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OPENING UP INTERNATIONAL TRADE IN EASTERN EUROPE

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1. INTRODUCTION

One of the explicit goals of Soviet and East European economic policy during the Communist period was to limit economic dependence on the west. It can be expected then that today's liberalization and opening up of these economies will result in a huge increase in their international trade with market economies. Accounting for perhaps 15% of world income, the opening up of these economies to commerce would introduce new supplies of goods and export market opportunities at a scale and speed that is quite unprecedented in modern history. It is crucial to ask who they will trade with, and what and how much they will trade.

This paper offers answers to a sub-set of these questions. First we estimate the volume and direction of East European and Soviet trade. Our estimates suggest that trade within the Eastern bloc will remain static or fall, but that even with the present low levels of national income, trade with western markets could increase by four or five times. This extra trade will be spread around the world, with the largest percentage increases relative to current trade occurring with Japan and USA, the countries which currently trade least with the East. West European trade with the East will also increase very significantly. In absolute terms German trade is likely to increase by about the same amount as the USA's, and the combined EC trade by almost three times as much. However, Western Europe must expect to see its share of Eastern European markets declining relative to other industrial

countries', since it is starting from a comparatively high level. Relative to current totals liberalization in Eastern Europe and the Soviet Union could increase the USA's exports and imports by 20% and 11%, West Germany's by 24% and the UK's by 13% and 14%.

Clearly increases in exports and imports must proceed broadly in parallel; that is, if western producers are to reap existing opportunities for increased exports and investment opportunities, western consumers and firms must be allowed to benefit from increased supplies emanating from the East. It is through this route - and only this route - that western societies as a whole can benefit from Eastern liberalization and economic growth. Any attempt to boost western exports without a corresponding increase in imports is bound to fail, either because Eastern demand will be frustrated or because Eastern countries will fall ever further into debt.

The next question to ask is which sectors are most affected, and what are the implications for the western economies? The remainder of the paper considers two aspects of this question.

First we consider agriculture. The inefficiency of Soviet and Eastern European agriculture is well known. Farmers the world over, however, are among the most flexible of producers, and so we anticipate that the import of western technology and organisation, and the provision of higher rewards to farmers will stimulate production of agricultural products in Eastern Europe and the Soviet Union. With rising incomes domestic consumption

will also increase. Section 3 examines the likely net effect of these forces on agricultural production, export supply, domestic prices and world prices. In particular interest is focused on the effects of a closer integration of Eastern Europe with the EC's Common Agricultural Policy (CAP), and on the effects of a world-wide liberalization of the kind presently discussed in the Uruguay Round of multilateral trade negotiations. In both cases we find that developments in Eastern Europe will put considerable strain on the CAP. Even if the EC offers no preferential access to the new Eastern European output, that output will either have to be sold on world markets or will reduce Eastern imports from the world market, and hence will reduce world prices. We also note, however, that the changes implied by increased Eastern productivity are substantially smaller than those that would emanate from a desirable reform of the CAP itself.

Section 4 of the paper considers an important aspect of comparative advantage in manufactured goods. The present very low wage costs in the East, coupled with pessimism about possible inflows of capital, has led some observers to conclude that Eastern Europe's net manufactured exports would be concentrated on unsophisticated labour-intensive goods of the fashion presently produced in parts of Southern Europe and the NICs. There is clearly something in this view regarding the short run. Over the longer run, however, we have already argued in CEPR (1990) that human capital statistics rank Eastern Europe above the NICs and Southern Europe in terms of skills and education, and hence that their long-run strength seems likely to lie in

relatively more sophisticated goods. We now pursue this issue. First we exploit a new source of data (new to economists) to show that the quality of scientific education in Poland compares with that in several industrial countries while that in Hungary is among the best in the world. Moreover, these quality indicators correlate positively (and significantly) with comparative advantage in sophisticated engineering goods. Second, we consider the proportion of school children receiving secondary education, which recent research has identified as a crucial determinant of an economy's ability to grow. Again Eastern Europe looks more like Western than Southern Europe or the NICs. These are important conclusions, not least for Southern Europe where there is presently a widespread fear that local producers will be out-competed by Eastern Europe.

