Steven C. Wheelwright-Spyros Makridakis: Forecasting methods for Management. 3rd Ed., John Willey and Sons, New York, 1980, pp. 362.

Bobek ŠUKLEV 315

Dugoročni razvoj Jugoslavije — Ostvarenja, ciljevi, protrebe. (Prilozi sa skupa održanog u SANU od 27 do 29 januara, 1982. god., izdanje Srpske akademije nauka i umetnosti, serija Ekonomski zbornik, Knjiga II, str. 550).

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THE IMPACT OF ECONOMIC REFORM ON MACROECONOMICS POLICY IN YUGOSLAVIA: SOME ECONOMETRIC EVIDENCE*

*John P. BURKETT***

I. INTRODUCTION

In Yugoslavia in the mid-1960's, administrative controls were downgraded from instruments of first resort to measures for emergency use in case of failure of indirect, macroeconomic instruments (Burkett, 1981, Chs. 1—2). One wonders if this change reduced the precision or speed with which planners could adjust investment expenditure and foreign trade flows.

To answer this question, one needs a technique which can disentangle and quantify the several influences on investment and foreign trade. The technique which seems most promising for this purpose is multiple regression analysis. Nonetheless, previous econometric investigations have not answered the question fully, either because they were designed to explore other issues or because they were improperly conducted (Burkett, 1981, Ch. 3). Hence, econometrics has an underutilized potential for yielding insights into the impact of the reform on the precision and speed with which planners adjust investment and foreign trade flows. To exploit that potential is the purpose of this paper.

There now exists a considerable variety of econometric techniques suitable for identifying structural change. These may be classed as descriptive, Bayesian, and classical. Prominent among the descriptive techniques are those based on plots of cumulative sums and sums of squares of recursive residuals, plots of the estimated coefficients of moving regressions, and the fitting of time-trending regressions (Brown, Durbin, and Evans, 1975). Among the applicable Bayesian techniques are the computation, for coefficients of variables associated with structural change, of the range of estimates which could

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** Assistant Professor, University of Rhode Island.

be produced by varying the specification with respect to other variables (Leamer, 1978, p. 195). The classical techniques most often used are Chow's variant of the F-test and a t-test on dummy variables (Gujarathi, 1970).

The last class of techniques has the advantage that, being classical, it is most fully implemented in standard computer software and most familiar to economists. Of the two commonly used classical techniques, the t-test is preferable to Chow's F-test on both economic and statistical grounds. The t-test is easier to interpret economically because it associates the structural change with particular coefficients whereas the F-test only indicates whether change has occurred somewhere in a vector of coefficients. The t-test is more robust than the F-test because tests on means are less sensitive to departures from normality than are tests on rations of variances (Kendall and Stuart, 1967, pp. 465—469). For these reasons, only t-tests are employed in this paper.

II. THEORIES OF INVESTMENT AND FOREIGN TRADE

The classical tests for structural change are only valid when the model is correctly specified. Consequently, before undertaking tests for the effects of the reform on investment, exports, and imports, it is necessary to attempt to specify equations for these variables which are consistent with economic theory and Yugoslav institutions. Unfortunately, the economic theory of Illyria has few unambiguous implications for aggregate investment, exports, and imports; while the economic theories of capitalism and central planning have limited relevance to Yugoslavia. Hence, the model developed below owes less to any body of theory than it does to hunches formed while studying Yugoslav institutions, economic history, and econometric models.

Planners influence investment expenditure primarily by acting on the supply of investment finance rather than the demand for finance or the demand for and supply of investment goods. Therefore, the supply of finance equation is the focus of interest in investigating how the reform affected the planners' influence on investment expenditure.

The explanatory variables in an investment finance supply equation must obviously include either the investment targets or policy instruments such as the lending terms set by the social investment funds and the National Bank. Aside from plan targets or policy instruments, the explanatory variables should include enterprise net revenue, possibly lagged one year. Net revenue is relevant because, whether or not enterprises would choose self-financing if the alternative were unrationed borrowing, the usual state of affairs is that a degree of self-finance is a condition for obtaining investment loans. Occasionally, a shortage of internally generated finance prevents firms from utilizing all the available external finance. /[A case of this sort was reported in Slovenia in the mid-1970's (Mencinger, 1977).]/ A one-year

lag might be assumed because enterpises are commonly forbidden to expend revenue in the year it is earned.

Although it is the supply of investment finance equation which is the focus of interest, some consideration must be given to the demand for finance. Investment demand may depend on the expected marginal efficiency of investment, real interest rates, the expected change in aggregate demand, and the existing capital stock. It is unlikely that the variables on which supply and demand depend adjust rapidly enough to ensure that supply and demand equilibrate quarter by quarter. Although excess demand is probably the more common regime, occasional periods of excess supply cannot be ruled out *a priori*. The possibility of excess supply implies that not all observations necessarily lie along the supply curve. The use of observations generated by a regime of excess supply to estimate a supply curve may bias the estimates. Unbiased estimates can only be obtained by disequilibrium estimation of a model containing supply and demand equations and a minimum condition. Nonetheless, the estimation of a supply equation under the maintained hypothesis that supply never exceeds demand is defensible on three bases. First, the prevalence of excess demand is suggested by the anecdotal evidence (Burkett, 1981, Ch. 1) Second, estimation under the maintained hypothesis of no excess supply is at least useful in furnishing initial estimates of parameters which can then be used as starting values for interative estimation techniques within a disequilibrium framework. Third, disequilibrium estimates are seldom qualitatively different from equilibrium ones. [Portes and Winter (1980) estimate 28 coefficients using both equilibrium and disequilibrium methods. None of the equilibrium estimates differ in sign from the disequilibrium estimates, although six coefficients which appear significant using equilibrium methods appear insignificant using disequilibrium techniques.]

Aside from the question of disequilibrium, the existence of an investment demand equation raises the issue of simultaneous equations bias. This worry can be disposed of by noting that both regressors proposed for the supply equation are predetermined: the net revenue variable is lagged four quarters and the investment targets are chosen before the start of the year to which they apply.[1]

If the reform had any impact on foreign trade, it was more likely to have been on the import demand and export supply schedules than on the import supply and export demand schedules. The former two schedules are therefore the focus of interest. However, before discussing these schedules, it is worth considering how they can be disentangled from the import supply and export demand schedules. Unlike the Yugoslav investment finance market, the world market for goods

[1] The fact that the regressors are predetermined does not, of course, guarantee that the regressors and the error term are statistically independent. In particular, one might worry that the target variable is not independent of the error. This issue is dealt with in Appendix B.

which Yugoslavia imports and exports can plausibly be assumed to clear quarter by quarter, making disequilibrium estimation unnecessary. Simultaneity problems might nonetheless exist. Fortunately, these problems are not likely to be great for a country like Yugoslavia which is small in relation to the world market and committed for political reasons to 'capillary' (diversified) trade. For such a country the exogeneity of export and import prices is a reasonable assumption. (The consequences of relaxing the assumption will be explored empirically later in this paper.)

Export supply might depend on a great many variables and *a priori* considerations do not help much in selection. Here I shall simply list some of the variables with which I experimented and the reasons why they might be relevant. An index of export prices is an obvious choice for an explanatory variable. However, the sign of the coefficient is not so obvious. Illyrian theories predict negatively sloped supply curves in some cases and positively sloped ones in others (Ward, 1967, Chs. 8 and 9). Horvat's 'realistic' theory predicts a positively sloped schedule. (Both Illyrian and 'realistic' theories pertain to the supply curve of a firm. They have only indirect relevance to the supply of exports.) Central planners (of whom the Yugoslav federal planners are a pale copy) seem to have a non-negatively sloped supply schedule (Burkett, Portes, and Winter, 1981). The precise mix of Illyria, Horvat's 'reality', and central planning in Yugoslavia remains to be determined. Besides the export price, the supply schedule would also depend on the domestic price, if currency convertability were to include some sort of activity or stock variable. Output, capacity, and the extent that the dinar is inconvertible, import prices rather than domestic prices may be the relevant variable with which to compare export prices. In addition to prices, the export supply schedule should include some sort of activity or stock variable. Output, capacity, and inventories of finished goods, alone or in combination, are all candidates for this role. Finally, to assess the role of planning, it is necessary to include in the export equation either an export target or a set of policy instruments.

Yugoslavia's export supply schedule is likely to look rather different from those of either capitalist or centrally planned economies. Capitalist economies are commonly supposed to have perfectly elastic export supply schedules. Such an assumption is unrealistic for Yugoslavia because of inconvertibility, bottlenecks, and government concern for export earnings. Centrally planned economies' exports appear to depend on, *inter alia*, domestic excess demand for consumption goods (Burkett, Portes, and Winter, 1981). Prices of consumer goods are more flexible in Yugoslavia than in centrally planned economies, and the possibility of excess demand emerging, let alone influencing exports, is correspondingly less.

Import demand may be assumed to depend on prices, activity or stock variables, and policy measures. An import price index should appear in the demand equation, presumably with a negative coefficient. Price indices for domestic products and/or exports might be included with expected positive coefficients. The relative importance of domestic prices and export prices will depend on the ease with which dinars can be exchanged for dollars, and the extent to which imports are substitutes for domestic goods. Aggregate activity variables such as social product might be included in the equation. However, some disaggregation may be appropriate, considering the different import-intensities of different sectors. (Agricultural production might be more important as a supply of import-substitutes than as a source of demand for imported intermediate or final products.) The stock of raw material is another variable which might be tried. Finally, either an import target or a set of policy instruments must be included in the equation to test for possible change in the planners' influence.

