Valuing Changes in UK Buy-To-Let Tax Policy on a Landlord's Strategic Default and Negotiation Options.

Michael Flanagan*

Manchester Metropolitan University, UK

Dean Paxson**

University of Manchester, UK

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*MMU Business School, Centre for Professional Accounting and Financial Services, Manchester, M1 3GH,UK. m.flanagan@mmu.ac.uk. +44 (0) 1612473813. Corresponding Author.

**Manchester Business School, Manchester, M15 6PB, UK. dean.paxson@mbs.ac.uk. +44 (0) 1612756353.

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Abstract

We extend the commonly valued strategic default option by proposing and developing a strategic renegotiation option, where we assume an instantaneous renegotiation between a lender and a UK landlord triggered by a declining rental income. We ignore the prepayment option given that UK interest rates are unlikely to lower in the medium term. We then investigate how a reduction in mortgage tax relief might differentially affect the optimal acquisition threshold and the exercise of the default or renegotiation options.

We model the renegotiations by considering the sharing of possible future unavoidable foreclosure costs in a Nash bargaining game. We derive closed form solutions for the optimal loan terms, such as LTV (Loan To Value) and the coupon offered by the lender to a landlord. We demonstrate that the ability of either party to negotiate a larger share of unavoidable foreclosure costs in one's favour has a significant influence on the timing of the optimal *ex post* negotiation decision, which will invariably precede strategic default. A reduction in tax relief for interest payments has significantly different effects, contingent on option type, on investment entry and exit (default or negotiation) as well as on the appropriate LTV and coupon offered to the landlord by the lender.

1. Introduction

We study the strategic negotiation and default options, where there is a instantaneous renegotiation or default between lender and landlord with a mortgage on a residential property, triggered by a declining rental income, and value the benefits of such option to both parties. The negotiation option is closely related to the default option, where the landlord has the ability to make monthly payments on their mortgage, but chooses not to do so. We ignore the strategic prepayment option in this analysis given that the expected direction of interest rates is upwards.

The study is motivated firstly by the current concern expressed by the Governor of the Bank of England (and policy committees) regarding the danger to the sustainability of the UK economic recovery posed by the rapid growth in the Buy-To-Let residential mortgage sector. Governor Carney said that *"the problem is that investors might sell their properties at the same time if property prices or rental incomes fall"* (FT 2015b). The UK BTL housing segment is significant (Bank of England 2015) and according to the Financial Times (FT 2015a), the total housing wealth owned by UK landlords is now greater than that owned by mortgaged owner occupiers.

Secondly, it is motivated by the current debate in the UK over possible negative effects of the proposed reduction in mortgage tax relief on BTL investments. We therefore attempt to quantify the net effect of future tax relief and potential default or renegotiation options on a UK landlords optimal decision assuming that a prepayment option is essentially valueless. In the second case, reduced mortgage tax relief together with a landlord's mortgage options will influence both the landlord and lenders view of the optimal entry and exit decisions. In the first case, falling rental income or property prices may be of value to the landlord in (re)negotiating mortgage payment concessions from the lender rather than defaulting. In which case, it is prudent for the lender to consider (price) the effect of any possible renegotiation in the original contract.

Experian/Oliver Wyman (2010) identify strategic defaulters as those who have not serviced their mortgage for a considerable period (180+ days) but have chosen to continue to service their auto or credit card loans within the agreed period (< 60 days). They estimate that 19% of all US residential homeowners could later be considered strategic defaulters. We assume that some UK landlords may, albeit in differing quantities, choose to strategically default to maximise wealth in a declining house price or rental income market. However, due to the differing legal status of UK BTL mortgage contracts some of these landlords may also attempt to renegotiate initially.

We outline the main assumptions for both a strategic default option (Model 1) and the strategic negotiation option (Model 2) in Section 2. We set the model in the context of a residential investment (e.g. UK BTL[1]) mortgage. The tenant who pays the rent and consumes the asset is a separate party from the landlord who makes the investment and pays the mortgage to the lender.

In Section 3, we outline the derivation of the compound investment and negotiation options (Model 2) as well as of the comparative compound investment and default options (Model 1) with notation defined in the glossary. Detailed derivation of the closed form solutions have been largely omitted for clarity but can be obtained from the corresponding author upon request.

In the subsequent Section 4, using stylised UK BTL mortgage data, we examine and highlight the fundamental differences between the negotiation option and the default option. We highlight the effect of heterogeneous negotiation and mortgage tax relief on the endogenous exercise threshold expressed in terms of negative equity, mortgage yield spread, Loan-To-Value (LTV) and Debt Coverage Ratio (DCR) ratios. We critically assess this approach in Section 5.

[1] Greater than 95% of mortgages in the UK BTL market are of the interest only payment type with 25 year terms. Association of Residential Letting Agents Website 2009

2. Model Outline and Assumptions

The "non-recourse" mortgage contract in the UK covers the relationship between lender and landlord, whereby the landlord is assumed to have limited liability and can default on the mortgage contract at any time with no short term consequences to a subsequent credit rating. We assume the mortgage debt is perpetual, with the landlord making only a coupon payment to the lender.

We use rental income rate (or rental service flow) instead of the more usual stochastic property price for the BTL landlord residential mortgages to drive both the default and negotiation model. We believe this is justified from two viewpoints. Firstly, Kau and Keenan (1995) state, *"Economic logic would dictate that the house price would be the expected discounted value of future service flows, rather than the service flows being a specified proportion of the current house price".* Secondly, landlords with interest only mortgages might still receive a "good" rental income rate (or service flow) but have a property whose current "spot" value is less than the value at mortgage origination. Therefore, rental income is probably of more importance to many landlords.

