OLIVERA-TANZI EFFECT: THEORY AND IT'S MANIFESTATION IN THE CROATIAN STABILIZATION PROGRAMME

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1. INTRODUCTION

Inflation is often considered to be the apple of paradise, despite all the unpleasant experiences with it.

When the government consumption, according to some rough estimations, amounts over 50°/o of gross domestic product, and when, therefore, the changes in the field of public finances can have serious implications, the possible effects of inflation on the budget become of great concern, as well as the effects of inflation on the economy as a whole. It is already well known that the power to issue money provides some additional resources for the government, in the form of the so called seigniorage. But, on the other hand, printing money may cause inflation which could influence the real collection of "normal" taxes. Recently, The Republic of Croatia has experienced high rates of inflation accompanied by a decline in real public revenues. In other words, Olivera-Tanzi effect occurred.

The aim of the paper is to explain the mechanisms of functioning of Olivera-Tanzi effect, to describe the experiences of those countries where that effect happened, to identify the circumstances under which it arises, and to estimate the intensity as well as the reasons for its occurrence in Croatia before and after the beginning of implementation of the Stabilisation programme. The authors' intention was to find the answer to the question whether the circumstances changed in last two years, or the same things would have happened if the initial price increase had been allowed. The authors want to induce further investigations in the field of interrelations between inflation and fiscal

policy, and the investigation of relationship between the fiscal and monetary policies as well.

In the second part of the paper the logic of the Olivera-Tanzi effect is presented, taking the Olivera-Tanzi effect as a dynamic process happening to the real revenue from inflation as well as to the real revenue from "normal" taxes, in the period of accelerated inflation.

The third part is the overview of the experiences of a number of countries that faced the selfperpetuating interrelation between inflation and fiscal deficit. Olivera-Tanzi effect in the Republic of Croatia in the period 1992 - 1994 will be empirically analysed in the fourth part. In the fifth, concluding part we give some suggestions that follow from the findings based on the Croatian experience, as well as the suggestions for the future policymaking.

2. THEORETICAL FRAMEWORK OF THE OLIVERA-TANZI EFFECT

The theory has already become familiar with the term Olivera-Tanzi effect and it has been used in describing the decrease in the real government revenues in the period of rising inflation.[1] Government revenues could be considered a sum of revenues from "normal" taxes, and the revenues from inflation tax. In connection with this, there are two parallel processes going on behind Olivera-Tanzi effect. The first one is the process of the reaction of the real inflation tax revenues to the rate of inflation, and the second one is the reaction of the real tax revenues from "normal" sources (e.g. sales tax, corporation income tax, personal income tax) to the rate of inflation.

[1] *This phenomenon was first noticed after the very first hyperinflation (according to Cagan's definition), the one that occurred in Germany after the World War I (Bresciani-Turroni, 1936, in: Canavese, Heymann, 1992). The phenomenon got its name later, after J. H. G. Olivera (1967) and V. Tanzi (1977) who were the first to interpret it by means of the standard analytical tools.*

The revenue from the inflation tax can be seen as the tax rate - the inflation rate, π multiplied by the tax base - the real money balances m. According to Cagan (1956) the real demand for money changes with respect to the rate of inflation. In other words, the real demand for money moves according to the expression:

(1) $$m=m_0 e^{-a\pi},$$

where a denotes the coefficient of the sensitivity of the real demand for money with respect to the anticipated rate of inflation, and mo denotes the demand for money when n = 0. The real revenue from the inflation tax is, then,

(2) $$IR = \pi m_0 e^{-a\pi}$$

The inflation tax maximizing rate of inflation is $\pi=1/\alpha$, that means that the revenue from the inflation tax reaches its maximum when the elasticity of the demand for money with respect to the rate of price change is unity.[2]

On the other hand, the revenue from "normal" taxes also responds to the price increase. If the tax system is generally progressive, the real tax revenues could stay unchanged when prices increase, or even rise. Nevertheless, if the inflation is high, it can be expected with greater certainty that the government would collect smaller amount of taxes in real terms, and that the loss of real resources would be the greater the longer the lag between the moment the taxable event occurred and the moment the government collects the tax (Tanzi, 1978). The case of the

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$$\frac{\delta IR}{\delta \pi} = m_0 e^{\alpha\pi} - \alpha\pi e^{-\alpha\pi} = 0 \quad \text{when} \quad \alpha\pi = \frac{1}{\alpha}$$

$$\epsilon_{m,\pi} = (\alpha m_0 e^{-\alpha\pi}) \frac{\pi}{m_0 e^{-\alpha\pi}} = \alpha\pi$$

loss of real tax revenues induced by inflation is known as Olivera-Tanzi effect.

The real value of the "normal" taxes the government collects, assuming that the elasticity of the real tax revenues to the increase in real GDP, is then:

(3) $$T_{\pi} = \frac{T_0}{(1+\pi)^n},$$

that is

(4) $$T_{\pi} = T_0 e^{-\beta\pi},$$

where T_0 denotes the effective tax burden in the inital period, n is the average collection lag expressed in months, and β denotes the coefficient of the average collection lag expressed in months.

Total revenue in the period of inflation will then be the sum of the expressions (2) and (4), or

(5) $$TR_{\pi} = \pi m_0 e^{-\alpha\pi} + T_0 e^{-\beta\pi}.$$

The rate of inflation that maximizes the total government revenue is [3]

(6) $$\pi^* = \frac{1}{\alpha + \beta \frac{T(\pi^*)}{IP(\pi^*)}}$$

The expression $\beta \frac{T(\pi^*)}{IP(\pi^*)}$ in the denominator is positive, which