Of the three equations, that for imports may most closely resemble its counterparts in models of market and centrally planned economies. Indeed, the gulf between the behavior of market and centrally planned economies is narrower for import than for exports or investment. Nonetheless, a Yugoslav import demand equation can be expected to exhibit some distinctive features. In comparison to the corresponding import demand of an economy with a fully convertible currency, Yugoslav import demand can be expected to be influenced relatively little by the domestic price level. The prices of consumer goods in Yugoslavia respond more readily to excess demand than do those of centrally planned economies. So excess demand on this market is not likely to be as important in explaining Yugoslav imports as it is in explaining those of centrally planned economies.

III. SPECIFICATION

Specification of equations for investment,[2] imports, and exports must be influenced not only by economic theory but by data availability and econometric technique as well. To test for structural change in 1965—67, one needs numerous observations on either side of this divide. However, the more years one uses, the more structural change may occur within either subperiod. Furthermore, consistent time series are difficult to extend beyond the period 1959—76. In order to get enough observations while staying within the bounds of this period, one must use the data which are at least quarterly in frequency.

The need for quarterly data constrains the specification in some respects. For example, because comprehensive data on federal revenues and expenditures are available only on an annual basis, fiscal instruments cannot be directly modelled. Quarterly series for some instruments (e. g. customs tariffs) can be constructed. However, data for a few instruments are not of much use unless these instruments

[2] In this and the following sections, for the sake of brevity, the investment finance supply equation will be referred to simply as the investment equation.

can be assumed to be proxies for all others. Such an assumption would often be contravened by Yugoslav reality. For instance, in the 1960's tariff rates rose, but this rise did not represent an all-round increase in protectionism. Rather, it represented a partial compensation for the dismantling of other import barriers. To put tariff rates in the import equation without also putting in some measure of non-tariff barriers to trade would be misleading. Unfortunately, it is not possible to quantify all the relevant instruments. Instead of employing a partial and possibly unrepresentative set of policy instruments it is better to use the plan targets as proxies for the instruments. (Targets have been used successfully in equations for investment in two models of Hungary, the country which most closely resembles Yugoslavia (Hewett, 1979; Simon, 1980.), Series for investment and export targets can be constructed from the annual social plans and policy resolutions. However, targets are subject to formal or informal revision within the plan period. In order that the timing of plan revisions be reflected accurately, frequent observations on targets are needed. Unfortunately, the only published targets are for periods of a year or longer. Although I have interpolated quarterly targets (see Appendix for details), I have not been able to adjust the series to conform to informal revisions of annual plans. Thus my target series are imperfect proxies for the true targets, let alone the instruments.

Regrettably, a complete series cannot be constructed for import targets. Plan documents do not regularly contain numerical targets for imports. Rather, they frequently specify only that imports should be adjusted in the course of the year in the light of foreign exchange earnings. Planners, recognizing that imports can be adjusted more rapidly than exports, evidently regulate imports so as to temporarily absorb shocks to other components of the balance of payments. A reasonable proxy for planners' influence is therefore a lagged value of foreign exchange reserves.

Targets are given in plan documents in the form of growth rates. To avoid converting these growth rate targets into targets for levels, it is tempting to specify all the variables in growth rates. However, in an equation in which all variables are growth rates, there is no way in which displacement of relative levels can be rectified over time. It seems implausible that the growth rate of, say, exports should bear a fixed relationship to the growth rate of inventories regardless of the initial levels of these two variables. In more technical terms, it is dangerous to assume that the left-hand side and right-hand side polynomials in lag operators have a common root of unity. It is better to start off with a general specification in terms of current and lagged values of variables measured as levels and then test the validity of restrictions such as common roots (Hendry and Mizon, 1978). In order to obtain quarterly targets for the level of investment and the level of exports I utilized the target growth rates in conjunction with data on actual lagged investment and exports.

Just as it is desirable to begin with a general specification in levels, it is advisable to start with seasonally unadjusted data, lest inappropriate adjustment distort the dynamics. Unfortunately, most of the readily available data needed for estimating export and import equations and the data needed for generating the net revenue term in the investment equation are seasonally adjusted by the Bureau of the Census's Method II, variant x-11. The use of data adjusted by this procedure can lead to autocorrelation and dynamic specification errors and hence to inconsistent and inefficient estimates (Wallis, 1974). Furthermore, seasonal adjustment uses up some degrees of freedom. The exact number of degrees of freedom lost is difficult to calculate, but is appromaxitely eleven, according to Lowell (Lowell, 1963 cited in Maddala, 1977, p. 340). These problems must be borne in mind when interpreting the estimates reported below.

Neither economic theory nor data availability constrain tightly the specification of functional form. The two most convenient functional forms with which to begin are the linear and log-linear ones. A suspicion that price elasticities might be more stable than the slopes of linear supply and demand schedules led me to initially cast the export and import equations in log-linear form. No such considerations pertain to the investment equation, so I began with a linear specification of it. Subsequent tests for skewness and kurtosis indicated that the log-linear specification of the export and import equations is satisfactory, but that the linear specification of the investment equation can be rejected. Reformulation of the investment equation in logs eliminated the problem of non-normal residuals. With two exceptions, all the variables in the regressions reported below are measured in natural logarithms. The two exceptions, net revenue and plan underfulfillment, are variables which can take non-positive values and consequently cannot be expressed as logarithms.

A number of specification issues remain open. The exact definition and selection of variables can hardly be decided by any other method than experimentation. This approach would present no problems if there were two samples drawn from the same population, one sample to be used for specification and the other to be used for final estimation and hypothesis testing (Theil, 1971, pp. 603—604). Unfortunately for econometricians, though perhaps fortunately for the Yugoslavs, the reform only occurred once. The same data must be used for both specification and estimation even though it is known that such a procedure affects the sampling distribution of the estimators. To assist the reader in discounting the reported standard errors I briefly describe the data-dependent specification search.

Of Leamer's six categories of specification search, the ones employed in deriving the results presented here are proxy search, interpretive search, and post-data model construction. A proxy search explores "different ways of measuring a common set of hypothetical variables" (Leamer, 1978, p. 7). A search of this kind was undertaken for variables measuring the influence of planners. Alternative definitions of the target variables for investment and imports are discussed in the data appendix. In the import equation, planners' concerns were represented alternatively by lagged values of foreign exchange reserves and lagged values of the cumulative trade balance. Early in the specification search it was ascertained that both variables had significant positive estimated coefficients. The reserves variables was selected because it is a more comprehensive measure of the external balance.

An interpretive search experiments with restrictions in order to improve estimates of a model which in its most general form contains so many collinear variables that unrestricted estimates are unacceptable (Leamer, 1978, p. 121.) Zero restrictions are most frequently adopted. All variables, save the proxies for planners' influence, were candidates for exclusion. (The proxies for planners' influence could not be excluded without abandoning the project of testing for change in their coefficients). The choice of regressors was guided by the dual criteria that (a) the signs of the coefficients should be consistent with economic theory, and (b) the t-statistics should exceed unity under at least some methods of estimation. (An exception to this rule was made in the export equation because one regressor (DXT) with a t-statistic consistently below unity is of central theoretical interest.)

Post-data model construction occurs when the theory underlying a model is revised in response to the data (Leamer, 1978, p. 8). The three data instigated hypotheses embodied in the model reported below are that exports increase when domestic demand is slack, as indicated by accumulation of inventories of finished goods, that imports increase following poor harvests, and that speculative imports were more tightly controlled before the reform than afterwards.

The specification search was 'unbiased' in the sense that choice of specification was not made with a view to strengthening or weakening the case for reform-induced structural change. Nonetheless, this specification search, like any other, does discount the significance of the final estimates (Leamer, 1978, pp. 12—13).

The final specification of the investment equation is:

$$I = \alpha_0 + \alpha_1 IT + \alpha_2 DIT + \alpha_3 U + \alpha_4 DU + \alpha_5 NR_{-4} + \varepsilon_1$$

where,

I = log (IN/PP)
IN = nominal investment in fixed assets, socialist sector
PP = producers' price index, manufacturing, deseasonalized
IT = log of target for I
DIT = O before 1965III, IT thereafter

$$U = \left\{ \sum_{i=1}^{q} (IT_i - I_i),\ q = \text{number of elapsed quarters since the beginning of the year, } q = 1, 2, 3 \right.$$

DU = O before 1965III, U thereafter
NR_{-4} = net revenue of productive sector (total revenue — taxes — material costs) at constant prices, deseasonalized, lagged four quarters.

If, as anecdotal evidence suggests, the federal planners exerted a powerful influence on investment, at least before the reform, then the elasticity of investment expenditure with respect to investment targets (α_1) should be close to unity. The reform of the investment system was completed in mid-1965 (OECD 1970, p. 11), therefore the discontinuity of DIT occurs between the second and third quarters of 1965. The elasticity of investment expenditure with respect to investment targets in the post-reform period is $\alpha_1 + \alpha_2$. If the reform reduced the responsiveness of investment expenditure to investment targets, then α_2 should be negative.

Centrally planned economies often exhibit an annual cycle, in which plans are at first underfulfilled and then made good by 'storming'. A similar pattern can be found in quarterly data on investment expenditures in pre-reform Yugoslavia. To capture this seasonal pattern, the equation includes a variable, U, measuring plan underfulfillment cumulated during the current year. Storming died out after the reform. To capture this change in seasonality, the shift variable, DU, has been included in the equation. The coefficients of U and DU can be expected to be positive and negative, respectively.

