17 Tax Evasion

17.1 Introduction

It is not unusual to be offered a discount for payment in cash. This is almost routine in the employment of the services of builders, plumbers, and decorators. It is less frequent, but still occurs, when major purchases are made in shops. While the expense of banking checks and the commissions charged by credit card companies may explain some of these discounts, the usual explanation is that payment in cash makes concealment of the transaction much easier. Income that can be concealed need not be declared to the tax authorities.

The same motivation can be provided for exaggeration in claims for expenses. By converting income into expenses that are either exempt from tax or deductible from tax, the total tax bill can be reduced. Second jobs are also a lucrative source of income that can be concealed from the tax authorities. A tax return that reports no income, or at least a very low level, is likely to attract more attention than one that declares earnings from primary employment but fails to mention income from secondary employment.

In contrast to these observations on tax evasion, the analysis of taxation in the previous chapters assumed that firms and consumers reported their taxable activities honestly. Although acceptable for providing simplified insights into the underlying issues, this assumption is patently unacceptable when confronted with reality. The purpose of this chapter can be seen as the introduction of practical constraints on the free choice of tax policy. Tax evasion, the intentional failure to declare taxable economic activity, is pervasive in many economies as the evidence given in the following section makes clear and is therefore a subject of practical as well as theoretical interest.

The chapter begins by considering how tax evasion can be measured. Evidence on the extent of tax evasion in a range of countries is reviewed. The chapter then proceeds to try to understand the factors involved in the decision to evade tax. Initially this decision is represented as a choice under uncertainty. The analysis predicts the relationship among the level of evasion, tax rates, and punishments. Within this framework the optimal degree of auditing and of punishment is considered. Evidence that can be used to assess the model's predictions is then discussed. In the light of this, some extensions of the basic model are considered. A game-theoretic approach to tax compliance is presented where taxpayers and governments interact strategically. The last section emphasizes the importance of social interaction on compliance decisions.

17.2 The Extent of Evasion

Tax evasion is illegal, so those engaging in it have every reason to seek to conceal what they are doing. This introduces a fundamental difficulty into the measurement of tax evasion. Even so, the fact that the available estimates show that evasion constitutes a significant part of total economic activity underlines the importance of measurement. The lost revenue due to tax evasion also confirms the value of developing a theory of evasion that can be used to design a tax structure that minimizes evasion and ensures that policy is optimal given that evasion occurs. Before proceeding, it is worth making some distinctions. First, *tax evasion* is the failure to declare taxable activity. Tax evasion should be distinguished from *tax avoidance*, which is the reorganization of economic activity, possibly at some cost, to lower tax payment. Tax avoidance is legal, whereas tax evasion is not. In practice, the distinction is not as clear-cut, since tax avoidance schemes frequently need to be tested in court to clarify their legality. Second, the terms *black*, *shadow*, or *hidden economy* refer to all economic activities for which payments are made but are not officially declared. Under these headings would be included illegal activities, such as the drug trade, and unmeasured activity, such as agricultural output by smallholders. Added to these would also be the legal, but undeclared, income that constitutes tax evasion. Finally the *unmeasured* economy would be the shadow economy plus activities such as do-it-yourself jobs that are economically valuable but do not involve economic transaction.

This discussion reveals that there are several issues concerning how economic activity should be divided between the regular economy and the shadow economy. For instance, most systems of national accounts do not include criminal activity (Italy, however, does make some adjustment for smuggling). In principle, the UN System of National Accounts includes both legal and illegal activities, and it has been suggested that criminal activity should be made explicit when the system is revised. Although this chapter is primarily about tax evasion, an attempt at the measurement of tax evasion may include some or all of the components of the shadow economy.

The essential problem involved in the measurement of tax evasion is that its illegality provides an incentive for individuals to keep the activity hidden. Furthermore, by its very nature, tax evasion does not appear in any official statistics. This implies that the extent of tax evasion cannot be measured directly but must be inferred from economic variables that can be observed.

A first method for measuring tax evasion is to use survey evidence. This can be employed either directly or indirectly as an input into an estimation procedure. The obvious difficulty with survey evidence is that respondents who are active in the hidden economy have every incentive to conceal the truth. There are two ways in which the problem of concealment can be circumvented. First, information collected for purposes other than the measurement of tax evasion can be employed. One example of this is the use that has been made of data from the Family Expenditure Survey in the United Kingdom. This survey involves consumers recording their incomes and expenditures in a diary. Participants have no reason to falsely record information. The relation between income and expenditure can be derived from the respondents whose entire income is obtained in employment that cannot escape tax. The expenditures recorded can then be used to infer the income of those who do have an opportunity to evade. Although these records are not surveys in the normal sense, studies of taxpayer compliance conducted by revenue collection agencies, such as the Internal Revenue Service in the United States, can be treated as survey evidence and have some claim to accuracy.

The second general method is to infer the extent of tax evasion, or the hidden economy generally, from the observation of other economic variables. This is done by determining total economic activity and then subtracting measured activity, which gives the hidden economy. The *direct input* approach observes the use of an input to production and from this predicts what output must be. An input that is often used for this purpose is electricity, since this is universally employed and accurate statistics are kept on energy consumption. The *monetary* approach employs the demand for cash to infer the size of the hidden economy on the basis that transactions in the hidden economy are financed by cash rather than checks or credit cards. Given a relationship between the quantity of cash and the level of economic activity, this allows estimation of the hidden economy. What distinguishes alternative studies that fall under the heading of monetary approaches is the method used to derive the total level of economic activity from the observed use of cash. One way to do this is to assume that there was a base year in which the hidden economy did not exist. The ratio of cash to total activity is then fixed by that year. This ratio allows observed cash use in other years to be compounded up into total activity. An alternative has been to look at the actual use of banknotes. The issuing authorities know the expected lifespan of a note (i.e., how many transactions it can finance). Multiplying the number of notes used by the number of transactions gives the total value of activity financed.

Table 17.1 presents estimates of the size of the hidden economy for a range of countries. These figures are based on a combination of the direct input (actually use of electricity as a proxy for output) and money demand approaches. Further details can be found in the source reference. The table clearly indicates that the hidden economy is a significant issue, especially in the developing and transition economies. Even for Japan

Table 17.1
Hidden economy as percentage of GDP, average over 1990 to 1993

Developing	Transition	OECD
Egypt 68–76%	Georgia 28–43%	Italy 24–30%
Thailand 70%	Ukraine 28–43%	Spain 24–30%
Mexico 40–60%	Hungary 20–28%	Denmark 13–23%
Malaysia 38–50%	Russia 20–27%	France 13–23%
Tunisia 39–45%	Latvia 20–27%	Japan 8–10%
Singapore 13%	Slovakia 9–16%	Austria 8–10%

Source: Schneider and Enste (2000).

and Austria, which have the smallest estimated size of hidden economy, the percentage figure is still significant.

As already noted, these estimates are subject to error and must be treated with a degree of caution. Having said this, there is a degree of consistency running through them. They indicate that a value for the hidden economy of at least 10 percent is not an unreasonable approximation. Therefore the undeclared economic activity is substantial relative to total economic activity. Tax evasion is clearly an important phenomenon that merits extensive investigation.

17.3 The Evasion Decision

The estimates of the hidden economy have revealed that tax evasion is a significant part of overall economic activity. We now turn to modeling the decision to evade in order to understand how the decision is made and the factors that can affect that decision.

The simplest model of the evasion decision considers it to be just a gamble. If taxpayers declare less than their true income (or overstate deductions), there is a chance that they may do so without being detected. This leads to a clear benefit over making an honest declaration. However, there is also a chance that they may be caught. When they are, a punishment is inflicted (usually a fine but sometimes imprisonment) and they are worse off than if they had been honest. In deciding how much to evade, the taxpayer has to weigh up these gains and losses, taking account of the chance of being caught and the level of the punishment.

A simple formal statement of this decision problem can be given as follows. Let the taxpayer have an income level Y, which they know but is not known to the tax collector. The income declared by the taxpayer, X, is taxed at a constant rate t. The amount of unreported income is $Y - X \geq 0$ and the unpaid tax is $t[Y - X]$. If the taxpayer evades without being caught, their income is given by $Y^{nc} = Y - tX$. When the taxpayer is caught evading, all income is taxed and a fine at rate F is levied on the tax that has been evaded. This gives an income level $Y^c = [1 - t]\,Y - Ft\,[Y - X]$. If income is understated, the probability of being caught is p.

Assume that the taxpayer derives utility $U(Y)$ from an income Y. After making declaration X, the income level Y^c occurs with probability p and the income level Y^{nc} with probability $1 - p$. In the face of such uncertainty the taxpayer should choose the income declaration to maximize expected utility. Combining these facts, the declaration X solves

$$\max_{\{X\}} E\,[U(X)] = [1 - p]\,U\big(Y^{nc}\big) + pU\big(Y^{c}\big). \tag{17.1}$$

The solution to this choice problem can be derived graphically. To do this, observe that there are two states of the world. In one state of the world, taxpayers are not caught evading and have income Y^{nc}. In the other state of the world, they are caught and have income Y^c. The expected utility function describes preferences over income levels in these two states. The choice of a declaration X determines an income level in each state, and by varying X, the taxpayer can trade off income between the two states. A high value of X provides relatively more income in the state where the taxpayer is caught evading and a low value of X relatively more where the taxpayer is not caught.

