

# **An Econometric Study of Hyperinflation in Yugoslavia**

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## **An Econometric Study of Hyperinflation in Yugoslavia<sup>1</sup>**

The economic crisis of the 80's, including complex problems of structural dislocations, productive inefficiency and economic system imperfections, has deepened and reached catastrophic proportions with the war in the former Yugoslavia and the economic blockade of the new Yugoslavia. The main constant signs of the difficult economic situation in all of Yugoslavia were a chronic balance of payments deficit and constant inflation. On top of these, economic blockade and war in the former Yugoslav regions caused appearance of some new problems: a tremendous impoverishment of the economy and population, neglecting progress and lagging behind in all spheres of human life and activities, mostly in science, technology, and culture.

As a consequence of cutting off commodity transactions with the former Yugoslav republics and the world, and of cutting the inflow of foreign capital, along with the exhaustion of the domestic capital resources, inflationary financing of public expenditures and the new production became the only source of financing. The two main features of macroeconomic policy: the so called "socialization of the losses", namely dividing the burden of economic losses caused by the UN economic sanctions, and an out of dimension unproductive consumption, as compared to the deeply lowered level of production and real sources of taxation, led to inflationary financing of the ever growing budget deficit. Actually, all kinds of macroeconomic imbalance the deficit can cause<sup>2</sup> were in action: printing money excessively (showed up as inflation), excessive use of foreign reserves (balance of payments crisis), high domestic borrowing (in effect, taking possession of private savings, led to debt crisis and pushing out private investment); only foreign borrowing was eliminated by the UN sanctions.

The reliance of the government on seigniorage revenue to finance the deficit led to hyperinflation. As a consequence, the monthly inflation rate rose from about 50% after imposing the economic blockade by mid 1992, to an average of more than 200% in the first seven months of 1993, and then very rapidly to about a million % by the end of 1993<sup>3</sup>, which caused a complete destruction of the efficiency of the tax system (the Keynes-Olivera-Tanzi effect).

The high inflation resulted with completely distorted relations in all economic activities, with the inverse responses to all legal economic undertakings. Especially personal incomes suffered - real salaries have dropped in two years to less than 20% of their initial level (and the productivity level per employed to only 40%). Above all, the economic sanctions and inadequate economic policy measures pushed the most vital part of the economy, individual producers and small entrepreneurs, to the side of black market operations (gray economy, roughly estimated, has reached almost 50% of the total economic activities). The most frequent black market transactions became the immediate exchange of dinars into foreign currency. The

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<sup>1</sup>The paper is based on a more circumstantial research of the hyperinflation in Yugoslavia (1991-1993), as a part of the project undertaken by the Government of Serbia (finished in December '93), prior to the new stabilization policy measures. The conclusions were opposed to the official concept of "controlled inflation", advocated by the Federal Economic Council, that prevailed for more than a year.

<sup>2</sup>See: Fischer, S. and W. Easterley (1990).

<sup>3</sup>According to some statistics, the inflation rate rose to even more than 300 million % in January 1994, before the new economic program started.

inevitable acceleration of the hyperinflation spiral caused the beginning of the national currency crash and the beginning of pure natural exchange.

Such a tremendous negligence of the policy makers to take proper actions in time were explained by the inability to simultaneously achieve mutually opposed goals: hindering of the further downfall of the production activity and the standard of living of the population, on one hand, and restraining of the inflation, on the other. Furthermore, the monetary authorities claimed that monetary policy was mostly passive, adapting to the growing price index. Indeed, even some of the empirical research gave evidence that the exchange rate of the dinar (as an index item in the price level) grew much faster than the monetary emission. As the time lag in the cause chain shortened, and as the high inflation and shortages made all the measuring far from precise, the proper diagnosis was less apparent.

As a result of the economic blockade of all international economic transactions, including the use of the Yugoslav financial means blocked in foreign banks, the need for foreign currency funds caused the black exchange market to be passed over in silence and apparently used by the state agencies as means for obtaining foreign currency funds from the only sector in dispose of them - the citizens. Therefore, the high inflation had to serve double cause for the state: to spend more than earned and to obtain foreign currency means from the individuals.