Bank and investment funds commonly require enterprises to participate with their own resources in investment projects. Therefore, enterprise net revenue (NR) appears in the equation, with a coefficient which may be expected to be positive. The four quarter lag reflects the usual prohibition against expending revenue in the year in which it is earned.

The final specification of the export supply equation is:

$$X = \beta_0 + \beta_1 PX + \beta_2 IFG_{-1} + \beta_3 XT + \beta_4 DXT + \beta_5 X_{-1} + \beta_6 DX_{-1} + \varepsilon_2$$

where,

X = log of export quantity, deseasonalized
PX = log of export price index (U.S. dollars), deseasonalized
IFG_{-1} = inventories of finished goods at constant prices, deseasonalized, lagged one quarter
XT = log of target for X
DXT = O before 1967I, XT thereafter
X_{1-} = X lagged one quarter
DX_{-1} = O before 1967I, X_{-1} thereafter

In this equation, β_1 is the price elasticity of supply, the sign of which is uncertain *a priori*. β_2 represents an incremental stockflow relationship or velocity, and is presumably positive. β_3 is the pre-reform elasticity of export supply with respect to export targets. Anecdotal evidence suggests that planners exerted some influence on exports, but less than on investment. Therefore, β_3 may be expected to be greater than zero, but less than α_1. The reform of the foreign trade system was not completed until January 1967 (OECD, 1970, p. 12); consequently, the discontinuity in the series for DXT and DX_{-1} occurs between 1966IV and 1967I. The post-reform elasticity of export supply with respect to export targets is $\beta_3 + \beta_4$. If the reform reduced the impact of change in export targets on export supply, then β_4 and $\beta_5 + \beta_6$ are the pre- and post-reform partial adjustment parameters, respectively.

The final spedification of the import demand equation is:

$$M = \gamma_0 + \gamma_1 IP + \gamma_2 AP + \gamma_3 PM + \gamma_4 S + \gamma_5 DS + \gamma_6 R_{-2} + \gamma_7 DR_{-2} + \gamma_8 R_{-3} + \gamma^9 DR_{-3} + \gamma_{10} DR_{-4} + \gamma_{11} DR_{-4} + \gamma_{12} M_{-1} + \varepsilon_3$$

where,

M = log of import quantity index, deseasonalized

IP = log of industrial production index, deseasonalized

AP = log of agricultural production index, deseasonalized

PM = log of import price index (U. S. dollars), deseasonalized

$$S = \begin{cases} 1 & \text{for two quarters prior to dealuation} \\ -1 & \text{for two quarters following devaluation} \\ 0 & \text{at other times} \end{cases}$$

DS = 0 before 1967I, S thereafter

R = log of foreign exchange reserves (U. S. dollars), deseasonalized

R_{-q} = R lagged q quarters

DR_{-q} = 0 before 1967I, R_{-q} thereafter

M_{-1} = M lagged one quarter

Industrial production uses imported materials and is linked to industrial investment, which requires imported equipment. Hence the elasticity of imports with respect to industrial production, γ_1, can be expected to be positive. Agricultural production, in contrast, uses relatively small amounts of imported materials and equipment, while supplying import substitutes. Consequently, the elasticity of imports with respect to agricultural production, γ_2, can be expected to be less than γ_1 and possibly negative.

In periods immediatiely before and after devaluation imports are subject to special forces. If the goverment, trying to avoid or postpone devaluation imposes effective controls but later, having finally devalued the currency, relaxes the control, the imports may be depressed in the pre-devaluation period and elevated thereafter until stocks are rebuilt to normal levels. This pattern prevailed on each of the two occasions in the pre-reform period on which the dinar was devalued. In the last half of 1960, the authorities were concerned to build up foreign exchange reserves prior to the introduction of foreign trade reforms in the new year. Accordingly, they tightened import controls, particularly on consumer goods (*Ekonomska politika*, 1 May 1960, pp. 433—434; Bilandzic 1968, p. 100). In the first half of 1965, the authorities were again trying to build up foreign exhange reserves in preparation for reforms. The plan for 1965 called for moderating the growth of imports. Importers were required to finance at least 20% of their imports with their own resources and to pay in full the customs duties, insurance charges, turnover taxes, and transportation charges (National Bank of Yugoslavia, *Annual Report*, 1965, pp. 35—72). Thus, even if enterprises anticipated the devaluations of 1960I and 1965III they were not in a good position to accelerate imports in the preceding quarters. Hence one can expect that the coefficient of S will be negative.

However, if devaluation is anticipated and nothing is done to stop speculation, imports may surge before the devaluation and be depressed thereafter until stocks are run down to normal levels. This pattern has been reported in post-reform period: »Anticipation of devaluation contributed to the big imports« of the second half of 1970 (Institut za Spoljnu Trgovinu, 1970, p. 151). Thus, one can expect the coeficient of DS to be positive and larger absolute terms than that of S.

Planners respond to erosion of foreign exchange reserves by curbing imports. Therefore, the coefficient of reserves, suitability lagged, should be positive. If the switch from administrative controls to indirect macroeconomic instruments as the primary policy tools increased the time required to effect changes in the volume of imports from, say, two to four quarters, then the coefficient of R_{-2} and the sum of the coefficients of R_{-4} and DR_{-4} might be expected to be positive, while the sum of the coefficients of R_{-2} and DR_{-2} and the coefficient of R_{-4} might be expected to be insignificantly different from zero. The discontinuity in the series for DS, DR_{-2}, DR_{-3} and DR_{-4} occurs between 1966IV and 1967I because the foreign trade reform were completed in January 1967. The partial adjustment hypothesis rationalizes the inclusion of the lagged dependent variable. The expected sign of the coefficient of M_{-1} is, of course, positive.

IV. ECONOMETRIC TECHNIQUES

A large number of estimation techniques are now available. Because estimates can be sensitive to the estimator chosen, a variety of estimators must be used to check the robustness of the estimates. In this section are presented estimates obtained from ordinary least squares (OLS), ridge regression, the Cochrane-Orcutt procedure (CORC), and the two-stage Cochrane-Orcutt procedure (TSCORC).

To establish a consistent notation with which to discuss the statistical problems which arise with these estimators ,it is useful to restate here the standard linear model:

$$y = X\beta + \varepsilon$$
$$E(\varepsilon) = 0$$
$$V(\varepsilon) = \sigma^2 I$$

y is an n-element random vector (the dependent variable)

x is an observed nxK matrix of rank K (the design or regression matrix)

β is a K-element vector of unknown parameters

ε is an n-element disturbance vector

In terms of this model, the OLS estimator of β is $b = (X'X)^{-1}X'y$ and the OLS estimator of $V(b)$ is $s^2\ (X'X)^{-1}$ where $s^2 = e'e/(n\text{-}K)$ and $e = y - Xb$. Under frequently encountered circumstances, the OLS estimator has undesirable properties, which are discussed below. Nonetheless, Monte Carlo studies provide some evidence OLS estimates exhibit less bias in the presence of multi-collinearity than do TSLS estimates and smaller mean squared errors when exogenous variables are measured with error than do limited information single equation estimates (Johnston, 1972, pp. 410, 415). Whether or not OLS estimates have these virtues, they certainly provide a convenient starting point for the diagnosis of statistical problems and their treatment by more sophisticated estimators. For this reason, OLS estimates are presented in the first columns of tables 1, 2, and 3.

The Gauss-Markov theorem assures us that of all linear unbiased estimators of β, b is the one with the smallest sampling variance. That is to say, any other linear unbiased estimator of β has a covariance matrix which exceeds V(b) by a positive semi-definite matrix. However, these minimum variance may still be quite large. If the matrix of sums of cross products, X'X, is nearly singular, the variances of the coefficient estimates, the diagonal elements of $s^2\ (X'X)^{-1}$, may be too large for some purposes. Smaller variances can be obtained by employing a biased estimator. One family of such estimator is the family of ridge estimators, $b(k) = (X'X + kI)^{-1}X'y$, $0 \leq k < \infty$. It has been shown that for any β there exists a $k > 0$ such that each element of b(k) has a smaller mean square error than the corresponding element of b (Seber, 1977, p. 90). Unfortunately, the value of k which minimizes mean squared error is a function of β, which is unknown (Leamer, 1978, p. 138). In practice, one must run several regressions with different values of k. For each equation, I have obtained ridge estimates for 19 different values of k, namely, .001, .002, .003, .004, .005, .006, .007, .008, .009, .010, .020, .030, .040, .050, .060, .070, .080, .090, and .100. Of these estimates ,two for each equation are reported in tables 1, 2, and 3. The estimates reported are those corresponding to (a) the smallest value of k for which the condition number attains a local minimum, and (b) the value of k for which the condition number attains a global minimum, within the indicated set of 19 values of k.

Ridge regressions can be given a Bayesian interpretation. If the prior distribution of the coefficients is $N(0, \tau^2 I)$, then the posterior distribution is $N[b(k), \sigma^2 (X'X + kI)^{-1}]$ with $\sigma^2 = k\tau^2$ (Maddala, 1977, p. 384). The indicated prior is not mine, but that of a person who expects no regression relationship between the specified regress and regressors, i. e., a person who finds the specification implausible in all respects. Therefore, the ridge regressions may be of special interest to skeptical readers.