The details of this trade-off can be identified by considering the two extreme values of X. When the maximum declaration is made so that $X = Y$, the taxpayer's income will be $[1 - t]Y$ in both states of the world. Alternatively, when the minimum declaration of $X = 0$ is made, income will be $[1 - t(1 + F)]Y$ if caught and Y if not. These two points are illustrated in figure 17.1, which graphs income when not caught against income when caught. The other options available to the consumer lie on the line joining $X = 0$ and $X = Y$; this is the opportunity set showing the achievable allocations of income between the two states. From the utility function can be derived a set of indifference curves—the points on an indifference curve being income levels in the two states that give the same level of expected utility. Including the indifference curves of the utility function completes the diagram and allows the taxpayer's choice to be depicted. The taxpayer whose preferences are shown in figure 17.1 chooses to locate at the point with declaration X^*. This is an interior point with $0 < X^* < Y$—some tax is evaded but some income is declared.

Besides the interior location of figure 17.1 it is possible for corner solutions to arise. The consumer whose preferences are shown in panel a of figure 17.2 chooses to declare

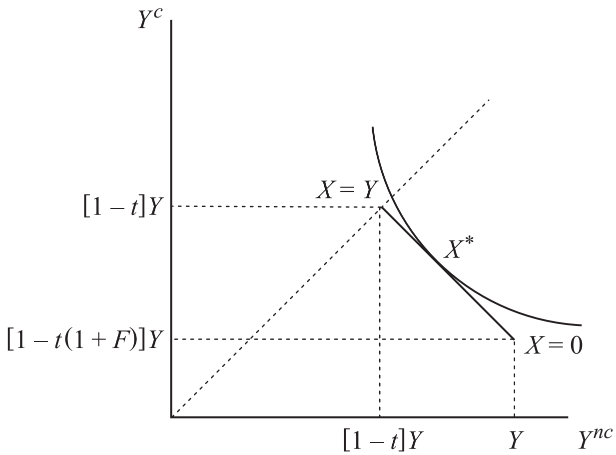

Figure 17.1
Interior choice: $0 < X^* < Y$

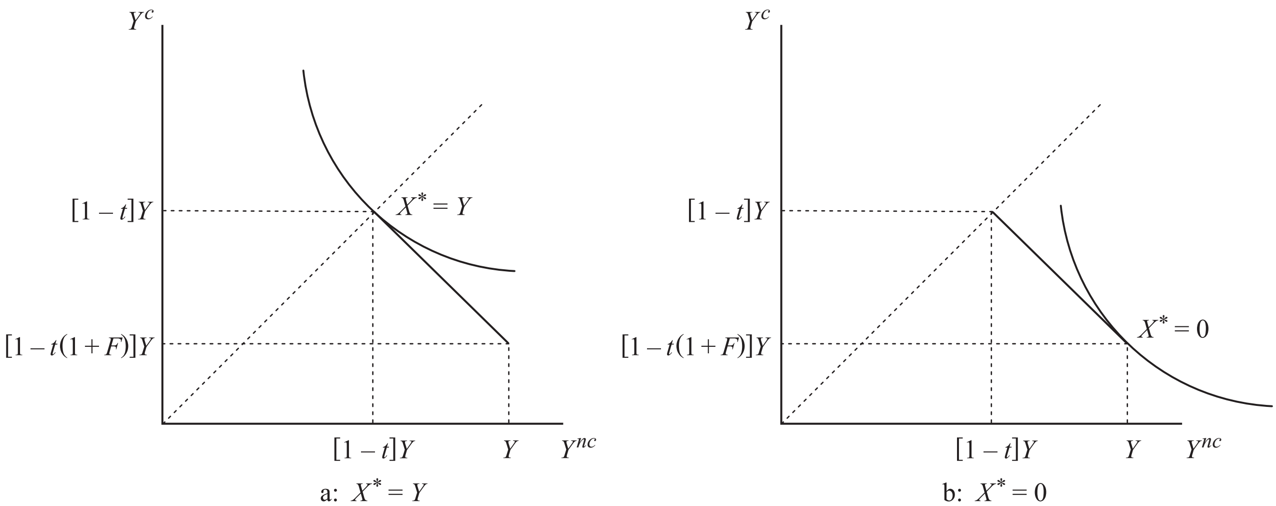

Figure 17.2
Corner solutions

his entire income, so $X^* = Y$. In contrast the consumer in panel b declares no income, so $X^* = 0$.

The interesting question is what condition guarantees that evasion will occur rather than the no-evasion corner solution with $X = Y$. Comparing the figures it can be seen that evasion will occur if the indifference curve is steeper than the budget constraint where it crosses the dashed 45 degree line. The condition that ensures that this occurs is easily derived. Totally differentiating the expected utility function (17.1) at a constant level of utility gives the slope of the indifference curve as

$$\frac{dY^c}{dY^{nc}} = -\frac{[1-p]\,U^{'}(Y^{nc})}{pU^{'}(Y^c)}, \tag{17.2}$$

where $U^{'}(Y)$ is the marginal utility of income level Y. On the 45 degree line $Y^{nc} = Y^c$, so the marginal utility of income is the same whether or not the tax evader is caught. This implies that

$$\text{Slope of indifference curve} = -\frac{1-p}{p}. \tag{17.3}$$

What this expression suggests is that all the indifference curves have the same slope, $-\frac{[1-p]}{p}$, where they cross the 45 degree line. The slope of the budget constraint is seen in figure 17.1 to be given by the ratio of the penalty $Ft\,[Y - X]$ to the unpaid tax $t[Y - X]$. Thus

$$\text{Slope of budget constraint} = -F. \tag{17.4}$$

Because of these features the indifference curve is steeper than the budget constraint on the 45 degree line if $\frac{1-p}{p} > F$, or

$$p < \frac{1}{1+F}. \tag{17.5}$$

This result shows that evasion will arise if the probability of detection is too small relative to the fine rate.

Several points can be made about this condition for evasion. First, this is a trigger condition that determines whether or not evasion will arise, but it does not say anything about the extent of evasion. Second, the condition is dependent only on the fine rate and the probability of detection, so it applies for all taxpayers regardless of their utility-of-income function $U(Y)$. Consequently, if one taxpayer chooses to evade, all taxpayers should evade. Third, this condition can be given some practical evaluation. Typical punishments inflicted for tax evasion suggest that an acceptable magnitude for

F is between 0.5 and 1. In the United Kingdom, the Taxes Management Act specifies the maximum fine as 100 percent of the tax lost, which implies the maximum value of $F = 1$. This makes the ratio $\frac{1}{1+F}$ greater or equal to $\frac{1}{2}$. Information on p is hard to obtain, but a figure between 1 in a 100 or 1 in a 1,000 evaders being caught is probably a fair estimate. Therefore $p < \frac{1}{2} < \frac{1}{1+F}$, and the conclusion is reached that the model predicts all taxpayers should be evading. In the United States, taxpayers who understate their tax liabilities may be subjected to penalties at a rate between 20 to 75 percent of the underreported taxes, depending on the gravity of the offence. The proportion of all individual tax returns that are audited was 1.7 percent in 1997. This is clearly not large enough to deter cheating, and everyone should be underreporting taxes. In fact the Taxpayer Compliance Measurement Program reveals that 40 percent of US taxpayers underpaid their taxes. This is a sizable minority but not the widespread evasion the theoretical model would predict. So taxpayers appear to be more honest than might be expected.

The next step is to determine how the amount of tax evasion is affected by changes in the model's variables. There are four such variables that are of interest: the income level Y, the tax rate t, the probability of detection p, and the fine rate F. These effects can be explored by using the figure depicting the choice of evasion level.

Take the probability of detection first. The probability of detection does not affect the opportunity set but does affect preferences. The effect of an increase in p is to make the indifference curves flatter where they cross the 45 degree line. As shown in figure 17.3, this moves the optimal choice closer to the point $X = Y$ of honest declaration. The amount of income declared rises, so an increase in the probability of detection reduces the level of evasion. This is a clearly expected result, since an increase in the likelihood of detection lowers the payoff from evading and makes evasion a less attractive proposition.

A change in the fine rate only affects income when the taxpayer is caught evading. The consequence of an increase in F is that the budget constraint pivots round the honest report point and becomes steeper. Since the indifference curve is unaffected by the penalty change, the optimal choice must again move closer to the honest declaration point. This is shown in figure 17.4 by the move from the initial choice of X^{old} when the fine rate is F to the choice X^{new} when the fine rate increases to $\hat{F}$. An increase in the fine rate therefore leads to a reduction in the level of tax evasion. This result, and the previous result, show that the effects of the detection and punishment variables on the level of evasion are unambiguous.