2. THE SIZE AND DIRECTION OF EAST EUROPEAN TRADE[1]

Economic theory offers rather poor advice about the volume and direction - as opposed to the composition - of international trade, and yet these are issues of considerable importance both economically and politically. In this section we explore the potential volume and direction of Eastern-bloc trade using an unsophisticated but apparently robust model of bilateral trade flows - the gravity model.

2.1 THE GRAVITY MODEL

2.1.1. The gravity model stems from Linnemann (1966), who proposed it as a pragmatic way of combining three sets of determinants of the size of a bilateral international trade flow:

the importer's demand, the exporter's supply and the costs of doing business[2]. Its theoretical foundations have never be made entirely secure - see Wang and Winters (1991) - and yet it has considerable intuitive appeal and has been used regularly since 1966 for a wide range of tasks - e.g. Aitken (1973), Bergstrand (1985), Slama (1983), and Brada and Mendez (1985). We use it here to characterise the trading patterns of a large sample of market economies and then assume that eventually Eastern Europe and the Soviet Union will slot into the same pattern.

The gravity model refers to countries' total trade and may be estimated on cross-section data referring to a single year or period. It is best thought of as providing a long-run equilibrium view of trading patterns; hence for now we ignore the issue of how Eastern Europe will progress from its present position to the estimated equilibrium. The model describes the trade flow from a particular origin (i) to a particular destination (j) in terms of the framework in table 1.

TABLE 1 ABOUT HERE

Country i's potential supply of exports depends on its national product and on the ratio of its production for export to total production. The former is represented by GNP, while the latter - the openness ratio - tends to vary inversely with population. Population proxies the physical size of an economy, with larger economies more able to satisfy their own needs under autarky. This is most plausibly thought of in terms, first, of economies of scale and, second, of the positive correlations between

TABLE 1: THE GRAVITY MODEL OF EXPORTS FROM i TO j

variable	sign	explanation
GNP of i	+	export supply; number of varieties available
population of i	-	larger countries are more self-sufficient and less specialised
GNP of j	+	import demand; demand for variety
population of j	-	self-sufficiency, less specialised, local economies of scale
distance	-	transaction costs; "economic horizons"
adjacency	+	common land border reduces trade costs, increases contacts
trade preferences	+	reduced trade costs

NOTE: The logarithm of the trade flow is linearly related to the logarithms of the explanatory variables.

population and geographical size and between the latter and natural resource endowments. Very similar arguments pertain to the import side of the equation: higher income suggests higher demand while higher population suggests greater self-sufficiency.

The remaining variables reflect the costs of trade, or trade resistance. The main natural obstacles to international trade are transport and transactions costs. The former are related to distance, while the latter are at least partly related to the 'economic horizon' of a country. People are commonly held to be better informed about, and have closer ties with, near-by countries, and so we use the geographic distance as the main proxy for both the natural obstacles to two countries' mutual trade. This is supplemented, however, by an adjacency dummy which is non-zero if i and j share a common land border; it reflects reductions in both cultural and transportation frictions between adjacent countries over and above the effect of distance.

The principal artificial obstacles to trade are trade policies. Here the critical issue is the extent to which such barriers affect flows differentially and hence we (a) omit from the estimation any trade flows that are known to be distorted for political reasons (e.g. Iran-Iraq, China and Eastern Europe), and (b) make allowance for preferential trading arrangements by including a series of dummy variables.

The gravity model does not relate trade directly to prices. This exclusion stems from the general equilibrium nature of analysis,

in which prices are endogenous and merely adjust to equate supply and demand. As Leamer and Stern (1970) observe, this does not imply that prices are ineffective in allocating resources. On the contrary, prices are assumed to adjust quickly and demand and supply are assumed to be responsive enough to prices to bring about an equilibrium rapidly.

