give rough rounded estimates of the value of their house. The round value effect might bias our estimates if disproportionately many round values are in the treatment or the control group. To address this issue, we include a dummy variable for round house values divisible by £50k in the model as a control variable. In addition, we control for year specific effects that affect the whole economy by including year dummies.

Summary statistics

Table 2 shows summary statistics for the variables used in our empirical analysis for the largest regression sample (40 percent band around the cut-off). The average house value in the sample is £220,000 and 4.7 percent of households moved within a year. To analyse whether different types of moves are differentially affected, we divide moves into three categories based on the distance of move: less than 10km, 10-30km and over 30km. In addition, we use information about the main reason of moving given by the respondents. We divide these reasons into three categories: 'housing and area related', 'employment related' and 'other or unknown' (includes missing values). Housing related reasons and other or unknown reasons are the most common categories. Moves motivated mainly by job related reasons seem to be rare. This may partly reflect how the survey question is formulated. Employment motives may still be important even if they are not the main reason of move. Moving distance and main reason of move being employment related are strongly positively correlated and we think that by analysing the distance of move we can gain additional insight into whether the stamp duty hinders relocation of the workforce. Only one percent of short distance moves (less than 10km) but about 13 percent of moves beyond 30km are mainly job related. Similarly, 56 percent of short distance moves but only 18 percent of long distance moves are mainly housing related.

3.1.2. Empirical specification

We use regression analysis to estimate the impact of an increase in the stamp duty rate on the propensity to move of owner-occupier households. The estimation of the effect of the stamp duty is challenging because stamp duty liabilities are likely to be correlated with other factors that affect mobility. However, the fact that the stamp duty rate for the whole property jumps at certain cut-off points can be used to identify the impact of the stamp duty. More

[10] Housing transactions are not recorded directly in our data. The estimate was calculated by checking whether owner-occupiers who had no additional property when they moved have an additional property two years later.

specifically, we use the RD method discussed in Lee and Lemieux (2010). The idea is to compare mobility rates below the £250k cut-off point, where the stamp duty amount increases sharply, with the moving probability of households above the cut-off point. We estimate a regression model of a mobility dummy on a dummy for being above the cut-off point and include a flexible but smooth function of house values in the set of control variables. The house value variables pick up the impact of all determinants of mobility correlated with house values, apart from the stamp duty. Hence, we will obtain a reliable estimate of the effect of the stamp duty on mobility clean from confounding factors that might otherwise bias our estimates.

We estimate a reduced form model evaluating the mobility effect of being above the £250k threshold compared with being below the cut-off. We estimate by OLS the following model:

$$Move_{it} = \beta_t + \beta_1 Treat_{it-1} + f(House\ Value_{it-1}) + u_{it}, \quad (1)$$

where the dependent variable $Move_{it}$ is the mobility indicator that gets the value one if household i moved between $t - 1$ and t. The treatment variable takes the value one if the household's self-assessed house value exceeds £250k. The function $f(House\ Value_{it-1})$ is a 1^{st} – 4^{th} order polynomial of self-assessed house values. To facilitate comparability of the treatment and control groups, we limit the data to 20, 30 or 40 percent bands around the cut-off.

Our empirical model can be interpreted as a reduced form of a fuzzy RD design. Arguably, the discontinuity we exploit is likely to be fuzzy because we can't be sure whether all households reporting house values above the limit are affected by the 3 percent tax rate. Standard fuzzy RD analysis uses a discontinuity in the likelihood of obtaining the treatment as an instrument for the actual treatment status in a Two-Stage-Least-Squares regression. This approach is not feasible with the BHPS data because there is no way to identify the treated households with certainty. We argue that the reduced form of the fuzzy RD likely produces downward biased estimates of the actual treatment effect, because the treatment group as defined in (1) likely measures actual treatment status with error, which leads to attenuation bias towards zero.

The identifying assumption of the model is that other determinants of mobility develop smoothly with respect to house values and are therefore captured by the f function. The ability of households to precisely manipulate whether they are to the right or to the left of the cut-off would invalidate the design. Manipulation of the self-assessed value is naturally possible but households do not have incentives to misreport in the BHPS survey. Manipulation of the actual value of the house may be possible too by, for example, neglecting renovation. However, local demand and supply conditions are the main drivers of house prices and therefore precise manipulation is impossible.