Therefore, the main goals of the paper presented were to empirically establish the inflationary mechanism in Yugoslavia, to make transparent the main causes and to identify the main source of the inflationary spiral, to warn of the necessity for the immediate stabilization policy measures, and to state the necessary assumptions for the stabilization program and the revival of the productive activities.

The econometric techniques used are an extensive analysis of the time series properties, analysis of the causality and dynamic structure by VAR models, and the use of structural simulation models.

### **Analysis of macroeconomic variables and their causality**

The time series analysis of relevant macroeconomic variables has to show the main characteristics of the time series that we use in evaluation of the economic policy measures. It is important to estimate the possibility and speed of the negative trends' turns in the key segments of the economy.

In order to examine the validity of the assumption that after complete or partial suspension of the sanctions high rates of growth can be expected, we counted moving average rates of growth for 12 month periods. For industrial production maximum average rate was 1.4% in the period from September 1987 until August 1989. It is a rather high rate of growth, comparing to the maximum for former Yugoslavia (also about 1.4%) which was achieved only during 1985 and 1979. Relatively high rates of growth of about 2% per month (during 12 month period) are rare and appeared for the last time from March 1963 until February 1964. We have to bare in mind, however, that at that time the country was more stable, and the international situation much more favourable than now. In 1994 we cannot expect any significant improvement in that respect. Therefore we conclude that the economic history of the former and of the present Yugoslavia refutes expectations of possibly high rates of growth of the industry production in the long run.

On the other hand, a decrease of the industry production shows a far larger "flexibility", for the phenomenon of very large negative growth rates is by no means rare in the past. Minimum average monthly rates of production decrease are about twice higher in absolute values than the maximum rates. This asymmetry between minimum and maximum rates asserts that it is much more difficult to start going and maintain at a high level the production activity during a year, than it is the case with its decline.

As for the other macroeconomic indicators, they all show a much larger span between minimum and maximum average monthly growth rates. That means that for them, a very fast growth, but as well a very fast decrease, are more probable. This suggests that if the conditions of the international environment allow, the economic policy measures could create very favourable atmosphere for achieving relatively high growth rates of the foreign exchange activities. Taking as an illustration the growth of exports and imports in 1989 and 1990, when foreign exchange transactions were not obstructed, we could count with the monthly rates of 6 or 8%.

To answer the question of possible speed of the negative trend turnovers, we start with the decomposition of the time series variance, according to the contributions of the seasonal, trend-cycle and irregular components. It has been established that, for the production activity series, after 6-9 months the trend-cycle component starts to dominate relative to the season. The irregular component's contribution is practically negligible. The implication of this result is that a single change of factors influencing production, i.e. imports, can significantly cause its negative trend turnover only after 6-9 months.

With the foreign exchange indicators, as on the side of imports as of exports (total and decomposed), we find that mostly after 12 months a single change of the trend-cycle component significantly effects the variability of the original series (an exception being exports and imports of commodities, where it takes about 9 months). For all these indicators the same characteristics is that almost 50% of the variability of the original series is due to the random component, even after 12 months. Therefore we can assume that exogenous factors by large designate the foreign exchange fluctuations.

The indicators of the speed of change, namely negative trend turnovers in macroeconomic variables show how long a trend-cycle component moves in the same direction on the average, regardless of whether it is an upward or downward trend. So, for the industry production activity, it takes 7 months on the average before a trend turnover occurs.

Theoretical models designed for market economies become unsuitable to explain current events in the Yugoslav economy. Because of the indefiniteness of the structure we are attempting to model, we chose a methodological approach flexible enough to capture the specific structure in certain subperiods. The basis of it is the vector autoregression model (VAR model). We use the simplest version of the model (no restrictions on parameters) to grasp the elaborated facts of the economy. Statistical analysis of the time series characteristics should give answers to the following questions:

1. What is the nature of the nonstationarity of the time series, namely, how to achieve their stationarity? The answer to this question gives some direct suggestions to the policy makers in how to treat short run fluctuations in view of the long run development policy.

2. Is there a relationship between the time series which would provide their long run accordance? Cointegration is a concept used to analyze the existence of this long run accordance of series, namely of the long run equilibrium.

We have chosen five key indicators, each of which shows the state of an economy: index of the industry production, inflation rate, rate of money supply (M1), rate of growth of the exchange rate and rate of growth of wages. The period of observation is January 1988 until October 1993.

