NBER WORKING PAPER SERIES

MACROECONOMIC ADJUSTMENT AND FOREIGN TRADE OF CENTRALLY PLANNED ECONOMIES

John Burkett

Richard Portes

David Winter

Working Paper No. 736

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

August 1981

NBER Working Paper #736
August 1981

Macroeconomic Adjustment and Foreign Trade of Centrally Planned Economies

ABSTRACT

This empirical study stresses the underlying macroeconomic forces which determine foreign trade flows in CPEs. The general specification includes a planners' demand equation for the volume of imports, a planners' supply equation for the volume of exports, and a rest-of-world demand equation for the export price level. The planners' behavioural equations include variables for activity levels, trade balance constraints, prices, and domestic excess demand. The import price is exogenous. This simultaneous equation model is estimated on annual data from the mid-1950s to the mid-1970s, for Czechoslovakia, the GDR, Hungary, and Poland. Maximum likelihood estimation in a nested hypothesis testing framework allows selection of restricted versions of the general model for each country. Estimated price elasticities accord with the underlying theory, and the excess demand variables perform well.

Professor John Burkett
Department of Economics
University of Rhode Island
Kingston, R.I.

Professor Richard Portes
Department of Economics
Birkbeck College
7-15 Gresse Street
London W1P 1PA
England

and

Ecole des Hautes Etudes
en Sciences Sociales
Paris

Mr. David Winter
Department of Economics
University of Bristol
40 Berkeley Square
Bristol
England

Macroeconomic Adjustment and Foreign Trade of Centrally Planned Economies*

John Burkett
Birkbeck College, University of London

Richard Portes
Birkbeck College, University of London
Ecole des Hautes Etudes en Sciences Sociales, Paris
Research Associate, National Bureau of Economic Research, Inc.

David Winter
University of Bristol

August 1981

1. Introduction

In this paper we study empirically how the foreign trade flows of centrally planned economies (CPEs), considered as macroeconomic variables, are related to other macroeconomic variables. We do not disaggregate imports or exports either geographically or by commodity. Rather, we are concerned to bring out as clearly as possible how foreign trade aggregates

---

* We are grateful to the SSRC (UK) for research support. Portes also thanks the Maison des Sciences de l'Homme. Bill Branson, John Muellbauer, Stan Rudcenko and Ron Smith have been especially helpful at various stages but should not be held responsible for the use made here of their generous assistance and comments. An earlier version of this paper was presented at the Econometric Society World Congress, Aix-en-Provence, August 1980, and issued as Birkbeck Discussion Paper in Economics No. 84 (October 1980). The current version was discussed at the 1981 N.B.E.R. Summer Institute.

respond to macro-level forces. In particular, we model how the planners adjust import and export volumes in pursuit of aggregate-level objectives subject to aggregate-level constraints and pressures.

This emphasis on seeking macroeconomic regularities in CPE foreign trade runs counter to some themes in the literature. First, there is Kornai's (1981) recent far-reaching critique of the application of any form of strictly macroeconomic analysis to CPEs. He maintains that in these economies relative prices are so distorted, micro-level excess demands so widespread, and "forced substitution" consequently so extensive that the aggregation problem is qualitatively worse than for market economies, indeed insurmountable. We argue here and elsewhere, however, that macro-economic analysis and macroeconometrics are in fact useful in understanding how CPEs work (see Portes, 1980, 1981; Portes and Winter, 1980).

On the foreign trade side, the literature has quite naturally stressed the specificity of CPE institutional structures, the differences from market economy mechanisms, and a certain degree of arbitrariness (even capriciousness) in "planned" foreign trade (see Pryor, 1963; Nove, 1965; Levine, 1968). As Weiss and Wolter (1979) suggest, as long as we see CPE imports and exports simply as "closing" the material balances, filling gaps and disposing of surpluses, we tend to regard their trade as unstable and unpredictable. But this is a typically micro-

economic perspective, and as they point out, both their own work and other recent empirical studies do not validate it, even at the micro level (see also Rosefielde, 1973; van Brabant, 1973; Brada, 1976; Vanous, 1978a, 1978b).

The planners are concerned with maintaining both internal and external balance, and the two are necessarily related for any economy. Thus there will be some effect of domestic demand (and excess demand) on foreign trade. With fixed domestic prices, the planners are the fundamental equilibrating mechanism in the economy (Portes 1979a, 1979b, 1979c). Disaggregation would lose some aspects of this search for macroeconomic equilibrium, however justified it might otherwise be to take account of specific characteristics of intra-CMEA as opposed to East-West trade, or of trade in machinery as opposed to trade in agricultural goods, etc.

We treat four countries on a comparable basis: Czechoslovakia, the GDR, Hungary, and Poland. The data are annual observations from the mid-1950s to the mid-1970s (so the coverage is the same as in Portes and Winter, 1980). It is part of our maintained hypothesis that the general macroeconomic framework for foreign trade is similar across these four countries, with some differences for which we can test within the same

general structure.[1] We assume also that the central planners exhibit stable behaviour which is rational in the sense of maximisation subject to constraints.