If all households respond similarly to the stamp duty, our results for the £250k cut-off can be generalized to apply for the whole population in the UK and possibly tell us something about the effects of similar taxes in other countries as well. With heterogeneous responses, the

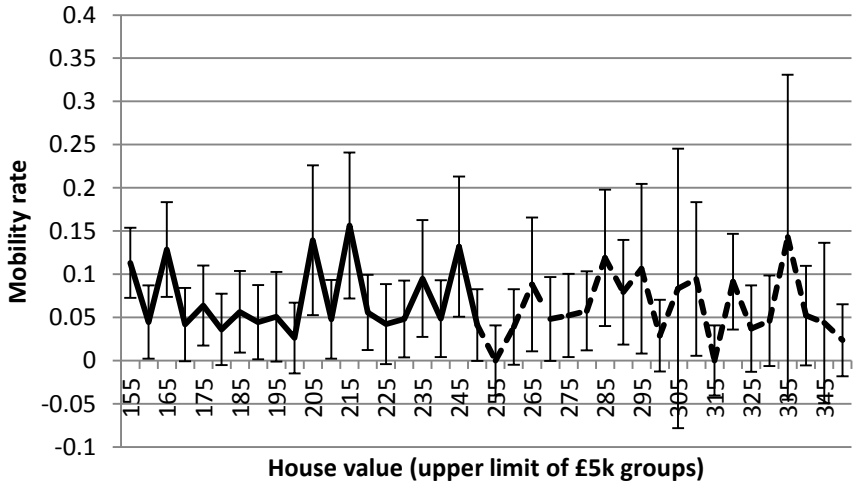
results may apply to a smaller sub-population. Drawing on Lee and Lemieux (2010), our estimates can be interpreted as a weighted average of treatment effects of the British owner-occupier households in the BHPS data. The weight of each household is the probability that their self-assessed house value falls within the band around the cut-off used in each specification we estimate.

The panel property of the data and the lumpiness of the distribution of self-assessed house values have potential implications for statistical inference. Firstly, since the households in our sample are observed in multiple years, we have to account for within household correlation of the error terms. Hence, we cluster the error terms at the household level in our base specification. Another potential issue regarding statistical inference was pointed out by Lee and Card (2008), who discuss RD analysis with a discrete assignment variable. They argue that specification errors in the fitted regression line imply that at each discrete value there is an error component positively correlated within observations at that particular point, which means that standard errors are downward biased. They show that clustering standard errors by the values of the discrete assignment variable solves the problem. In principle, the self-assessed house value is a continuous variable and in the BHPS data there are observations at 147 different self-reported values within the broadest house value band we use (£150k – £350k). However, 97.7 percent of the observations are concentrated at values divisible by £5k. We construct a new house value variable by rounding house values up to the closest value divisible by £5k and use it as an alternative assignment variable in a robustness check where we cluster standard errors at the house value group level in addition to the household level. Clustering at all of the 147 discrete values is not feasible because of very few observations at several non-round values. Clustering at the house value group level may be problematic with the samples using the 20 percent and 30 percent bands around the £250k cut-off because the number of clusters is limited. With the 40 percent band, however, the number of house value clusters is reasonably large (40 clusters). This robustness check indicates to what extent standard errors clustered only at the household level are likely to be downward biased.

3.1.3. Results

We start with a descriptive analysis of mobility, in which we do not restrict the functional form of the relationship between the house value and mobility. Figure 7 illustrates predicted mobility for £5k wide house value groups from a regression of the mobility indicator on house value group dummies. The line in Figure 7 is highly volatile, but it seems to suggest that there is a downward shift in the moving probability when the self-assessed house value exceeds £250k. Next, we test for the statistical significance of this downward shift and attempt to quantify it with our RD type method.

FIGURE 7
Mobility and self-assessed house values



Notes: Predicted mobility from a regression of a move dummy on house value group dummies. Solid line indicates house values with 1 percent stamp duty rate and dashed line indicates house values with 3 percent stamp duty rate.

Table 3 reports the results of the adverse impact of the stamp duty increase on observed household mobility (Prediction 2). In the first column, we show the naïve regression where we do not control for house values. Columns 2 – 5 report the results with 1st – 4th order polynomials of house values. Rows 1 – 3 use 20, 30 and 40 percent bands around the £250k cut-off. The Akaike Information Criterion (AIC) is shown in italics to assist specification selection.

In the first column, the coefficient on the treatment indicator is close to zero and insignificant, but becomes negative and significant when the house value controls are added. With the +/-20 percent band, the estimates vary from -0.02 and insignificant to -0.055 and significant. Using a wider band makes the estimates more stable and decreases the standard errors. With the 30 percent band, the estimate is -0.025 and highly significant in the second column and stays virtually unchanged in the 3rd column. In the fourth column the coefficient is 0.22 and significant at the 5 percent level. We take this specification with the 30 percent band and the 3rd order polynomial of house values as our preferred specification. The band is wide enough for reasonably precise estimation and the 3rd order polynomial is chosen because adding further polynomials increases the AIC score. Taken at face value, the point estimate of our preferred specification implies that the 2 percentage-point increase in the stamp duty rate reduces the propensity to move by about 2.2 percentage-points in absolute terms or by 31 percent in relative terms.[11] In row 3, using a 40 percent band around the cut-

[11] The relative decrease in propensity to move was calculated by comparing the treatment effect estimate (2.2 percentage points) in our preferred model specification to the predicted moving propensity (7 percentage points) in the treatment group absent of the treatment. The relative reduction in mobility is 2.2/7 = 31 percent.

off, the coefficient is insignificant with the 1st order polynomial but becomes significant with the 2nd order polynomial or with higher order polynomials.

