NBER WORKING PAPER SERIES

ANTI-TAX REVOLUTIONS AND SYMBOLIC PROSECUTIONS

Holger C. Wolf

Working Paper No. 4337

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 1993

I thank Richard Eckhaus, Rüdiger Dornbusch, Stanley Fischer, Roger Gordon and Jim Poterba for helpful comments. Financial support from the Center for European Studies, Harvard University is gratefully acknowledged. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

NBER Working Paper #4337
April 1993

ANTI-TAX REVOLUTIONS AND SYMBOLIC PROSECUTIONS

ABSTRACT

We extend the traditional tax evasion model to take account of the interaction between individual compliance decisions and perceived detection probabilities. The generalization provides a rationale for "anti-tax revolutions" characterized by a sudden shift of a significant fraction of the tax paying citizenry from compliance to tax evasion with unchanged fundamentals and monitoring rules. We establish, with an application to hyperinflation, the possibility of multiple compliance equilibria with lock-in effects. Finally, we demonstrate the potential cost effectiveness of "symbolic prosecution" as an equilibrium shifting device in preference to permanent changes the monitoring process.

Holger C. Wolf
Department of Economics
Stern School of Business
New York University
90 Trinity Place
New York, NY 10006
and NBER

In contrast to the individual tax payer's compliance choice, the *aggregate* manifestation of tax evasion, the "anti-tax revolution" characterized by a fairly sudden shift of a significant fraction of the tax paying citizenry from compliance to tax evasion, has attracted scant analytical attention. Yet the whole may well be more than the sum of its parts. Specifically, we model tax revolutions as manifestations of an underlying multiple equilibria structure of tax compliance decisions. In this setting, aggregate shifts towards non-compliance can be optimal responses even in an environment where an individual not taking account of other taxpayer's behavior would find it optimal to comply.

An individual's decision whether to cheat on taxes depends, *ceteris paribus*, on her perceived detection probability. For a given monitoring outlay and a non-random audit policy, this perceived probability in turn depends negatively on the *expected* number of tax cheaters in the remainder of the population. The combination of the negative dependence of the probability of detection on the number of tax cheaters with the negative dependence of the return to non-compliance on the probability of detection creates a *strategic complementarity*: the attractiveness of cheating for any individual increases in the number of other cheaters. If strong enough, the strategic complementarity can generate multiple rational expectations equilibria indexed on prior beliefs about the number of cheaters in the tax paying population: the belief that other tax payers will cheat can be sufficient to induce the individual to cheat and *vice versa*.[1]

We present a formalization of the tax compliance problem with endogenous detection probabilities in the next section. While sudden shifts of large fractions of the tax-owing population from compliance to cheating are unlikely in politically and economically stable systems, they are a frequent occurrence in times of political and economic turmoil. In section two we turn to inflation as an example of such a setting. Informal evidence suggests a sharp decline in tax honesty during several Latin American mega inflations. The worsening compliance record seems moreover to have persisted into the post-stabilization period. Our model provides a rationalization both for the initial decline and for the persistence of low tax compliance. In the last section we turn to policy issues. In contrast to the state independent optimal auditing strategies implied by the standard approach, the model developed below suggests a role for the bunching of the monitoring effort in a single period in order to coordinate expectations on the high-compliance equilibrium.

1 Multiple Equilibria In Compliance Choices

The game between taxpayers and the collection agency has attracted substantial attention. The traditional approach (Allingham and Sandmo(1972), Srinivasan(1973)), models the individual choice as an expected utility maximization problem: the complying tax payer receives a certain post-tax income, the tax cheater faces an uncertain income depending on whether or not she is audited. Given her risk aversion, the individual maximizes her expected utility treating the auditing probability as a parameter.[2] The collection agency in turn selects the optimal auditing strategy (defined over the number of audits and the fine imposed on tax cheaters) maximizing total revenues net of auditing costs.[3]

We maintain the assumption that the individual regards the probability of detection as independent of her own decision but determine the rational expectations equilibrium probability endogenously as a function of the number of tax payers deciding to cheat and the aggregate resources spent on monitoring. Under this extension, the probability of detection decreases *ceteris paribus* in the total number of cheaters. The externality linking the aggregate detection probability, and hence the expected return on tax evasion to individual compliance choices can generate multiple rational expectations equilibria indexed on the expected rate of compliance.

