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Authors

Adelman, Irma
Berck, Peter
Labus, Miroljub
et al.

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DIVISION OF AGRICULTURE AND NATURAL RESOURCES
UNIVERSITY OF CALIFORNIA, Berkeley

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ADJUSTMENT UNDER DIFFERENT TRADE STRATEGIES: A MEAN-VARIANCE ANALYSIS WITH A CGE MODEL OF THE YUGOSLAV ECONOMY

by

Irma Adelman, Peter Berck, Miroljub Labus, and Dusan Vujovic

California Agricultural Experiment Station
Giannini Foundation of Agricultural Economics

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1. Introduction

A major focus of Bela Balassa's research since the mid-seventies has been on the comparative performance of economies pursuing different trade strategies under external shocks. Using data from different economies over various periods of time (see e.g. Balassa 1984, 1986 and 1987), he has demonstrated that, on the average, economies that have engaged in export oriented growth have adjusted better to the two oil shocks than economies that have engaged in import substitution policies. He has therefore argued that the proper policy response by developing countries to the more variable and slower growing international environment of the 1970s and 1980s is to shift to open development strategies and export their way out of the debt crisis. In his later writings (see e.g. Balassa 1989), he has emphasized that this shift requires institutional reform within developing countries to make them more flexible and more responsive to price signals.

The analytic literature on trade under uncertainty does not come up with unequivocal results concerning optimal commercial policies. Some models of trade under uncertainty indicate that uncertainty in international markets may make it optimal for a risk-averse country to move towards autarky (Ruffin 1974, Sarris 1985, and Cheng 1987). This line of research thus suggests that, under uncertainty, import substitution may well be superior to export led growth. However, the literature on trade under uncertainty also indicates that optimal adjustment policies differ with the structure of the model (e.g., how much substitution has been built in); the timing of decisions (e.g., whether decisions must be taken before the uncertainty is revealed or can be postponed till after the uncertainty has manifested itself); the objectives of the

adjustment (e.g. whether the aim of adjustment is to achieve stability, growth, or better income distribution); and the modelling of the shocks (e.g. whether uncertainty is additive or multiplicative, and whether the shock is a price or a quantity shock). Theoretical conclusions thus tend to be model-and-situation specific and to offer no general guidelines concerning optimal development and adjustment strategies under uncertainty (see Adelman et. al. 1989).

Empirically, actual adjustments to the oil shocks of 1973 and 1979 and to the debt shocks of the 1980s have varied greatly among countries. And the variety in country adjustment patterns has been more complex than the simple dichotomy of export orientation or import substitution (see Corbo and de Melo 1986 for adjustment in Latin American countries, and Lin 1986 for East Asian countries). In particular, in addition to differences in commercial policies, there have also been differences among countries in the extent of efforts to liberalize domestic commodity and credit markets, the extent of efforts to reduce total absorption, in inflation rates and in measures to control them, and in the extent of debt-led growth. The sequencing of different policy measures has also varied substantially among countries as have the initial conditions prevalent before adjustment began. While some clusters of policies can be labeled import substitutionist and others export expansionist, the adjustment policies of individual countries do not correlate perfectly with either trade regime. Furthermore, countries have switched among trade regimes with sufficient rapidity so that the full effects of neither policy regime can be fully captured by following given countries' experiences.

While some economies have clearly adjusted more successfully to shocks arising in the external sector than others, it is hard to disentangle from cross-country evidence how much of the relative success of particular countries was due to differences in policies (e.g., with respect to protection), how much was due to differences in economic structure, and how much was due to the fact that

the same external shock impacts differently on economies that have been pursuing different development strategies in the past and are of different sizes.

In the present paper, we investigate the transition from import substitution to an export-oriented strategy in the context of a single economy, Yugoslavia. Yugoslavia has followed different trade policies during the last two decades. The year 1980 saw the culmination of a long period of import substitution and growing foreign debt. The year 1984 reflects a strong short-term external adjustment based on an IMF stand-by arrangement that was regarded as a first step towards an export-oriented strategy. It was done under substantial governmental pressures to export and continued import rationing, but without neutral tariff policies and without an increase in the economic flexibility of the domestic economy. The year 1987 reflects a relaxation of governmental pressures to export, gradual reduction in import quotas, and greater, though still incomplete, flexibility and openness of the trade regime. None of the years portray "fully open" trade regime, in the Balassa-Baghwati sense. However, both 1984 and 1987 reflect attempts to embark on export-oriented growth. Both 1984 and 1987 reflect tradeoffs between external and internal adjustment relative to 1980. We study the characteristics of these tradeoffs , as well as the robustness to shocks arising in international markets under these different trade regimes.

Our methodology is to develop three separate CGE models (one for 1980, one for 1984, and one for 1987) based on the SAMs appropriate for each of these years. The model solutions are used to study the economic characteristics of these three different periods. To study the stability of the economy to external perturbations, we then construct a set of random international shocks on most of the exogenous variables in the model. The distribution of these shocks is based on an empirically derived variance-covariance matrix among shocks. We then expose each CGE model to the same set of 100 random shocks drawn from this distribution and compute the expected values and variances of the equilibrium

values of the endogenous variables for each of the three years. We thus standardize the shocks to which the model economy is exposed. By comparing the means and variances of the endogenous CGE variables in response to the same exogenous shocks under three trade regimes, we can compare the robustness of the economy to shocks under different strategies. Since our comparison is based on comparative statics, our results reflect how the economy reacts to shocks in the long run, after enough time has elapsed to allow the economy to reach a new equilibrium. Unlike experiments produced by nature, our simulations are standardized for the nature of the shock and the basic structure of the economy, except for differences induced by the effects of trade regimes. Our simulations also reflect equilibrium responses.