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[3] $\frac{\delta TR}{\delta \pi} = \frac{\delta T_{\pi}}{\delta \pi} + \frac{\delta IR}{\delta \pi} = 0$, when $\pi^* = \frac{1}{\alpha + \beta \frac{T(\pi^*)}{IP(\pi^*)}}$

means that the rate of inflation maximizing total government revenue is, due to the destructive influence of the inflation on the real revenues from "nominal" taxes, lower than the rate of inflation that would maximize the government revenue in the absence of that influence. In other words,

$$\frac{1}{\alpha + \beta \frac{T(\pi^*)}{IP(\pi^*)}} < \frac{1}{\alpha}$$

Assuming the rate of inflation were exogenous, the choice of the adequate rate of inflation involves great responsibility, for it can influence the revenues from the inflation tax on one hand, and the revenues from the "normal" taxes on the other hand. The above analysis shows that:

a) the lower the initial level of the real money balances, and the greater the share of the government revenues collected through "normal" taxes, the greater the fall of the total revenues caused by inflation, and the lower the rate of inflation maximizing the total revenues,
b) the lower the initial tax burden, and the bigger the share of inflation tax in the total revenues, the higher the rate of inflation that maximizes the total revenues,
c) the greater the sensitivity of demand for money with respect to price changes, the smaller the revenues from inflation tax, and the lower the rate of inflation that maximizes the total revenues,
d) the larger the collection lag, the bigger the erosion of the real revenues caused by inflation, and the lower the rate of inflation that maximizes the total government revenues.[4]

[4] *It has to be pointed out that the former analysis of the revenues from the inflation tax is based on following assumptions: 1) the only cause of inflation is the inflationary finance of the fiscal deficit, 2) the money supply changes only as a consequence of the deficit financing, 3) that inflationary expectations equal the actual price changes, 4) that the monetary multiplier equals 1, that is, private banks do not evolve in money creation.*

Olivera-Tanzi effect is the case when the price increase exceeds the optimal rate of inflation and when the erosion of real collection of tax revenues surmounts the gains from any further money creation. The moment when this will happen depends on parameters m_0, T_0, β and α. On the other hand, whether the Olivera-Tanzi effect would operate and will it operate strongly or not, will depend on the features of the tax system. In other words, Olivera-Tanzi effect will be the' stronger,

a) the lower the progressivity of all forms of taxes, that means the lower the elasticities of "normal" tax revenues with respect to the price increase,
b) the higher the share of indirect sales taxes and excises with specific tax rates in total tax revenues,
c) the more difficult the tax system accommodates to the price increases by introducing discretionary measures like e. g. increase in tax rates, shortening the statutory lag for paying taxes, by raising up penalties for paying taxes after they fall due, indexing tax bases and strengthening the tax administration.

Some analyses show that the Olivera-Tanzi effect causes the increase in fiscal deficit. This follows from the fact that the nominal government expenditures increase almost instantaneously and in the same proportion as prices, that is, they do not change in real terms. Along with the decline of the real government revenues, this causes the steady rise of the fiscal deficit. Therefore, having no possibility for revenues to keep the pace with the price increase and with the rise of nominal expenditure other then the initial deficit, the government faces certain amount of unintended deficit, which depends on the rate of inflation.

The inflation itself, however, is often a consequence of unsustainable fiscal deficit. In other words, when there are limited possibilities for broadening the tax base, when the domestic capital market is insufficiently developed, and the level of external reserves is low, money creation is the only possible way to finance the surplus of

government expenditures over the government revenues. The mutual relationship between the fiscal deficit and inflation is almost perfect under such circumstances. It is then obvious that the simultaneous link between the inflation and the fiscal deficit causes a selfperpetuating interference of those two phenomena, whereby every further step of this interference means a higher rate of inflation and deficit. It seams logical to raise the question whether there is some rate of inflation at which those tendencies stop, that means some rate of inflation that would provide for the government some inflation tax revenue that would be sufficient to cover the initial deficit as well as the deficit provoked by inflation, or does that process necessarily lead to an explosion of the deficit and inflation (Kiguel, 1989; Choudhry, 1990; Canavese, Heymann, 1992).

If the initial amount of fiscal deficit is

(7) $$D_0 = G_0 - T_0 \quad ,$$

in times of inflation, owing to the collection lag it becomes

(8) $$D_\pi - G_0 - T_\pi \quad ,$$

where

(9) $$D_\pi = D_0 + d\,(\pi) \quad ,$$

In the above expressions D = fiscal deficit, T = tax revenues, G = government expenditures, d = a part of the actual deficit, which depends on the rate of inflation.

Equilibrium is reached when the real inflation revenues match the total deficit, that is when D_π = IR (Choudhry, 1990).

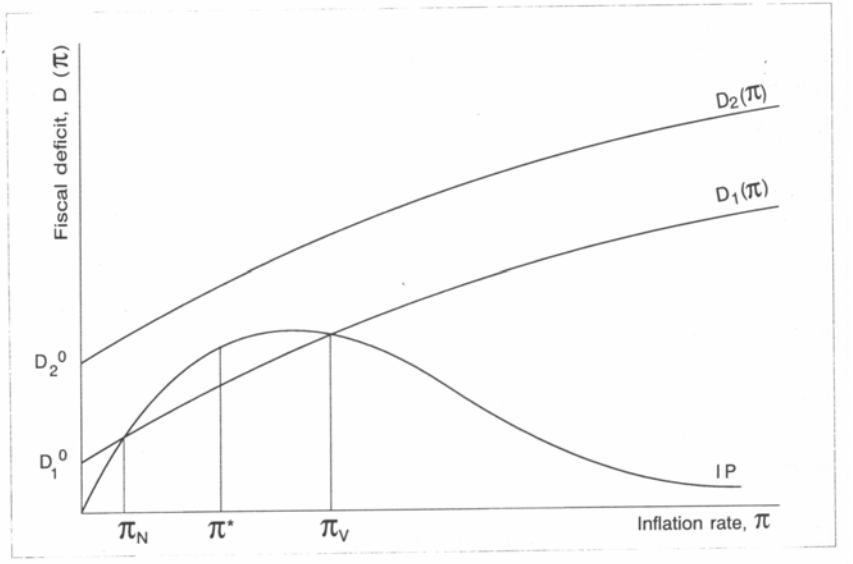
The fiscal deficit function is the increasing one since its first order derivative is positive. That means that the real fiscal deficit increases

together with the rate of inflation, and that it reaches its maximum since its second order derivative is negatives.[5]

If one assumes the function of the demand for real money balances of the Cagan type, and the shape of the fiscal deficit function mentioned above, the equilibrium inflation rate can be determined graphically (Figure 1).