2.1.2 Estimation The estimating equation is a log-linear regression of trade on the variables reported in Table 1. It is estimated on data from market economies because we wish to describe "normal" trade patterns, and, to ensure the widest possible country coverage in defining "normal", the model is estimated on data from the years 1984-86, averaged over three years to reduce the effects of temporary distortions. For a variety of reasons we cannot include all countries in the world, but our sample contains 76 countries - 19 industrial and 57 developing, see Appendix Table 1 - which account for about 80 per cent of total world trade over 1984-86[3]. The trade data refer to total merchandise trade and are expressed in $US millions; they were obtained from the IMF's Direction of International Trade. We have used recorded import data as the basic source, resorting to export data only to fill in gaps[4].

The GDP data (measured in $US million) are taken from the World Bank's World Development Indicators and are averaged over 1984-86, while the population data (in millions) are taken from the same source but refer only to 1985. Distances are measured in nautical miles (1 nautical mile = 1.15 land mile) as the shortest

navigable distance between countries' main ports, plus the overland distance from the ports to the economic centres of the countries concerned. For countries in continental Europe, however, where overland communication is predominant, the direct rail or road distance between economic centres is used for the empirical analysis[5]. The preference dummies refer to ex-colonial relationships, economic integration schemes, unilateral preferences from industrial countries to developing countries and EC preferences to certain developing countries.

The estimates, which are reported in Table 2, confirm our hypotheses above. All the coefficients except for two dummy variables have the expected signs, and most, including all those on the non-dummy variables are statistically different from zero. The proportion of the variance explained - over 70% - is also very satisfactory.

TABLE 2 ABOUT HERE

2.1.3. Economic Integration Not all the coefficients on preferential trade and integration arrangements are significantly different from zero, but we retain them in the equation to ensure that their absence does not bias the estimates of the main parameters. We would not wish to make too much out of the precise sizes of the dummy co-efficients, and neither shall we make use of them below. Nevertheless it is worth considering their general implications for Eastern European trade.

The strongest and best-defined effect refers to a regional

TABLE 2: ESTIMATES OF THE GRAVITY MODEL OF TRADE FLOWS

(Dependent variable: log of export from i to j)

Explanatory Variable	Coefficient	t-statistic
Constant	-12.49	34.32
GNP of i	1.17	58.19
Population of i	-0.38	15.67
GNP of j	1.02	42.75
Population of j	-0.22	8.19
Distance from i to j	-0.75	22.28
Dummy variables:		
adjacency	0.78	3.27
EC	0.70	2.17
EFTA	-0.02	0.05
ECOWAS	-0.31	0.34
SADCC	1.25	0.97
CACM	2.10	1.32
AG	0.38	0.55
LAIA	0.96	2.85
ASEAN	2.25	5.15
UK Ex-Colonial	1.91	4.96
French Ex-Colonial	0.73	1.24
GSP	0.35	2.92
ACP	0.89	4.20
ACP*	1.05	5.27

NOTES: 4320 observations,

The dummy variables (Aij and Pxxx) take value 2 when i and j satisfy the criterion for inclusion and 1 otherwise. The

preference dummies refer to the following arrangements. They are the sub-set of those identified in Greenaway and Milner (1990) for which we had sufficient country coverage to identify an effect: European Communities (EC), European Free Trade Association (EFTA), the Economic Community of West African States (ECOWAS), the South African Developing Co-Ordination (SADCC), the Central American Common Market (CACM), the Andean Group (AG), Latin American Integration Association (LAIA) and Association of South East Asian Nations (ASEAN). The ex-colonial relationships refer to British (UK) and French (FRANCE) colonies. Unilateral preferences include the Generalised System of Preferences (GSP) and the EC's preferences under the Lomé convention (ACP for ACP exports to the EC and ACP* for the reverse flow).

grouping of relatively small countries (ASEAN), but the co-efficients on the other regional groupings are disappointing in their degree of definition or the size of their effects. Hence while history and geography may encourage some thoughts of Eastern European co-operation, it is not clear that such a group would emulate ASEAN rather than ECOWAS. Moreover, the gravity model can not distinguish between trade creation and trade diversion, so that one certainly can not generalise from the increases in intra-bloc trade recorded in Table 2 to increases in welfare. Outside the intra-developing country groupings, the British ex-colonial links are strong, but the broader preferential schemes relatively weak. We interpret this as meaning that it is difficult and time-consuming to build up effective trade preferences, especially between richer and poorer countries, probably because the schemes typically entail a wide range of restrictions and reservations - see, for example, Svedberg (1981). Hence short of full accession, Eastern Europe should not expect to gain a huge amount in terms of trade volume from favoured access to the EC or other markets[6].