In particular, a representative tax payer believing all other taxpayers to be honest may face an expected detection probability rendering compliance optimal while the same tax payer, believing all other taxpayers to be cheaters, and hence expecting a lower detection probability, may prefer to cheat. Equally tough monitoring schemes can thus be associated with very different degrees of tax honesty, depending on the "tax mentality".[4] The model hence provides an explanation for the markedly different estimated compliance rates across countries with fairly similar auditing and penalty structures.[5]

The one period economy is populated by N risk-neutral workers of two types with VNM utility functions. Type 1 (2) workers make up a fraction p $(1-p)$ of the population and receive a real income of k_1 $(k_2, k_2 < k_1)$ per period, with associated tax liability of t_1 $(t_2, t_2 < t_1)$. While her type is revealed to the worker at the beginning of the period, the government must pay an audit cost (normalized to unity) to learn the type of a particular worker. Workers announce a type and pay the corresponding tax. They receive no utility from government expenditure. To deter tax cheating, the government allocates a fixed

real expenditure T to random audits of individuals reporting an income of k_2 and levies a penalty $(t_1 - t_2) + W$ on tax cheaters.

The *ex-ante* probability of detection is given by $r(Q) = \frac{T}{[(1-p)N+Q]}$ i.e. by the ratio of audits to the *expected* number of individuals reporting to be of type 2. The latter group is composed of the $(1-p)N$ individuals reporting truthfully and of some number $Q \leq pN$ of type 1 individuals misreporting their type. The *ex ante* probability of detection is thus conditional on the prior concerning Q, with range $r(Q) \in [\frac{T}{N}, \frac{T}{[(1-p)N]}]$ and $\frac{dr(Q)}{dQ} < 0$. Type 1 individuals choose among reporting truthfully (T) and cheating (C). The stochastic income of a tax cheater is given by

$$U_C(Q) = r(Q)U(k_1 - t_1 - W) + (1 - r(Q))U(k_1 - t_2) \tag{1}$$

with $\frac{\partial U_C(Q)}{\partial Q} > 0$: an increase in the total number of cheaters increases the expected individual return to cheating. The maximization problem, conditional on Q, is given by

$$Max(E[U_C, U_T]) = Max[r(Q)U(k_1 - t_2 - W) + (1 - r(Q))U(k_1 - t_2)\,, U(k_1 - t_1)] \tag{2}$$

Three cases arise:

$$\text{A: } [U_T < U_C(0)] \quad \text{B: } [U_T > U_C(Pn)] \quad \text{C: } [U_C(0) < U_T < U_C(Pn)]$$

Cases A and B correspond to the familiar analysis of compliance choice: tax evasion is individually optimal (non-optimal) regardless of the prior concerning other tax payers' decisions. The interesting case is C: conditionally on no other (all other) high income workers evading taxes, tax evasion is individually non-optimal (optimal). Both the honest and the cheating outcome are subgame perfect rational expectations Nash equilibria. The equality of the two utility schedules defines a critical value Q^* satisfying

$$r(Q^*)U(k_1 - t_2 - W) + (1 - r(Q^*))U(k_1 - t_2) = U(k_1 - t_1) \tag{3}$$

below (above) which honesty (cheating) is the optimal strategy.

On a theoretical level, the choice of equilibrium is indeterminate: any "sunspot" capable of shifting expectations to the other side of Q^* alters the equilibrium. In practice, sudden equilibrium shifts from widespread honesty to equally widespread cheating are rarely observed in stable economic and political systems, suggesting a fair degree of stability of expectations.[6] In contrast, economic, social and political upheaval is frequently associated

with radical changes in behavioral patterns and have frequently been accompanied by "anti tax revolutions". Historical examples include war taxation (anti-crusade-tithe uprising in France 1188), resentment against occupation forces (Israelite revolt of 66 A.D), perceived injustice of tax distribution (peasant wars) and desire for political participation (Boston Tea party).[7] We now turn to hyperinflation as a particular instance of upheaval to illustrate the model.