Figure 1

FISCAL DEFICIT AND INFLATION



The equilibrium is reached where the two schedules intersect. There are two such points - one at the low inflation rate, π_L, and one at high rate of inflation, π_H. Since the second order derivatives of both

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$$\frac{\delta T\pi}{\delta \pi} = \beta \quad D_\pi > 0 ,$$

$$\frac{\delta^2 D_\pi}{\delta \pi^2} = -\beta^2 D_\pi < 0 ,$$

schedules are negative in the neighbourhood of low equilibrium inflation rate, stable equilibrium is reached at that inflation rate. Namely, at that level of inflation any further monetary expansion leads to the increase in real revenues from the inflation tax and diminishes the deficit, thereby reducing the need for further inflationary finance and leading the system to the equilibrium. If the initial fiscal deficit is so high that there is no monetary expansion that could cover it, there is no equilibrium rate of inflation. Such unsustainable level of fiscal deficit could be even the one that is lower than the maximum revenue from inflation, since there is the part of unintended fiscal deficit caused by the rate of inflation maximizing the inflation tax. When there is no stable equilibrium of that dynamic process, any further attempt to increase inflation revenue through money creation deepens the gap between the real government revenues and the real government expenditures (Choudhry, 1990).

From the above analysis one can conclude that if there is a possibility for Olivera-Tanzi effect to occur, there are at least two arguments in favour of low, rather then high inflation. High inflation can, on one hand, lead to great loss in real tax revenues. On the other hand, high inflation causes the increase in the difference between the real government revenues and real government expenditures and can provoke the selfgenerating and intensifying interrelation of fiscal deficit and inflation, thus destabilizing monetary and fiscal sphere of macroeconomics.

3. OLIVERA-TANZI EFFECT IN SOME EMPIRICAL INVESTIGATIONS

Many investigations imply that the Olivera-Tanzi effect followed almost all high inflations. Among those investigations there are those on the phenomena at the time and after extreme inflationary financing in Austria, Germany, Poland and Hungary after the World War I (Franco, 1990), in Columbia, Dominican Republic, Brazil and Indonesia in the late 50's and 60's (Aghevli, Khan, 1977 and 1978), in Argentina in the

late 60's and 70's (Tanzi, 1977) and in Bolivia in the period of hyperinflation in 1985 (Sacks, 1985).

The experiences of Austria, Hungary, Poland and Germany after the World War I

The fall of the Habsburg monarchy caused economic crises in two newly established, and therefore politically and economically rather weak countries - Austria and Hungary. As it seems natural for such political circumstances, these crises were reflected in high budget deficit of both countries, which resulted in the first hyperinflation to be recorded. The stabilization programmes in both countries were initiated and supported by the League of Nations, which was the predecessor of to-day IMF. The most important parts of the stabilization programmes were fiscal reforms, and the stopping of the decrease of the value of domestic currency (Franco, 1990). The data show that in Austria, there were no significant changes in real government expenditures, while at the same time there was a sudden increase in tax revenues, which made it possible to balance the state budget. It is very interesting that the League of Nation, predicted the similar developments in Hungary, drawing upon the experiences of Austria. The predictions happened to be correct. In Hungary there also occurred the decline of the fiscal deficit during the implementation of the stabilization programme, that is after stopping inflation, whereby the major contribution to that decrease came from the rise in exactly those taxes that were untouched by the fiscal reform (consumption tax, duties). The League of Nations cited in its final reports on the stabilization programmes in Austria and Hungary that "budget equilibrium followed (the stabilisation), it did not precede".

The Polish crisis in the beginning of the 20's of this century was caused by the political factors, too. In 1919, after having been split among Russian, Habsburg and German empires for hundred years, the new Poland appeared within entirely new borders. The Polish economic crisis

was characterized by the growth of the public sector and very high discrepancy between the public expenditures and public revenues. In a young country, that has only a limited choice of instruments for financing fiscal deficit, inflation was a logical consequence. The stabilization programme that started in 1923 did not succeed in stopping the expansion of the public expenditures, and the inflationary finance partly continued even after the central bank became independent from the state. Namely, the government retained the right to print coins and small notes. In the 1924 and 1925 the money creation decreased, and due to the positive influence of the fall of inflation to the real tax revenue, the budget was almost balanced.

The case of Germany is similar to the cases of Austria and Hungary regarding the reactions of real tax revenues to the rate of inflation. On the other hand, the difference is in that the explosion of prices in Germany after the World War I. was not simply the consequence of insufficient power of the state to collect resources to finance public needs, but it was the result of the collapse of the public finances caused by paying war reparation obligations. The stabilization programme aimed at placing the existing tax system on a "golden basis" in the period of the high inflation (in 1919 and 1920 it reached about 900% a year) and very low coverage of the public expenditures by the public revenues. Though there was no lowering of public expenditures, the situation in the budget recovered very quickly due to the increase in real collection of tax revenues.

In all the four examples of hyperinflation there occurred losses in the fiscal system, that is, there was Olivera-Tanzi effect. The main prerequisite of the Olivera-Tanzi effect in the cases mentioned above was inflationary financing of the budget deficit that resulted in extremely 'high rates of inflation, which, in the situation of inefficient tax administrations of those countries, and together with the long collection lags caused inflation to "bite" a part of the tax revenues.

The experiences of Brazil, Columbia, Thailand, Dominican Republic and Indonesia

The following cases of the countries for which the relationship between the fiscal deficit and inflation was to a certain extent different. That are the cases of Dominican Republic, Columbia and Thailand in the period 1961 - 1974, and in Brazil between 1964 and 1974. Those countries had in that period the rates of inflation of various levels, but their common characteristics were undeveloped capital market and the limited space for broadening the tax base. Therefore the inflation tax remained as the only possibility of financing even the lowest budget deficit. The proof that there was Olivera-Tanzi effect can be drawn from the fact reached by Aghevli and Khan (1978), which states that in all of the four countries concerned it took much more time for tax revenues to accommodate the price changes than it was the case with public expenditures, regardless what was the initial inflation level.

