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SQUATTING, EVICTION, AND DEVELOPMENT

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Abstract

This paper explains both squatting and preemptive eviction by landowners within the context of incomplete land markets. The model shows that squatting is not inevitable in incomplete property markets; instead, it arises from optimal landowner decisions not to fully exercise property rights. The analysis explains why squatters' housing investments and owners' preemptive eviction rates tend to be higher than efficient and why eviction rates for open property are inefficiently high. It also examines informal land markets comprising potential squatters and owners and shows why they need not fully resolve inefficient squatter investment and landowner eviction decisions.

Keywords: land property rights, squatting, eviction, land development

JEL Codes: O17, O18, R31

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1 Introduction

Squatting, or unilaterally using someone else's land without paying rent, is one of the most visible features of real estate markets in many developing economies. Although wide-spread in some agricultural regions as well, over one third of the urban population engages in squatting in many developing countries (Garr 1996). In conjunction with pervasive squatting, preemptive eviction by some landowners represents another prevalent practice. What is puzzling about this practice is why, rather than simply allowing squatting to continue until the land is ready to be developed for higher (and legal) uses, landowners sometimes enclose their property or preemptively evict squatters well in advance of their decision to develop the land.

Hoy and Jimenez (1991), in the closest antecedent to the approach taken here, present a useful framework for studying these questions, a model of an incomplete land market in which landowners are precluded from renting to squatters while they wait to develop their land. Hoy and Jimenez view squatting as the result of high transactions costs or legal restrictions on owners that prevent them from collecting rent from potential squatters. In addition, preemptive eviction represents the owner's attempt to reduce squatting by promising to evict regardless of whether or not such eviction is profitable once squatting actually takes place. The assumption that landowners can commit to strategies that are not credible plays an important role in their analysis, however, for without it there is no preemptive eviction in their model.

This paper offers a model of the landowner-squatter relationship to explain both the apparent pervasiveness of squatting as well as the practice of enclosure or preemptive eviction.[1] The model retains the usual characterization of squatting as rent-free land use without explicit permission of the landowner. This model initially assumes, like Hoy and Jimenez (1991), that institutional restrictions or high transactions costs preclude landowners from collecting rents from squatters, thereby leading to incomplete land markets. Here, however, neither landowners nor squatters can commit to

[1] Squatting on government land is also a widespread phenomenon in many developing countries. This analysis does not address government policies regarding squatting and eviction for public land. See Jimenez (1985) for an analysis of the case in which the government assumes the responsibility for eviction.

strategies that are not credible.

In contrast with earlier studies, this paper shows that incomplete land markets need not inexorably lead to active squatting. Instead, following de Meza and Gould (1992), this paper envisions the private enforcement of property rights as an explicit choice made by property owners. In this view, squatting occurs only when the land owner explicitly decides not to exercise his or her property rights of exclusivity by enclosing the land or otherwise engaging in preemptive eviction.[2] Thus, rather than explaining squatting as the inevitable outcome of exogenous institutional restrictions preventing landowners and temporary land users from engaging in mutual transactions, squatting is instead the consequence of the owner's rational decision to temporarily relinquish property rights. In addition, the model illustrates that the attractiveness of continually defending property from squatting (that is, enclosure or preemptive eviction) hinges upon the difference between the cost of privately enforcing private property rights by preventing squatters from settling on one's land and the expected cost of letting squatters remain until development becomes profitable, then evicting the squatters immediately prior to development.

The analysis shows that squatters tend to invest in more housing capital than is efficient, the owner's preemptive eviction or land enclosure rates tend to be higher than is efficient, and owners tend to evict squatters on unenclosed or open property over a wider range of realized states than is efficient. The intuition for these three inefficiency results arise only in part from squatters' investment decisions. Although squatters recognize that their housing capital investment may yield zero (consumption) returns in the event that the owner chooses to clear his land for formal market uses, their investment decisions do not take into account the additional burden put on the landowner in the event the land is to be cleared; greater squatter structural density increases the demolition cost to clear the land for formal development. Thus, squatters tend to invest in more housing capital than is efficient. At the same time, landowners recognize at the outset squatter motives for greater housing capital investment. This makes it profitable to enclose and defend against squatting a wider range

[2] We follow Hoy and Jimenez (1991) and define preemptory eviction as keeping the land clear of squatters even in the absence of immediate development for the formal sector.

of properties than could be justified if housing investment hence demolition costs were lower. As a result, the squatters' over-investment in housing capital motivates more landowners to enclose their property than is efficient.

For land that is left open to squatters, however, the inefficient landowner eviction behavior arises from another source. Once squatters have put their housing capital into place, the institutional constraint that precludes them from dealing with landowners in the market also prevents them from bidding their full consumption value for the informally developed land that they occupy. Thus, there is a range of formal market land uses that generate lower benefits than those that would be enjoyed by the squatters. But because the formal land market does not price squatting as a competing alternative use, the landowner has an incentive to clear the land of the squatters' housing and develop it for the formal sector use even when formal sector returns are lower than the foregone benefits to the evicted squatters. As a consequence, landowners tend to evict over a wider range of formal sector demand functions than is efficient.

This paper also demonstrates why introducing an informal land market comprising potential squatters and owners does not necessarily resolve the inefficiency of squatter investment and owner eviction decisions. Because the squatters' poverty precludes formal methods of adjudicating squatter contract violations ex post, landowners must resort to taking the land rent in the form of lump-sum bonds. Such bonding, however, does not force squatters to fully internalize the marginal eviction costs of their housing capital decisions. Thus, squatters invest in more housing capital than is efficient even when contracting with owners is allowed.

The discussion is organized as follows. Section 2 presents a model of the landowner-squatter interaction and examines the properties of the equilibrium. Section 3 extends the framework to study how enclosure or preemptive eviction can be an optimal credible strategy for landowners, and considers some implications. Section 4 compares the equilibrium outcome with the Pareto efficient benchmark. Section 5 extends the model to the situation where transactions costs are sufficiently low or the government relaxes institutional restrictions to allow for a legitimate informal land market in which the owner can collect land rent from erstwhile squatters. Section 6 concludes.