If $V(\varepsilon)$ is not diagonal, OLS gives sampling variances for predictors and coefficient estimators which are needlessly large and gives biased estimates of the covariance matrix of coefficient estimators. To circumvent these problems iterative autoregressive methods are used. These amount to performing OLS regression; using the OLS residuals

to estimate the first order autocorrelation coefficient of the disturbances, ρ, using this estimate of ρ to transform the variables into quasi-first differences $(y_t - \hat{\rho} y_{t-1},\ x_t - \hat{\rho} x_{t-1})$; iterating until successive estimates of p differ by less than some predetermined amount (.001 in the estimates presented below). A variety of autoregressive techniques exist. The one used in this chapter is the Prais-Winsten method, which preserves the first observation by applying the transformation:

$$y_1^* = (1 - p^2)^{1/2} y_1,\quad x_1^* = (1 - \hat{p}^2)^{1/2} x_1.$$

If plim $(X'\varepsilon/n) \neq 0$, the OLS estimator, b, is inconsistent. This problem is likely to arise if the regress and and regressors are linked by more than one equation. Under these conditions, one may need to use an estimator which is consistent for simultaneous equations. One such estimator is the two-stage least square estimator. If the Cochrane-Orcutt procedure is combined with two-stage least squares, the resulting estimator (TSCORC) is robust in the face of autocorrelated disturbances and correlation of regressors with disturbances.

V. ESTIMATES

Theory, specification, and techniques having been discussed, the estimates themselves can now be presented. The top portions of tables 1, 2, and 3 show the estimated coefficients, with standard errors in parentheses. The middle portion of each table contains summary statistics. The summary statistics, which may be unfamiliar, are defined as follows:

$K = (\lambda_L/\lambda_S)^{1/2}$ (condition number of the matrix) where λ_L, and λ_S are the largest and smallest eigenvalues of $X'X$ or $X'X + kI$ in the case of ridge regression

$$\sqrt{b_1} = \left(\left(\frac{1}{n} \sum_{t-1}^{n} e_t^3 \right)^2 / \left(\frac{1}{n} \sum_{t-1}^{n} e^2 \right)^3 \right)^{1/2} \quad \text{(coefficient of skewness)}$$

$$b^2 - 3 = \frac{1}{n} \sum_{t=1}^{n} e_t^4 / \left(\frac{1}{n} \sum_{t=1}^{n} e_t^2 \right)^2 - 3 \quad \text{(coefficient of excess kurtosis)}$$

The standard errors of the coefficients of skewness and excess kurtosis are computed on the assumption of normality. I have used the coefficients of skewness and kurtosis to perform tests for departures from normality in the distribution of the residuals. The test procedure may be summarized as follows: $\sqrt{b_1}$ and b_2 are transformed into standardized normal deviates, using equations, charts, and tables provided by D'Agostino and Pearson (1973). The sum of the squares of the standardized normal deviates is distributed as X^2 (2) under the hypothesis of normality. In none of the regressions reported in tables 1, 2, or 3 can the hypothesis or normality be rejected at the .1 level using this test. Being unable to reject the normality hypothesis, one may legitimately employ the t-test for the significance of the estimated coefficients.

Table 1

Regressions for Investment Expenditure 1960IV—1976IV

	OLS	Ridge k = .005	Ridge k = .01	CORC p = .5814
C	.0650	.0991	.1278	.0120
	(.0860)	(.0821)	(.0795)	(.0799)
IT	.9956	.9665	.9429	1.0557
	(.0639)	(.0587)	(.0552)	(.0549)
DIT	—.0972	—.0823	—.0706	—.1043
	(.0349)	(.0314)	(.0291)	(.0400)
U	.0245	.0106	.0009	.0963
	(.0366)	(.0306)	(.0264)	(.0363)
DU	—.0584	—.0454	—.0365	—.1101
	(.0367)	(.0308)	(.0267)	(.0372)
NR4	.0065	.0064	.0063	.0044
	(.0018)	(.0017)	(.0017)	(.0015)
R^2	.9396	.9394	.9389	.9336
S. E.	.1125	.1127	.1131	.1000
K	53.295	30.705	11.284	—
DW	1.2832	1.3188	1.3444	1.9098
$\sqrt{b_1}$	—.2006	—.2328	—.2591	—.2875
	(.2971)	(.2971)	(.2971)	(.2971)
$b_2{}^{-3}$	—.0171	.0500	.1166	—.2358
	(.5862)	(.5862)	(.5862)	(.5862)
outliers	63I A<F	63I A<F	63I A<F	
	66I A<F	66I A<F	66I A<F	
	67III A<F	67III A<F	67III A<F	

Standard errors of coefficient estimates are given in parentheses. For 59 degrees of freedom the probability of $|t| \leq 1.67$ is approximately .9 and the probability of $|t| \leq 2.66$ is approximately .99, where t is the ratio of a normal variant with zero mean to its standard error.

Table 2

Regressions for Export Volume, 1959III—1976IV

	OLS	Ridge k = .001	Ridge k = .060	CORC ρ = .5385	TSCORC ρ = .5335
C	.3045	.3478	.9781	.6523	.6630
	(.1622)	(.1540)	(.1132)	(.2170)	(.2254)
PX	—.0342	—.0246	.0487	—.0316	—.0441
	(.0520)	(.0358)	(.0298)	(.0740)	(.0790)
IFG_{t-1}	.0852	.0827	.1434	.1517	.1475
	(.0463)	(.0398)	(.0251)	(.0707)	(.0728)
XT	.0961	.1399	.2813	.2819	.2354
	(.1353)	(.0796)	(.0270)	(.1588)	(.1702)
DXT	.0423	—.0046	.0023	.0082	.0160
	(.1854)	(.0221)	(.0035)	(.2197)	(.2286)
X_{-1}	.8363	.7931	.4499	.6165	.6253
	(.1148)	(.0723)	(.0271)	(.1374)	(.1402)
DX_{-1}	—.0318	—.0009	.0040	—.0089	—.0133
	(.1215)	(.0145)	(.0023)	(.1438)	(.1494)
$\bar{R}^2$	.9874	.9874	.9804	.9707	.9892
S. E.	.0418	.0418	.0521	.0376	.0379
K	7156.3	54.222	11.803	—	—
D. W.	1.2173	1.1917	.6575	1.8693	1.8247
$\sqrt{b_1}$	.2513	.2121	—.1729		
	(.2868)	(.2868)	(.2868)		
$b_2{}^{-3}$	—.3573	—.4401	—.8029	—.8042	
	(.5663)	(.5663)	(.5663)	(.5663)	
outliers	61IV A<F	61IV A<F	61IV A<F	62III A>F	62III A>F
	62III A>F	62III A>F			
	62IV A>F	62IV A>F			

Standard errors of coefficient estimators are given in parentheses. For 63 degrees of freedom, the probability of $|t| \leq 1.671$ is approximately .9 and the probability of $|t| \leq 2.390$ is approximately .99.

Table 3

Regressions for Import Volume, 1960II—1976IV

	OLS	Ridge $k = .001$	Ridge $k = .005$	CORC $\rho = .6410$	TSCORC $\rho = .5846$
C	2.0004	2.0764	2.2762	3.2619	3.1913
	(.8337)	(.8045)	(.7310)	(.9477)	(1.0175)
IP	.1219	.1383	.1870	.3836	.3344
	(.1028)	(.0972)	(.0856)	(.1384)	(.1719)
AP	—.1500	—.1605	—.1673	—.1771	—.2248
	(.1787)	(.1728)	(.1613)	(.2123)	(.2314)
PM	—.2552	—.2479	—.2378	—.3853	—.3645
	(.0698)	(.0673)	(.0654)	(.1152)	(.1077)
S	—.0540	—.0528	—.0492	—.0443	—.0457
	(.0198)	(.0196)	(.0192)	(.0162)	(.0166)
DS	.0687	.0670	.0636	.0580	.0593
	(.0234)	(.0232)	(.0230)	(.0195)	(.0198)
R_{-2}	.0838	.0760	.0607	.0904	.0942
	(.0299)	(.0259)	(.0215)	(.0242)	(.0249)
DR_{-2}	—.0237	—.0162	—.0052	—.0394	—.0408
	(.0449)	(.0268)	(.0108)	(.0344)	(.0352)
R_{-3}	.0553	.0512	.0487	.0748	.0714
	(.0298)	(.0260)	(.0228)	(.0241)	(.0240)
DR_{-3}	—.0250	—.0111	.0001	—.0153	—.0158
	(.0540)	(.0281)	(.0100)	(.0330)	(.0341)
R_{-4}	—.0336	—.0240	—.0090	—.0107	—.0160
	(.0301)	(.0272)	(.0235)	(.0247)	(.0248)
DR_{-4}	.0564	.0358	.0169	.0685	.0700
	(.0448)	(.0274)	(.0113)	(.0338)	(.0348)
M_{-1}	.7855	.7692	.7069	.4909	.5609
	(.0819)	(.0769)	(.0651)	(.0982)	(.0999)
$\bar{R}^2$	.9857	.9882	.9851	.9683	.9889
S. E.	.0521	.0523	.0532	.0458	.0457
K	652.92	315.53	225.57		
D. W.	1.2287	1.2237	1.1613	1.6252	1.6385
$\sqrt{b_1}$	—.0765	—.0902	.0033	.0281	
	(.2928)	(.2928)	(.2928)	(.2928)	
$b_2{-}3$	—.7525	—.8171	—.9151	—.8591	
	(.5780)	(.5780)	(.5780)	(.5780)	
outliers	73III A<F	73III A<F	73III A<F	none	none

Standard errors of coefficient estimators are given in parentheses. For 50 degrees of freedom the probability of $|t| \leq 1.6775$ is approximately .9 and the probability of $|t| \leq 2.6820$ is approximately .99.

