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EXPORT EXPANSION AND ECONOMIC GROWTH IN YUGOSLAVIA*

Some Empirical Evidence

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ABSTRACT

This paper provides an analysis of the interdependence between export growth and the growth of GDP in the Yugoslav economy, and between the growth of export and the growth of output in Yugoslav manufacturing industry in the 1952—1987 period. The application of co-integration and causality tests has shown that, at the level of the economy as a whole, a unidirectional causal relationship exists between export to output. In the case of manufacturing industry there is a significant unidirectional causal relationship running the other way, from output to export. The results indicate the presence of autarchic tendencies in the Yugoslav economy in the long run, arising from the strong influence of domestic demand as the primary generator of economic growth.

1. INTRODUCTION

The numerous empirical studies of the interdependence of export and economic growth in developing countries which appeared in the literature during the seventies and the eighties with the aim of confirming or contesting export-led strategy, can be divided into two strands. The first, and larger group consists of cross-country aggregate analyses, the second of analyses of the interdependence of export growth and economic growth for specific countries and for a chosen

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period, i.e., analyses based on a comparison of time series for each of the countries surveyed. This paper belongs to the second group, except that it is confined to Yugoslavia and to comparisons with results available for a certain number of Newly Industrializing Countries (NICs).

Analyzing ten well-known previous empirical analyses of export and economic growth, Jung and Marshall (1985, pp. 3—4) pointed out that the general approach consisted in regressing real growth with respect to the (simultaneous) growth of real exports, and that the proposition that export growth causes economic growth was generally borne out. It is a characteristic of all the studies that they point out that export causally precedes output growth. With the aim of testing the direction of causality, Jung and Marshall chose the Granger test.[1] This orientation also springs from the fact that cross-sectional tests or, respectively, international cross-sectional regressions, possess an inherent short-coming linked to the assumed structural stability of cross-country coefficients, i.e., to the assumption of a significant similarity in the functioning of the economies of different countries.

A causality test was undertaken for each of 37 developing countries for the 1950—81 period, where the growth rate of output was measured by the yearly percentage change of real GNP (or GDP), and the growth rate of exports was measured by the yearly percentage change of real export.[2] The sample of developing countries surveyed does not include Yugoslavia. The results obtained show that a significant positive causal relationship is characteristic of only four countries. Even in the case of many NICs (e.g. Brazil, Korea, Taiwan) which are widely claimed in the literature to have achieved a high rate of economic growth through a policy of export promotion, no causal relationship was found. However, we should also bear in mind that the results of the test depend on the choise of the period. To give an example, the picture for Asian NICs would be probably different if the analysis began with the sixties, when the majority of these countries followed export-led growth strategies. This is corroborated by the findings of Chow (1987) concerning the causality between the growth of industrial sector exports and industrial development in the case of eight NICs, which are incidentally the most successful in their orientation towards export expansion (Argentina, Brazil, Hong Kong, Israel, Korea, Mexico, Singapore, Taiwan). Through the application of a Sims test he came to the conclusion that in the case of six countries there exists a bidirectional causal relationship between export growth and the growth of manufacturing output, which means that export causes the development of manufacturing industries. However, causality in the opposite direction also holds. There-

[1] For all that, the hypotheses which presume negative correlations between two variables still retain their credibility (see: Jung and Marshall (1985, p. 4)).

[2] For a number of countries the time series were shorter; the minimum is 15 observations.

fore, these are mutually linked variables in the development process, and the results confirm export-led strategies even for small open economies.

Studies by other authors include Yugoslav data in the analysis of the influence of export on economic growth. In this sense, Kavoussi (1984) uses Spearman rank correlation of the growth rates of export and GNP. On the other hand, Feder (1982) uses the production function as the framework of analysis, and estimates the parameters of production functions for the export and non-export sector, including besides of labour and capital a third variable — "export performance" (the growth of real export multiplied by the share of export in GDP). A group of 19 semi-industrialized less-developed countries, including Yugoslavia, is analyzed in the 1964—73 period. In view of the established significant difference in marginal factor productivities in the export and non-export sectors, the findings support export-oriented policies, because such policies enable the economy to come closer to the optimal allocation of resources, as well as to reach a significantly higher general level of productivity. This is not the case with inward-oriented economies.

It should especially be pointed out that, from year to year in Yugoslavia, the unit increase of production required a rising quantum of additional investments, so that the cumulated extremely high rates of investment at the end of the seventies were only the result of a tendency to substitute the low efficiency of investments in the economy by steadily increasing investment, even at the cost of escalating the indebtedness of the economy both to domestic and foreign banks. The share of gross domestic investment in GDP reached 34,5% in 1979, and 31,7% in 1980. At the beginning of the eighties, when it became obvious that the debt burden had become the primary limiting factor on economic growth, economic policy-makers stressed export growth as a priority objective. There was an evident "export campaign", as well as an orientation towards export at all costs. Studies of a causal relationship between output growth and export growth in Yugoslavia, similar to the ones published by Jung and Marshall and Chow, were not undertaken for the above-mentioned period.

