

## **The Welfare Effects of Switching from Consumption Taxation to Inflation Taxation in Iran's Economy**

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### **Abstract**

The net effects of switching from consumption taxation to inflation taxation on resource allocation and welfare crucially depend on production externalities. With elastic labor supply, raising inflation taxation decreases leisure, but increases the levels of real consumption, capital, and output. Moreover, this tax switch has two opposing effects on the level of real money balances: A positive effect through the rise in output caused by the faster nominal money growth and a negative one through the fall in the ratio of real money balances to output. In the absence of any production externality the negative effect dominates the positive effect. The real effect of this tax switching on resource allocation depends on the behavior of labor supply. If there is not a trade-off between leisure and labor supply, then the real effect of switching to inflation taxation on real consumption, capital and output would disappear. With elasticity of labor supply, the welfare effect of this tax switch is conditional on the production externality. In the absence of production externality, inflation taxation always reduces welfare. With a strong enough production externality, switching from consumption taxation to inflation taxation may raise welfare by correcting the under-investment of capital and the under-supply of labor.

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### **1. Introduction**

Government finances can expand with nominal money growth and tax consumption. Individuals allocate income to consumption and investment in both capital and real money balances, and allocate time to labor and leisure. In this environment, switching from consumption taxation to inflation taxation drives up the cost of holding money, and thus reduces the demand for real money balances relative to income as is mentioned in the literature.

Further, the decrease in real money balances reduces the marginal benefits of consumption and leisure with a non-separable utility function concerning these arguments, which tends to reduce consumption and leisure and accordingly labor increase. The increased labor in turn raises the marginal product of capital and stimulates capital accumulation, leading to higher output per capita.

In the budget balances of the government, switching from consumption taxation to inflation taxation, declines consumption tax, tending to raise consumption. Given the standard constant elasticity of intertemporal substitution form of the utility function in the literature on economic growth, the net effect on the ratio of consumption to output is zero. Thus, as output rises with the nominal money growth rate, so does consumption. The increase in consumption tends to raise welfare but the decline in leisure tends to reduce the welfare. The net effects of the tax switch on real money balances and welfare depend crucially on production externalities (Ho et al., 2007). If labor supply were fully inelastic in our model, then switching from consumption taxation to inflation taxation would have no real effect on real consumption, capital and production in the long-run.

Since the positive effect of the switch to inflation taxation on output takes time to reach its full potential through promoting capital accumulation, the relative strength of the positive welfare effect also depends on the elasticity of intertemporal substitution. More elastic intertemporal substitution accelerates growth and hence strengthens the positive welfare effect. The net welfare effect of switching from consumption taxation to inflation taxation can be positive so long as the externality is strong enough. However, when considering the entire equilibrium path in a tractable AK model with a strong enough

externality for endogenous growth, a positive net welfare effect of this tax switch also requires the elasticity of inter temporal substitution to be sufficiently high. By reducing the consumption tax and raising the inflation tax to finance, a given government fiscal commitment can stimulate production in the long-run in our model, as opposed to the long-run neutrality of money growth in Rebelo and Xie (1999) without a consumption tax.

The paper is organized as follows: Section 2 reviews the related studies in the field. Section 3 introduces the model. Section 4, Maximizes welfare function in steady state. Empirical results are present in Section 5 and the last section concludes.

## **2. Literature Review**

When money enters directly in to the utility function and interacts with an elastic labor, money is generally non-supernatural (Brock, 1974; and Ho et al., 2007). If money and capital were substitute, higher monetary growth enhances capital accumulation (Tobin, 1965). In the case, money is required for purchasing capital goods, higher anticipated inflation decreases steady-state real balances and capital stock, and hence a reversed Tobin effect emerges (Stockman, 1981; Lu et al., 2011).