Now consider the effect of an increase in income from the initial level Y to a higher level $\hat{Y}$. This income increase causes the budget constraint to move outward. As already

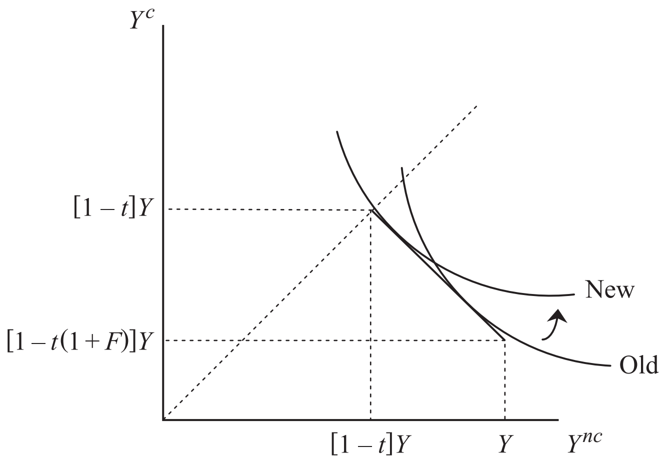

Figure 17.3
Increase in detection probability

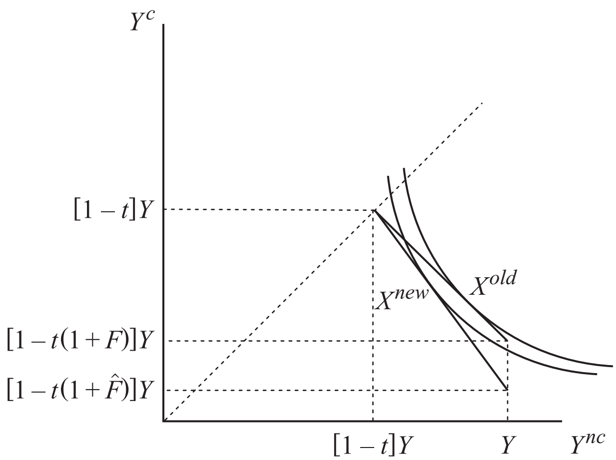

Figure 17.4
Increase in the fine rate

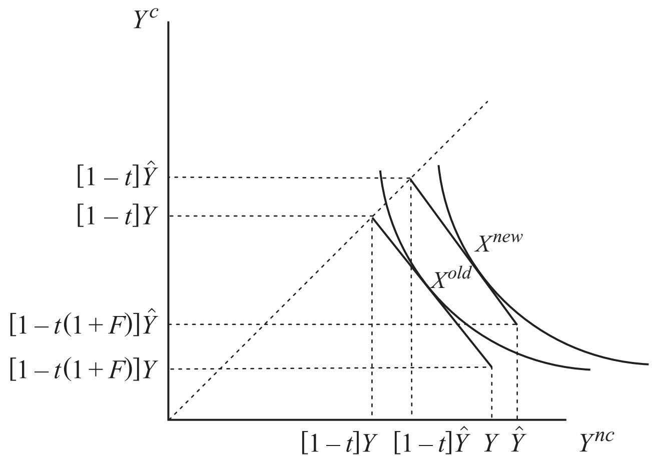

Figure 17.5
Income increase

noted, the slope of the budget constraint is equal to $-F$, which does not change with income, so the shift is a parallel one. The optimal choice then moves from X^{old} to X^{new} in figure 17.5. How the evasion decision is affected depends on the degree of absolute risk aversion, $R_A(Y) = -\frac{U''(Y)}{U'(Y)}$, of the utility function. What absolute risk aversion measures is the willingness to engage in small bets of fixed size. If $R_A(Y)$ is constant as Y changes, the optimal choices will be on a locus parallel to the 45 degree line. There is evidence, though, that in practice, $R_A(Y)$ decreases as income increases, so wealthier individuals are more prone to engage in small bets, in the sense that the odds demanded to participate diminish. This causes the locus of choices to bend away from the 45 degree line, so that the amount of undeclared income rises as actual income increases. This is the outcome shown in figure 17.5. Hence, with decreasing absolute risk aversion, an increase in income increases tax evasion.

The final variable to consider is the tax rate. An increase in the tax rate from t to $\hat{t}$ moves the budget constraint inwards. As can be seen in figure 17.6, the outcome is not clear-cut. However, when absolute risk aversion is decreasing, the effect of the tax increase is to reduce tax evasion. This final result has received much discussion because it is counter to what seems intuitive. A high tax rate is normally seen as providing a motive for tax evasion, whereas the model predicts precisely the converse. Why the result emerges is because the fine paid by the consumer is determined by t times F. An increase in the tax rate thus has the effect of raising the penalty. A tax rate increase takes income away from the taxpayer when they are caught—the state in which they

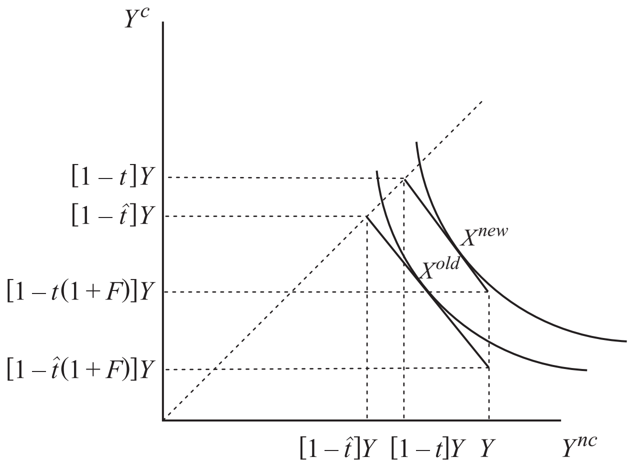

Figure 17.6
Tax rate increase

have least income. It is through this mechanism that a higher tax rate can reduce evasion.

This completes the analysis of the basic model of tax evasion. It has been shown how the level of evasion is determined and how this is affected by the parameters of the model. The next section turn to the issue of determining the optimal levels of auditing and punishment when the behavior of taxpayers corresponds to the predictions of this model. Some empirical and experimental evidence is then considered and used to assess the predictions of the model.

17.4 Auditing and Punishment

The analysis of the tax evasion decision assumed that the probability of detection and the rate of the fine levied, when caught evading, were fixed. This is a satisfactory assumption from the perspective of the individual taxpayer. From the government's perspective, though, these are variables that can be chosen. The probability of detection can be raised by the employment of additional tax inspectors, and the fine can be legislated or set by the courts. The purpose of this section is to analyze the issues involved in the government's decision.

It has already been shown that an increase in either p or F will reduce the amount of undeclared income. The next step is to consider how p and F affect the level of revenue raised by the government. Revenue in this context is defined as taxes paid plus the money received from fines. From a taxpayer with income Y, the expected value (it is expected, since there is only a probability the taxpayer will be fined) of the revenue collected is

$$R = tX + p[1+F]t[Y-X]. \tag{17.6}$$

Differentiating with respect to p shows that the effect on revenue of an increase in the probability of detection is

$$\frac{\partial R}{\partial p} = [1+F]t[Y-X] + t[1-p-pF]\frac{\partial X}{\partial p} > 0, \tag{17.7}$$

whenever $pF < 1-p$. Recall from (17.5) that if $pF \geq 1-p$, there is no evasion, so p has no effect on revenue. Carrying out the differentiation for the fine rate shows that if $pF < 1-p$

$$\frac{\partial R}{\partial F} = pt[Y-X] + t[1-p-pF]\frac{\partial X}{\partial F} > 0. \tag{17.8}$$

An increase in the fine will therefore raise revenue if tax evasion is taking place. Again, the fine has no effect if $pF \geq 1-p$ and there is no evasion. These expressions show that if evasion is taking place, an increase in the probability of either detection or the fine will increase the revenue the government receives.

The choice problem of the government can now be addressed. It has already been noted that an increase in the probability of detection can be achieved by the employment of additional tax inspectors. Tax inspectors require payment; as a consequence an increase in p is costly. In contrast, there is no cost involved in raising or lowering the fine. Effectively, increases in F are costless to produce. From these observations the optimal policy can be determined.

Since p is costly and F is free, the interests of the government are best served by reducing p close to zero while raising F toward infinity. Serge Kolm has termed this the policy of "hanging taxpayers with probability zero." Expressed in words, the government should put virtually no effort into attempting to catch tax evaders but should severely punish those it apprehends. This is an extreme form of policy, and nothing like it is observed in practice. Surprising as it is, it does follow from the logical application of the model.

Numerous comments can be made about this conclusion. The first begins with the objective of the government. In previous chapters it was assumed that the government is guided in its policy choice by a social welfare function. There will be clear differences between a policy designed to maximize revenue and one that maximizes welfare. For instance, inflicting an infinite fine on a taxpayer caught evading will have a significantly detrimental effect on welfare. Even if the government does not pursue welfare maximization, it may be constrained by political factors such as the need to ensure re-election. A policy of severely punishing tax evaders may be politically damaging especially if tax evasion is a widely established phenomenon.

