UNCERTAINTY, INFORMATION AND THE INFLATION TAX IN LDCs

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Abstract

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Most literature on the inflation tax considers the effects of an inflation occurring at a steady rate and with the perfect foreknowledge of market participants. In this paper, a model of an optimal uncertain inflation tax is developed. Despite the fact that the average risk averse consumer is assumed to form expectations rationally, the maximization of private welfare may require the government to conceal information on shocks from private agents. This result undermines the conventional wisdom that inflation is less harmful if it is more predictable. Results are obtained on the relation between the expected value and variability of inflation and a number of parameters including the variability of output, the costs of adjusting government expenditure, and the return on stores of value other than money. A synthesis of the monetarist and structuralist approaches to inflation in LDC's is developed.
Introduction

Most literature on the inflation tax considers the effects of an inflation occurring at a steady rate and with the perfect foreknowledge of market participants. Johnson (1967) has expressed some frustration with this approach, remarking that, "Contrary to the assumptions of the 'inflation tax' model, inflation does not proceed at a steady and well anticipated rate, but proceeds erratically with large politically determined variations in the rate of price increase." Indeed, there is some evidence that the absolute variability of the inflation rate is correlated with the rate itself (Logue and Willett, 1976). This paper, develops a model in which an unpredictable inflation tax is optimal. This uncertainty stems from fluctuations in production activities, for instance, the impact of weather on agriculture, rather than from political events.

The model assumes that the individuals in the economy derive satisfaction from the consumption of a private good and of a public good. The sole aim of government policy is to maximize the expected utility of the average consumer by providing the optimal quantity of the public good subject to certain constraints. The first restriction is that the government must plan its expenditure on the public good before the level of output is known, and it is costly but possible to deviate in either direction from this plan. This assumption is especially relevant to LDC's where much of government expenditure is on goods and services (Prest, 1972), generally involving projects of relatively long duration. This situation contrasts with the relative importance of transfers in developed country budgets which, political opposition aside, are more easily adjusted than are the programs of LDC governments.
After the level of output is determined, the government raises revenue via an inflation tax and decides whether to adjust the level of government expenditure. Other methods of taxation have been excluded from the model for analytical convenience, but could be incorporated, and would be set before the realization of income. This sequence emphasizes the fact that the inflation tax is undoubtedly the most easily adjustable form of taxation.\(^3\)

The actions of the government in raising revenue in response to any realization of output lead to a corresponding rate of inflation. It is assumed that consumers know the random distribution of output and therefore the distribution of rates of inflation. Thus consumers are rational in the sense of Muth (1961). Given any distribution of inflation rates, consumers determine optimal holdings of real money balances subject to a transactions technology. In deciding on the optimal distribution of inflation rates, the government takes into account this behavior of the average consumer.

I investigate cases in which the government knows the realization of output before the average consumer. In these situations the government can implement an increase in the money supply before consumers know the level of output. An important and paradoxical result of this model is that the expected utility of the average risk averse consumer is higher if the government can withhold information about the particular realization of income. Consumers are then left to make their decisions knowing only the distributions of income and the rate of the inflation tax. Particular examples are given where no information is better than full information. These results imply that inflation may be more harmful when it is more predictable.

A number of parameters influence the expected value and variability of
the optimal inflation rate in this model. The most important are: the variability of output, the costs of adjusting government expenditure, the return on stores of value other than money, and the dependence of utility on the two types of goods. The role of these structural parameters in determining the behavior of the rate of inflation lend support to a structuralist perspective on inflation in LDC's despite the traditional monetarist mechanism of price increase embodied in the model.