We assume a "spot" rental income rate net of operating expenses but subject to taxes (τ). When the property is performing well, landlords will collect all the net excess cash flows after servicing the debt payments. On the other hand, landlords also supply the needed funds to service the debt when there are shortfalls in net rental income, if it is in their interest to do so -- an example being the property still having positive net equity. The situation is different if the rental or property market is not performing well, as remarked by Governor Mark Carney (FT 2015b), as default is generally costly to the lender and landlord. The landlord injects no new equity to prepay and new

loan debt ((re)mortgaging and equity withdrawal) is not available to the landlord due to declining house prices, rental income rate or credit restrictions.

On default (Model 1), the landlord loses all housing equity as the lender repossess the collateral. The lender will only receive the house value less foreclosure costs to cover any outstanding debt or alternatively might continue to operate the property at the lower rental yield but with consequences for the lender's balance sheet loss provisions. Alternatively, after a successful negotiation (option) (Model 2), the landlord pays a lower fixed monthly payment and retains ownership of the property and consequent rental income.

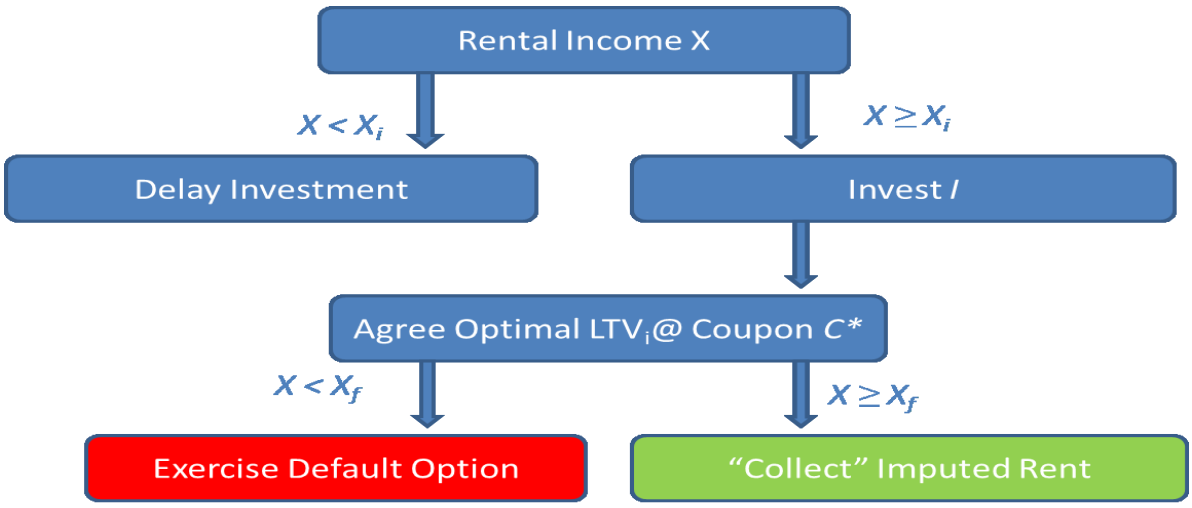
Consequently for Model 2, proactive lenders and landlords will try to avoid costly foreclosure and attempt to negotiate and agree a forbearance mitigation program. For Model 2, we introduce a parameter ϕ $(0 \leq \phi \leq 1)$ to model the effect and strength of this (re)negotiation regarding the sharing of foreclosure costs which is distributed to the satisfaction of both parties. For ease of exposition, we refer to a landlord who negotiates a smaller notional share of the unavoidable foreclosure costs as a weak landlord ($\phi \to 0$) and one who negotiates a larger share ($\phi \to 1$) as a strong landlord. We construct ϕ as a heterogeneous variable indicating the immediate view taken by both the lender and landlord on how much of the unavoidable foreclosure costs the other would be liable for to condition or influence their *ex-ante* mortgage negotiation.

Another critical assumption for both models is that the lender's foreclosure costs are a percentage (α) of the property value V(x) implied by the net rental income rate x is supported by the observation that a UK residential property is generally independently valued only once at the initial mortgage contract negotiation and then once again at the renegotiation stage.

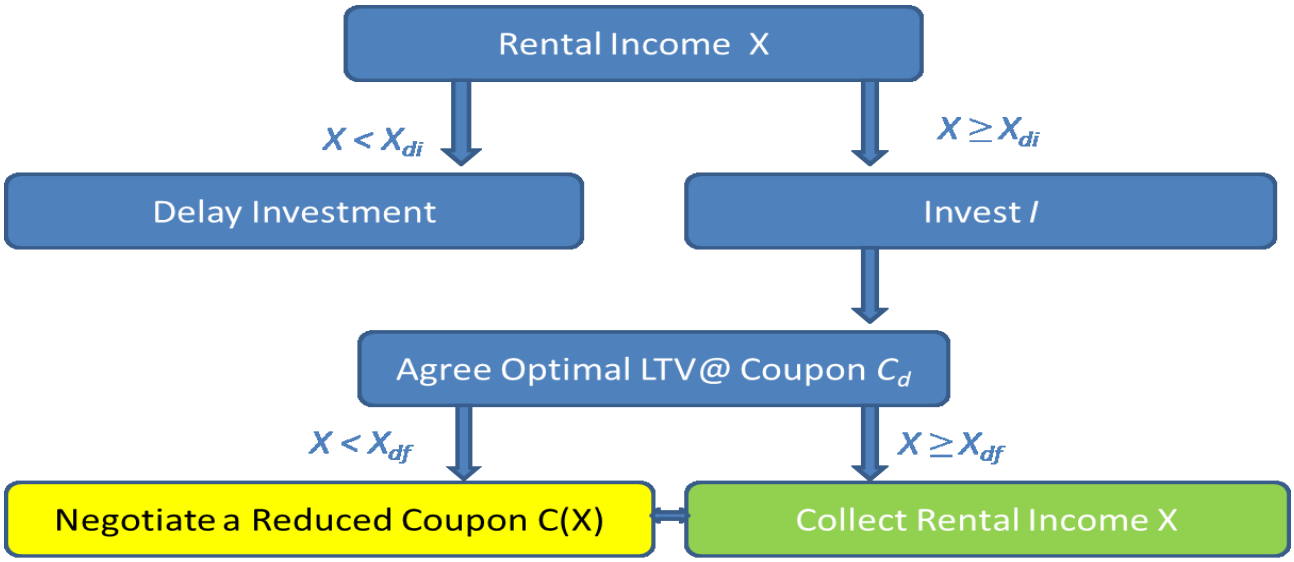
In contrast to the traditional option theoretic approach, as described by Kau and Keenan (1995), we arrive at our solution to the negotiation option (Model 2) by adapting from Fan and Sundaresan (2000) to cover the landlord's irreversible negotiation and investment options. Their methodology is an expansion on the endogenous default approach to corporate debt found in corporate finance literature e.g. Leland (1994) whereby the management chooses the timing of default to maximise equity value. The Leland (1994) approach is used to derive the solution to the default option (Model 1). In general, option theoretic models proceed, using a backwards numerical solutions approach, to calculate the value of the default and prepayment options using two stochastic factors (property prices and interest rates) and a finite mortgage term (Kau and Keenan 1995).