Some studies support a rate of money growth for a positive nominal interest rate by considering additional factors such as production externality, elastic labor supply, and distortion of other taxes on labor, output, and consumption. In Phelps (1973), Braun (1994), and Palivos and Yip (1995), inflation taxation leads to a higher welfare than income taxation as a means of public finance<sup>1</sup>. In Rebelo and Xie (1999), money does not affect production in the steady state, but can alter it during the transition toward the steady state; and the transitional effect be exploited by monetary policy to improve welfare, if there are production externalities.

Ho et al. (2007) offered a comparison of the welfare cost between a seignorage tax and a consumption tax in the public finance approach in a model with real balances and leisure in utility. They found that without a production externality, a seignorage tax always had a higher welfare cost than a consumption tax in the long- run. With a

production externality, a seignorage tax not only had a smaller welfare cost than a consumption tax but may have a welfare gain.

Lu et al. (2010), investigates welfare costs between seignorage and consumption taxes in a neoclassical growth model with a cash-in-advance constraint. They compares equilibrium along transitional dynamic and steady-state paths and finds that because of lower consumption and leisure and thus higher welfare costs of consumption taxes during early periods, the welfare cost of consumption taxes is larger than the welfare cost of seignorage taxes.

Izadkhasti et al. (2015) from sensitivity analysis in a steady state found that without externality of production, by increasing inflation tax rate, the ratio of consumption to GDP remains constant, but labor, capital stock and production will increase. With decrease in the ratio of real money balances to GDP and leisure, the level of social welfare in steady state decreases. Considering production externality, capital stock and a rapid production increase, welfare level increases in steady state.

### 3. The Basic Model

The problem of determining the optimal structure of taxes to finance a given level of expenditures is called the Ramsey problem, after the classic treatment of Ramsey (1928). In the representative-agent models we have been using, the Ramsey problem involves setting taxes to maximize the utility of the representative agent, subject to the government's revenue requirement.

#### 3-1. Household

the economy is populated by infinite families whose wealth is in the form of either money or capital. Each household solves the following maximization problem:

$$\max W = \int_0^{\infty} u(c_t, m_t, l_t) \exp[-\rho t] dt, \quad u_c, u_m > 0, u_{cc}, u_{mm} < 0$$

(1)

$$s.t. : \quad \frac{da_t}{dt} = \frac{dk_t}{dt} + \frac{dm_t}{dt} = w_t(1-l_t) + r_t k_t - (1+\tau_c)c_t - \tau_m m_t$$

(2)

Where,  $c$ ,  $m$  and  $l_t$  are real consumption, real money balances, and leisure respectively.  $\rho$  is the constant rate of time preference.  $k_t$  is the capital stock,  $\tau_m$  is a rate of inflation tax, and  $\tau_c$  is a rate of consumption tax. Assume that the rate of population growth is zero. The transversality condition ruling out the Ponzi game is given as:

$$\lim_{t \rightarrow \infty} e^{-\rho t} \lambda_t a_t = 0 \quad (3)$$

### 3-2. Firms

Firms produced a final good by using capital  $K_t$ , and labor  $(1 - l_t)$ , according to the following technology:

$$Y_t = A(1 - l_t)^{1-\alpha} K_t^\alpha \bar{K}_t^\psi \quad 0 < \alpha < 1, 0 < \psi \leq 1 - \alpha \quad (4)$$

Where  $Y_t$  is the final output,  $A$  is total factor productivity, and  $\alpha$  measures the importance of capital relative to labor in production. Average capital  $\bar{K}$  exhibits spillovers of degree  $\psi$ . Marginal product of factors are:

$$w_t = A(1 - \alpha) K_t^{\alpha+\psi} (1 - l_t)^{-\alpha} \quad (5)$$

$$r_t = A\alpha K_t^{\alpha+\psi-1} (1 - l_t)^{1-\alpha} \quad (6)$$

Where  $w_t$  is the real wage rate and  $r_t$  is the real interest rate.

