Tax Evasion and Habit Formation[*]

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November 1, 2004

Abstract

The introduction of habit formation in preferences means that the individuals derive utility from the comparison of the current level of own consumption with that in the previous period. Therefore, when individuals choose their current consumption, they are simultaneously setting a standard of living that will be used to evaluate the utility accruing from the level of future consumption. This paper analyzes how the introduction of habits modifies the optimal tax evasion decision. I consider a two period model where the taxpayer has to decide the amount of income he wants to report to the tax authorities and the amount he wants to save. When individuals conceal part of their true income from the tax authority, they face the risk of being audited and hence of paying the corresponding fine. I show that, under decreasing absolute risk aversion the introduction of habit formation reduces the amount of evaded income.

JEL Classification Number: H23, H26
Key words: Tax evasion, Habit formation

1. Introduction

The aim of this paper is to analyze how the existence of consumption habits modifies the optimal taxpayer decision. Tax evasion models have traditionally assumed that taxpayers obtain utility exclusively from the level of their own current consumption. However, in the presence of habits, the utility derived from a given level of present consumption will depend on a reference level, which can be interpreted as a standard of living.

Allingham and Sandmo (1972) considered a simple model to solve the individual tax evasion problem. This approach (complemented later by Yithzaki, 1974) is at odds with empirical evidence. Taking approximated values for the inspection probability, fine and tax rate, and considering a level of risk aversion similar to the risk aversion exhibited in other situations, the model predicts that people should evade more income than the real data shows.[1] This paper tries to solve the previous discrepancy endowing the basic model with new elements aimed at better describing the taxpayer behavior. To this end I modify the basic model of tax evasion assuming that the utility of a taxpayer depends on the difference between his current consumption and that in the previous period. Therefore, when taxpayers decide their current consumption, they are simultaneously setting a reference with respect future consumption is compared to.

Several recent papers in macroeconomics and finance have introduced habit formation in the agent's utility function in order to reconcile some empirical facts with the more traditional formulations that assumed time-separable preferences. Some authors that have followed this line of research are for example Abel (1990, 1999) who provided a possible explanation of the equity premium puzzle; Ljungqvist and Uhlig (2000) who studied the effects of fiscal policy under habit formation and Carroll et al. (1997,2000) and Shieh et al. (2000), who carried out an analysis of the effects of habit formation on economic growth. The introduction of this habit formation process has qualitative consequences for the maximization problem faced by consumers since, when they choose their current consumption, they also decide a standard of living that will be compared with the level of future consumption.

I consider a model where individuals live for two periods. Young individuals have an exogenous income and they only must decide the amount they want to save. In the second period, taxpayers receive the capital income accruing from their saving, which is subjected to a proportional tax rate. A taxpayer could reduce his burden tax by declaring an amount of capital income less that the actual one. There is uncertainty

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[1]It should be mentioned the difficulty of measuring the tax evasion magnitude. Therefore, some bias could be possible in estimating the discrepancy between the real data and the one predicted by the Allingham-Sandmo's model.

in the second period since, if an agent is inspected by the tax authorities, his initial capital income will be reduced by the fine that he has to pay. Moreover, the second period utility is the outcome from the comparison between second period consumption and the previous one. In this context, I will investigate the effects both on savings and on declared income (and, as a by-product, on consumption) of a variation in the intensity of habits formation.

I find that, if the intensity of habit formation on consumption increases, the amount of declared income becomes larger when the individuals' utility exhibits decreasing absolute risk aversion and the relative risk aversion is large enough. In this model is also interesting to analyze what happens with the amount of concealed income, as the second period income is now endogenous. I obtain that the amount of evaded income decreases if the relative risk aversion is less than one and the absolute risk aversion is decreasing.

The paper is organized as follows. Section 2 presents the individual decision problem. In Section 3 I analyze the effects both on the consumption path and on the amount of declared income of a change in habits on consumption. Finally, Section 4 contains some concluding remarks.

2. The taxpayers' problem

Let us consider a large economy populated by a continuum of identical individuals. The mass of individuals is normalized to one. These individuals live for two periods and, when they are young (period 1), receive an exogenous income y, which is the same for all individuals. In this period, taxpayers have to decide the amount S of income that they want to save.