To ensure tractability and obtain closed form solutions we employ just one stochastic factor with a perpetual mortgage term. We believe this approach is justified as the stochastic interest rate factor is mainly of influence on the prepayment option (which we assume is valueless for distressed landlords) and additionally interest rates have been stable and low for some considerable period in the UK.

Figure 1 Buy-To-Let Landlord Mortgage Negotiation Option Model Flow Diagrams



Model 1 – The Invest and Default Option



Model 2 – The Invest and Negotiate Option

Legend

x : Net rental income rate after operating expenses and local property taxes but before mortgage payment tax deduction.
x_i : Optimal rental rate at where the borrower would invest with a default option.
x_{di} : Optimal rental rate at where the borrower would invest with an negotiation option.
x_f : Optimal rental rate at where the borrower would default with a default option.
x_{df}: Optimal rental rate at where the borrower would negotiate.
. Perpetual mortgage payment to the lender for the default only option (tax deductible).
c_d : Perpetual mortgage payment to the lender for the negotiation option (tax deductible).
(X): Renegotiated mortgage payment (after negotiation) which depends on property price.
I : Initial property investment made at the critical investment thresholds.

Figure 1 summarises the options available to the landlord. The blue boxes in both Models 1 and 2 are the initial purchase option followed by the box in yellow (Model 2) which represent the negotiation option and the default option in the red box (Model 1).

As a consequence of the assumption that the UK BTL mortgage contract is incomplete but not asymmetrical, given the widely available amount of data on residential house prices, the lender and landlord play a generalised Nash cooperative game (Yellow box, Model 2, Figure 1) to avoid foreclosure costs. They have incomplete but no asymmetric knowledge of each other's options, and costs, and having *ex-ante* negotiated the initial mortgage contract (LTV and mortgage payment in the blue boxes) conditional on anticipated default, may *ex-post* renegotiate the contract should a credible threat of default arise due to an unfavourable shock to spot rental incomes.

We then allow the mortgage to be modified with a new lower mortgage coupon (C(x)) on a successful negotiation. What happens should rental incomes later recover above the negotiation trigger point is immaterial in this exposition. Should the landlord or lender not renegotiate, then Model 1 applies, and with continuing negative rental income shocks, the landlord will optimally exercise the default option (Red box, Model 1, Figure 1).

The question arises as to whether lender and landlord can *ex- ante* discover each other's relative negotiation strength ϕ. Whether or not, it is however possible for both to agree that ϕ will be in a range from 0 to 1 just as it is also possible for both to *ex-ante* know all possible future rental incomes and foreclosure percentages. Both parties therefore *ex-ante* calculate trigger points and decide under what conditions they will optimally instantaneously agree a (re)negotiated mortgage coupon, based on an anticipated share of the unavoidable foreclosure costs. Under these assumptions, both lender and landlord will *ex-ante* anticipate the same range of outcomes.

We will show in Section 4, for typical UK BTL landlords, that optimal negotiation option exercise should normally occur earlier than a comparative strategic default option exercise for all landlords but strong negotiators should exercise their negotiation option earlier than weak negotiators. We show that the lenders *ex-ante* mortgage yield spread should increase to pay for the landlord's *ex-post* strategic negotiation option. We also show probable effects of the impending BTL mortgage tax relief reduction on UK landlord's entry and exit decisions.

3. Strategic Default and Negotiation Option Models

The rental income process is exogenous and the landlord and lender have rational expectations and are sufficiently small to have no effect on local rental income. The net rental income *x* after operating expenses will then have the mortgage payment to the lender c^* (for the default option, Model 1) and c_d (for the strategic negotiation option, Model 2) deducted. The mortgage payment $c*$ or c_d is tax deductible. We assume that on a yearly basis, gross receipts minus gross payments lead to a taxable profit, or the landlord has other taxable income. The landlord thus chooses a mixture of equity and (risky) debt to finance the property investment *I* at an endogenously chosen time *T*.

We assume that the landlord has only one property with a net rental income before interest and taxes given by a gBm (geometric Brownian motion).

$$dx = \mu x dt + \sigma x dW \qquad [1]$$

where *W* is a standard Brownian motion, μ the net rental drift and σ is the rental volatility.

The landlord decides when to exercise the investment option by purchasing the property for a fixed cost *I* and then collects the net stochastic rental stream of x $(x \geq 0)$.