Section 1 of this paper presents a brief overview of the salient features of Latin American inflation. Section 2 develops the formal model. Section 3 discusses the relationship between the parameters of the model and the behavior of the inflation rate. Section 4 addresses the issue of the optimal amount of information for the government to provide the private economy. Section 5 presents concluding remarks emphasizing the place of the paper in the monetarist-structuralist debate.
1. **Factual Aspects of LDC Inflation**

Before developing the theoretical model, it is worthwhile underlining the potential importance of the issues by examining some benchmark figures on average rates of inflation and the variability and predictability of the rate. Table 1 presents some statistics on the inflation rate in a number of South American countries, and for comparison, the U. S. Three facts emerge from this comparison:

1. As is well known, almost all these countries have experienced average inflation rates well in excess of the U. S. rates.

2. The variability of these rates has been much higher in these LDCs than in the U. S. For several countries, the standard deviation of the inflation rate has exceeded the mean.

3. The predictability of inflation has also been much lower in these LDCs than in the U. S. Column 3 of Table 1 gives the standard error of the regression of the inflation rate on a constant, inflation lagged one period and inflation lagged two periods. The ratio of the standard error to the standard deviation (Column 4) is one measure of the fraction of variability that cannot be predicted by the simple ARIMA model. Ecuador provides a spectacular example of unpredictable inflation with the standard error exceeding the standard deviation (possible because the two calculations use different degrees of freedom).

The inflation equations were also estimated with inflation lagged three years as an additional independent variable and with a first order autocorrelation parameter. For most countries neither of these additions was statistically significant. The picture presented in Table 1 is also consistent with the evidence presented by Logue and Willett (1976).
While the biggest contrast is between the U. S. and South American experience, there are also wide contrasts within the LDC group. Compare, for instance, the variability and predictability of inflation in Colombia, Ecuador and Peru where the average rate was roughly similar. The theoretical framework developed in this paper provides hypotheses about why some countries may have opted for more variable rates of inflation. The model is also used to discuss the welfare implications of less predictable inflation.
2. A Model of the Inflation Tax Under Uncertainty

Output, \( y_\theta \), is assumed to be a random variable dependent on the state of nature \( \theta \) occurring with probability \( \pi_\theta \). For simplicity there are two states of nature, \( \theta = 1 \) and 2, and one representative consumer who acts as though he were one of many identical individuals. The representative consumer chooses \( x \), the proportion of each period's output which is not marketed. The remaining amount of output is sold for the available money supply \( m_0 \) at price \( p_{0,\theta} \), so that

\[
(1) \quad p_{0,\theta} = \frac{m_0}{(1-x)y_\theta}.
\]

At the end of the period, the consumer spends the proceeds from the sale of \( (1-x)y_\theta \). At this time, the government also makes purchases by printing additional money \( \Delta m_\theta \). The condition that total money demand equal the total value of supply determines the price at the end of the period, \( p_{1,\theta} \):

\[
(2) \quad p_{1,\theta} = \frac{m_0 + \Delta m_\theta}{(1-x)y_\theta}.
\]

Real government revenue is given by

\[
(3) \quad R_\theta = \frac{\Delta m_\theta}{p_{1,\theta}} = \pi_\theta (1-x)y_\theta
\]

where \( \pi_\theta \equiv (p_{1,\theta} - p_{0,\theta}) / p_{1,\theta} \).
The individual obtains utility from consumption of a public good \( g_\theta \) provided by the government and from consumption of a private good \( c_\theta \):

\[
U_\theta = u[g_\theta] + v[c_\theta].
\]

The utility function is assumed separable to facilitate analysis but this assumption is not critical. Private consumption is given by

\[
c_\theta = ky_\theta - \delta[x]y_\theta + p_{0,\theta} (1-x)y_\theta / p_{1,\theta}.
\]

The first term represents the quantity of output which is not marketed. The second term gives total physical deterioration on storage of the non-marketed part of output. The percentage rate of depreciation \( \delta[x] \) increases with the percentage of total output which is withheld. The specific form of \( \delta[x] \) used throughout this paper is

\[
\delta[x] = \delta_0 x + \delta_1 x^2 / 2,
\]

with \( \delta_0 \) and \( \delta_1 > 0 \). The final term of expression (5) gives the part of consumption made possible by repurchases at the end of the period and implicitly includes the effect of the inflation tax. Equation (5) can be simplified as

\[
c_\theta = (1 - \delta[x] - \hat{p}_\theta (1-x))y_\theta.
\]