In their second period of life, individuals only receive the capital income accruing from their saving. The gross rate of return on saving is constant and equal to R. The capital income is subjected to a proportional tax rate $\tau \in (0, 1)$. Each individual declares an amount of capital income equal to x and, therefore, the amount τx denotes the taxes that are voluntarily paid. Each agent will be audited by the tax authorities with probability p. The inspection allows the tax authorities to find out the true income of an audited individual. Note that, even if the income of an individual were known by the tax authorities, no penalties could be imposed without an inspection certifying the existence of tax fraud. Individuals have to pay a fine $f(\tau)$ on unreported income if they are caught evading. I will consider two alternative assumptions. The first one consists of imposing a penalty proportional to undeclared income and independent of the tax rate. In this case, we have $f(\tau) = \pi$ as in Allingham and Sandmo (1972). For every unreported unit of income the taxpayer must pay a constant proportion π. This specification also requires that $\pi > \tau$ since, otherwise, tax evasion would not be punished. The second specification is based on imposing the penalty on evaded taxes as in Yitzhaki (1974). In this case we have that $f(\tau) = \pi\tau$ with $\pi > 1$, where the inequality is necessary to guarantee that a tax evader pays

a penalty greater than the taxes paid by a honest taxpayer. Threfore, the previous assumptions mean that $f(\tau) > \tau$.

Consumption in the second period of life takes place after taxes on declared capital income have been paid and potential inspection occurs. Notice that consumption in the second period is a random variable that takes the value $RS - \tau x - f(\tau)(y - x)$ with probability p and the value $RS - \tau x$ with probability $1 - p$.

The temporal sequence of events in each period is summarized in the following table:

First period	Second period
Individuals receive their exogenous income.	Return on saving is received.
Saving takes place	Individuals declare their capital income and pay de corresponding taxes.
	Tax inspection occurs withprobability p and the corresponding fine is paid.
First period consumption takes place.	Second period consumption takes place.

The preferences of an individual are defined by a time-additive Von Neumann-Morgenstern utility function

$$u(C_1) + \delta E\left(u\left(\widetilde{C}_2\right)\right)$$

where C_1 is the first period consumption of an individual, $\widetilde{C}_2$ is the value of random consumption in the second period. The random variable $\widetilde{C}_2$ takes two values,

$$\widehat{C}_2^N = RS - \tau x - \gamma C_1, \tag{2.1}$$

and

$$\widehat{C}_2^Y = RS - \tau x - f(\tau)(y - x) - \gamma C_1, \tag{2.2}$$

which correspond to the value of the habit adjusted second period consumption if the taxpayer is inspected and if he is not, respectively. The parameter $\delta > 0$ is the discount factor applying on future utility. The utility function u is twice continuously differentiable with $u' > 0$ and $u'' < 0$, and satisfies the Inada conditions $\lim_{C \to 0} u'(C) = \infty$ and $\lim_{C \to \infty} u'(C) = 0$ in order to guarantee interior solutions for consumption.

I assume that first period consumption imposes a minimum level for future consumption so that the utility of second period consumption will depend on the difference between second period consumption and first period consumption. Note

that I use the "additive" functional form to introduce habits on consumption in this framework. [2]

Therefore, a taxpayer chooses the amount of saving S and the declared income x in order to solve the following program:

$$Max \ \left\{ u(C_1) + (1-p)\delta u\left(\widehat{C}_2^N\right) + p\delta u\left(\widehat{C}_2^Y\right) \right\},$$

subject to

$$C_1 = y - S, \tag{2.3}$$

(2.1) and (2.2), where $\gamma \in (0,1)$ measures the importance of the standard set by own past consumption. Substituting (2.3) into (2.1) and (2.2) the effective second period consumptions become:

$$\widehat{C}_2^N = RS - \tau x - \gamma (y-S), \tag{2.4}$$

and

$$\widehat{C}_2^Y = RS - \tau x - f(\tau)(y-x) - \gamma (y-S). \tag{2.5}$$

An interior solution to the previous maximization problem must satisfy the following first order conditions:

$$(1-p)\delta \tau u'\left(\widehat{C}_2^N\right) = p\delta \left[f(\tau) - \tau \right] u'\left(\widehat{C}_2^Y\right), \tag{2.6}$$

$$u'(C_1) = (1-p)\delta (\gamma + R) u'\left(\widehat{C}_2^N\right) + p\delta (R - Rf(\tau) + \gamma) u'\left(\widehat{C}_2^Y\right). \tag{2.7}$$