Let $r > 0$ denote the risk free interest rate. Assume $r > \mu$ for convergence. Let the tax rate be $0 \leq \tau < 1$. Property value is given by $V(x) = E(x) + D(x)$ where $E(x)$ is the equity value and $D(x)$ the debt value. After tax and without option value, the all equity financed property value $V(x)$ is

$$V(x) = E(x) = \frac{x}{K} \quad \text{where} \quad K = \frac{r - \mu}{1 - \tau}$$

However, by using debt to partly finance the property purchase, additional tax benefits can accrue due to the tax deductibility of the mortgage interest payments, so the landlord chooses a mixture of equity and mortgage finance at investment time T_o.

After purchasing the property and taking on the mortgage liability, if the rental income x is sufficiently or consistently low, the landlord may consider defaulting on the mortgage payments, forcing the lender to consider repossession or foreclosure. In this case, following Leland (1994) the liquidation value to the lender is $(1-\alpha)\mathrm{V}(x)$ while the landlord will retain zero equity.

Also, due to declining rental income, the landlord may delay or threaten to delay coupon payments triggering a negotiation between landlord and lender. With this (alternative) strategic negotiation option, the lender may not wish to repossess but instead renegotiate the mortgage contract resulting in a new lower coupon payment. The new coupon payment is conditional on the current rental income rate and the "surplus" generated by avoiding costly liquidation being "notionally" divided between the landlord and lender based on their relative negotiating or sharing position denoted respectively by ϕ and $1-\phi$ (ϕ=1=>landlord has all the negotiating power).

The renegotiation importantly results in a lower "more affordable" mortgage payment. Because of the perpetual nature of the mortgage this does not imply any form of mortgage modification but rather mortgage forbearance. We treat ϕ as a heterogeneous variable with a maximum value of 1 determined by each party's knowledge of the other's foreclosure costs and their desire to mitigate or delay the effect and costs of default. In other words, both the lender and the landlord take a view on how much of the unavoidable foreclosure costs the other would be liable for and condition their *ex ante* loan negotiation on this view. We model the negotiation between landlord and lender as a cooperative generalised Nash bargaining game (Sundaresan and Wang, 2007).

The methodological approach to solving the problem is similar to a perpetual American (scale) option entry/exit problem and a solution is found for the different ODEs in terms of the critical entry and exit thresholds for the default or negotiation (bargaining) options, respectively, x_i or x_{di} and x_f or x_{df}. Solutions are of the form $F(x) = A_0 + A_1 x^{\gamma} + A_2 x^{\beta}$ with the appropriate boundary conditions leading to different specific solutions.

Conventionally modelled default results in the lender acquiring the investment property. The value of the property is exactly the asset value of an all equity-financed property just before default less foreclosure costs. However, with exercise of the negotiation option, landlord and lender negotiate a new coupon, conditional on the optimal sharing of the avoidable foreclosure costs, at the negotiation trigger point x_{df} with both willing to temporarily change or adapt the contract terms. The lender would agree a renegotiated coupon *C(x)* based on the current rental income rate, lower than the initial coupon c_d (agreed at the investment threshold x_{di}) and the landlord would continue to own and operate the property[2].

Let $V_0(x, c)$ be the property value before investment. The landlord chooses the optimal investment threshold x_{di} and the optimal mortgage repayment c_d to maximise his equity position $E_0(x, c)$. As the rental income x approaches infinity, the mortgage becomes riskless and hence the property value must satisfy an upper boundary condition whereby

$$\lim_{x \to \infty} V(x, c) = \frac{x}{K} + \frac{\tau c}{r} \qquad [2]$$

[2] UK BTL data show that if landlord and lender fail to agree, almost all rental properties are initially operated by the lender under a UK "Receiver of Rent" clause allowing the lender to legally receive rent directly from the occupier (bypassing the landlord) but without title to the property. The foreclosure option is only exercised in exceptional circumstances and the landlord never exercises the default option.

Lower boundary conditions for the strategic negotiation option differ from the default option as lender/landlord are prepared to vary the contract terms at the lower threshold, where the total value of the property $V(x_{df}, c_d)$ still includes the value of future tax benefits and is thus higher than the all equity financed asset property value. The landlord and lender thus bargain over a larger amount (when $x \leq x_{\mathrm{df}}$) resulting in a property asset value *V(x)* of

$$V(x) = \frac{x}{K} + \frac{\tau c_d}{r}\left(\frac{-\gamma}{\beta - \gamma}\right)\left(\frac{x}{x_{df}}\right)^{\beta} \quad when\ x < x_{df} \qquad [3]$$

$$V(x) = \frac{x}{K} + \frac{\tau c_d}{r}\left[1 - \left(\frac{\beta}{\beta - \gamma}\right)\left(\frac{x}{x_{df}}\right)^{\gamma}\right] \quad when\ x \geq x_{df} \qquad [4]$$

$$\text{where } \beta > 1, \gamma < 0 \text{ are the roots of } \frac{\sigma^2 x^2}{2} + (\mu - \sigma^2/2)x - r = 0$$

The equity equation *E(x)* ($x < x_{\mathrm{df}}$) is also adjusted to account for the new coupon $C(x)$

$$\frac{1}{2}\sigma^2 x^2 \mathrm{E}_{xx}(x) + \mu x \mathrm{E}_x(x) - rE(x) + (1 - \tau)x - C(x) = 0 \quad when\ x < x_{\mathrm{df}} \qquad [5]$$

With upper boundary conditions the same for both the negotiation and default options, we obtain revised lower boundary conditions from the "extra" value of $V(x)$ using equation [4] and the negotiation sharing rule to get

$$\lim_{x \downarrow x_{df}} E(x) = \phi\left(\frac{\alpha x_{df}}{K} - \frac{\tau c}{r}\frac{\gamma}{\beta - \gamma}\right) \qquad [6]$$

Differentiating [6] gives

$$\lim_{x \downarrow x_{df}} E_x(x) = \phi\left(\frac{\alpha}{K} - \frac{\tau c}{x_{df} r}\frac{\gamma\beta}{\beta - \gamma}\right) \qquad [7]$$