### 3-3. Government

Assume that government uses a consumption tax and inflation tax to finance consumption expenditure  $G_{cot}$  and uses others revenue to finance capital expenditure  $G_{cat}$ , Denoting  $G_t = G_{cot} + G_{cat}$ . Assume that consumption government spending is a fixed fraction  $\beta$ , of final output with  $\beta > 0$ . Suppose that the consumption government budget is balance at each point in time:

$$\tau_c c_t + \tau_m m_t = G_{cot} = \beta f(k_t, 1 - l_t), \beta > 0 \quad (7)$$

## 4. Maximizing Welfare Function in Steady-State

By considering the utility function by:

$$W = \int_0^{\infty} \left[ \frac{(c_t^\delta m_t^\theta l_t^\eta)^{1-\epsilon}}{1-\epsilon} \right] \exp(-\rho t) dt \tag{8}$$

Where  $\delta$ ,  $\theta$ , and  $\eta$  measure the importance of real consumption, real money balances, and leisure, respectively, and  $1/\epsilon$  is the elasticity of intertemporal substitution. The steady-state welfare function obtained as follows (Izadkhasti et al., 2015):

$$W^{ss} = \frac{\Phi [F(\tau_c, \tau_m)]^{1-\epsilon}}{1-\epsilon} \tag{9}$$

Where

$$F(\tau_c, \tau_m) = \frac{(\rho + \tau_m)^{\delta+\eta} (1 + \tau_c)^{-\delta} [\delta(\rho + \tau_m) + \theta \tau_m]^{\frac{\psi(\delta+\theta)}{1-\alpha-\psi}}}{\{\eta(\rho + \tau_m) + (1-\alpha)[\delta(\rho + \tau_m) + \theta \tau_m]\}^{\frac{1-\alpha-\psi}{1-\alpha-\psi}}}$$

and

$$\Phi \equiv \frac{1}{\rho} \{ \delta^\delta \theta^\theta \eta^\eta [A(1-\alpha)^{1-\alpha} (\frac{\alpha}{\rho})^{\alpha+\psi}]^{\frac{\delta+\theta}{1-\alpha-\psi}} \}^{1-\epsilon} > 0$$

The steady-state welfare level  $W^{ss}$ , is a function of the rates of consumption tax and inflation tax.  $\Phi > 0$  is a constant and independent of the consumption tax and inflation tax. The steady-state welfare level is monotonically increasing with F. We focused on F in the welfare analysis with or without the production externality.

With respect to equation (7), Izadkhasti et al. (2015), obtained consumption-output ratio and real money balances- output ratio in the steady-state:

$$\beta = \frac{\tau_c \delta (\rho + \tau_m)}{(1 + \tau_c) [\delta (\rho + \tau_m) + \tau_m \theta]} + \frac{\tau_m \theta}{[\delta (\rho + \tau_m) + \tau_m \theta]} \tag{10}$$

In the absence of any production externality ( $\psi = 0$ ), the steady-state welfare level in equation (8), reduces to:

$$F(\tau_c^{ss}, \tau_m^{ss}) \equiv \frac{(\rho + \tau_m^{ss})^{\delta+\eta} (1 + \tau_c^{ss})^{-\delta}}{\eta(\rho + \tau_m^{ss}) + (1-\alpha)[\delta(\rho + \tau_m^{ss}) + \theta \tau_m^{ss}]} \tag{11}$$

In the case with consumption taxation only, from equation (10), we

have  $\tau_c^{ss} = \beta / 1 - \beta$ , and:

$$F^0(\tau_c^{ss}) = \frac{(\rho)^{-\theta} (1-\beta)^\delta}{\eta + (1-\alpha)\delta} \quad (12)$$