Our results support Balassa's thesis concerning the stability of export-oriented development and the crucial role of institutional adjustment. The results also offer additional insights into the trade-offs between debt-servicing and debt-repayment and domestic welfare, and the dependence of preferred trade-strategy choices on the degree of risk aversion of policy makers.

2. The Methodology

The present study applies the methodology used by Adelman and Berck (1989) to study food security to the analysis of robustness to external shocks under different trade regimes. The remainder of this section describes: (1) the construction of the international shocks; (2) the CGE model used to transform the probability distribution of these shocks into a probability distribution of prices, incomes, domestic production and imports and exports; and (3) the indicators of domestic welfare.

The Shocks

In this model we analyze shocks to the domestic economy arising from

international sources: world prices of imports and exports in each of four traded sectors (agriculture, industry, energy, and services); workers' remittances; and the exchange rate. Our method of modelling the shocks was to consider as shocks the deviations from the values of the variables that could be predicted one year ahead. The values of the variables were first normalized so that their 1972 values were unity. The normalized values were then regressed over the period 1972 to 1987 on their lagged values and a constant. The deviations from these regressions were then taken as the values of the shocks.

The data for these regressions came from various sources. For the world price variables, the price data for Yugoslav imports and exports was constructed from the three-digit SITC classifications in the United Nations' International Trade Statistics Yearbooks for various years. Prices for imports and exports at the three-digit level were computed from the value and weight information in Tables 4 and 5 and then aggregated to the two-digit level by using value shares. The world price index for services, which represent mostly tourism and transport, was constructed from a weighted average of the "transport" and "hotel and restaurant" GNP deflators in the National Accounts of Germany and United States. This index was used for both service imports and exports. Information on worker remittances and exchange rates was taken from the International Monetary Fund's Financial Statistics Yearbooks for various years.

The equations fit with R-squares varying between .400 and .867 ; all had significant coefficients. Most of the variance in industrial export prices was systematic; and most of the variance in the import price of agriculture was random. Table 1 gives the correlation matrix and the coefficients of variation of the shocks. The standard errors are substantial, yielding coefficients of variation between 10% and 35%. Energy prices had the highest variance; the exchange rate had the lowest coefficient of variation over the sample period. The off-diagonal elements in the matrix indicate that the correlations among

Table 1:

Correlations and Standard Errors of Shocks

	Exchange Rate	World Price Indexes: Services	Imports: Agriculture	Imports: Industry	Imports: Energy	Exports: Agriculture	Exports: Industry	Exports: Energy	Workers' Remittances
				Correlations					
Exchange Rate	1.00	-0.58	-0.39	-0.29	-0.08	-0.30	0.18	-0.06	-0.06
World Price Indexes:									
Services	-0.58	1.00	0.61	0.26	-0.24	0.53	-0.38	-0.28	-0.28
Agriculture Imports	-0.39	0.61	1.00	0.11	-0.21	0.34	-0.23	-0.40	-0.40
Industry Imports	-0.29	0.26	0.11	1.00	0.47	0.01	0.21	0.31	0.31
Energy Imports	-0.08	-0.24	-0.21	0.47	1.00	-0.32	0.62	0.82	0.82
Agriculture Exports	-0.30	0.53	0.34	0.01	-0.32	1.00	-0.27	-0.13	-0.13
Industry Exports	0.18	-0.38	-0.23	0.21	0.62	-0.27	1.00	0.61	0.61
Energy Exports	-0.06	-0.28	-0.40	0.31	0.82	-0.13	0.61	1.00	1.00
Workers' Remittances	-0.06	-0.28	-0.40	0.31	0.82	-0.13	0.61	1.00	1.00
				Coefficients of Variation (in %)					
	10.66	13.15	35.21	25.51	32.83	21.29	14.20	19.98	19.98

Source: Computed from data for 1972-1987 derived from International Trade Statistics Yearbook (various years), International Financial Statistics Yearbook (various years), and data published by the Federal Statistical Office and the National Bank of Yugoslavia.

shocks are significant. In particular, worker remittances have a correlation of unity with the world price of energy exports and .82 with the world price of energy imports; worker remittances thus tend to mitigate the effects of high import prices. Except for energy prices, the correlation between the world price of Yugoslav imports and exports is not all that high. The correlation matrix also suggests some tendency to counteract the effects of high exchange rates by world prices of tourism.

The shocks themselves were constructed by drawing 100 nine-tuples of shocks from a multivariate t-distribution with the estimated variance-covariance matrix and three degrees of freedom. A t-distribution was used because it has relatively fat tails, and our sample period included the two oil shocks and the grain price shock of 1973-4, and these shocks could not be adequately represented with a multivariate normal distribution.

Mapping of External Shocks into Domestic Activity Incomes and Prices

Computable General Equilibrium Models (CGE) were used to map the random external shocks into variances of imports, exports, GDP and consumer group incomes and prices. Three CGE models, one for 1980, one for 1984 and one for 1987 were used to translate the same distribution of external shocks into distributions of the endogenous variables. The models were identical in analytic structure, but they were each based on a Social Accounting Matrices (SAM) for the appropriate year. The basic CGE has six sectors (agriculture, energy, industry, construction, productive services and non-productive services), and eight institutions (three household types - rural, urban and mixed -, enterprises, general government, collective consumption, and two rest of the world accounts - clearing and convertible -). Both micro and macro closures in the model are Keynesian.

We discuss here only the departures from the standard specification of CGE models. (For detailed descriptions of the standard CGE model, see Adelman and

Robinson (1978) and Dervis, de Melo and Robinson(1982)). Not surprisingly, these departures are in three areas: the specification of factor markets, the specification of firm behavior, and the specification of international trade.