Further development leads to closed form expressions for the key outputs for the strategic negotiation option and the comparable outputs for the default option.

a) The landlord's investment threshold for the negotiation option x_{di} is given by

$$x_{di} = \frac{\beta}{\beta - 1} K \left[1 + \frac{\tau}{gL}\right]^{-1} I \quad [8]$$

where $g = \left[\frac{\beta}{\beta - \gamma}(1 - \gamma)\right]^{-\frac{1}{\gamma}} = \frac{x_{di}}{x_{df}}$ and $L = \frac{1 - \tau(1 - \phi)}{1 - \phi\alpha}$

The investment threshold for the default option x_i is given by

$$x_i = \frac{\beta}{\beta - 1} K \left[1 + \frac{1}{h}\frac{\tau}{1 - \tau}\right]^{-1} I \quad [9]$$

where $h = \left[1 - \frac{\gamma(\tau + \alpha(1 - \tau))}{\tau}\right]^{-1/\gamma} = \frac{x_i}{x_f}$

b) The mortgage coupon rate for the negotiation option c_d (for $x \geq x_{df}$) is given by

$$c_d = r\frac{\gamma - 1}{\gamma}\frac{\beta}{\beta - 1}(gL + \tau)^{-1} I \quad [10]$$

The mortgage coupon rate for the default option c^* (for $x \geq x_f$) is given by

$$c^* = r\frac{\gamma - 1}{\gamma}\frac{\beta}{\beta - 1}[h(1 - \tau) + \tau]^{-1} I \quad [11]$$

We show in Section 4 that the consequence of these different results for the default and negotiation option is that lenders *ex ante* mortgage yield spread should increase significantly to pay for the landlord's *ex post* negotiation option.

c) Landlords renegotiate with lenders when $x(t) < x_{df}$, where x_{df} is the endogenously determined negotiation threshold given by

$$x_{df} = \frac{\beta}{\beta - 1} K \left[g + \frac{\tau}{L} \right]^{-1} I \qquad [12]$$

Landlords default/foreclose with lenders when $x(t) < x_f$, where x_f is the endogenously determined default threshold given by

$$x_f = \frac{\beta}{\beta - 1} K \left[h + \frac{\tau}{1 - \tau} \right]^{-1} I \qquad [13]$$

We show in Section 4 that the implications of these equations are that negotiation option exercise will occur earlier than the default option exercise for all landlords but strong landlords will exercise their negotiation option earlier than weak landlords.

We define the optimal *risk adjusted or market* LTV_{di}/LTV_i at mortgage origination x_{di} *or* x_i as the contemporaneous market value of debt divided by the property value at mortgage origination and is defined for the negotiation option as

$$LTV_{di} = \frac{D(x_{di}, c_d)}{V(x_{di}, c_d)} \qquad [14]$$

and for the default option as

$$LTV_i = \frac{D(x_i, c^*)}{V(x_i, c^*)} \qquad [15]$$

The ex post yield spread at origination is defined as

$$YS_{di} = \frac{c_d}{D(x_{di}, c_d)} - r \quad [16]$$

and

$$YS_i = \frac{c_*}{D(x_i, c^*)} - r \quad [17]$$

for both options respectively where D(.) is the value of debt at the investment threshold x_i or x_{di}.

The debt interest coverage ratio at origination is defined for the negotiation and the default option respectively as the net rental income rate at origination divided by the mortgage payment after tax

$$DCR_{di} = \frac{x_{di}}{c_d(1-\tau)} \quad [18]$$

and

$$DCR_i = \frac{x_i}{c^*(1-\tau)} \quad [19]$$

In Section 4, we use these equations to define optimal landlord negotiation regions in terms of mortgage control parameters of LTV and DCR ratios rather than rental income rate *x*.

4 Negotiation and Default Option Analysis –A Stylised Example

Recently the UK Chancellor George Osborne has announced that mortgage tax relief for BTL landlords will be greatly reduced and we therefore examine the effect of changes in tax policy on a landlord's entry and exit decision under both models. We explore the effects of tax policy changes on both options, given that landlords may negotiate instead of defaulting or vice versa.

The negotiation option represents the relationship between the investment and financing decisions, where the initial *ex-ante* purchase decision is dependent on a (potential) renegotiation between lender and landlord. On the other hand, the default (non-bargaining) option represents the relationship where the landlord makes the purchase decision knowing that non-payment of the mortgage will result in the forfeiture of all equity.

In both models, the value of the property $V(x)$ depends essentially on a) the spot value of the rental income common to both options b) the future value of the tax benefits of the renegotiation or default options and c) the value of the exit (put) element of the renegotiation or default option. Our models therefore links the landlord's tax option directly with his default or renegotiation option as a function of rental income.

The parameter ϕ represents heterogeneous characteristics of the landlord in relation to the lender impacting on their ability to negotiate. Recognising the impreciseness and difficulty of measuring this parameter, we observe how ***the negotiation region***, delineated by the extreme corner values of ϕ = (0, 1), in the various graphs, compares to the single ***default point***. *Ex-ante* mortgage origination, a landlord and lender will only know that their relative bargaining positions *ex-post* a negotiation event must lie between these two extremes.