Our various point estimates vary around our preferred estimate with the attached standard errors also varying around the standard error of the preferred estimate. Overall, our results provide strong supporting evidence that an increase in the stamp duty has a significant negative effect on household mobility.

Distance and type of moves

In Table 4, we explore the proposition that an increase in the stamp duty tax rate more strongly adversely affects short distance moves (Prediction 2). We divide moves into three groups based on the straight line distance of move: less than 10 kilometers, 10-30 kilometers, and over 30 kilometers. The shares of these groups in our sample are 56 percent, 17 percent and 27 percent. We use indicators for these categories as outcome variables in model (1). The results imply that the overall effect found in Table 3 is *solely driven by short-distance mobility* (less than 10km). Medium- and longer-distance mobility appear to be unaffected by the stamp duty. A likely explanation for this finding is that short-distance mobility is often related to adjustments of housing consumption. A 2 percentage point increase in the stamp duty may outweigh the benefits of typical housing consumption adjustments, such as buying one room more or less, but it may not outweigh the benefits associated with longer distance moves. The latter are typically related to other important decisions, such as changes in employment or family status.[12]

In Table 5, we test the proposition that the stamp duty has a stronger impact on housing related than on employment related household mobility (Prediction 3). We use information on the primary reason of moving to divide moves into three groups: 1) Job related mobility, 2) housing and area related mobility, and 3) reason of move 'other or unknown'. The share of moves mainly motivated by job related reasons is only about 5 percent, which makes it difficult to identify a separate effect on job motivated moves. This issue notwithstanding, the results in Table 5 are in line with our interpretation of the distance-of-move results in Table 4. Coefficients for housing and area motivated moves are always negative and highly statistically significant in three of the six specifications while the coefficients for job related moves are close to zero and insignificant. This finding is consistent with a setting where the benefit derived from a job-related move has a low mean but a high variance. In such a setting we should observe few job-related moves and very few of them should be affected by the stamp duty. The results are less clear-cut for mobility for 'other and unknown' reasons. The negative and sometimes significant coefficients are indicative that part of the negative mobility effect of the stamp duty may be attributable to a reduction in this kind of moves.

[12] Consistent with this conjecture, Buck (2000) finds that job-related moves in the UK tend to be over longer distances (across rather than within Local Authority Districts).

Validity tests and robustness checks

A standard way of testing the validity of the RD design is to check if predetermined characteristics of households change significantly at the cut-off. If the flexible but smooth function of the assignment variable (self-assessed house values in our case) adequately captures other relevant factors, we should not observe changes in background characteristics of households at the cut-off. Specifically, we are concerned that households with a high underlying propensity to move and houses worth slightly above £250k (in the absence of the tax notch) may be better informed about the stamp duty and may therefore be more likely to report precisely £250k rather than slightly above £250k. To test this, we estimate model (1) using several observed determinants of mobility as the dependent variable. The variables used are: the age of the household head, dummy for kids, household income and two indicators of education (GCE A-levels or higher and bachelor degree or higher) as the dependent variable. If the sorting story was true we would expect to find significant coefficients in the balancing tests. The balancing tests for education are particularly important because in addition to being related with mobility, education may also be related with how well the household knows the stamp duty system.

Table 6 shows the results of the balancing tests with a 3rd order polynomial of house values in Panel A and 4th order polynomial in Panel B. Panel A, indicates that income, the likelihood of having children and education are not correlated with the treatment variable but, in the specification with the 40 percent band, age is statistically significantly higher in the treatment group. However, when we add the 4th order term of house values in Panel B, the coefficient becomes insignificant even with the 40 percent band.

In order to test whether our results might be driven by age and other confounding factors correlated with the treatment indicator we include age, dummy for kids, log of household income, dummy for GCE A-levels or higher, dummy for bachelor degree or higher and region dummies (19 regions) as control variables in model (1). Table 7 shows the results. The coefficients on age of household head, dummy for kids and log of household income are negative and significant and the dummy for bachelor degree is positive and significant (not shown in the tables). The coefficients on the treatment indicator are very similar to the specifications without the additional controls in Table 3, which increases our confidence in the finding that the stamp duty decreases mobility. The robustness of the results to observed determinants of mobility suggests that unobserved omitted variables are unlikely to bias our estimates significantly.

