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TAX EVASION AND THE LAUNDERING DECISION

by

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ABSTRACT

Contrary to a standard assumption in the tax evasion literature, the tax authorities rarely detect all undeclared income of investigated taxpayers. In the case of self-employed professionals, who may engage in a large number of income generating transactions during the tax year, the tax authorities do not even attempt to detect actual income at source. Instead, the authorities *assess* the undeclared income on the basis of approximate economic indices, such as the unexplained increase in taxpayers' net worth. This, however, might generate incentives for tax evaders to engage in costly laundering maneuvers aimed at making the increase in their net worth appear as stemming from a tax-exempt source. The present paper inquires into the tax evader's decision of whether (and to what extent) to launder his undeclared income, investigating the interrelationships between laundering and tax evasion as well as the optimal design of anti evasion-laundering policy. The findings stress the importance of incorporating direct means of detecting laundering maneuvers into the tax enforcement system. Failure to acknowledge the laundering phenomenon might even result, if laundering opportunities arise, in total loss of revenue from self-employment income.

I. INTRODUCTION

A standard assumption in the theoretical literature on tax evasion, originating by Allingham and Sandmo (1972), is that if audited by the tax authorities, the tax evader's actual income (and thus his undeclared income) is fully discovered. While this assumption seems appropriate for wage-earners whose income is derived from a limited number of sources, it is hardly acceptable for self-employed professionals (such as plumbers, cab drivers, accountants or private doctors) who may engage (sometimes in addition to wage employment) in a large number of income generating transactions, some (if not most) of which are carried out without any form of registration. Recognizing this, Das-Gupta (1994) has formulated a model of tax evasion by 'hard-to-tax' groups, for whom the tax authorities' ability to detect a given transaction has no bearing on their ability to detect any other transaction. The main result of the model, that the deterrent effect of penalties (as well as expected tax collection) diminishes with the number of transactions by which a given annual income is generated, may help explain why in practice the tax authorities rarely attempt to detect actual income at source. Instead, the authorities *assess* the income of 'hard-to-tax' professionals on the basis of approximate economic indices.[1]

[1]Such assessment, known as presumptive income taxation, is widely used in many developing and industrial countries. Some countries apply income presumptions for certain sectors not only for auditing purposes, but as a genaral means for assessing taxpayers' income (rather than taxing on an actual income base). While in most cases the presumptive approach has been followed for administrative reasons, there are also efficiency and equity considerations involved (see: Tanzi and Casanegra de Jantscher (1987) and Musgrave (1990)).

One method of income assessment practiced in many countries is the comparison of beginning-of-year and end-of-year net worth (i.e., assets minus debts).[2] The premise underlying this method is that the increase in the taxpayer's net worth over the year, adjusted (downwards) for non-income receipts and (upwards) for estimated consumption expenditures during the year, should approximate his post-tax declared income. The unexplained increment to net worth is perceived as undeclared income, unless the taxpayer can prove that it stems from some tax-exempt source (e.g., gifts, compensations, inheritances, capital gains from asset selling, lottery winnings, etc.).[3] This, however, may generate incentives for taxpayers to make part (or all) of their undeclared income appear as stemming from such a source, or to obscure the actual increase in net worth by disguising it as a legitimate loan. Such a fraudulent maneuver is generally known as income 'laundering'. As reported by Clarke and Tigue (1976), laundering is widely practiced by 'white-collar' criminals, seeking to enjoy the proceeds of tax evasion, bribary, embezzlement, or illegal stock manipulations while being able to provide, if requested, a solid explanation regarding the sources for their luxurious life style and rapid asset accumulation; it usually requires the services of a third party for the provision of false documents and entails an appropriate cost.[4]

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[2]This is usually done by requesting prospective candidates for investigation to submit a net worth statement at the beginning of the tax year and, if actually investigated, to submit a second statement at the end of the year. For a detailed description of the Israeli experience with the net worth assessment method see Wilkenfeld (1973).

[3]An alternative assessment method, derived from impressions of the standard of living maintained by taxpayers, is based on the premise that one who appears to be living well must have a good income. The difference between the assessed expenditures on maintaining a given standard of living and post-tax declared income is attributed to undeclared income, again, unless it is proved otherwise by the taxpayer. As an independent means of assessing income, the standard of living method is generally considered to be less reliable than that based on net worth.

[4]Laundering techniques are abundant, including, inter alia, the smuggling of money to a secret Swiss or a Caribbean bank account and its repatriation in the disguise of a legitimate bank loan (which

The tax evasion literature has so far overlooked the availability of laundering opportunities and their effect on the evasion decision.[5] The present paper addresses this issue under the net worth approach to income assessment. Section II begins with a formal description of the laundering environment. Sections III and IV identify entry conditions into laundering and discuss their effects on tax evasion, viewing laundering as either a foolproof or a risky activity, respectively. Section V examines the implications on deterrence policy, whereas Section VI concludes with some related remarks.

II. THE LAUNDERING ENVIRONMENT

Consider a professional worker who may divide his labor efforts between wage and self-employment. Suppose that his wage income during a given

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requires payments for currency exchange commissionn, courier and bank fees, bribes, etc.), the purchasing of winning lottery tickets from winning individuals at prices higher than the respective prizes (using the tickets as a proof of the unexplained increment in net assets), or the installing of luxury accessories in one's house so as to sell it at higher than its market value (claiming that the buyer was particularly enthusiastic about its location or the overlooking view).