The analysis, using equations detailed in Section 3, proceeds as follows:

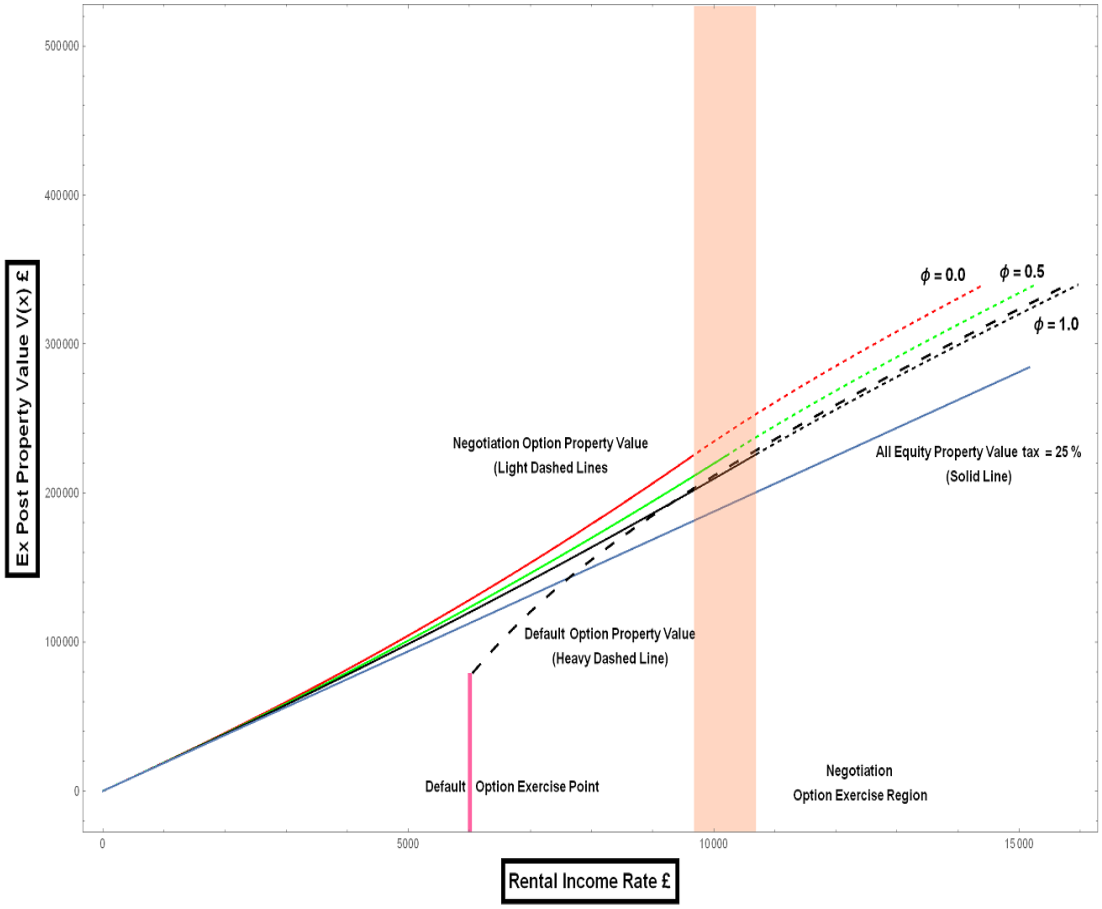
a) Calculate the landlord's investment entry trigger and consequent optimal mortgage debt (LTV), resulting coupon payment, yield spread and debt coverage ratio.
b) Establish the optimal investment exit point in the case of a default option and coupon bargaining range in the case of a negotiation option.
c) Illustrate some model sensitivities to tax rates, foreclosure costs, rental growth and volatility.

Figure 2 overleaf illustrates the combined effect of rental income, tax benefits and default or renegotiation on the landlord's (real) *ex post* property value. We delineate in Figure 2 the optimal negotiation "region", defined as the range of optimal exit values x_{df} for $0 \leq \phi \leq 1$. We super impose the optimal trigger for the default option. Negotiation will always occur earlier than default where rental income constantly decreases.

The straight blue line, represents the *ex post* property value of an all equity-financed property at a tax rate of 25% superimposed as a reference line. No (future) tax benefits accrue under this scenario and therefore acts as a lower bound. The introduction of mortgage debt with a consequent reduction in tax payable due to the mortgage coupon increases the real value of the property. In the case of the default option, this is represented by the one black stippled line. In the case of the negotiation option, the value will also depend on negotiation strength and ranges from the black line ($\phi = 1$) to the red stippled line ($\phi = 0$). The weak (negotiating) landlord can borrow more and hence pays a higher coupon enjoying greater tax benefits. The mortgage company is happy to lend the weak negotiator more because they will lose less (share more) in any subsequent renegotiation.

Upon exercise of the negotiation option, the landlord continues to "operate" the property. However, upon exercise of the default option, the lender forecloses and sells the property receiving $(1-\alpha)$ times the all equity financed property value.

Figure 2 Ex-Post Property Value vs. Rental Income Rate and Bargaining Power for the Negotiation and Default Option



The three concave curves labelled ϕ=0.0, 0.5 and 1.0 are the property values *V(x)* under mortgage financing and τ=25%. Using equations [3],[4]
Property value increases as ϕ decreases reflecting the greater benefit of the tax shelter when the landlord has weak bargaining power.
In all 3 negotiation cases the property always has value as the lender will adjust the coupon payment so that the landlord continues to operate.
The rectangular shaded region is defined as the upper and lower limits of the bargaining parameter wherein negotiation optimally occurs.
The heavy dashed curve is the property value for the default (non bargaining option) and terminates at the exit threshold where the lender will foreclose and sell the property with α = 30% foreclosure costs while the landlord gets nothing.
Parameter values (Appendix B) : I = 153000, r = 0.05, μ = 0.01, τ = 0.25, α = 0.3 and σ = 0.15

We show in Table 1 (comparing panels 1 and 2) that the effect of a tax policy reducing the taxable benefits would differ depending on whether landlords had a strategic default or negotiation option. Landlords possessing a strategic default option would enter the market earlier at a lower rental income, a lower LTV and exit the market at a lower rental income i.e. delaying default.