One could think that such an argument is not relevant because, if the punishment is large enough to deter cheating, it should not matter how dire it is. If fear keeps everyone from cheating, the punishment never actually occurs and its cost is irrelevant. The problem with this argument is that it ignores the risk of mistakes. The detection process may go wrong, or the taxpayer can mistakenly understate taxable income. If the punishment is as large as possible, even for small tax underpayments, then mistakes will be very costly. To reduce the cost of mistakes, the punishment should be of the smallest size required to deter cheating. Minimal deterrence accomplishes this purpose.

A further observation, and one where the consequences will be investigated in detail, concerns the policy instruments under the government's control. The view of the government so far is that it is a single entity that chooses the level of all its policy instruments simultaneously. In practice, the government consists of many different departments and agencies. When it comes to taxation and tax policy, a reasonable breakdown would be to view the tax rate as set by central government as part of a general economic policy. The probability of detection is controlled by a revenue service whose objective is the maximization of revenue. Finally the punishment for tax evasion is set by the judiciary.

This breakdown shows why the probability and fine may not be chosen in a cohesive manner by a single authority. What it does not do is provide any argument for why the fine should not be set infinitely high to deter evasion. An explanation can be found by applying reasoning from the economics of crime. This would view tax evasion as just another crime, and the punishment for it should fit with the scheme of punishments for other crimes. The construction of punishments relies on the argument that they should provide incentives that lessen the overall level of crime. To see what this means, imagine that crimes can be ranked from least harmful to most harmful. Naturally, if someone is going to commit a crime, the authorities wish that they commit a less harmful one rather than a more harmful one. If more harmful ones are also more rewarding (think of robbing a bank while armed compared to merely attempting to snatch cash), then a scheme of equal punishments will not provide any incentive for committing the less harmful crime. What will provide the right incentive is for the more harmful crime to also have heavier punishment. So the extent of punishment should be related to the harmfulness of the crime: punishment should fit the crime.

This framework has two implications. First of all, the punishment for tax evasion will not be varied freely in order to maximize revenue. Instead, it will be set as part of a general crime policy. The second implication is that the punishment will also be quite modest, since tax evasion is not an especially harmful crime. Arguments such as these are reflected in the fact that the fine rate on evasion is quite low—a value between 1.5 and 2 would not be unrealistic. As already noted, the maximum fine in the United Kingdom is 100 percent of the unpaid tax, but the Inland Revenue may accept a lesser fine depending on the "size and gravity" of the offense.

Putting all of these arguments together suggests adopting a different perspective on choosing the optimal probability of detection. With the tax rate set as a tool of economic policy and the fine set by the judiciary, the only instrument under the control of the revenue service is the probability of detection. As already seen, an increase in this raises revenue but only does so at a cost. The optimal probability is found when the marginal gain in revenue just equals the marginal cost—and this could occur at a very low value of the probability of detection.

17.5 Evidence on Evasion

The model of tax evasion has predicted the effect that changes in various parameters will have on the level of tax evasion. In some cases, such as the effect of the probability of detection and the fine, these are unambiguous. In others, particularly the effect of changes in the tax rate, the effects depend on the precise specification of the tax system and on assumptions concerning attitudes toward risk. These uncertainties make it valuable to investigate further evidence to see how the ambiguities are resolved in practice. The analysis of evidence also allows the investigation of the relevance of other parameters, such as the source of income, and other hypotheses on tax evasion, such as the importance of social interaction.

There have been two approaches taken in studying tax evasion. The first was to collect survey or interview data and use econometric analysis to provide a quantitative determination of the relationships. The second was to use experiments to provide an opportunity for designing the environment to permit the investigation of particular hypotheses.

When income levels ascertained from interviews were contrasted to those given on the tax returns of the same individuals, a steady decline of declared income as a proportion of reported income appeared with income rises. This finding is in agreement with the comparative statics analysis. Table 17.2 provides a sample of data to illustrate

Table 17.2
Declaration and income

Income interval	17–20	20–25	25–30	30–35	35–40
Midpoint	18.5	22.5	27.5	32.5	37.5
Assessed income	17.5	20.6	24.2	28.7	31.7
Percentage	94.6	91.5	88.0	88.3	84.5

Source: Mork (1975).

Table 17.3
Explanatory factors

Variable	Propensity to evade	Extent of evasion
Inequity	0.34	0.24
Number of evaders known	0.16	0.18
Probability of detection	−0.17	
Age	−0.29	
Experience of audits	0.22	0.29
Income level	−0.27	
Income from wages and salaries	0.20	

Source: Spicer and Lundstedt (1976).

this. Interviewees were placed in income intervals according to their responses to interview questions. The information on their tax declaration was then used to determine assessed income. The percentage is found by dividing the assessed income by the midpoint of the income interval.

Econometrics and survey methods have been used to investigate the importance of attitudes and social norms in the evasion decision. The study reported in table 17.3 shows that the propensity to evade taxation is reduced by an increased probability of detection and an increase in age. An increase in income reduces the propensity to evade. With respect to attitude and social variables, both an increase in the perceived inequity of taxation and of the number of other tax evaders known to the individual make evasion more likely. The extent of tax evasion is increased by attitude and social variables but also by the experience of the taxpayer with previous tax audits. The social variables are clearly important in the decision to evade tax.

As far as the effect of the tax rate is concerned, data from the US Internal Revenue Services Taxpayer Compliance Measurement Program survey of 1969 shows that tax evasion increases as the marginal tax rates increases but is decreased when wages are a significant proportion of income. This result is supported by employing the difference between income and expenditure figures in National Accounts as a measure of evasion. In contrast, a study of Belgian data found precisely the converse conclusion, with tax increases leading to lower evasion. Therefore these studies do not resolve the ambiguity about the relation between marginal tax rates and tax evasion.

Turning now to experimental studies, tax evasion games have shown that evasion increases with the tax rate and that evasion falls as the fine is increased and the detection probability reduced. Further results have shown that women evade more often than men but evade lower amounts and that purchasers of lottery tickets, presumed to be less risk averse, are no more likely to evade than nonpurchasers but evade greater amounts when they do evade. Finally the very nature of the tax evasion decision has been tested by running two sets of experiments. One was framed as a tax evasion decision and the other as a simple gamble with the same risks and payoffs. For the tax evasion experiment some taxpayers chose not to evade even when they would under the same conditions with the gambling experiment. This suggests that tax evasion is not viewed as just a gamble.

There are two important lessons to be drawn from this brief review of the empirical and experimental results. First, the theoretical predictions are generally supported except for the effect of the tax rate. The latter remains uncertain with conflicting conclusions from the evidence. Second, it appears that tax evasion is more than the simple gamble portrayed in the basic model. In addition to the basic element of risk, there are social aspects to the evasion decision.

17.6 Effect of Honesty

The evidence discussed in the previous section has turned up a number of factors that are not explained by the basic model of tax evasion. Foremost among these are that some taxpayers choose not to evade even when they would accept an identical gamble and that there are social aspects of the evasion decision. The purpose of this section is to show how simple modifications to the model can incorporate these factors and can change the conclusions concerning the effect of the tax rate.

The feature that distinguishes tax evasion from a simple gamble is that taxpayers submitting incorrect returns feel varying degrees of anxiety and regret. To some, being caught would represent a traumatic experience that would do immense damage to their self-esteem. To others, it would be only a slight inconvenience. The innate belief in honesty of some taxpayers is not captured by representing tax evasion as just a gamble nor are the nonmonetary costs of detection and punishment captured by preferences defined on income alone. The first intention of this section is to incorporate these features into the analysis and to study their consequences.

A preference for honesty can be introduced by writing the utility function as

$$U = U(Y) - \chi E, \tag{17.9}$$

where χ is the measure of the taxpayers honesty and, with $E = Y - X$ the extent of evasion, χE is the utility (or psychic) cost of deviating from complete honesty. To see the consequence of introducing a psychic cost of evasion, suppose that taxpayers differ in their value of χ but are identical in all other respects. Taxpayers with higher values of χ will suffer from a greater utility reduction for any given level of evasion. In order for them to evade, the utility gain from evasion must exceed the utility reduction. The population is therefore separated into two parts: some taxpayers choosing not to evade (those with high values of χ) and others who evade (those with low χ). It is tempting to label taxpayers who do not evade as honest, but this is not really appropriate, since they will evade if the benefit is sufficiently great.

Let the value of χ that separates the evaders from the nonevaders be denoted $\hat{\chi}$. A change in any of the parameters of the model (p, F, and t) now has two effects. First, it changes the benefit from evasion, which alters the value of $\hat{\chi}$. For instance, an increase in the rate of tax raises the benefit of evasion and increases $\hat{\chi}$ with the consequence that more taxpayers evade. Second, the change in the parameter affects the evasion decision of all existing tax evaders. Putting these effects together, it becomes possible for an increase in the tax rate to lead to more evasion in the aggregate. This is in contrast to the basic model where the tax rate increase would reduce evasion.

The discussion of the empirical evidence has drawn attention to the positive connection between the number of tax evaders known to a taxpayer and the level of that taxpayer's own evasion. This observation suggests that the evasion decision is not made in isolation by each taxpayer but is made with reference to the norms and behavior of the general society of the taxpayer. Given the empirical significance of such norms, the second part of this section focuses on their implications.