2 An Application: Tax Compliance And Inflation

A negative link between inflation and real tax revenues forms a common feature of high inflation periods. The traditional explanation attributes the erosion of the real value of nominal tax liabilities to the lag between the assessment and the payment date.[8] The erosion effect is reinforced by behavioral responses of tax payers postponing payment until the last permissible date.[9] Reduced tax compliance forms a third link between inflation and revenues. Anecdotal evidence suggests a widespread worsening in tax honesty during several Latin American mega inflations. In contrast to the erosion effects, the reduced compliance typically persists survives the stabilization and thus constitutes a lingering cost.

Both the emergence and the persistence of widespread tax cheating are easily rationalized in the above model. The emergence may derive partly from psychological motives: governments perceived to be failing in their duties command less loyalty by their citizens, decreasing the stigma of being branded a tax cheat.[10] Our model implies that a -sufficiently general- anti-government mood shift typical of the later phase of hyperinflation suffices to shift the economy to the low compliance equilibrium with subsequent lock-in.

Lacking indexation of nominal tax liabilities and fines may provide a second link between tax honesty and inflation. Let t_i denote the real taxes under full indexation (or zero inflation). Actual taxes are given by $t_i I(q,\pi)$ where the function $I(q,\pi)$ captures the erosion effect. q and π denote the degree of indexation, defined between 0 (no indexation) and 1 (full indexation) and the inflation rate. Analogously, we define a discount function $J(s,\pi)$ for the fine imposed on tax shirkers, where s denotes the indexation factor for the fine. The discount functions obey:

$$I(1,\pi) = I(q,0) = J(1,\pi) = J(s,0) = 1 \; \forall s,q,\pi \quad \frac{\partial I(q,\pi)}{\partial q} > 0 \quad \frac{\partial J(s,\pi)}{\partial q} > 0 \qquad (4)$$

To simplify notation, denote the utility difference between the expected income under honesty and cheating as

$$Y(Q,q,s,\pi) = U(k_1 - t_1 I(q,\pi)) - r(Q)U(k_2 - t_1 I() - WJ(s,\pi)) - (1-r(Q))U(k_1 - t_2 I()) \quad (5)$$

We first consider the case $q = 1$ and $s < 1$. Even if full compliance is unconditionally optimal at zero inflation ($Y(Pn,1,s,0) > 0$) there now exists an inflation rate π^* defined by $Y(0,1,s,\pi^*) = 0$ at which cheating becomes unconditionally optimal. Thus a sufficiently large temporary increase in the inflation rate leads to a temporary decline in tax compliance, reinforcing the erosion effect but vanishing after stabilization. In contrast, if the economy exhibits multiple equilibria at zero inflation ($Y(0,1,s,0) > 0 > Y(Pn,1,s,0)$) a temporary inflation blip sufficient to make non-compliance unconditionally optimal for one period shifts the system -in the absence of further shocks- *permanently* to the low compliance equilibrium, providing an explanation for persistently low real revenues in the aftermath of stabilization. If both taxes and fines are indexed, the elasticity of tax compliance with respect to inflation depends on the relative degree of indexation. In the extreme case of q=0 and s=1, an increase in the rate of inflation lowers the expected benefit from tax evasion and hence improves tax honesty.

Tax compliance may thus be systematically influenced by inflation. The reverse direction of causation also holds. We consider a government with given real expenditures g exceeding maximum steady state seignorage. Taxes are completely indexed. The deficit is fully monetized, in steady state we thus have

$$g = TR(Q)I(q,\pi) + \pi L(\pi) \quad (6)$$

where $L(\pi)$ denotes the real money demand and $TR(Q) = [((1-p)N + Q)t_2 + (Pn - Q)t_1 + r(Q)[t_1 - t_2 + w]Q]I()$ denotes real tax revenues. If (6) admits zero inflation as a solution and the economy exhibits multiple tax compliance equilibria at zero inflation a temporary increase in government expenditure, financed by seignorage, may suffice to shift the equilibrium permanently from full to low compliance. In consequence, the budget remains unbalanced once expenditure returns to the previous level, requiring a higher steady state inflation rate.

3 Policy

The individual incentive to evade taxes forces the collection agency to devise auditing rules and penalties for cheaters. In doing so, the agency faces a tradeoff: an increase in audits raises both compliance and outlays. An agency maximizing tax revenues *net* of auditing costs will thus perform checks on tax payers up to the point at which the marginal return from increased compliance equals the marginal cost of auditing.