We carried out a number of additional robustness checks, the results of which we report in various Appendix Tables. To begin with, as a further test for whether households with a high underlying propensity to move sort into the self-assessed house value of £250k, we re-estimated Table 3 dropping all households that self-report exactly £250k. The results reported in Appendix Table A1 are similar despite losing many observations. Our results survive even when we limit the sample to households who say they are willing to move. In this subsample,

sorting on unobserved propensity to move should not be a problem. The results are shown in Appendix Table A2.

In our base specification, we fit the same polynomial over the whole range of house values and only allow the intercept to change at the cut-off. Restricting the polynomials to be the same on both sides of the cut-off can be considered intuitively unappealing, because it implies that we use data on the right of the cut-off to estimate the function on the left, and vice versa. We therefore estimate a more flexible specification in which we allow the slope of the regression line to differ by treatment status. That is, we estimate the coefficients on the n^{th} order polynomials of house values separately for the sample below and above the cut-off. We report results with 1^{st} and 2^{nd} order polynomials of house values, so that the maximum number of parameters used is the same as in our base specification. The results are reported in Appendix Table A3. Again, all estimates are negative and some of them are statistically significant. As expected, the standard errors go up in some specifications, especially with the 2^{nd} order polynomial.

Another concern is that our results might be driven by some irregularities related to the reporting of house values around round numbers. In order to test this possibility, we run placebo tests with artificial cut-offs set at £200k, £225k, £275k and £300k. We focus on our core specifications that use a 30 percent band around the cut-off and 3^{rd} and 4^{th} order polynomials of house values. The results are shown in Appendix Table A4. One of the eight placebo tests gives a positive and significant coefficient at the 10 percent-level, the rest are small and insignificant. The fact that our method does not give significant negative coefficients at artificial cut-offs increases our confidence in the finding that the decrease in mobility at £250k is indeed caused by the 2 percentage-point increase in the stamp duty at the cut-off.

Finally, standard errors in Table 3 are clustered at the household level to make them robust for correlation in the error term within household. As discussed in Section 3.1.2., the error terms may, in addition, be correlated within different self-assessed house values. In Appendix Table A5 we show the results with the 40 percent band using £5k wide house value groups as the assignment variable and two-way clustering. The coefficients on the treatment indicator in Appendix Table A5 are almost identical to those in Table 3. A comparison of standard errors in Appendix Table A5 with the standard errors in Table 3 (40 percent band) suggests that the one-way clustered standard errors in Table 3 are only slightly downward biased. Two-way clustering increases standard errors by around 0.002 depending on the specification – the significance levels do not change.

The analysis thus far has focused on the adverse impact of the stamp duty on *household-specific* mobility decisions by assessing self-assessed house values around a tax rate cut-off and has revealed that the adverse effect may be mainly confined to short distance and housing related moves.

In the analysis that follows, as a cross-validation check, we focus instead on the distribution of observed transaction prices. In doing so we draw on a recent literature on 'bunching' (e.g., Saez, 2010; Slemrod, 2010; Seim, 2012; Kleven and Waseem, 2013; Kopczuk and Munroe, 2013; Best and Kleven, 2013) and use actual housing transaction price data from the Land Registry to provide estimates of the aggregate effect of the stamp duty on the volume of housing transactions.

While this additional analysis does not allow us to identify the impact of the stamp duty on actual household mobility and for different types of moves, it has a number of alternative virtues. Firstly, our estimates of the effect of the stamp duty on household mobility vary significantly across specifications and are not always precisely estimated. In contrast, the estimates that are based on the Land Registry data arguably provide a rather precise estimate of the overall effect of the stamp duty on the sales volume. This is because the Land Registry dataset covers *all* housing transactions in England and Wales and therefore yields a much larger sample size. Secondly, the fact that we use an alternative dataset (that consists of actual transaction prices rather than self-assessed house values) and an alternative methodological approach allows us to further assess the validity and quantitative significance of our core finding – the behavioural response of households to the stamp duty. Thirdly, whereas self-assessed house values do not allow us to identify the treated households with certainty, actual transaction prices provide concise information on the treatment. Lastly, as discussed above, a move does not necessarily equate a housing transaction and vice versa. Hence, estimating the impact of the stamp duty on the transaction volume provides additional insights.

3.2. Impact on transaction volume

3.2.1. Land Registry data

The housing transactions data for our aggregate analysis comes from the British Land Registry, which records the price and some minimal information on the property of each housing transaction in England and Wales. For our analysis we use data for England for the years 2003 to 2008. We limit the sample to transactions between £150k and £350k (40 percent band around the cut-off value of £250k), which leaves us roughly 2.8 million transactions.