Social norms have been incorporated into the model of the evasion decision in two distinct ways. One approach is to introduce social norms as an additional element of the utility cost to evasion. The additional utility cost is assumed to be an increasing function of the proportion of taxpayers who do not evade. This formulation captures the fact that more utility will be lost, in terms of reputation, the more out of step the taxpayer is with the rest of society. The consequence of this modification is to reinforce the separation of the population into evaders and nonevaders.

An alternative approach is to explicitly impose a social norm on behavior. One such social norm can be based on the notion of Kantian morality and, effectively, on having individuals assess their fair contribution in tax payments toward the provision of public goods. This calculation then provides an upper bound on the extent of tax evasion. To calculate the actual degree of tax evasion, each taxpayer performs the expected utility maximization calculation, as in (17.1), and evades whichever is the smaller out of this quantity and the previously determined upper bound. This formulation is also able to provide a positive relation between the tax rate and evaded tax for some range of taxes and to divide the population into those who evade tax and those who do not.

The introduction of psychic costs and of social norms is capable of explaining some of the empirically observed features of tax evasion that are not explained by the standard expected utility maximization hypothesis. This is achieved by modifying the form of preferences, but the basic nature of the approach is unchanged. The obvious difficulty with these changes is that there is little to suggest precisely how social norms and utility costs of dishonesty should be formalized.

17.7 Tax Compliance Game

An initial analysis of the choice of audit probability was undertaken in section 17.4. It was argued there that the practical situation involves a revenue service that chooses the probability to maximize total revenue, taking as given the tax rate and the punishment. The choice of probability in this setting requires an analysis of the interaction between the revenue service and the taxpayers. The revenue service reacts to the declarations of taxpayers, and taxpayers make declarations on the basis of the expected detection probability.

Such interaction is best analyzed by formalizing the structure of the game that is being played between the revenue service and the taxpayers. The choice of a strategy for the revenue service is the probability with which it chooses to audit any given value of declaration. This probability need not be constant for declarations of different values and is based on its perception of the behavior of taxpayers. For the taxpayers, a strategy is a choice of declaration given the audit strategy of the revenue service. At a Nash equilibrium of the game, the strategy choices must be mutually optimal: the audit strategy must maximize the revenue collected, net of the costs of auditing, given the declarations; the declaration must maximize utility given the audit strategy.

Even without specifying further details of the game, it is possible to make a general observation: predictability in auditing cannot be an equilibrium strategy. First, no

Revenue service

		Audit	No audit
Taxpayer	Evasion	$Y-T-F,\ T+F-C$	$Y,\ 0$
	No evasion	$Y-T,\ T-C$	$Y-T,\ T$

Figure 17.7
The audit game

auditing at all cannot be optimal because it encourages maximal tax evasion. Second, auditing of all declarations cannot be a solution either because no revenue service incurs the cost of auditing where full enforcement induces everyone to comply. Finally, prespecified limits on the range of declarations to be audited are also flawed. Taxpayers tempted to underreport income will make sure to stay just outside the audit limit, and those who cannot avoid being audited will choose to report truthfully. Exactly the wrong set of taxpayers will be audited. This establishes that the equilibrium strategy must involve randomization.

But how should the probability of audit depend on the information available on the tax return? Since the incentive of a taxpayer is to understate income to reduce their tax liabilities, it seems to require that the probability of an audit should be higher for low-income reports. More precisely, the probability of an audit should be high for an income report that is low compared to what one would expect from someone in that taxpayer's occupation or given the information on previous tax returns for that taxpayer. This is what theory predicts and what is done in practice.

A simple version of the strategic interaction between the revenue service and a taxpayer is depicted in figure 17.7. The taxpayer with true income Y can either evade (reporting zero income) or not (truthful income report). By reporting truthfully, the taxpayer pays tax T to the revenue service (with $T < Y$). The revenue service can either audit the income report or not audit. An audit costs C for the revenue service to conduct but provides irrefutable evidence as to whether the taxpayer has misreported income. If the taxpayer is caught evading, he pays the tax due, T, plus a fine F (where the fine includes the cost of auditing and a tax surcharge so that $F > C$). If the taxpayer is not caught evading, then he pays no tax at all. The two players choose their strategies simultaneously, which reflects the fact that the revenue service does not know whether the taxpayer has chosen to evade when it decides whether to audit. To make the problem interesting, we assume that $C < T$, so the cost of auditing is less than its potential gain, which is to recover the tax due.

There is no pure strategy equilibrium in this tax compliance game. On the one hand, if the revenue service does not audit, the agent strictly prefers evading, and therefore the revenue service is better off auditing as $T + F > C$. On the other hand, if the revenue service audits with certainty, the taxpayer prefers not to evade as $T + F > T$, which implies that the revenue service is better off not auditing. Therefore the revenue must play a mixed strategy in equilibrium, with the audit strategy being random (i.e., unpredictable). Similarly for the taxpayer the evasion strategy must also be random.

Let e be the probability that the taxpayer evades, and p the probability of audit. To obtain the equilibrium probabilities, we solve the conditions that the players must be indifferent between their two pure strategies. For the government to be indifferent between auditing and not auditing, it must be the case that the cost from auditing, C, equals the expected gain in tax and fine revenue, $e[T + F]$. For the taxpayer to be indifferent between evading and not evading, the expected gain from evading, $[1 - p]T$ equals the expected penalty pF. Hence in equilibrium the probability of evasion is

$$e^* = \frac{C}{T + F}, \tag{17.10}$$

and the probability of audit is

$$p^* = \frac{T}{T + F}, \tag{17.11}$$

where both e^* and p^* belong to the interval $(0, 1)$ so that both evasion and audit strategies are random.

The equilibrium probabilities are determined by the strategic interaction between the taxpayer and the revenue service. For instance, the audit probability declines with the fine, although a higher fine may be expected to make auditing more profitable. The reason is that a higher fine discourages evasion, thus making auditing less profitable. Similarly evasion is less likely with a high tax because a higher tax induces the government to audit more. Note that these results are obtained without specifying the details of the fine function, which could be either a lump-sum amount or something proportional to evaded tax. Evasion is also more likely the more costly is auditing, since the revenue service is willing to audit at a higher cost only if the taxpayer is more likely to have evaded tax.

The equilibrium payoffs of the players are

$$u^* = Y - T + e^*[T - p^*[T + F]], \tag{17.12}$$

for the taxpayer and

$$v^* = (1 - e^*)T + p^*[e^*[T + F] - C], \tag{17.13}$$

for the revenue service. Substituting into these payoffs the equilibrium probabilities of evasion and audit gives

$$u^* = Y - T, \tag{17.14}$$

$$v^* = T - \frac{C}{T + F}T. \tag{17.15}$$

Because the taxpayer is indifferent between evading and not evading, his equilibrium payoff is equal to his truthful payoff $Y - T$. This means that the unpaid taxes and the fine cancel out in expected terms. Increasing the fine does not affect the taxpayer. However, a higher fine increases the payoff of the revenue service, since it reduces the amount of evasion. Hence increasing the penalty is Pareto-improving in this model. The equilibrium payoffs also reflect the cost from evasion. Indeed, for any tax T paid by the taxpayer, the revenue service effectively receives $T - \Delta$, where $\Delta = \frac{C}{T+F}T$ is the deadweight loss from evasion. Thus evasion involves a deadweight loss that is increasing with the tax rate.

17.8 Behavioral Models

The analysis of the evasion decision based on the expected utility function produced very clear and precise results. It provided a sufficient condition for a taxpayer to conceal some income and determined the response of the taxpayer to changes in the key variables (f, p, t, and Y). It is rare for a model to provide such unambiguous conclusions. Unfortunately, not all the results it produces are in agreement with the evidence.

When evaluated at the levels of audit probability and fine rate the model predicts that all taxpayers will engage in evasion whenever the opportunity arises. The extent of evasion varies across countries, but there are many countries for which honest payment of taxes is the predominant behavior. For these countries the model does not predict the correct level of evasion. The model also predicts that the level of evasion falls when the tax rate rises. This is a consequence of the fine being a multiple of the tax evaded so that the "effective" punishment is *ftE*, where E is the amount of evasion. The effective punishment for a given amount of evasion increases as the tax rate increases so discouraging evasion. Intuition suggests a high tax rate should provide an incentive to evade, whereas the model predicts the opposite. The empirical and experimental evidence on this point is mixed. This has not prevented a presumption developing in the literature that the result is wrong, from which it follows that the model is inadequate and must be improved.