2 Squatting and Eviction

We begin with the simplest situation, the results of which are needed to consider preemptive eviction or enclosure in the next section. The general setting is the following. In the first stage, the potential squatters invest in housing capital as improvements on the land, taking into account that the landowner might choose to clear the land later. At the same time, the owner announces the eviction policy to be enacted later in the second stage. Squatters are rational and only believe credible announced eviction policies; therefore, the owner's stated eviction policy must be optimal ex post. In the second stage, the landowner observes the realized demand for his land in the formal sector market, then decides whether or not to expend the resources necessary to clear the land of squatters and develop the land for the formal sector. The strategic interaction between squatters and owners arises because the owners' subsequent decisions to clear the land mean that the squatters lose their housing capital investment. In addition, though, the more intensely squatters themselves develop the land they occupy with housing capital, the more costly it is for landowners to subsequently remove the capital when clearing the land for later development.

This strategic interdependence links the squatters' and owner's decisions and the credibility condition on landowner strategy leads to a particularly simple model structure. The squatters decide how much capital to put into place on the land, contingent upon the anticipated landowner eviction policy. At the same time, the landowner decides (and announces) what the eviction policy will be, contingent upon the realized demand for the property in the formal market and the cost of clearing the squatters' improvements from the land. Unlike earlier models, here the landowner's eviction policy must be credible, which in effect reduces the first stage owner strategy to announcing the eviction policy that is optimal ex post. Credibility is an economically reasonable condition in a sequential decision model like this one. Further, restricting attention to strategies that endogenously fulfill the credible commitment requirement greatly simplifies the structure of the game and allows the solution to be characterized as the Nash equilibrium below.

2.1 Landowner behavior

We start with the second stage of the game in order to focus on credible landowner strategies. Given the amount of capital improvements that the representative squatter has put on the land, at this stage of the game the landowner observes the realized demand in the formal market and then decides whether or not to develop the land. Let s index the realized state for land demand in the formal property market. The index s is distributed over $[0, 1]$ with cumulative density F. The present value of the net rent to the land if developed for use in the formal sector property market is $V(s)$, where $V_s > 0$. In addition, $V(0) < 0$ so that there exist some realized states in which land rents in the developed state are not high enough to cover the required development costs.

If developed for the formal market, the owner earns $V(s)$ from the plot of land. Let h denote the housing capital improvements constructed on the land by squatters. Before developing the land for the formal market, the landowner must therefore first clear the land at cost $c(h)$, where $c_h > 0$. The landowner will develop the land for the formal sector when $V(s) \geq c(h)$ and will leave the land undeveloped when $V(s) < c(h)$. Thus, conditional on the squatter's chosen h, the landowner's second stage decision is to develop the land for all realized states $s \geq \theta$ and leave the land undeveloped for all realized states $s < \theta$, where the critical state θ satisfies

$$V(\theta) = c(h) \tag{1}$$

The landowners optimal strategy is summarized by the critical value implicitly defined by (1),

$$\theta = \phi(h) \tag{2}$$

with $\phi_h = c_h/V_s > 0$. The function (2) represents the landowner's credible strategy which is announced in the first stage of the game and is summarized by the curve labeled ϕ in figure 1.

2.2 Squatter behavior

To keep the notation as simple as possible, consider a representative squatter whose behavior reflects the symmetric Nash equilibrium of a large number of identical competitive squatters on the plot of land.[3] The representative squatter must make his housing capital investment decision prior to knowing with certainty whether or not he will be evicted by the landlord. The representative squatter's utility is a function of housing capital h applied to the plot of land, and nonhousing goods consumption x. Utility is $u(x,h)$ if the squatter is not evicted from the land and $u(x,0)$ if evicted from the land. The utility function exhibits the usual properties. Finally, the squatter's opportunity cost is u^o, the equilibrium expected utility obtainable outside the urban area.

The landowner's eviction policy is reflected in the probability of eviction, given by the function

$$\pi(\theta) = \int_{\theta}^{1} f(s)ds \tag{3}$$

where f is the marginal density of s. The squatter's expected utility is therefore

$$Eu = [1 - \pi(\theta)]u(x,h) + \pi(\theta)u(x,0) \tag{4}$$

The squatter's best response to the landowner's eviction policy is found by maximizing (4) subject to the budget constraint

$$I = px + rh \tag{5}$$

where I is income and p and r are the nonhousing goods price and housing capital price, respectively. Substituting (5) into the expected utility function, the representative squatter's first order condition is

$$[1 - \pi(\theta)][u_h(x,h) - \frac{r}{p}u_x(x,h)] - \pi(\theta)\frac{r}{p}u_x(x,0) = 0 \tag{6}$$

[3] Each of the n squatters occupies $(1/n)$ of the land. In order to conserve notation, the exposition in the text normalizes the individual representative squatter's plot to one without loss of generality. The implicit assumption of a large number of atomistic squatters rules out the representative squatter taking the role of leader in a leader-follower game. At the same time, note that the requirement that the landowner can only adopt (and announce) a credible second stage eviction strategy rules out the landowner acting as a leader in a leader-follower game. The large number of squatters and credible landowner behavior lead us to focus on the Nash solution.

with $x = (I - rh)/p$. Rearranging reveals the usual consumer marginal condition for risky housing consumption,

$$[(1-\pi)u_x(x,h) + \pi u_x(x,0)]/(1-\pi)u_h(x,h) = \frac{p}{r} \tag{7}$$

that is, the marginal rate of substitution between non-housing and housing measured along the expected utility indifference curve equals the relative price (Dardanoni 1988, Turnbull 1994).

Denote the squatter's maximum expected utility from this problem as Eu^*. The squatter's participation constraint is fulfilled for $Eu^* \geq u^o$, in which case the squatter's optimal strategy is a function of landowner behavior, implicitly defined by (6)

$$h = \psi(\theta, I, p, r) \tag{8}$$

Implicitly differentiating (8), it can be shown that $\psi_I \geq 0$ implies $\psi_\theta > 0$. That is, the landowner's credible eviction strategy and the squatter's construction strategy are strategic complements when housing is a normal (or income neutral) good for the squatter. It is also straightforward to show that normality or neutrality of squatter housing demand ($\psi_I \geq 0$) ensures a downward-sloped demand ($\psi_r < 0$). Following the usual taxonomy, $\psi_p \gtreqless 0$ as housing and other goods are Marshallian substitutes (complements).

The squatter's optimal strategy is conditional upon the landowner's optimal eviction strategy, θ, and is depicted as the curve ψ in figure 1. Further, $\psi_I > 0$ (housing normality) implies that higher squatter income shifts this curve to the left and higher housing capital cost shifts it to the right. The effect of an increase in the price of non-housing goods on the locus depends upon the demand relationship summarized in the previous paragraph.