We have several objectives. First, we wish to identify the directions and magnitudes of the responses of trade flows to domestic and foreign sector macro variables in these four CPEs. Second, we shall test alternative hypotheses about planners' foreign trade behaviour. Both these investigations will yield comparisons across countries. We shall also consider whether the overall structure has been stable over time in individual countries, and in particular, whether behaviour changed noticeably at the beginning of the 1970s, as is often claimed.

II The Macroeconomic Framework of CPE Foreign Trade

We begin with the relevant institutional features of CPEs and their consequences for foreign trade (for details, see Holzman, 1968; Wiles, 1968; Neuberger and Tyson, 1980; Wolf, 1980).[2] The "price equalisation account" completely separates domestic prices from foreign prices. The foreign trade enterprises buy imports and sell exports at foreign currency prices, which for their internal accounts are converted to units of domestic currency at an accounting exchange rate bearing no relation to the domestic price level. They sell the imports to and buy exports from domestic users and producers, respectively, at the domestic prices, which are typically fixed (by the planners)

for long periods. The accounting profit or loss on the aggregate of these transactions is directly appropriated by the state budget.

Hence there is no functioning exchange rate, no link between domestic and foreign prices, and no link between trade and foreign exchange reserve flows on one hand and monetary assets held by households and firms on the other. The currency is inconvertible, there are no "autonomous" international capital flows (and those accommodating trade are directly controlled by the planners), and no real balance effects arise from the foreign sector. Furthermore, most of the endogenous feedback mechanisms characteristic of macroeconomic relations in market economies are broken (Portes, 1980). And the planners can and normally do ensure full employment directly.

Thus the CPEs do not exhibit the "demand multiplier" effects of Keynesian macroeconomics; in particular, exports have no demand multiplier effects. They do however finance the imports essential to production, so we may have a "bottleneck multiplier", insofar as a fall in exports might force cuts in imports, hence in production, hence in export supply .... With the rigidities of the physical planning system, we should also expect relatively low price-elasticities of import demand and export supply. The domestic economy is substantially "insulated" from events in the foreign sector, since many of the transmission and propagation channels operating in market economies are not effective in CPEs (see Neuberger, Portes, and Tyson, 1981).

On the other hand, all the standard national income identities apply also to the CPEs. In particular, the balance of trade (net exports) must equal output minus absorption (domestic utilisation). If planned absorption cannot be met by planned output plus net imports, there will be excess demand domestically; if planned output exceeds planned absorption by more than the economy can transfer abroad in net exports at acceptable terms of trade, there will be excess supply domestically. Either case can of course occur with markets for both exports and imports in equilibrium.

Just as in a market economy, the planners must also consider both internal and external balance as policy objectives, as well as the potential conflict between them. Our underlying model of the process of plan construction in an open CPE and the relations between internal and external balance is set out in Portes (1979c). The planners in plan construction (ex ante) maximise a utility function defined on household consumption and government expenditure, subject to constraints representing aggregate balance between availability and utilization of output, equilibrium on the consumption goods and labour markets, and a balance of trade target depending on past balance of trade outcomes. In plan implementation, planners' errors and exogenous shocks will in general create disequilibria which will not be eliminated by price changes.

In the present paper we relax two assumptions of the original model: that export prices are exogenous, and that imports are in fixed proportion to output. Here, we allow the demand curve for exports to be downward sloping, and the ratio of imports to output is determined endogenously. The model thus modified suggests that current quantities of imports and exports will depend on output, foreign trade prices, the balance of trade target, and the requirements of internal balance. We do assume that the typical CPE is a "small" country as an importer, though not as an exporter. Thus imports are taken to be in infinitely elastic supply at a price given by world market conditions.

The model has some interesting implications for the price elasticities of import demand and export supply. Whereas Holzman (1968) suggests the price elasticity of import demand for CPEs is near zero and the price elasticity of export supply is near -1, we expect the former to be less than zero and the latter to be greater than -1. First, an improvement in the terms of trade will permit an increase in real wages and (assuming a positively sloped labour supply schedule) output. Thus a fall in import prices is likely to lead to an increase in imports even if imports are in fixed proportion to output. Similarly, a rise in export prices is unlikely to lead to a proportionate fall in export volume, given the trade balance target. Second, an improvement in the terms of trade may bring an

increase in trade turnover relative to national income. Thus a fall in import prices may lead to increased import (and export) volume and a rise in export prices may cause an increase in the quantity of exports (and imports).

Note finally a problem to which we return below: in principle, depending on the lags actually operating in the processes of plan construction and implementation, output might depend on imports, as well as the converse. This relation might arise not only from import "bottleneck effects" (the role of imported intermediate goods in production), but also from the effects of consumer goods imports on overall consumer goods supply, hence on labour supply. But inventories might be sufficient to make these effects operate with significant lags.

III Specification of the Model

Our model has three equations and three endogenous variables, exports (volume), imports (volume) and export price. The behaviour of the planners determines the two quantities through the demand for imports and the supply of exports relationships. The various importing agencies in the rest of the world determine export demand. We normalize this relationship on export prices partly for convenience and partly on the grounds of realism. Clearly any normalization is to some extent arbitrary, and the FIML estimates we give below are independent of normalization.