Summing up the results we can conclude that all the macroeconomic indicators, taken separately, show sensibility of their long run development on the short run fluctuations. Moreover, their combined development indicates that unpredictable variations of the long run component of the economic activity is significantly influenced by short run fluctuations (business cycles) and that in the long run these series do not converge to the equilibrium. Therefore the question is whether in their interaction there is a relationship that would result in a stable equilibrium path in the long run.

The obtained cointegration tests results suggest that there are at least two linear combinations of the included variables that are stationary, i.e. the existence of the long run equilibrium relationship between exchange rate, money, prices, wages and production was confirmed. Using policy measures on the exchange rate, money and prices, it is possible to bring the other aggregates in mutual long run accordance.

On the basis of the obtained results we can state:

1. The price increase does not cause money supply. This rejects the hypothesis that the monetary policy adjusts *ex post* to the realized inflation rates, namely that the monetary policy was passive in the observed period.
2. All variables, aside production, cause the price increase, which was to be expected. It is important to note that the effect of inflatory expectations is also very significant, the fact explained theoretically in Cagan's (1956) model of hyperinflation.
3. Money supply increase is not affected by other indicators, except for a weak causality from production. At the moment of lowering the productive activity, starts a pressure on the monetary authorities for selective credits, thus causing an increase of the money supply. However, there is no feedback, which means that the increase in money supply does not cause an adequate production level increase. Therefore the money supply increase is an exogenous variable.
4. Money supply causes inflation rate increase, as well as an increase in the exchange rate. At the same time there is an absence of causality from money supply to the exchange rate. The series we use are monthly, and as the black market reacts within a month to the primary emission increase, that means that the effect takes place in shorter intervals than those used in the analysis. At the same time, there is no feedback from the exchange rate to the money supply.
5. Exchange rate is the variable with the highest value of  $F$  statistics in the inflation rate equation. With the above explanation of causality relation between money supply and exchange rate, this result gets a new meaning. The exchange rate

increase appears to transmit the influence of the money supply to the rise in prices.

6. Between the increase of exchange rate and nominal wages increase there is a both ways causality, the causality from exchange rate to wages being more intensive. Although money supply increase is not directly explicit, we can recognize it indirectly via causality between money supply and exchange rate. So, although wages increase influences price increase, in the causality chain this variable was ordered lower than the money supply and the exchange rate.

Summing up the obtained results of causality testing, we can state that in the causality ordering at the highest place of all analyzed variables is money supply increase. That means it directly or indirectly causes increases in all other variables, but does not affect production activity increase. This result supports the so called "fiscal" explanation of inflation causes, different to the previous period until 1989, when "balance of payments" explanation was relevant.

Using an alternative way of expressing VAR model, the variance decomposition of inflation is possible. We want to determine the level in which unanticipated increase of money supply or exchange rate contribute to the variability of the price increase. The results are conditioned by the causality ordering of the variables. It is usually suggested to put at the first position the variable whose unanticipated influence we want to examine, namely an exogenous variable. In our case it is the money supply and the exchange rate. At the end of the causality ordering is the variable whose variance of prediction we want to decompose, i.e. inflation rate.

Our analysis was made using two orderings. The difference between them is in which variable is at the first position: money supply, then exchange rate, or vice versa. As expected, when money supply is at the first position in causality ordering, an average of over 65% of the variance of the inflation prediction can be attributed to it. The share of all other variables, except exchange rate, is much less expressive.

Setting exchange rate increase at the first position ahead of the money supply, as expected, a larger share of variance is attributed to this variable. As for the money supply increase, its share is still large, although its position in ordering is lower than that of exchange rate. Also, the share of money in explaining price variability increases during time (setting at further distance the prediction horizon), and the share of exchange rate slowly decreases. Comparing the analysis results for the two orderings (corresponding to "fiscal" and "balance of payments" explanations of inflation main causes), we can state that money supply's share is relatively less expressed when money changes position from the first to the second, that it is the case with the exchange rate. Therefore, we can conclude that the variance decomposition of inflation proved the exogeneity of the money supply increase and a significant influence on the price increase by its unanticipated changes.

## **The model**

In order to establish an econometric model of simultaneous equations representing the mechanism of Yugoslav hyperinflation, we take the period from the beginning of 1991 (beginning of the war in former Yugoslav republics) until October 1993 (last data available).