Bearing this in mind, we here briefly review our methodology of testing the hypothesis of export-led growth in the case of Yugoslavia, and then present empirical findings and results of co-integration and causality tests for the chosen period (1952—87). Finally, we draw some conclusions.

2. CO-INTEGRATION AND GRANGER CAUSALITY

The present study differs from earlier work in one major regard. Prior to causality testing of the interdependence between export growth and output growth we examine whether a stable long-run relationship existed between export and output. Economic theory usually posits equilibrium relations between groups of variables. The equilibrium are assumed to be valid in the long-run, but in the short-run, devia-

tions from the equilbrium are possible. In practice, econometrians are faced with data which in the main describe short-run adjustment and not long-run equilibrium.

The theory of co-integration of time series recently introduced into the econometric literature (see, e.g., Engle and Granger (1987)) may be taken as corresponding to the theoretical notion of a long-run equilibrium relationship.

Definition: Integration. A purely non-deterministic time series X_t is said to be integrated of order d [denoted $X_t \sim I(d)$], if its dth difference is a stationary and invertible ARMA process.

Definition: Co-integration. Series X_t and Y_t are both I(d) processes. If there exists a constant α such that $Z_t = X_t - \alpha Y_t$ is $I(d - b)$ with $b > 0$, then the series X_t and Y_t are said to be co-integrated.

An important implication of this definition is that if we have $X_t \sim I(dx)$ and $Y_t \sim I(dy)$ then these two series cannot possibly be co-integrated if $dx \neq dy$. Also, if we have a bivariate co-integrated system then either X must Granger cause Y or Y must Granger cause X or both of these statements are true.

A number of tests have been proposed in the literature to determine if series X_t and Y_t are co-integrated. They are based mainly on the work of Bhargava (1983), Fuller (1976) and Dickey and Fuller (1979, 1981) to fest for unit roots and co-integration.

The present paper concentrates on four tests for unit roots and co-integration :the Dickey—Fuller (DF) test, augmented Dickey—Fuller (ADF) test, Dickey—Fuller ϕ_3 test and co-integrating regression Durbin—Watson (CRDW) test. These tests are briefly discussed below.

DF and ADF tests are based on the t-value of the coefficient of Z_{t-1} in the OLS regression:

$$\Delta Z_t = \alpha + \rho Z_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Z_{t-i} + \varepsilon_t \tag{1}$$

The order of p is chosen to be sufficiently large to ensure that the estimated residual series ε_t, is white noise. When $p = 0$ the DF test is defined, and for $p > 0$, we specify an ADF test. The null hypothesis that Z_t have a unit root is rejected if ρ is negative and significantly different from zero.

The Dickey—Fuller ϕ_3 test is a likelihood ratio test of the unit root hypothesis. We run next an OLS regression

$$Z_t = \alpha + \gamma t + \rho Z_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Z_{t-i} + \varepsilon_t \tag{2}$$

which has a residual sum of squares, say URSS. Further regression is run on the null model ($\gamma = 0$ and $\rho = 1$) which has a residual sum of squares, say RRSS. The likelihood ratio ϕ_3 statistic is the computed

$$\phi_3 = [RRSS - URSS)/2] \,/\, [URSS/(n - 3 - p)]$$

and compared with the critical values to test the hypothesis that the time series Z_t is a random walk with drift α.

These tests are used to determine the order of integration and also to test the co-integration hypothesis. In the latter case Z_t is substituted by the OLS residuals from the co-integrating regression

$$X_t = a + bY_t + u_t \tag{3}$$

The test statistic of the CRDW test is the ordinary DW statistic of regression in equation (3). The null hypothesis is that X_t and Y_t are not co-integrated, the DW statistic being zero under the null.

The test procedures applied below are as follows. We first test the hypothesis that the logarithm of the real GDP and real export are of the same order of integration. If we cannot reject this hypothesis, we can go on to test for co-integration by testing the residuals from the co-integrating regressions to see if they appear to be I(0). If we cannot reject the hypothesis that the co-integrating residuals are I(1) we conclude that the time series are not co-integrated.

If we reach the conclusion that the real GDP and export are co-integrated then the next stage of our analysis is the nature of the causal dependence between them.

Granger (1969) has introduced into economics a definition of causality which can be verified by an adequate statistical procedure. Although causality in the Granger sense came under heavy criticism early on[3], it has become a part of the econometric tool-kit. In working with non-experimental data, it is a rule that we do not possess a priori knowledge about structural relationships between the observed quantities. In other words it is impossible to define a well-founded theoretical model with parameters which can be statistically identified. In those cases, results obtained on the basis of Granger's methodology can be very useful.