3.2.2. Empirical specification

The bunching of transaction prices at the cut-off, illustrated in Figure 4, indicates that there is a behavioural response to the tax rate notch. As discussed in Section 2, one potential explanation for bunching at £250k and the following hollow region with very few sales is capitalization of the tax into the price and by tax avoidance with convex costs. Our focus is on the adverse impact of the tax rate increase on the volume of sales which shows up as missing mass further away from the hollow region right of the cut-off. In order to estimate the reduction in the sales volume due to the tax rate increase, we fit a polynomial to the price distribution and include a dummy for transactions above £250k, as well as controls for values

close to the cut-off and natural bunching at round values. We aggregate the distribution of transactions to £5,000 wide bins to smooth it, and in order to avoid using data overly far from the cut-off we limit the sample to £150k – £350k. We include dummies for bins close to the cut-off to eliminate the impact of the local bunching of sales to the treatment effect estimate. The model can be written as follows:

$$ln(N_{jt}) = \beta_t + \beta_1 Treat_{jt} + f_t(Price_{jt}) + \lambda_1 Bin240_{jt} + \ldots + \lambda_6 Bin265_{jt} + \delta_1 Round50_{jt} + \delta_2 AfterRound50_{jt} + u_{jt}. \quad (2)$$

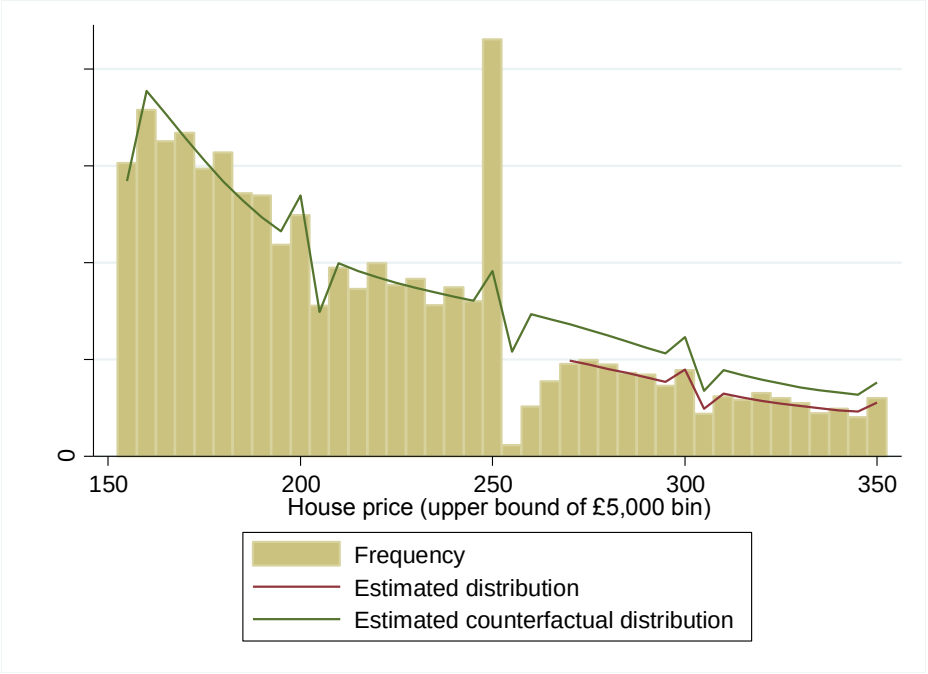
The dependent variable is the log of transactions in bin *j* in year *t*. The treatment indicator takes the value one for bins above £250k. Parameter β_1 gives the difference between the estimated empirical distribution and the counterfactual distribution in the absence of the notch. Function *f* is a polynomial of the upper bound of the bin. The shape of the polynomial is allowed to vary by year. The model includes dummies for bins close to the cut-off where bunching occurs. Based on visual examination of the distribution, controlling for six bins with upper bounds £240k, £245k, £250k, £255k, £260k and £265k seems sufficient for eliminating the effect of bunching on the shape of the estimated counterfactual distribution. We test for the robustness of the results to including dummies for more bins. Finally, the distribution clearly exhibits excessive mass at round values and dips after round values. To capture this pattern in the data, we include a dummy (*Round50*) for bins with round values divisible by £50k and a dummy for bins immediately after these round values.

3.2.3. Results

Table 8 shows the results of the effect of the tax on the sales volume. We use 3rd to 7th order polynomials of the price in different columns. In the upper panel we include dummies for six bins around the cut-off and in the lower panel we include eight dummies. The coefficient on the dummy for transactions above £250k is negative in all specifications. Based on the AIC statistic, 5th to 7th order polynomials seem sufficient. In these specifications the coefficient on the dummy for transactions above the cut-off is highly significant and indicates that the 2 percentage point increase in the tax rate leads to roughly a 30 percent reduction in sales (a similar magnitude compared to that found in related studies – discussed in the introduction section – for other countries). This result is robust to including more bin dummies for groups close to the cut-off that are potentially affected by bunching.

Figure 8 illustrates the fit of the model with a sixth order polynomial of house price and six bin dummies using one year of data (2006). The solid top line is the estimated counterfactual distribution in the absence of the tax rate increase and the solid bottom line is the estimated actual price distribution. The gap between the two lines is the effect of the tax rate increase on the sales volume. The saw-tooth pattern at round values arises from controlling for bins divisible by £50k and bins after them.