Where the assumption  $\theta + \eta + \delta = 1$  has been used to simplify the expression. In the case with inflation taxation only, from equation (10), we have  $\tau_m^{ss} = \beta\delta\rho / [\theta(1-\beta) - \beta\delta]$ , and:

$$F^0(\tau_m^{ss}) \equiv \frac{(\rho\theta)^{-\theta} (1-\beta)^{\delta+\eta} [\theta(1-\beta) - \beta\delta]^\theta}{\eta + (1-\alpha)\delta} \quad (13)$$

By comparing the two regimes in the steady-state without any production externality and with  $\beta > 0$  and  $\theta > \delta\beta / [1 - \beta]$ , shows that using consumption taxation to finance government spending obtains a higher welfare level than using pure inflation taxation. Without any production externality, we have:

$$\frac{F(\tau_c^{ss})}{F(\tau_m^{ss})} = \frac{\theta^\theta}{(1-\beta)^\eta [\theta(1-\beta) - \beta\delta]^\theta} \equiv \mathcal{B}(\beta) \quad (14)$$

Obviously, at  $\beta = 0$  we have  $\mathcal{B} = 1$ , and for  $\beta > 0$  we have  $\mathcal{B} > 1$ . In the steady-state without any production externality and with  $\beta > 0$ , if both consumption taxation and inflation taxation are used to finance government spending, government maximizing welfare function  $F(\tau_c^{ss}, \tau_m^{ss})$  in equation (8), subject to its budget constraint (10). Lagrangian function is as follows:

$$L = F(\tau_c^{ss}, \tau_m^{ss}) + \mu \left\{ \frac{\tau_c \delta (\rho + \tau_m^{ss})}{(1 + \tau_c^{ss}) [\delta (\rho + \tau_m^{ss}) + \tau_m^{ss} \theta]} + \frac{\tau_m^{ss} \theta}{\delta (\rho + \tau_m^{ss}) + \tau_m^{ss} \theta} - \beta \right\} \quad (15)$$

Where,  $\mu$  is the multiplier. The first-order condition with respect to  $\tau_c^{ss}$  is:

$$\frac{\partial L}{\partial \tau_c^{ss}} = -\frac{\delta F(\tau_c^{ss}, \tau_m^{ss})}{1 + \tau_c^{ss}} + \frac{\delta \mu (\rho + \tau_m^{ss})}{(1 + \tau_c^{ss})^2 [\delta (\rho + \tau_m^{ss}) + \theta \tau_m^{ss}]} = 0 \quad (16)$$

The first-order condition with respect to  $\tau_m^{ss}$ , we get:

$$\frac{\partial L}{\partial \tau_m^{ss}} = -\frac{F(\tau_c^{ss}, \tau_m^{ss})[\eta + (\delta + \theta)(1 - \alpha)]}{\eta(\rho + \tau_m^{ss}) + (1 - \alpha)[\delta(\rho + \tau_m^{ss}) + \theta\tau_m^{ss}]} + \frac{F(\tau_c^{ss}, \tau_m^{ss})(\delta + \eta)}{\rho + \tau_m^{ss}} \quad (17)$$

$$+ \frac{\mu\delta\rho\theta}{[\delta(\rho + \tau_m^{ss}) + \theta\tau_m^{ss}]^2(1 + \tau_c^{ss})}$$

With any production externality, if  $\partial L / \partial \tau_m^{ss} > 0$ , it is convenient to start with consumption taxation  $\tau_c^{ss} = \beta / (1 - \beta)$  and  $\tau_m^{ss} = 0$ . Starting with consumption taxation we have  $F(\tau_c^{ss}, \tau_m^{ss}) / \mu = (1 - \beta) / \delta$ ,  $F(\tau_c^{ss}, \tau_m^{ss}) > 0$ . If  $\partial L / \partial \tau_m^{ss} < 0$  at  $\tau_c^{ss} = \beta / (1 - \beta)$  and  $\tau_m^{ss} = 0$ , then there should be deflation  $\tau_m^{ss} = \pi < 0$  and accordingly  $\tau_c^{ss} > \beta / (1 - \beta)$ . Using  $F(\tau_c^{ss}, \tau_m^{ss}) / \mu = (1 - \beta) / \delta$ ,  $F(\tau_c^{ss}, \tau_m^{ss}) > 0$  in equation (16) and rearranging terms, we have:

$$\text{sign} \frac{\partial L}{\partial \tau_m^{ss}} = \text{sign} \{-\theta(1 - \alpha)\} < 0 \quad \text{at} \quad \tau_c^{ss} = \frac{\beta}{1 - \beta} \text{ and } \tau_m^{ss} = 0 \quad (18)$$

In the steady-state without any externality and with  $\beta > 0$ , if both consumption taxation and inflation taxation are used to finance government spending, their optimal mix to maximize welfare, the rate of the inflation tax should be negative and the rate of consumption tax should be positive. The intuition is as follows: Since real money balances and consumption enter the utility symmetrically, there is a uniform taxation principle saying that the government should tax both at the same rate in order to avoid distorting the margin between consumption and real money balances<sup>2</sup>. This consideration implies that the rates of consumption and inflation taxes should be equal. However, real money balances are also an asset and ideally, the government does not want to distort the return on money relative to the return on capital to avoid distorting the margin between real money balances and capital. Since capital income is not taxed in our model, this consideration implies that the inflation tax should be zero. Combining the consumption-money consideration with the capital-



money consideration suggests that, in the absence of any externality, the consumption tax should exceed the inflation tax. Moreover, in the spirit of the Friedman rule, because the social cost of producing money is zero, there should be a negative inflation tax such that the cost of holding money can be as close to zero as possible. As a result, the optimal inflation tax is negative along with a positive consumption tax. However, the underlying nominal money growth rate should exceed the rate that corresponds strictly to the Friedman rule, because of the distortions of the consumption tax and the negative inflation tax on leisure and consumption.

In the steady-state with production externality and with  $\beta > 0$ , if both consumption taxation and inflation taxation are used to finance government spending, government maximizing welfare function  $F(\tau_c^{ss}, \tau_m^{ss})$  in equation (8), subject to its budget constraint (10).

Lagrangian function is as follows:

$$L = F(\tau_c^{ss}, \tau_m^{ss}) + \mu \left\{ \frac{\tau_c^{ss} \delta (\rho + \tau_m^{ss})}{(1 + \tau_c^{ss}) [\delta (\rho + \tau_m^{ss}) + \tau_m^{ss} \theta]} + \frac{\tau_m^{ss} \theta}{\delta (\rho + \tau_m^{ss}) + \tau_m^{ss} \theta} - \beta \right\} \quad (19)$$

Differentiating the Lagrangian with respect to  $\tau_m^{ss}$ , we have:

$$\begin{aligned} \frac{\partial L}{\partial \tau_m^{ss}} = & - \frac{F(\tau_c^{ss}, \tau_m^{ss})(1 - \alpha - \eta\psi)[\eta + (\delta + \theta)(1 - \alpha)]}{(1 - \alpha - \psi)\{\eta(\rho + \tau_m^{ss}) + (1 - \alpha)[\delta(\rho + \tau_m^{ss}) + \theta\tau_m^{ss}]\}} + \frac{F(\tau_c^{ss}, \tau_m^{ss})(\delta + \eta)}{\rho + \tau_m^{ss}} \\ & + \frac{F(\tau_c^{ss}, \tau_m^{ss})\psi(\delta + \theta)^2}{(1 - \alpha - \psi)[\delta(\rho + \tau_m^{ss}) + \theta\tau_m^{ss}]} + \frac{\mu\delta\rho\theta}{[\delta(\rho + \tau_m^{ss}) + \theta\tau_m^{ss}]^2(1 + \tau_c^{ss})} \end{aligned} \quad (20)$$