According to equation (2.6), the taxpayer compares the marginal utility obtained from an extra unit of consumption when the inspection does not occur with the loss that takes place when the individual is caught and, thus, punished. Observe from (2.6) that positive evasion $(RS > x)$ occurs if and only if $(1-p)\tau > p\left(f(\tau) - \tau\right)$, which is the usual condition found in the tax evasion literature. Equation (2.7) tells us that the taxpayer equates the utility of an extra unit of first period consumption with the expected utility obtained from a marginal increase in second period consumption. Finally, substituting equation (2.6) into (2.7) in order to remove $\widehat{C}_2^Y$, we obtain

$$u'(C_1) = (1-p)\delta u'\left(\widehat{C}_2^N\right) \left[\gamma + R + \frac{\tau \left(R - Rf(\tau) + \gamma\right)}{f(\tau) - \tau} \right]. \tag{2.8}$$

We are now in the position of studying the effects of changes in habits intensity γ.

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[2]In the literature, two alternative forms have been used to introduce habits. The first one is the "additive" one, according to habits play in fact the role of a minimum level of consumption. The second functional form is the "multiplicative" one, where consumers' utility depends on their current level of consumption relative to a reference level determined by habits.

3. The effects of changes in habits on consumption

In order to evaluate the effect of the change in the intensity of habit formation on consumption, first observe from differentiating (2.3), (2.4) and (2.5) that

$$dC_1 = -dS, \tag{3.1}$$

$$d\widehat{C}_2^N = RdS - \tau dx - d\gamma \left(y - S\right) + \gamma dS, \tag{3.2}$$

$$d\widehat{C}_2^Y = RdS - \tau dx - Rf(\tau)dS + f(\tau)dx - d\gamma \left(y - S\right) + \gamma dS. \tag{3.3}$$

Define the index of absolute risk aversion $\Phi(C) = -\frac{u''(C)}{u'(C)} > 0$. Taking the first order conditions (2.6) and (2.8), and logarithmically differentiating both sides of these equations, we obtain

$$\Phi\left(\widehat{C}_2^N\right) d\widehat{C}_2^N = \Phi\left(\widehat{C}_2^Y\right) d\widehat{C}_2^Y, \tag{3.4}$$

$$\Phi(C_1)dC_1 = \Phi\left(\widehat{C}_2^N\right) d\widehat{C}_2^N - \frac{1}{\gamma + R(1-\tau)}d\gamma. \tag{3.5}$$

Finally, using the expressions (3.1), (3.2), and (3.3) to substitute into (3.4) and (3.5), and dividing by $d\gamma$ we obtain the following equations:

$$\left[(R+\gamma)\,\Phi\left(\widehat{C}_2^N\right) - (R - Rf(\tau) + \gamma)\,\Phi\left(\widehat{C}_2^Y\right)\right] \frac{dS}{d\gamma} =$$

$$\left[\tau\Phi\left(\widehat{C}_2^N\right) + (f(\tau) - \tau)\,\Phi\left(\widehat{C}_2^Y\right)\right] \frac{dx}{d\gamma} - (y - S)\left[\Phi\left(\widehat{C}_2^Y\right) - \Phi\left(\widehat{C}_2^N\right)\right] \tag{3.6}$$

$$\left[-\Phi(C_1) - (R+\gamma)\,\Phi\left(\widehat{C}_2^N\right)\right] \frac{dS}{d\gamma} =$$

$$-\tau\Phi\left(\widehat{C}_2^N\right) \frac{dx}{d\gamma} - \Phi\left(\widehat{C}_2^Y\right)(y - S) - \frac{1}{\gamma + R\left(1 - \tau\right)} \tag{3.7}$$

Observe that we have a system of two equations and two unknowns, $\frac{dS}{d\gamma}$ and $\frac{dx}{d\gamma}$. Solving this system, we will obtain the sign of the previous derivatives. It is important to remark that our results will not depend on the assumptions made about the structure of the fine that an individual must pay if he is inspected.

The following proposition summarizes the results.