The individual chooses \( x \) to maximize his expected utility given (7) and his information about \( y_\theta \), \( g_\theta \) and \( \hat{p}_\theta \). In this section I discuss two alternative
assumptions about this information. The first assumption is that the consumer knows \( \theta \) and therefore \( y_\theta, z_\theta \) and \( \hat{p}_\theta \) when choosing \( x \) (full information). The alternative assumption is that the consumer knows only the probability distribution of \( \theta, y_\theta, z_\theta \) and \( \hat{p}_\theta \) when choosing \( x \) (no information).

With full information, the consumer chooses a different \( x \) conditional on each value of \( \theta, x_\theta \), to maximize (4) subject to (7). The first order condition is given by

\[
(8) \quad v'[c] \left(-\delta_0 - \delta_1 x_\theta + \hat{p}_\theta \right) y_\theta = 0
\]

so that, if \( 0 \leq x_\theta \leq 1 \),

\[
(9) \quad x_\theta = \frac{\hat{p}_\theta - \delta_0}{\delta_1} \quad \theta = 1, 2
\]

With foreknowledge, no cash balances are held unless \( \hat{p}_\theta < \delta_0 + \delta_1 \). Furthermore, there is a maximum amount of revenue which can be raised in state \( \theta \) independent of the revenues raised in other states of nature. Substituting from (9) into (3) and maximizing \( R_\theta \) with respect to \( \hat{p}_\theta \) yields

\[
(10) \quad \hat{p}_\theta^* = \frac{\delta_1 + \delta_2}{2}.
\]

Thus the revenue maximizing rate of inflation is well defined for this transaction model. As is well known, this maximum revenue is given where the elasticity of money demand is one (Friedman, 1971).

Without any information on \( \theta \) the consumer chooses one value of \( x \) to
maximize

(11) \[ EU = \mathbb{E}\{u[g] + v[c]\} \]

subject to (5) giving the first order condition

(12) \[ E\{v'[c](-\delta_0 - \delta_1 x + \hat{p})y\} = 0. \]

Equation (11) implies

(13) \[ x = \frac{E\{v'[c](\hat{p} - \delta_0)y\}}{E\{v'[c]\delta_1y\}}. \]

Under these conditions, \( \hat{p}_0 > \delta_0 + \delta_1 \) does not imply \( x=1 \). Only if \( \hat{p}_0 > \delta_0 + \delta_1 \) for all states of nature is it necessary that \( x=1 \) and no money balances are held.

The contrast between the way \( x \) is determined under complete information and no information has important implications for policy. Variability in income and consequently in government revenues may be more easily dealt with if private agents have imperfect knowledge of \( \theta \). Consider a situation where a severe shortfall in income lowers the revenues from a given inflation rate and, in a more elaborate model, the revenues from other taxes. If individuals are immediately aware of the shortfall in income, \( x \) is determined by (9) and the maximum possible revenue may be quite low. Any attempt to raise increased
revenue by an even higher $p_\theta$ is defeated by individuals' movement out of real balances. Yet, the shortfall in revenues, by jeopardizing almost completed projects, may have particularly severe effects.

Now consider a situation where the government is able to print money and spend it without individuals' having knowledge that a state associated with a high shadow price of revenue has occurred. A high $p_\theta$ in one state is only partially reflected in state $\theta$ because agents make money-holding decisions before a realization of the state and at that stage, a particular state has only a probability of occurrence. Money balances decrease in all states as a consequence of the increase in inflation in any one state, of course, since decisions are made rationally. But withholding information about $y_\theta$ does give the government the opportunity to transfer inflation tax revenues between states.

On the other hand, the withholding of information increases uncertainty and one might expect that this loss offsets the gains just mentioned when consumers are risk averse. Recent literature on monetary policy and rational expectations (for instance, Berro, 1975) has concluded that it is optimal to reveal all information to private agents. Indeed, these authors view the revelation of information as a substitute for policy. Sections 3 and 4 of this paper will demonstrate that it need not be optimal to reveal all information to the private agents.

