Part III: The Social Context of Markets

Part I reviews the core neoclassical model of market prices, supply, and demand. Part II reviews extensions of the core that deepen the analysis by incorporating time, uncertainty, entrepreneurship, the designing of the products brought to market, multiproduct firms, and the effects of government policies on market outcomes. If one wants to understand market networks, these are all important topics and ones that can be generalized and extended in various ways. In many cases, there are thousands of papers and many dozens of books that cover the same topics in much greater depth than a textbook can. The purpose of the book and its chapters is to introduce the core "idea base" of mainstream micro-economics.

Many "non-rational" puzzles have been neglected by our focus on rational-choice based models. The neglect of such puzzles can be justified if they can be relegated to special contexts or have features that cannot be generalized easily to most market settings. Other topics that are amenable to rational choice-based analysis have been neglected, because they are discussed in Part III.

Most of the topics reviewed in Part III are ones that were hidden in the "other things being equal" assumptions that implicitly frame each of the models developed in parts I and II. For example, it is taken for granted that civil and criminal law exists and that those aspects of the legal system allow things to be voluntarily exchanged, assure that contracts are enforced, and that criminal activity either does not exist or has been reduced to levels that can be ignored without significant loss in generality. The significance of the law to markets is taken up in Chapter 14.

Another topic is the extent to which economic processes are largely separate from political processes. In Chapter 12, it was demonstrated that many public policies affect economic outcomes. Are these policies determined through processes that are entirely separate from markets or are they—at least to some extent—generated by the efforts of market participants to increase their net benefits or profits through effects on prices or the extent of competition. Domestic producers, for example, profit from tariffs. Would they not lobby to have such tariffs adopted as public policies? If so, to what extent is their lobbying activity likely to be effective? This and other similar topics are taken up in Chapter 15.

Another neglected factor is culture—especially internalized norms. Many economists—from Kenneth Arrow to Friedrich Hayek—believe that religion-based and other norms affect non-market behavior. If so, to what extent can the behavior induced be modelled and demonstrated to affect the nature and extent of markets? A series of introductory models of such effects is reviewed in Chapter 16.

Another missing piece in our characterizations of markets is the organizational aspects of commercial organizations. Are firms mere nodes in the network of contracts out of which networks of exchange and production are made, or does the organization of firms contribute to their success? If so, to what degree? An introductory review is provided in Chapter 17.

Finally, there is the matter of whether markets matter or not? To what extent can they be regarded as institutions that are in some sense "good." It turns out that the same utilitarians that gave economics the notion of "utility maximizing behavior" also developed philosophical ideas that could be used to determine whether markets are good or not, whether they might be improved through public policies or not. This normative strand of microeconomics is taken up in Chapter 18.

Chapter 19 concludes the text with a broad-brush overview of the implications of the ideas and models reviewed in the first 18 chapters.

Chapter 14: Law and Economic Development

I. Law as a Strategy for Reducing Risk and Uncertainty

Chapters 7 and 8 showed how individuals and markets adjust to risk and uncertainty. For example, Chapter 7 showed that if individuals believed that the probability of defective units of a good increases, sales would diminish and prices would as well. Chapter 8 indirectly implied that if one knew for sure that an investment would be profitable, it would be made. Whereas if too little information was available to reach such conclusions only persons with unusual traits are likely to undertake such investments—e.g. persons who are overconfident in their assessments or persons with unusual abilities to perceive what others neglect—the number of persons undertaking the uncertain investments is limited to these somewhat unusual persons. In both cases, markets tend to be smaller than they would have been if the quality of a good or investment were known beforehand with certainty. Insurance companies and other risk diverting institutions tend to emerge in cases of risk, but are less likely to do so in cases of uncertainty.

Another method for reducing uncertainty is a society's legal system. It makes it clear who owns what and, in most contemporary societies, allows the owners of most things to trade them with others. The analysis of Chapters 7 and 8 implies, for example, that if the ownership of some types of goods was uncertain, trade in those goods would be diminished relative to the settings in which ownership was clear and broadly recognized. The latter would make the purchasers of the goods the new owners—whereas in the former case purchasers would be less certain about whether they would be owners of such goods, and the expected net benefits of purchases would be below that of the setting where property rights are clear and well understood.

Similarly, the core neoclassical models implicitly assume that voluntary exchange is the only method through which resources can be shifted from one person to another. For example, within an Edgeworth box, in the absence of exchange, the goods stay in the hands of their original owners. Neither person even considers stealing from the other, nor offering the other a gift. Similarly, sellers and purchasers are assumed to always operate in "good faith." Promises made to deliver goods after an initial payment, or to provide payment after goods or services are delivered are always kept. There is no risk or uncertainty associated with ownership or commercial transactions in the core models.

Whether this is because the societies in which neoclassical economics emerged were relatively low-crime settings or relatively trustworthy folks, or because the possibility of crime was simply ignored in order to clear the way for focusing on the essential elements of trade and price determination, it remains true that such possibilities were left out of the models.

That they were left out does not imply that crime is irrelevant for price theory or for understanding the extent of economic development. It simply implies that there are neglected aspects of the choice settings modeled that might affect the extent and efficiency of markets.

The use of rational choice models to analyze the effects of punishment on crime rates was begun by Gary Becker (1968), who demonstrated that rational choice models could be used to understand the decisions of criminals. Becker suggests that most criminals should be regarded as rational law breakers, rather than psychopaths or fundamentally immoral or amoral persons. Rational choice models also can be used to shed light on the interests that non-criminals have in discouraging crime.

Becker's work was followed in short order by books by Gordon Tullock (1971) and Richard Posner (1972), who began exploring the economic implications of judicial institutions, civil law systems, and the effects of changes in civil law on crime rates and economic development. In the late 1990s, the effects of law codes and legal institutions began to be incorporated into econometric models of economic development. A useful survey of that literature can be found in Dam (2007). In general, that body of research demonstrates that differences in legal systems often have systematic effects on the extent of a nation's economic development.