A typical example of the Olivera-Tanzi effect were the events in Indonesia in the period 1951 - 1972 (Aghevli, Khan, 1977). The price increase started at the end of 50's when the financial needs of the government rose due to the political turmoil, and the crisis was even sharpened by heavy draught that in 1961 led to the drastical decrease in food supplies and to the additional price increase. That caused the serious increase in nominal government expenditures. As the rise in the government revenues considerably fell behind the price increase, the government was forced to finance the deficit by money creation. The selfperpetuating process of increase in deficit and inflation occurred, so that in the middle of the 60's inflation almost reached the hyperinflationary level. The element that contributed to the slow accommodation of the real government revenues to the price increase was the inefficient method of tax collection, the structure of the tax revenues where the indirect taxes and taxes of international trade prevailed. The econometric analysis showed that for the accommodation of the tax level to the price level it took 4.5 months on the average, whereby the expenditures reacted to the price increase

with an average fag of only 1.5 months, that is three times faster. Therefore, the Indonesian case showed that when the prices increase, the real taxes follow them harder and harder, which results in increasing deficit.

Argentinean experience

The fall of real tax revenues in Argentina, in the period 1968 - 1976 was analysed by Tanzi (1978). His analysis is limited solely to the revenue side of the budget, but it takes into account "normal" tax revenues as well as the inflation tax revenues, and deals with the behaviour of their sum. From the beginning until the end of the period considered, inflation climbed from one-digit level to the three-digit level, that is to 400% percent. The price development reflected in the development of the real tax revenues, which, in that period of time fell from almost 20% share in the GDP to 12-13% of GDP in the period of the highest inflation.

Tanzi described the relationship between the price increase and the fall of the real tax revenues with the expression according to which the total revenues are $TR_\pi = \pi m_0 e^{-\alpha\pi} + (T_0/(1+\pi)^n)$. He simulated the development of the total revenues by taking the initial share of taxes in GDP, which amounted to 20% or 0.2, as the tax burden at zero inflation (T_0). For the coefficient m_0 (the share of the money balances in the GDP) he used its preinflationary level of 15%, that is 0.15. He calculated that the weighted average collection lag for the whole period was 5 months. Tanzi estimated econometrically the value of the parameter α (the sensitivity of the demand for money with respect to the rate of inflation), and found out that its value changed in that period, that is, in the period with low inflation it was 2.458, and in the years with high inflation it was 0.564. By introducing the values of the needed parameters in the formula for total revenues, Tanzi showed that the actual total real revenues of the government followed almost the same pattern as his formula predicted. The "normal" tax revenues were falling along with the increase in inflation, while the inflation tax

revenues were increasing in the first period, and decreasing later, as the consequence of the fall of the demand for the real money balances. At the same time Tanzi explained that the maximal attainable real government revenue depends on the coefficient of the sensitivity of the demand for money with respect to the rate of inflation. At low rates of inflation, the demand for money reacts heavily to the fall in the real value of money, so it showed that in the beginning of the development of the inflationary spiral, due to the narrowing of the base of the inflation tax, the total revenue-maximizing rate of inflation was 15%. Later, at the high level of inflation the ratio of money to GDP becomes so low that it was impossible for it to get any lower, and the sensitivity of the demand for money with respect to inflation decreased. Under such circumstances the total revenue maximizing rate in Argentina was 100%. At rates higher than 100% the erosion of the collection of the real "normal" revenues would be so strong that it would be producing negative effects that offset the positive effects of the inflation tax revenues.

The Bolivian experience

Very strong Olivera-Tanzi effect was noticed in the Bolivian hyperinflation in 1985-86 (Sachs). After the World War II it was the only one hyperinflation in the sense of the Cagan definition of hyperinflation, and one of the highest inflations ever. In the first half of 1985 inflation amounted to 26000%, and from May to August 1985 even 60000%. The cause of that very high inflation was the complete loss of the credibility of the government incurring debt crisis, and it was directly initiated by the imbalance in the balance of payments, caused by the price decrease of the Bolivian export products in the international market. Before the inflation started, the Bolivian tax system was very weak. The former governments accumulated deficits and the problem of how to finance them had been solved by foreign indebtedness. When it was not possible any more, governments shifted to money creation. As the time passed by, inflation got an incredible acceleration, while, at the same time, the real inflation tax revenues

failed to increase on one hand, and the real collection of all other taxes collapsed. In spite of the sharp decrease in the government expenditures, the deficit became the persistent problem. With the beginning of implementation of the stabilization programme at the end of 1985 the real tax revenues of the central government rose considerably. The main reason was the effect of the devaluation of pesos on the prices of the energents and, according to that, the increase of the ability of public enterprises (state oil company) to pay taxes. Already in the following year the budget was balanced, and it even became slightly positive.

The Bolivian experience is just another example of how easy it is to get into the whirlpool of inflation and fiscal deficit, that is, how easy the Olivera-Tanzi effect starts to operate, but they show as well that the increase in real government revenues usually occurs once the price stabilisation has been started.

It can be observed that the relationship between the real tax revenues and the rate of inflation has been noticed, but there was different attention given to it, or it was analysed differently. The conclusions about that relationship have been reached upon the insight into the data on the development of the rate of interest and the real tax revenues, on the basis of the tests of simple regressions, but also by constructing more complex models with simultaneous equations.

The results of the analysis, regardless of the analytical method, show that in the conditions that lead into inflation, the interrelations between the level of real tax revenues and the rate of inflation are being induced. The examples imply that the fiscal deficit, no matter where it does stem from, is in the majority of cases the initiator of those unfavourable developments. The deficit is, thus, the necessary, but not the sufficient condition for the Olivera-Tanzi effect to happen. The sufficient condition is that there is no possibility for the government to cover the deficit in noninflationary ways. The negative relationship between the real tax revenues and inflation is the stronger the more

regressive the tax system as a whole, that is, the more is it based on the indirect and specific taxes, the weaker the tax administration, the looser the fiscal discipline of the tax payers, and the more difficult the tax system accommodates to the price increase (by indexing the tax bases, by increasing the tax rates and by shortening the collection lags).