The government maximizes the expected utility of private consumers through decisions made both before and after the realization of $\theta$. Ex ante, the government commits itself to a project of size $\theta$. Once $\theta$ is known to the government, changes in the size of projects can be made, but only at a cost $C$
which depends on the deviation of actual expenditure \( g \) from planned expenditure \( G \). The cost of adjustment is given by

\[
(14) \quad C = C[G - G]
\]

where \( C[0] = 0, -1 < C'[x] < 0 \) for \( x < 0 \) and \( C'[x] > 0 \) for \( x > 0 \). Any choice of \( g \) implies a rate of inflation \( \hat{p} \) via the government's budget constraint:

\[
(15) \quad g_\theta + C[g_\theta - G] = R_\theta
\]

and equation (3). This structure of the model represents the long gestation period of government projects with the need to raise revenues while the project is in progress.

If the private agents have full information then \( G \) is chosen so that

\[
(16) \quad \frac{\partial EU}{\partial G} = E \left( \frac{u'C'}{1+C'} \right) = 0
\]

since \( dc_\theta/dx_\theta = 0 \) from (8). Because \( u' > 0 \), this condition requires \( C' \) to be positive in one state and negative in the other so that \( g_\theta \) exceeds planned \( G \) in one state and falls short of it in the other state. The additional first order conditions are

\[
(17) \quad \frac{\partial EU}{\partial p_1} = \pi_1^y \left\{ \frac{u'}{1+C'} \left( (1-x_1) - \hat{p}_1 \left( \frac{x_1}{p_1} \right) \right) - v' (1-x_1) \right\} = 0
\]
and

\[
\frac{\partial EU}{\partial p_2} = (1-\pi_1)y_2 \left\{ \frac{u'}{1+C'} \left( (1-x_2)^\gamma - p_2 \frac{\partial x_2}{\partial p_2} \right) - v'(1-x_2) \right\}_{\varepsilon=2} = 0
\]

where \( u' \) and \( v' \) and \( C' \) are evaluated at \( \varepsilon=1 \) and 2 in equations (17) and (18) respectively as indicated at the end of the braces.

In the case where private agents have no information about the actual \( \varepsilon \), the first order conditions are given by:

\[
\frac{\partial EU}{\partial C} = E \left( \frac{u'C'}{1+C'} \right) = 0
\]

\[
\frac{\partial EU}{\partial p_1} = \pi_1 y_1 \left\{ \frac{u'}{1+C'} \left( (1-x)^\gamma - p_1 \frac{\partial x}{\partial p_1} \right) - v'(1-x) \right\}_{\varepsilon=1}
\]

\[
-(1-\pi_1)y_2 \left\{ \frac{u'}{1+C'} \left( \frac{\partial}{\partial p_2} \frac{\partial x}{\partial p_2} \right) \right\}_{\varepsilon=2} = 0
\]

\[
\frac{\partial EU}{\partial p_2} = -\pi_1 y_1 \left\{ \frac{u'}{1+C'} \left( \frac{\partial}{\partial p_2} \frac{\partial x}{\partial p_2} \right) \right\}_{\varepsilon=1}
\]

\[
+ (1-\pi_1)y_2 \left\{ \frac{u'}{1+C'} \left( (1-x)^\gamma - p_2 \frac{\partial x}{\partial p_2} \right) - v'(1-x) \right\}_{\varepsilon=2} = 0.
\]
Equation (19) implies, as did (16), that $g_g$ exceeds $G$ in one state and falls below it in the other state. Equations (20) and (21) indicate the interdependence of optimal rates of inflation for each state of nature. This result contrasts with the independence of inflation rates implied by (17) and (18).
3. Comparative Static Simulations:

The model developed in the preceding section has the structure of an optimal tax problem (see, for instance, Sandmo, 1976). Agents maximize utility with respect to those variables directly under their own control, taking as given the variables under government control. This first stage of maximization yields a rule relating agents' decisions to variables under government control and to exogenous parameters. In the next stage, the government maximizes agents' utility with respect to those variables under government control taking as given the behavior rule of agents determined in the first stage and the exogenous parameters.