The model has two sector-specific factors of production (labor and capital) reflecting the lack of factor markets in the Yugoslav economy. Capital is fully employed in each period and its rate of return varies, while labor has exogenously set sectoral wages reflecting persistent labor immobility and wage differentials across sectors and varying employment. Value added is a CES aggregation of the factors of production with elasticities of substitution ranging between .3 in agriculture and 1.2 in services. Gross domestic production is a Leontief aggregation of value added and intermediates.

Self-management is one of the distinctive features of firm-behavior in the Yugoslav economy which needs to be modeled. In theory, self-management simply implies a different maximand for the firm -- the maximization of value added per worker. Traditional labor-management theory has demonstrated that a prototypical self-managed firm following this maximand under ceteris paribus conditions generates lower employment and output than a comparable profit-maximizing firm. The self-managed firm also has a negatively sloped supply curve which gives rise to the notorious Ward paradox (i.e. the firm responds to higher prices with output and employment contraction - see Ward 1958, Vanek 1970, and Domar 1966). However, these presumed theoretical responses are under challenge (see. e.g. Kahana 1989, Bonin and Fukuda 1986), and cannot easily be reconciled with the empirical Yugoslav evidence (see e.g. Sapir 1980, Nishimizu and Page 1982 and Bateman, Nishimizu and Page 1986).

Furthermore, the legislative concept and definition of the socialist labor-managed firm bears only a limited resemblance to the theory of the labor-managed economy developed around the Ward-Vanek work. The legislative definition of socialist self-management (SSM) is heavily affected by non-economic (ideological,

political, national, and other social) concepts. Moreover, the real self-management system, which is what we attempt to model, is also very different from the legislative definition, let alone from labor-management theory. The real SSM is an outcome of selective implementation of the legislation, decided upon through an overly complex and often obscure regionalized political process, and operates under specific institutional arrangements (including excessive economic regulation).

Specifically, the real environment in the sample period included such features as exogenously set minimum employment rates by sector; constraints on the use of retained profits for wages and/or exogenously set "proportions in enterprise income distribution"; minimum and maximum wage controls; discretionary tax exemptions for poorly performing enterprises and other subsidies. Since the Yugoslav CGE model was built as an applied model, we adopted a specification of firm-behavior which could accommodate most of these features. This was accomplished by splitting the factor demand relationships in the model from the determination of factor incomes. Factor demands follow the marginal-value-product rule subject to minimum employment constraints. Factor incomes are computed subject to additional government-set sector-and-region specific constraints on enterprise income distribution. (See Vujovic et. al. 1985 and 1986, and Vujovic and Labus 1989. For an alternative approach to modelling self-managed firm-behavior and labor-market clearing procedures in the context of the first Yugoslav CGE model see Robinson and Tyson 1985.)

Another peculiar feature of the Yugoslav economy (as well as of other socialist economies) is the presence of two different trade and current accounts: convertible and clearing. Convertible trade consists of trade in which companies import and export in response to market signals subject to trade restrictions, and commodity and financial flows need to be in equilibrium. A convertible current account surplus (deficit) results in lower (higher) foreign debt and/or

increased (decreased) foreign exchange reserves. Clearing trade is determined on a long-term (five years) contractual basis at the state level (commodity lists), with little or no reference to world-market prices. Clearing trade occurs only with the Eastern block and it need not balance ex post. Imbalances can occur because of unanticipated changes in commodity prices, the clearing exchange rate, or because of a failure to deliver contractually agreed upon quantities. A clearing trade surplus translates into an "involuntary zero-interest open-ended grace-period" loan which can only be repaid by running a trade deficit with the same country in subsequent periods. But this might be very difficult to achieve since commodity lists are predetermined years in advance and the deficit-running country has no incentive to remedy the problem. Needless to say, a current account surplus with a clearing area has a strong inflationary impact in the surplus country.

Due to its relative size (between 20 and 30% of total foreign trade) and different behavior, clearing trade was modeled separately from convertible trade and convertible balance of payments. In practice, the clearing dollar rate is pegged to the US dollar, which was modeled by linking the clearing exchange rate to the convertible exchange rate in the model. To enable shocks in the convertible exchange rate, a fixed convertible exchange rate version of the model was used, and the clearing exchange rate was allowed to adjust. Both clearing and convertible exports followed the Powell and Gruen (1968) constant elasticity of transformation specification, but clearing exports had a very low elasticity of transformation. Similarly, both export demands were modeled with constant elasticities, but clearing export demands were very inelastic. Both clearing and convertible imports were modeled with fixed quantities and gave rise to import rents which accrue to enterprises. Armington functions were used to determine the changes in the composition of total domestic supply.

The data base for the three CGE models consisted of independently estimated

Social Accounting Matrices[1] *for 1980, 1984, and 1987. Model parameters for 1984 (elasticities, consumption shares, level and shift parameters etc.) were estimated from time series starting in 1965 and going to 1984. A detailed account of the procedures used in estimating the 1984 SAM and the 1984 CGE parameters is given in Vujovic et. al. 1986, and Vujovic and Labus 1989. Parameters for 1980 and 1987 were kept at their 1984 values except for the trade and the trade-related elasticities. Specifically, the elasticities of export demand, the elasticities of substitution between imported and domestic commodities, and the elasticities of transformation between supply to domestic and supply to world markets were all changed from their 1984 values.*

In 1980 import substitution was the dominant trade orientation. There was little flexibility in shifting supply from domestic markets to exports because production was mostly oriented towards satisfying domestic market needs. World demand for Yugoslav exports was rather inelastic because there were binding import restrictions in OECD countries for major Yugoslav exports. Substitution between domestic and imported commodities was low, at the margin, since the domestic market was flooded with imported goods. To reflect these different conditions in 1980 we lowered the respective 1980 elasticities by 20% relative to 1984.