Such analyses shed light on the economic effects of differences among civil and criminal law systems, and thereby provide evidence of the effects of legal systems on the scope of the networks of exchange, production, and innovation. Perhaps surprisingly, the effects of different legal systems on the extent of markets were largely neglected by the economic development literature that emerged in the 1960s—until the late 1990s. Analyzing the microeconomics behind such effects is the main focus of this chapter.

This chapter develops a series of lean models that show why laws and law enforcement affect the size and extent of market networks.

Laws and law enforcement affect the risks associated with crimes (criminal law), contracts and property rights (civil law), and the recovery of damages from accidents (tort law). The results provide a theoretical explanation for the empirical evidence that legal systems have economic consequences.[1]

II. The Extreme Case: Hobbesian Anarchy

> Whatsoever therefore is consequent to a time of War, where every man is Enemy to every man; the same is consequent to the time, wherein men live without other security, than what their own strength, and their own invention shall furnish them withal. In such condition, there is no place for Industry; because the fruit thereof is uncertain; and consequently no Culture of the Earth; no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society; and which is worst of all, continual Fear, and danger of violent death; And the life of man, solitary, poor, nasty, brutish, and short. [Hobbes, Thomas. (1651). *Leviathan* (pp. 70-71). Neeland Media LLC. Kindle Edition.]

The value added by laws and law enforcement can be most easily illustrated with a short analysis of a choice setting without law. To do so, a model using elementary non-cooperative game theory is developed. It demonstrates why life in a lawless society tends to be highly uncertain and unpleasant, even if it is not necessarily quite as unpleasant as the quote from Hobbes suggests.

The choice setting examined is one where individuals choose among four strategies, but the results would be similar if there were just two strategies or a continuum of strategies. The results can also be extended to rivalry among several equally powerful groups such as extended families, tribes, local warlords, or nation states who are interested in extending their territories or control over resources.

The first choice setting analyzed is a setting analogous to an Edgeworth box. Two people live near to each other. Each has four possible strategies. They can use all or part of their

[1] For a similar but complementary overview of such rational choice models and results see Skaperdas (1992) or Cooter and Parisi (2009).

time to produce useful resources for themselves by growing them or harvesting them from nature, and the remainder (if any) to try to take (steal) some of their neighbor's production for the day, week, or year.

The following game matrix illustrates various combinations of payoffs associated with the possible time-allocation choices of the two neighbors. In game matrices, the strategies available to the participants are discrete rather than a continuum. This is sometimes a perfectly accurate representation of choice settings similar to the one modeled, but more often is a simplification to sharpen results and make the logic of the interdependence between decision makers clearer.

The payoff combinations of the matrix below assume that nature's bounty may be harvested with constant returns to the time invested, and that stealing produces control over a greater share of their neighbor's productive output as more time is invested in stealing—although their own output falls as time is shifted from productive uses to thievery (or self-defense). As less and less time is shifted to production, overall output falls, which reduces the overall net gains from theft.

Table 14.1 The Hobbesian Dilemma as a Time Allocation Game
Payoffs as (Al, Bob)

Bob / **Al**	100% produce, 0% theft	75% produce, 25% theft	50% produce, 50% theft	25% produce, 75% theft
100% produce, 0% theft	100, 100	50, 125	15, 135	5, 120
75% produce, 25% theft	125, 50	75, 75	35, 90	25, 75
50% produce, 50% theft	135, 15	90, 35	50, 50	30, 45
25% produce, 75% theft	120, 5	75, 25	45, 30	25, 25

Non-cooperative game theory usually assumes that decisions are made independently of one another and that the participants each attempt to maximize their payoff from the game. Each cell includes payoffs for Al and Bob for the various combinations of strategies. Al's payoff is in the left-hand entry and Bob's in the right-hand entry (Al's payoff, Bob's payoff).

The simplest way to think about their respective choices is to imagine that each participant maps out a "best reply function" similar to that previously used in the Cournot duopoly market setting in Part I and in Chapter 13 of Part II. When developed from a game matrix, the best reply function is not generated analytically, but by inspection.

In effect, Al says to his or herself, what should I do if Bob invests all of his time in productive activities? If Bob invests 75% of his time in productive activities? If Bob invests half of his time in productive activities? If Bob invests 25% of his time in productive activities. When you underline each best response, you'll have characterized the player's best reply function.

Nash equilibria occur in cells where both payoffs in a cell are underlined. The conditions for a Nash equilibrium are satisfied when each is simultaneously on their best-reply functions.

In this particular matrix, there is only a single Nash equilibrium. If you look at Al's payoffs, you'll see that in this particular choice setting, Al should always invest 50% of his or her time in stealing from (or attacking) Bob. Al has a "**pure dominant strategy**." A single strategy yields the highest payoff regardless of what Bob does. The game is symmetric—in that the strategies are all the same and the payoffs are mirror images of each other, so if Bob goes through the same thought process, he also has a simple best-reply function, because he also has a pure dominant strategy. Bob will invest 50% of his time in stealing from (or attacking) Al, regardless of what Al does.

Thus, the only place where the two best reply functions are simultaneously satisfied is the cell where the payoffs are (50, 50). (This is the only cell in which both "payoffs" are underlined.) This is a Nash equilibrium, because neither can do better by changing their strategy, given what the other has chosen to do. The highlighted cell is the unique Nash equilibrium in this contest.

The outcome is not as bad as the one characterized by Hobbes (which could emerge under somewhat different assumptions about the tradeoffs between production and theft), but the equilibrium is still pretty bad. Only half of the feasible total output is produced. In economic terms, the real GNP of this community is only half its potential real GNP, because of the prevalence of thievery.

That reduction in joint output will reduce the quality and extent of meals and of other necessities and material comforts for both community members—and also increases their risks from crises of various kinds—because fewer reserves, if any, are accumulated.

Opportunities for exchange, as in an Edgeworth box, are also more limited than they could have been, because less output is produced by each.

Keep in mind that this is not because of a failure to optimize. Both are doing the best that they can, given what the other is doing. It is because of the absence of clear property rights and effective law enforcement—the absence of civil and criminal law.