[5]Actually, money laundering has failed to attract any analytical treatment at all, with two recent exceptions: Walter's (1985) study of the international market for financial secrecy and Yaniv's (1994) analysis of the individual's decision to launder money which has been the product of a criminal act (and concealed from the authorities by its nature), so as to avoid investigation initiated by unexplained spending capacity. A major laundering channel examined (which Clarke and Tigue (1976) claim to be commonly practiced by organized crime attempting to penetrate legitimate business) is declaring illegal proceeds as income stemming from a legal source (and paying the appropriate taxes). Obviously, a rational underreporter of legal income would not consider redeclaration as a reasonable laundering option, unless different income sources are subject to different rates of taxation. In this case, discussed in Yaniv (1990a), incentives may arise for a special form of tax evasion under which total income is truly declared while its true *composition* is not. Income source misreporting may then be viewed as a technique of laundering (sometimes less expensively) an unreported higher-taxed income by overreporting a lower-taxed source of income.

period, $G(\geq 0)$, as well as his self-employment income (net of related expenses), $Y(>0)$, are subject to a constant tax rate, θ, where taxes due on wage income are fully deducted at source by withholding regulations.[6] Suppose also that the taxpayer's net worth (i.e., the net value of his assets) at the beginning of the period, W_0, is known to the tax authorities, but his self-employment income over the period is known to him alone. He is thus required by law to declare his income to the tax authorities by filing a tax return.

Suppose, however, that the taxpayer considers the possibility of declaring to the authorities less than his true self-employment income, in which case his undeclared income, $S(\leq Y)$, will be taxed, if detected, at a penalty rate, $f\theta$, where $f>1$.[7] Suppose further that the tax authorities have no way of tracing out his actual income at source. Detection of tax evasion is only possible through the examination of his net worth at the end of the period, which, by assumption, is fully revealed (i.e., he does not 'stash' or give away property), as well as his consumption during the period. Assuming also that the taxpayer has no tax-exempt receipts of any kind (including capital gains from asset selling), and adjusting W_0 to take account of consumption expenditures, his net worth at the end of the period if not detected, W^+, will be

$$W^+ = W_0 + (1-\theta)M + \theta S, \tag{1}$$

where $M \equiv G+Y$ denotes total actual income and W_0, M and S (and thus W^+) are

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[6]While this implies that taxes due on wage income cannot be evaded by the employee, the withholding system might generate incentives for *employers* to cheat the tax authorities, by remitting less than the amount withheld [Yaniv (1988, 1995), Hagedorn (1989)] or by collaborating with employees in withholding less than required [Yaniv (1992), Baldry (1993)].

[7]This implies that the penalty is imposed on the evaded tax, θS (as first suggested by Yitzhaki (1974)), *rather than on the undeclared income* (as assumed by Allingham and Sandmo (1972)). The only difference between the implications of the alternative penalty schemes lies in the possible effects of changes in the tax rate, θ, on the taxpayer's behavior.

measured in real terms (of a composite market good, for example). The increase in the taxpayer's net worth above that explained by his post-tax declared income constitutes his undeclared income, since

$$W^{+} - [W_0 + (1-\theta)(M-S)] = S. \tag{2}$$

Applying the penalty to undeclared income, the taxpayer's final net worth in case of detection, W^{-}, will, however, be

$$W^{-} = W_0 + (1-\theta)M - (f-1)\theta S. \tag{3}$$

Suppose now that the taxpayer considers the option of laundering his undeclared income (i.e., disguising its true source by false documentation) at a constant unit cost, γ.[8] Suppose also that he is free to decide on the exact amount to be laundered, $L(\leq S)$.[9] If, with a known probability p, his tax return is audited by the tax authorities (who compare his declaration with the increase in his net worth), his penalty will depend on whether or not the authorities are convinced that an increment of L dollars to his net worth stems indeed from a tax-exempt source. If, with a (subjective) probability 1-q, the authorities are convinced, the penalty will only apply to the unexplained increment, $S - (1+\gamma)L$. Not only does laundering increase the explained increment to net worth by L dollars, it also leaves less to be explained, moderating the actual increase in net worth by the laundering costs of γL dollars. If, however, the tax authorities are not convinced, his laundering maneuver and costs are bound to be revealed. Consequently,

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[8]If different income sources were subject to different rates of taxation, the taxpayer could also launder an unreported higher-taxed income by overreporting a lower-taxed income, the unit cost γ representing the lower tax rate. This possibility has been discussed in Yaniv (1990a), where the taxpayer is assumed to overreport his *entire* unreported income (i.e., there is no 'pure' underreporting), and where his gain, as well as his penalty if detected, depends on the difference between the tax rates.

[9]That is, there are no indivisibility problems on the supply side of laundering services, as there are, for example, if the taxpayer can only purchase winning lottery tickets of given prizes.

the penalty for tax evasion will apply to his entire undeclared income, and an additional penalty, at the rate of $\delta f\theta$, where $\delta \geq 0$, might be imposed on L for attempted laundering.[10] We hereafter refer to these alternative cases as 'partial detection'[11] and 'full detection', respectively.

Finally, suppose that the taxpayer's utility at each possible 'state of the world' depends on net worth only, and that he chooses S* and L* so as to maximize the expected utility of his prospect. The utility function is assumed to be strictly concave, implying that the taxpayer is risk-averse.