By contrast, in 1987 substantial trade and current account surpluses were achieved and a partial move towards export trade orientation was accomplished.

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1. The Yugoslav Federal Statistical Office has a long tradition of producing Input-Output tables: Between 1955 and 1980 twelve tables were produced, and two more (for 1983 and 1987) are being finalized at present. The ideas of integrated national accounts were highly praised by both Yugoslav statisticians and economists since early 1950's, but inconsistencies between data sets collected and processed by different government agencies prevailed. An elaborate attempt to integrate the accounts following the official Material Product System (MPS) concept was produced as an independent research project within the Federal Statistical Office (See Lj. Stjepanovic 1984). It later served as a base for producing a full fledged Social Accounting Matrix for 1984 (See Lj. Stjepanovic 1986) and for developing the SAMs for 1980 and 1987 used in the CGE models for the respective years.

Firms had become more competitive, had increased the efficiency of input use, especially of energy and imported intermediates, and had raised their ability to move into foreign markets by producing goods more suitable for exports. World demand for Yugoslav exports was more elastic because the composition of exports had changed and a smaller fraction of exports was subject to import restrictions. After years of import restrictions, substitution possibilities between domestic and imported commodities had increased, particularly in consumer and capital goods. We reflected these new conditions in 1987 by increasing the respective elasticities by 20% relative to 1984.

The Evaluation of Robustness and Welfare Changes

To provide information on the robustness of the economy under different trade regimes, the three CGE models were each run 100 times, once for each of the previously computed combinations of shocks.

The adjustment of the economy from the debt-supported import substitution policies followed up to 1980 towards the export-oriented adjustment and debt service of the 1980s generated welfare losses in the economy. Since the representative consumer in each group is assumed to be risk averse, the instability in real incomes generates additional welfare losses. To evaluate the magnitude of these welfare losses, we compute the expected equivalent-variation for the consumer with the mean income of his group. The equivalent-variation is the amount of money one would have to pay a consumer to make him as well off as he would have been in the comparison-base in the absence of shocks. The expected equivalent-variations for each year relative to the base in that year represent the welfare costs of instability. The expected equivalent variations with respect to 1980 reflect both the cost of adjustment and the costs of instability relative to the 1980 base.

The CGE model uses a linear expenditure system (LES) to represent consumers. The ordinal indirect utility function associated with that demand

system is given by $v(y,p)$, where y is the income of the average consumer and p is the vector of prices he faces. For an LES, $v = (y-m'p) \prod p_i^{\alpha i}$, where m is the "subsistence" vector, and the α_i are the marginal shares of income spent on good i. Let the expected utility be

$$EU = E\left[\frac{v^{1-\beta}}{1-\beta}\right]$$

where the expectation is taken over the 100 replicates. This utility function has decreasing absolute risk aversion and increasing, asymptotically constant, relative risk aversion. It also has positive and diminishing marginal utility. We chose a value of β equal to 0.3. For the cases we consider, the product of the prices to the power α_i is nearly one in the base and the values of $m'p$ are 60% of income for urban groups, 50% of income for mixed rural-urban groups, and 40% of income for rural groups. (The value chosen for the income share of the subsistence bundle for urban households corresponds to the relative income level at which the Yugoslav government either: authorizes the use of the federal development fund; subsidizes consumption and intervenes through transfers; grants income tax exemption; or authorizes minimum guaranteed wages. For rural households the subsistence share is lower because of auto-consumption.)

3. Results

Tables 2-5 summarize the behavior of the model Yugoslav economy under international shocks in our three model years. Table 2 summarizes the macro variables for the income and activity flows, while Table 3 summarizes the macro variables for the trade flows. Columns 2, 7, and 12 of the tables indicate the base solution values for major variables in the CGE models; columns 3, 8, and

13 of the tables indicate the expected values of the solution values of the variables under 100 random shocks; columns 4, 9 and 14 list the standard deviations of the solution values under the 100 shocks; columns 5, 6, and 10 indicate the minimum, and columns 11, 15 and 16 the maximum solution values. Since variances give the same weight to both positive and negative deviations from the base solution, and since very risk averse policy makers care primarily about the relative frequency of adverse outcomes, these are summarized in table 4. Finally, table 5 indicates the welfare evaluation of these outcomes.

The first point to emerge from table 2 is that for most of the income and activity flows, the expected values are close to the base solutions and that the standard deviations of the solutions are small. Even though the shocks themselves have coefficients of variation averaging 22% and ranging from 10.7% (on the exchange rate) to 35% (on agricultural import prices), the coefficients of variation of the endogenous income and activity flows average only 2.17%. Only enterprise incomes and rural household incomes and consumptions have coefficients of variation exceeding 5%. Thus, on the average, the economy operates so as to considerably dampen the amplitudes of the fluctuations of domestic activities and incomes in response to external shocks. The mapping of external shocks on the domestic economy is very contractionary, despite many non-neoclassical rigidities built into the model. Substitution effects through international trade and through changes in the structure and levels of domestic production and consumption result in substantial smoothing of domestic fluctuations regardless of trade regime. Table 3 indicates that the trade flows are considerably more variable than the income and activity flows, though their amplitudes are still much below those of the shocks. The coefficients of variation of exports and imports average 4.4%, roughly twice those of the income and activity flows. Fluctuations in convertible trade are more pronounced than fluctuations in total trade; and fluctuations in exports are more pronounced