Notice that if a legal system existed that sufficiently penalized theft, more of the community's potential output could be realized. For example, if a legal system reduced payoffs from stealing by 40 utils in each of the cells where some stealing occurs, a new pure dominant strategy emerges, namely use all of one's time productively. Such a fine lowers the payoffs sufficiently that stealing no longer pays.

It is in this manner that a legal system can be economically relevant. In the Hobbesian game matrix above, such a legal system would double the extent of production—and would likely significantly extend opportunities for mutually advantageous exchange.

A Continuous Form of the Hobbesian Dilemma

Game matrices allow for various non-standard "shapes" for the payoff functions since they are not constrained to be points on a continuous, strictly concave, differentiable function. In principle, the numbers in a game matrix can have any plausible pattern. If we model such a choice setting with continuous strategy domains, some of that flexibility is lost, but one gets a more realistic characterization of strategies and strategy sets, which are rarely of the all or nothing variety.

To create a choice setting where players can allocate their time any way that makes sense to them, one simply needs to characterize a production function and a stealing function for each player. If we have no reason to assume that the people are different, then we can assume that each has the same production and stealing functions. We'll initially assume relatively simple concrete functions that have numerical counterparts similar to those of the game matrix above.

Suppose that production takes place with constant returns to scale and is simply $Q_i^P = 10T_i$. Suppose also that the stealing function ultimately determines how the goods produced are allocated. An example of such a function is

$$Q_i = [S_i/(S_i + S_j)] * [10T_i + 10T_j].$$

The total resources controlled by participant i are Q_i^S i, which is the amount of participant i's own production that is protected plus that taken from his or her neighbor or lost to his or her neighbor. Individual i is the person being focused on and individual j is the other person. The term in brackets is the sum of the outputs of the two neighbors. Suppose that each participant has 16 hours to allocate between production and stealing, and that the time spent producing goods and services is denoted as T_i for player i. In that case, $T_i = 16 - S_i$.

We can use the substitution method to write player 1's payoff function as:

$$Q_1 = [S_1/(S_1 + S_2)] * [10(16 - S_1) + 10(16 - S_2)] \qquad (14.1)$$

For stealing efforts greater than 0, Equation 14.1 holds. However, if $S_1 + S_2 = 0$, then Q_1=100. (There is a discontinuity in the payoff function, if neither engages in thievery.)

Differentiating and setting the result equal to zero characterize i's best level of theft as a function of the time allocation decision of the other player.

$$\frac{dQ_1}{dS_1} = \left[\frac{S_2}{(S_1+S_2)^2}\right][10(16 - S_1) + 10(16 - S_2)]$$

$$-10[S_1/(S_1 + S_2)] = 0 \text{ at } S_1^* \qquad (14.2)$$

The "upper" terms are player 1's marginal benefits from theft. The "lower" term is player 1's marginal cost of theft. To characterize 1's best reply function, solve equation 14.2 for S_1. This turns out not to be possible, although some useful simplification of the first order condition is possible. First, multiply by $(S_1 + S_2)^2$, divide by 10, and then isolate the marginal cost term (the last term)

$$S_2 [(16 - S_1) + (16 - S_2)] = S_1(S_1 + S_2) \rightarrow 32S_2 - S_1S_2 - S_2^2 = S_1^2 + S_2S_1 \rightarrow$$

$$32S_2 - S_2^2 = S_1^2 + 2S_2S_1 \qquad (14.3)$$

Equation 14.3 characterizes player 1's best reply function, although no closed form solution for S_1* as a function of S_2 exists.

Equations 14.2 and 14.3 make it clear that in this characterization of the Hobbesian setting, there is no pure dominant strategy. The choice of the other player determines each player's optimal extent of thievery.

Nonetheless, and perhaps surprisingly, we can characterize the Nash equilibrium. In a symmetric game, a likely equilibrium is one where $S_1^* = S_2^*$. To determine whether such an equilibrium exists, assume that $S_1 = S_2$, substitute for S_2 in the function characterizing participant i's best reply, then solve for S_1.

Substituting yields: $32S_1 - S_1^2 = S_1^2 + 2S_1^2$

Dividing both sides by S_1 and gathering terms yields: $32 = 4S_1 \rightarrow S_1 = 8$.

Thus, at the symmetric Nash equilibrium,

$S_1^{**} = S_2^{**} = 8$ hours of stealing, as in the game matrix. (14.4)

At the Nash equilibrium each neighbor spends exactly half of his or her time attempting to steal (or equivalently attempting to protect his or her own production from predation) and so their collective output is only half what it could be, as was the case in the setting illustrated in the game matrix.

This was not entirely a coincidence, because a similar process was used to characterize the extent of resources under each player's control to generate the payoffs in the game matrix, although it was not exactly the same process.

What matters is not the specific numerical result, but that the two-person village is poorer because significant time and attention is devoted to stealing (or preventing theft) rather than engaging in productive activities. It is possible that voluntary exchange may take place between the two persons at the equilibrium that emerges, although not necessarily the case.[2]

---

[2] In a one-good world, no trade would take place. But if each person produces a different good, then some trade might take place at the Nash equilibrium, although trade would have to be of the simultaneous variety, because neither person is trustworthy.

In either case, the Nash equilibrium illustrates one of the possible impacts of activities that are often termed criminal activities on the extent of markets.

As in the game matrix, it is possible that a well-enforced law against thievery can eliminate the problem. To characterize the optimal fine or fine schedule, take another look at equation 14.2, the first order condition. The first term is the expected marginal benefit or marginal revenue of theft. The second is the marginal cost of theft. To discourage all theft, the (expected) fine has to make the marginal cost of theft larger than its marginal benefits for all possible combinations of stealing efforts by the two neighbors.[3] That property will induce a "corner solution" as in our very early analysis of why consumers often purchase zero units of goods that are for sale at a posted price. Together the game matrix and the continuous version of the Hobbesian setting show why the absence or presence of law affect the size of trading networks.