As for the indexation of the tax bases, it has to be emphasized that some countries (Israel for example), remained uninfected by the domino-effect of the inflation and deficits, thanks to the introduction of the system of comprehensive indexation at the right time (Sadka, 1990). But, such a way of fighting the Olivera-Tanzi effect succeeds only by chance and in relatively stable economies. Therefore, there is a general recommendation to keep away from taking inflation as remedy for satisfying the increasing needs of the government, or, what seems even better, to keep the government consumption on those levels that the government can afford.[6]

[6] *The aforementioned examples could be misused, or they could be misunderstood. They are all cases of very high inflations and hyperinflations, so they could lead to a conclusion that there is a danger only if there is an excessive inflation. On the contrary, one has to infer differently. The cases of very high inflations and hyperinflations are being considered because hyperinflation, like the picture under the microscope, allows us to see some things clearer then it could be possible in some less extreme cases. What can be seen in the moments of hyperinflation can easily happen even when the intensity of the price increase is not so strong. So one has to take the advice given by Choudhry (1993) which says that, thanks to the causal relationship between the deficit and inflation, the sustainable level of deficit is much lower than it has usually been thought. In the same way, even in small doses, inflation is a very dangerous way of collecting taxes, because very low inflation can also have negative influence on the budget balance, the higher the tax burden in the country (the share of the taxes in GDP) and the lower the ratio of money to GDP.*

4. OLIVERA-TANZI EFFECT IN THE CROATIAN STABILIZATION PROGRAMME OF 1993

The theoretical framework given by Julio G. Olivera and Vito Tanzi on the effect of inflation on inflation tax revenue, real "normal" and real total taxes gives clear determinants of the fiscal policy in the period of the implementation of the stabilization programme. The classical Olivera-Tanzi relationship between inflation and real tax burden (Figure 2) is the one when the maximum of the share of the inflation tax in the GDP (IR) is reached at the rate of inflation π_A (point A), the ratio of the real normal taxes in GDP (T) falls together with the inflation, and maximum of the real total taxes (TR) is therefore reached at lower rate of inflation, π_B (point B). This shape of "normal" tax curve is characterised by the tax system without indexation, in which the collection lags cause the inflationary devaluation of the real tax revenues, which, at unchanged level of the real expenditures results in fiscal deficit. The deficit is the smaller the lower the inflation rate, and it is predominantly financed by inflation tax. In the interval between π_A and π_B the decrease of deficit caused by disinflation is greater then the loss of the inflation tax. The same levels of the real fiscal revenues (points C and D, for example) can be attained at the different rates of inflation, π_C and π_D, respectively. Although lowering of the rate of inflation from π_C to π_D would be neutral from the fiscal point of view, those two combinations have completely different macroeconomic implications. At point C real expenditures are covered by normal taxes and by inflation tax, that means there is some deficit, while at the point D the deficit is being eliminated, as well as the inflation tax as the source of its financing.

The fiscal position, such as in the point D, is the policy known as "financing out of real sources". Since the inflation tax is equally "real" as any other tax (Dornbusch, 1991), such a mixture of financing should probably be named "financing out of stable sources". The emphasis in the analysis of the Olivera-Tanzi effect should be on the stability of the sources of finance.

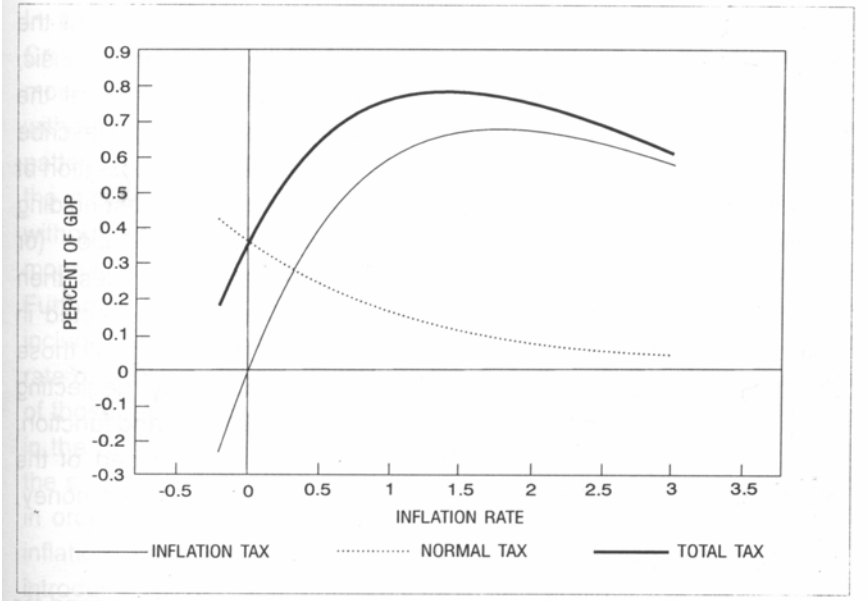
The effect of disinflation on fiscal revenues of a country depends on the factors that determine the position, the shape and the structure of the curve of the total real tax revenues, and that are the characteristics of the fiscal, monetary and the whole economic system of a country.

In the countries passing the phase of disinflation the points of maximum of inflation tax and total taxes change. That means that such processes cause some shifts in the possible sources of financing government expenditures, and that the way how the monetary phenomena affect fiscal phenomena change, as well. The Tanzi's findings for Argentina, that the total fiscal revenue-maximizing rate of inflation was considerably lower at the lower than at the higher inflation rates, show clearly that there was some shift of one or both components of the real total taxes. Structural shift of the curves in the two-dimensional space determined by the inflation and the fiscal revenues could be attributed to some third variable. In the inflation tax component that could only be the variables that are not included in the Tanzi's specification of the demand for the real money balances.

The empirical analyses of the Croatian stabilization show that under the strong currency substitution the exchange rate is one variable causing structural shift of the inflation tax curve. If the country implements a heterodox antiinflationary programme, the intensity of the reverse currency substitution is the stronger, the higher the credibility of the programme. The shifts of the normal taxes can be influenced by the reverse currency substitution as well, but also by those essential changes in the fiscal system that usually follow the heterodox antiinflationary programmes.