Table 4

Sums of Estimated Coefficients and the Standard Errors of the Sums

	OLS	Ridge[1]	Ridge[2]	CORC	TSCORC
$\hat{\alpha}_1 + \hat{\alpha}_2$	.8984	.8842	.8723	.9514	
	(.0428)	(.0414)	(.0405)	(.0348)	
$\hat{\alpha}_3 + \hat{\alpha}_4$	—.0339	—.0348	—.0355	—.0138	
	(.0094)	(.0093)	(.0093)	(.0102)	
$\hat{\beta}_3 + \hat{\beta}_4$	.1384	.1352	.2846	.2400	.2515
	(.1153)	(.0816)	(.0268)	(.1453)	(.1492)
$\hat{\beta}_5 + \hat{\beta}_6$	.8045	.7922	.4538	.6076	.6120
	(.0843)	(.0728)	(.0268)	(.1085)	(.1093)
$\hat{\gamma}_4 + \hat{\gamma}_5$	.0146	.0142	.0144	.0137	.0136
	(.0136)	(.0135)	(.0136)	(.0111)	(.0113)
$\hat{\gamma}_6 + \hat{\gamma}_7$	.0602	.0598	.0555	.0510	.0534
	(.0378)	(.0335)	(.0226)	(.3011)	(.0320)
$\hat{\gamma}_8 + \hat{\gamma}_9$	.0303	.0402	.0487	.0594	.0556
	(.0464)	(.0325)	(.0246)	(.0324)	(.0329)
$\hat{\gamma}_{10} + \hat{\gamma}_{11}$	.0228	.0117	.0079	.0578	.0540
	(.0415)	(.0327)	(.0255)	(.0329)	(.0336)

At the bottom of each table are listed the outliers, which are defined as dates for which the absolute value of the residual exceeds twice the standard error of the regression. Actual values of the dependent variable in excess of the fitted values are indicated by 'A>F', while the opposite situation is indicated by 'A<F'.

Although tables 1, 2 and 3 contain all the information required to test the significance of the estimated coefficients for the preform period, they omit one type of information required to perform the corresponding tests for the post-reform period, namely, the covariances between estimated coefficients. This deficiency is made good in table 4, which presents estimates of, and standard errors for, the post-reform elasticity of investment expenditure with respect to in-

[1] The first column of ridge estimates corresponds to $k = .005$ for the investment equation and $k = .001$ for the export and import equations.

[2] The second column of ridge estimates corresponds to $k = .010$ for the investment equation, $k = .060$ for the eäport equation, and $k = .005$ for the import equation.

vestment targets $(\alpha_1 + \alpha_2)$, the post-reform underfulfilment reaction coefficient $(\alpha_3 + \alpha_4)$, the post-reform elasticity of export supply with respect to export targets $(\beta_3 + \beta_4)$, the post-reform partial adjustment coefficient for exports $(\beta_5 + \beta_6)$, the coefficient of the devaluation dummy variable $(\gamma_4 + \gamma_5)$, and the post-reform elasticities of imports with respect to reserves lagged two, three, and four quarters $(\gamma_6 + \gamma_7, \gamma_8 + \gamma_9, \gamma_{10} + \gamma_{11})$. The standard errors are computed according to the formula:

$$s.e.\ (x + y) = [var\,(x) + var\,(y) + 2 \cdot cov\,(x, y)]^{1/2}.$$

The estimates for the investment equation are shown in table 1. The OLS estimates are given in column 1. Here, the estimated coefficient of DIT is negative and significantly different from zero in a two-tailed test at the .01 level, suggesting a reduction in the influence of investment plans on investment targets. The elasticity of actual with respect to planned investment expenditure is estimated to have been .9956 in the pre-reform period and .8984 in the post-reform period. The estimated coefficient of U is positive, but not significantly different from zero, suggesting a weak tendency in the pre-reform period for underfulfilment of targets early in a year to be compensated for by 'storming' later in the year. The estimated coefficient of DU is negative, but only significant at the .2 level. The estimate for $(\alpha_3 + \alpha_4)$ is negative and significant at the .01 level, suggesting that once the investment slipped below target in the post-reform period it tended to stay there for the year. The estimated coefficient of NR_{-4} is positive and significant, which is consistent with the theory that enterprises' ability to participate in investment projects with internally generated funds influences investment expenditure, and that enterprise revenue is not generally released for investment until a year after it is earned.

Although the estimated coefficients are economically plausible, they are statistically suspect, as indicated by some of the summary statistics. The condition number of the regression matrix is 53.295, which, though comparatively small, indicates that there is some room for shrinking variances by application of ridge regression. The Durbin-Watson statistic is 1.2832, which falls in the critical region defined by the 1% points. Under the hypothesis of zero first order autocorrelation, the Pan Jie-Jian probability of a Durbin-Watson statistic for this sample size being as low as 1.2832 is .0004. The serial correlation may arise from an incorrect choice of functional form, serially correlated omitted variables, measurement error in the dependent variable, or deseasonalization. Attempts to find an economic explanation for the autocorrelation were unsuccessful. The presence of unexplained serial correlation indicates a need to adopt some technique, such as CORC, which produces unbiased estimates of the covariance matrix despite serial correlation of the errors.

In columns 2 and 3 of table 1 are ridge estimates for $k = .005$ and $k = .010$, these being the values of k for which the condition number attains its first local minimum and its global minimum as

k is allowed to range from 0.0 to 0.1 in 19 steps. In comparison to the OLS estimates, the ridge estimates, apart from the intercept, are shrunken towards the origin, as the Bayesian interpretation of ridge regression would lead one to except. In comparison to the t-statistics for the OLS estimates, those for the ridge regressions are slightly higher for the intercept, IT, and NR_{-4}, and slightly lower for DIT, U, and DU. The R^2 and S. E. for the ridge regressions are worse than for the OLS regression. (The sum of squared residuals is necessarily larger for ridge regressions than for OLS, though sometimes the sum of squared forecast errors is smaller (Watson and White, 1976, p. 1097.) The Durbin-Watson statistics for the ridge regressions are somewhat better than for OLS, but still in the critical region defined by the 5% points and in the inconclusive region defined by the 1% points. Overall, the ridge regressions do not tell a story qualitatively different from the OLS regression.

The CORC estimates for the investment equation are shown in column 4, table 1. The most noteworthy changes with respect to the OLS and ridge estimates are increases in the absolute values of the estimated coefficients of U and DU. The CORC estimates of these coefficients are .0963 and —.1101 with t-statistics of 2.6529 and —2.9597, respectively. These estimates strengthen the impression that before the reform, but not afterwards, underfulfilment of investment plans early in a year was made up by 'storming' later in the year. The CORC estimate of $(\alpha_3 + \alpha_4)$ is —.0138, which is significant only at the .2 level. The summary statistics reported for CORC are based on residuals calculated using quasi-first differenced data. It is these residuals which are always used in computing the standard errors of CORC estimates and therefore these residuals which should be used in computing the coefficients of skewness and excess kurtosis. However, the use of these residuals makes the summary statistics of CORC not directly comparable to those of OLS and ridge regressions. The condition number is not reported because it is not easily obtainable for CORC. There are no outliers in the residuals derived from quasi-firts differenced data. For residuals derived from the untransformed data, the outliers are the same as reported for OLS and ridge estimates, plus 1964I (>F), 1964III (A>F), and 1968 (A>F).

Before leaving table 1, it may be worthwhile to attempt to interpret the outliers from the investment equation. In all cases, it is actual rather than fitted investment which is far from trend. In 1963I and 1966I it was construction work rather than equipment production which was exceptionally depressed. The slump in construction in 1963I may have been due to flooding during the winter (Savezni Zavod za Statistiku (hereafter abbreviated as SZS), *Statistički dokumenti*, August 1976). The construction slump in 1966I may be related to the uncertainty induced by the implementation of the reform. The decline in investment in 1967III may be due to a policy change during the previous quarter. At that time, the rediscounting ceiling was lowered from 20% to 15% of the sum of deposits liable to the legal reserve requirement. Withdrawal of funds on this count amounted to 706 million dinars (National Bank of Yugoslavia, *Annual Report*, 1967, p. 26). The outlier in the untransformed CORC residuals in 1964III is not easy to interpret economically.

The estimates for the export equation are shown in table 2. Looking first at the OLS estimates, one can see that the only regressors with estimated coefficients which differ significantly from zero are IFG_{-1} and X_{-1}. These variables have estimated coefficients of the expected (positive) sign. The insignificance of the estimated price elasticity does not cause surprise if it is recalled that aggregate export supply behavior may contain elements of CPE supply behavior, with its non-negative elasticities, Illyrian supply behavior, with its uncertain elasticities, as well as the 'realistic' supply behavior described by Horvat, with its positive elasticities. The insignificance of the estimated coefficient of XT is more surprising, in view of the wide range of export promotion policies at planners' disposal, particularly before the reform. The insignificance of the estimated coefficients of DXT and DX_{-1} suggests that the reform affected neither the impact of policy nor the lag between the adoption of a policy and its full consequences.