Some special characteristics of the system and the period studied have to be taken into account. First of all, the economy operates under the economic sanctions imposed by the UN

since June 1992. The number of workers employed is institutionally determined (practically held constant during the economic sanctions) and so is the average wage rate. Commodity and raw material stocks have no correlation with the level of production, since they are formed for opposite reasons: either as a reserve to compensate future deficiency, or as a result of inability to realize production. The nominal rate of exchange of dinar is no longer an economic policy instrument, but is formed as a result of black market transactions and price changes. The quantity of the disposable foreign currency reserves is considered one of the main limitations, because of the high established dependence of the Yugoslav production and consumption on imports and economic blockade.

Real wages are highly connected with the real money supply (since the half of 1991 the correlation coefficient for their rates of change is 0,966), and they fall faster than overall productivity (with insignificant correlation between their rates of change). The fall of real wages and the rise of the real exchange rate is not, however, followed by the corresponding balance of payments surplus.

In explaining industry production fluctuations, it has been established that imports become the main factor, beside real money supply, especially after imposition of the economic sanctions, although with a little longer time lag of its effect than before.

Opposite to the usual treatment of exports as exogenous and imports as endogenous variables in econometric models, here exports result from the previous month's production and immediate real money changes, and imports is an externally determined variable. The foreign exchange balance and the change of regimes influence foreign currency reserves, which in turn, together with the money supply and price changes, determine the real exchange rate of dinar.

The inflation rate change is determined mainly by the supply of money and so has a built in effect of the previous change of real exchange rate. The quantity of money supply, as the main instrument of economic policy, and the rate of inflation, determine the real money quantity. Real money influences exports, with a time lag industrial production, and also real wages, which depend on their previous achieved level and are negatively correlated with the real exchange rate.

The causality chain is represented by the enclosed chart. The oval frames represent exogenous variables taken into account in the simulations conducted further on, and the other exogenous influences are ignored (because of the lack of data).

All estimated equations are highly significant (at the 5% level), signs and levels of the estimated parameters are as expected, and the  $R^2$ 's, Durbin-Watson and Dickey-Fuller<sup>4</sup> statistics show that the model includes all most important factors necessary to sufficiently explain the variations of endogenous variables.

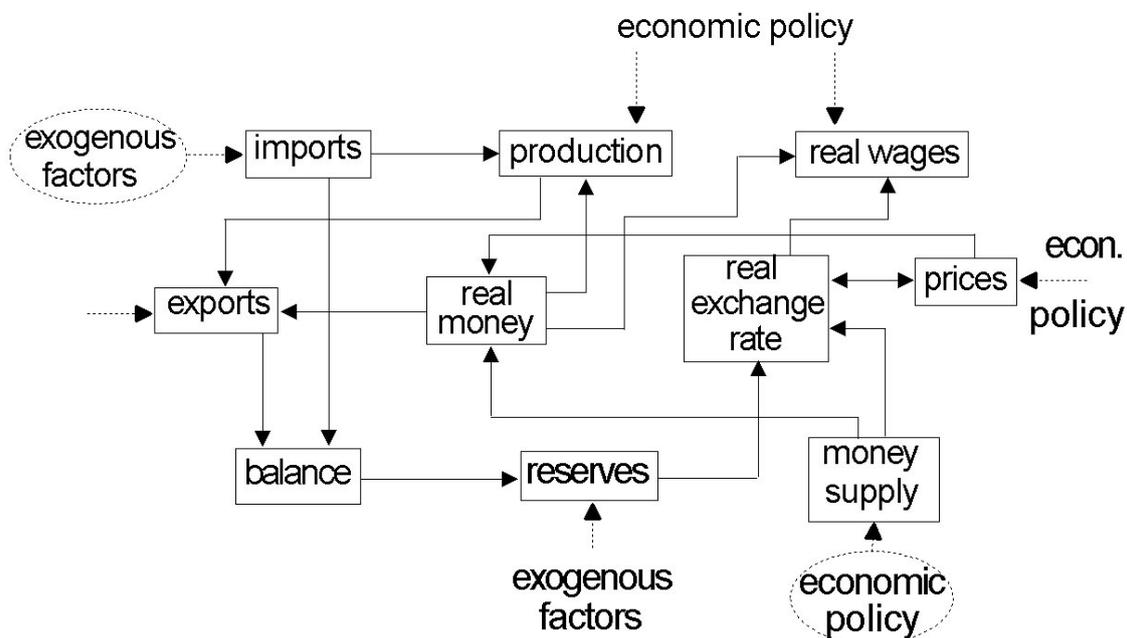
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<sup>4</sup>The DF statistics proposed by Dickey and Fuller (1981) tests for cointegration by testing for a unit root in the residuals. All the reported DF values are highly significant, indicating cointegrating equations.