Figure 2

INFLATION TAX, NORMAL AND TOTAL TAXES AS A PERCENTAGE OF GDP



The money demand function applied by Olivera and Tanzi, as well as by the others afterwards could be characterised as a long term money demand function, based on very rigid assumptions of unitary income elasticity and of the zero elasticity of demand for money with respect to the other alternative measures of the opportunity cost, like exchange rate for example.

In analysing the demand for money at high inflation rate the short time dynamics of the accommodation of the actual level of money balances to the preferred level ofmoney holdings is of great importance (Hwang, 1985). The sensitivity of the demand for money in short term depends also on the velocity of that accommodation. However, the most serious shortcoming of the specification of the money demand function used is the omittance of the opportunity cost of holding money. The theoretical analysis shows that in the full specification (including the elements of

the opportunity costs like interest rate and/or exchange rate) of the demand for money in high inflation and high currency substitution countries, the coefficient at the rate of inflation would "hide" the parameters of the accommodation of the demand for money and the parameters of "money illusion" (Anušić, Rohatinski and Šonje, ed., 1995).[7] Similarly, the coefficient at the opportunity cost of the alternative financial instruments would describe the additional elements like the strength of the effect of substitution of the domestic with the foreign currency and/or with the interest holding deposits. If the opportunity cost is tightly linked to inflation (or indexed), like this is often the case in the high inflation countries, then the total influence of inflation on demand for money is reflected in several parameters, not only in the coefficient α. In this way, all those effects are implicitly included in the coefficient α. By neglecting opportunity costs from the specification of the money demand function, the estimate at the inflation rate reflects and "hides" a part of the interest rate and/or exchange rate elasticity of the demand for money, too.

The econometric estimation of the full specification of the demand for money in the Republic of Croatia showed that in the period after the stabilisation measures have been introduced, a significant increase in the elasticity of the demand for money with respect to the interest rate and with respect to the change of the exchange rate happened (Anušić, Rohatinski and Šonje, ed., 1995). In other words, the fall of the nominal exchange rate in the period of stabilisation is much more reflected in the increase in money demand then it would have been the case in the period before the stabilisation programme. Equally, if there was the depreciation of exchange rate in the prestabilisationary manner, the decrease of the demand for the domestic currency would be four times greater than in the period before stabilisation.

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[7] The parameter of "money illusion" descrihes the sensitivity of the preferred level of money with respect to inflation (Patinkin, 1965: Gapinski, 1982).

The econometric estimation of the inflation tax in Croatia in the period before and after stabilisation.

In this paper the specification of the money demand function in Croatia is based on the theoretical background of the short term money demand function in the presence of currency substitution and without a priori estimation of the coefficient of "money illusion" and the pattern of the accommodation of the actual level of money holdings to the preferred level. The specification includes the income variable without the a priori assumption on the unitary income elasticity of money demand. This hypothesis will be tested econometrically. Furthermore, in contrast to the theory, the specification does not include the elements of the opportunity costs (like interest rate or the rate of change of the exchange rate). It is expected that the omission of those variables would result in higher price elasticity than the one in the full specification. The used form also contains the variable of the structural shift of the inflation rate in the period after stabilisation in order to test the hypothesis that the revenue-maximizing rate of inflation changed after the stabilisation programme has been introduced. The econometric estimation of such money demand function in the period January 1991 - October 1994 gives us the following results:

$$Im_t = 0.0443 + 0.8505\ Im_{t-1} + 0.1587\ IY_t - 0.5698\ INFLA_t$$
$$(0.55) \quad (30.47) \quad (2.52) \quad (-6.72)$$
$$- 2.6270\ (INFLA_t * DUM9311X_t) - 0.0303\ DUM1_t - 0.0424\ DUM2_t$$
$$(-1.31) \quad (-0.79) \quad (-1.12)$$
$$+ 0.0027\ DUM4_t - 0.0210\ DUM5_t - 0.0052\ DUM6_t + 0.0696 DUM7_t$$
$$(0.07) \quad (-0.58) \quad (-0.14) \quad (1.87)$$
$$+ 0.0149\ DUM8_t - 0.0320\ DUM9_t + 0.0389\ DUM10_t$$
$$(0.41) \quad (-0.87) \quad (1.05)$$
$$- 0.0054\ DUM11_t + 0.0582\ DUM12_t$$
$$(-0.13) \quad (1.49)$$

$RBAR^2 = 0.9918$; DW = 1.85; SEE = 0.0507; F = 365; Period: 91:1-94:10

where:

Im = the logarithm of the real value of M1 at the end of month,
Im_t = In ($M1_t/P_t$), where P, stands for the implicit deflator of GDP,
IY = the logarithm of the real GDP,
INFLA = the rate of the change in the implicit deflator of GDP,
$INFLA_t = (P_t/P_{t-1} - 1)$,
$DUM9311X_t$ = binary variable for the period 1993:11-1994:10;
DUM9311X = 1 in that period, and DUM9311X = 0 in all other months,
DUM_x = binary variable for the month X; $DUM_x = 1$ in the month X,
and $DUM_x = 0$ in all other months.

The estimated elasticity of the demand for money in the period before stabilisation was -0.5698*π and for the period after stabilisation -3.1968*π. This means that the revenue maximizing rate of inflation in the period before stabilisation is:

$$\pi^*_{pre} = 175.5\% \text{ a month,}$$

and in the period after stabilisation:

$$\pi^*_{post} = 31.3\% \text{ a month.}$$

The estimated income elasticity of the money demand is 1.06, that is close to the upper boundary of the elasticity in the Baumol-Tobin theory of the money demand, as well as to the assumption taken by Tanzi in his theoretical framework.[8]

The shift of the inflation tax curve in the period after the stabilisation can be seen on the Figure 3.[9]