III. FOOLPROOF LAUNDERING

We begin analyzing the taxpayer's behavior under the assumption that he views laundering as a foolproof device to reduce his penalty liability. That is, suppose that the taxpayer has no doubt in his ability to convince the tax authorities, if being audited, that the amount laundered is tax-exempt, hence $q=0$. Laundering per se thus becomes a non-risky operation, contributing no additional uncertainty to the model. Expected utility is therefore given by

$$E[U(W)] = (1-p)U(W^{nd}) + pU(W^{pd}), \tag{4}$$

where $$W^{nd} = W^{+} - \gamma L \tag{5}$$

and $$W^{pd} = W^{-} + [f\theta(1+\gamma) - \gamma]L \tag{6}$$

[10]That is, the penalty on laundering is imposed on the undeclared income falsely claimed to stem from a tax exempt source, and is assumed to be proportional to the penalty evaded due to such claim, $f\theta L$. Notice, however, that since laundering involves a direct cost, there is a 'penalty' for unsuccessful laundering even if $\delta=0$.

[11]The possibility of partial detection of the taxpayer's undeclared income has also been considered by Wadhawan (1992). However, while Wadhawan assumed that the amount detected is a random variable, drawn out of a given density function, the present paper allows the amount detected to be determined by the taxpayer via his laundering decision.

denote his final net worth in case of non-detection and partial detection, respectively.

Suppose first that the taxpayer became aware of the laundering option only *after* he had filed his income tax return.[12] The laundering decision is thus seperate from his predetermined evasion level. The first-order condition determining S^* is[13]

$$EU_S = \theta[(1-p)U'(W^+) - (f-1)pU'(W^-)] = 0, \tag{7}$$

whereas that determining L^* is

$$EU_L = -\gamma(1-p)U'(W^{nd}) + [f\theta(1+\gamma) - \gamma]pU'(W^{pd}) = 0. \tag{8}$$

The second-order conditions for the maximization of expected utility, $EU_{SS}<0$ and $EU_{LL}<0$, are satisfied by risk-aversion.[14] A sufficient requirement for tax evasion ($S^*>0$) is $EU_S\,|_{S=0} > 0$, which immediately dissolves to the well-known condition $pf<1$. A sufficient requirement for laundering ($L^*>0$) is

$$EU_L\,|_{L=0} = -\gamma(1-p)U'(W^+) + [f\theta(1+\gamma) - \gamma]pU'(W^-) > 0, \tag{9}$$

which, after the substitution of (7), reduces to $\theta(1+\gamma) > \gamma$.[15] Contrary to

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[12]Alternatively, suppose that laundering opportunities (to be described below) have emerged only after the taxpayer filed his income tax return.

[13]As usual, subscripts are used to denote partial derivatives; that is, $EU_i = d(EU)/di$, $EU_{ii} = d^2(EU)/di^2$, for $i = S, L$.

[14]Clearly, risk-aversion $[U''(W)<0]$ ensures that

$EU_{SS} = \theta^2[(1-p)U''(W^+) + (f-1)^2pU''(W^-)] < 0,$

$EU_{LL} = \gamma^2(1-p)U''(W^{nd}) + [f(1+\gamma)\theta - \gamma]^2pU''(W^{pd}) < 0.$

[15]Notice that while $W^+=W^-$ for $S=0$, $W^{nd}=W^+ > W^{pd}=W^-$ for $L=0$.

intuition, *laundering might be practiced even if $\theta < \gamma$*. To see why, notice that laundering a dollar of undeclared income reduces the unexplained increment to net worth by more than a dollar (i.e., by $1+\gamma$ dollars). It thus saves the taxpayer $f\theta(1+\gamma)$ dollars in case of an audit while costing him γ dollars in any case. However, he could have avoided the possible loss of $f\theta(1+\gamma)$ dollars in the first place by reducing underreporting by $(1+\gamma)$ dollars at the price of $\theta(1+\gamma)$ dollars. Given that $\theta(1+\gamma) > \gamma$, laundering offers loss avoidance at a lower price (even if γ exceeds θ), making it more attractive at the margin. Figure 1 illustrates the new opportunity boundary, of the slope $\gamma/[f\theta(1+\gamma) - \gamma)]$, now open for the taxpayer, starting at any evasion-equilibrium point, E_0. The laundering-equilibrium point is reached at E_1, where the taxpayer, who evades 'ac' in taxes, spends 'ab' on laundering, choosing a lower W^{nd} but a higher W^{pd}.

It is also interesting to identify the condition under which the taxpayer will launder a fraction $1/(1+\gamma)$ of his undeclared income, sufficient to avoid penalty altogether. Setting $EU_L \,|_{L=S/(1+\gamma)} \geq 0$ reveals that this occurs when $pf\theta(1+\gamma) \geq \gamma$. That is, when the expected gain per laundered dollar is at least as high as its certain cost. While a positive expected profit per *undeclared* dollar $[\theta(1-pf) > 0]$ is sufficient to ensure entry into *tax evasion*, a positive (more precisely, a non-negative) expected profit per *laundered* dollar is more than sufficient to ensure entry into *laundering*; it actually ensures 'full' laundering of the undeclared income.

Assuming $pf\theta(1+\gamma) < \gamma < \theta(1+\gamma)$, so that an interior optimum prevails, Appendix A examines the effect on laundering of parameter changes occuring *after* the filing of the taxpayer's return. An increase in the income tax rate, the penalty rate or the audit probability is found to unambiguously *increase* the amount laundered, the latter due to a positive substitution effect whereas the two former due to same-direction (positive) substitution and wealth effects. The substitution effect arises because an increase in either θ, f, or p increases the expected gain per laundered dollar, $pf\theta(1+\gamma)$, without affcting the cost,[16] thus raising the relative