Given the state monopoly of foreign trade, one may question the existence of an autonomous export supply schedule. Under a wide range of assumptions about planners' objectives, the optimal volume of exports depends on the price elasticity of demand. If this elasticity were variable there would be no unique supply price, and attempts to estimate a supply schedule would be meaningless. Fortunately the data are consistent with the hypothesis that the price elasticity of demand is constant. (Our tests of this hypothesis are described below.)

In the most general version, we specify import demand and export supply completely symmetrically. The planners are considered to fix the volumes of exports and imports in relation to four different determinants: the general level of activity in the economy, prices, balance of payments constraint, and excess demand pressures within the economy. The general level of activity is measured by net material product (NMP), prices by the appropriate unit value indices (PX for exports, PM for exports). The balance of payments constraint is measured by last period's trade balance defined in ratio form (TB).

Two quite different variables were used to measure excess demand inside the CPE. Excess demand can occur either in the consumption goods market or in the investment goods market. The occurrence of excess demand in the two markets may be associated (see Kornai, 1981), but not necessarily. In any case, we expect the reaction of the planners to excess demand

in these markets to be different. The costs to the planners of excess demand for consumer goods and its possible repercussions on labour supply behaviour and political stability are quite different from those involved in the delay of an investment project. In the event, our measure of excess demand for investment goods, the growth of gross investment and defence expenditures, never had a significant role and was dropped from the specification at an early stage of estimation.

Our measure of excess demand on the consumer good market was taken from the disequilibrium estimates given in Portes and Winter (1980), updated where possible. The variable was constructed from the demand and supply relationships estimated in a model that did not assume market clearing. Our excess demand variable here is the ratio of fitted demand to fitted supply at constant prices.

The general forms of the import demand and export supply equations are as follows:

$$M_t = a_o + a_1 NMP_t + a_2 PX_2 + a_3 PM_t + a_4 TB_{t-1} + a_5 ED_{t-1} + u_{1t} \quad (1)$$

$$X_t = b_o + b_1 NMP_t + b_2 PX_t + b_3 PM_t + b_4 TB_{t-1} + b_5 ED_{t-1} + u_{2t} \quad (2)$$

All variables are measured in natural logs, and

M_t = the volume of imports

X_t = the volume of exports

NMP_t = net material product

PX_t = the price of exports

PM_t = the price of imports

TB_{t-1} = the ratio of the value of exports to the value of imports in the previous period

ED_{t-1} = the ratio of estimated demand for consumption goods to estimated supply, lagged one period

u_{1t}, u_{2t} = random error

Note that the way in which the indices have been constructed and the logarithmic specification imply the identity:

$$TB_t = X_t + PX_t - M_t - PM_t \qquad (3)$$

The above specification has been termed general, to distinguish it from the more restricted models presented below. We are aware, however, that the dynamic specification is not particularly general. But with our relatively small data samples, it is not possible to estimate general lag structures which could then be restricted along lines suggested by the data. Some slightly different lag specifications were estimated and are discussed below. It could also be argued along rational expectations lines that TB_{t-1} and ED_{t-1} capture all relevant past information on the economy.

So far, we have limited our discussion to two equations of our three equation system. The third, the export demand equation,

determines the price of exports. It is specified as follows:

$$PX_t = c_o + c_1 X_t + c_2 WT_t + c_3 PW_t + u_{3t} \qquad (4)$$

where (as before) all variables are given in natural logs.

WT_t = a weighted average of CMEA and market economy import values.[3]

PW_t = a weighted average of CMEA and market economy export prices.[3]

u_{3t} = a random error term

The two exogenous variables in equation (4) provide identifying restrictions for the first two equations. (At least one of the two exogenous variables in equation (4) is required for identification.)

In practice, we could not reject the hypothesis that the export demand equations for Czechoslovakia, Hungary, and Poland were homogeneous in prices. Therefore we estimated these equations in the form

$$PR_t = c_o + c_1 X_t + c_2 WTD_t + u_{3t} \qquad (5)$$

where $PR_t = PX_t - PW_t$

and $WTD_t = WT_t - PW_t$.

Furthermore, in the case of Czechoslovakia we could not reject the restriction that $c_1 = -c_2$. Hence we estimated the export demand equation for Czechoslovakia in the form

$$PR_t = c_o + c_1 XR_t + u_{3t} \qquad (6)$$

where $XR_t = X_t - WTD_t$.

Each of the above demand functions is log-linear, with the assumption of a constant price elasticity of demand. This assumption is required for the existence of an autonomous export supply schedule. Because of the importance of the constant elasticity specification we tested it against more general functional forms, but found that the additional coefficients were never significantly different from zero.

The equations (1), (2) and (4) form our three-equation system in the most general specification for which we attempted to estimate it. A number of variants which allowed for a different dynamic structure were also estimated, and these are discussed below. For our general specification we expect the coefficients to take the following signs:

$a_1, a_2, a_4, a_5 > 0; a_3 < 0$ (import demand)

$b_1 > 0; b_4, b_5 < 0; b_2, b_3 \gtrless 0$ (export supply)

$c_2, c_3 > 0; c_1 < 0$ (export demand)

The one exception to conventional signs on income and price elasticities might arise for b_2 and b_3, if the volume of exports is determined so as to satisfy a balance of payments target, given other variables (see Section II). The lagged balance of trade term has a positive relation with current imports and a negative one with current exports. The excess demand variable

has a positive coefficient for import demand and a negative one for export supply, reflecting the planners' attempts to achieve macroeconomic equilibrium. In the export demand equation, world trade and world trade prices affect export prices positively.