Table 2:

Income and Activity Flows

(in 1980 billions of dinars)

	1980					1984					1987				
	BASE	MEAN	ST. DEV	RANGE		BASE	MEAN	ST. DEV	RANGE		BASE	MEAN	ST. DEV	RANGE	
GDP at Factor Cost [d]	1704	1704	40	1591	1835	1753	1747	52	1533	1900	1805	1805	38	1631	1930
Institution/Factor Income:															
Enterprise [e], [h]	494	495	40	382	622	464	459	45	273	591	493	492	41	310	625
Wages [f], [i]	1027	1026	2	1023	1032	788	788	1	786	790	974	974	1	972	976
Disposable Income: [f], [g]															
Rural Households	87	85	6	73	106	76	74	7	61	97	72	71	4	63	84
Mixed Households	318	317	4	308	332	236	235	5	226	251	272	271	3	266	281
Urban Households	732	729	8	714	757	536	533	8	518	561	657	656	5	646	672
Consumption: [f]															
Rural Households	80	78	6	67	97	84	82	6	71	101	63	62	2	57	71
Mixed Households	303	302	4	293	316	250	248	4	240	263	240	239	2	235	247
Urban Households	700	697	8	682	723	503	501	7	486	527	554	553	4	545	567
Collective Consumption [a]	132	131	0	131	133	171	170	1	169	172	231	231	0	230	232
Domestic Supply: [e]															
Agriculture	433	432	4	423	446	480	479	5	467	497	464	463	3	452	472
Energy	424	422	6	408	443	474	472	11	447	508	400	399	5	387	417
Industry	2169	2162	24	2115	2244	2025	2019	22	1972	2094	2253	2249	14	2210	2296
Construction	484	483	3	477	492	312	311	2	306	318	319	319	2	313	324
Productive Services [b]	872	869	10	849	903	695	692	9	673	724	894	892	7	876	915
Non-productive Services [c]	589	588	2	584	595	314	313	2	310	319	591	590	1	587	595

a) Consists of health care, social security, education etc.
b) Includes Transport, Wholesale and Retail Trade, Tourism and Catering, Business Services and Crafts.
c) Includes Banking, Insurance, Housing, Government, Education, Health.
d) Converted to constant prices using the implicit Gross Material Product deflator.
e) Converted to constant prices using the Producer Price index.
f) Converted to constant prices using the Consumer Price index.
g) Household income after taxes, including remittances and private transfers.
h) Equivalent to net retained profits before taxes. Excludes wage and interest payments.
i) Gross wages, net of income in kind, before taxes and contributions, subsidies, and transfers.

Source: Computed from one hundred replicates of random shocks to the Yugoslav CGE models for each of the analyzed years.

Table 3:

Trade Flows (in millions of dollars)

	1980 c)					1984 d)					1987 e)				
	BASE	MEAN	ST. DEV	RANGE		BASE	MEAN	ST. DEV	RANGE		BASE	MEAN	ST. DEV	RANGE	
Exports Goods & Services:															
Total	14930	15073	497	13359	15983	13637	13755	397	12399	14702	15814	15877	235	15049	16402
Agriculture	451	462	38	379	584	460	475	55	354	686	466	475	46	363	640
Of which Convertible	308	311	19	256	412	248	251	16	202	342	324	328	25	259	459
Industry	10005	10069	329	9138	10826	10277	10338	336	9446	11165	10506	10489	398	8509	11578
Of which Convertible	6736	6616	689	2925	7847	6838	6714	741	2788	8055	7166	7063	819	2773	8551
Construction	114	116	8	94	149	75	78	13	45	136	769	778	48	679	1007
Of which Convertible	72	72	1	67	76	22	22	0	20	23	612	613	13	567	656
Services	3321	3378	213	2784	4235	2716	2764	184	2289	3552	5204	5262	312	4611	6756
Of which Convertible	2095	2095	39	1965	2206	1847	1848	36	1725	1957	4135	4143	89	3841	4421
Imports Goods & Services:															
Total	18016	17909	1528	13255	22371	13431	13513	1250	9826	18784	14492	14475	1266	10363	19989
Of which Convertible	16492	16433	198	16080	17165	10117	10080	133	9833	10557	12344	12322	87	12104	12626
Foreign Trade Balance Goods & Services	-3087	-2836	-1390	-6618	1239	207	243	1326	-5775	3847	1322	1402	1294	-4313	5370
Share Clearing Trade (%)	22.0%	22.4%	0.3%	4.4%	40.8%	29.5%	30.3%	0.4%	11.6%	54.3%	18.9%	19.2%	0.3%	1.0%	44.4%
Terms of Trade Effect a)	0	294	1346	-2872	4963	0	102	1226	-3090	4802	0	210	1408	-3360	6078
Import Controls Rents b)	0	44	1587	-4575	5073	0	-135	1355	-5573	4015	0	-8	1319	-5804	4321

a) Computed as the change in the terms of trade times the volume of exports.
b) Rents are computed as the difference between the world prices and the solution prices under the quota times the import quota quantity.
c) Converted to US Dollars using the 1980 period average exchange rate of 24.64 Dinars per Dollar.
d) Converted to US Dollars using the official 1984 statistical exchange rate of 125.67 Dinars per Dollar.
e) Converted to US Dollars using the 1987 period average exchange rate of 725.0 Dinars per Dollar.