EQUATIONS		R <sup>2</sup>	DW	DF
(1)	$IP = 19.53 + 0.34 IP(-1) + 0.05 RMO(-1) + 0.05 IM(-6)D$	0.93	2.28	-6.82
(2)	$EX = -89.78 + 1.68 IP(-1) + 0.17 RMO$	0.94	1.91	-5.45
(3)	$BL = EX - IM$			
(4)	$CRZ = -4.37 + 0.04 BL + 4.96D + 28.93D3 - 24.26D6$	0.87	1.88	-5.99
(5)	$LCI = 0.91 LCI(-1) + 0.09 RER(-1)$	0.89	2.14	-5.99
(6)	$RER = 0.96 RER(-1) - 0.06 dCI + 0.13 dCMO - 1.52 CRZ(-1)D$	0.86	2.80	-8.48
(7)	$RMO = 0.96 RMO(-1) + 0.21 CMO - 0.20 CI$	0.95	1.81	-5.13
(8)	$RWG = 187.40 + 0.39 RWG(-1) + 0.36 RMO(-1) - 1.75 RER(-1)$	0.98	1.81	-5.18

<p>IP = industrial production index  MO = money supply (M1)  IM = imports  EX = exports  BL = foreign exchange balance  RZ = foreign currency reserves  CI = inflation rate  ER = exchange rate of dinar  WG = wages</p>	<p>R = at the beginning of a word real (deflated) quantity  D = at the end of a word denotes a dummy (or multiple of a dummy) variable for sanctions, since June 1992  C = at the beginning: rate of change  L = at the beginning: natural logarithm  d = at the beginning: difference, <math>dx_t = x_t - x_{t-1}</math></p>
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The estimated model is linear (although some of the variables are expressed in terms of changes or change rates) and recursive (by order: 1, 5, 7, 8, 2 and so on), so that simulations and forecasts are quite simple. The presence of lags of dependent variables with a coefficient close to unity (as in inflation rate, real money supply and real exchange rate equations) indicates a higher order of integration for the respective series than for the remainder of the

equation (the linear combination of other present series). On the other hand, the industry production index and real wages series show an autoregressive coefficient of less than 40%. This can also be interpreted as very long necessary adjustment periods for the former series, and a very short adjustment period for the latter ones (about a half of a month).

The estimated structural model confirms all previous conclusions on the causality mechanism in creating hyperinflation. However, it could not have been used for forecasting without slight modifications. They included reestimation of the parameters using a shorter recent period and also exclusion of some insignificant regressors (for instance, dummy variables) in a couple of equations.

Forecasting values of exogenous variables (imports and the rate of change of money supply) gives a basis for simulation of future values of all endogenous variables, as conditional expectations for the given changes in exogenous variables. Two simple simulations are particularly interesting. One of them is based on the simple extrapolation of exogenous variables moving average trends. The values of endogenous variables generated thus by the model show very unfavourable trends. For instance, real money quantity becomes null in December of 1993, exports in the following month, and the industry production index in March of 1994.

The other simulation of interest actually searches for the conditions which would make it possible for the production growth to achieve the level of industry production from the beginning of 1993. Since the externally determined imports cannot be enlarged freely, only the growth of real money can serve the purpose. The model estimates a necessary 30% rate of growth of real money per month, for at least 6 months (which amounts to almost 5 times larger quantity of real money). The effects of real money increase are soon measurable in the foreign exchange sector, further as lowering the pressure on exchange rate of dinar, and so indirectly on the inflation rate as well (including a rise in real budget revenues). Not only that it is very difficult to increase the real capital by such monthly rate, but the production effect amounts to merely restoring the level of more than a year ago!