Insofar as thievery relies on stealth and surprise, it may be said to increase the uncertainty of life in Hobbesian circumstances. However, unlike entrepreneurship in Chapter 8, the effect of crime is to retard economic development rather than spur it onwards.

In some cases, this occurs because of effects on the labor supply, as in the previous illustrations; in others it does so by making both production and trade risky activities as developed below.

III. Crime and Punishment in a More Civilized Society

The previous section illustrates an essential problem that confronts markets in the period before rules emerge that inhibit activities that tend to reduce the extent of trade and the density of trading networks. In societies that use private property as a solution to commons problems and as a spur to productive activities, internalized norms and law enforcement may jointly operate to reduce rates of theft, although not necessarily to zero. In societies that have extensive joint ownership, various use-rights may exist, and overuse would be the crime of interest. In the first case, the rights may be tradable, in which case markets would tend to emerge. Things that one produces may be deemed to be the producer's property and such

[3] This is not to imply that perfect enforcement of ownership rights is possible or easy, but simply to demonstrate that if it were, then rational choice models of crime imply that zero rates of criminal activity are, in principle, feasible. In larger communities, it is not always obvious who the criminals are.

owners may be free to trade the things produced or their services to others for other goods and services. In the second case, use rights might or might not be tradeable, and markets would tend to arise in the areas where use rights were tradable and in the things and services deemed to be personal property.

Hobbes imagines that those trapped in his dilemma would agree to form a government of some kind that enforces basic civil and criminal laws. Whether such agreements were ever consummated or not, the previous section shows why they might broadly advance the welfare of those living in a community. This is not to say that every law does so, but to point out that there is at least a subset of laws that do so.

When penalties reduce returns from stealing, a rational criminal invests less time in such activities. As more time is spent on productive activities, supplies of necessities, material comforts, and reserves for crises increase.

Imperfect Enforcement of the Law

This section assumes, as in Becker's classic paper on crime and punishment, that law enforcement is more or less honestly undertaken and that fines or other punishments that can be given money-equivalents are imposed on those caught engaging in illegal (e.g., criminal) activities. It also follows Becker's and Tullock's analysis in assuming that not all crimes are reported, nor all criminals identified, brought to trial, convicted, and punished. This uncertain or probabilistic chain of events is represented as a probability of punishment function. The probability of punishment increases with the number of crimes undertaken and with the governmental resources devoted to the criminal justice system, $F = f(N, G)$, with f monotonically increasing in N and decreasing in G.

The punishment is denoted in dollars and may consist of a variety of penalties with J being the amount that a potential criminal would be willing to pay to avoid the punishment. J increases with the number of known crimes that an individual criminal has convicted of and with his or her opportunity cost employment, and the type of punishment imposed—that latter being held constant for the model, $J = j(N, w^0)$, with function j increasing in N and in w^0. Other possible losses from engaging in crime such as reduced self-esteem and diminished reputations among one's friends, family, and employers. These too are assumed to be constant for individual criminals in order to develop a relatively lean model of criminal decisionmaking.

The revenue generated by criminal activity varies with the type of crime engaged in and with the efficiency of the supportive criminal network known to the individuals contemplating criminal activities, as with stolen goods resellers (sometimes called fences). Individual criminals are assumed to have individualized criminal revenue functions because skills at thievery and relationships with the supportive criminal network vary. To simplify, we'll simply assume that each potential criminal's total revenue from crime increases with the number of crimes undertaken, $R_i = r_i(N_i)$, with the revenue function r_i being monotone increasing in N and subject to diminishing returns.

The probability of punishment functions are also individualized. Again, skills and contacts in the criminal network vary among potential criminals and both affect the probability of being detected, arrested, and punished. Insofar as some criminal networks provide shelter and legal services for some of the persons in their group, the probability of being caught and punished varies. The probability, F_i, of being caught and punished increases with the number of crimes committed, N_i, and with the extent of resources, G, invested in the criminal justice system, $F_i = f_i(N_i, G)$. Potential criminals are assumed to differ in their access to criminal networks, skill sets, and assessments of the penalty schedules. The "i" subscript is intended to account for these factors, without explicitly modelling them.

The expected net revenue from an individual's activity, Π_i, can be written as:

$$\Pi_i \;=\; r_i(N_i) \;-\; f_i(N_i, G) j_i(N_i, w_i^0) \qquad (14.5)$$

Criminal i's optimal crime rate, N_i^*, can be characterized by differentiating equation 14.5 with respect to N and setting the result equal to zero.

$$\Pi_{iN} \;=\; r_{iN} \;-\; f_{iN} j_i - f_i j_{iN} = 0 \;\equiv H \quad at\ N_i^* \qquad (14.6)$$

The first term is i's marginal revenue, and the latter is i's expected marginal cost. The functions are each individualized, as denoted by subscript i. Partial derivatives are also denoted with subscripts.

It bears noting that the presumed equality that characterizes N_i^* may not occur in the positive domain for all individuals. We can consider all those persons whose expected marginal costs are always greater than their expected marginal benefits to be "honest" in the sense that they never engage in crime given their productivity as criminals and their associated subjective penalty schedules.

Those who engage in crime rates greater than zero are the subpopulation of the community that is regarded to be criminal—although there is a spectrum of such criminals from petty or occasional criminals (low N_i*) to full-time criminals (relatively high N_i*). The boundary between those two subgroups is not "given" but is determined by personal assessments of expected net revenues in this model. If expected net revenues fall, the number of criminals falls. If those assessments increase, the number of criminals increases.