Source: Computed from one hundred replicates of random shocks to the Yugoslav CGE models for each of the analyzed years.

than fluctuations in imports. Imports are not constant despite physical quantity constraints because they also depend on the random import prices, the random convertible exchange rate and on the model solution for the clearing exchange rate. Despite small coefficients of variation, the range in outcomes is nevertheless substantial. For example, the minimum value of GDP at factor cost was 10% below the base solution; and minimal rural household incomes were 14.3% below the base values, on the average. Tables 2 and 3 indicate that the shift from import substitution policies of the seventies towards export-oriented adjustment has had different effects on domestic and international disequilibrium. Adjustment to international disequilibrium has been very substantial, while economic growth has been sluggish and real household incomes first declined substantially and then recovered somewhat, while still remaining significantly below 1980.

The extent of external adjustment is described in Table 3. In 1980, the foreign trade deficit on goods and services was 2.8 billion dollars. The strong export pressures coupled with stringent import quotas imposed in 1984, turned the deficit into a surplus of 240 million dollars. By 1987, a surplus of 1.4 billion was achieved. The surplus was not only on goods and services, but also on current account. The current account surplus was due not only to the surplus on the balance of goods and services but also to continued strong inflow of remittances and somewhat lower interest payments on foreign debt (both interest rates and the debt outstanding declined in 1984 and 1987).

Domestically, GDP at factor cost continued to grow, but very slowly (.6% annually between 1980 and 1984 and 1.1% between 1984 and 1987). Enterprise incomes declined less than wages between 1980 and 1984 (enterprise incomes declined by 7% while wages declined by 23%) and recovered relatively more than wages between 1984 and 1987 (enterprise income was virtually the same in 1987 as in 1980 while wages were still 5% less than in 1980). Household real incomes

declined substantially between 1980 and 1984 (by 26%) with urban incomes declining the most and rural household incomes the least. Between 1984 and 1987 household incomes recovered, but remained 12% below 1980.

The functional distribution of income changed between periods: the share of rural household incomes rose by 20% between 1984 and 1987 and then fell by 23%, ending up 7% below its 1980 share. The share of urban households first fell slightly (by 2%) and then rose somewhat (by 3%). Consumption expenditures were more stable than incomes, with savings taking up more of the adjustment burden. Domestic supply declined more than household incomes in 1984, so that in 1984 the availability of goods and services was tight. The reverse happened in 1987: domestic supply increased 75% more than domestic incomes, leading to a relaxation of shortages. The composition of domestic supply changed substantially, especially in 1984: a higher share of agriculture and industry, and substantially less services, especially non-productive services.

The variances under shock had a systematic pattern. Under the export-oriented IMF-adjustment of 1984, the vulnerability of the economy to shocks generally increased relative to 1980, especially in the income and activity flows. There were some exceptions, which indicate the bias of policy: wages, consumption flows, and the domestic supplies of industry, construction, and both productive and nonproductive services had lower standard deviations in 1984 than in 1980. Supply was stabilized through greater dependence on domestic production and lower variance of domestic production. Wages had a lower variance under shocks in 1984 because, even though substitution between labor and capital was possible in the model and there were fluctuations in employment, the minimum employment constraints were binding more often. Consumption was more stable in 1984, despite more fluctuating incomes, because the volatility of household incomes was passed on to household savings. But only wages and rural household consumption had lower coefficients of variation in 1984 than in 1987. On the

trade side, the picture was more complex: total exports, total imports and the total trade balance on goods and services were more stable in 1984 than in 1980, but, on the export side, the greater stability of the totals was achieved through greater variability in the components.

In 1984, the economy was more constrained and more rigid than in 1980, because there was no significant change in the institutional structure of the economy accompanying the trade reorientation. Furthermore, the export orientation was accomplished by measures that, effectively, forced the economy to export and cut imports. The increase in exports was not simply a response to price incentives, such as devaluation, but also a result of the foreign exchange retention scheme adopted in 1983. Before the foreign debt crisis of 1982-83 companies were allowed to keep large portion of their foreign exchange earnings and the supply of foreign exchange on the black market was ample. As the Federal Government increased the surrender-rate on foreign exchange earnings to provide sufficient foreign exchange for debt servicing and energy imports, and as regional governments claimed a larger share of foreign exchange earnings for imports of intermediates for non-tradeable activities, the supply of foreign exchange on the black market fell considerably. Many companies had to export to achieve a reliable inflow of foreign exchange for essential imports (spare parts and intermediates) needed to maintain production.

In 1987, the variances of the income and activity flows were all smaller than in 1980. On the trade side, the picture was more mixed. Main convertible exports (industry, construction, and services) which represent 74.4% of total exports, were all more variable in 1987 than both in 1984 and 1980. The variability of total exports decreased continuously between 1980 and 1987, and total convertible exports, and both total and convertible imports were less variable in 1987 than in 1984. The variances in total individual exports were above 1980 and generally above 1984 as well.

By 1987, firms had partially adapted to export-orientation. The mix of output was more export-oriented; production was less dependent on imported intermediates; and firms had become more efficient in their intermediate-input use. There had been some expenditure-switching between imports and domestic production on the final demand side as well. The increase in exports was more incentive-driven, due to a series of very substantial abrupt currency devaluations combined with continuous exchange rate adjustments following differential inflation rules. While import quotas continued to decline, substitution of domestic intermediate and domestic final demand in domestic supply made the quotas less onerous. Some institutional changes were introduced: price controls were largely abolished; official foreign exchange markets were established; accounting rules were changed to reflect market valuation of assets and replacement cost depreciation; nominal interest rates were continuously adjusted to yield positive real interest rates; credit expansion was strictly controlled; and more stringent financial discipline was imposed on companies and banks. The end result was a more flexible economy, more driven by market calculus, and better able to respond to signals from the world market.