2.3 Equilibrium squatting and eviction

This section derives the game equilibrium and examines its comparative static properties. From the properties of (2) and (8), the squatter's investment in housing capital and the landowner's critical demand state are strategic complements. The private market equilibrium is the Nash solution $\{\theta^*, h^*\}$ satisfying (2) and (8) pictured in figure 1. The owner's response function ϕ and the squatter's response function ψ are upward-sloped in $\theta - h$ space. Assume the Lipschitz condition, that each party's own strategy dominates the other party's strategy effects on own marginal returns. As a consequence, ϕ is steeper than ψ, thereby ensuring a unique Nash equilibrium.

Because $V(0) < 0$, the cost of clearing the land of squatters and their housing exceeds the net return to land in its lowest realized state $s = 0$, or $V(0) < c(\psi(0))$. Therefore, as long as the net return to developed land in the highest realized state exceeds the cost of clearing squatters from the land, that is, as long as $V(1) > c(\psi(1))$, then there exists an equilibrium in the interior of the strategy space. For example, as in figure 1, $\theta^* > 0$ and the equilibrium strategy entails the owner allowing squatting in lieu of development for those plots of land with the lowest realized net returns in the formal land market (i.e., those plots for which realized $s < \theta$).

It is useful to consider how the formal sector demand for land, clearing costs, and other factors affect the equilibrium squatting and eviction strategies. To find the effect of an increase in the demand for developed property in all states s, introduce the shift parameter β_v into the formal sector net return function, $V(s, \beta_v)$, where $V_\beta > 0$. Totally differentiating the system (2) and (8) and solving in the usual way yields

$$\frac{\partial \theta^*}{\partial \beta_v} = \frac{-V_\beta}{V_\theta J} < 0 \qquad (9)$$

$$\frac{\partial h^*}{\partial \beta_v} = \frac{-\psi_\theta V_\beta}{V_\theta J} < 0 \qquad (10)$$

with $J = 1 - \phi_h \psi_\theta > 0$ from the Lipschitz condition. An increase in demand for developed property in all states increases the range of states over which net returns exceed clearing costs. As a consequence, the critical state θ declines for each given h, shifting the ϕ curve to the left in figure 1. Since the squatter's strategic response is not directly affected by the increase in V, the ψ curve remains stable and the net effect on equilibrium is to decrease the equilibrium squatting intensity and increase the range of states over which the land will actually be developed.

Similarly, we can introduce the shift parameter β_c into the clearing cost function,

$c(h, \beta_c)$, where $c_\beta > 0$ and $c_{h\beta} > 0$. Differentiate the system (2) and (8) to find

$$\frac{\partial \theta^*}{\partial \beta_c} = \frac{c_\beta}{V_\theta J} > 0 \tag{11}$$

$$\frac{\partial h^*}{\partial \beta_c} = \frac{\psi_\theta c_\beta}{V_\theta J} > 0 \tag{12}$$

Higher clearing costs shift the landowner's ϕ curve to the right in Figure 1, increasing the equilibrium squatting intensity and decreasing the range of states for which the land is developed.

The following results for squatter income, capital price, and the price of other goods are also useful for later derivations:

$$\frac{\partial \theta^*}{\partial I} = \frac{c_h \psi_I}{V_\theta J} > 0 \tag{13}$$

$$\frac{\partial h^*}{\partial I} = \frac{\psi_I}{J} > 0 \tag{14}$$

$$\frac{\partial \theta^*}{\partial r} = \frac{c_h \psi_r}{V_\theta J} < 0 \tag{15}$$

$$\frac{\partial h^*}{\partial r} = \frac{\psi_r}{J} < 0 \tag{16}$$

$$\frac{\partial \theta^*}{\partial p} = \frac{c_\beta \psi_p}{V_\theta J} \gtreqless 0 \text{ as } \psi_p \gtreqless 0 \tag{17}$$

$$\frac{\partial h^*}{\partial p} = \frac{\psi_p}{J} \gtreqless 0 \text{ as } \psi_p \gtreqless 0 \tag{18}$$

Summarizing, factors that increase squatter housing demand, like higher squatter income or lower housing capital cost, lead to less eviction and more intensive squatting on the property, as can be readily seen from a leftward shift in the ψ locus in figure 1.

3 Enclosing the Property to Prevent Squatting

This section generalizes the model to allow the landowner to exercise his property rights by enclosing his land or engaging in preemptive eviction. In the absence of a legally imposed risk of adverse possession by squatters, the landowner never has an incentive to clear the land of squatters unless the land is to be immediately developed for the formal market.[4] This section extends the landowner's strategy space, allowing the owner to prevent squatting by physically enclosing the property and continually defending it against squatting. Alternatively, we can view this process as immediate eviction before squatters employ their total housing capital on the land, with vigorous defense of the property thereafter. Assume that the cost of enclosure and monitoring is m.

The sequence of decisions is now as follows: First, the landowner decides whether to enclose the property at cost m. If he does, then incurring m ensures that the land will be vacant when the market ripens and the land demand state s is subsequently observed in the formal property market. At that time, the owner must decide whether or not to develop the land. Given no clearing cost (with no squatters to remove), the landowner develops the land as long as the net return is positive. Let σ denote the state for which $V(\sigma) = 0$. The owner develops the land for the formal sector for all realized $s \geq \sigma$ and leaves the land fallow otherwise. The expected return when enclosing the property is

$$EV^e = \int_{\sigma}^{1} V(s)f(s)ds - m \tag{19}$$

On the other hand, the landowner incurs no enclosure and monitoring costs if he instead chooses to leave the land open to squatters until the formal sector market ripens. The subsequent series of decisions then follow those articulated in the previous section: squatters make their decisions in light of the probability that the landowner will evict, then the demand state is realized and the owner evicts extant squatters if $s \geqq \theta$ and does not if $s < \theta$ according to the criterion derived in the previous section. In the event that the landowner does not enclose his property, the second stage equilibrium is $\{\theta^*, h^*\}$ defined by the Nash solution to (2) and (8). In this case, the landowner's expected net return to leaving the land open is

$$EV^o = \int_{\theta^*}^{1} \left(V(s) - c(h^*)\right) f(s)ds \tag{20}$$

[4] This paper does not consider the implications of adverse posession laws, which vary by country. For discussion of some of the economic issues surrounding how adverse posession laws modify private property rights, see, for example, Miceli and Sirmans (1995) and Baker, Miceli, Sirmans, and Turnbull (2001).