For the purpose of our analysis, we assume that there exists a pair of linear covariance-stationary time series (Y_t, X_t). On the basis of this assumption, there is an AR representation of this process, i.e. we can write

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} a(L) & b(L) \\ c(L) & d(L) \end{bmatrix} \begin{bmatrix} Y_t \\ X_t \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix} \tag{4a}$$

(4b)

where a(L), b(L), c(L) and d(L) are polynomials of an infinite order and L is the lag operator (for instance, $a(L) = \sum_{k=1}^{\infty} a_k L^k$), and u_t i v_t are nonautocorrelated disturbances with expectation zero and contem-

[3] See, for instance, Zellner's critique (1979) of Granger's definition of causality from 1969 and the article by Jacobs, Leamer and Ward (1979) where they show what is really tested by Granger's methodology. Sim's (1972) and Geweke's (1978) identification of Granger's non-causality and econometric exogeneity has been shown to be unjustified; see, for instance, Engle, Hendry and Richard (1983).

poraneous covariance matrix. The existence of a Granger causal relationship between Y_t and X_t implies that either b(L) or c(L) or both have non-zero coefficients. Granger has shown (1969, pp. 432—3) that if the coefficients b_k are jointly zero, X does not cause Y, and in the opposite case the direction of causal relationship goes from X to Y. Similarly, if coefficients c_k are jointly zero, we may say that Y does not cause X, otherwise the direction of the causal relationship goes from Y to X.

The above model represents the basis of the so-called direct Granger test (Sargent, 1976). Other procedures are also defined for the testing of the existence and type of causal relationships: the Sims test, modified Sims test and Haugh-Pierce test.[4]

The procedure of testing the hypothesis that X does not Granger cause Y by the Granger test starts from some finite lag length in model (4a). The same goes for model (4b), when we are testing teh hypothesis that Y does not Granger cause X. As for the choice of lag length, two approaches can be found in the literature. In the first instance, the length is a priori fixed (see, eg., Chow (1987) and Jung and Marshall (1985) and, in the second instance, the problem of model selection is solved on the basis of optimality criterion. Due to the absence of a uniformly most powerful statistic, the appropriate lag length was determined by using five alternative criteria: Akaike's (1969) final prediction error (FPE), Akaike's (1974) information criterion (AIC), Schwarz (1978), Shibata (1980) and Hannan—Quinn (1979) criteria.[6]

For causality testing we follow the approach advocated by Hsiao (1979) with minor modifications. As Kang (1989) demonstrated the sequential search method proposed by Hsiao and used in the literature is inadequate because it will not generally find the best forecast model. The order of lag in a(L) and b(L) (equation (4a)) varies between 0 and M (maximum order of lag) and contrary to Hsiao we compute optimality criteria for every combination of lag length of a(L) and b(L) (there will be $(M + 1)^2$ combinations). If the minimum, for example, of the FPE is obtained for the combination of lag length of a(L) and b(L) where the lag length of b(L) is nonzero, then X Granger causes Y. If the lag length of b(L) is zero then X does not Granger cause Y.

In order to test that the OLS residuals from the models (1), (2), (3) and (4) are white noise, we used the modified Ljung—Box (1978) Q-statistic.

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[4] For alternative causality tests, see Sims (1972), Pierce and Haugh (1977) and Geweke, Meese and Dent (1983).

[5] For a review of alternative criteria for estimating the order of a vector autoregressive process, see Judge, Griffits, Hill, Lütkepohl and Lee (198), pp. 686—688).

[6] The FPE and AIC estimates are not consistent but asymptotically overstimate the true order of the generating AR process with a nonzero probability. Hannan and Quinn and Schwarz criteria are consistent estimation rules, and Shibata defined an asymptotically efficient estimator. Several relationships exist between the various order-determination methods. Good algebraic and Monte Carlo comparisons of the above criteria are reported by Gooijer, Abraham, Gould and Robinson (1985), Lütkepohl (1985) and Nickelsburg (1985).

3. EMPIRICAL EVIDENCE

The study covers the period 1952—1987. We also investigate a relationship between export and output in a sub-period — 1965—1987. The choice for the sub-period of analysis was dictated above all by the institutional characteristics of the Yugoslav economic system up to the mid-sixties. Although self-management and a market orientation were proclaimed at the beginning of the fifties, it is only from the mid-sixties, with the onset of economic reform, that Yugoslav firms became more autonomous. One of the radical turning points in economic policy induced by the 1965 economic reform concerns the foreign trade sector. A greater opening towards the world market, and a much wider exposure of domestic producers to foreign competition, was declared as a long term objective. The liberalization of imports, i.e. a more pronounced reduction in import customs barriers coupled with a simultaneous decrease of export subsidies to domestic exporters, the establishment of a uniform foreign exchange rate and the devaluation of the dinar were all undertaken in order to promote exports and improve the balance of payments.[7] In a dynamic context, in accordance with the orientation towards the strengthening of qualitative factors of economic growth, the objectives consisted in equilibrating the balance of payments and the convertibility of the dinar. In a bid to ascertain if this economic reform altered the relationship between export and output we include in our analysis the sub-period 1965—1987.

We will be concerned with four series; these are: GDP: the log of real gross domestic product; EXPORT: the log of real export; GDPM: th log of real gross domestic product in manufacturing industries; and EXPORTM: the log of real export in manufacturing industries. (Data definitions are supplied in an Appendix.)