[16]It is interesting to note that if the penalty is imposed on the undeclared income, rather than on the

attractiveness of laundering on the margin. The wealth effect arises because an increase in either θ or f reduces net worth, which, under the accepted assumption of decreasing absolute risk-aversion, tends to discourage risk-taking (thus encouraging laundering to lower the expected penalty). However, an increase in the unit cost of laundering, while generating a negative substitution effect, would unambiguously decrease the amount laundered only if $f\theta\geq 1$, for which the wealth effect is also negative, irrespective of risk-aversion response to net worth changes.[17] Appendix A shows also that *the greater the predetermined level of undeclared income, the greater will be the amount laundered as well as the fraction laundered out of undeclared income. Hence, laundered income rises faster than undeclared income.*

Allowing now the taxpayer to jointly determine his undeclared income and the amount laundered, the first-order conditions for the maximization of expected utility become

$$EU_{s} = \theta[(1-p)U'(W^{nd}) - (f-1)pU'(W^{pd})] = 0 \qquad (10)$$

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evaded tax, a change in θ would have no effect on the expected gain. Consequently, the substitution effect would drop, and the positive relationship between L^* and θ would hold by the positive wealth effect only. This is in contrast to the relationship existing between S^* and θ, where the positive substitution effect drops under the *assumed* penalty scheme, leaving behind an unambiguous negative wealth effect.

[17]Obviously, the conventional interpretation of the wealth effect in tax evasion models (applied above for a change in θ and f), is inapplicable to this case. Perceiving, however, risk-aversion as a stimulant for cushioning any exogenous shock affecting either 'state of the world' net worth (Yaniv, 1990b), an increase in γ, which decreases W^{nd} and, given $f\theta>1$, *increases* W^{pd}, would generate two same-direction wealth effects to encourage risk-taking (i.e., to decrease L^*), as this would help to increase the former and to decrease the latter. However, when $f\theta<1$, an increase in γ decreases W^{pd} as well, producing two opposite-direction wealth effects: if net worth were to fall by the same amount in both 'states of the world', the greater risk-aversion in the state of detection would suffice to imply that L^* should rise; since net worth falls less in the state of detection, the result is ambiguous.

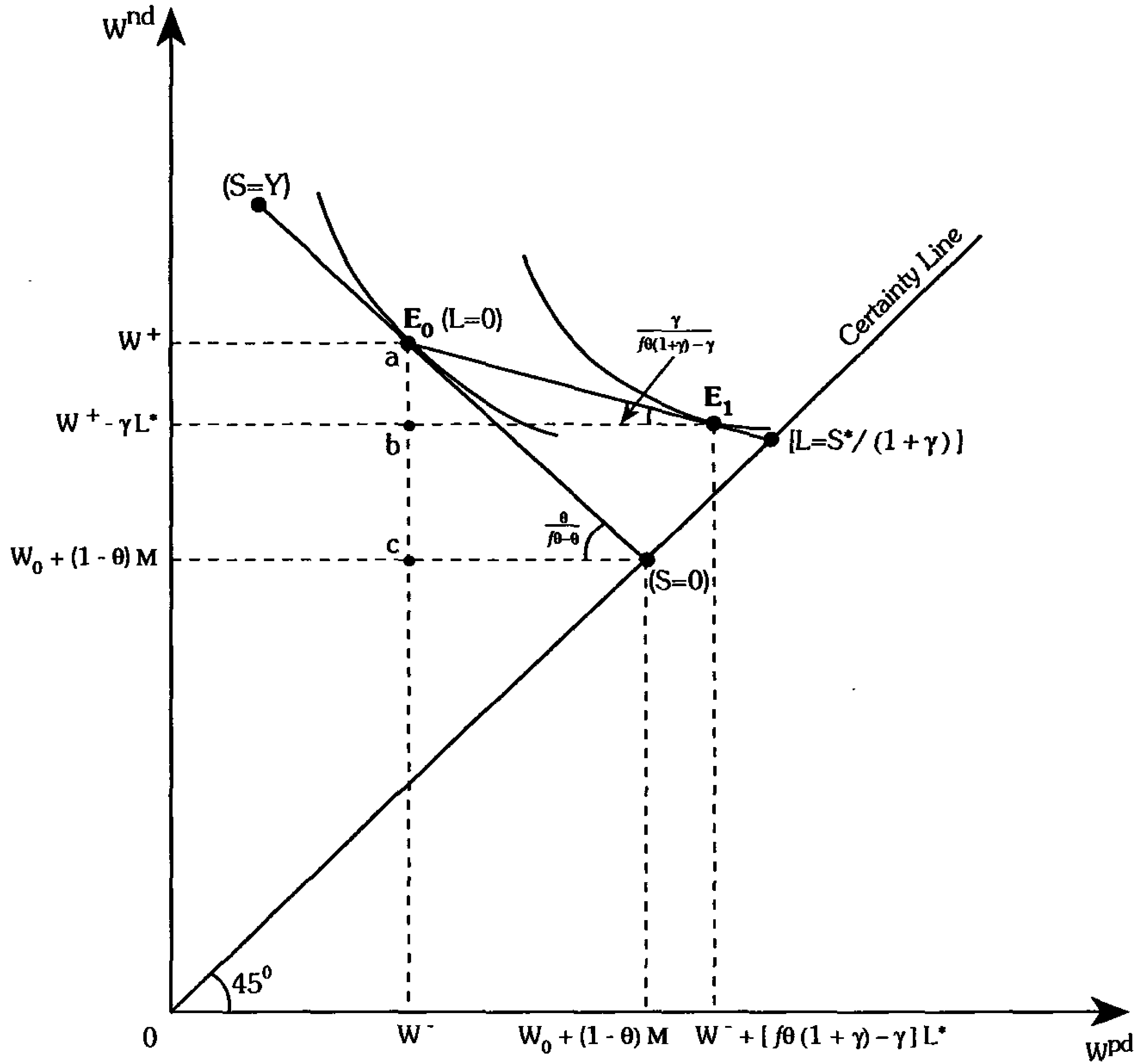

Figure 1: The evasion-laundering eqvilibrium

and (8). Evaluating (10) at $S=0=L$ reveals that the entry condition into tax evasion is still $pf<1$, that is, independent not only of the income tax rate but of the laundering cost rate as well. The entry condition into laundering is thus left intact, $\theta(1+\gamma)>\gamma$, dependent, in contrast, on both rates. However, substituting (10) into (8) we obtain