FIGURE 8
The effect of the stamp duty on transaction volume (2006 data)



4. Conclusions

The previous literature suggests two main channels through which the stamp duty may have detrimental effects on the functioning of the economy. Firstly, by increasing moving costs, the stamp duty may deter the unemployed from taking up jobs far from their residence or workers from switching to more productive jobs. Secondly, the stamp duty can make households tolerate larger discrepancies between the characteristics of their actual and the desired dwelling before moving. As a result, the match between dwellings and households is on average worse than in the absence of the tax. The increased mismatch on the housing market may lead to 'waste' in the form of misallocation costs due to, for example, large households living in too small apartments and small households living in too large apartments simply because the stamp duty associated with moving outweighs the benefits of moving.

The stamp duty induced increase in moving costs will only have these adverse effects if it actually reduces mobility. Our findings suggest that the stamp duty indeed decreases household mobility substantially; a 2 percentage-point increase in the stamp duty reduces household mobility by around 2 to 3 percentage points. This implies a reduction in mobility of around 30 percent. Our analysis of short- and longer-distance moves indicates that the effect is solely attributable to the stamp duty's adverse impact on short-distance moves, which are typically related to adjustments in housing consumption. This implies that the

stamp duty may lead predominately to misallocation of dwellings in the housing market. Its impact on the functioning of the labour market may be fairly limited.

One interesting feature of the British housing market is the fact that owner-occupier moves are comparably rare. During our sample period (2003 to 2007) and based on the full BHPS (not just our regression sample), the average propensity of a UK owner-occupier household to move during a calendar year was only 5.1 percent. This contrasts to the household mobility in the United States. Owner-occupier households in the US were more than twice as likely to move during our sample period: Based on the Panel Study of Income Dynamics (PSID) the propensity of US owner-occupier households to move during a calendar year was on average 11.5 percent. Both, UK and US owner-occupier households face housing transfer taxes, though in most US states and municipalities this tax is not very substantial. According to our results, differences in the transfer tax rates alone cannot explain this difference in mobility rates. In 2007 the average stamp duty rate faced by homeowners in the UK was 1.25% (based on the BHPS). A simple application of our preferred point estimates to all homeowners suggests that eliminating the stamp duty in the UK would increase mobility by 1.4 percentage-points to 6.5%, which is still much lower than the mobility rate for owner-occupiers in the US.

Given the magnitude of the negative effect of the stamp duty, particularly on short-distance and housing related mobility, we conclude that the stamp duty likely has very substantial detrimental effects on the functioning of the housing market. This implies that the stamp duty on residential properties is an inefficient way of collecting tax revenue. Taxes on land (and housing) consumption that apply independently of whether a household moves also have real property as the basis of taxation but are less distorting.

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Tables

TABLE 1
Stamp duty schedule (during sample period)

Purchase price	Stamp duty rate
Up to £125,000	0%
Over £125,000 to £250,000	1%
Over £250,000 to £500,000	3%
Over £500,000 to £1 million	4%
Over £1 million	5%

TABLE 2
Summary statistics (40 percent band around the £250k cut-off)

Variable	Obs.	Mean	Std. Dev.
Self-assessed house value	17997	221.8	47.9
Moved between t-1 and t	17997	0.047	0.211
Moved less than 10 km	17997	0.026	0.160
Moved 10 - 30 km	17997	0.008	0.087
Moved over 30 km	17997	0.013	0.113
Moved mainly for employment reasons	17997	0.003	0.052
Moved mainly for housing or area reasons	17997	0.021	0.143
Moved mainly for other or unknown reasons	17997	0.023	0.153
Round house value (divisible with £50k)	17997	0.344	0.475
Household has children	17997	0.340	0.474
Annual household income	17528	37787	24681
Age	17669	52.1	14.8
GCE A-levels or higher	17149	0.645	0.478
Bachelor degree or higher	17149	0.194	0.396

TABLE 3
Stamp duty and mobility

Dependent variable: household moved (0/1)						
Band around	Order of polynomial of house value					
£250k cut-off	NO	1st	2nd	3rd	4th	N
20 %	-0.001	-0.02	-0.037**	-0.055**	-0.044	6665
	[0.007]	[0.018]	[0.018]	[0.027]	[0.028]	
	-916	*-916*	*-926*	*-927*	*-929*	
30 %	0.006	-0.025***	-0.027***	-0.022**	-0.029**	14151
	[0.004]	[0.008]	[0.010]	[0.010]	[0.014]	
	-4742	*-4764*	*-4762*	*-4764*	*-4763*	
40 %	0.003	-0.011	-0.015*	-0.029***	-0.024**	17997
	[0.004]	[0.007]	[0.008]	[0.009]	[0.011]	
	-4946	*-4949*	*-4949*	*-4963*	*-4961*	

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies, dummy for round house value. Standard errors clustered at household level brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion shown in italics.