The natural response to the perceived failings of the model is to consider the range of alternative choice models proposed by behavioral economics. These alternative models can be understood as relaxing the very restrictive assumptions of expected utility theory. The behavioral models can be viewed as special cases of the general formulation of the value function

$$V = \sum_{i=1}^{n} w_i(p_1, \ldots, p_n)v(x_i), \tag{17.16}$$

where $w_i(p_1, \ldots, p_n)$ are *decision weights* and $v(x_i)$ the *payoff function*. The interpretation is that the decision maker (the taxpayer for an evasion decision) knows that the true probabilities of the events are $p_1, \ldots, p_n$. However, in their evaluation of the alternatives they transform these probabilities into the decision weights. The usual assumption in behavioral economics is that unlikely events are typically assigned a decision weight greater than the probability. So, if the chance of auditing is small, it is given much greater weight in the subjective assessment of the taxpayer. The logic is of the kind "I know only 4 percent of people are audited but if I evade I will almost certainly be audited." A utility function, denoted $U(x_i)$, is a special case of a payoff function that satisfies the additional assumptions $U'(\cdot) > 0$ and $U''(\cdot) < 0$. Expected utility fits into this formulation with $w_i(p) = p_i$, and $v(x_i) = U(x_i)$.

Rank dependent expected utility begins by ranking the outcomes from worst to best. For tax evasion the worst outcome is Y^c and the best outcome is Y^n. It then assigns a weight $\varpi(Y^c)$ to the worst outcome and $1 - \varpi(Y^c)$ to the best outcome, where it is assumed that $\varpi(0) = 0$ and $\varpi(1) = 1$. The value function can then be written as

$$\max_{\{E\}} V(E) = \varpi(p)\,U(Y^c) + [1 - \varpi(p)]\,U(Y^n). \tag{17.17}$$

Furthermore it is assumed that the weighting function is inverse S-shaped (concave, then convex). This has the effect of inflating low probabilities and deflating large probabilities. In practice, the probability of audit is low, so it is natural to take $\varpi(p) > p$. By comparing (17.17) to the expected utility function of the standard model, we can see that the sufficient condition for evasion to occur with rank dependent expected utility is $1 - \varpi(p) - \varpi(p) f > 0$. Since the weighting inflates the probability of detection, this provides a stricter sufficient condition, and so p must be lower than in the standard model before evasion occurs.

It should be noted that although this formulation changes the prediction about the extent of evasion, it does not change the comparative static effect of a change in the tax rate, t. Given a probability, p, the change of variables $1 - \varpi(p) \equiv 1 - q$, $\varpi(p) \equiv q$ can be made, and the optimization becomes that of the standard model but with p replaced by q. The qualitative properties of the comparative statics are therefore unchanged.

Prospect Theory is based on three assumptions. First, payoffs are based on gains and losses relative to a reference point. Second, the payoff function is concave in gains but convex in losses. Third, the additional utility from a small gain is less then the utility reduction from a small loss. Two issues arise in applying this theory to the evasion decision. Since there is no natural reference point or functional form for the payoff, there is considerable flexibility within Prospect Theory for the representation of the choice problem. The combination of concavity and convexity means that there is often no interior solution for the choice problem so that the evasion choice is all-or-nothing.

The latter point is now illustrated for a commonly used version of Prospect Theory. The payoff function is assumed to take the power function form

$$v(z) = \begin{cases} z^{\beta}, & z \geq 0, \\ -\gamma(-z)^{\beta}, & z < 0. \end{cases}$$

The effect of the parameter γ is to give the payoff function a kink at zero when $\gamma \neq 1$. It is usually assumed that $\gamma > 1$, which ensures that the utility fall from a small loss is greater than the utility rise from a small gain. Assume that the reference level of income, R, is income after the correct tax payment, so that $R = Y[1 - t]$. Then, if the taxpayer is caught, the loss relative to the reference level is

$$Y^{c} - R = -ft[Y - X]. \tag{17.18}$$

If the taxpayer is not caught the gain is

$$Y^{n} - R = t[Y - X]. \tag{17.19}$$

Combining these assumptions determines the payoff function

$$V = p\left[-\gamma\,[ft\,[Y-X]]^{\beta}\right] + [1-p]\,[t\,[Y-X]]^{\beta}\,. \tag{17.20}$$

Observe that this payoff function can be factored as

$$V = E^{\beta}\left[[1-p]\,t^{\beta} - p\gamma f^{\beta} t^{\beta}\right], \tag{17.21}$$

where the level of evasion is $E = Y - X$. It can be seen directly from (17.21) that the optimal choice of evasion is $E = Y$ if $[1-p] - p\gamma f^{\beta} > 0$ but $E = 0$ if $[1-p] - p\gamma f^{\beta} < 0$. The choice of reference point and payoff function combines to ensure that there will always be a corner solution (except for when $[1-p] - p\gamma f^{\beta} = 0$, in which case the taxpayer is indifferent about the value of E). The taxpayer either declares honestly or declares nothing. The tax rate does not affect this decision, so the model also predicts that changes in the tax rate will not affect the amount of evasion.

The central feature of *Disappointment Theory* is the comparison of the outcome that is achieved with the outcomes that could have been achieved. When the realized outcome is poor, an amount of disappointment reduces the payoff. This provides a disincentive to undertake risky actions that may lead to poor outcomes. In the context of tax evasion this will, ceteris paribus, reduce the chosen level of evasion. We now consider whether the inclusion of disappointment modifies the sufficient condition for evasion or the tax effect.

Let $\tilde{Y}(E)$ denote the random level of income after evading an amount E. $\tilde{Y}(E)$ is equal to Y^c with probability p and Y^n with probability $1-p$. For Disappointment Theory the payoff with an amount of evasion E is written as

$$V = \mathcal{E}[U(\tilde{Y}(E))] - \mathcal{E}[D(\tilde{Y}(E) - \mathcal{E}[\tilde{Y}(E)])], \tag{17.22}$$

where $D(\tilde{Y}(E) - \mathcal{E}[\tilde{Y}(E)])$ is the disappointment function and the $\mathcal{E}$ the expectations operator. It is assumed that $D(\tilde{Y}(E) - \mathcal{E}[\tilde{Y}(E)]) > 0$ if $\tilde{Y}(E) < \mathcal{E}[\tilde{Y}Y(E)]$ and $D(\tilde{Y}(E) - \mathcal{E}[\tilde{Y}(E)]) < 0$ if $\tilde{Y}(E) > \mathcal{E}[\tilde{Y}(E)]$. The interpretation of (17.22) is that the payoff is composed of two parts. The first part arises from expected utility of income as in the standard model. The second part subtracts the disappointment that arises. From the definitions of Y^n and Y^c it follows that

$$\mathcal{E}[\tilde{Y}(E)] = pY^c + [1-p]\,Y^n = Y[1-t] + [1-p-pf]\,tE. \tag{17.23}$$

If the taxpayer is audited, then income is Y^c, which is less than $\mathcal{E}[\tilde{Y}(E)] = Y[1-t] + [1-p-pf]tE$, so the disappointment is positive. Conversely, $Y^c > Y[1-t] + [1-p-pf]\,tE$, so the disappointment is negative if the taxpayer is not caught.

Substituting for $\tilde{Y}(E)$ (17.22) can be written

$$V = pU(Y[1-t] - ftE) + [1-p]U(Y[1-t] + tE) - pD(-[1-p][1+f]tE) - [1-p]D(p[1+f]tE). \tag{17.24}$$

From the objective in (17.24) the necessary condition for evasion to occur is that

$$\frac{\partial V}{\partial E}|_{E=0} > 0. \tag{17.25}$$

Calculating the derivative gives

$$\frac{\partial V}{\partial E} = -pftU'(Y^c) + [1-p]tU'(Y^n) + pD'(-[1-p][1+f]tE)[1-p][1+f]t - [1-p]D'(p[1+f]tE)p[1+f]t. \tag{17.26}$$

It can be seen immediately that when $E = 0$, the third and fourth terms cancel. The sufficient condition for evasion to occur is then $1 - p - pf > 0$, which is identical to that for the standard model. In addition the payoff is dependent on tE, so the solution for E will involve a term in $\frac{1}{t}$. Hence, as t increases, E will fall. Therefore the model does not provide a route to reversing the direction of the tax effect.

Ambiguity Theory applies when there is a lack of precise knowledge of the audit probability so the taxpayer forms a second-order probability distribution over possible audit probabilities. An increase in ambiguity means an increase in dispersion of this probability distribution. Experimental evidence shows people are heterogeneous with respect to preferences over ambiguity. This implies that the sufficient condition for evasion to occur will differ across taxpayers.

Ambiguity can be represented in the payoff by putting weight γ on the worst outcome, λ on the best outcome, and $[1-\lambda-\gamma]$ on the expected value given the belief, p, about probability of audit. This gives the payoff

$$V = \gamma \min_{\{x_1,\dots,x_n\}} v(x) + \lambda \max_{\{x_1,\dots,x_n\}} v(x) + [1-\lambda-\gamma]\sum_{i=1}^{n} p_i v(x_i). \tag{17.27}$$

The sum $\gamma + \lambda$ represents the amount of perceived ambiguity and $1 - \lambda - \gamma$ is the degree of confidence in the belief p. Individuals can differ in their personal values of γ and λ. Preferences with γ relatively large describe a pessimistic individual who is concerned about what will happen if the very worst outcome arises: as γ tends to 1, the preferences are entirely focused on the minimum possible payoff.