$$EU_L = [\theta(1+\gamma) - \gamma]EU'(W) = 0, \tag{8'}$$

which implies that a simultaneous solution of (10) and (8) is only possible if $\theta(1+\gamma)=\gamma$. Hence, $L^*=0$ in this case, since laundering does not offer the taxpayer a better tradeoff between W^{nd} and W^d than that already existing through evasion. Only if γ falls below $\theta(1+\gamma)$ will laundering incentives arise. This, however, implies that $EU_L>0$ for any L if evasion is optimal, inducing a corner solution at $L^* = S^*/(1+\gamma)$, which fully neutralizes the expected penalty. Expected utility thus reduces to $E[U(W)] = U(\hat{W})$, where

$$\hat{W} = W_o + (1-\theta)M + (\theta - \frac{\gamma}{1+\gamma})S. \tag{11}$$

Given that $\theta(1+\gamma) > \gamma$, expected utility will be maximized by setting $S^* = Y$. Hence, tax evasion will not just rise with the emergence of foolproof laundering opportunities. Actually, *the tax evader will choose to conceal his entire self-employment income, laundering the amount needed to fully offset the unexplained increase in his net worth. Consequently, the audit probability and the penalty rate will cease to be effective in deterring tax evasion on the margin. Combatting laundering thus becomes an inevitable tool for preventing all taxes due on self-employment income from escaping the tax collector.*

IV. RISKY LAUNDERING

The fact that most professional workers declare some positive income from self-employment suggests that they do not consider their laundering options as a foolproof means of disguising their undeclared income. Let us therefore impose uncertainty on the laundering decision, assuming $0 < q \le 1$. Expected utility will then be given by

$$E[U(W)] = (1-p)U(W^{nd}) + p[(1-q)U(W^{pd}) + qU(W^{fd})], \tag{12}$$

$$\text{where} \qquad W^{fd} = W^{-} - (\gamma + \delta f\theta)L \tag{13}$$

denotes the taxpayer's net worth in case of full detection.

Considering first the case where tax evasion is predetermined by (7), the first-order condition determining L^* becomes

$$EU_L = -\gamma(1-p)U'(W^{nd}) +$$

$$p\{[f\theta(1+\gamma) - \gamma](1-q)U'(W^{pd}) - (\gamma + \delta f\theta)qU'(W^{fd})\} = 0. \tag{14}$$

Evaluating (14) at $L=0$, reveals that entry into laundering now requires that $\theta[(1-q)(1+\gamma) - q\delta] > \gamma$, which is a stricter condition than before, as the (expected) gain per laundered dollar in case of being audited is lower (even if $\delta=0$). Given θ, γ and δ, laundering will be practiced if $q < [\theta(1+\gamma) - \gamma]/\theta(1+\gamma+\delta) \equiv \bar{q}$, a prerequisite for which is still $\theta(1+\gamma) > \gamma$. Similarly, evaluating (14) at $L=S/(1+\gamma)$, the necessary condition for 'full' laundering becomes $p\{f\theta(1+\gamma) - q[(\gamma + \delta f\theta)U'(W^{fd})/U'(\hat{W}) - \gamma]\} \ge \gamma$, which is also stricter than before, due to the riskiness now involved in attempting laundering.

Examining the effect on laundering of parameter changes, Appendix B shows that while the substitution effect is, in general, of the same sign as that identified in the foolproof case, the wealth effect is ambiguous, as laundering, which serves to reduce risk, is now subject to risk itself. Consequently, risk-aversion, which previously acted solely to *encourage* laundering, now also acts schizophrenically to *discourage* laundering. In particular, no clear-cut relationship emerges between the amount laundered and the predetermined level of undeclared income. The newly added parameters, the probability of laundering detection and the penalty on laundering, have, however, an unambiguously negative effect on the amount laundered. The deterrence effect of the former holds even if there is no additional penalty for laundering, since it establishes a risk that the costly 'investment' in laundering will yield no return.

When undeclared income and the amount laundered are jointly determined, the first-order conditions for the maximization of expected utility are

$$EU_S = \theta\{(1-p)U'(W^{nd}) - (f-1)p[(1-q)U'(W^{pd}) + qU'(W^{fd})]\} = 0 \qquad (15)$$

and (14). Substituting (15) into (14) we obtain

$$EU_L = pf\{[\theta(1+\gamma) - \gamma](1-q)U'(W^{pd}) - (\gamma + \delta\theta)qU'(W^{fd})\} = 0, \qquad (14')$$

which, given $pf<1$, may be satisfied at an interior solution. Since laundering responds ambiguously to most parameter changes when evasion is predetermined, clear-cut comparative static results on either L or S can hardly be expected when evasion is simultaneously adjusted. Even the effect of a change in δ or q becomes ambiguous: while an increase in either parameter reduces L when S is held fixed, it now generates a negative substitution effect on S, which might *increase* L and offset the previously obtaimed deterence effect. Similarly, the deterrence effect on S is obscured when L is simultaneously adjusted. However, at $q = 0$, dS^*/dL is unambiguously positive (see Appendix B). Hence , a rise in q above zero is bound to discourage evasion not only directly, but also indirectly through the fall in laundering (given, of course, that $pf\theta(1+\gamma) < \gamma$). Similarly, at the laundering entry threshold, $q = \bar{q}$, dS^*/dL is also unambiguously positive (reducing to the simple term γ/θ). Hence, a fall in q, although not affecting evasion directly, will indirectly encourage evasion through its inducive effect on laundering. *It thus follows that tax evasion would unambiguously increase with the emergence of risky laundering opportunities. Contrary, however, to the foolproof case, the tax evader, acknowledging the possibility that the tax authorities might unveil his laundering maneuver, would not necessarily evade his entire income.*

