1 How Property Rights Impact Economic Activity

Hernando De Soto is a Latin American economist who has argued that specifying *well-defined and well-protected private property rights in Latin America would substantially increase per capita income in this region*. A brief summary of his views is found on [http://en.wikipedia.org/wiki/Hernando_de_Soto_Polar](http://en.wikipedia.org/wiki/Hernando_de_Soto_Polar)

He has focused on the issue of *land titling*. This means that private individuals and families are given formal property rights for land which they have previously occupied informally or used on the basis of customary land tenure. De Soto makes the case that providing formal titles increases security of land tenure, supports development of markets in land, and allows better access to credit (using land titles as collateral).

Consider the paper, "Barbed Wire, Property Rights, and Agricultural Development", which is about protecting your property from others. The paper describes how open land that is developed for animal grazing will not only be used by your own cattle or horses, but since it is open, animals that don’t belong to you will graze on your land as they roam. The punchline is that as barbed wire became less expensive, it became less expensive to protect grazing land by fencing it with barbed wire, and it thus became more profitable to develop land for grazing since only a farmer’s own animals are to graze there.

Let’s see how we can model the security of land rights in an economic model.

The economy is one in which an individual has some raw land, which we will call \( l \). The raw land must be transformed into productive land, which we call \( l \). This productive land creates output. The production from the productive land is then consumed by the individual. An individual’s maximization problem with perfect property rights, which means that no one can use your land is:

\[
\text{max } u(c) + v(1 - h)
\]

subject to the production constraint

\[
A * l \geq c
\]

and subject to the constraint

\[
A * l \geq c
\]
We also have that the restriction that $h$ be non-negative.

The function $u(c)$ is increasing in $c$, which is consumption, and we also assume that the function $v(1 - h)$ is decreasing in $h$, where $h$ is the amount of time devoted to improving the land. An individual has one unit of time that can be allocated to either improving the raw land and turning it into productive land, or it can be used for some other activity. The benefit of using your time in an activity other than land improvement is represented by the function $v(1 - h)$. Thus, the opportunity cost of improving the land is that you are not allocating your time to another activity. The function $A * l$ is the technology that uses productive land to produce output. You can think of it as farmland that yields crops after labor has been used to plant the crops and care for the crops, or land that has been developed for grazing that produces cattle. Specifically, one unit of land is used to produce $A$ units of the consumption, where $A$ is a fixed production coefficient. The function $g$ is a production technology that uses labor ($h$) to turn raw land ($\hat{l}$) into productive land ($l$). The function $g$ is increasing in both of its arguments, $h$ and $\hat{l}$ and the partial derivatives of $g$ are positive, and there is also diminishing marginal products, which means that the partial derivative of $g$ with respect to $h$ becomes smaller as $h$ becomes large, and similarly for the partial derivative of $\hat{l}$.

Now, we will model property rights on land as the idea that someone can take a fraction of your productive land. For every unit of productive land you put forward, a fraction $\tau$ of that land will be taken by someone else, where we assume that $0 \leq \tau < 1$. If someone else uses your land, then it is not available for you to use. Perfect property rights protection means that $\tau = 0$, which is the economy just above. With imperfect property rights, $\tau > 0$. The individual land developer takes the value of $\tau$ as exogenous and makes their decisions taking into account the value of $\tau$.

With imperfect property rights, the problem becomes:

$$\max\{u(c) + v(1 - h)\}$$

subject to:

$$A * (1 - \tau)l \geq c$$

and

$$g(h, \hat{l}) \geq l$$

Let’s take the first order conditions to see how changes in property rights - which means changes in $\tau$ - impacts incentives and the decision to make land
productive. We form the Lagrangian below, in which $\lambda_1$ is the multiplier on the constraint $A(1-\tau)l \geq c$, and $\lambda_2$ is the multiplier on the constraint $g(h,\hat{l}) \geq l$:

$$L = \max\{u(c) + v(1-h) + \lambda_1(A(1-\tau)l - c) + \lambda_2(g(h,\hat{l}) - l)\} \quad (7)$$