At an early stage in the estimation, more general lag specifications were investigated. These included redefining the main trending variables in first difference form, including a lagged dependent variable, a lagged exports term in the export demand equation, and time trends in each equation. In no case was the more general specification unambiguously superior. It should be noted that the expected signs of the lagged trade balance terms imply negative implicit coefficients of the lagged dependent variable in equations (1) and (2).

Another alternative specification is that instead of last year's trade balance, a cumulative measure of trade performance would provide a better measure of the effect of past performance on the current perceived trade balance constraint. These countries do not publish data on their foreign exchange reserves, so a three-year sum of trade balance terms was tried. The preliminary estimates using this term were not, however, superior to those obtained with the one-year trade balance. The latter is clearly less than satisfactory, and we should at least try to allow for the recent rapid accumulation of convertible currency debt by

these countries, but reliable time series for this debt begin only from 1971. Starting from these data, it may be possible to develop an alternative measure for use in future work.

In view of our preliminary results, we preferred our general specification in the form we have given. The hypothesis that there is no first order serial correlation can be rejected in all cases. But our preliminary search over more complicated dynamic specifications indicated that this apparent serial correlation could not be substantially reduced except at an excessive cost in lost degrees of freedom.

At this stage, we also considered whether current NMP should be treated as an endogenous variable. The volume of imports, at least, could affect NMP. It is not our purpose here to estimate a complete macroeconomic model of a CPE, in which NMP is determined endogenously. Nevertheless, we investigated the cost of assuming that NMP is exogenous, by replacing the current value of NMP with an ad hoc instrument. The resulting estimates all indicated a small negative bias arising from ignoring the endogeneity of NMP. Since the coefficients changed by less than one estimated standard error, we decided that it was simpler to treat the current value of NMP as exogenous.

IV Results

The initial investigations of the robustness of our general specification which we have been discussing were based on two-stage least squares estimates (TSLS). However, once we had adopted the general model we went over to full information maximum likelihood estimation and based tests of restrictions on the general model on the likelihood ratio criterion.

Our initial TSLS and FIML estimates indicated the presence of serial correlation. In order to obtain unbiased estimates of the standard errors we adopted a technique (ARFIML) which assumes a first-order vector autoregressive error process. Under this assumption the current error of one equation may depend not only on its own lagged value but also on the lagged values of the errors of the other two equations. Such a vector autoregressive process is plausible whenever there may be both contemporaneous correlation of errors across equations and serial correlation of errors within equations. The technique and the package which implements it are described in Hendry and Srba (1980). Under the maintained hypothesis of first-order vector autoregressive errors, we conducted χ^2 tests of restrictions on the matrix of autoregressive parameters. The hypothesis that the

matrix is diagonal could be rejected for every country but Hungary. The preferred model for Hungary was reestimated under the restrictions of a diagonal matrix, using TSP's FIML routine. The eigenvalues of the matrices of autoregressive parameters were all within the unit circle, indicating stability of the error processes.

Perhaps more interesting than the serial correlations are the contemporaneous cross-equation correlations of residuals. If these correlations were large in absolute value they might indicate that the same omitted variables were exercising major influences on two or more of the endogenous variables. On the one hand one might suspect that unobserved variables such as production bottlenecks, labor unrest, bad weather, etc. would influence imports positively and exports negatively. On the other hand, any omitted variable which increases imports and has no direct influence on exports might be expected to have an indirect positive effect on exports via the balance of trade constraint. Similarly any influence which increases exports will relax the balance of trade constraint and permit greater imports.

In practice, we found that the contemporaneous correlations of the residuals of the export supply and import demand equations were generally small, suggesting that the above-mentioned factors were unimportant or mutually offsetting. Only in the case of Poland was the contemporaneous

correlation of residuals from the export and import equations above .5 for both the general and restricted model. A possible explanation is that Poland may have been operating, at least for some part of the period, with exceptionally small foreign exchange reserves and unused borrowing capacity. If Poland was operating unusually close to a trade balance constraint, any reduction in exports would have to be closely matched by a contemporaneous reduction in imports, while any increase in imports would need to be financed by an increase in exports.

Table 1

Contemporaneous cross-equation correlations of residuals

	Cor (r_m, r_x)		Cor (r_m, r_p)		Cor (r_x, r_p)	
	general model	restricted model	general model	restricted model	general model	restricted model
Czechoslovakia	.01	-.24	-.90	-.79	-.01	.24
G.D.R.	-.34	-.28	-.35	-.29	.18	.05
Hungary	.51	-.03	-.09	-.43	-.06	.52
Poland	.58	.61	-.43	-.40	-.07	-.03

r_m = residual from import equation

r_x = residual from export supply equation

r_p = residual from export demand equation

Starting from the general model we tested a number of restrictions, seeking the most parsimoniously parameterised model which could not be rejected. In particular, we tested the hypothesis that the import demand and export supply schedules are homogeneous in prices ($a_2 = -a_3$, $b_2 = -b_3$) and that certain coefficients are zero. In the tables which follow we present in the first column the general model and in the second column the most restricted acceptable model. Restricted coefficients are starred. None of the restricted models presented here can be rejected at the .10 level.