Given the subsequent optimal behavior embodied in the above expected returns to the strategies of enclosure and leaving the land open, the landowner's optimal strategy is to enclose the land when $EV^e \geq EV^o$ and to leave the land open otherwise. Define the monitoring cost that leaves the landowner indifferent between the two strategies as μ. This critical monitoring cost value satisfies $EV^e = EV^o$, which yields

$$\mu = \int_{\sigma}^{\theta^*} V(s)f(s)ds + \int_{\theta^*}^{1} c(h^*)f(s)ds \tag{21}$$

Since $dEV^e/dm < 0$ and $dEV^o/dm = 0$ using (19) and (20), landowners who face enclosure costs higher than μ will choose to leave the land open to squatters. Landowners who face enclosure costs lower than μ will choose to enclose their land and defend it against squatters until the formal sector market ripens for its ultimate development.

This implies that owners enclose only those properties for which enclosure costs are sufficiently low (less than μ): *landowners actively defend their property rights when the cost of doing so is sufficiently low.* And to the extent that this requires continually clearing the land before squatters have had the chance to put housing capital into place, this strategy looks like eviction without immediate land development.

It is also interesting to note that the critical monitoring cost value μ is itself a function of the equilibrium strategies in the later stages of the squatter-landowner game. Differentiating (21) and using $V(\theta^*) - c(h^*) = 0$ from (1) to simplify:[5]

$$\frac{\partial \mu}{\partial \beta_v} = \int_{\sigma}^{\theta^*} V_\beta(s)f(s)ds - \pi(\theta^*)c_h(h^*)\left(\frac{\partial h^*}{\partial \beta_v}\right) + V(\sigma)V_\beta(\sigma)f(\sigma)/V_s(\sigma) > 0 \tag{22}$$

The sign follows from (10). Since there will in general be a range of property types with different β_v values, this result illustrates that the critical monitoring cost values μ will also vary across property types. Recall that the landowner of a particular plot of land will choose to enclose if and only if his $m \leq \mu$. Therefore, if we assume that all owners face the same monitoring cost m, then the owners of higher β_v land, that is, land with greater expected formal sector net rents, will opt to enclose their land while owners of lower β_v land will allow initial squatting. This implies that *greater expected formal sector returns to land in all states tends to widen the range of*

[5]Note that $V(\sigma, \beta_v) \equiv 0$ so that σ is an implicit function of β_v, with $d\sigma/d\beta_v = -V_\beta/V_s < 0$.

properties for which landowners will engage in enclosure or preemptive eviction (by (22)) *and decrease the intensity of squatting in those areas left unenclosed by owners* (by (10)).

Now consider how greater clearing costs affects the owner's enclosure decision. Differentiate (21)with respect to the cost parameter to obtain

$$\frac{\partial \mu}{\partial \beta_c} = \pi(\theta^*)\left(c_\beta(h^*) + c_h(h^*)\left(\frac{\partial h^*}{\partial \beta_c}\right)\right) > 0 \tag{23}$$

Following the preceding analysis, (23) shows that landowners with higher clearing costs will enclose their land while those with lower costs will not. This further implies that *higher clearing costs for all property owners will increase the range of property types for which landowners will enclose or preemptively evict* (by (23)) *while increasing the squatting intensity on those plots that are left open* (by (12)). Both are intuitively appealing outcomes. But one policy implication that arises from these results is that increasing the legal hurdles for owners to evict squatters–policies sometimes justified in the interests of equity–increases eviction costs and not only increases the intensity of squatting on open land but also increases the amount of preemptive eviction or enclosure. In this sense, public policies that make eviction more difficult tend to reduce the amount of land left open to squatters.

Now differentiate (21) to find how greater squatter income affects the critical monitoring cost

$$\frac{\partial \mu}{\partial I} = \pi(\theta^*)c_h(h^*)\left(\frac{\partial h^*}{\partial I}\right) > 0 \tag{24}$$

where the sign follows from (14): *higher incomes for informal land users increase the range of property types for which enclosure is adopted.* This is because the expected cost of clearing the land for development rises as squatters invest in more housing capital when the land is left unenclosed.

Finally, whether higher prices of nonhousing goods increase or decrease the range of property types that the owners choose to enclose depends upon the squatter's demand relationship between housing and other goods. Differentiating (21) yields the effect of other goods price on μ as

$$\frac{\partial \mu}{\partial p} = \pi(\theta^*) c_h(h^*) \left(\frac{\partial h^*}{\partial p} \right) \gtreqqless 0 \quad \text{as} \quad \psi_p \gtreqqless 0 \tag{25}$$

Thus, if housing and other goods are Marshallian complements, as is likely the case for consumers spending a large portion of their incomes on food, clothing, and other non-housing essentials, then $\psi_p < 0$.[6] In this case (25) implies that higher prices of other goods lead to a narrower range of property types enclosed and (18) implies less intensive squatting on the land that landowners have left open. Graphically, factors that increase the squatter's demand for housing shift the ψ curve to the right in figure 1 and thereby tend to decrease the equilibrium intensity of squatting and the cost of clearing squatting in the event the land is to be developed. This lower clearing cost increases the owner's expected return to leaving the land open, thereby justifying leaving land open for a wider range of property types.

This last result is relevant to consumer subsidy reform policies often advocated for governments of developing countries. Structural reform in developing countries often requires reducing distorting taxes and government subsidies on food, fuel, or other nonhousing goods for urban consumers. But these policy changes also increase consumer prices of these goods. Aside from the obvious efficiency and redistribution effects, the analysis here implies that this type of reform also increases the range of land types that owners choose to leave open to squatters, thereby exacerbating squatting in the land market. It is worth emphasizing that the more extensive squatting in this case arises from the greater supply of land left open to squatters by owners rather than a greater demand for land by squatters.

In summary, the optimal decisions of land owners may include allowing squatting when property markets are not complete. Nonetheless, the question remains: is the resultant squatting efficient? This question is the examined in the next section.

[6] It can be shown that a housing consumption uncertainty analogue to the usual Slutsky equation holds (see, e.g., Turnbull (1995), chapter 4). In elasticity form, $\eta(\psi, p) = \eta(\psi, p)_{dEu=0} - (px/I)\eta(\psi, I)$. As in the certainty model, here the compensated cross price elasticity $\eta(\psi, p)_{dEu=0} > 0$ unambiguously. However, a sufficiently large proportion of spending on goods other than housing (px/I) leads to a stronger income effect on housing demand under normality, in which case the cross price elasticity under uncertainty is negative: $\eta(\psi, p) < 0$.