V. OPTIMAL DETERRENCE POLICY

While the tax authorities are unable to detect (even with a highly loose budget) *all* income generating transactions of 'hard-to-tax' professionals, thus opting to assess the evaded income by the unexplained increase in net worth, they *might* still be able to refute a false claim that a given increment to net worth has stemmed from some specific tax-exempt source (without necessarily revealing its true origin). This, however, requires additional resources (beyond those necessary to determine the increase in net worth) for in-depth examination and collaboration of the taxpayer's allegation, and should be outweighed against the expected increase in tax and penalty collection (as well as against the alternative use of resources for the investigation of additional taxpayers). Hence, exposing *all* laundering maneuvers taken by 'hard-to-tax' professionals may not be optimal. On the other hand, avoiding laundering detection efforts altogether is bound to result, if laundering opportunities exist, in a total loss of revenue from self-employment income. It thus follows that some efforts must be undertaken to rebut (and punish) at least *some* false claims, making it known that the probability of failing to convince the tax authorities in the authenticity of an alleged source for the unexplained increase in net worth is positive.

Formally, the expected revenue of the tax authorities from a typical professional worker, $E(T)$, stems from the taxes he pays on his declared income as well as from the expected penalties on both the unexplained increment to his net worth and the amount he launders. That is,

$$E(T) = \theta\{M - S + pf[(1-q)(S - (1+\gamma)L) + q(S+\delta L)]\} =$$

$$\theta\{M - (1-pf)S - pf[(1-q)(1+\gamma) - q\delta]L\}. \qquad (16)$$

Clearly, both evasion and laundering reduce the revenue expected from the taxpayer below his true tax liability, θM. Moreover, as shown in the previous sections, laundering is accompanied by increased evasion; when laundering is foolproof ($q=0$), expected revenue would even drop down to the amount withheld, θG, as $L=S/(1+\gamma)$ and $S=Y$.

Given θ and f (set exogenuously by the tax laws), the standard approach in the tax enforcement literature is to allow the tax authorities to choose the audit probability, p, so as to maximize a utilitarian welfare function (subject to a given revenue constraint).[18] Suppose accordingly that the tax authorities, being aware of the laundering activity, are faced with the more complicated problem of choosing p and q (i.e., the 'width' *and* 'depth' of auditing) as well as δ, so as to maximize the expected social welfare of the 'hard-to-tax', $E(V)$, *subject to a fixed (net of collection costs)* revenue requirement, $\bar{T}$. Suppose also that collection costs, $C(p, q)$, increase with either p or q, so that $C_p>0$ and $C_q>0$, where $C_{pp}\geq 0$ and $C_{qq}\geq 0$. Denoting by N the number of the 'hard-to-tax' and assuming that they all have the same preferences and opportunities, the tax authorities' problem can be stated as

$$\max_{p,q,\delta} \; E(V) = N\{(1-p)U(W^{nd}) + p[(1-q)U(W^{pd}) + qU(W^{fd})]\} \tag{17}$$

$$\text{s.t: } N\theta\{M - (1-pf)S - pf[(1-q)(1+\gamma) - q\delta]L\} - C(p, q) = \bar{T},$$

where W^{nd}, W^{pd} and W^{fd} are given by (5), (6) and (13), respectively.

The necesary conditions for an interior maximum with respect to p, q and δ, are (applying the Envelope Theorem, and rearranging)

$$[U(W^{nd}) - U(W^{pd})]/q + [U(W^{pd}) - U(W^{fd})] = (\mu/q)(ET_p - C_p/N) \tag{18}$$

$$[U(W^{pd}) - U(W^{fd})] = (\mu/p)(ET_q - C_q/N) \tag{19}$$

$$LU'(W^{fd}) = (\mu/pqf\theta)ET_\delta, \tag{20}$$

respectively, where μ is the Lagrange multiplier of the budget constraint. Since raising either deterrence instrument above zero entails welfare loss

[18]See, for example, Slemrod and Yitzhaki's (1987) analysis of the optimal size of the tax collection agency and Cowell's (1990, ch. 8) enlightening discussion of enforcement policy design.

and raising the first two instruments incur additional collection costs, the only rationale for law enforcement is that the marginal revenue is positive. We thus assume that $ET_k > 0$ at the optimum, for $k = p, q, \delta$. Condition (20) then implies that $\mu>0$ at that point. It immediately follows that $ET_p > C_p/N$ and $ET_q > C_q/N$ at the optimum. The first result is analogous to that of Slemrod and Yitzhaki (1987), implying, the same as the second result, that detection efforts should halt at a point where the marginal revenue per taxpayer is still greater than the marginal collection cost (rather than being pushed further to the net-revenue maximization level). The reason for this is, of course, the utilitarian requirement that the expected welfare of the 'hard-to-tax', which is adversely affected by enforcement efforts, will be respected.