The Mean-Variance Frontier

Rational individuals and rational policy makers would prefer outcomes on the mean-variance frontier. That is, they would only choose among outcomes that are low-mean low-variance, moderate-mean and moderate-variance, and high-mean high-variance. They would eschew outcomes which are low-mean, high-variance. Looking at table 2, with very few exceptions noted in our discussion of variances above, the income and activity flows for year 1984 are low-mean high-variance and are therefore dominated by either 1987 or 1980. For total exports, 1987 dominates 1980 and 1984 and is a moderate-mean, moderate-variance year. With respect to total convertible exports, year 1984 is dominated by either 1980 or

1987. For industrial exports, service exports, convertible industrial exports, and convertible service exports, all three years are on the on the mean-variance frontier. Similarly, for total imports, all three years are on the mean variance frontier. However, for the overall trade balance on goods and services, both 1980 and 1984 are dominated by 1987.

The mean variance frontier thus makes it evident that except for exports and rural household consumption, 1984, a year of transition to export-orientation without significant domestic structural adjustment, is dominated by either the import-substitution year of 1980 or by the year of substantial adjustment to export-orientation of 1987. Which trade situation is preferred by policy-makers on mean variance grounds depends on whether independent value is attached to exports and rural consumption, over and above total household consumption and the overall trade balance. Generally, one would tend to conclude from the mean-variance analysis that the partial-transition-situation of 1984 is dominated in mean-variance terms by either 1980, the high-mean high-variance year for most variables, or by 1987, the low-mean low-variance year for all but exports and the trade balance.

Feasibility apart, mean variance considerations suggest that the basic policy choices are between import-substitution and substantial adjustment of the economy to export-orientation. Partial adjustment to export orientation leads to inferior outcomes. Which strategy choice is preferred depends on the risk aversion of policy makers, and on the weight they attach to international adjustment versus domestic adjustment. The low-risk-aversion choice for domestic outcomes is import substitution; the high-risk-aversion choice for domestic outcomes appears to be export-expansion with substantial domestic structural and institutional adjustment to export-orientation. If primary weight is attached to external adjustment and the trade balance on goods and services is taken as the major indicator of the extent of external adjustment, export-orientation

with substantial adaptation (reflected in our results by 1987) is the only solution on the mean-variance frontier.

Frequency of Adverse Outcomes

Not all variability is unwelcome. In particular, risk averse individuals and policy makers want to avoid outcomes below the mean and enjoy outcomes above the mean. This asymmetric view of variability is not reflected in the variance. We reflect this asymmetry in Table 4, which lists the relative frequency of adverse outcomes in our 100 replicates. We chose three different comparison standards: 3 and 10 percent below the own mean, and 10 percent below the 1980 mean.

Table 4 indicates that the sample probability of GDP at factor cost being 3% below its own mean is 7% in 1980, as much as a 15% in 1984, and only 4% in 1987. However, the sample-probability of GDP at factor cost falling as much as 10% below the 1980 base was negligible in all years. Enterprise incomes had a high probability of adverse outcomes in all years. For example, in 1984, there was a 31% probability of enterprise incomes being 10% below 1980. By contrast, wages had a negligible probability of adverse outcomes except in 1984, when there was a sample-probability of unity of wages falling more than 10% below 1980. All household incomes had high probabilities of being 10% below 1980. Total exports had a 25% probability and convertible exports had a 10% probability of having values less than 10% below 1980 in 1984. Convertible exports had a higher relative frequency of adverse outcomes than total exports, both overall and in individual sectors. Imports were declining, so that the probability of being 10% below the 1980 mean was quite high in both 1984 and 1980. Perhaps most significantly, the trade balance on goods and services had a probability of about 50% of being as much as 10% below its own mean, but only a 1% probability of falling 10% below 1980. Both the terms of trade effects and the import control

Table 4:

Frequency of Adverse Outcomes in 100 Runs

	1980			1984			1987		
	Own Base - 3%	Own Base - 10%	'80 Base - 10%	Own Base - 3%	Own Base - 10%	'80 Base - 10%	Own Base - 3%	Own Base - 10%	'80 Base - 10%
GDP at Factor Cost	7	0	0	15	0	1	4	0	0
Institution/Factor Income:									
Enterprise	35	7	7	31	14	31	29	7	9
Wages	0	0	0	0	0	100	0	0	0
Disposable Income:									
Rural Households	36	2	2	37	13	66	32	0	94
Mixed Households	0	0	0	1	0	100	0	0	100
Urban Households	0	0	0	0	0	100	0	0	58
Exports Goods & Services:									
Total	16	1	1	12	1	25	3	0	0
Of which Convertible	20	7	7	22	7	10	19	4	1
Industry	12	0	0	12	0	0	9	3	2
Of which Convertible	26	8	8	26	10	8	29	9	5
Services	29	4	4	33	4	96	27	4	0
Of which Convertible	6	0	0	6	0	88	5	0	0
Imports Goods & Services:									
Total	35	9	9	35	10	98	28	11	96
Of which Convertible	0	0	0	0	0	100	0	0	100
Trade Balance Goods&Services	52	47	47	53	52	1	58	49	1
Terms of Trade Effect [a]	55	55	55	59	59	64	62	62	65
Import Controls Rents [a]	58	57	57	53	53	64	58	58	62

a) For definition see footnotes to table 3.

Source: Computed from one hundred replicates of random shocks to the Yugoslav CGE models for each of the

rents were, by definition, centered around a zero mean in all years. Since renst absorb the effects of import quantity quotas, they were quite variable; the probability of all types of adverse outcomes was therefore large.