In models without externality effects, the optimal strategy is *ceteris paribus* state independent.[11] The existence of multiple equilibria in tax compliance alters the cost-benefit calculus facing the collection agency: starting from a situation of widespread cheating, a *one time* coordination of expectations on the compliance equilibrium carries *permanent* dividends.[12] The attempt to coordinate may take the form of a temporary sharp increase in audits beyond the point justified by within period net revenue maximization. Once the shift in compliance behavior has been achieved, the optimal auditing strategy is given by the traditional state independent rule. On a theoretical level, the use of *conditional* audit rules provides an alternative route towards ensuring full compliance. By making either the number of audits or the penalty for cheaters conditional on the total *expected* number of cheaters, the non-compliance equilibrium can -in principle- be costlessly eliminated.

In practice, the informational requirements for a audit strategy conditional on the *expectations* of the typical tax payers are likely to be prohibitive. However, measures aimed at affecting tax payer psychology may provide a second cost-efficient route towards increased honesty. Argentina and Mexico have successfully mounted anti-evasion policies based on targeted and highly visible prosecution of public figures. These programs, although not affecting the actual cost-benefit calculus of the *typical* tax payer and hence being ineffective in traditional tax evasion models, have resulted in sizeable increases in the tax share of GDP.[13]

4 Conclusion

Individual decisions regarding tax compliance depend on the perceived probability of detection, which in turn depends upon the number of *other* tax payers deciding to cheat. The negative externality running from individual compliance choices to the probability of

detection, together with the negative dependence of the expected return to cheating on the probability of detection gives rise to the possibility of multiple rational expectation "sunspot" equilibria indexed on the prior about other tax payer's compliance choices. In particular, we may observe self-justifying anti-tax revolutions occurring in settings in which *individual* tax avoidance would be utility reducing.

The possibility of low compliance traps carries implications for optimal auditing policy. In contrast to the familiar state invariant auditing strategies, the opportunity to achieve a shift of equilibrium from low to high compliance and thus a permanent dividend of current period audits justifies a bunching of auditing effort in a single period even if current audit costs exceed current returns in terms of higher compliance. A second route for policy focuses on the generation of a favorable "sunspot" coordinating expectations on the high compliance equilibrium.

The argument outlined above extends easily to other instances of costly regulations enforced by at least partly random audits, such as environmental regulations, labor safety rules and trade embargoes, suggesting a potential role for targeted symbolic prosecutions in these areas.

Footnotes

1. Dixit and Nalebuff in **Thinking Strategically** Page 382, footnote 9 quote a mimeo by Cyrus Chu of Taiwan National University, "Justifying Short Lived Enthusiasm In Law Enforcement" apparently applying a similar idea to speed limit enforcement. The idea of multiple compliance equilibria seems to have been first formulated by Schlicht (1985) in a model based on the assumption that individuals incur "psychic costs" if they deviate from established rules. Benjamini and Maital (1985) propose a model similar to Schlicht's in which the "stigma" attached to rule violation decreases in the number of other violators.

2. See *inter alia* Reinganum and Wilde(1985) and Greenberg(1984) for recent formulations. Cowell (1990) and Elffers et al. (1991) contain recent literature surveys.

3. See *inter alia* Kemp and Ng (1979) and Polinsky and Shavell (1979).

4. Schmolders (1970). See Dornstein (1976) and Strumpel (1969) for evidence on differences in tax mentality across societies.

5. Cowell (1990) and Elffers et al. (1991) contain recent surveys of the evidence. As an illustration, Haycraft (1985) provides an intriguing historical explanation for low tax morale in Italy.

6. The models proposed by Benjamini and Maital (1985) and Schlicht (1985) in which individuals deviating from current mainstream behavior experience "psychic costs" or are "stigmatized" provide a possible explanation for the stability of the expectational equilibria.

7. See Mohring (1986), Farmer (1957) and Neveux (1984) for accounts of the these episodes.

8. Cf. Keynes(1923), Oliveira (1967) and Tanzi (1977).

9. Cf.Patzauer (1925).

10. Cf. Lewis (1982) on the psychology of tax evasion.

11. In case A above, full compliance can alternatively be ensured by increasing W or T to the point where $Y(Pn, q, s, \pi) > 0$ for $\forall\pi$.