Because this type of model embodies a two-tiered maximization process, the response of the endogenous variables to change in the parameters is generally very difficult to analyze. Comparative static propositions are quite rare in this literature and recourse is often made to simulation examples (for instance, Atkinson and Stiglitz, 1972). In this section, I follow a simulation strategy to indicate possible responses of the average rate and variability of inflation to changes in the parameters of the model.

The utility function used in the simulations is:

\[ U[s_0, c_0] = (s_0)^\alpha + (c_0)^\beta \]

where \( \alpha \) and \( \beta \) are constants with \( 1 > \alpha > 0 \) and \( 1 > \beta > 0 \). The specific form of the investment adjustment function employed is

\[ C[s_0 - G] = A(s_0 - G)^2 \]
where $A$ is constant.

Tables 2 to 9 give the results of changes in eight parameters. Column 1 indicates the parameter which varies and the values it takes in the particular experiment. Those parameters which are held constant in any experiment take the values:

\[
\begin{align*}
\Pi_1 &= .5 & A &= .1 \\
\alpha &= .5 & \beta &= .5 \\
\delta_0 &= .05 & \delta_1 &= .2 \\
\gamma_1 &= \gamma - \gamma & y_2 &= \gamma + \Pi_1 \sigma / (1 - \Pi_1) \\
\gamma &= 30 & \sigma &= 10.
\end{align*}
\]

An increase in $\gamma$ results in a variance preserving increase in the expected value of $y_\theta$. An increase in $\sigma$ results in a mean preserving increase in the variance of $y_\theta$. The heading labelled 'no information' indicates the results for the model of equations (13) and (19)-(21), and the heading labelled 'full information' gives the results for equations (9) and (16)-(18).\(^6\)

The following observations can be made about these simulations:

1. In all cases, the expected utility of consumers is higher if they do not know the state of nature when deciding on a transactions strategy. This result is consistent with the theoretical results of Section 4.

2. Decreases in $\Pi_1$, $\sigma$, and $A$ all raise the expected utility of consumers.
3. Increases in $\delta_0$, $\delta_1$ and $\bar{y}$ all raise expected utility. This effect of an increase in $\delta_0$ and $\delta_1$, the parameters of depreciation on physical stores of value, may seem surprising but has a natural interpretation. Increases in the $\delta_1$ make consumers less willing to avoid the inflation tax and enhance the government's ability to provide public goods with less deadweight loss. This observation helps explain why governments undertaking inflation taxation also opt for the widespread interference with the holding of other assets characterized by Shaw and McKinnon as financial repression. If one interprets increases in the $\delta_1$ as increased repression, this behavior may well be optimal.

4. Increases in $\sigma$ and $A$ both increase the variability of the inflation rate, raising inflation in bad periods and lowering inflation in good periods. It is likely that $\sigma$ and $A$ are both relatively high in LDC's in comparison to developed economies, helping to account for the relatively high variability observed in LDC rates.

5. Increases in $\Pi_1$ and $\beta$ both lower the optimal inflation rate in both states of nature.

6. Increases in the $\delta_1$ and $\alpha$ raise the optimal inflation rate in both states. This effect of the $\delta_1$ can be explained as indicated in point 3.

7. Inflation is high in periods of low income and low in periods of high income. This result contrasts with the prediction of traditional Keynesian macroeconomics, and is an outcome of this paper's emphasis on production uncertainty stemming from such factors as the influence of weather on agriculture. Any realistic attempt at formulating a complete picture of LDC macroeconomic behavior would have to synthesize both approaches.