The first order conditions are obtained by differentiating $L$ with respect to $c, h, \text{and } l$:

$$u'(c) - \lambda_1 = 0 \quad (8)$$

$$-v'(1-h) + \lambda_2 g_h(h,\hat{l}) = 0 \quad (9)$$

$$\lambda_1 A(1-\tau) - \lambda_2 = 0 \quad (10)$$

We can combine these equations to get:

$$-v'(1-h) + u'(c) A(1-\tau) g_h(h,\hat{l}) = 0 \quad (11)$$

Now let’s rearrange the equation to get:

$$v'(1-h) = u'(c) A(1-\tau) g_h(h,\hat{l}) = 0 \quad (12)$$

Now we can see how changes in property rights impact the decision to develop land. To see this, let’s interpret the last equation. The left hand side is the opportunity cost of creating productive land. The left hand side says that devoting additional time to making productive land means taking away time from other activities, which you value at the margin as $v'(1-h)$. Thus, $v'(1-h)$ is the opportunity cost, or marginal cost, of using your labor to create additional productive land. The right hand side of the equation is the marginal benefit of using additional time to create productive land. Specifically, using one more unit of time allows you to create additional productive land, and the amount of additional productive land that is created is just the marginal product of labor, which is given by $g_h(h,\hat{l})$. Next, you keep $(1-\tau)$ units of the additional productive land that you create. Thus, devoting one more unit of time to produce land means you have $(1-\tau)g_h(h,\hat{l})$ units of land that you can devote to produce the consumption good. Now, given that you have $(1-\tau)g_h(h,\hat{l})$ additional units of land, the additional consumption that you are able to obtain is given by $A(1-\tau)g_h(h,\hat{l})$. Finally, we obtain the marginal value of that additional consumption by multiplying it by marginal utility, which is $u'(c)$. Thus, the marginal benefit of devoting additional time to create productive land is given by $u'(c) A(1-\tau)g_h(h,\hat{l})$. 

3
Next, we will see how \( \tau \) impacts the determination of \( h \). To do this as simply as possible, assume that that \( v(1 - h) = \ln(1 - h) \), so the marginal utility is \( \frac{1}{1 - h} \). Moreover, assume that \( u(c) = c \), so that \( u'(c) = 1 \). Finally, assume that \( g(h, \hat{l}) = h \times \hat{l} \), and assume that \( \hat{l} \) is fixed. Plugging these three assumptions into the last equation, we get

\[
\frac{1}{1 - h} = A \times (1 - \tau) \hat{l}
\]  

Now we can see that a low value of \( \tau \) means a high value of \( h \), and a high value of \( \tau \) means a low value of \( h \).

To see how good protection of property rights induces producer to create a lot of productive land, and how bad protection of property rights induces producers to create less productive land, note that a large value of \( \tau \) results in the right hand side of the equation being small. The only other component in this equation that can change is \( h \), given our assumption that \( A \) and \( \hat{l} \) are fixed. If \( (1 - \tau) \) is small, then we need \( h \) to be smaller than it is when \( (1 - \tau) \) is larger. You can see this immediately because the only way for the left hand side to match a low value of the right hand side is for \( h \) to be relatively small. A lower value of \( h \) means that less productive land is created, which in turn means that there is less consumption. The bottom line is that the incentive to create productive land depends on the payoff to doing that. With very good protection of property rights, then there is a strong incentive to create productive land because you keep what you produce. With poor protection of property rights, that means you lose part of what you produce, which means that there is a lower incentive to create productive land. Note that we adopted some assumptions to show this result in the simplest possible way, which includes the assumptions that \( u(c) = c \) and \( g(h, \hat{l}) = h \times \hat{l} \). The same result will also hold for more general functional forms for these functions.