According to the rational criminal model, individual behavior changes as the marginal revenues and expected marginal cost of crime increases. To see the logic behind such claims, we'll use the implicit function theorem and equation 14.6 to characterize the crime rate of a typical criminal (a person in the middle of the subset of individuals committing crimes).

$$N_i^* = n_i(w_i^0, G) \qquad (14.7)$$

The implicit function differentiation rule can be used to determine the effect of an increase in governmental resources to an honest and diligent judicial system on a rational criminal's behavior:

N_{iG}^* = dH/dG/-(dH/dN) =

$$-[\,f_{iNG}j_i + f_{iG}j_{iN}]/-[r_{iNN} - f_{iNN}j_i - 2f_{iN}j_{iN} - f_i j_{iNN}] < 0 \qquad (14.8)$$

The denominator is again positive if we assume that the expected net revenue function for criminal i is strictly concave. In that case, the numerator determines the qualitative response of a rational criminal to increases in the probability of punishment.

We'll thus focus on signing the numerator. The probability of punishment increases with N and G and so the cross partial in the first term, f_{iNG}, is positive. The terms j_i and j_{iN} are both positive, so all the terms with partial derivatives in the numerator are positive. Their multiplication by negative signs implies that the numerator has a value that is less than zero. Criminals diminish their crime rates as enforcement efforts increase, because an increase in expected punishments increases each criminal's marginal cost.

Although not modeled, that effect also diminishes to some extent the population of criminals by reducing the expected net income associated with crime for "marginal" criminals. Both effects imply that crime rates fall in the community of interest.

The implicit function differentiation rule can also be used to determine the effect of an increase in the typical criminal's opportunity cost (here proxied by their wage rate in the non-criminal sector):

$$N^*_{iw_i^0} = \mathrm{dH/dw}_i^0/-(\mathrm{dH/dN}) = \frac{[-f_{iN}j_{iw_i^0} - f_i j_{iNw_i^0}]}{-[\Pi_{iNN}]} < 0 \qquad (14.9)$$

The denominator is again positive if we assume that the expected net revenue is strictly concave. (The denominator is the same as for equation 14.8, but is written in a shorter form.) The perceived severity of the punishment increases with the opportunity cost wage, and so the cross partial is also positive. f_i and f_{iN} are both positive, so both the terms with partial derivatives in them are positive. Their respective multiplication by negative signs implies that the numerator is less than zero.

Overall, the model implies that rational criminals respond to incentives. They diminish their crime rates as the perceived marginal punishment increases and as the opportunity cost of criminal activities increases, because both variables increase each criminal's expected marginal cost—other things being equal. Although not modeled, the same effect also diminishes the population of criminals by reducing the expected net income associated with crime for "marginal" criminals. The crime rates of rational criminals increase as anticipated marginal revenues increase and as expected penalties fall.

Together these effects suggest that the Hobbes argument about law enforcement has merit. Regardless of whether a government is grounded in a social contract or not, as long as criminals bear some risk of punishment for their crimes, criminal activity will diminish and markets will tend to expand. Any government with a judicial system that is reasonably honest and diligent tends to discourage crime by decreasing the anticipated net marginal revenues of criminal activities.

IV. Crime and the Extent of Markets

In addition to the effects noted in the previous sections, reductions in crime rates often reduce risks that would otherwise be associated with production and ownership. In such cases, reductions in crime rates further increase economic prosperity through effects on risks that affect the supply of and demand for goods and services in the community of interest.

Thievery and the Theory of the Firm

Consider, for example, a product which may be stolen between the manufacturing stage of production and its sales to a customer. After which, there is a chance that it will be stolen from the purchaser of the good.

Let us first consider how theft affects a firm's optimization problem. Suppose that every unit produced by Acme is subject to theft before it is sold, with probability F^F. Assume that the probability of such thefts is an increasing function of the crime rate characterized by 14.7, $F^F = f(G, w^0)$. Suppose also that its product is sufficiently unique that it faces a downward sloping demand curve for its product, $Q^D = b(P, P^O, Y)$, where P is the selling price of the good, P^0 is the price of a good substitute for its product, and Y is average consumer income for the group that purchases Acme's type of product.

Acme's output decision is affected by internal theft because this affects the expected revenues realized by producing its product. To see this, we have to characterize Acme's expected profit maximizing output. The implicit function theorem can be used to characterize its best selling price for a given output as $P = p(Q, P^O, Y)$. Assume that Acme produces its good with a single input production function, Q = q(L), and that it purchases it labor in a competitive market. Using the implicit function theorem, we can characterize the firm's use of labor as L = l(Q) and its cost function as C = w l(Q). The firm's expected loss of output between production and sales is $\mathrm{F}^F\mathrm{Q}$—the probability of theft times the output produced.

Acme's expected profit function is thus:

$$\Pi^e = p(Q, P^O, Y)(1 - \mathrm{F}^F)\mathrm{Q} - \mathrm{wl(Q)} \qquad (14.10)$$

In this case, Acme's revenue is an expected value because, on average, $(1 - \mathrm{F}^F)$ of the quantity produced disappears between its production and sale. Differentiating with respect to Q and setting the result equal to zero allows Acme's expected profit maximizing output to be characterized as:

$$\Pi^e_Q = \mathrm{P}(1 - \mathrm{F}^F) + \mathrm{P}_Q(1 - \mathrm{F}^F)\mathrm{Q} - \mathrm{wL}_Q = 0 \;\equiv\; H \;\; at\; Q^* \qquad (14.11)$$

This first order condition is similar to models of firm decision making developed in the first part of the book except for the term that characterizes the pilferage rate, F^F. To characterize the effect of an increase in the probability of theft between the point where the product is made and sold, we first use equation 14.11 and the implicit function theorem to characterize the firm's output decision as:

$$Q^* = s(P^O, Y, w, F^F) \qquad (14.12)$$

Then we apply the implicit function differentiation rule to determine the effect of pilferage on output.

$$Q^*_{F^F} = \frac{dH/dF^F}{-dH/dQ} = \frac{-(P + P_Q Q)}{-\Pi_{QQ}} < 0 \qquad (14.13)$$

The sign of the numerator is determinative as usual if the profit function is strictly concave. However, the numerator cannot be signed in the usual way because the first term inside the parentheses is positive and the second is negative.

Note, however, that the term inside the parentheses is the marginal revenue function for a firm of this type without pilferage. The term inside the parentheses thus must be positive in the range of interest; thus, the overall derivative of the effect of pilferage on production is negative.