One reason why only two coefficients are significant is that the regression matrix is ill-conditioned, as indicated by a condition number of 7156.3. Furthermore, the OLS estimator loses its minimum variance property in the presence of autocorrelation; and the presence of positive autocorrelation is indicated by a Durbin-Watson statistic of 1.2173, which is in the critical region defined by the 1% points. (The DW statistic is biased towards 2 when the lagged dependent variable is a regressor. Thus, although a DW statistic near 2 does not allow one to accept the hypothesis of zero autocorrelation, a DW statistic far from 2 does allow one to reject the hypothesis (Theil, 1971, p. 414.) While ill-conditioning and autocorrelation impede inference about the significance of each of the estimated coefficients, a third problem, simultaneity, is particularly relevant to the price variable. *A priori*, it is possible that demand for Yugoslav exports is less than perfectly elastic. Empirically, preliminary attempts to estimate a demand schedule suggested that the hypothesis of perfect elasticity cannot be easily rejected. Nonetheless, the possibility of simultaneous equations bias cannot be ruled out at this stage.

To show the effects of reducing the ill-conditioning of the regression matrix, ridge estimates are presented in columns 2 and 3. These two sets of estimates correspond respectively to $k = .001$ and $k = .060$, these being the values of k for which the condition number attains its first local minimum and its global minimum as k ranges from 0.0 to 0.1 in 19 steps. In comparison to the t-statistics for the OLS estimates, those for the ridge estimates are higher for the intercept, PX, IFG_{-1}, XT, and X_{-1}. For DXT and DX_{-1} the t-statistics for the two ridge regressions straddle the corresponding t-statistics for OLS. The most dramatic differences are that the estimated coefficient of XT, which is insignificant in OLS estimation, is significant in ridge estimates, at the .1 level for $k = .001$ and at the .01 level for $k = .060$ and that the estimate of $(\beta_3 + \beta_4)$, which is insignificant in OLS results, is significant in ridge results at the .2 level for $k = .001$ and the .01 level for $k = .060$. This difference tends to confirm the suspicion that export plans are more important than OLS estimates alone indicate. Of the two ridge regressions, that for $k = .001$ may be preferred on the grounds that it has a condition number nearly as low as that of the ridge regression with $k = .060$, while having estimated coefficients which are generally closer to the (unbiased) OLS estimates. From a glance at the summary statistics, one can see that the chief problem with the ridge estimates is autocorrelation.

To indicate how the estimates are affected by correction for serial correlation, CORC estimates are presented in column 4. In comparison to the OLS results, the most distinctive feature of the CORC results are the estimates for β_3 and $(\beta_3 + \beta_4)$, which are significant in OLS regression, but significant, if only at the .2 level, in CORC estimation.

To access the robustness of the OLS, ridge, and CORC estimates to possible simultaneous equations bias, two-stage CORC estimates are presented in the last column of table 2. Here, PX is treated as an endogenous variable for which an instrument is constructed using current and lagged variables of the exogenous variables and lagged variables of X and PX. The TSCORC estimates are very much like those derived using its single state analog. In particular, the estimated coefficient of PX is insignificant in TSCORC estimation, as in all other estimation procedures. Thus, the TSCORC estimates indicate that either export demand is highly elastic or the single state estimators for the supply equation are not seriously affected by simultaneous equations bias.

The best estimates appear to be those derived using ridge regression with $k = .001$ and using the Cochrane-Orcut procedure. These two sets of estimates suggest that inventories of finished goods, export targets, and lagged exports are the primary determinants of export supply. These estimates also indicate that there was no significant shift at the time of the reform in the influence of policy variables either in terms of immediate impact or long-term effect.

The outliers listed at the bottom of table 2 relate to quasi-first-differenced data in the case of CORC and TSCORC regressions and to untransformed data in the other cases. In terms of untransformed data, the outliers for CORC are 1961IV (A<F) and 1968I (A<F). It may be of some interest to attempt an explanation of the outliers. All of the outliers involve a substantial departure of actual values from trend. The export slump in 1961IV can be attributed to the combination of a poor harvest, disruption caused by the introduction of foreign trade reforms, and the discriminatory effects of intra-EEC tariff cuts (OECD, 1962, pp. 30—31; *Ekonomska politika*, 21 January 1961, p. 118). The dramatic growth of exports in the second half of 1962 was, in part, the result of mid-year policy revisions which included redirection of bank loans to export industries (OECD, 1962, pp. 12—14). The export slump in 1968I is more puzzling. One possible explanation for it is that enterprises anticipated and waited for the adoption, in the second quarter, of export promotion policies including increased

bank credit for financing sales abroad (National Bank of Yugoslavia, 1968, pp. 64—5). What do these outliers indicate about the specification of the export equation? The conjunction of an export slump and a poor harvest in 1961IV suggests that agricultural output should be among the regressors for exports. However, when this specification was tried, the estimated coefficient of agricultural output was never significantly different from zero. The importance of policy revisions in 1962 and 1968 indicates that while policy exerts a major influence on exports, annual plan targets are an imperfect proxy for unobserved policy instruments.

Estimates for the import equation are shown in table 3. All but one of the estimated coefficients derived by OLS (shown in column 1) take the expected signs. The surprise is the negative estimated coefficient of R_{-4}. As it is insignificant and there is no obvious *post hoc* rationalization for its sign, it had best be regarded as zero.

The estimated coefficients of PM, S, DS, R_{-2}, and M_{-1} are significant at the .01 level and that for R_{-3} is significant at the .10 level. The insignificance of the estimated coefficients of IP and AP is surprising and suggests that the OLS estimators may not be best for this problem. Simultaneous equations bias may be suspected, at least in the case of IP. No less surprising than the insignificance of the estimated coefficients of IP and AP is the significance of the estimate of $\gamma_6 + \gamma_7$. The significant positive estimate of $\gamma_6 + \gamma_7$ may indicate either that the planners unexpectedly retained, after the reform, the ability to adjust imports quickly, or that serial correlation in the series for reserves obscures the length of time required to adjust imports in response to changes in reserves.

Further statistical problems are revealed by the summary statistics. Some ill-conditioning, possibly due to multicollinearity, is indicated by the condition number, 652.92. Positive serial correlation is indicated by a low Durbin-Watson statistic, 1.2287.

The possibilities of reducing the variance of coefficient estimators are explored with the help of ridge regression in columns 2 and 3. These two sets of estimates correspond respectively to $k = .001$ and $k = .005$, these values of k standing out from others tried as being, respectively, the smallest for which the condition number attains a local minimum and that for which the condition number attains its global minimum. Of the two sets of ridge estimates, the first may be preferred on the grounds that it represents a large reduction in ill-conditioning (and therefore a large reduction in the variance of the estimator) with a very small value of k (and therefore a very small bias). The signs of the estimated coefficients are the same in ridge regression as in OLS, except for the coefficient of DR_{-3}, which is insignificant in all cases. The absolute values of the t-statistics for the ridge regression are higher than those for OLS in the cases of the intercept, IP, AP, R_{-2}, R_{-3}, DR_{-4} and M_{-1}, and lower in the cases of S, DS, DR_{-3}, and R_{-4}. In the remaining cases (PM, DR_{-2}) the t-statistics for $k = .001$ exceed those for OLS, which in turn exceed those for $k = .005$. The only major differences are that the estimates of γ_1 and $(\gamma_8 + \gamma_9)$ are insignificant in OLS estimation and in ridge estimation with $k = .001$, but significant at the .1 level in ridge regression with $k = .005$.

While ridge regression helps reduce ill-conditioning, it leaves untouched the problems of serial correlation. Hence it is not surprising to find that Durbin-Watson statistics for the ridge estimates are just as bad as for the OLS ones.

CORC estimates are presented in column 4. The signs of the estimated coefficients are all the same for the CORC procedure as for OLS. The most noteworthy differences relate to γ_1, $(\gamma_8 + \gamma_9)$, Y_{11}, and $(\gamma_{10} + {}_{11})$. The estimates of these coefficients are insignificant in the OLS regressions, but significant at the .1 level or better in the CORC regression.

The remaining worry is that simultaneous equations bias may be affecting the estimated coefficients of IP. To assess the extent of simultaneous equations bias the two stage Cochrane-Orcutt procedure was applied, using as instrumental variables lagged values of IP and current and lagged values of the other regressors. The TSCORC estimates are shown in the last column of table 3. These are much like their CORC counterparts, except that the TSCORC estimate of the coefficient of IP is slightly smaller and significant at the .10 level rather than at the .01 level.

In columns for CORC and TSCORC estimates the summary statistics are based on the quasi-first-differenced data. There are no outliers when residuals are computed from this data. The outliers corresponding to untransformed data are 1961IV (A>F), 1971II (A>F) and 1973III (A>F). The first occurs in a peak in the import series. The second and third occur near the crest of another import boom. The last occurs in an import trough. The import explosion in 1961IV may be due to the liberalization of the foreign trade system earlier in the year. The import expansion of 1970—1971 was bigger than desired by the authorities and contributed to a 47% drop in foreign exchange reserves (*Službeni list*, 11 February 1971, p. 137; IMF, 1973, pp. 476—479). The question is why the authorities did not respond to the erosion of reserves by curbing imports as usual. The answer may be that decision making was paralyzed at the time by a political deadlock. Measures proposed in Belgrade were unacceptable in Croatia, and vice versa (Rusinow, 1977, p. 252). The outlier in 1973 raises a puzzle which is the reserve of that for 1970. In 1973, unlike in 1970, there was no precipitous decline in reserves to alarm the authorities; indeed reserves had been growing steadily since 1971III. Nonetheless, the authorities undertook several policies tending to curb import demand. These measures included an increase in the dinar requirement for enterprises borrowing abroad, a tightening of incomes policy, an investment squeeze, and the introduction of 'stabilization' taxes. The motivation for these measures was a desire to introduce more discipline into enterprise finances, which were then marked by serious 'illiquidity', and to deflate the economy sufficiently to permit liberalization of the trade regime without a collapse of the trade balance (OECD, 1974, pp. 45—54). The lesson of the four outliers is that foreign trade regimes and policies are even more important determinants of imports than indicated by a regression in which foreign reserves are their sole proxy.