TABLE 4
Stamp duty and mobility – differential effects by distance of move

Distance of move:	Less than 10 kilometers		10 – 30 kilometers		Over 30 kilometers	
Band around	Order of polynomial of house value					
£250k cutoff	3rd	4th	3rd	4th	3rd	4th
20 %	-0.057***	-0.048***	0.013	0.013	-0.001	-0.002
	[0.018]	[0.018]	[0.011]	[0.012]	[0.014]	[0.014]
	-7559	-7564	-12317	-12317	-9186	-9186
30 %	-0.025***	-0.032***	0.002	0.009	0.007	0.000
	[0.006]	[0.008]	[0.005]	[0.007]	[0.005]	[0.008]
	-19372	-19372	-30310	-30311	-22038	-22037
40 %	-0.026***	-0.026***	-0.001	0.004	0.003	0.003
	[0.005]	[0.006]	[0.004]	[0.005]	[0.005]	[0.006]
	-23120	-23118	-36730	-36733	-27561	-27559

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies and dummy for round house value. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.

TABLE 5

Stamp duty and mobility – differential effects by primary reason of move

Type of move:	Employment reasons		Housing and area related reasons		Other or unknown reasons	
Band around	Order of polynomial of house value					
£250k cutoff	3rd	4th	3rd	4th	3rd	4th
20 %	0.01	0.009	-0.027	-0.015	-0.032*	-0.03
	[0.007]	[0.008]	[0.019]	[0.021]	[0.019]	[0.018]
	-17833	*-17832*	*-6356*	*-6365*	*-5139*	*-5137*
30 %	0.005	0.007	-0.019***	-0.009	-0.004	-0.023**
	[0.003]	[0.005]	[0.007]	[0.010]	[0.007]	[0.009]
	-43659	*-43660*	*-16181*	*-16182*	*-13735*	*-13742*
40 %	0.002	0.007*	-0.020***	-0.017**	-0.01	-0.01
	[0.003]	[0.004]	[0.006]	[0.008]	[0.006]	[0.008]
	-55263	*-55271*	*-19077*	*-19075*	*-16601*	*-16599*

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies and dummy for round house value. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.

TABLE 6

Balance of covariates tests

Panel A: 3rd order polynomial of house value					
Band around £250k cutoff	Age	Kids (0/1)	Ln(HH income)	GCE A-levels or higher	Bachelor or higher
30 %	0.66	-0.002	0.035	0.021	0.01
	[0.730]	[0.025]	[0.036]	[0.025]	[0.022]
40 %	1.926***	-0.021	0.008	-0.006	-0.017
	[0.658]	[0.022]	[0.032]	[0.022]	[0.020]
Panel B: 4th order polynomial of house value					
Band around £250k cutoff	Age	Kids (0/1)	Ln(HH income)	GCE A-levels or higher	Bachelor or higher
30 %	0.589	0.038	0.028	0.041	0.043
	[0.979]	[0.033]	[0.050]	[0.033]	[0.029]
40 %	0.442	0.016	0.034	0.017	0.018
	[0.798]	[0.027]	[0.040]	[0.027]	[0.024]

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies, dummy for round house value. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01.

TABLE 7

Stamp duty and mobility – controls added

Dependent variable: household moved (0/1)						
Band around	Order of polynomial of house value					
£250k cutoff	NO	1st	2nd	3rd	4th	N
20 %	0.002	-0.025	-0.044**	-0.075***	-0.061**	6263
	[0.007]	[0.019]	[0.019]	[0.029]	[0.029]	
	-828	*-829*	*-841*	*-843*	*-849*	
30 %	0.005	-0.023***	-0.027***	-0.025**	-0.032**	13310
	[0.004]	[0.008]	[0.010]	[0.010]	[0.014]	
	-4414	*-4432*	*-4430*	*-4431*	*-4429*	
40 %	0.003	-0.01	-0.013	-0.027***	-0.026**	16983
	[0.004]	[0.007]	[0.008]	[0.009]	[0.011]	
	-4750	*-4753*	*-4751*	*-4765*	*-4763*	

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies, dummy for round house value, age, dummy for kids, 18 region dummies, dummy for GCE A-levels or higher, dummy for bachelor degree or higher. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.