In the general model for Czechoslovakia, the estimated import and export demand equations conform to expectations. In contrast, the estimated export supply schedule looks surprising. The only estimated coefficients in this equation which are significantly different from zero are those of TB_{-1} and ED_{-1}, and the latter has an unexpected positive sign.

In the parsimonious model for Czechoslovakia, homogeneity is imposed on the import demand equation and four insignificant variables are excluded. The ability of only two variables (TB_{-1} and ED_{-1}) to explain well over 99% of the variance of X is due to the upward trend in X and ED_{-1} and the downward trend in TB_{-1}. The positive estimated coefficients of both ED_{-1} terms may be ascribed to the commodity composition of Czech trade.

Table 2

ARFIML Estimates for Czechoslovakia (1955-1977)

		General model	Restricted model
Import Demand	C	2.21	4.01
		(0.79)	(0.28)
	NMP	0.44	0.47
		(0.13)	(0.05)
	PX	1.14	0.69*
		(0.22)	(0.11)
	PM	-0.85	-0.69*
		(0.16)	(0.11)
	TB_{-1}	0.09	0.00*
		(0.24)	
	ED_{-1}	0.36	0.38
		(0.20)	(0.17)
	SEE	.032	.024
Export Supply	C	4.45	6.62
		(1.01)	(0.14)
	NMP	-0.06	0.00*
		(0.18)	
	PX	0.26	0.00*
		(0.24)	
	PM	0.09	0.00*
		(0.16)	
	TB_{-1}	-0.36	-0.31
		(0.11)	(0.09)
	ED_{-1}	1.30	1.19
		(0.28)	(0.21)
	SEE	.028	.032
Export Demand	C	-0.66	-0.57
		(0.24)	(0.26)
	XR	-0.10	-0.09
		(0.04)	(0.04)
	SEE	.022	.023
Value of twice log-likelihood		535.15	529.69

*Restricted coefficient

Table 3

ARFIML Estimates for G.D.R. (1957-1977)

		General model	Restricted model
Import Demand	C	-3.82	-3.85
		(0.25)	(0.23)
	NMP	1.83	1.83
		(0.05)	(0.05)
	PX	3.34	2.90
		(0.36)	(0.29)
	PM	-2.49	-2.13
		(0.27)	(0.20)
	TB_{-1}	0.16	0.27
		(0.14)	(0.11)
	ED_{-1}	1.74	1.34
		(0.57)	(0.41)
	SEE	.028	.029
Export Supply	C	-3.84	-3.77
		(0.18)	(0.14)
	NMP	1.83	1.82
		(0.04)	(0.03)
	PX	-0.02	0.00*
		(0.23)	
	PM	-0.04	0.00*
		(0.15)	
	TB_{-1}	0.53	0.64
		(0.14)	(0.11)
	ED_{-1}	-0.60	-0.56
		(0.42)	(0.37)
	SEE	.013	.012
Export Demand	C	-3.48	-3.51
		(0.20)	(0.17)
	X	-0.03	-0.05
		(0.04)	(0.03)
	WT	0.03	0.04
		(0.02)	(0.02)
	PW	0.72	0.72
		(0.08)	(0.06)
	SEE	.019	.018
Value of twice log-likelihood		506.83	505.99

* Restricted coefficient

Table 4

FIML Estimates for Hungary (1958-1975)

		General model	Restricted model
Import Demand	C	-8.05	-3.43
		(1.67)	(0.44)
	NMP	1.75	1.74
		(0.14)	(0.09)
	PX	1.19	0.77*
		(1.80)	(0.45)
	PM	-1.20	-0.77*
		(1.34)	(0.45)
	TB_{-1}	0.11	0.00*
		(0.16)	
	ED_{-1}	0.65	0.54
		(0.61)	(0.62)
	SEE	.065	.064
Export Supply	C	-9.84	-3.20
		(1.11)	(0.22)
	NMP	1.58	1.70
		(0.09)	(0.04)
	PX	2.59	0.65*
		(1.20)	(0.21)
	PM	-2.04	-0.65*
		(0.89)	(0.21)
	TB_{-1}	0.08	0.00*
		(0.11)	
	ED_{-1}	-0.73	-0.58
		(0.41)	(0.28)
	SEE	.043	.034
Export Demand	C	-3.79	1.70
		(0.89)	(0.39)
	X	-0.31	-0.24
		(0.09)	(0.07)
	WTD	0.35	0.26
		(0.08)	(0.06)
	SEE	.026	.017
Value of twice log-likelihood		368.88	217.32†

* Restricted coefficient

† Not comparable to value in column one. The general model estimated by FIML may be compared to the restricted model estimated by FIML with 2 log L = 363.30.