The effects differ for those landlords possessing a strategic negotiation option depending on whether they are strong or weak negotiators. Weak landlords would slightly accelerate market entry while strong landlords would significantly accelerate entry. Weak landlords would slightly delay negotiation while strong landlords would delay negotiation but not as markedly as those landlords with a default option.

Table 1 Comparison of Different Tax Rates on Selected Entry and Exit Results

The table below gives a range of results for two different values of τ = 0.25 and 0.05.
The first subtable represents the results for the base parameter case used in Figures 2 to 4
Parameter values (Appendix B) : I = 153000, r = 0.05, μ = 0.01, τ = 0.25 and 0.05, α = 0.3 and σ = 0.15

ϕ	Coupon £	Entry Rental £	Exit Rental £	Entry LTV %	Entry Yield Spread bp	Entry DCR
Foreclosure % α = 30% ,σ=0.15, τ=0.25						
0.0	17868	11963	9613	96	157	0.89
0.5	13810	12691	10198	75	144	1.23
1.0	10427	13298	10685	58	132	1.70
Default	11268	13147	6062	69	76	1.56
Foreclosure % α = 30% ,σ=0.15, τ=0.05						
0.0	17159	11488	9232	95	137	0.70
0.5	14311	11569	9296	79	135	0.85
1.0	11568	11647	9359	64	132	1.06
Default	5916	11807	3183	40	19	2.10

The effect of lower tax relief highlighted in Table 1 demonstrates that the optimal coupon paid by a landlord with a default option is significantly lower because of a lower yield spread and lower LTV reflecting the lower debt capacity from the tax change. The optimal coupon for a landlord with a negotiation option is more nuanced with the weak landlord paying a lower coupon and the strong landlord paying a higher coupon reflecting the higher LTV and lower debt capacity.

We conclude by summarising key graphical data in Table 2 overleaf and show the effect of changes in foreclosure costs α and rental income volatility σ.

Increases in rental income rate volatility with no changes in other parameters behaves as expected delaying investment, increasing yield spreads and reducing debt capacity (LTV) at origination. It must be remembered however that a landlord might well "enter" the market at a lower volatility and "exit" the market some years later at a higher volatility. In which case, default and negotiation would initiate much earlier than predicted for lower tax reliefs.

The higher the foreclosure costs, the lower the LTV the lender should agree with the strong landlord while continuing to offer the same LTV to the weak landlord. A large decrease in (LTV) lending capacity from 75% to 64% can still be observed for the equilibrium value of ϕ=0.5 as foreclosure costs increase from 30% to 60%.

The option to renegotiate the mortgage payment is not a "free ride" or a costless option for the landlord. From Table 3 it is clear that the lender charges *ex-ante* higher yield spreads for this right compared to the default option. The lender is no worse off in whatever bargaining position he finds himself and in most cases will be better off. Ultimately, if the lender cannot agree a new mortgage payment with a landlord, then he can always foreclose with inevitable foreclosure costs.

Interpretation of the results with respect to the effects of a reduction in mortgage tax relief is perilous as landlords might well enter the market in a low volatility rental period (Table 2, Panels 1 and 2) and reduced mortgage tax relief but then exit the market in a high volatility rental period regime (Table 3, Panel 3). This appears to introduce a filtering process by which more strategic defaulters and strong negotiators are selected.

Table 2 Key Results for a Range of Different Parameters Illustrating the Negotiation Option Sensitivity

The table below gives a range of results for different values of α and σ to illustrate the sensitivity of the output results.
The second subtable are the results for the base parameter case used for the preceding figures
with parameter values (Appendix B) : I = 153000, r = 0.05, μ = 0.01, τ = 0.25, α = 0.3 and σ = 0.15
The first subtable demonstrates the effect of increased foreclosure costs α from 30% to 60%
The third subtable demonstrates the effect of increased rental volatility σ from 0.15 to 0.25.

ϕ	Coupon £	Entry Rental £	Exit Rental £	Entry LTV %	Entry Yield Spread bp	Entry DCR
Foreclosure % α = 60% ,σ=0.15						
0.0	17868	11963	9613	96	157	0.89
0.5	11711	13067	10500	64	144	1.49
1.0	6291	14039	11281	35	132	2.98
Default	9831	13404	5289	61	67	1.82
Foreclosure % α = 30% ,σ=0.15						
0.0	17868	11963	9613	96	157	0.89
0.5	13810	12691	10198	75	144	1.23
1.0	10427	13298	10685	58	132	1.70
Default	11268	13147	6062	69	76	1.56
Foreclosure % α = 30% ,σ=0.25						
0.0	33244	16353	13094	97	383	0.66
0.5	25689	17345	13888	77	364	0.90
1.0	19394	18171	14550	59	346	1.25
Default	16086	18606	6336	61	176	1.54

5. Summary and Conclusions

This is essentially a theoretical paper which attempts to add a heterogeneous element to the normal homogenous approach to mortgage option analysis as well as illustrating how tax policies might have differing effects is a heterogeneous setting. To this end, we have introduced an additional bargaining parameter ϕ (related to future unavoidable foreclosure costs) and compared to the traditional option theoretic mortgage default treatment. This parameter ϕ is a convenient construct to divide the benefits of avoiding foreclosure costs between lender and landlord. On this basis, in any case, we have derived simple closed form relationships between parameters such as landlord tax status, lender's foreclosure costs and their relative bargaining power on the resulting yield spread, debt coverage and LTV ratios.

The predicted effect in the entry scenario above of the reduction in UK BTL mortgage tax relief under the model assumptions is to reduce lender's debt capacity, increase the required mortgage deposit and lower the rental income rate at which the landlord enters the market. In this world, it is likely that the "quality" of new BTL landlords entering or investing will be higher under the new tax regime while the "quality" of existing BTL landlords under the existing mortgage tax relief is likely to be lower.