In the case of tax evasion there are only two outcomes: Y^n and Y^c, with $Y^c < Y^n$. The payoff function for ambiguity then reduces to

$$V = \gamma v(Y^c) + \lambda v(Y^n) + [1 - \lambda - \gamma]\left[pv(Y^c) + [1 - p])v(s_h)\right]$$
$$= [\gamma + [1 - \lambda - \gamma]\, p]\, v(Y^c) + [\lambda + [1 - \lambda - \gamma]\,[1 - p]]\, v(Y^n) \qquad (17.28)$$

The form of (17.28) reveals that in this context ambiguity is equivalent to a particular weighting of the probabilities. As the degree of confidence in the belief goes down ($1 - \gamma - \lambda \to 0$), the weights tends to λ and γ. These are individual-specific attributes and are not related to the objective probability, p. They are instead entirely determined by the individual attitude toward ambiguity.

When the payoff function is a utility function ($v(Y) = U(Y)$), the implications of the ambiguity model can be compared directly to the standard model. The sufficient condition for evasion to take place can be read directly from (17.28), since the weighting replaces p in the standard model by $\gamma + [1 - \lambda - \gamma]\, p$. Provided that $\gamma + [1 - \lambda - \gamma]\, p > p$, the sufficient condition for evasion to take place will be stricter. As far as the effect of the tax rate is concerned the ambiguity model does not change the outcome if the payoff function is a utility. It only changes the weighting, so the comparative statics of the tax rate remain the same.

The idea of more or less ambiguity is an interesting one for the tax compliance decision because it raises important policy questions about the likely effect of making auditing processes more or less transparent. It is possible that increasing ambiguity by making policy less transparent will increase compliance. The model will also yield a different necessary condition for evasion that will be individual-specific, and it can predict higher levels of compliance than the standard model. It does not change the direction of the tax effect.

The models discussed above have a variety of different implications for the evasion decision. Most can affect the sufficient condition for evasion. For the standard model this condition is the same for all taxpayers because they all use the same objective probability in the formation of expected utility. Behavioral models permit the weights to vary between individuals. The weights can also differ from the true probability, so the sufficient condition can be stricter and reduce the predicted number of taxpayers engaged in evasion. What these models cannot easily do is change the direction of the tax effect. This comparative static result is a consequence of the fine being determined by the tax rate. As long as the payoffs depend on the product of t and E, an increase in the tax rate will reduce the amount of evasion.

17.9 Compliance and Social Interaction

It has been assumed so far that the decision by any taxpayer to comply with the tax law is independent of what the other taxpayers are doing. This decision is based entirely on the enforcement policy (penalty and auditing) and economic opportunities (tax rates and income). In practice, however, we may expect that someone is more likely to break the law when noncompliance is already widespread than when it is confined to a small segment of the population. This observation is supported by the evidence in table 17.3, which shows that tax compliance is susceptible to social interaction.

The reasoning behind this social interaction can be motivated along the following lines: the amount of stigma or guilt I feel if I do not comply may depend on what others do and think. Whether they also underpay taxes may determine how I feel if I do not comply. As we now show, this simple interdependence among taxpayers can trigger a dynamic process that moves the economy toward either full compliance or no compliance at all.

To see this, consider a set of taxpayers. Each taxpayer has to decide whether to evade taxes. Fixing the enforcement parameters, the payoff from evading taxes depends on the number of noncompliers. On the one hand, the payoff from noncompliance is increasing with the number of noncompliers because then the chance of getting away with the act of evasion increases. On the other hand, the payoff from compliance decreases with the number of noncompliers. The reason can be that you suffer some resentment cost from abiding with the law when so many are breaking the law. Therefore individuals care about the overall compliance in the group when choosing to comply themselves.

It follows from this that the choice of tax evasion becomes more attractive when more taxpayers make the same choice of breaking the law. Because of the way interactions work, the choice of tax evasion becomes more attractive when more taxpayers make the same choice of breaking the law. The aggregate compliance tendency is toward one of the extremes: only the worst outcome of nobody complying or the best outcome of full compliance are possible. This is illustrated in figure 17.8 depicting the payoff from compliance and noncompliance (vertical axis) against the noncompliance rate in the group (horizontal axis). At the intersection of the two payoff functions, taxpayers are indifferent between compliance or noncompliance. Starting from this point, a small reduction in noncompliance will break the indifference in favor of compliance and trigger a chain reaction toward increasing compliance. Alternatively, a small increase in noncompliance triggers a chain reaction in the opposite direction making noncompliance progressively more attractive.

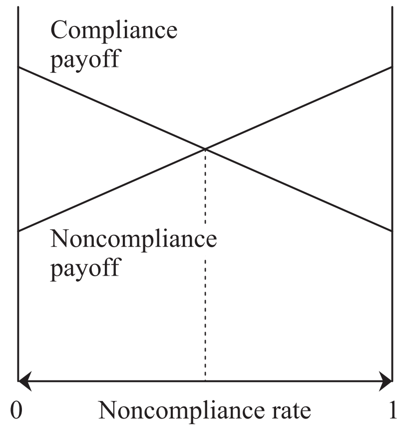

Figure 17.8
Equilibrium compliance

In this situation, how do we encourage taxpayers to abide by the law when the dynamic is pushing in the opposite direction? The solution is to get a critical mass of individuals complying to reverse the dynamic. This requires a short but intense audit policy backed by a harsh punishment in order to change the decisions of enough taxpayers that the dynamics switch toward full compliance. When at this new full-compliance equilibrium, it is possible to cut down on audit costs because compliance is self-sustained by the large numbers of taxpayers who comply. It follows from this simple argument that a moderate enforcement policy with few audits and light penalties over a long period is ineffective. Another interesting implication of this model is that two countries with similar enforcement policies can end up with very different compliance rates. Social interaction can be a crucial explanation for the astoundingly high variance of compliance rates across locations and over time that are much higher than can be predicted by differences in local enforcement policies.

17.10 Conclusions

Tax evasion is an important and significant phenomenon that affects both developed and developing economies. Although there is residual uncertainty surrounding the accuracy of measurements, even the most conservative estimates suggest the hidden economy in the United Kingdom and United States to be at least 10 percent of the measured economy. There are many countries where it is very much higher. The substantial size of the hidden economy, and the tax evasion that accompanies it, require understanding so that the effects of policies that interact with it can be correctly forecast.

The predictions of the standard representation of tax evasion as a choice with risk were derived and contrasted with empirical and experimental evidence. This showed that although it is valuable as a starting point for a theory of evasion, the model did not incorporate some key aspects of the evasion decision, notably the effects of a basic wish to avoid dishonesty and the social interaction among taxpayers. The analysis was then extended to incorporate both of these issues.

Further Reading

The literature on tax evasion is summarized in:

Cowell, F. A. 1990. *Cheating the Government*. Cambridge: MIT Press.

For a comprehensive survey of the extent of tax evasion in a wide range of countries, see:

Schneider, F., and Enste, D. H. 2000. Shadow economies: Size, causes, and consequences. *Journal of Economic Literature* 38: 77–114.

The earliest model of tax compliance is:

Allingham, M., and Sandmo, A. 1972. Income tax evasion: A theoretical analysis. *Journal of Public Economics* 1: 323–38.

The economic approach to crime is developed in:

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

Empirical and experimental evidence is found in:

Baldry, J. C. 1986. Tax evasion is not a gamble. *Economics Letters* 22: 333–35.

Mork, K. A. 1975. Income tax evasion: Some empirical evidence. *Public Finance* 30: 70–76.

Spicer, M. W., and Lundstedt, S. B. 1976. Understanding tax evasion. *Public Finance* 31: 295–305.

On the effect of social interaction on law compliance, see:

Glaeser, E. L., Sacerdote, B., and Scheinkman, J. A. 1996. Crime and social interaction. *Quarterly Journal of Economics* 111: 506–48.

A game-theoretic model of the strategic interaction between taxpayer and enforcement agency, including honest taxpayers, is in:

Graetz, M., Reinganum, J., and Wilde, L. 1986. The tax compliance game: Towards an interactive theory of law enforcement. *Journal of Law, Economics and Organization* 2: 1–32.

Scotchmer, S. 1987. Audit classes and tax enforcement policy. *American Economic Review* 77: 229–33.

On the effect of fiscal corruption and the desirability of a flat tax, see:

Hindriks, J., Keen, M., and Muthoo, A. 1999. Corruption, extortion and evasion. *Journal of Public Economics* 74: 395–430.

The literature on behavioral models of evasion and social interaction is surveyed in:

Hashimzade, N., Myles, G. D., and Tran-Nam, B. 2012 Applications of behavioural economics to tax evasion. *Journal of Economic Surveys* (forthcoming).

Exercises

17.1 Economic efficiency requires that consumers exploit all opportunities to increase their welfare. Does this argument legitimize tax evasion?

17.2 Should the welfare of tax evaders be included in an assessment of social welfare? What if their inclusion implied that tax evasion should not be punished? Would you provide the same arguments for violent crimes?