Table 5

ARFIML Estimates for Poland (1955-1975)

		General model	Restricted model
Import Demand	C	-2.21	-2.23
		(0.43)	(0.43)
	NMP	1.47	1.47
		(0.09)	(0.09)
	PX	1.82	2.17
		(0.64)	(0.65)
	PM	-1.84	-2.24
		(0.67)	(0.71)
	TB_{-1}	0.20	0.19
		(0.18)	(0.19)
	ED_{-1}	0.16	0.00*
		(0.34)	
	SEE	.047	.049
Export Supply	C	-2.95	-2.98
		(0.40)	(0.37)
	NMP	1.63	1.64
		(0.08)	(0.08)
	PX	1.00	1.12
		(0.86)	(0.80)
	PM	-1.67	-1.82
		(0.91)	(0.88)
	TB_{-1}	-0.25	-0.27
		(0.27)	(0.25)
	ED_{-1}	-0.03	0.00*
		(0.46)	
	SEE	.054	.054
Export Demand	C	-7.05	-7.08
		(0.46)	(0.44)
	X	-0.37	-0.38
		(0.06)	(0.06)
	WTD	0.39	0.39
		(0.07)	(0.07)
	SEE	.022	.022
Value of twice log-likelihood		440.10	439.69

*Restricted coefficient

Consumption goods comprise a larger percentage of Czech imports than of Czech exports. As a consequence, Czechoslovakia can increase the supply of consumption goods by undertaking a balanced expansion of trade. Thus excess demand for consumption goods need not be countered by a reduction in exports.

In the case of the G.D.R., the general model contains three estimated coefficients which are smaller than their standard errors, namely, those of the price terms in the export supply equation and that of X in the export demand equation. In the restricted model the price variables are excluded from the export supply equation and the estimated coefficient of X in the export demand equation is significantly less than zero. The only unexpected sign in the restricted model is that of the estimated coefficient of TB_{-1} in the export supply equation. One might suspect that TB_{-1} is picking up the effects of the lagged dependent variable. But when we reestimated the model with TB_{-1} broken up into its components (X_{-1}, PX_{-1}, M_{-1}, PM_{-1}), we found that the estimated coefficient of X_{-1} was not significantly different from zero.

The possibility of a negatively sloped export supply schedule may raise doubts about the stability of the

export markets of the G.D.R. If prices rise when there is excess demand, the market is obviously stable because the supply schedule is more steeply sloped than the demand schedule. Under Marshallian quantity adjustment assumptions, however, the export market is clearly unstable. But these assumptions are not relevant to CPE export supply. Holzman (1968) expected a negatively sloped export supply curve not because he supposed economies of scale to be important, but because he believed export quantity is adjusted to fulfil a trade balance target despite demand price fluctuations. Under Holzman's assumptions, the quantity supplied falls when demand price exceeds supply price.

The time series available for Hungary are shorter than those for the other three countries. This prevented us from obtaining ARFIML estimates of the general model. Ordinary FIML estimates of this model are presented in column one of Table 4. The reported standard errors may be biased downwards by the presence of serial correlation. Nonetheless it is evident that estimated coefficients of TB_{-1} are not significantly different from zero and that the model is nearly homogeneous in prices. By excluding TB_{-1} from the model and imposing homogeneity we obtained a restricted model which could be estimated by ARFIML. On the basis of these estimates we could not

reject the hypothesis that the matrix of autoregressive parameters was diagonal. Consequently we reestimated the restricted model with a diagonal matrix. The estimated coeffients of this last model (as shown in column two) all take the expected signs, and all except that of ED_{-1} in the import equation differ significantly from zero.

In the case of Poland all of the estimated coefficients of the general model have the expected signs and all but those of ED_{-1} and that of TB_{-1} in the export supply equation exceed their standard errors. When ED_{-1} is excluded, as in the restricted model, all of the remaining estimated coefficients exceed their standard errors. The sum of the estimated coefficients of X and WTD in the export demand equation nearly vanished, so we estimated a model in which PR depends only on (X - WTD). This restriction was rejected at the .10 level although not at the .05 level. The restriction made very little difference to the estimated coefficients.

We wish to draw attention to the estimates of price elasticities and the role of excess demand in our model. Because import prices are exogenous, the price elasticity of import demand is simply the coefficient of PM in the import equation. Estimates of these coefficients taken from the restricted models are collected in the first column of Table 6. In each case except that of Hungary both the general and the restricted models suggest a price

elasticity of import demand significantly less than zero. For Hungary, the elasticity is weakly determined in the general model but significantly negative in the restricted model.

Table 6

Estimates of Short-Run Own Price Elasticities

	Import demand*	Export supply**
Czechoslovakia	-0.69	0
G.D.R.	-2.13	0
Hungary	-0.77	0.48
Poland	-2.24	0.68

* The coefficient of PM in the import demand equation

** The product of the coefficient of PX in the export supply equation and the coefficient of PW in the export demand equation. For Czechoslovakia and the G.D.R., the zero restrictions are accepted by the data.

Because export price is endogenous and there is a state monopoly of foreign trade, the price elasticity of export supply cannot simply be read off from the estimated coefficients of PX in the export supply equation. An increase in export demand will have an effect on the quantity supplied which will in turn have an effect on

the demand price of exports. To circumvent this problem we have calculated the elasticity of export supply with respect to world market prices by multiplying together the estimated coefficients of PX in the export supply equation and PW in the export demand equation. These products are reported in the second column of Table 6. The elasticity of export supply with respect to world market prices is zero for Czechoslovakia and the G.D.R. (restrictions which are not rejected by the data) but positive for Hungary and Poland.