As noted above, a necessary condition for two series to be co-integrated is that they are integrated in the same order. Thus, we examine whether the variables studied have unit root. To this end we present, in Table 1, Dickey—Fuller (DF), Augmented Dickey—Fuller (ADF) and Dickey—Fuller ϕ_3 statistics for our raw data series and first differences thereof.

Table 1. *Unit root tests, Period 1952—1987*

	Levels				Changes			
	GDP	EXP	GDPM	EXPM	GDP	EXP	GDPM	EXPM
Dickey—Fuller 't' statistic	—3.16	—2.56	—5.21	—4.04	—7.63	—6.88	—2.77	—4.81
Augmented Dickey—Fuller 't' statistic								

[7] The reform of the foreign trade sector was completed in January 1967.

p = 1	—4.06	—4.87	—3.71	—3.45	—2.35	—3.49	—2.45	—3.50
p = 4	—3.70	—4.17	—3.72	—3.96	—0.84	—1.67	—0.90	—0.97
Dickey—Fuller Φ_3 statistic								
p = 1	10.51	11.47	5.81	6.15	7.29	15.88	10.25	21.02

Period 1965—1987

	Levels				Changes			
	GDP	EXP	GDPM	EXPM	GDP	EXP	GDPM	EXPM
Dickey—Fuller 't' statistic	—2.54	—2.08	—1.87	—2.55	—3.73	—5.05	—3.71	—3.74
Augmented Dickey—Fuller 't' statistic								
p = 1	—2.14	—2.27	—1.17	—2.43	—2.60	—4.52	—3.79	—3.56
p = 4	—1.51	—2.95	—1.96	—2.67	—0.74	—1.57	—2.16	—0.83
Dickey—Fuller Φ_3 statistic								
p = 1	3.30	4.45	0.66	2.86	5.54	16.79	9.18	13.23

Notes: The Ljung-Box Q-statistics are not reported because they are all insignificant at the 1% level, or better, for all equations.

By using the critical values for unit root test statistics from Table 2. we may conclude that all the series are probably I(2) process in the 1952—1987 period, but for the sub-period 1965—1987, we may conclude that as differencing once produces stationarity, all the series are I(1).

Table 2. *Critical values for unit root test statistics*

statistic	1%	5%	10%
Dickey—Fuller 't' statistic [Fuller (1976, p. 373)]			
n = 25	—2.66	—1.95	—1.60
n = 50	—2.62	—1.95	—1.61
Augmented Dickey—Fuller 't' statistic; p = 1 [Fuller (1976, p. 373)]			
n = 25	—4.38	—3.60	—3.24
n = 50	—4.15	—3.50	—3.18
	—3.77	—3.17	—2.84
Dickey—Fuller ϕ_3 statistic; p = 1 [Dickey—Fuller (1981, p. 1063]			
n = 25	10.61	7.24	5.91
n = 50	9.31	6.73	5.61
CRDW [Bhargava (1983, p. 32)]			
n = 20	1.50	1.10	
n = 25	1.28	0.93	
n = 30	1.11	0.79	
n = 35	0.98	0.69	

Given that the output and export series are all I(2) processes we then proceeded to test for co-integration, normalizing on both GDP and EXPORT by using the changes of the variables. With regard to the question of whether the results of the co-integration tests are sensitive to the results of the unit root tests, we apply the co-integration tests to the levels of the variables. OLS estimates for the complete period and sub-period are given in Tables 3. and 4.

Table 3. *Co-integrating regressions and tests for co-integration*

Period 1952—1987

	Levels		Changes	
	GDP	EXPORT	GDP	EXPORT
Constant Coefficients	3.7280	—4.110	0.0601	0.07726
GDP	—	1.170	—	—0.22616
EXPORT	0.8334	—	—0.0856	—
R^2	0.9752	0.9752	0.0194	0.0194
Ljung-Box Q(10)	44.4	39.2	17.3	7.5
	(0.0)	(0.0)	(0.07)	(0.67)
CRDW	0.866	0.872	2.13	1.99
Dickey—Fuller 't' statistic	—3.02	—3.05	—6.58	—6.01
Augmented Dickey—Fuller 't' statistic				
p = 1	—1.89	—2.21	—2.18	—3.31
p = 4	—1.58	—1.79	—0.89	—1.53
Dickey—Fuller ϕ_3 statistic				
p = 1	4.08	4.18	7.54	16.50

Period 1965—1987

	Levels		Changes	
	GDP	EXPORT	GDP	EXPORT
Constant Coefficients	0.9921	—0.4336	0.03982	0.04562
GDP	—	0.8787	—	—0.00804
EXPORT	1.0911	—	—0.0016	—
R^2	0.9587	0.9587	0.00001	0.00001
Ljung-Box Q(10)	10.75	11.81	12.80	14.68
	(0.38)	(0.30)	(0.24)	(0.14)
CRDW	1.42	1.47	1.19	2.10
Dickey—Fuller 't' statistic	—3.26	—3.36	—2.81	—5.25
Augmented Dickey—Fuller 't' statistic				
p = 1	—2.98	—3.16	—1.41	—5.07
p = 4	—1.75	—1.89	—0.08	—1.56
Dickey—Fuller ϕ_3 statistic				
p = 1	4.47	4.71	2.82	16.54

Notes: R^2 denotes the coefficient of determination, Q(10) denotes the Ljung-Box statistic with 10 degrees of freedom (marginal significance levels in parenthesis).