A glance at the optimum conditions reveals also that the L.H.S of (18) is greater than that of (19). Hence,

$$\frac{ET_p - C_p/N}{q} > \frac{ET_q - C_q/N}{p} \tag{21}$$

at the optimum. Rearranging we may write (21) as

$$\varepsilon_{c,p}(\Gamma_p - 1) > \varepsilon_{c,q}(\Gamma_q - 1), \tag{22}$$

where $\varepsilon_{c,k} \equiv kC_k/C>0$ denotes the elasticity of collection costs with respect to k and $\Gamma_k \equiv N(ET_k/C_k)>1$ represents the additional revenue from increasing k *per dollar* of additional collection cost. Contrary to the simple cost-benefit rules, the yields per additional dollar of resources spent on either policy instrument (i.e., Γ_p and Γ_q) must not only be greater than one dollar, they should not necessarily equal each other at the social optimum. More specifically, when $\varepsilon_{c,q} \geq \varepsilon_{c,p}$, condition (22) implies that p and q should be chosen such that $\Gamma_p > \Gamma_q$. Otherwise, the socially desired relation between Γ_p and Γ_q is ambiguous.

Finally, since the welfare loss from raising q [the L.H.S. of (19)] is zero at $q=\bar{q}$ (where $W^{pd}=W^{fd}=W^{-}$), the sufficient condition for the tax authorities to provide incentives for laundering (i.e., choose $q<\bar{q}$) must be the same as that under a net-revenue maximization policy, namely, that the marginal savings in collection costs exceed the marginal loss in revenue. That is

$$ET_{q|q=\bar{q}} = \theta(1-pf)\left.\frac{dS^*}{dq}\right|_{q=\bar{q}} + pf\gamma\left.\frac{dL^*}{dq}\right|_{q=\bar{q}} < C_{q|q=\bar{q}}/N. \tag{23}$$

However, since $dS^*/dq = (dS^*/dL)(dL^*/dq)$ at $q=\bar{q}$, and $dS^*/dL = \gamma/\theta$ at this point (see Appendix B), laundering incentives will be provided if $\gamma(dL^*/dq)_{|q=\bar{q}} < C_{q|q=\bar{q}}/N$. That is, if the reduction in the tax authorities' costs to eliminate laundering is greater than the resulting increase in taxpayers' laundering costs - otherwise transfered to the authorities as tax revenue.

VI. *CONCLUDING REMARKS*

Applying the net worth approach to the assessment of actual income, we have inquired into the tax evader's decision of whether (and to what extent) to engage in costly laundering maneuvers so as to make the increase in his net worth appear as stemming from a tax-exempt source. Showing that laundering is accompanied by increased evasion, the paper stresses the importance of incorporating direct means of laundering detection into the tax enforcement system. In particular, when laundering is viewed by the tax evader as a foolproof means of concealing his undeclared income, deciding in favor of laundering is bound to result (if it is jointly determined with tax evasion) in the concealment of his *entire* income from self-employment. Some general guidelines for the optimal design of anti evasion-laundering policy have thus been offered.

A simplifying feature of the laundering model constructed in this paper is that there is only one laundering option of a given unit cost. In practice, however, the tax evader may face a large number of laundering channels of different costs and reliability. A choice of the laundering channel, or of several laundering channels through which different amounts will be laundered, may be necessary. A possible extension of the present model is to allow for this complexity, letting the taxpayer to choose the unit cost of laundering (and thus the laundering channel), assuming naturally that the higher the cost the more reliable the channel (that is, the lower the probability that it would be refuted by the tax authorities). Laundering channels of sufficiently high cost may be assumed to be foolproof and laundering channels of zero cost - to be totally unreliable.

Another basic feature of the model is that the audit probability is exogenously fixed. A broader approach could make the audit probability dependent upon visible evidence for an exceptional increase in a taxpayer's wealth (such as a recently purchased secondary residence, luxury car or yacht). The skillful evader should then be concerned with how to *use* his undeclared income (an important issue ignored in the tax evasion literature), specifically with its preferred division between visible and non-visible assets (the former supposedly contributing to utility more than the latter, but increasing the audit probability as well). In the case where the unexplained increase in net worth is assessed on the basis of two net worth statements, rather than solely on the basis of visible signs of wealth, incentives may arise to overreport assets on the first statement (to establish an explanation for the expected rise in actual net worth) and underreport assets on the second.

The focus of this paper has been on the *demand* for laundering. The *supply* side (which, together with aggregate demand, determines the unit cost of laundering) deserves public attention as well. As Walter (1985) reports: "money laundries have become big business, involving bank employees, executives, lawyers, accountants and other professionals at all levels... government agents running an undercover drug operation are getting solicited with all kinds of offers from business and professional people willing to provide them with false documents to give them an apparently legitimate source of income or to avoid taxes" (p. 80). Indeed, over the last decade, much American Congressional and law enforcement effort has been devoted to developing statutes for use not only against those who launder money but also against those who assist them, stating, inter alia, that it is illegal to "conduct or attempt to conduct a financial transaction if it is known that the proceeds used in the transaction are from an illegal activity" as well as to "take part in a transaction that is designed to conceal or disguise, in any mannar, the proceeds of an illegal activity".[19] Combatting suppliers of laundering services is bound to reduce the availability of laundering channels, raise the unit cost of laundering and adversely affect laundering incentives. A comprehensive approach to the design of anti evasion-laundering policy should allow tax authorities to set the probability of detection and penalty for *both* demanders and suppliers of laundering services, incorporating (domestic) suppliers' utility as well into the social welfare function.

[19] See "Money Laundring and Asset Forfeiture", International Money Laundering and Asset Forfeiture Training, Department of the Treasury, Internal Revenue Service, 1995.