As the risk of theft increases, production falls, prices rise (recall that the firm's demand curve is downward sloping), and the demand for labor decreases for every firm affected by a similar risk of pilferage—even if firms are risk-neutral decision makers, as assumed.

Crime and the Theory of Consumer Behavior

The demand side of the market is fundamentally similar. Consider the case where a consumer, Al, purchases some units of a good that has a positive probability of being stolen equal to F^C. We'll assume that all are stolen if any are stolen. In that case, the expected utility associated with a purchase of Q_1 units of the good 1 is $U^e = (1 - F^C)U(Q_1, Q_2) + F^C U(0, Q_2)$.

The usual budget constraint holds for this model, $W = P_1 Q_1 + P_2 Q_2$. The budget constraint implies that $Q_2 = \frac{W - P_1 Q_1}{P_2}$. After substitution, the expected utility function is:

$$U^e = (1 - F^C)U\left(Q_1, \frac{W - P_1Q_1}{P_2}\right) + F^C U(0, \frac{W - P_1Q_1}{P_2}) \quad (14.14)$$

Note that the quantity consumed is zero if all of it is stolen after it is purchased, although a full price was paid for it, so the quantity of good 2 consumed is not affected by the theft of good 1 (although in a richer model it could be).

Differentiating with respect to Q_1 allows the optimal purchase of good 1 to be characterized.

$$U^e_{Q_1} = (1 - F^C)\left[U_{Q_1} + U_{Q_2}\left(\frac{-P_1}{P_2}\right)\right] + F^C\left[U_{Q_2}\left(\frac{-P_1}{P_2}\right)\right] = 0 \equiv H \text{ at } Q_1^* \quad (14.15a)$$

There is no U_{Q_1} in the second bracketed term, because we have assumed that all of Q_1 is taken. Thus, Q_1=0 after every theft. As a consequence, the partial derivative of U with respect to the stolen good is always zero after the theft. Neither the quantity nor utility increases in that case as more of good 1 is purchased.

If we ignore the effect of holdings of good 1 on the marginal utility of good 2, equation 14.15a can be rewritten in terms of expected subjective marginal benefits and costs as:

$$[(1 - F^C)U_{Q_1}] - [U_{Q_2}]\left(\frac{P_1}{P_2}\right) = 0 \quad at\ Q_1^* \quad (14.15b)$$

In the second case (equation 14.15b), the first term is the expected marginal benefit of good 1 and the second term is its expected marginal cost. Note that the marginal cost—the sacrifice in marginal utility from fewer units of good 2 is borne with certainty, because good 2 is, by assumption, not of interest to thieves.

Had theft occurred with certainty, a corner solution would have existed. Good 1 would not have been purchased, because the marginal benefits realized from buying it would be below its marginal subjective cost, $U_{Q_2}\left(\frac{P_1}{P_2}\right)$. Moreover, if theft is unavoidable, extra purchases of good 1 would not help, but would reduce consumption of good 2.

The implicit function theorem implies that Al's demand for good 1 is a function of its price, the price of its best substitute, personal income or wealth, and the probability that it will be stolen.

$$Q_1^* = b(P_1, P_2, W, F^C) \quad (14.16)$$

The derivatives with respect to P_1, P_2 and W are similar to those in Chapter 2. The derivative with respect to the probability of theft is new and is the main focus here.

The implicit function theorem differentiation rule and equation 14.15a can be used to characterize the effect of an increase in the probability of theft on the quantity of good 1 purchased.

$$Q^*_{1F^C} = \frac{H_{F^C}}{-H_{Q_1}} = \frac{-[U_{Q_1}] - U_{Q_2Q_1}\left(\frac{-P_1}{P_2}\right)}{-U^e_{Q_1Q_1}} < 0 \qquad (14.17)$$

The denominator will be positive if the expected utility function is strictly concave, which it will be if the utility function is strictly concave as assumed in neoclassical models of consumer behavior.

To sign the numerator is straightforward: it is the negative of the marginal utility of the good stolen and the negative of the cross partial between the two goods. Marginal utilities of goods are greater than zero in the absence of satiation, cross partials have been routinely assumed to be positive throughout the text, which implies that the numerator has a negative sign.

Thus, Al purchases fewer units of good 1 as the probability of it being stolen increases. And, it is possible that there is a probability of theft that is high enough in some choice settings that Al purchases no units of good 1. That is to say, an F^C exists such that "corner solutions" occur and only good 2 is purchased.

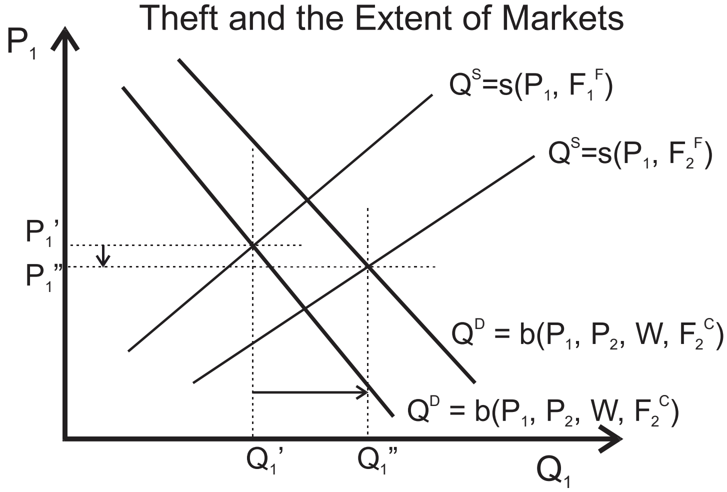
Crime, Law Enforcement, and the Extent of Markets

Together the above analyses of the effect of theft on both supply and demand functions imply that markets expand when laws against thievery are diligently and honestly enforced. As more resources or better juridical institutions are developed, thievery falls and markets expand.