Table 4. *Co-integrating regressions and tests for co-integration*
Period 1952—1987

	Levels		Changes	
	GDPM	EXPORT	GDPM	EXPORT
Constant Coefficients	1.3742	—1.2435	0.05858	0.00386
GDPM	—	1.0104	—	0.93830
EXPORTM	0.9753	—	0.21930	—
R^2	0.9854	0.9854	0.2058	0.2058
Ljung-Box Q(10)	32.7	21.2	7.4	11.9
	(0.0)	(0.0)	(0.69)	(0.29)
CRDW	0.630	0.638	1.40	2.11
Dickey—Fuller 't' statistic	—2.23	—2.44	—4.15	—6.54
Augmented Dickey—Fuller 't' statistic				
p = 1	—1.53	—1.70	—3.73	—6.39
p = 4	—0.48	—0.77	—1.35	—1.91
Dickey—Fuller ϕ_3 statistic				
p = 1	2.64	2.59	14.24	26.68

Period 1965—1987

	Levels		Changes	
	GDPM	EXPORT	GDPM	EXPORT
Constant Coefficients	—0.4115	0.8979	—2.85	—2.18
GDPM	—	0.8265	—0.87	—1.39
EXPORTM	1.1455	—	3.13	2.93
R^2	0.9467	0.9467	0.04767	0.00129
Ljung-Box Q(10)	13.50	14.77	—	0.84361
	(0.20	(0.14)	0.1174	—
CRDW	0.88	0.93	0.09901	0.09901
Dickey—Fuller 't' statistic	—2.05	—2.40	4.27	11.05
Augmented Dickey—Fuller 't' statistic				
p = 1	(0.93)	(0.35)	—2.62	—4.60
p = 4	1.36	1.90	—0.88	—1.34
Dickey—Fuller ϕ_3 statistic				
p = 1	—3.17	—4.58	4.69	12.83

A preliminary inspection of three tests of co-integration reveal that, for the co-integration regression in the level of the variables in the 1952—1987 period, we are unable to reject the assumption that these variables are not co-integrating vector. In the same period, co-integration test results suggest that the changes of the variables are co--integrated. In the sub-period there is no definite conclusion about the nature of the co-integration of the series. These co-integration test results suggest use of the first differences of variables in the model

(4) in the Granger causality test in 1952—1987 period and the levels of variables in 1965—1987 period. We also check whether the results of causality tests critically depend upon the definition of the variables (levels or changes) used in the causality analysis.

For the Granger test, the maximum lag was preset at 4 years. Table 5 shows the results of applying the alternative criteria in the Granger test to the first differences of the series GDP, EXPORT, GDPM and EXPORT in the 1953—1987 period.[8]

Table 5. *Optimal lag length for the Granger test of causality Period 1953—1987*

Changes of the GDP, EXPORT, GDPM and EXPORTM variables

Criterion	Causality Pattern							
	GDP⇐EXPORT		GDP⇒EXPORT		GDPM⇒EXPORTM		GDPM⇐EXPORTM	
	GDP	EXPORT	GDP	EXPORT	GDPM	EXPORTM	GDPM	EXPORTM
FPE	4	4	2	3	2	2	1	4
AIC	0	1	2	1	2	2	1	0
Schwarz	0	1	2	1	2	1	1	0
Shibata	0	1	2	1	2	2	1	0
Hannan—Quinn	0	1	2	1	2	2	1	0

In general, the pattern of causality did not depend on the optimality criterion used for model selection. The FPE criteria did, as theory implied, suggest an overparametrized model compared to the order selected by the other indicators. In the 1952—1987 period the Granger test indicates that real export of the economy as a whole Granger-causes real GDP, but the opposite is not true. This means that, in the case of Yugoslavia, the hypothesis of export promotion has been confirmed. In the case of manufacturing industry, our results support the hypothesis of unidirectional causality from real GDP to real export.

In table 6, the results of the Granger test for the series GDP, EXPORT, GDPM and EXPORT both in levels and changes are presented in the 1965—1987 period.

From the above results, there is no clear evidence of causality interdependence between output and export in the sub-period. The results of the causality tests are very sensitive to alternative optimality criteria and definition of the data (levels or changes) due to the short length of the series used (only 23 observations).

[8] Since the results of causality testing in the case of levels of GDP and export are identical to the results in the case of using the changes of the variables, we report only the last one.