Using  $F(\tau_c^{ss}, \tau_m^{ss})/\mu = (1 - \beta)/\delta$ ,  $F(\tau_c^{ss}, \tau_m^{ss}) > 0$  in this equation and rearranging terms, we have:

$$\begin{aligned} \text{sign} \frac{\partial L}{\partial \tau_m^{ss}} = & \text{sign} \left\{ (1 - \eta)\psi\theta[\eta + \delta(1 - \alpha)] - \delta\theta(1 - \alpha)(1 - \alpha - \eta\psi) \right\} \\ \text{at } \tau_c^{ss} = & \frac{\beta}{1 - \beta} \text{ and } \tau_m^{ss} = 0 \end{aligned} \quad (21)$$

Note that  $\partial L / \partial \tau_m^{ss}$  is increasing in  $\psi$ . If  $\psi$  approaches  $(1 - \alpha)$ , then:

$$\text{sign} \frac{\partial L}{\partial \tau_m^{ss}} = \text{sign}\{\theta\eta(1-\alpha)(1-\eta)\} > 0 \quad (22)$$

In the steady-state with  $\beta > 0$ , when consumption taxation is used to finance government spending, inflation taxation should also be used together if  $\psi \in (0, 1 - \alpha)$  is large enough. If  $\partial L / \partial \tau_m^{ss} > 0$  at  $\tau_c^{ss} = \beta / (1 - \beta)$  and  $\tau_m^{ss} = 0$  then  $\tau_m^{ss} = \pi^{ss} > 0$ .

With a weak production externality  $\psi \in (0, 1 - \alpha)$ , we are able to compare inflation taxation with consumption taxation. Using consumption taxation to finance government spending means  $\tau_c^{ss} = \beta / (1 - \beta)$  and  $\tau_m^{ss} = 0$ . Substituting these into the definition of  $F(\tau_c, \tau_m)$  we have:

$$F(\tau_c^{ss}) = \frac{\rho^{-\theta} (1-\beta)^\delta \delta^{\frac{\psi(\delta+\theta)}{1-\alpha-\psi}}}{[\eta + (1-\alpha)\delta]^{\frac{1-\alpha-\eta\psi}{1-\alpha-\psi}}} \quad (23)$$

Similarly, with inflation taxation  $\tau_m^{ss} = \beta\delta\rho / [\theta(1-\beta) - \beta\delta]$  and  $\tau_c^{ss} = 0$ , we have

$$F(\tau_m^{ss}) \equiv \frac{(\rho\theta)^{-\theta} (1-\beta)^{\delta+\eta} [\theta(1-\beta) - \beta\delta]^\theta \delta^{\frac{\psi(\delta+\theta)}{1-\alpha-\psi}}}{[\eta(1-\beta) + (1-\alpha)\delta]^{\frac{\psi(\delta+\theta)}{1-\alpha-\psi}}} \quad (24)$$

In the steady-state with  $\beta > 0$ , and  $\theta > \delta\beta / [1 - \beta]$ , if  $\psi \in (0, 1 - \alpha)$  is large enough, then using inflation taxation to finance government spending obtains a higher welfare level than using consumption taxation. The ratio of the two welfare levels is defined as:

$$\frac{F(\tau_c^{ss})}{F(\tau_m^{ss})} = (1-\beta)^{-\eta} \left[ \frac{\theta}{\theta(1-\beta) - \beta\delta} \right]^\theta \times \left[ \frac{\eta(1-\beta) + \delta(1-\alpha)}{\eta + \delta(1-\alpha)} \right]^{\frac{1-\alpha-\eta\psi}{1-\alpha-\psi}} \equiv H(\beta) \quad (25)$$

Here, it is obvious that  $H(0) = 1$ , for  $\beta > 0$ ,  $\theta(1-\beta) > \beta\delta$  and for a

large enough  $\psi$  we have  $H(\beta) < 1$ .