Figure 14.1 provides a geometric illustration of these results of the above model in a perfectly competitive market with upward sloping supply curves and downward sloping demand curves. Theft rates are assumed to have fallen from F^F_1 to F^F_2 and from F^C_1 to F^C_2 in the illustration. The competitive price-taking case is illustrated rather than the price-setting case, because the geometry is simpler to depict and interpret, and qualitatively the same.

The case depicted clearly illustrates why reductions in thievery for whatever reason tend to expand markets, making both firms and consumers better off—although not the thieves.

Figure 14.1: The Probability of Theft and the Extent of Markets



The microeconomic analysis above illustrates why markets tend to expand when property claims are deemed to be legitimate, ownership rights can be lawfully transferred from one individual or group to another through voluntary exchange, and thievery is discouraged by law. Market output increases because the scope for exchange increases as risks fall for consumers and firms. Supply may also increase as labor is shifted from thievery to productive activities.

However, thievery is not the only type of crime that affects the extent of markets. There are other behaviors that tend to be subject to criminal and civil law penalties that have more subtle effects on the extent of markets.

V. The Problem of Fraud

> Most foolish of all, and the meanest, is the whole tribe of merchants, for they handle the meanest sort of business by the meanest methods, and although their lies, perjury, thefts, frauds, and deceptions are everywhere to be found, they still reckon themselves a cut above everyone else simply because their fingers sport gold rings. Erasmus, Desiderius. (1509). *In Praise of Folly* (Kindle Locations 1681-1684). Penguin Books Ltd. Kindle Edition.

This section explores how another type of behavior that is often considered to be immoral or criminal may also undermine markets, namely fraudulent claims made by buyers or sellers.

One might at first imagine that fraudulent claims would simply be rejected by potential buyers or sellers, who would immediately recognize the false claims being made on either or both sides of a market transaction. This would be true, for example, if the neoclassical assumptions about informed buyers and sellers were accurate.

However, when ignorance on either side of a market transaction exists, false claims may be made and to some extent believed. Indeed, the mere possibility of fraudulent claims may greatly reduce the scope for some types of market transactions as demonstrated below.

Both sellers and buyers may make misleading claims, but we'll focus on those of sellers rather than buyers. The logic and consequences of fraud by buyers are very similar to that analyzed for sellers. As before, we'll first use elementary game theory to illustrate the essential logic of the problem and then develop a model grounded in neoclassical understandings of decisionmaking and market equilibria.

Fraud in a Trading Game

Suppose that a merchant is selling a type of product for which two versions exist. One is a low-cost product that either tastes bad or breaks down within a few weeks of use. The other is one that either tastes good or is extremely durable. Assume that the two versions of the product are indistinguishable at the point of sale, but that the low quality—less tasty or durable—version of the good is far less costly to produce than the higher quality—more tasty or more durable—version of the product. Because of their similarities at the time of sale, sellers can potentially realize much greater profits by falsely claiming that they are selling high quality goods, while actually selling the low-quality versions of the goods.

Unlike the cases analyzed in Chapter 7, where poor quality was an accidental consequence of random errors in production or of the uncertain effects of weather, in this case, sellers may intentionally misrepresent the lower quality units as high quality units in the pursuit of higher profits.

Table 14.2 illustrates this choice setting. In the context of voluntary exchange, an offer by a seller has to be accepted by the prospective buyer if a sale is to take place. In the setting of interest, the making of offers and accepting them are both costly activities. Both activities require time and attention; and, in addition, both making and assessing offers may require various materials or transportation costs to be borne.

Table 14.2: The Dilemma of Fraud

		Bob (buyer)	
		Accept or solicit offer	Ignore all offers
Al (seller)	Fraudulent offer	(A ,B) (3, –3)	(A , B) (–1, 0)
	Honest offer	(2, 2)	(–1, 0)
	Do not make offers	(0, –1)	(0, 0)

Neither participant in the trading game has a pure dominant strategy. However, there is a unique Nash equilibrium—namely the no-trade equilibrium in the lower right-hand corner of the matrix. Gains to trade are possible, but the temptation to engage in fraudulent offers is sufficient that the honest offer cell is not a stable outcome.

It bears noting that the "money-back guarantee" solution to the uncertain quality case explored in Chapter 7 is not a solution to the problem of fraud, because it is impossible for purchasers to distinguish between truthful guarantees and non-truthful ones at the point of sale.

Legal penalties for fraud are a possible solution. If the expected fines for fraudulent offers are sufficient, the temptation to engage in them may disappear. In the case depicted, an expected penalty greater than 1 is sufficient. It eliminates the higher profit from the fraudulent offer. To be entirely successful, the fine has to offset the cost savings of the low-quality type of the product.[4]

[4] Note that in this context, such penalties may eliminate the temptation for fraud without generating a market for the good in question. The bottom 2x2 game has two equilibria, one

Degrees of Misrepresentation—the Continuous Case

In the continuous version of this choice setting, a mix of defective and high-quality units may be brought to market. In such cases, the probability that particular units are of low quality is known to sellers, but is not likely to be known to buyers.

Were the probability known to buyers, the demand side of the market would be similar to the purchase of goods that varied in quality unintentionally modeled in Chapter 7.

In this case, rather than know F, Al has an estimate for F^e based loosely on experience in local markets. It may or may not be accurate, but would influence Al's choices if Al uses statistical thinking. Al's expected utility maximizing purchase of goods 1 and 2 can be represented as:

$$U^e = (1 - F^e)U(Q_1^H, Q_2) + F^e U(Q_1^L, Q_2). \quad (14.18)$$

The budget constraint is the usual one: $W = P_1 Q_1 + P_2 Q_2$. In a two-good model, the budget constraint implies that $Q_2 = \frac{W - P_1 Q_1}{P_2}$.