The Welfare Evaluation

In Table 5, we summarize our calculations for expected utility and equivalent variations. Of course, the utility numbers in the table are only ordinal; any monotone transformation of these numbers would be equally valid. The table indicates that external adjustment was achieved at the cost of a steady decline in household utilities between 1987 and 1980 for all household groups. For example, the expected utility of rural households declined by 31% between 1987 and 1980; and that of urban households declined by 27% over that period. The cost of adjustment was thus quite substantial. But, except for the rural households, welfare was diminishing at a declining rate.

The equivalent variations with respect to their own bases (next to last row of table 5) represent the percent increase in base income that would be required to compensate individuals for the variability in their utilities induced by the distribution of external shocks. The equivalent variations rise between 1980 and 1984 and then decline in 1987, winding up lower than in 1980. They are largest for rural groups and smallest for urban groups. The largest equivalent variation indicates that a compensation of 2.69% of base income would be required to keep rural households at the same utility level as they had in the 1984 base. The smallest equivalent variation indicates that a compensation of .19% would be needed to restore urban households to the same utility levels as in the 1987 base. One way to look at these equivalent variations is to compare them with the rate of growth of GDP. On the average, about eight months of growth of income at the average rate of growth of GDP between 1980 and 1987 would be required to compensate the average Yugoslav household for the shock-induced

Table 5:

Household Utilities and Equivalent Variations

Household Type	RURAL			MIXED			URBAN		
	1980	1984	1987	1980	1984	1987	1980	1984	1987
Base Utility	22.8	20.1	15.7	49.7	39.2	35.0	76.1	59.4	55.6
Expected Utility:									
Mean	22.4	19.8	15.5	49.5	39.0	35.0	75.9	59.2	55.5
Variance	1.3	1.5	0.4	0.2	0.3	0.1	0.3	0.4	0.1
Minimum	20.5	17.6	14.4	48.7	38.1	34.5	74.9	58.2	55.0
Maximum	26.6	24.2	17.7	51.3	41.0	35.9	78.1	61.5	56.6
Equivalent Variations:*									
W.R.T. Own Base	2.18%	2.69%	1.46%	0.41%	0.57%	0.26%	0.32%	0.45%	0.19%
W.R.T. 1980 Base	2.18%	18.54%	42.39%	0.41%	29.22%	39.39%	0.32%	30.11%	36.31%

* Numbers are percent of base income required as compensation to keep households at the same utility level as in the respective base.

Source: Computed from one hundred replicates of random shocks to the Yugoslav CGE models for each of the analyzed years.

variance in their household income.

The equivalent variations relative to the 1980 base (last line of table 5) indicate the magnitudes of compensation required to restore household utilities to the 1980 base as well as to compensate households for the variability in their incomes. These compensations are very large. For example, a transfer of 42.4% of 1980 income would be required to restore rural households in 1987 to their 1980 base utility; for urban households, the analogous number is 36.3%. The lion share of the calculated compensation is for the reduction in expected utility. Since the marginal utility of income is declining, and our LES utility function applies only to above subsistence income, the equivalent variation is larger than the ratio of incomes as well as larger than the ratio of expected utilities. For example, for rural households, our calculations indicate that for 1987 the required compensation is 35% larger than the decline in the ratio of utilities between 1987 and 1980. The order of magnitude of the equivalent variation is not sensitive to the values of $1 - \beta$; but it is sensitive to the ratio of subsistence income in total income. The higher that ratio, the higher the ratio of the equivalent variation to the ratio of utilities.

These calculations indicate that the cost of adjustment to Yugoslav households has been enormous. For example, assuming an average rate of growth of income equivalent to the average rate of growth of real GMP between 1975 and 1987, it would take about 12 years of income growth to compensate rural households for their loss in utility during the period of external adjustment. Our equivalent variation calculations also indicate that, in relative terms, rural households have borne a larger share of the burden of adjustment. In absolute terms, however, the transfer required to restore urban households to their 1980 utility levels would be close to five times as large as the transfer required to compensate rural households. The total economywide equivalent

variation required in 1987 to restore all households to their utility levels of 1980 would amount to 23.6% of the 1987 GDP at factor cost. The cumulative compensation required to maintain the utility of all households at the 1980 level throughout the entire 1980-1987 period is an astronomical 111% of the 1987 GDP at factor cost.

4. Conclusions

Our calculations fully support the contention of Bela Balassa concerning the robustness to external shocks of economies following alternative trade strategies, once the structure of the economy, its institutions, and its efficiency have adjusted to the shift from import-substitution to export-orientation. They also underscore the crucial importance of the structural adaptation of the economy to export-oriented growth for minimizing the costs of adjustment and reducing the vulnerability of the economy to shocks. Year 1984, which reflects very partial adjustment of the Yugoslav economy to export orientation, is dominated in the mean-variance sense by either 1980 or 1987. It reflects the worst of all possible worlds, achieving both less of a current-account surplus than 1987, and imposing much larger welfare losses than either 1980 or 1987. Once the economy has adapted its economic and institutional structure, and its behavior patterns are more fully suited to export-orientation, adjustment to external imbalance is both higher and the costs of adjustment to debt-servicing and debt-repayment are smaller.

In a mean-variance sense, the choices appear to be between the high-mean high-variance import-substitution year of 1980 or the low-mean low-variance export-orientation year of 1987. As Balassa has emphasized in his writings, high risk aversion on the part of a country or its leaders would lead the country to

prefer the low-variance export-orientation to the high-variance import substitutionist policies, once the country has successfully adjusted to the shift in trade orientation. In utility terms, all households would have preferred 1980 to 1987 by a large margin, were the debt-led import substitutionist policies of the previous decade sustainable. But since continuation of these policies has become infeasible, export-orientation with structural and institutional adjustment appears to provide a better, though not easy, answer.

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