However should the rental market subsequently worsen, as feared by Governor Carney, then it is likely that rental volatility would increase substantially whereby exit thresholds which were valid for a lower volatility regime when landlords entered the market would be no longer valid. In this scenario, landlords who enter the market with reduced tax benefits might actually bargain and negotiate more "ruthlessly" leading to Governor Carney's worse fears.

The strategic negotiation option has been demonstrated to have *ex-post* distinct economic and financial consequences as compared to a default option. It remains to empirically investigate whether this idea of UK BTL landlords strategically delaying payments and negotiating actually occurs within an option theoretic equity optimising framework or rather within some other "affordability optimising" framework. We believe that an empirical investigation as to whether strategic negotiation exists might serve as a leading indicator could from the above exposition have merit and value.

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Glossary

x : Net rental income rate after operating expenses and local property taxes but before mortgage payment tax deduction.

x_i : Optimal rental rate at where the landlord would invest with only a default option.
x_{di} : Optimal rental rate at where the landlord would invest with only a negotiation option.
x_f : Optimal rental rate at where the landlord would default with only a default option.
x_{df} : Optimal rental rate at where the landlord would threaten to default option.

$x_{ae\ \tau=0}$: Optimal investment threshold with all equity (*ae*) financing and no taxes.
$x_{ae\ \tau>0}$: Optimal investment threshold with all equity (*ae*) financing and with taxes.

σ : Net rental income rate volatility.
μ : Net rental income rate drift.
β, γ : Roots of $\frac{\sigma^2 x^2}{2} + (\mu - \sigma^2/2)x - r = 0$
α : Lender's foreclosure costs as a percentage of the property value *V(x)* implied by the net rental income rate *x* at either x_i or x_{di}.
τ : Landlords tax rate
r : Risk free rate of return
c^* : Perpetual mortgage payment to the lender for the default only option (tax deductable).
c_d : Perpetual mortgage payment to the lender for the negotiation option (tax deductable).
$C(x)$: Renegotiated mortgage payment (after negotiation) which depends on rental rate *x*.
ϕ : Heterogeneous bargaining or sharing parameter which lies between 0 and 1.
I : Initial property investment made at the critical investment thresholds x_i or x_{di}.

LTV_{di} : Risk adjusted Loan to Value ratio at origination x_{di} for the negotiation option
LTV_i : Risk adjusted Loan to Value ratio at origination x_i for the default only option.
DCR_{di} : Risk adjusted Debt Interest Coverage Ratio for the negotiation option.
DCR_i : Risk adjusted Debt Interest Coverage Ratio at origination x_i for the default only option
YS_{di} : Risk adjusted Yield Spread for the negotiation option at origination x_{di}
YS_i : Risk adjusted Yield Spread for the default only option at origination x_i.
$W_{df/f}$: Wedge factor defined as the ratio of the critical trigger points $\frac{x_{df}}{x_f}$.

$V(x, c)$: Property value as a function the net rental income rate and mortgage payment.
$E(x, c)$: Equity value as a function of the net rental income rate and mortgage payment.
$D(x, c)$: Debt value as a function of the net rental income rate and mortgage payment.

K : defined as $\frac{(r-\mu)}{1-\tau}$.
L : defined as $\frac{1-\tau(1-\phi)}{1-\phi\alpha}$ used for the negotiation option.
g : defined as $\left[\frac{\beta}{\beta-\gamma}(1-\gamma)\right]^{-\frac{1}{\gamma}} = \frac{x_{di}}{x_{df}}$ used for the negotiation option.
h : defined as $\left[1 - \frac{\gamma(\tau+\alpha(1-\tau))}{\tau}\right]^{-1/\gamma} = \frac{x_i}{x_f}$ used for the default only option.

Appendix A – UK Private Residential Buy-to-Let Data Assumptions

The private BTL housing market, encouraged by successive UK government policy, has become very significant within the total UK housing market with total gross lending in 2005 of £25 billion (CML 2009)[3].

Mortgage data for the UK "Buy to Let" market is from the Council of Mortgage Lenders (CML 2009) and the Association of Residential Letting Agents[4]. The main differences between datasets revolve, crucially, around the reported LTV. In 2007, the average BTL mortgage advance was £130000 which at the (CML) average LTV of 85% implies an initial investment I of £153000 or landlord equity of £23000. The average mortgage rate was 6.5% and the risk free rate (10 year UK bonds) was approx 5% in the same period. The private landlord might have expected some net positive drift in the gross yield of 1%. (ARLA 2009)

The yearly mortgage payment at 6.5% is £8500/year. We assume that the landlord would then require a minimum rental income of £10500 to cover payments to the lender and management cost. This is equivalent to a 125% rental cover which is slightly higher than the indicated average minimum of 120%.

At a recommended rental cover of 150% and approximate management costs of 20% the gross rental return would be £12700/year with £8500 going to the lender, £2500 on operating costs and the balance (before tax) of £1700 to the landlord. The personal tax rate of the landlord is assumed to be 25%, rental volatility of 15% and a lender's loss severity α of 30%.

The £1700 (after tax) would represent a basic return of 5.5% ($\tau = 25\%$) on the landlord's equity (excluding any capital appreciation), but of course this basic return does not reflect the full value of the options available to the landlord including strategic default and renegotiation of the partial funding arrangement.

[3] The UK mortgage market had a pool of 12m outstanding mortgages in 2007 of which 1 million (£120 billion) were BTL mortgages. (CML 2009), Industry Data, *http://www.cml.org.uk/industry-data/industry-data-tables/*

[4] ARLA (professional landlords) reports that 40% of landlords had an aggregate LTV ratio of 50% or less with 20% having a LTV of 75% or greater. The average LTV reported by CML was 85%.
ARLA (2009), The ARLA History of Buy to Let Investment 2001 to 2008, *http://www.arla.co.uk/buytolet/specialreports.aspx*