4 Efficient Squatting and Eviction

A Pareto efficient squatting intensity and eviction rate $\{\hat{h}, \hat{\theta}\}$ is the strategy that maximizes the expected returns to land developed for the formal sector subject to the constraint that the representative squatter attains (at least) expected utility $\overline{u}$:[7]

$$\max_{h,\theta} \int_{\theta}^{1} (V(s) - c(h))\, f(s) ds \tag{26}$$

$$\text{s.t. } [1 - \pi(\theta)]u(x, h) + \pi(\theta)u(x, 0) \geq \overline{u}$$

$$I = px + rh$$

$$0 \leq \theta \leq 1, \quad h \geq 0$$

Given that the efficiency criterion is independent of distribution considerations, including the budget constraint $I = px + rh$ of the representative squatter in the above problem ensures that the resource constraint for the economy is fulfilled.

As is well-known, there is no unique efficient solution. Therefore, we focus on the efficient solution most closely related to the decentralized private equilibrium $\{h^*, \theta^*\}$ that yields the squatter expected utility Eu^*. This requires setting the squatter utility constraint in the above problem equal to the expected utility that the squatter would attain in the private decentralized or market equilibrium depicted in figure 1: $\overline{u} = Eu^*$.

The Lagrangian function for problem (26) is

$$\begin{aligned} L \;=\; & \int_{\theta}^{1} [V(s) - c(h)] f(s) ds \\ & + \lambda_1 \left[[1 - \pi(\theta)] u\left(\frac{I}{p} - \frac{rh}{p}, h\right) + \pi(\theta) u\left(\frac{I}{p} - \frac{rh}{p}, 0\right) - Eu^* \right] \\ & + \lambda_2 (1 - \theta) \end{aligned} \tag{27}$$

The appropriate Kuhn-Tucker conditions are:

$$\frac{\partial L}{\partial \theta} = f(\theta)[c(h) - V(\theta)] + \lambda_1 f(\theta)[u(x, h) - u(x, 0)] - \lambda_2 \leq 0 \tag{28}$$

[7] The standard approach to finding an efficient solution assumes an equality utility constraint. The inequality squatter utility constraint adopted here results in an equality constraint in the efficient solution. The inequality formulation, however, allows us to exploit the implicit slackness conditions on the Kuhn-Tucker multiplier to more easily derive results.

$$\left(\frac{\partial L}{\partial \theta}\right)\theta = 0;\ \theta \geq 0 \tag{29}$$

$$[1-\theta] \geq 0;\ \ \lambda_2[1-\theta] = 0;\ \ \lambda_2 \geq 0 \tag{30}$$

$$\frac{\partial L}{\partial h} = -\pi c_h + [u_h(x,h) - \frac{r}{p}u_x(x,h)][1-\pi] - \frac{r\pi}{p}u_x(x,0) \leq 0 \tag{31}$$

$$\left(\frac{\partial L}{\partial h}\right)h = 0;\ \ h \geq 0 \tag{32}$$

$$[1-\pi(\theta)]u\,(x,h) + \pi(\theta)u\,(x,0) - Eu^* \geq 0;\ \ \lambda_1 \geq 0;\ \ \left(\frac{\partial L}{\partial \lambda_1}\right)\lambda_1 = 0 \tag{33}$$

where $x = (I - rh)/p$. Note that the case in which $h = 0$ allows for "enclosure" as one possibility.[8]

The following represent key normative results for the efficient solution $\{\hat{h}, \hat{\theta}\}$.

Proposition 1 *(i) Some eviction is efficient:* $\hat{\theta} < 1$. *(ii) The efficient squatting intensity is positive:* $\hat{h} > 0$.

Proof. *(i)* To prove by contradiction, Suppose $\hat{\theta} = 1$ so that $\pi = 0$. Then (31) reduces to $u_h(x,h) - ru_x(x,h)/p = 0$ with $x = (I - rh)/p$, that is, h maximizes squatter utility under certainty. Denote this maximum squatter utility under certainty as $\tilde{u}$. But $\tilde{u} > Eu^*$ under risk aversion, which in turn means that the third condition in (33) requires $\lambda_1 = 0$. Using this result, (28) implies $(\partial L/\partial \theta) < 0$ so that complementary slackness (29) requires $\theta = 0$, which contradicts the initial supposition $\theta = 1$. Therefore, the supposition cannot be true and (30) implies $\hat{\theta} < 1$.

*(ii)*To prove by contradiction, suppose $\hat{h} = 0$ for $\hat{\theta} \in (\sigma, 1)$ from *(i)*.[9] By (33) this further implies that $u(x,0) \geq Eu^*$, which violates the assumed squatter participation condition $Eu^* > u^o > u(x,0)$. Therefore, the supposition cannot be true and $\hat{h} > 0$. ■

Note that $\hat{h} > 0$ for all land implies that enclosure is not ever efficient. The rationale for this conclusion is as follows. The possibility that $V(s) < 0$ for some realized states explains why it is never efficient to enclose land to prevent squatters,

[8] Notice that this formulation ignores the cost of enclosure, which biases the solution in favor of keeping the land vacant until developed for the formal sector. Yet, as shown below, such enclosure is not efficient.

[9] We note in passing that $\theta > \sigma$ follows immediately from the proposition and (28) and(30).

even when such enclosure is costless. After all, it is not efficient to develop the land for formal use when $V < 0$ in the realized state; if the land is enclosed then both the interim and subsequent use value to squatters is foregone, too. In any case, the decentralized market solution derived earlier shows that landowners choose foreclosure when the cost of implementation is sufficiently low, which is clearly an inefficient outcome.

Given that private decisions to enclose land are never efficient, what about those other plots of land that owners choose to leave open to squatters? Can we make any comparisons for these parcels of land? To do so, note that the proposition means that the Kuhn-Tucker efficiency conditions can be further simplified to the following conditions for internal equilibrium:

$$V(\theta) - c(h) = \lambda_1[u(x, h) - u(x, 0)] \tag{34}$$

$$[u_h(x, h) - \frac{r}{p}u_x(x, h)](1 - \pi) - \frac{r\pi}{p}u_x(x, 0) = \pi c_h \tag{35}$$

To interpret these conditions, note that $V(\theta) - c(h)$ is the return to the landowner of evicting the squatter and developing the land in the marginal state θ. The expression $\lambda_1[u(x, h) - u(x, 0)]$ is the marginal benefit to the squatter of not being evicted in state θ–the monetized utility differential. Thus, (34) has the familiar interpretation that the efficient eviction rate balances the expected marginal net benefits to both parties. Similarly, the left hand side of (35) is the squatter's marginal expected utility from increasing housing capital while the right hand side is landowner's expected marginal clearing cost of housing capital. The efficient squatting intensity balances the representative squatter's marginal benefit of housing against the marginal cost of squatter housing borne by the landowner.