After substitution, the expected utility function is:

$$U^e = (1 - F^e)U\left(Q_1^H, \frac{W - P_1 Q_1}{P_2}\right) + F^e U(Q_1^L, \frac{W - P_1 Q_1}{P_2}) \quad (14.19)$$

Differentiating with respect to Q_1 allows the optimal purchase of good 1 to be characterized.

$$U_{Q_1}^e = (1 - F^e)\left[U_{Q_1}^H + U_{Q_2}^H\left(\frac{-P_1}{P_2}\right)\right] + F^e\left[U_{Q_1}^L + U_{Q_2}^L\left(\frac{-P_1}{P_2}\right)\right] = 0 \equiv H \quad at\ Q_1^* \quad (14.20)$$

The implicit function theorem implies that Al's demand for good 1 is a function of its price, the price of its best substitute, personal income or wealth, the quality of the two possible types of good 1 and the probability that a poor-quality item is mistakenly purchased.

$$Q_1^* = b(P_1, P_2, W, F^e, Q_1^H, Q_1^L) \quad (14.21)$$

---

where the gains are realized, and the other where they are not. But this is still an improvement over the case where the mutual gains to trade cell is never an equilibrium.

This demand function is similar to the one analyzed in Chapter 7 without the possibility of fraud. However, a fraudulent seller chooses F (not F^e) to maximize his or her profits given its demand curve, rather than producing defective units accidentally. How that choice influences consumer choices would depend on the linkages between the consumer's subjective probability and the fraudster's chosen probability. If they are correlated, the comparative statics will resemble those of firms selling products of uncertain quality in Chapter 7.

In cases in which purchasers know the average defect rate and its variance among all merchants, but not that of particular sellers, a merchant may profit by having a higher than average defect rate, as long as it is not discernible by a typical customer—even after the purchase—because of the variance in a consumer's estimate of the average defect rate. For example, if consumers can only detect differences in quality that are two standard deviations below the norm, a pragmatic firm owner might attempt to produce a mix of high- and low-quality units that are just below that threshold for detection.

If this pattern of behavior became common among firms, the result would be a declining time series of average quality, as pragmatic sellers adjust the mix of goods brought to market to exploit buyer confidence intervals. The end result would be that average quality falls through time and the market gradually disappears, as in the classic Akerlof (1970) paper where he developed the so-called Lemons dilemma.[5] In that case, markets would be similar to that described by Erasmus in the quote at the beginning of this section. In some cases, fraud-prone services may find no willing buyers and the result would be the no-trade equilibrium characterized by Table 14.2.[6]

---

[5] It bears noting that if such pragmatic sellers claim that their product mix is accidental, buyers may ask for a "money-back guarantee" and be willing to pay a premium for such insurance and there may be sufficient pressure that firms do so—but pragmatic sellers may not always make good on their guarantees. They may, for example, insist on evidence, challenge buyer claims of poor quality, endlessly postpone reimbursements, and so forth.

[6] An entrepreneurial firm that believed it could develop a reputation for making honest offers might avoid the temptation to profit from fraudulent offers, partly for that reason, and if successful be able to charge a premium for its product over those sold by firms without a reputation for quality. So, laws are not the only possible escape from the dilemma

If consumers are able to identify firms that sell at higher average quality—through reading reviews of products or social networks—such firms will attract additional customers and those with relatively high rates of fraud would tend to lose business. In such cases, at least some markets would be largely self-policing.

In either case, a well-enforced anti-fraud law that punished sellers for making fraudulent or significantly misleading claims would reduce the extent of false claims made by most pragmatic sellers. As a consequence, markets for goods whose quality cannot be reliably assessed at the point of sale would reemerge and flourish. Again, market-supporting laws would increase the depth and breadth of markets.

VI. A Few Conclusions

Chapter 14 illustrates why at least some well-enforced laws can increase the extent of markets, and it also illustrates how rational choice models can be used to characterize relationships between legal systems and the extent of markets—a relationship that is not mentioned in the core neoclassical models or many economic textbooks. Relatively few new assumptions are required to examine the economic implications of laws on the extent of market networks. Indeed, arguably what is needed is dropping an assumption—namely that all market-relevant conduct is fundamentally voluntary. No coercion takes place, no theft, and no fraudulent claims.

As with the extensions to risk and entrepreneurship, analysis of such neglected relationships can often shed light on significant determinants of market outcomes. In the case of law enforcement, regional differences in laws and in the quality of law enforcement may affect the extent of markets both at a point in time and through time through effects on capital accumulation and entrepreneurship.

Insofar as differences in laws and the manner in which laws are enforced occur within a nation through time and differ among nations at point in time, this variation provides another partial explanation for variations in the extent and growth of markets—one that is neglected by the core models. Microeconomics clearly needs to go beyond the lean neoclassical models of price theory if its aim is to account for the existence of markets and

---

of fraud, but it does require the ability of consumers to accurately assess "reputations" among firms in some way.

differences among them. A prerequisite for the existence of markets is that ownership rights exist, and they can be transferred from one person to another through voluntary transactions. Law and law enforcement is one way to account for both tradeable property rights and the possibility and relative frequency of voluntary exchange, as developed in this chapter.

References

Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488–500.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 76(2), 169–217.

Cooter, R. D., & Parisi, F. (2009). *Foundations of law and economics*. Edward Elgar Publishing Limited.

Dam, K. W. (2007). *The law-growth nexus: The rule of law and economic development*. Rowman & Littlefield.

Doucouliagos, C., & Ulubasoglu, M. A. (2006). Economic freedom and economic growth: Does specification make a difference? *European Journal of Political Economy*, 22(1), 60–81.

Haggard, S., MacIntyre, A., & Tiede, L. (2008). The rule of law and economic development. *Annual Review of Political Science*, 11, 205–234.

Leamer, E. E. (1983). Let's take the con out of econometrics. *American Economic Review*, 73(1), 31–43.

Posner, R. A. (1972). *Economic analysis of law*. Little, Brown and Company.

Skaperdas, S. (1992). Cooperation, conflict, and power in the absence of property rights. *American Economic Review*, 82(4), 720–739.

Tullock, G. (1971). *Logic of the law*. Basic Books.

Xu, G. (2011). The role of law in economic growth: A literature review. *Journal of Economic Surveys*, 25(5), 833–871.