The results of these simulations emphasize some important possibilities which need to be considered in assessing the inflationary experience of LDC's.
4. **The Optimal Amount of Information**

Consider a situation in which the government can reveal or withhold information about the state of nature prior to the agent's choice of a transactions strategy ($x$). Using a somewhat restricted version of the model of Section 2, I establish that it is optimal to conceal all information from the private economy. To begin this analysis, the amount of revenue, $R$, which must be raised is assumed given and independent of the state of nature. This type of restriction could derive from a special form of $u(\cdot)$. Further, only differences between expected utility with complete information (EU) and without any information (EU) about $\sigma = 0$ are considered. At $\sigma = 0$, EU=EU, and I derive conditions on the sign of EU-EU for $\sigma$ slightly greater than zero. Finally, assume $E=.5$.

First consider $EU$. Since $R$ is given, (15) is irrelevant and the basic equations determining the $\hat{p}_\theta$ are (3) and (9) i.e.

\begin{equation}
R = \hat{p}_\theta (1-x_\theta) v_\theta \quad \theta = 1, 2
\end{equation}

and

\begin{equation}
\hat{p}_\theta = \delta_1 x_\theta + \delta_\theta \quad \theta = 1, 2.
\end{equation}

Further, $EU$ is given by

\begin{equation}
EU = .5(v_1^T c_1 + v_2^T c_2).
\end{equation}
For notational simplicity, \( \phi_0 \) is defined by \( \phi_1 = 1 \) and \( \phi_2 = -1 \). The following results are valuable in subsequent calculations and follow from equations (7), (9), and (24) - (26):

\[
(27) \quad \frac{\partial c_\theta}{\partial x_\theta} = -\hat{p}_\theta y_\theta < 0
\]

\[
(28) \quad \frac{\partial^2 c_\theta}{\partial x_\theta^2} = -\delta_1 y_\theta < 0
\]

\[
(29) \quad \frac{\partial^2 c_\theta}{\partial x_\theta \partial \sigma} = \phi_0 \hat{p}_\theta \text{ of sgn } \phi_0
\]

\[
(30) \quad \frac{\partial c_\theta}{\partial \sigma} = -\phi_0 \frac{(2\delta_1 + \delta_0^2 - \hat{p}_\theta^2)}{2\delta_1} \text{ of sgn } -\phi_0
\]

\[
(31) \quad \frac{\partial^2 c_\theta}{\partial \sigma^2} = 0
\]

\[
(32) \quad \frac{dx_\theta}{d\sigma} = \phi_0 \hat{p}_\theta \frac{(\delta_0 + \delta_1 - \hat{p}_\theta)}{y_\theta \delta_1 (\delta_1 + \delta_0 - 2\hat{p}_\theta)} \text{ of sgn } \phi_0
\]

\[
(33) \quad \frac{\partial}{\partial \sigma} \left( \frac{dx_\theta}{d\sigma} \right) = \phi_0 \frac{dx_\theta}{y_\theta d\sigma} > 0
\]

\[
(34) \quad \frac{\partial}{\partial x_\theta} \left( \frac{dx_\theta}{d\sigma} \right) = \phi_0 \frac{(\delta_1 + \delta_0 - \hat{p}_\theta)^2}{\delta_1^2 y_\theta (\delta_1 + \delta_0 - 2\hat{p}_\theta)^2} \text{ of sgn } \phi_0.
\]
These results imply that

\[ \frac{d\text{EU}}{d\sigma} \bigg|_{\sigma=0} = 0 \]

since \( dv_1/d\sigma = -dv_2/d\sigma \) at \( \sigma=0 \). It can be shown similarly that

\[ \frac{d\text{E}_U}{d\sigma} \bigg|_{\sigma=0} = 0 \]

and that

\[ \frac{dx}{d\sigma} \bigg|_{\sigma=0} = 0 \]

in the case where there is no information and \( x_1 = x_2 = x \). Thus

\[ \frac{d(EU - E_U)}{d\sigma} \bigg|_{\sigma=0} = 0. \]

To sign \( E_U - EU \) slightly away from \( \sigma = 0 \) it is necessary therefore, to sign \( d^2(EU - E_U)/d\sigma^2 \).