The reported price elasticities of imports and exports are short-run elasticities. To work out the long run elasticities one must take account of the presence of the lagged dependent variables in the trade balance term. Where the estimated coefficients of TB_{-1} take the expected signs the long-run elasticities will be smaller in absolute value than their short-run analogs. This relationship between long- and short-run elasticities means that some overshooting occurs in response to price changes.

The estimated elasticities of import demand and export supply with respect to lagged excess demand can be read off directly from Tables 2-5. As expected, the estimated elasticity of imports with respect to excess demand is always positive, although for Hungary and Poland it is not significantly different from zero. The estimated elasticity of exports is negative and significant, as

expected, for the GDR and Hungary. It is negative but insignificant for Poland. Surprisingly, it is positive and significant for Czechoslovakia. As noted above, the positive influence of lagged excess demand on both Czech imports and exports may be explained by the lower share of consumption goods in Czech exports than in Czech imports.

The lagged trade balance term did not perform as well as the excess demand variable in the planners' behavioural equations. We indicated above that it might be a poor proxy for the determinants of the balance of trade constraint which the planners perceive when they are formulating the plan. That a trade balance constraint is actually perceived does receive strong support, however, from the excellent performance of the export price in the import demand equation, where it appears with a significant positive coefficient for all four countries.

The estimated first order serial correlation coefficients do indicate significant autocorrelation in some instances. We could not accept diagonality of the coefficient matrix for three of the four countries; and considering only the diagonal elements, six out of twelve are significant. On the other hand, only three exceed 0.35 (in the Czechoslovakian export supply, East German export price, and Polish import demand equations). We were nonetheless concerned about the stability of the estimates, especially in view of the limited number of observations. We also thought the end of the 1950s and the beginning of the 1970s might mark off qualitatively different periods in foreign trade behaviour for these countries; and we

wanted in any case to identify any years which appeared anomalous.

We therefore carried out two types of tests. One was for structural stability. The Chow test is inappropriate in a simultaneous model of this kind, so we used dummy variables. For each country in separate experiments we introduced into all three equations a dummy variable, first for a shift in 1960, then for a shift in 1971. We could test for each of these years whether the dummy variable should appear in any individual equation and whether the likelihood ratio criterion indicated it should appear for the model as a whole. For the restricted models, only the 1960 shift in the Polish export demand equation appeared significant, and that did not hold for the Polish model as a whole. Otherwise, we could accept the absence of any shift in individual equations and in the entire model for each country for both years. This is particularly interesting in that it does not confirm the view that there were discrete, dramatic changes in the planners' foreign trade behaviour, especially at the beginning of the 1970s. It is also very encouraging support for the overall stability of the estimates.

Second, we examined the performance of dynamic simulations of the estimated restricted models and the outlying observations in these simulations (where a simulation substantially over- or under-predicted the actual value of the dependent variable). The standard errors of the simulation residuals are given in Table 7 and may be compared with the structural standard errors shown in the second columns of Tables 2-5.

Table 7

Standard Errors of Residuals from Dynamic Simulation of Restricted Models

	Czechoslovakia	G.D.R.	Hungary*	Poland
Import demand	.052	.057	.063	.041
Export supply	.057	.023	.044	.048
Export demand	.032	.023	.017	.025

*These are for the general model for Hungary.

The estimated models are clearly robust under simulation and track rather well. For the twelve equations, there were in total only ten observations lying two or more standard errors away from the simulated paths. Of these, four were from 1973 (under-predicting export prices for the G.D.R. and Hungary, import volumes for the G.D.R. and Poland) and two from 1974. The extraordinarily severe credit restrictions in Hungary in 1969 (following the 1968 reforms) pushed imports well below predicted levels, and actual Czechoslovakian exports were much under their simulated level in 1968. This leaves only two outliers without obvious explanations (under-prediction of Polish imports in 1962 and export prices in 1957).

The tests for structural stability and the dynamic simulations may be regarded as additional diagnostics, which we regard as important in view of the limitations of our data in relation to the amount of information we have sought to extract from them. The estimates stand up well, and we can

add that they were all duplicated using alternative algorithms. Finally, we stress the protection against data-mining provided by estimating the same model, with similar results, over time series for four different countries with similar economic characteristics. This is a great benefit from doing explicitly comparative macroeconomics.

V. Conclusions

Starting from the general specification in equations (1), (2) and (4) we have for each country been able to select a plausible parsimonious model. In the case of Czechoslovakia, NMP, the terms of trade, and lagged excess demand determine imports, while the lagged trade balance and lagged excess demand determine export supply. For the G.D.R., NMP, the export price, the import price, the lagged trade balance and lagged excess demand all influence imports, while only NMP, the lagged trade balance, and lagged excess demand affect the supply of exports. In the case of Hungary, NMP, the terms of trade, and lagged excess demand have symmetrical effects on imports and export supply. For Poland, NMP, the price of exports, the price of imports, and the lagged trade balance have symmetrical effects on exports and imports. All four countries are found to face downward sloping demand curves with constant price elasticities.