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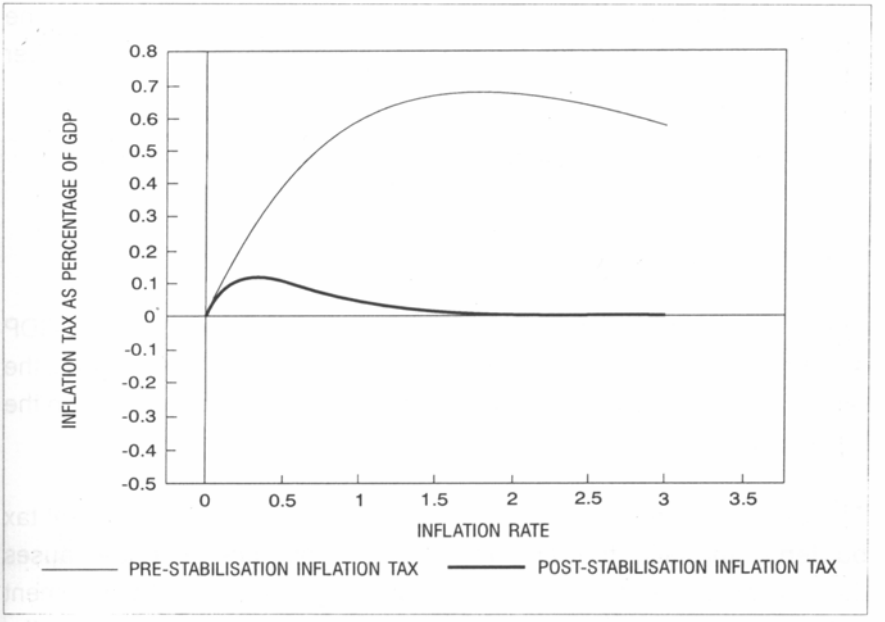
[8] By dividing the estimated equations by the income level the original form of the equation used by Tanzi in his paper could be obtained.
[9] In this paper we give the graphics of the Olivera-Tanzi effect with the rate of inflation on the X axis and with the tax burden on the Y axis.

The values of both curves are obtained on the basis of the estimated functions of money demand. In the period before stabilisation, inflation over 30% which prevailed at that time, would result in additional real inflation tax revenues. According to the estimated equation, the level of revenue maximizing inflation in Croatia stood at 175.5% monthly. Under such circumstances it would, however, be uncertain whether the demand for money would have fallen together with inflation (the elasticity was -0.5698*π) or would that mechanism have started to accelerate. Then, the π^*_{pre} would be lower than the estimated one.

Figure 3
THE INFLATION TAX BEFORE AND AFTER THE STABILISATION PROGRAMME



In the period after the stabilisation there was a considerable change in the possibility to finance government expenditures with inflation tax. The maximum of the inflation tax revenues can now be achieved at much lower inflation rate (31.3% monthly) and the decrease of the maximum level from 67% of the GDP in the period before stabilisation to the 12% of GDP in the period after stabilisation leads to a conclusion

that there is not much room for inflationing the Croatian economy. To a stronger inflationary shock the Croatian economy would react with heavy substitution of domestic currency. In this way, the reversal of inflation to its stabilisation level would result in lower inflation tax, and at higher rates of inflation, even in its absolute decline.

Econometric estimation of the normal tax in Croatia in the period before and after stabilisation.

The normal tax function follows the Tanzi's assumption of variable price elasticity of the real revenues from "normal" sources, with an additional structural shift variable in the period after stabilisation. The equation is estimated for the period December 1991 - December 1994:

$$\ln (T_t/Y_t) = \underset{(-28.70)}{-1.0178} - \underset{(-4.62)}{0.7759}\, INFLA_t - \underset{(-0.61)}{2.1870}\, (INFLA_t * DUM9311X_t)$$

$RBAR^2$=0.4256; DW=1.71; SEE=0.1254; F=74; Period: 91:12-94:12

where T_t/Y_t denotes the ratio of tax revenues in the Croatian GDP accounted on the cash basis, and $INFLA_t$ and $DUM9311X_t$ denotes the rate of inflation and the structural shift variable, respectively, like in the last equation.

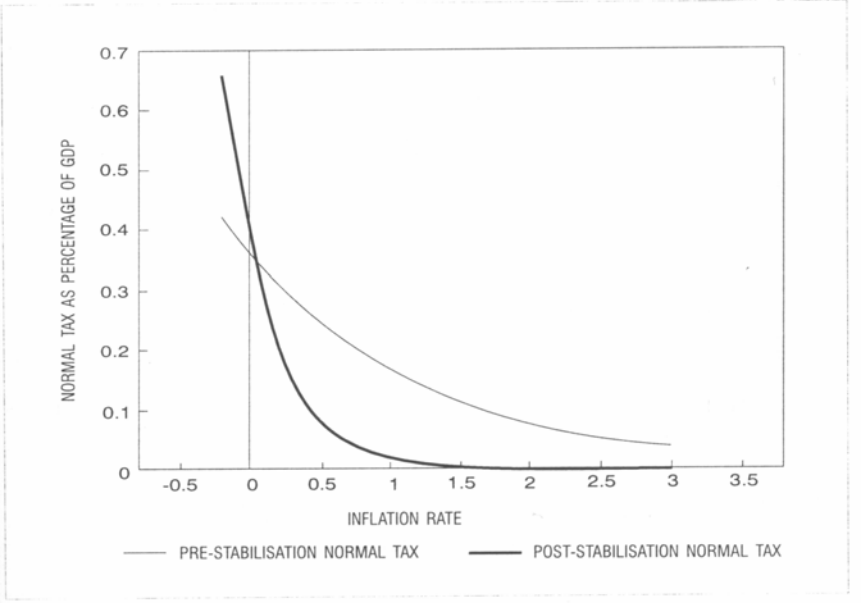
The estimates show that at zero rate of inflation, there is the real tax burden of the GDP that amounts to 36%. Any price increase causes the erosion of the real tax revenues lowering this ratio. This statement holds in the period before stabilisation, and for the period after the stabilisation as well. In the period before stabilisation the price elasticity of real tax burden of the Croatian GDP was $-0.7759*\pi$. In the period after stabilisation the estimated price elasticity is $-2.9629*\pi$, although with unsatisfying statistical properties.