Conditions (34) and (35) can be used to graphically portray the efficient solution relative to the private decentralized decision equilibrium. The right hand side of (34) is positive so that $V(\hat{\theta}) - c(\hat{h}) > 0$ and the locus of points aa satisfying (34) lies to the right of the landowner's strategy function ϕ in figure 1. The left hand side of (35) is recognizable as dEu/dh, which is the left hand side of the squatter's utility maximization condition (6). The right hand side of (35) is positive, which therefore implies that the efficient solution satisfies $dEu/dh > 0$. Given $d^2Eu/dh^2 < 0$, the locus of points bb satisfying (35) must lie to the right of the squatter's strategy function ψ in figure 1. The efficient mix of $\{\hat{\theta}, \hat{h}\}$ must lie generally as pictured by the intersection of aa and bb in figure 1 (for the same squatter expected utility Eu^*) Recalling that in the model a higher critical value of θ corresponds to evicting over a *narrower* range of realized states, figure 1 illustrates the following result.

Proposition 2 *For land that is not privately enclosed, it is never the case that the equilibrium squatter housing capital intensity and eviction rate are both simultaneously lower than the efficient levels for the same squatter expected utility: For given squatter expected utility* $\overline{u} = Eu^*$, *either (i)* $h^* > \hat{h}$ *and* $\theta^* \geq \hat{\theta}$; *(ii)* $h^* \leq \hat{h}$ *and* $\theta^* < \hat{\theta}$; *or (iii)* $h^* > \hat{h}$ *and* $\theta^* < \hat{\theta}$.

The notion that landowners tend to evict over a wider range of realized land demand states than is efficient is intuitively appealing. The underlying assumption is that land markets are incomplete because landowners cannot legitimize the housing quality created by squatters by renting land to them outside the formal sector. But once squatters have invested in their housing, the institutional constraint that precludes them from dealing with landowners in the market also prevents them from bidding their value for the informally developed land they occupy, so owners do not take into account the costs of their eviction decisions to squatters. As a consequence, the landowner has an incentive to clear the land of the squatters' housing and develop it for the formal sector use even when formal sector returns are lower than the foregone benefits to the evicted squatters. In terms of the proposition: landowners tend to evict over an inefficiently wide range of realized formal sector demands.

Similarly, the notion that equilibrium squatting intensity is generally higher than the efficient level is not surprising at face value. Even though squatters know that there is a probability that their housing capital investment will yield them zero returns when the owner chooses to clear the land to develop it for the formal sector, their investment decisions do not take into account the demolition costs imposed on the landowner in the event the land is to be cleared; greater squatter structural density increases the demolition cost to clear the land for formal development. This demolition cost externality explains why squatters tend to invest in more housing capital than is efficient.

Although intuitively appealing, this squatter over-investment result does contrast with Hoy and Jimenez (1991), who conclude that squatters tend to under-invest in housing capital. Note, however, that Hoy and Jimenez assume that the landowner can commit to behavior that is not credible in the first stage. This is the key assumption that allows them to assume that owner acts like a Stackelberg leader and squatters act as followers in the game. In their model, the owner's strategic leadership role internalizes an additional marginal return to eviction in the form of the lower housing capital investment which is the squatter response to a higher eviction probability. This prompts the owner to evict more frequently than is efficient and, as a result, the squatters reduce their investment in housing capital below the efficient level. Ultimately, then, Hoy and Jimenez's inefficiency result differs from the normative conclusions in this paper because squatters in their framework myopically accept landowner announcements that are not credible. In contrast, in this model squatters believe that the landowner's announced eviction policy is credible only when it is optimal ex post. This credible commitment constraint rules out the type of Stackelberg behavior that drives Hoy and Jimenez' (1991) squatter under-investment result.

5 Legalizing the Informal Squatter Market

If the lack of a land market nexus between squatters and owners creates the private decisions inefficiency found in the previous section then the inefficiency should disappear when there is a market in which squatters can participate to express their demands to owners. This section removes the exogenous restriction on owners that is assumed in the previous sections. It allows owners the opportunity to rent their land directly to erstwhile squatters in the context of an informal market, in contrast with the formal sector market summarized in the return function $V(s)$. For convenience this discussion retains the "squatter" terminology to indicate informal sector land users even though the term is no longer technically correct.

Consider the model without land enclosure or preemptive eviction. Although not pursued here, the model can be extended to take enclosure into account using the approach taken earlier. Owners are allowed to collect land rent from squatters without providing the minimum improvements or housing capital required by building codes or zoning restrictions. They cannot, however, supply improvements or structures to the squatters without meeting the legal restrictions; that is, all owner-supplied improvements or housing capital must meet the restrictions of the formal sector. In the first stage of the game, the representative squatter pays the competitive informal land rent R and makes his housing capital decisions while the landowner announces the (credible) eviction policy. In the second stage, the demand state s is realized for the formal sector and the owner decides whether or not to clear the land for such use. If he does clear the land and develop it, he returns the squatter's rent R, and earns the net formal sector return $V(s) - c(h)$, as in the previous model.[10] If he does not clear the land, he retains the squatter's rent R and leaves the squatter unmolested. As before, credibility requires that the first stage announced eviction policy must coincide with the second stage eviction decision.

First consider the representative squatter's behavior. In this case the squatter's expected utility is

$$Eu = [1 - \pi(\theta)]u\left(\frac{I - R - rh}{p}, h\right) + \pi(\theta)u\left(\frac{I - rh}{p}, 0\right) \tag{36}$$

Maximizing the above, the squatter's optimal housing capital, conditional on θ, satisfies the condition

$$[1 - \pi(\theta)]\left[u_h(x, h) - \frac{r}{p}u_x(x, h)\right] - \pi(\theta)\frac{r}{p}u_x(x + R/p, 0) = 0 \tag{37}$$

with $x = (I - R - rh)/p$.