Again consider \( d^2v_1/d\sigma^2 \):

\[ \frac{d^2v_1}{d\sigma^2} = v_1 \left( \frac{3c_1}{3x_1} \frac{dx_1}{d\sigma} + \frac{3c_1}{3\sigma} \right)^2 + v_1 \frac{d}{d\sigma} \left( \frac{3c_1}{3x_1} \frac{dx_1}{d\sigma} + \frac{3c_1}{3\sigma} \right). \]
Now

\[
\frac{d}{d\sigma} \left( \frac{3c_1}{\delta x} \frac{dx}{d\sigma} + \frac{3c_1}{\delta \sigma} \right) = -2 \nu_1 \frac{dx}{d\sigma} \left( \frac{(\delta_1 + \delta_0 - \hat{p}_1)^2 + \delta_1^2 \delta_0 - 2\hat{p}_1^2}{\delta_1^2 (\delta_1 + \delta_0 - 2\hat{p}_1)^2} \right) < 0
\]

Similarly, the same expression as equation (40) evaluated at \( \theta = 2 \) is also negative. And since \( \nu_1'' < 0 \), \( d^2\nu_1/d\sigma^2 \) is negative and so is \( d^2E\nu/d\sigma^2 \) at \( \sigma = 0 \).

Next consider \( d^2\bar{\nu}_1/d\sigma^2 \) where the bar again denotes no information.

\[
\frac{d^2\bar{\nu}_1}{d\sigma^2} \bigg|_{\nu_1'' \rightarrow 0} = \bar{\nu}_1'' \left( \frac{3c_1}{\delta x} \frac{dx}{d\sigma} + \frac{3c_1}{\delta \sigma} \right)^2 + \bar{\nu}_1' \frac{d}{d\sigma} \left( \frac{3c_1}{\delta x} \frac{dx}{d\sigma} + \frac{3c_1}{\delta \sigma} \right)
\]

Using (13) and (37) it can be shown that

\[
\frac{d}{d\sigma} \left( \frac{3c_1}{\delta x} \frac{3x}{\delta \sigma} + \frac{3c_1}{\delta \sigma} \right) \bigg|_{\sigma = 0} = \left( \frac{3c_1}{\delta x} \frac{\hat{p}_1}{\delta \sigma} \right) \bar{\nu}_1''
\]

Substituting (42) into (41) and comparing this expression with (39) at \( \sigma = 0 \) shows that \( d^2E\nu/d\sigma^2 \) dominates \( d^2E\bar{\nu}/d\sigma^2 \) in absolute value. Therefore

\[
\frac{d^2(E\nu-E\bar{\nu})}{d\sigma^2} < 0
\]

and, since \( E\nu = E\bar{\nu} \) and \( d(E\nu-E\bar{\nu})/d\sigma = 0 \) at \( \sigma = 0 \), for a small \( \sigma \), \( E\nu - E\bar{\nu} < 0 \).
and it is better to conceal information than to reveal it.

There are a number of important extensions of this result. First, the same result can be proved for unequal probabilities in a similar fashion. Second, \( R \) need not be given exogenously. The government could choose \( R (\text{or} \ G) \) before the realization of \( \theta \) as in Sections 2 and 3. Thus \( G \) would maximize \( \text{EU} = E(u[G] + v[c]) \). It would still be optimal to conceal all information since it is optimal to do so for any given value of \( R \). In particular, it would increase welfare to conceal information when choosing \( R^* \) the optimal \( R \) if information were not concealed. Of course, it may be optimal to choose an \( R \) different from \( R^* \) once the decision to conceal information is made, but this choice would only further increase welfare.

Third, it can be shown by a similar argument that it is better to conceal all information about \( \theta \) even if the alternative is to reveal only a little information. The government could provide partial information about \( \theta \) via an indicator variable \( \phi \). If \( \theta_1 \) actually occurred \( \phi_1 \) could be announced with probability \( P_1 \) and \( \phi_2 \) with probability \( (1-P_1) \).