The main question therefore becomes how to provide for such real money growth. The emission of money in the state of high inflation devaluates by itself, so that the first step of economic policy is to cut the inflation by cutting the emission of money and loans and restart by very strict monetary and fiscal discipline.

The peculiarity of the Yugoslav case of high inflation is that the stabilization program has to be undertaken in conditions of total economic blockade by the whole world, and that it is supposed to be just a phase in a complex process of the economy transition. The first problem, namely total blockade of the otherwise inadequate Yugoslav financial means abroad, and inability to approach international financial institutions, makes the task the more difficult. On the other hand, hyperinflation has enormously devaluated the quantity of money in operation, so that the higher the inflation, the easier it is to restart with an emission that would be covered by the federal foreign currency reserves.

In order to speed up the production recovery, government has to take a number of stimulative measures (lowering ineffective employment, changing the tax systems, introducing adequate credit policy, etc.). At the same time it is crucial to facilitate the foreign exchange. There is no hope that a substantial industry recovery can take place under the economic sanctions, and without any foreign capital resources.

The lack of domestic financial means is a consequence of not only high inflation and tremendous impoverishment of the economy and the population, but of a shaken credibility of the banking system as well. It is therefore unavoidable to respect economic laws in the monetary sphere, to provide independence of the central bank and to institutionalize and make operational monetary markets (for money, capital and foreign currencies). It is the only way to improve the efficiency of using the scarce resources. In the opposite case, there will always be an uncontrolled, black market, and gray economy, with no possibilities for economic policy interventions, no optimal use of resources and no facility to achieve the economic targets.

## Conclusions

»The main established cause chain in the inflatory spiral is: *money rate of exchange prices salaries*. Of all analyzed series, only the rate of money supply had an autonomous growth. This is easily expected, baring in mind that a tremendous share of budget deficit in GDP is being cover by the money emission, and that all other analyzed variables are dependent on the money supply.

»»»»The analyzed system shows an explosive divergence from the equilibrium, which calls for immediate economic policy actions. The first task must be cutting the inflation, by eliminating its sources. The established inflatory mechanism requires implementation of an orthodox anti-inflation policy, therefore a substantial diminishing of the share of budget expenditures in GDP, eliminating budget deficit, as well as a very strict control of monetary emission.

»Real wages had a far larger descending than all other real series in the observed period, with yet further tendency of widening the gap between wages and prices. Real wage level is the first variable that by the model simulation (in the pessimistic scenario) falls to null. Therefore a heterodox approach (using income policy to bring down the inflation) could be counter-productive. Economic policy has to prevent further decline of the standard of living and to distinguish between productive work salaries and social benefits. The absence of economic criteria in distribution, beside social and political criteria, is the main cause of high inflation.

»A longer term revival of the productive activity downward trend and installing of an internal equilibrium cannot be achieved under conditions of the international economic blockade. Therefore economic sanctions suspension is a decisive factor for the complete economic recovery of Yugoslavia.

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The current stabilization program (started January 24, 1994) has proved the results of our study (finished half a year ago) to be right. An orthodox antiinflation approach, consisting of tight fiscal and financial policies and a fixed exchange rate, led to a rapid disinflation. Actually, price stabilization was achieved even before the budget deficit had been eliminated. A

significant rise of average wage rate and industry activity took place, due to the growth of real money emission (the supply of money being still held lower than the demand).

Unfortunately, the rapid reduction in inflation at the beginning of a stabilization program is always the easy part, to maintain price stability over time is the real problem. Sustained economic growth is possible only within a sound macroeconomic framework, in which fiscal policy plays a crucial role. Also, traditional anti-inflation programs (tight fiscal policy and a fixed exchange rate, as the orthodox part) often have to be combined with price and wage controls (heterodox stabilization programs), at least as a temporary device<sup>5</sup>. As a matter of fact, not only real imbalances cause chronic inflation in transition economies, but also resistance to changes and constant pressures on government to soften budget constrains. Low credibility (lack of conviction of the part of the population that the government can bring down inflation in the long term) and inflatory expectations also play an important role. And even for fixed future deficits, the expectation for future inflation can increase current inflation, despite of an apparently contractionary monetary policy today.

As for the second problem of the stabilization program, it still does not seem to be a promising step toward the process of recuperation of the Yugoslav economy to a stable, open market system. Thus the second phase of the program would have to include the changes in the economy structure as well.

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