APPENDIX: COMPARATIVE STATICS

A. Foolproof Laundering

Totally differentiating (8) with respect to L and any parameter k (= θ, f, γ) which may affect net worth, we obtain (holding S constant)*

$$\frac{dL^*}{dk} = -\frac{1}{EU_{LL}}(1-p)U'(W^{nd})\left[(W^{nd})_{Lk} + \frac{\gamma}{f\theta(1+\gamma)-\gamma}(W^{pd})_{Lk}\right] +$$

$$+\frac{\gamma}{EU_{LL}}(1-p)U'(W^{nd})\left[(W^{pd})_k R_A(W^{pd}) - (W^{nd})_k R_A(W^{nd})\right], \qquad \text{(a)}$$

where $R_A(W) = -U''(W)/U'(W) > 0$ is the Arrow-Pratt absolute risk-aversion measure. The upper term of (a) represents the substitution effect, the sign of which depends solely on the parameters of the model. The lower term is the wealth effect, the sign of which depends also on risk-aversion behavior with net worth changes. Assuming decreasing absolute risk-aversion [$R_A(W^{pd}) > R_A(W^{nd})$], and substituting into (a) the values of $(W^i)_k$ and $(W^i)_{Lk}$ summarized in the table below

	θ	f	γ
$(W^{nd})_{Lk}$	0	0	-1
$(W^{pd})_{Lk}$	$f(1+\gamma)$	$\theta(1+\gamma)$	$f\theta-1$
$(W^{nd})_k$	$-(M-S)$	0	$-L$
$(W^{pd})_k$	$-(M-S) - f[S - (1+\gamma)L]$	$-\theta[S - (1+\gamma)L]$	$(f\theta-1)L$

we have $dL^*/d\theta > 0$, $dL^*/df > 0$, and $dL^*/d\gamma < 0$ if $f\theta \geq 1$. Totally diferentiating (8) with respect to L and p yields $dL^*/dp = -\gamma U'(W^{nd})/pEU_{LL} > 0$.

*For notational convenience we denote $(W^i)_k = d(W^i)/dk$ and $(W^i)_{Lk} = d^2(W^i)/dLdk$, for i = nd, pd.

Considering the effect on laundering of a change in undeclared income, we may substitute into (a) $(W^{nd})_{LS} = (W^{pd})_{LS} = 0$, $(W^{nd})_S = \theta$, and $(W^{pd})_S = -(f-1)\theta$, obtaining $dL^*/dS > 0$. Examining the effect of a change in undeclared income on the *proportion* laundered, we have

$$\frac{d(L^*/S)}{dS} = \frac{S(dL^*/dS) - L^*}{S^2} =$$

$$= \frac{(1-p)\gamma U'(W^{nd})}{S^2 EU_{LL}} \{R_R(W^{pd}) - R_R(W^{nd}) - (1-\theta)M[R_A(W^{pd}) - R_A(W^{nd})]\}, \quad \text{(b)}$$

where $R_R(W) = -WU''(W)/U'(W) > 0$ is the Arrow-Pratt relative risk-aversion measure. Assuming non-decreasing relative risk-aversion $[R_R(W^{pd}) \leq R_R(W^{nd})]$, yields $d(L^*/S)/dS > 0$.

B. Risky Laundering

Totally differentiating (14) with respect to L and k, we obtain (holding S constant)

$$\frac{dL^*}{dk} = \left.\frac{dL^*}{dk}\right|_{q=0} - \frac{1}{EU_{LL}} pqU'(W^{fd})[(W^{fd})_{Lk} + \frac{\gamma + \delta f\theta}{f\theta(1+\gamma) - \gamma}(W^{pd})_{Lk}] +$$

$$- \frac{1}{EU_{LL}} pqU'(W^{fd})[\gamma + \delta f\theta][(W^{fd})_k R_A(W^{fd}) - (W^{pd})_k R_A(W^{pd})], \quad \text{(c)}$$

where $(dL^*/dk)|_{q=0}$ is given by (a). Hence, risky laundering contributes an additional component to both the substitution and wealth effects produced by a change in k. It can easily be verified that while the additional substitution effect is of the same sign as that emerging in the full-proof case [with the exception of $k=\gamma$, for which it is unambiguously negative only if $f\theta<(1+\delta)/\delta]$, the additional wealth effect is always of the opposite sign, obscuring the sign of (c). However, since $dL^*/d\delta|_{q=0} = 0$, substituting $(W^{pd})_{L\delta} = 0$, $(W^{fd})_{L\delta} = -f\theta$, $(W^{pd})_{\delta} = 0$ and $(W^{fd})_{\delta} = -f\theta L$ into (c) we unambiguously obtain $dL^*/d\delta < 0$. Also, differentiation of (14) reveals that $dL^*/dq < 0$, as expected, whereas $dL^*/dp > 0$ as before. When evasion and laundering are jointly determined, the comparative static results for either L or S are, in general, ambiguous. Two important exceptions concerning the relationship between evasion and laundering at the critical points $q=0$ and $q=\ddot{q}$ (relevant for deterrence policy) are

$$\left.\frac{dS^*}{dL}\right|_{q=0} = \frac{\theta U''(\hat{W})}{EU_{ss}}[\gamma(1-pf) + p(f-1)f\theta(1+\gamma)] > 0,$$

and

$$\left.\frac{dS^*}{dL}\right|_{q=\ddot{q}} = \frac{\theta\gamma}{EU_{ss}}[(1-p)U''(W^+) + (f-1)^2pU''(W^-)] = \frac{\gamma}{\theta} > 0.$$

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