The competitive rent for land in the informal market is that which drives expected squatter utility equal to the opportunity utility level, u^o. Thus, R satisfies the competitive bid rent equilibrium condition

$$[1 - \pi]u\left(\frac{I - R - rh}{p}, h\right) + \pi u\left(\frac{I - rh}{p}, 0\right) = u^o \tag{38}$$

[10] The results for this model can be shown to also pertain to the case where the landowner does not return the rent payment to the squatter if he chooses to evict. This alternative case is examined briefly later.

where h is the implicit solution to (37). Conditional upon the squatter's opportunity cost u^o, the locus of points satisfying (37) and (38) is given by $\tilde{\psi}$ in figure 2.[11] Implicitly differentiating (37) yields $\partial h/\partial R < 0$ so that $\tilde{\psi}$ must lie to the right of ψ for $R > 0$.

Now consider the landowner's behavior. The return to the land is $V(s) - c(h)$ if developed for the formal sector and R if not. Define θ as the critical demand state in which the net return to developing land for the formal sector equals the informal sector rent,

$$V(\theta) - c(h) = R \tag{39}$$

The owner's optimal second stage behavior is to develop the land for all $s \geq \theta$ and leave the land rented to the squatter for all $s < \theta$. Conditional on u^o, the owner's credible strategy satisfies (39) and (38). The locus of points characterizing the landowner's strategy is $\tilde{\phi}$ in figure 2. Since $R > 0$, it follows that the left hand side of (39) is greater than zero, which in turn implies that $\tilde{\phi}$ lies to the right of the previously derived curve labeled ϕ in figure 2.

The equilibrium strategy for both parties is the Nash equilibrium $\{\tilde{\theta}, \tilde{h}, \tilde{R}\}$ defined by (37), (39), and (38), the intersection of $\tilde{\psi}$ and $\tilde{\phi}$ in figure 2. The characteristics of these loci immediately reveal that the equilibrium with a squatter land market generally lies to the southeast of the equilibrium without the squatter land market. The next result is clear from the figure.

Proposition 3 *When compared with the case in which there is no informal squatter land market, the squatter land market will never lead to greater eviction coupled with greater squatter capital intensity: either (i)* $h^* > \tilde{h}$ *and* $\theta^* < \tilde{\theta}$*; (ii)* $h^* \leq \tilde{h}$ *and* $\theta^* < \tilde{\theta}$*; or (iii)* $h^* > \tilde{h}$ *and* $\theta^* \geq \tilde{\theta}$*.*

Loosely put, the squatter land market tends to reduce the eviction rate and squatting intensity (that is, it is possible that either the eviction rate or squatting intensity increase, but not both at the same time). This is an intuitively appealing outcome. The informal land market creates a channel though which squatters can express the value of the land to them. This rent increases the owner's opportunity cost of development for the formal sector, which in turn reduces the range of demand states

[11] Note that R varies along both $\tilde{\psi}$ and $\tilde{\phi}$ in the diagram.

for which eviction is profitable. At the same time, the competitive squatter rent decreases squatter equilibrium utility, thereby decreasing the squatter's demand for housing capital. Although offset somewhat by the lower probability of eviction, this decreased demand for squatter housing capital tends to lower the equilibrium squatting intensity.

Does this market connection between owners and erstwhile squatters restore efficiency? To make the relevant comparison, set the utility constraint the problem (26) equal to the utility consistent with the competitive bid price equilibrium, u^o, and modify it to take into account the informal rent R that expresses the squatter's land valuation in monetary terms. The Pareto efficient solution $\{\hat{h}, \hat{\theta}, \hat{R}\}$ is that which maximizes the expected formal sector and informal sector returns to land subject to the squatter expected utility constraint, u^o :

$$\max_{h,\theta,R} \int_{\theta}^{1} \left(V(s) - c(h)\right) f(s)ds + [1 - \pi(\theta)]R \tag{40}$$
$$\text{s.t. } [1 - \pi(\theta)]u\left(\frac{I - R - rh}{p}, h\right) + \pi(\theta)u\left(\frac{I - rh}{p}, 0\right) = u^o$$
$$0 \le \theta \le 1; \quad h \ge 0$$

Consider the efficient solution. In this case the Kuhn-Tucker conditions for this version of the Pareto efficient problem include the following:

$$V(\theta) - c(h) - R = \lambda_1 \left[u\left(\frac{I - R - rh}{p}, h\right) - u\left(\frac{I - rh}{p}, 0\right)\right] \tag{41}$$

$$(1 - \pi)\left[u_h\left(\frac{I - R - rh}{p}, h\right) - \frac{r}{p}u_x\left(\frac{I - R - rh}{p}, h\right)\right] - \frac{\pi r}{p}u_x\left(\frac{I - rh}{p}, 0\right) = \pi c_h \tag{42}$$

$$(1 - \pi)u\left(\frac{I - R - rh}{p}, h\right) + \pi u\left(\frac{I - rh}{p}, 0\right) = u^o \tag{43}$$

Since the right hand side of (41) is positive,[12] $V(\hat{\theta}) - c(\hat{h}) - R > 0$ so that the $\theta - h$ combinations satisfying the efficiency conditions (41) and (43) must lie to the right of $\tilde{\phi}$, say dd in figure 2. Similarly, the locus satisfying (42) and (43) can be shown to

[12] For the squatter to voluntarily rent the land it must be true that $u\left(\frac{I-R-rh}{p}, h\right) > u\left(\frac{I-rh}{p}, 0\right)$. This condition also pertains for efficient squatter occupation.

be to the right of the squatter private decision strategy locus $\tilde{\psi}$, say cc. The efficient solution is where the cc and dd loci intersect, and the following pertains, extending the earlier result for the model with no squatter-owner informal market nexus.

Proposition 4 *For land that is not privately enclosed, it is never the case that the private decentralized equilibrium with an informal squatter land market, $\{\theta^*, h^*, R^*\}$, yields a squatter housing capital intensity and an eviction rate that are both simultaneously lower than the efficient levels for equal squatter expected utility: for $u' = u^o$ either (i) $h^* > \hat{h}$ and $\theta^* \geq \hat{\theta}$; (ii) $h^* \leq \hat{h}$ and $\theta^* < \hat{\theta}$; or (iii) $h^* > \hat{h}$ and $\theta^* < \hat{\theta}$.*

This proposition establishes that decisions made within the context of the decentralized private market tend to greater eviction and more squatter housing capital than is efficient.

Why does introducing a land market connection between landowners and squatters not resolve the inefficiency of the private market outcome? The persistent inefficiency is largely attributable to the remaining externality in the owner-squatter nexus, the cost confronting the owner for clearing the squatter's capital from the land. This continues to drive a wedge between the owner's and squatter's net marginal benefits from developing the land for the formal sector. As a consequence, the owner still has an incentive to evict more frequently and the squatter uses more capital than is efficient.