The principal implications of the estimated import equations, of which those estimated by CORC and TSCORC are most reliable, are the following: industrial production, import prices, and policy variables are major determinants of import demand. Adjustment of imports to changes in these variables is rather slow, however, as indicated by an estimated coefficient of lagged imports of about .56. At the time of the reform, there was an increase in the lag between a change in reserves and the effects of policy measures taken in response to changes in reserves. (This increase in the lag is indicated by the negative estimated coefficient of DR_{-2} and the positive estimated coefficient of DR_{-4}.) After the reform, the authorities were no longer so able and/or willing, as previously, to curb speculative imports prior to devaluations.

VI. CAVEATS AND CONCLUSIONS

The t-tests for structural change employed in this paper rest on assumptions of classical statistical inference, which are not fully appropriate in the present context. In particular, in the absence of a unique, well-developed macroeconomic theory fitting Yugoslav institutions, specification of investment and trade equations is an *ad hoc* affair, involving some data mining. Thus, the results obtained here are less certain than a literal interpretation of the t-statistics suggests.

The investment equation is a supply of finance equation, which should ideally be estimated in a disequilibrium framework together with a demand for finance equation. If disequilibrium estimation were employed, some of the t-statistics might well be lower than those reported here.

The use of seasonally adjusted data may have induced dynamic specification errors. The possibility of such errors places a question mark over those results which pertain to change in the length of time required for policy measures to be adopted and to take effect.

In the absence of time series for a representative set of policy instruments, it has been necessary to use as proxies series for investment and export and foreign exchange reserves. These proxies are not always adequate, as an analysis of outliers has revealed. Policies may be revised without altering formal targets. International reserves are not the planners' sole concern when regulating imports. The importance of policy measures is probably understated by the proxies employed.

If despite these problems one is entitled to draw any conclusions, they are the following: first, the reform was associated with a downward shift in the elasticity of investment with respect to investment

targets and a shift from 'storming' to cumulative underfulfilment of targets.

Second, the 1967 foreign trade reform did not produce any statistically significant shifts in the coefficients of the export supply equation. The slight shift that may have occurred almost certainly did not conform with the reformers' intention to reorient the economy towards exports.

Finally, the 1967 foreign trade reform was associated with an increase in the lag between a change in reserves and the effects of policy measures taken in response to changes in reserves and with a decrease in the planners' willingness and/or ability to curb speculative imports in the run up to devaluation.

APPENDIX A: DATA

I. *Sources*

Unless otherwise indicated, all data ultimately come from the statistical bulletins of the Savezni Zavod za Statistiku and the Služba Društvenog Knjigovodstva. The sources of other data are as follows:

Industrial Production Index: S.Z.S., *Studije, Analize i Prikazi* 49, p. 78; O.E.C.D., *Main Economic Indicators*, various issues.

Official Reserves of Foreign Exchange: I.M.F., *International Financial Statistics*, various issues.

Investment Expenditure: O.E.C.D., *Main Economic Indicators*, various issues.

Target for Growth of Investment: *Službeni list*, various issues.

Target for Growth of Exports: *Službeni list*, various issues.

II. *Generation of Quarterly Time Series for Targets*

Targets are given in the pre-reform "social plans" and post-reform "policy resolutions", published in *Službeni List*, in the form of annual rates of growth, sometimes real and sometimes nominal. I adjusted the nominal targets by the rates of inflation forecast in the social plans and policy resolutions to obtain targets in real terms. The adjustment formula is $r_t = (n_t - i_t) / (1 + i_t)$, where r_t is the real rate of growth, n_t is the nominal rate, and i_t is the forecast inflation rate for time t. (I also experimented with using the actual rather than the forecast rate of inflation, but this procedure sometimes generated absurdly low targets in real terms.)

To convert target growth rates into target levels, two procedures were tried. The first procedure is to set the target level equal to a multiple of the actual level lagged four quarters, the multiple being determined by the target growth rate. That is, $L_t^* = (1 + r_t) L_{t-4}$, where L_t^* is the target level, r_t is the target growth rate, and L_{t-4} is the actual level lagged four quarters. The other procedure is to require that in each year the sum of the quarterly target levels grow smoothly during the year while summing to an annual total equal to $(1 + r)$ times the actual level in the previous year. In this procedure the first step is to calculate the annual target level, $AL_t^* = (1 + r) AL_{t-1}$, where AL_{t-1} is the annual level lagged one year. Then the quarterly target levels are calculated as:

$$QL_{ti}^* = (1 + r)^{(i-1)/4} AL_t^* / [1 + (1 + r)^{1/4} + (1 + r)^{1/2} + (1 + r)^{3/4}],$$

$$\mathrm{QL}_{ti}^* = (1 + \mathrm{r})^{(i-1)/4}\ \mathrm{AL}_t^* / [1 + (1 + \mathrm{r})^{1/4} + (1 + \mathrm{r})^{1/2} + (1 + \mathrm{r})^{3/4}],$$

$i = 1, 2, 3, 4$ where, t denotes the year and i the quarter. Finally, the series QL_{ti}^* is seasonally adjusted using TSP's SAMAQ procedure.

The correlation between the two series for investment target levels is .8513 and that for export target levels is .9842. Equations estimated with the two series do not differ markedly except with regards to fourth-order serial correlation.

The first method of deriving quarterly targets is more appropriate for use with seasonally unadjusted data for actual levels of target variables, while the second is better suited for use with seasonally adjusted data. Thus target levels derived by the first method were used in the investment equation and target levels derived by the second method were used in the export equation. Time series for these target levels are reproduced below.

Table 5

Quarterly Investment Targets (billions of 1970 dinars)

	I	II	III	IV
1960	1.6466	2.8971	3.3183	5.2012
1961	2.0393	3.6535	4.1069	5.2245
1962	2.7142	4.1941	4.7038	6.7242
1963	2.8629	4.5709	5.1381	7.3972
1964	2.7411	5.7563	6.0912	1.0150
1965	3.6601	7.0476	6.9053	9.5606
1966	4.7025	6.8214	6.2393	8.5685
1967	3.7896	6.7533	6.9046	8.4499
1968	4.2467	6.5319	5.6816	7.6096
1969	4.5560	8.3322	7.7257	10.6213
1970	5.3679	8.8218	8.8913	11.8231
1971	7.4739	10.2372	9.9787	12.4572
1972	7.7763	9.7193	8.9525	10.6822
1973	7.3436	10.5580	9.4037	12.9398
1974	7.5013	10.2014	9.0618	12.2470
1975	8.2462	11.3859	11.2031	13.8963
1976	9.3480	12.6891	13.0727	19.1488

Note that these targets are transformed into natural logarithms before being used in the investment equation.

Table 6

Index for Quarterly Export Targets (total actual 1970 exports = 100)

	I	II	III	IV
1959	9.8073	10.0107	10.2040	10.3969
1960	11.6024	12.0108	12.4439	12.8697
1961	12.3225	12.3827	12.4339	12.4756
1962	13.2150	13.6592	14.1064	14.5548
1963	15.0406	15.3678	15.6992	16.0231
1964	17.0994	17.4785	17.8495	18.2108
1965	17.2008	17.3378	17.4612	17.5801
1966	20.0710	21.5541	21.0351	21.5120
1967	21.9980	22.5240	23.0560	23.5814
1968	21.1562	21.3280	21.4731	21.6302
1969	21.9067	22.2828	22.6578	23.0197
1970	23.6106	23.8206	24.0316	24.2219
1971	26.2171	26.3333	26.4308	26.5180
1972	27.9108	28.5144	29.1186	29.7206
1973	32.6471	33.2785	33.9070	34.5295
1974	34.3509	34.8163	35.2808	35.7219
1975	35.2434	35.7711	36.2764	36.7763
1976	33.7526	33.8921	34.1858	34.3817

Note that these targets are transformed into natural logarithms before use in the export equation.

APPENDIX B: THE EXOGENEITY OF TARGET VARIABLES

In the investment and export equations targets for investment and exports, respectively, are used as regressors. In the import equation lagged official reserves are used as a proxy for the unobserved import target.

The two target variables and the proxy are, in a sense, predetermined: the targets are chosen by the authorities before the start of the year to which they apply and the official reserves variable is lagged. However, being predetermined in this sense is not a sufficient condition for statistical exogeneity. Nor does the fact that targets are under government control guarantee statistical exogeneity (Cooley and LeRoy, 1981, p. 838).

Yet if the least squares estimates offered in this paper are to be unbiased it is necessary that the regressors be statistically exogenous, i.e. statistically independent of the unobserved explanatory variables (Maddala, 1977, p. 151).

There are three ways in which the target variables and official reserves might fail to be independent of the omitted variables. First, the target variables or official reserves might influence omitted variables. Second, lagged omitted variables might influence the target variables or reserves. Finally, both the target or reserves variables and some omitted variables might be under the influence of a third set of variables. Possible sources and consequences of each of these types of violation of exogeneity will be considered in turn.