TABLE 8

Effect of the stamp duty on transaction volume

Dependent variable: ln(Number of transactions in bin)					
	Order of polynomial of house value				
	3rd	4th	5th	6th	7th
Price>£250k	-0.142***	-0.142***	-0.287***	-0.287***	-0.315***
	[0.044]	[0.045]	[0.070]	[0.071]	[0.109]
	-504.6	*-505.4*	*-512.7*	*-514.3*	*-515.7*
6 bin dummies £240k-£265k	Yes	Yes	Yes	Yes	Yes
Price>£250k	-0.097	-0.097*	-0.282***	-0.282***	-0.331**
	[0.063]	[0.055]	[0.094]	[0.092]	[0.164]
	-504.5	*-510.9*	*-516.7*	*-519.5*	*-520.9*
8 bin dummies £235k-£270k	Yes	Yes	Yes	Yes	Yes

Notes: Table shows coefficients on the treatment indicator (house price>$250k). Polynomial of house price is allowed to vary by year. Additional control variables: year dummies, dummies for round house price and price after round values. Robust standard errors in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.

Appendix Tables

TABLE A1
Stamp duty and mobility – households reporting a self-assessed house value of £250,000 dropped

Dependent variable: household moved (0/1)						
Band around	Order of polynomial of house value					
£250k cut-off	NO	1st	2nd	3rd	4th	N
20 %	-0.001	-0.02	-0.038**	-0.056**	-0.045	4706
	[0.007]	[0.018]	[0.018]	[0.027]	[0.028]	
	-204	-203	-213	-213	-215	
30 %	0.009**	-0.025**	-0.027**	-0.008	-0.014	12192
	[0.004]	[0.011]	[0.012]	[0.016]	[0.016]	
	-3947	-3960	-3958	-3961	-3962	
40 %	0.006	-0.002	-0.007	-0.035***	-0.031**	16038
	[0.004]	[0.009]	[0.010]	[0.013]	[0.014]	
	-4163	-4162	-4161	-4173	-4172	

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Households reporting self-assessed house values of £250,000 were dropped. Additional control variables: year dummies, dummy for round house value. Standard errors clustered at household level brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion shown in italics.

TABLE A2
Stamp duty and mobility – sample includes only households saying they would like to move

Dependent variable: household moved (0/1)						
Band around	Order of polynomial of house value					
£250k cut-off	NO	1st	2nd	3rd	4th	N
20 %	0.001	-0.05	-0.071	-0.111	-0.111	1409
	[0.023]	[0.055]	[0.058]	[0.082]	[0.082]	
	1059	*1059*	*1060*	*1062*	*1062*	
30 %	0.014	-0.081***	-0.086**	-0.080**	-0.053	2808
	[0.015]	[0.027]	[0.036]	[0.037]	[0.045]	
	1619	*1602*	*1604*	*1605*	*1604*	
40 %	0.018	-0.046*	-0.071**	-0.106***	-0.062	3774
	[0.014]	[0.024]	[0.029]	[0.032]	[0.041]	
	2280	*2271*	*2271*	*2266*	*2262*	

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Sample includes only households saying they are willing to move. Additional control variables: year dummies, dummy for round house value. Standard errors clustered at household level brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion shown in italics.

TABLE A3

Stamp duty and mobility – coefficients on n^{th} order polynomials allowed to vary on different sides of cut-off

Band around	Order of polynomial of house value	
£250k cutoff	1st	2nd
20 %	-0.035*	-0.049
	[0.018]	[0.035]
	-922	*-928*
30 %	-0.030***	-0.027
	[0.011]	[0.017]
	-4762	*-4759*
40 %	-0.011	-0.041***
	[0.009]	[0.014]
	-4948	*-4957*

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies and dummy for round house value. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.

TABLE A4

Placebo tests with artificial cut-offs

Dependent variable: household moved (0/1)			
Artificial	Order of polynomial of house value		
cut-off	3rd	4th	N
£200k	-0.012	0.000	15688
	[0.016]	[0.017]	
£225k	-0.003	0.006	14578
	[0.011]	[0.012]	
£275k	0.013	0.011	12149
	[0.013]	[0.013]	
£300k	0.005	0.039*	9409
	[0.013]	[0.022]	

Notes: The table shows coefficients on the placebo treatment indicator. Additional control variables: year dummies, dummy for round house value. Sample: +/- 30 percent band around the artificial cut-off. Standard errors clustered at household level in brackets. * p<0.1, ** p<0.05, *** p<0.01.

TABLE A5

Stamp duty and mobility – two-way clustering at house value group level and household level

Dependent variable: household moved (0/1)						
Band around	Order of polynomial of house value (rounded up to closest £5,000)					
£250k cutoff	NO	1st	2nd	3rd	4th	N
40 %	0.003	-0.012	-0.016*	-0.028***	-0.026**	17997
	[0.005]	[0.010]	[0.009]	[0.010]	[0.013]	
	-4946	*-4951*	*-4950*	*-4961*	*-4960*	

Notes: The table shows coefficients on the treatment indicator (house value>£250k). Additional control variables: year dummies and dummy for round house value. Standard errors clustered at house value group level (£5,000 groups) and household level in brackets. * p<0.1, ** p<0.05, *** p<0.01. Akaike Information Criterion is shown in italics.