When there is a production externality, the private rate of return on investment in capital is lower than the social rate, leading to underinvestment in capital. When the level of capital is below its socially optimal level, the private rate of return on labor must also be lower than the social rate, leading to a suboptimal solution with too little labor and much leisure. There for, the positive effects of inflation tax on labor and capital accumulation can increase the output. The rise in the inflation tax raises real consumption in the steady state<sup>3</sup>. With a strong enough externality, the rise in the inflation tax may raise real money balances in the steady state, rather than reduces it as in without production externality case<sup>4</sup>. Thus, the rise in the inflation tax can improve welfare level in the steady state when the production externality is strong enough for the welfare gain from increasing consumption and possibly real money balances dominate the welfare loss by decreasing leisure.

### 5. Empirical Results

Using numerical solution based on the parameterization  $\alpha = 0.3$ ,  $A = 1$ ,  $\rho = 0.1$ ,  $\theta = 0.1$ ,  $\epsilon = 0.5$ ,  $\eta = 0.3$  and  $\delta = 0.6$  in Iran's Economy, the quantitative implications of the results are illustrated in Tables 1. We first selected a benchmark case and made a steady-state welfare comparison with and without production externality.

**Table 1. Numerical Results in the Steady State With and Without Production Externality ( $\psi = 0.50$ )**

Cases	$\beta$	% $\tau_m$	% $\tau_c$	$c^{ss}$	$l^{ss}$	$m^{ss}$	$k^{ss}$	$y^{ss}$	$W^{ss}$
Benchmark	0.00	0.00	0.00	0.934	0.417	1.56	2.80	0.934	58.56
Without externality	0.23	-3.00	39.86	0.697	0.435	2.32	2.71	0.905	55.07
	0.23	-2.00	35.52	0.706	0.427	1.99	2.75	0.917	54.73
	0.23	-1.00	32.32	0.714	0.421	1.75	2.78	0.927	54.42
	0.23	0.00	29.87	0.719	0.417	1.56	2.80	0.934	54.14
	0.23	2.00	26.36	0.727	0.410	1.28	2.83	0.945	53.66
	0.23	4.00	23.97	0.733	0.405	1.08	2.86	0.952	53.26
	0.23	6.00	22.23	0.737	0.402	0.939	2.87	0.958	52.90
	0.23	23.43	0.00	0.752	0.390	0.959	2.93	0.977	53.03
	With weak externality	0.00	0.00	0.00	12.28	0.417	20.47	36.84	12.28
0.23		0.00	29.87	42.77	0.417	92.57	36.84	55.54	226.2
0.23		2.00	26.36	43.11	0.410	75.66	38.33	55.98	223.9
0.23		4.00	23.97	43.34	0.405	63.97	39.39	56.29	222.1
0.23		6.00	22.23	43.52	0.402	55.41	40.18	56.52	220.5

Source: Researchers Computations

In the Table 1, we assume that no government intervention happens in the first case in the benchmark. In the second case, either or both of consumption taxation and inflation taxation be used to finance government current expenditure as 23% of output ( $\beta = 0.23$ )<sup>5</sup>. When both instruments are used<sup>6</sup>, without production externality their optimal mix is a positive consumption tax and a negative inflation tax (a deflation transfer at a rate of nominal money growth -3.0%), implying higher real money balances than in the benchmark. Compared to the both instruments are used regarding real allocation and welfare, this optimal mix has higher leisure but lower levels of real consumption, capital, output and welfare in the steady-state than in the benchmark.

When the consumption tax is used alone to finance government spending, there is no real effect on the allocation of time and output. Since government spending is wasted, the consumption tax reduces the welfare. When the inflation tax is used alone in the steady-state, there is a greater loss in the welfare compared to the no intervention case because the inflation tax (at a 23.43%) reduces consumption,

leisure and real money balances compared to the no-intervention case. In this case, there is a greater loss in the welfare.