12. For any given model specification it is of course a trivial exercise to write down auditing rules eliminating cheating altogether, hence preempting the emerging of a no-compliance equilibrium. Historical experience however provides scant support for governments setting optimal auditing rules in the midst of crisis.

13. In Argentina, the share increased from 16.6 percent in 1990 to an estimated 22.5 percent in 1992 (Ministry of Economics). In Mexico, increased compliance sufficed to more than offset a drastic reduction in tax rates.

References

[1] Allingham, Michael and Agnar Sandmo (1972); "Income Tax Evasion: A Theoretical Analysis"; *Journal of Public Economics*, 1, 323-338.

[2] Benjamini, Yael and Shlomo Maital (1985); "Optimal Tax Evasion & Optimal Tax Evasion Policy: Behavioral Aspects"; in W. Gaertner and A. Wenig (eds.) **The Economics of the Shadow Economy**, Berlin: Springer.

[3] Carroll, J. (1989); "A cognitive-process approach of taxpayer compliance"; in J. Roth and J. Scholz (eds.); Taxpayer compliance: Volume 2. Social Science perspectives, University of Pennsylvania Press, Philadelphia, 228-72.

[4] Cowell, F. (1990); Cheating the Government; MIT Press, Cambridge.

[5] Dornstein, M. (1976); "Compliance with legal and bureaucratic rules: the case of self-employed taxpayers in Israel"; *Human Relations*, 29, 1019-34.

[6] Elffers, H., D. Hessing, H. Robben and P. Webley (1991); Tax Evasion; Cambridge University Press, Cambridge.

[7] Farmer, W. (1957); Makabees, Zealots and Josephus. ; New York.

[8] Greenberg, J. (1984); "Avoiding Tax Avoidance"; *Journal of Economic Theory*, 32, 1-13.

[9] Haycraft, J. (1985); Italian Labyrinth; Penguin, Harmondsworth.

[10] Kemp, M. and Y. Ng (1979); "The Importance Of Being Honest"; *Economic Record*, 55, 41-46.

[11] Keynes, J. (1923); A Tract On Monetary Reform; reprinted, The Royal Economic Society, London.

[12] Lewis, A. (1982); The Psychology of Taxation; Martin Robertson, Oxford.

[13] Mohring, H. (1986); "Geld zum Kampf gegen Ungl¨abige"; in U. Schultz (ed.); Mit dem Zehnten fing es an; Büchergilde Gutenberg, Frankfurt am Main.

[14] Neveux, H. (1984); "Die ideologische Dimension der franz¨osischen Bauernaufst¨ande im 17. Jahrhundert"; *Historische Zeitschrift*, 238, 265-285.

[15] Oliveira, J. (1967); "Money, Prices and Fiscal Lags: A Note on the Dynamics of Inflation"; *Banca Nazionale del Lavoro Quarterly Review*, 82, 258-67.

[16] Patzauer, Hans (1925); "Die Staatswirtschaft" in Bunzel, Julius (ed.); Geldentwertung und Stabilisierung in ihren Einflüssen auf die Soziale Entwicklung in Österreich; Schriften des Vereins für Sozialpolitik, Vol. 169, von Duncker and Humblot, München and Leipzig.

[17] Polinsky, A. and S. Shavell (1979); "The Optimal Tradeoff Between The Probability And Magnitude Of Fines"; *American Economic Review*, 69, 880-891.

[18] Reinganum, J. and L. Wilde (1985); "Income Tax Compliance In A Principle-Agent Framework"; *Journal of Public Economics*, 26, 1-18.

[19] Schlicht, E. (1985); "The Shadow Economy And Morals: A Note"; in W. Gaertner and A. Wenig (eds.) **The Economics of the Shadow Economy**, Berlin: Springer.

[20] Schmolders, G. (1970); "Survey Research In Public Finance: A Behavioral Approach To Fiscal Theory"; *Public Finance*, 25, 300-306.

[21] Srinivasan, T. (1973); "Tax Evasion: A Model"; *Journal of Public Economy*, 2, 339-346.

[22] Strumpel, B. (1969); "The contribution of survey research to public finance"; in A. Peacock (ed.), Quantitative Methods in Public Finance; Praeger, New York.

[23] Tanzi, V. (1977) ; "Inflation, Lags in Collection and the Real Value of Tax Revenue"; *IMF Staff Papers*, 24, 154-67.