Finally, it should be emphasized that this suppression of all information is optimal because information fulfills no other function than to allow agents to increase the expected deadweight loss of taxation. If agents could use information to make socially profitable decisions then this result on the optimality of no information would require modification. For instance, early warning of bad weather might not only warn agents of a relatively high future need for revenue by the government but might also allow an earlier harvest and higher output than otherwise. In this case there would be a trade off determining an optimal amount of information via an indicator of the type just discussed.\(^7\)
5. **Conclusions**

In the tradition of the inflation tax literature, this paper has sought the motivation for inflation in the consequent transfer of real resources to the government. The particular contribution of this paper is its emphasis on the interaction of uncertainty with the government's need for revenues to maximize the utility of private agents. An important result is that the government should withhold at least some information on the current state of the economy from private agents. If secrecy is possible, the government can improve the welfare of the average risk averse member of the private economy.

A number of important parameters which affect the average level and variability of inflation were identified. These parameters may vary from country to country and provide guidance on the factors causing different countries to opt for different patterns of inflation. It is in this sense that the paper emphasizes a synthesis of the structuralist and monetarist approaches to inflation in LDC's. Although the mechanism by which inflation is generated is monetarist, the decisions of the government on the inflation rate are made in response to real factors determining the value and costs of the revenues collected through inflation. Indeed, even the policies of financial repression adopted by LDC's can be rationalized, at least on a theoretical level, as consistent with optimizing behavior. It would seem that any model assuming a government pursuing rational goals with rational means must incorporate some aspects of the structuralist school. On the other hand, it would be extreme to argue that all inflations have been motivated by the rational calculation of optimizing governments.
1. Recent work on the inflation tax includes: Auerenheimer (1974), Barro (1972) and Friedman (1978). These papers provide a wide variety of references to the literature.

   An exception to the emphasis on certainty is the paper by Sjaastad (1976). In his paper, the motive for uncertain inflation derives from an ability to systematically fool moneyholders by sequentially varying the rate. Besides this reliance on irrational expectations, Sjaastad does not introduce any framework for making utility comparisons of different policies nor does he consider the optimal provision of information by the public sector to the private sector.

2. Phelps (1973) provides an analysis of the inflation tax in a model with many alternative taxes.

3. This flexibility relative to other taxes is probably most pronounced in LDC's. Another alternative to the inflation tax which is neglected is borrowing by the government in financial markets. Once again, this option is less available in LDC's because financial markets are little developed. To some extent the restricted role of credit markets in LDC's is a result of inflation and the accompanying policies of financial repression (Shaw, 1973 and McKinnon, 1973). But it would also seem that a lower level of development implies disproportionately smaller credit markets.
4. For a recent survey which includes a review of structuralism, see Kirkpatrick and Nixon (1976).

5. The inflation rate was measured as the annual percentage change in the CPI as reported in International Monetary Fund, International Financial Statistics.

6. To solve for the equilibrium values of the endogenous variables for a given set of parameters, I used the maximization routine of Goldfeld, Quandt and Trotter (1966). All calculations were done in double precision FORTRAN. Although no analytical proof of the uniqueness of equilibrium could be established, no examples of multiple equilibria were encountered.

7. Marshall (1974) and the authors cited by him discuss situations in which information can decrease traders' utility. This result obtains in the absence of future markets and arises because information, in effect, forces traders to participate in a lottery which need not exist. This result does not involve a deadweight response to taxation and is quite different from the mechanism discussed here. Weiss (1976) analyses situations in which the random taxation of individuals in an otherwise nonstochastic environment can decrease deadweight loss enough to raise expected utility. In his model there is less presumption that less information is better. And, clearly, his model cannot shed light on the transfer of revenues across states of nature allowed by the suppression of information.
References


Acknowledgments

I would like to thank Alan Blinder and Jonathan Eaton for very helpful comments on an earlier draft of this paper.
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