That the target or reserves variables influence omitted variables is quite likely. Indeed, one of the purposes of announcing targets is to influence expectations, a classic unobserved variable. The existence of this sort of violation of exogeneity means only that there are multiple channels by which the target or reserve variables may influence the dependent variables. The multiplicity of channels creates no problems so long as we are content to estimates the total, direct and indirect, effect of targets or reserves on the dependent variables and do not require a complete path analysis.

The second possible kind of violation of exogeneity occurs if a lagged omitted variable influences the target or reserves variables. There may exist economies in which this possibility is realized. For example, in the French economy it may happen that the lagged investment intentions of enterprise managers influence both investment targets and investment expenditure. However, Yugoslavia is not France. In Yugoslavia, national investment targets are not mere aggregations of enterprise investment intentions. The anecdotal evidence suggests that Yugoslav plans are meant to, and do, influence events rather than merely forecast them (Burkett, 1981, Chapters 1 and 2).

Finally, there is the possibility that targets or reserves and omitted variables both respond to a third set of variables. Again, there may exist economies in which targets for investment and enterprises' investment intentions (an omitted variable) are both governed by, say, anticipated changes in national income. However, this hypothetical economy is not Yugoslavia. The anecdotal evidence suggests that in Yugoslavia different considerations underlie planners, and managers, investment decisions. Planners choose investment targets in light of the projected potential national income and desired changes in its composition. Managers typically invest up to the limit of their borrowing capacity.

Analogous observations suggest that the second and third types of violation of exogeneity are not likely to be serious problems for export targets or lagged reserves (Burkett, 1981, Chapter 2).

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BIBLIOGRAPHY

Bilandžić, D. (1969), *Borba za samoupravni socijalizam u Jugoslaviji 1945—1973* (Zagreb).

Brown, R. L., J. Durbin, and J. M. Evans (1975), „Techniques for Testing the Constancy of Regression Relationships Over Time," *Journal of the Royal Statistical Society*, series B., Vol. 37, pp. 149—163.

Burkett, J. P. (1981), *Economic Reforms in Yugoslavia: Their Impact on Investment and Foreign Trade Policy, 1959—1976*, (University of California, Berkley, Ph. D. Thesis).

Burkett, J. P., R. Portes, and D. Winter (1981), *Macroeconomic Adjustment and Foreign Trade of Centrally Planned Economies*, (NBER).

Cooley, T. F. and S. F. Leroy (1981), „Identification and Estimation of Money Demand," *The American Economic Review*, Vol. 71, No. 5.

Chow, G. C. (1960), „Tests of Equality Between Subsets of Coefficients in Two Linear Regressions," *Econometrica*, Vol. 28, pp. 591—605.

D'Agostino, R. B., and E. S. Pearson (1973), „Tests for Departure from Normality. Empirical Results for the Distributions of b_2 and $\sqrt{b_1}$," *Biometrika*, Vol. 60, No. 3, pp. 613—622.

Ekonomska Politika (Belgrade), various issues.

Farebrother, R. W. (1974), „Gram-Schmidt Regression," *Applied Statistics*, Vol. 23, No. 3, pp. 470—475.

Gujarathi, D. (1970), „Use of Dummy Variables in Testing Equality Between Sets of Coefficients in Two Linear Regressions," *American Statistician*, Vol. 24, No. 5.

Hall, R., J. Brode, F. Ripley, S. Robinson, N. Sheflin, R. Fair, P. Kurukalaaratchy (1975), *Time Series Processor, User's Manual* (University of Essex).

Hendry, D. F., G. E. Mizon (1978), „Serial Correlation as a Convenient Simplification, Not a Nuisance: A Comment on a Study of the Demand for Money by the Bank of England," *The Economic Journal*, Vol. 88, pp. 549—563.

Hewett, E. (1979), „Hungarian Economic Model No. One," (discussion paper).

Institut za Spoljnu Trgovinu, *Yearly Economic Report* (Belgrade), various issues.

International Monetary Fund, *International Financial Statistics*, various issues.

Johnston, J. (1972), *Econometric Models*, (Tokyo: McGraw-Hill Kogakusha).

Jacobs, R. L., E. E. Leamer, and M. P. Ward (1979), „Difficulties with Testing for Causation," *Economic Inquiry*, Vol. 17, pp. 401—13.

Kendall, M. G., and A. Stuart (1967), *The Advanced Theory of Statisitcs*, second edition, Vol. 2, (London, Charles Griffin and Co.).

Leamer, E. E. (1978), *Specification Searches. Ad Hoc Inference with Nonexperimental Data*, (New York: John Wiley and Sons).

Lovell, M. C. (1963), „Seasonal Adjustment of Economic Times Series and Multiple Regression Analysis," *Journal of the American Statistical Association*, December, pp. 993—1010.

Maddala, G. S. (1977), *Econometrics* (Tokyo: McGraw-Hill Kogakusha).

Mencinger, J. (1977), interview, Ljubljana.

National Bank of Yugoslavia, *Annual Report* (Belgrade), various issues.

O.E.C.D., *Main Economic Indicators*, various issues.

O.E.C.D., *Yugoslavia, Annual Economic Survey*, various issues.

Portets, R. and D. Faner (1980), „Disequilibrium Estimates for Consumption Goods Markets in Centrally Planned Economies," *Review of Economic Studies*, Vol. 47, pp. 137—159.

Rusinow, D. (1977), *The Yugoslav Experiment, 1948—1974*, (London: C. Hurst and Co.).

Savezni Zavod za Statistiku, *Statistički Bilten* (Belgrade), various issues.

Savezni Zavod za Statistiku, *Statistički Dokumenti* (Belgrade), August 1976.

Savezni Zavod za Statistiku, *Studija, Analize, i Prikazi* (Belgrade), various issues.

Sebor, G. A. F. (1977), *Linear Regression Analysis*, (New York: John Wiley and Sons).

Shapiro, H. T. (1977), „Macroeconometric Models of the Soviet Union and Eastern European Economies: a Tabular Survey," *Econometrica*, Vol. 45, No. 8, pp. 1747—66.

Simon, A. (1980), „An Econometric Model of the Hungarian Economy," paper contributed to the fourth world congress of the Econometric Society, Aix-en-Provence.

Služba Društvenog Knjigovodstva, *Statistički Bilten* (Belgrade), various issues.

Službeni List S.F.R.J. (Belgrade), various issues.

Theil, H. (1971), *Principles of Econometrtics*, (New York: John Wiley and Sons).

Unied Nations (1977), *Yearbook of International Trade Statistics*, (New York).

Vanek, Jaroslav (1970), *The General Theory of Labor-Managed Market Economies* (Ithaca: Cornell University Press).

Wallis, K. F. (1974), „Seasonal Adjustment and Relations Between Variables," *Journal of the American Statistical Association*, Vol. 69, pp. 18—31.

Wampler, R. H. (1980), „Test Procedures and Test rPoblems for Least Squares Algorithms," *Journal of Econometrics*, No. 12, pp. 3—22.

Ward, B. (1967), *The Socialist Economy* (New York: Random House).

Watson, D. E. and K. J. White (1976), „Forecasting the Demand for Money Under Changing Term Structure of Interest Rates: An Application of Ridge Regression," *Southern Economic Journal*, Vol. 43, No. 2, pp. 1096—1105.

White, K. J. (1980), *SHAZAM, An Econometric Computer Program, Version 3.0.3.* (Houston: Social Science Computer Laboratory, Rice University).

UTICAJ REFORMI NA JUGOSLOVENSKE INVESTICIJE I SPOLJNU TRGOVINU

John P. BURKETT

Rezime

U članku su ispitane posledice jugoslovenske ekonomske reforme 1965—1967. godine u oblasti uticaja saveznih planera na agregatne investicije, izvoznu ponudu i uvoznu tražnju. U tu svrhu razvijene su teorije investicija i spoljne trgovine u usmeravanoj tržišnoj privredi sa samoupravnim preduzećima. Specifikovane su jednačine investicija, izvozne ponude i uvozne tražnje, imajući posebno u vidu pitanja iz specifikacionih istraživanja koja je pokrenuo Leamer. Strukturne promene u periodu reforme testirane su metodom pseudovarijabli koji je razvio Gujarathi. Jednačine su ocenjene metodom običnih najmanjih kvadrata, metodom krivolinijske regresije, Cochrane-Orcuttovim metodom i njegovim dvoetapnim analogonom.

Dokazano je da je reforma bila povezana sa silaznim pomakom elasticiteta investicionih izdataka u odnosu na investicione ciljeve, kao i sa pomakom od »akutnih« ka »hroničnim« podbačajima u ostvarivanju investicionih ciljeva. Takođe je dokazano da je reforma bila povezana sa povećanjem docnje efekata mera ekonomske politike preduzetih kao odgovor na promene deviznih rezervi u odnosu na same te promene, kao i sa smanjenjem spremnosti i/ili sposobnosti planera da obuzdaju spekulativni uvoz pre devalvacije. Nikakva signifikantna promena nije otkrivena kod krivulje izvozne ponude. Nalaz o neizmenjenom uticaju planera na izvoz konzistentan je sa nalazom o većoj sklonosti reformom decentralizovanih agenasa da svoju nedavno povećanu autonomiju iskoriste za opiranje administrativnim zabranama nametnutim investicijama i uvozu nego za suprotstavljanje izvoznom supsidijumu.