Proposition 3.1. *An increase in the taxpayer's habits intensity γ results in:*
    (a) a larger amount of saving.
    (b) a larger amount of declared income if the absolute risk aversion index is decreasing and the relative risk aversion is larger than $\frac{\gamma+R}{\gamma+R(1-\tau)}$.
    (c) a smaller amount of evaded income if the absolute risk aversion index is decreasing and relative risk aversion is larger than one.

Proof. (a) Solving the system formed by equations (3.6) and (3.7), we obtain the following explicit solutions for $\frac{dS}{d\gamma}$ and $\frac{dx}{d\gamma}$:

$$\frac{dS}{d\gamma} = \frac{BF - CE}{BD - EA}, \tag{3.8}$$

$$\frac{dx}{d\gamma} = \frac{FA - CD}{BD - EA}, \tag{3.9}$$

where

$$A = \left[\Phi\left(\widehat{C}_2^N\right)(R + \gamma) - \Phi\left(\widehat{C}_2^Y\right)(R(1 - f(\tau)) + \gamma) \right],$$

$$B = \left[\Phi\left(\widehat{C}_2^N\right)\tau + \Phi\left(\widehat{C}_2^Y\right)(f(\tau) - 1) \right],$$

$$C = -(y - S)\left[\Phi\left(\widehat{C}_2^Y\right) - \Phi\left(\widehat{C}_2^N\right) \right],$$

$$D = \left[-\Phi(C_1) - (R + \gamma)\Phi\left(\widehat{C}_2^N\right) \right],$$

$$E = -\tau\Phi\left(\widehat{C}_2^N\right),$$

$$F = -\Phi\left(\widehat{C}_2^N\right)(y - s) - \frac{1}{\gamma + R(1 - \tau)}.$$

Simplifying and collecting terms, it is easy to see that $BD - EA < 0$ and $BF - CE < 0$. We thus obtain a positive relation between γ and the amount of saving.

(b) It is immediate to see that under DARA and an index of relative risk aversion larger than $\frac{\gamma + R}{\gamma + R(1-\tau)}$, it holds that $FA - CD < 0$. Hence, an increase in γ implies a larger amount of declared income since $BD - EA < 0$ holds.

(c) Finally, we define the amount of evaded income e as the difference between the true income and the declared income, that is, $e = RS - x$. Therefore, the effect of a rise in the parameter γ on the amount of evaded income is

$$\frac{de}{d\gamma} = R\frac{dS}{d\gamma} - \frac{dx}{d\gamma}. \tag{3.10}$$

Substituting (3.8) and (3.9) in (3.10) and collecting terms, we obtain

$$\frac{de}{d\gamma} = \frac{1}{BD - EA} \left[\Phi\left(\widehat{C}_2^Y\right) - \Phi\left(\widehat{C}_2^N\right) \right] \left[\Phi(C_1)(y - S) - 1 \right].$$

Since it has been proved that $BF - CE < 0$, the sign of $\frac{de}{d\gamma}$ depends only on the sign of the numerator. Under DARA it holds that $\left[\Phi\left(\widehat{C}_2^Y\right) - \Phi\left(\widehat{C}_2^N\right) \right] > 0$. Therefore, if the index of relative risk aversion is always larger than 1, we have that $\frac{de}{d\gamma} < 0$. ∎

Proposition 1 shows that when habits are stronger, the amount of saving becomes larger and the amount of declared income rises under the assumptions of decreasing

absolute risk aversion and large enough relative risk aversion. In this context, taxpayers form habits so that they do not derive utility from the absolute level of their consumption but from the comparison of the level of current consumption with that in the previous period. The presence of this process of habit formation implies that consumers dislike more to experience changes along their consumption path. Note that when γ rises, the taxpayer's utility decreases for the same values of saving and declared income as now past consumption becomes more important and this increases the taxpayers' degree of risk aversion. Then, there exist two mechanisms through which taxpayers can react to an increase of the importance of habits. The first one is through saving since the consumer can outweigh the effect of habit by increasing his saving. Note that an increasing in the amount of saving reduces the first period consumption and then the effect of habits diminishes. The second mechanism is through the amount of declared income. When taxpayer decides to increase his amount of declared income, two different effects take place. On the one hand, if the taxpayer voluntary declares more income, he also will pay more taxes and consequently C_2^N will decreases. On the other hand, more declared income implies that the penalty that the taxpayer has to pay if he is caught will be lower and, under the necessary assumption that $f(\tau) > \tau$, C_2^Y increases. Therefore, under the assumption of decreasing absolute risk aversion, when individuals become less wealthy the absolute risk aversion rises and, thus, taxpayers tend to declare more in order to reduce their risk exposure. My results show that saving increases because taxpayers are more willing to substitute second period consumption for first period consumption and, that declared income rises because of the assumptions of decreasing absolute risk aversion and large relative risk aversion.