Table 6. *Optimal lag length for the Granger test of causality*
Period 1965—1987

Levels of the GDP, EXPORT, GDPM and EXPORTM variables

Criterion	Causality Pattern							
	GDP⇒EXPORT		GDP⇐EXPORT		GDPM⇒EXPORTM		GDPM⇐EXPORTM	
	GDP	EXPORT	GDP	EXPORT	GDPM	EXPORTM	GDPM	EXPORTM
FPE	1	4	3	3	2	4	2	4
AIC	1	1	1	1	0	1	2	3
Schwarz	1	1	1	0	0	1	1	0
Shibata	1	1	1	1	0	1	2	3
Hannan—Quinn	1	1	1	1	0	1	1	0

Period 1965—1987

Changes of the GDP, EXPORT, GDPM and EXPORTM variables

Criterion	Causality Pattern							
	GDP⇒EXPORT		GDP⇐EXPORT		GDPM⇒EXPORTM		GDPM⇐EXPORTM	
	GDP	EXPORT	GDP	EXPORT	GDPM	EXPORTM	GDPM	EXPORTM
FPE	4	2	3	0	2	4	1	0
AIC	2	2	1	0	1	1	1	0
Schwarz	0	1	1	0	1	1	1	0
Shibata	2	2	1	0	2	2	1	0
Hannan—Quinn	0	1	1	0	1	1	1	0

The results of testing the causal relationships between output and export at the level of the economy as a whole and of industry suggest mutually contradictory conclusions. At first glance, this may appear strange, if we take into account the fact that about two-thirds of Yugoslav exports and about half the country's output are provided by the industrial sector. Comparing the results of Jung and Marshall (1985) and Chow (1987) for the same countries, we see that Yugoslavia is no exception in this respect and that the existence of different types of causal relationships between output and export at the level of the economy as a whole and of industry is not a rare phenomenon.[9]

[9] E.g. Jung and Marhall established that for Brazil (in the period 1963—80) and Mexico (1951—81) there were no causal relationships between output and export. For Brazil (in the period 1960—80). Chow states that there is a mutual causal relationship between output and export, and for Mexico (1960—80) there is a unidirectional relationship — from export to output.

A detailed discussion of the results in order to explain the place and role of export and domestic demand factors in economic development strategy is beyond the score of this paper. However, the results obtained for the economy as a whole, and especially for manufacturing industry, only confirm the thesis that intensive participation in the world market, an objective of the 1965 economic reform, was difficult to achieve.

An explanation for the results obtained for the economy as a whole in the period 1952—1987 should be sought in the institutional characteristics of the economic system before 1965. Up to the economic reform, the industrialization of the country proceeded with a high level of protection from foreign competition. The state strictly controlled imports by means of quantitative and foreign exchange limitations and customs barriers. The strictest controls were applied to imports of those finished industrial goods which domestic industry was oriented to produce. At the same time, the state stimulated exports by various means, primarily with the aim of earning the foreign exchange essential for importing products. Most of the export-derived income was used to import capital goods essential for increasing the country's manufacturing potential and thereby bringing about more rapid economic development. Products for personal consumption were also imported, particularly at times when food deficits caused by poor harvests had to be substituted. In view of the subordination of export to the realization of an anticipated flow of imports directly intended to create a planned high growth rate, the empirical findings obtained for the period 1951—1987 are not surprising.

The results obtained in the sub-period, after the economic reform, do not lead to a definitive conclusion as to whether there was a change in the type of causal relationship we have established for the whole period 1952—1987. The aspiration to achieve faster economic growth through an expansion of exports, above all of finished industrial products, was not consistently implemented. The declared aim of the economic reform, that the export of highly finished industrial products should be the generator of manufacturing expansion, was, like the reform's other principles, quickly abandoned. The very direction of causality which we have established indicates that it is in domestic consumption that the sources for the high growth rate in industrial production (at least up to the end of the seventies) should be sought, which means that Yugoslavia shows all the characteristics of an inward-oriented economy.

Our results are compatible with those found in Burkett (1983) relating to estimates for the export equation for the period March 1959—April 1976. In the absence of a time series for a representative set of policy instruments, he concludes that:

> "... the 1967 foreign trade reform did not produce any statistically significant shifts in the coefficients of the export supply equations. The slight shift that may have occurred almost certainly did not conform with the reformer's intention to reorient the economy towards export."

In the sub-period (1965—87), not only did Yugoslavia not achieve a significant level of participation in world trade, but unfavourable tendencies also appeared in the export domain: Yugoslavia's share in total world exports fell permanently. A major cause of the drastic drop in the competitiveness of Yugoslav exports during the seventies lies in exchange rate policy. Prompt adjustments of the dinar exchange rate were not effected. The nominal exchange rate of the dinar remained the same during the period 1972—79, despite the fact that domestic prices tripled. If we take 1972 as our base, the real exchange rate dropped to 58,4 in 1979.[10]

Negative tendencies became especially pronounced after 1977. This year was characterized by a change in important regulations concerning foreign trade and foreign exchange transactions. The share of Yugoslav exports in the world exports of goods was 0,65% in 1966, 0,50% in 1977 and 0,48% in 1987. The share of Yugoslav imports in the world imports of goods rose from 0,80% to 0,90% in 1977, but then dropped suddenly, to 0,64% in 1985 and 0,52% in 1987.