17.3 Consider a consumer with utility function $U = Y^{1/2}$.

a. Defining the coefficient of absolute risk aversion by $R_A(Y) = -\frac{\partial^2 U/\partial Y^2}{\partial U/\partial Y}$, show that this is a decreasing function of Y.

The consumer is faced with a gamble that results in a loss of 1 with probability $p = 0.5$ and a gain of 2 with probability $1 - p$.

b. Show that there is a critical value of income Y^* at which the consumer is indifferent between participating in this gamble and receiving income Y^* with certainty. Hence show that the gamble will be undertaken at any higher income but will not at any lower income.

17.4 A consumer with utility function $U = Y^{1/2}$ has to choose between a job that provides income Y_0 but no possibility of evading tax and a job that pays Y_1 but makes evasion possible. What value of Y_1 makes the consumer indifferent between these two jobs? How does a change in the tax rate affect this level of income?

17.5 Given utility function $U = -\bar{e}^Y$.

a. Show that the coefficient of absolute risk aversion $R_A(Y) = -\frac{U''}{U'}$ is constant (where U' and U'' denote the first and second derivative of U with respect to Y, respectively). Show that $U' > 0$ (positive marginal utility of income) and that $U'' < 0$ (diminishing marginal utility of income).

b. Show that the undeclared income, $Y - X$, is independent of Y for a consumer with this utility function.
(*Hint:* For a function $y = e^{f(x)}$, the derivative is $\frac{dy}{dx} = e^{f(x)} \frac{df(x)}{dx}$.)

17.6 For the utility function $U = \log(Y)$:

a. Show that the coefficient of relative risk aversion $R_A(Y) = -\frac{U''}{U'}$ is constant (where U' and U'' denote the first and second derivative of U with respect to Y, respectively).

b. Show that the proportion of income not declared, $\frac{X}{Y}$, is independent of Y for a consumer with this utility function. (*Hint:* Let $X = \alpha Y$ in the first-order condition and show that Y can be eliminated.)

17.7 In a state-contingent income space, each person's indifference curves are generally bowed in toward the origin. Why does this imply that the person is risk averse?

17.8 Does it matter whether p and F are interpreted as subjective or objective quantities? If the revenue service chooses to prosecute celebrities for evasion while fining noncelebrities, does it believe in the objective interpretation?

17.9 A consumer with utility function $U = Y^{1/2}$ determines the amount of income to declare to the tax authority.

a. Denoting the probability of detection by p, the tax rate by t, and the fine by F, provide an expression for the optimal value of X.

b. For $F = \frac{1}{2}$ and $p = \frac{1}{2}$ show that the declaration X is an increasing function of t.

c. Assume that the revenue authority aims to maximize the sum of tax revenue plus fines less the cost of auditing. If the latter is given by $c(p) = p^2$, graph the income of the revenue authority as a function of p for $Y = 10$, $F = \frac{1}{2}$, and $t = \frac{1}{3}$. Hence derive the optimal value of p.

17.10 A consumer has a choice between two occupations. One occupation pays a salary of \$80,000 but gives no chance for tax evasion. The other pays \$75,000 but does permit evasion. With the probability of detection $p = 0.3$, the tax rate $t = 0.3$, and the fine rate $F = 0.5$, which occupation will be chosen if $U = Y^{1/2}$?

17.11 Use the parameter values from the previous exercise with the modification that pay in the occupation permitting evasion is given by \$40,000 $[1 - n]$, where n is the proportion of the population choosing this occupation. What is the equilibrium value of n? How is this value affected by an increase in t?

17.12 Consider the simultaneous move game between a taxpayer and a tax inspector. The taxpayer chooses whether or not to underreport his taxable income. The tax inspector chooses whether or not to audit the income report. The cost of auditing is $c > 1$, and the fine (including tax payment) imposed if the taxpayer is caught cheating is F (with $F > c > 1$). With a truthful report the taxpayer has to pay a tax of 1 unit of income. The payoffs are given in the matrix where the first number in each cell denotes the tax inspector's payoff and the second number is the taxpayer's payoff. Find the Nash equilibria of this game, considering both pure and mixed strategies.

	Under report	Truthful report
Audit	$F - c, -F$	$1 - c, -1$
No audit	0, 0	0, −1

17.13 A revenue service announces that it will only audit income declarations below a critical level Y^*. If you had an income in excess of Y^*, what level of income would you announce? Once declarations are made, will the revenue service act according to its announced auditing plans?

17.14 Consider the game between taxpayer and revenue service described in the payoff matrix below.

	Audit	No audit
Honest	100, −10	100, 10
Evade	Y, 5	150, T

a. For what value of T is (Evade, No audit) a Nash equilibrium?

b. Can (Evade, Audit) ever be a Nash equilibrium? What does this imply about the punishment structure?

c. Does a simultaneous move game capture the essence of the auditing problem?

17.15 Is tax evasion just a gamble?

17.16 "Those who follow social customs are fools." True or false?

17.17 (Crackdowns 1) Police often engage in "crackdowns" on crime, which are intermittent periods of high-intensity policing. Some examples include drunk driving interdictions accomplished using sobriety checkpoints, crackdowns on speeding achieved through a greater announced police presence on certain highways, or crackdowns on drug traffickings. Two features characterize our notion of random crackdowns. First, they are arbitrary, in the sense that they subject certain groups (identified by presence in a particular time or place, or by other observable characteristics), which are not notably different from other groups in criminal propensities, to higher intensity police monitoring. Second, they are publicized; that is, those who are subjected to crackdowns are informed about them before they engage in criminal activity aimed at particular neighborhoods. Discuss the potential costs and benefits of a similar crackdown policy to combat tax evasion. (*Hint:* You can also use behavioral arguments for nonrational choices.)

17.18 (Crackdowns 2) To illustrate the main idea behind a crackdown policy, consider an example where the tax enforcement agency seeks to minimize tax evasion subject to a fixed budget constraint. Consider a population of 100 taxpayers, half of whom would never evade taxes and half of whom would evade taxes unless it is sufficiently likely that they will be audited. A taxpayer's propensity to evade tax is unobservable to the tax enforcement agency. The tax enforcement budget is such that only 50 taxpayers can be audited.

a. Random audit: Suppose that taxpayers are audited at random, so that each taxpayer has a probability $\frac{1}{2}$ of being audited. Then what will be the compliance rate?

b. Crackdown audit: Suppose now that half of the taxpayers are selected based on observable characteristics (e.g., eye color) known to be independent of the propensity to evade taxes (so it is arbitrary). Nevertheless, suppose that all taxpayers in this group are audited and the rest of the taxpayers are not audited. Overall, 50 taxpayers are audited as required by the budget constraint. Then what will be the compliance rate? Compare with part a.

c. What objections would you make to this arbitrary crackdown tax enforcement?

17.19 Assume that 10 percent of the population will always evade paying taxes no matter what anyone else does. Equally 10 percent of the population will never evade paying taxes. The remaining 80 percent are more likely to evade when the proportion evading increases. Prove that there will be at least one equilibrium level of tax evasion. Show how multiple equilibria can occur. Which equilibria are stable?

17.20 Assume that all taxpayers have the utility function

$$U(Y^j) = \frac{\left[Y^j\right]^{1-\alpha} - 1}{1-\alpha},$$

where Y^j is income in state j, and $j = c, n$. When the taxpayer has true income Y, declares income level X, and evasion is detected, the fine is given by

$$F(X, Y) = [1 + s]\, t\, [Y - X].$$

Detection occurs with probability p.

a. Determine the optimal declaration and the resulting level of expected utility.

Now assume that taxpayers are offered a cutoff policy for audits: the policy is that no one who declares c or more will be audited; anyone declaring less than c will be audited for sure.

b. What is the optimal announcement under the cutoff rule?

c. Derive the condition that determines whether a taxpayer prefers the random audit policy or the cutoff rule. Will a taxpayer with true income below c ever prefer the cutoff rule?

17.21 Consider the optimal audit strategy of a tax authority. All taxpayers have either a low income Y_L or a high income Y_H, with $Y_L < Y_H$. They file a tax return, but the rich taxpayers may attempt to underreport. The proportions of taxpayers with high and low incomes are known, but a personal tax return can only be verified through an audit that costs c. There is a constant tax rate on income t and a fine consisting of a surcharge F on any underpaid tax. The parameters c, t, and F are not chosen by the tax authority.

a. Suppose that the tax authority can pre-commit to its audit polity. What is the optimal audit strategy for the tax authority? Is such a policy credible? Why or why not?

b. If there is a fixed fraction of high-income taxpayers who are known to report truthfully, what could be a credible audit strategy? What is the impact on the equilibrium audit strategy of an increase in the cost of auditing?

17.22 Tax evasion is sometimes described as "contagious," meaning that an increase in evasion encourages yet further evasion. In such circumstances, is the only equilibrium to have everyone evading?

17.23 An experiment is conducted in three different countries. Participants are told their income levels (in units of the local currency), the tax rate, the probability of detection, and the fine structure. These parameters are the same for all participants. It is found that the amount of income not declared is, on average, different among the countries. Discuss possible explanations for this finding.