In the standard static models of tax evasion the income is exogenous, whereas in the presented model the second period income is endogenous since it is determined by the amount of optimal saving. Then, more declared income does not imply less evaded income, since both saving and declared income increase. Proposition 1 shows that the amount of evaded income decreases, which means that the amount of declared income increases more than saving when habits become more important.

The effect of an increase on the habit intensity on the consumption profile is ambiguous in general. Trivially, first period consumption will decrease since the amount of saving is larger, and no other effects take place. This result was the expected one, since a reduction in first period consumption goes in the direction to offsetting the increase in the habit intensity. However, the effect on contingent second period consumption is ambiguous. This ambiguity is a consequence of the increase in the amounts of both saving and declared income. On the one hand, more saving implies more income and therefore more consumption. On the other hand, more declared income results in a higher tax bill, which reduces second period consumption. Finally, note that more declared income allows taxpayers to diminish the fine that they have to pay in case to be inspected by the tax authorities.

Nevertheless, I want to remark that the effect of a rise in the habits intensity on

second period consumption is not ambiguous under the strong assumption of constant absolute risk aversion (CARA). In this case, both consumptions C_2^N and C_2^Y will increase. Under the CARA assumption declared income increases in the same amount that RS does. Thus, the amount of evaded income remains constant. As $R > \tau$ it follows that the second period consumption when taxpayer is not inspected rises. Similarly, the second period consumption when inspection takes place also increases. It is easy to see that $C_2^Y = C_2^N - f(\tau)(RS - x)$ and as I mentioned before, the amount of concealed income does not change, so that C_2^Y becomes larger. The intuition of this result lies on the fact that an increase on habit intensity does not modify the amount of evaded income. When taxpayers become poorer, their absolute risk aversion does not vary so that they want to keep the same amount of investment in the risky asset. In this framework the amount of evaded income plays the role of a risky asset and, thus, taxpayers decide to evade the same amount as before.

4. Some Concluding Remarks

In this paper, I have introduced a habit formation process on consumption in order to analyze its consequence on tax evasion behavior. The results of my analysis show that, when habits are stronger, taxpayers reduce the amount of evaded income and they increase their saving. This is because the introduction of habits makes taxpayers more risk averse and, in order to offset this effect they end up declaring a larger amount of income. Therefore, the introduction of habit formation into the taxpayer's problem provides a reasonable explanation to the fact that the standard model of tax evasion predicts a level of evasion larger than the observed one.

One of the most controversial results in the tax evasion literature refers to the relationship between tax rates and declared income. Allingham and Sandmo (1972) showed that, under decreasing absolute risk aversion, the relation between declared income and tax rates is ambiguous when the fines are proportional to the amount of unreported income, while declared income is decreasing in the tax rate under the less realistic assumption of non-decreasing absolute risk aversion. On the other hand, Yitzhaki (1974) assumed that the fine paid by an audited evader is proportional to the amount of evaded taxes and he found that an increase in the tax rate increases the amount of declared income under decreasing absolute risk aversion. This modification of the Allingham and Sadmo model generates an unambiguous result that has not been supported by the empirical evidence since several studies have documented that higher tax rates tend to stimulate tax evasion.[3] Many authors such as Gordon (1989); Klepper et al. (1991), Lee (2001); and Panadés (2004), have searched for alternative models aimed at explaining this contradiction between the empirical findings and the theoretical predictions. It would be interesting to analyze if the introduction of a

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[3]Clotfelter (1983) and Poterba (1987) report a positive relation between tax rate and undeclared income using a real income data base.

process of habit formation in the preferences of taxpayers modifies the original result obtained by Yitzhaki (1974) in order to make it more plausible in empirical grounds.

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