The unsatisfactory performance of and drastic oscillations in the yearly rates of growth of exports in the period after 1977 should be attributed, above all, to the inadequate quality of export goods and to economic policy. As distinct from the previous period, a more active exchange rate policy during the eighties, together with simultaneous administrative control of imports, had an import substituting effect and was a major factor in balancing the foreign trade sector.[11] However, due to the high dependence of Yugoslav industry on intermediate imports, the curtailing of imports had to result in stagnation in certain years.

4. CONCLUSIONS

If we take into consideration all the limitations of the Granger concept of causality and the test, the results presented suggest the following conclusion:

1) In the period surveyed, we can observe at the level of the economy as a whole a unidirectional cause relationship between export growth and output growth (from export to output).

2) We come to the opposite conclusion in the case of manufacturing industry, which is not specific to the Yugoslav economy.

3) The explanation for the results obtained for the economy as a whole in the period under consideration should be sought in the

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[10] On the basis of the results of model projection, which can be used for orientation, Yagci and Kamin (1987), point out that domestic demand would have grown much slower, the rate of inflation would have been much lower, foreign debt at the end of 1979 would have been around 6 million dollars, and not 13,8 billion dollars, and the debt service ratio would have been 20,6% and not 22,7%, if prompt adjustment had been undertaken, i.e. if a policy of the real exchange rate of the dinar had been pursued.

[11] See: Mencinger and Križanić (1986, pp. 319—320).

institutional characteristics of the economic system which existed before the economic reform of 1965. This involved state stimulation of exports in order to mobilize resources for the import above all of capital goods essential for the realization of planned high levels of economic growth.

4) The direction of causality for the period after the 1965 economic reform indicates that the sources for the high rate of growth of industrial production (at least until the end of the seventies) should be sought in domestic consumption and not in the export of highly-finished industrial products, as declared in the reform. Our findings on the absence of export preorientation are compatible with results which are based on an evaluation of the export equation, and in themselves indicate the presence of strong autarchic tendencies in the Yugoslav economy in the long run.

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APPENDIX: DATA

We based the time series needed for our analysis on data taken from the Statistical Yearbook of Yugoslavia. The series of Gross Domestic Product based on constant 1972 prices has been used for the formation of the GDP time series (log of real gross domestic product).[12]. The same goes for GDPM (log of real gross domestic product in manufacturing industry).

The nominal value of exports in dinars was divided by the dollar exchange rate in the current year in order to determine exports in dollars. We then applied the 1972 exchange rate and obtained a series of nominal exports in dinars according to the 1972 exchange rate. Deflating by means of the 1972 export price index we formed a series of real export in constant 1972 prices. This procedure was applied in our analysis for drawing up the series of log of real export (EXPORT) and log of real export in manufacturing industry (EXPORTM).

[12] According to the Yugoslav accounting system we used in fact the so-called "social product". The social product is gross material product minus material costs. The gross material product (GMP) is the market value of output of all goods and productive services rendered by the economy over a particular period of time. It differs from GDP and GMP concepts in that it does not include nonproductive services such as those provided by the government or rendered in education, health, etc.

REFERENCES

Akaike, H., (1969), Fitting autoregressive models for prediction, *Annals of the Institute of Statistical Mathematics*, 21, pp. 243—247.

Akaike, H., (1973), Information theory and an extension of the maximum likehood principle, in B. N. Petrov and F. Csáki, (Eds.), *2nd International Symposium on Information Theory*, Akadémiai Kiadó, Budapest, pp. 267—281.

Bhargava, A., (1983), On the theory of testing for unit roots in observed time series, manuscript 83/67, ICERD, London School of Economics.

Burkett, J., (1983), The impact of economic reform on macroeconomics policy in Yugoslavia. Some econometric evidence, *Economic Analysis*, 3, pp. 213—243.

Chow, P. C. Y., (1987), Causality between export growth and industrial development: Empirical evidence from the NICs, *Journal of Development Economics*, 26, pp. 55—63.

Dickey, D. A. and W. A. Fuller, (1981), Likehood ratio statistics for autoregressive time series with a unit root, *Econometrica*, 49, pp. 1057—1072.

Engle, R. F. and C. W. J. Granger, (1987), Cointegration and error correction: representation, estimation and testing, *Econometrica*, 55, pp. 251—276.

Engle, R. F., D. F. Hendry and J.—F. Richard, (1983), Exogeneity, *Econometrica*, 51, pp. 277—304.

Feder, G., (1982), On export and economic growth, *Journal of Development Economics*, 12, pp. 59—73.

Fuller, W. A., (1976), *Introduction to statistical time series*, New York: John Wiley and sons.

Geweke, J., (1978), Testing the exogeneity specification in the complete dynamic simultaneous equation model, *Journal of Econometrics*, 7, pp. 163—185.

Geweke, J., R. Meese and W. Dent, (1983), Comparing alternative tests of causality in temporal systems, *Journal of Econometrics*, 21, pp. 161—194.

Gooijer, J. G. de, B. Abraham, A. Gould and L. Robinson, (1985), Methods for determining the order of an autoregressive-moving average process: A survey, *International Statistical Review*, 53, pp. 301—329.