This raises an additional question, whether it is possible for the owner and squatter to structure a *land* rent agreement internalizing this clearing cost externality. Unfortunately for the landowner (as well as for efficiency), simple agreements are likely to fail in this respect and complex agreements are as a practical matter too costly to verify and enforce, especially in light of "judgement proof" impoverished squatters. As an example of how simple agreements are likely to fail, consider the case where the owner requires the squatter to post a bond to cover the expected eviction cost when the rent is paid. It is interesting to note that the payment of the rent R agreed to in the first stage of the game can be viewed as including a lump-sum bond to cover the expected eviction cost for the landlord, where the landlord retains R regardless of his eviction decision.[13] That this does not alter the inefficiency result can be shown by modifying the squatter's expected utility (36) to include the lump-sum land rent R in the eviction state utility as well as the squatting state utility. In this case, it can be shown that the private market equilibrium will occur at the intersection of the ϕ locus (because R nets out of both sides of the equation describing θ) and a locus resembling $\tilde{\psi}$ in figure 2. This equilibrium is also inefficient, however, since the efficient solution lies to the right of $\tilde{\psi}$ in the figure. The source of the inefficiency is that the bond paid by the squatter is lump-sum while the owner's eviction cost varies with the amount of housing capital put in place by the squatter. Simply put, this externality marginal cost of the squatter's capital on the landowner cannot be internalized with a lump-sum bond in the land market.

6 Conclusion

This paper presented a formal model of the landowner-squatter relationship within the context of incomplete land markets to explain both the apparent pervasiveness of squatting as well as the practice of preemptive eviction by landowners. Whereas earlier work views squatting as the inevitable outcome from exogenous institutional restrictions, this model explains squatting as the owner's optimal decision not to exercise property rights. Owners allow squatting when it is too costly, relative to later eviction, to enclose and defend the property against unauthorized use.

The paper examined the comparative static properties of the equilibrium squatting, eviction, and enclosure as well as the efficiency properties of the private decentralized outcome. It showed that, because enclosure is never efficient, the private market enclosure rate is generally greater than the efficient benchmark. The results also show that, for property left unenclosed or open by the owners, squatters tend to invest too heavily in housing capital and owners tend to evict over a wider range of realized states than is efficient.

Finally, the model was extended to include a viable informal land market as a

[13] When the impoverished squatter cannot resort to high cost legal remedies and the owner similarly cannot apply legal remedies to obtain recompense from the impoverished (and possibly highly mobile) squatter, then the previous rent scheme is not incentive-compatible while this one is.

channel through which squatters and owners can interact directly. This analysis lead to the conclusion that such a market does not completely eliminate the inefficiency of the outcome. In the absence of a system allowing squatters to credibly commit to flexible bonds covering realized marginal eviction costs, even the informal squatter land market does not make squatters fully internalize the eviction cost externality that their housing investment decisions impose on owners.

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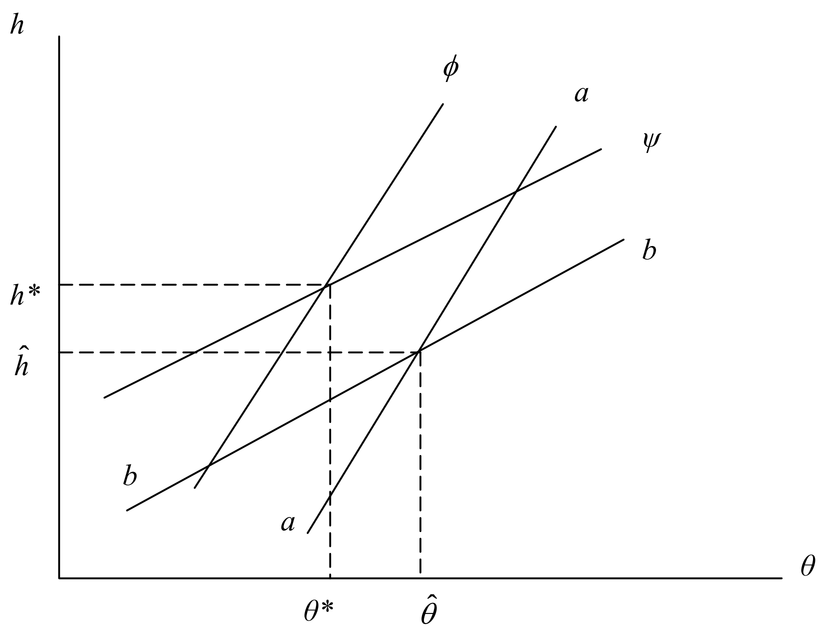

Figure 1

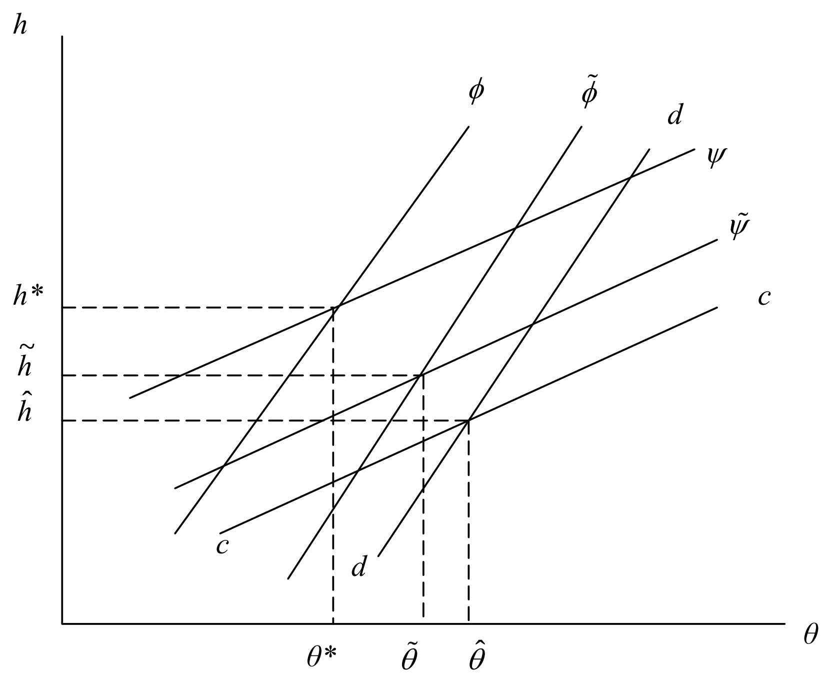

Figure 2