Figure 4 illustrates the estimated values of the share of the normal taxes in GDP in the period before and after stabilisation. Steeper slope

of the curve in the period after stabilisation is the consequence of higher price elasticity in that period. These findings imply the possibility of the functioning of the "ratchet effect" in the relationship between the inflation and the tax revenues. Lowering inflation will result in the increase of the real tax revenues and in lower budget deficit, while a subsequent increase in inflation to the initial level would cause even higher deficit then the one which could have been possible in the initial period. The moral of this result for the fiscal policy in Croatia is that any renewal of the inflation at the prestabilisationary level of about 30% a month would be disastrous for the public finances, and for the economic system as well.

Figure 4

THE REVENUES FROM NORMAL TAX BEFORE AND AFTER THE STABILISATION PROGRAMME



Figures 5 and 6 illustrate the values of the total real tax burden and its components in the period before and after the implementation of the stabilisation programme. The rate of inflation maximizing total potential fiscal burden in the period before stabilisation was 140.2% a month

(Figure 5). At this rate of inflation there would be a great loss of the real tax revenues, whereby the ratio of the real tax revenues in the GDP would fall to only 11.3%. This could result in huge deficit financed wholly from an unstable and uncertain source as the inflation tax.

However, in the period after stabilisation, the situation is completely opposite. The maximum of the fiscal burden can now be achieved at the zero rate of inflation. Although the inflation tax maximizing rate of inflation now amounts 31.3% monthly, as we already emphasised, the inflationary loss of the normal taxes exceeds the inflation tax gains.

Figure 5

TOTAL REAL SOURCES OF FINANCING BEFORE THE STABILISATION PROGRAMME, AND THEIR STRUCTURE

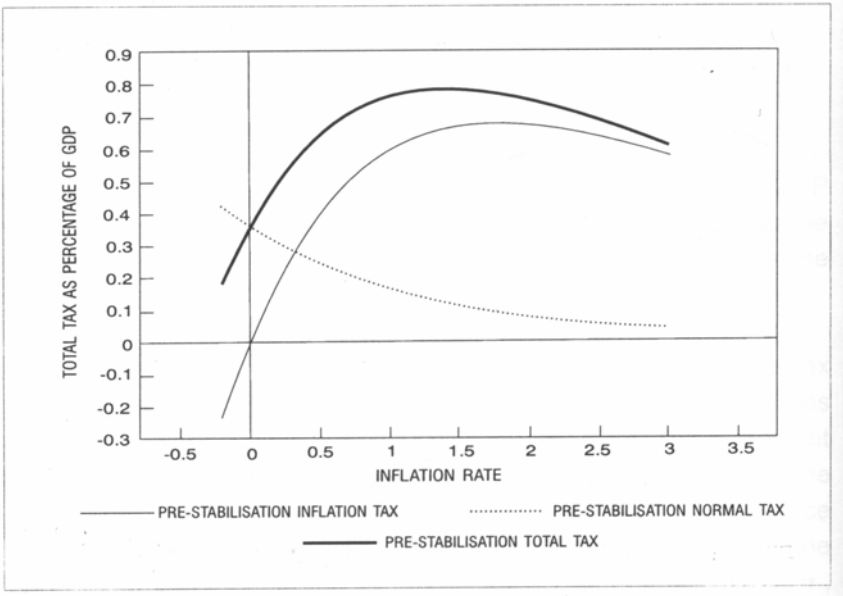
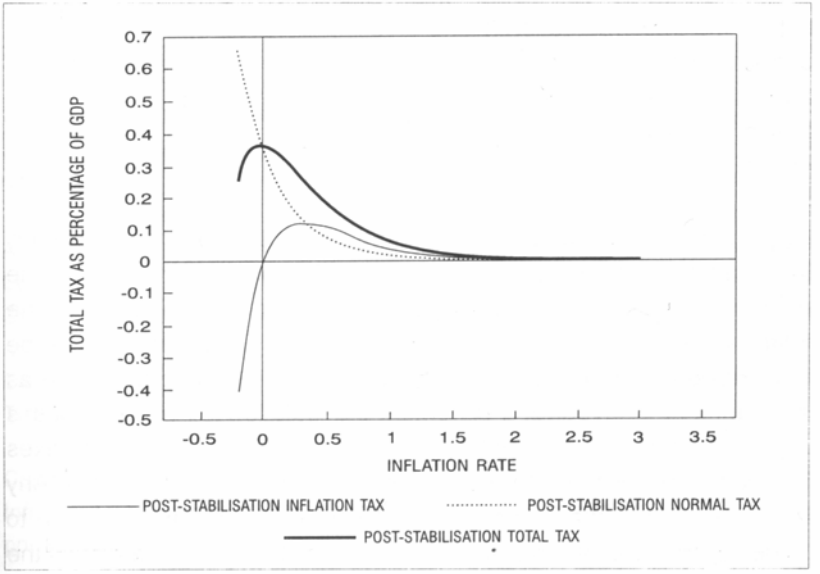


Figure 6

TOTAL REAL SOURCES OF FINANCING AFTER THE STABILISATION PROGRAMME, AND THEIR STRUCTURE



5. CONCLUSION

Inflation was not to the benefit of the Croatian fiscal policy neither before the implementation of the stabilisation programme, nor in the poststabilisation period. The analysis showed that in Croatia, inflation always has negative effects on the revenues from the normal taxes, that is, every inflation opens big possibilities for entering into the fiscal deficit.

For Croatia, the better economic future will certainly come. However, the road to that future will be to a great part determined by the economic policy of today. The empirical finding of this paper is that the inflation tax in the period after stabilisation in Croatia could be maximized at high rates of 31.3% monthly. For some, it can serve as an argument in favour of a statement that inflation is needed, but this is just one side of the medal. Inflationary erosion of the normal taxes is much stronger then the inflationary component of total taxes. Any involvement in inflationing of the Croatian economy in order to "finance" faster economic activity would result not only in a loss of the real tax revenues and in deficit, but it would also have the opposite effect - the loss of the total real fiscal revenues. Price stability guarantees the stability of financial sources for the economic recovery that is about to start. There is simply no other choice for the Croatian fiscal policy.

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