Granger, C. W. J., (1969), Investigating causal relations by econometric models and cross — spectral methods, *Econometrica*, 37, pp. 424—438.

Granger, C. W. J., (1980), Testing for causality: A personal viewpoint, *Journal of Economic Dynamics and Control*, 2, pp. 329—352.

Granger, C. W. J., (1988a), Some recent developments in a concept of causality, *Journal of Econometrics*, 39, pp. 199—211.

Granger, C. W. J., (1988b), Causality, cointegration, and control, *Journal of Economic Dynamics and Control*, 12, pp. 551—559.

Guilkey, D. K. and M. K. Salemi, (1982), Small sample properties of three tests for Granger — causal ordering in a bivariate stochastic system, *Review of Economics and Statistics*, 64, pp. 668—680.

Hannan, E. J. and B. G. Quinn, (1979), The determination of the order of an autoregression, *Journal of the Royal Statistical Society*, Series B, 41, pp. 190—195.

Hsiao, C., (1979), Autoregressive modeling of Canadian money and income data, *Journal of the American Statistical Association*, 74, pp. 553—560.

Hsiao, C., (1982), Autoregressive modeling and causal ordering of economic variables, *Journal of Economic Dynamics and Control*, 4, pp. 243—259.

Jacobs, R. L., E. E. Leamer and M. P. Ward, (1979), Difficulties with testing for causality, *Economic Inquiry*, 17, pp. 401—413.

Judge, G. G., W. E. Griffiths, R. C. Hill, H. Lütkepohl and T. C. Lee, (1985), *The theory and practice of econometrics*, Second edition, New York: John Wiley and sons.

Jung, W. S. and P. J. Marshall, (1985), Export, growth and causality in developing countries, *Journal of Development Economics*, 18, pp. 1—12.

Kang, H., (1989), The optimal lag selection and transfer function analysis in Granger causality tests, *Journal of Economic Dynamics and Control*, 13, pp. 151—169.

Kavoussi, R. M., (1984), Export expansion and economic growth — Further empirical evidence, *Journal of Development Economics*, 14, pp. 241—250.

Ljung, G. M. and G. E. P. Box, (1978), On a measure of lack of fit in time-series models, *Biometrika*, 65, pp. 297—303.

Lütkepohl, H., (1985), Comparison of criteria for estimating the order of a vector autoregressive process, *Journal of Time Series Analysis*, 6, pp. 35—52.

Mencinger, J. and F. Križanić, (1986), Funkcionisanje kursa u jugoslovenskoj privredi — ekonometrijska analiza, *Finansije*, 41, pp. 299—320.

Nelson, C. R. and G. W. Schwert, (1982), Test for predictive relationships between time series variables: A Monte Carlo investigation, *Journal of the American Statistical Association*, 77, pp. 11— 18.

Nickelsburg, G., (1985), Small-sample properties of dimensionality statistics for fitting VAR models to aggregate economic data: A Monte Carlo study, *Journal of Econometrics*, 28, pp. 183—192.

Pierce, D. A. and L. D. Haugh, (1977), Causality in temporal systems: Characterisation and survey, *Journal of Econometrics*, 5, pp. 165—293.

Sargent, T. J., (1976), A classical macroeconometric model for the United States, *Journal of Political Economy*, 84, pp. 207—237.

Schwarz, G., (1978), Estimating the dimension of a model, *The Annals of Statistics*, 6, pp. 461—464.

Shibata, R., (1980), Asymptotically efficient selection of the order of the model for estimating parameters of a linear process, *The Annals of Statistics*, 8, pp. 147—164.

Sims, C. A., (1972), Money, income, and causality, *American Economic Review*, 62, pp. 540—552.

Yugci, F. and S. Kamin, (1987), Macroeconomic policies and adjustment in Yugoslavia, *The World Bank — July 1987* (World Bank, Washington, DC).

World Bank, (1986), *World Development Report 1986*, Washington, DC.

Zellner, A., (1979), Causality and econometrics, in *Three Aspects of Policy and Policymaking*, eds. K. Krunner and A. H. Meltzer. Amstredam: North-Holland.

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EKSPANZIJA IZVOZA I EKONOMSKI RAST U JUGOSLAVIJI

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Rezime

U radu su prezentirani rezultati analize međuzavisnosti rasta izvoza i ekonomskog rasta u Jugoslaviji kako za privredu u celini tako i za

industriju, posebno u periodu od 1952. do 1987. godine. Primenom testova kointegracije i uzročnosti pokazano je da na nivou privrede kao celine postoji jednosmerna uzročna veza od izvoza ka rastu proizvodnje. U slučaju industrije postoji statistički značajna jednosmerna uzročna veza, ali u suprotnom smeru, od outputa ka izvozu. Rezultati ukazuju na prisustvo autarkičnih tendencija u jugoslovenskoj privredi na dugi rok, koje proističu iz snažnog uticaja domaće tražnje kao primarnog generatora ekonomskog rasta.