## 6. Conclusion

This paper considered the effects of switching from consumption taxation to inflation taxation on resource allocation and welfare. Concerning resource allocation, we found that switch to inflation taxation decreases leisure and real money balances, but increases the levels of consumption, capital, and output. The welfare effect of inflation taxation is conditional on the strength of production externality and on the elasticity of labor supply. In the absence of production externality, switch to inflation taxation always reduces the welfare, whether it used alone or with consumption taxation. In essence, as the rate of inflation taxation rises along with a falling consumption tax rate, the losses in welfare arising from the decreases in leisure and real money balances dominate the gain from the increase in consumption.

With a strong production externality, the positive output effect of the increasing from switch to inflation taxation may lead to a positive net effect on the level of real money balances. The effects of switching from consumption taxation to inflation taxation may raise welfare by correcting the under investment of capital and the under-supply of labor.

## Endnotes

- 1- Phelps (1973), Braun (1994), and Palivos and Yip (1995), assume that the government finances spending by an income tax and inflation tax.
- 2- See Atkinson and Stiglitz (1972) for more discussions on the uniform taxation principle.
- 3-  $c^{ss} = \Gamma_c^{ss} Y^{ss}$
- 4-  $m^{ss} = \Gamma_m^{ss} Y^{ss}$
- 5- Is according to central bank statistics of Iran.
- 6- However, the underlying inflation tax rate should exceed the rate that corresponds strictly to the Friedman rule, because of the

distortions of the consumption tax and the negative inflation tax on leisure and consumption.

### References

- Atkinson, A. B., and Stiglitz, J.E., (1972). The Structure of Indirect Taxation and Economic Efficiency. *Journal of Public Economics*, 1, 97-119.
- Braun, R. A., (1994). How Large Is the Optimal Inflation Tax? *Journal of Monetary Economics*, 34, 201-14.
- Brock, W. (1974). Money and Growth: The Case of Long- Run Perfect Foresight. *International Economic Review*, 15, 750-77.
- Ho, W-M., Zeng, J. & Zang, J. (2007). Inflation Tax and Welfare with Externality and Leisure, *Journal of Money, Credit and Banking*, 39(1): 105-131
- Izadkhasti, H, Samadi, S & Dallali Esfahani, R. (2015), the Effects of Inflation Taxation on Resource Allocation and Welfare in Iran's Economy: Presentation of a Neoclassical Endogenous Growth Model with Leisure and Production Externality, *Economic Research*, 50 (2), 253-280.
- Lu, C.H, Chen, B.L., and Hsu. M. (2011). The Dynamic Welfare Cost of Seigniorage Tax and Consumption Tax in a Neoclassical Growth Model with a Cash-In-Advance Constraint. *Journal of Macroeconomics*, 33 (2), 247-258.
- Palivos, T., and Yip, C.K. (1995). Government Expenditure Financing in an Endogenous Growth Model: A Comparison. *Journal of Money, Credit and Banking*, 27, 1159-78.
- Phelps, E. S. (1973). Inflation in the Theory of Public Finance. *Swedish Journal of Economics*, 75, 67-82.
- Ramsey, F.P., (1928). A Mathematical Theory of Saving, *the Economic Journal*, 38, (152), 543-559.
- Rebelo, S, and Xie, D. (1999). One the Optimality of Interest Rate Smoothing. *Journal of Monetary Economics*, 43, 263-82.
- Stockman, A., (1981). Anticipated Inflation and the Capital Stock in a Cash-in-Advance Economy. *Journal of Monetary Economics*, Vol. 8, No. 3, PP. 387-393.
- Tobin, J. (1965). Money and Economic Growth. *Econometrica*, 33,

671-84.

Wai-Ming Ho & Jinli Zeng & Jie Zhang. (2007). Inflation Taxation and Welfare with Externalities and Leisure. *Journal of Money, Credit and Banking*, 39 (1), 105-131.