Perhaps the greatest novelties in our results are the findings that the price elasticity of export supply is non-negative, except possibly in the case of the G.D.R., and that lagged excess demand has a significant influence on foreign trade, except in the case of Poland.

Overall, the evidence is consistent with our initial hypothesis that central planners, seeking simultaneously internal and external balance, adjust aggregate exports and imports in response to identifiable macroeconomic variables.

Footnotes

1. The lower foreign trade dependence of the USSR might suggest different relationships between foreign trade and macroeconomic adjustment than in other CPEs, but we do not deal with the Soviet Union here because of data limitations.

2. We ignore here the departures from this "standard system" made by Hungary in 1968 and Poland in the early 1970s.

3. WT is ℓn (.67 CMEA + .33 OTHER) where CMEA is total imports of COMECON countries, excluding the exporting country, and OTHER is imports of non-COMECON countries, both expressed in current US $; PW is $\ell n(\lambda P_{CMEA} + (1-\lambda)P_{ME})$ where λ is the average of the 1958 and 1975 shares of COMECON countries in the exporting country's exports; P_{CMEA} is a unit value index for intra-COMECON trade and P_{ME} is a unit value index for trade among market economies. Exchange rates and the world and regional import aggregates are taken from UN Yearbook of International Trade Statistics and UN Statistical Yearbook. All other data are from Rudcenko (1978). For all but Hungary, PM and PX are unit value indices constructed from the value data and quantity indices in Rudcenko (1978), while for Hungary, M and X are constructed from value data and unit value indices.

References

Brada, J., ed., 1976, Quantitative and analytical studies in East-West trade (Bloomington, Ind., IDRC).

Brown, A., and E. Neuberger, eds., 1968, International trade and central planning (Berkeley, Univ. of California Press).

Hendry, D., and Srba, F., 1980, Autoreg: a computer program library for dynamic econometric models with autoregressive errors, Journal of Econometrics 12, 85-102.

Holzman, F., 1968, Soviet central planning and its impact on foreign trade adjustment mechanisms, in: Brown and Neuberger (1968), 280-305.

Kornai, J., 1981, Economics of shortage (Amsterdam, North-Holland).

Levine, H., 1968, The effects of foreign trade on Soviet planning practices, in: Brown and Neuberger (1968), 255-279.

Marer, P., and J.M. Montias, 1980, East European integration and East-West trade (Bloomington, Indian University Press).

Neuberger, E., R. Portes, and L. Tyson, 1981, The transmission of external economic disturbances to centrally plannned economies, forthcoming in Joint Economic Committee, East European Economic Assessment, vol. 2 (Washington, D.C.).

Neuberger, E., and L. Tyson, eds., 1980, The transmission of external disturbances to Eastern Europe and the Soviet Union (New York, Pergamon).

Nove, A., 1965, The Soviet economy (London, Allen and Unwin).

Portes, R., 1981, Macroeconomic equilibrium and disequilibrium in centrally planned economies, forthcoming in Economic Inquiry.

Portes, R., 1979a, Review article: SOVMOD, Economic Journal 89, 669-674.

Portes, R., 1979b, Effets de la crise sur les pays de l'Est, Revue Economique, 1067-1114.

Portes, R., 1979c, Internal and external balance in a centrally planned economy, Journal of Comparative Economics 3, 325-345.

Portes, R., 1980, Central planning and monetarism: fellow travellers?, Birkbeck Discussion Paper in Economics No. 80.

Portes, R., and D. Winter, 1980, Disequilibrium estimates for consumption goods markets in centrally planned economies, Review of Economic Studies 47, 137-159.

Pryor, F., 1963, The Communist foreign trade system (Cambridge, Mass., MIT Press).

Rosefielde, S., 1973, Soviet international trade in Heckscher-Ohlin perspective (Boston, Lexington).

Rudcenko, S., 1978, Macroeconomic data on Czechoslovakia, GDR, Hungary, and Poland, 1950-1975, data bank available on request.

Rudcenko, S., 1979, Household money income, expenditure and monetary assets in Czechoslovakia, GDR, Hungary and Poland, 1956-1975, Jahrbuch der Wirtschaft Osteuropas 8, 431-450.

van Brabant, J., 1973, Bilateralism and structural bilateralism in intra-CMEA trade (Rotterdam, Rotterdam Univ. Press).

Vanous, J., 1978a, Econometric model of East-West trade of Project CMEA-FORTRAM, Discussion Paper No. 78-44, University of British Columbia.

Vanous, J., 1978b, Econometric model of intra-CMEA trade of Project CMEA-FORTRAM, Discussion Paper no. 78-46, University of British Columbia.

Weiss, F., and F. Wolter, 1979, Testing hypotheses for the volume and commodity composition of East-West trade, in: H. Giersch, ed., International economic development and resource transfer (Tubingen, J.C.B. Mohr), 229-256.

Wiles, P., 1969, Communist international economics (Oxford, Blackwell).

Wolf, T., 1980, On the adjustment of centrally planned economies to external economic disturbances, in: Marer and Montias (1980).