Turning to the main coefficients, we find strong income effects on trade, with elasticities exceeding unity, and mild, but well defined, population effects. The signs accord well with Linnemann's original interpretation of the gravity model, which stresses inter-industry trade, but also with more modern ones, which stress intra-industry trade - eg Barker (1977), Helpman and Krugman (1985) and Krugman (1989). Reparameterising the equation in terms of income per head and a size variable (either total GNP

or population) shows that, ceteris paribus, both affluence and size affect trade positively.

2.2 PREDICTING EASTERN EUROPEAN TRADE

We now apply the coefficients from Table 2 to Eastern European data to estimate those countries' trade potential based on data from 1985[7]. Since we do not know how long it will take for Eastern Europe to approach the long-run equilibrium provided by our model, this seems better than estimating trade for some arbitrary year in the future. We also compare our estimated potential with actual trade in 1985.

2.2.1 Data for Eastern Europe There is great ignorance about the levels of GNP in Eastern Europe, and published estimates vary by factors of ten for some countries, see CEPR (1990) or Collins and Rodrik (1991). Thus there is an unavoidable uncertainty about our estimates. Here we report results based only on Summers and Heston's (1988) GNP figures, which fall in the middle of the range of published estimates. Wang and Winters (1991) consider a wider range of data, and find the estimates of Eastern countries' total potential trade ranging from 65% to 400% of reported actual trade.

There are also severe problems with the estimates of the actual trade of Eastern Europe in 1985. For Hungary, Poland and Romania we take these from the Direction of International Trade, as we do for market economies, and we presume that these countries' coverage and valuation conventions are much the same as those for

market economies. For the remaining Eastern countries, however, while we can use the DIT wherever a market economy, Hungary, Poland or Romania is involved, we are obliged to collect mutual trade data from various issues of PlanEcon. These latter data depend on two potentially very distorted exchange rates. Trade between Eastern-bloc countries trade is reported in terms of transferable roubles and we have to convert these first into local currency and then into dollars according to conversion factors provided by PlanEcon.

The implied exchange rates between the transferable rouble and the dollar vary strongly by country. For Hungary and Poland, the countries most integrated with the West and able to meet IMF statistical requirements the rates for a dollar were R1.94 (Hungary) and R2.16 (Poland), but for the others they were R0.64 (Bulgaria), R1.38 (Czechoslovakia), R0.63 (East Germany), and R0.61 (USSR). Hence we suspect that the "actual" trade data quoted below between these latter countries are seriously exaggerated[8].

2.2.2. Potential Trade Tables 3 and 4 report our estimated potential trade flows for each Eastern country along with estimates of "actual" trade flows for 1985. Consider, first, trade within the Eastern bloc. Reported trade substantially exceeds predicted potential trade for the Soviet Union, Czechoslovakia, Bulgaria and East Germany, the countries with the most serious data problems. On the other hand, Poland seems not to have achieved its potential, while Hungary and Romania appear

to be roughly in trading equilibrium with their eastern partners.

TABLES 3 AND 4 ABOUT HERE

Overall, then, we believe that while Comecon - the trading arrangement between Eastern-bloc countries - caused a huge increase in the share of intra-CMEA trade in total trade, it probably did not increase the absolute level of intra-bloc trade much above "normal" levels. On the other hand, until the valuation of intra-bloc trade can be put on a sounder footing such a conclusion must remain very tentative.

Turning to trade with market economies, it is plain that Eastern European trade currently falls dramatically short of its potential. Hungary and Romania have trade volumes approaching one-third of potential, but for other countries the factor is about one-fifth. In terms of broad classes of market one sees the impact of politics on trade: trade is currently least restricted relative to potential with developing countries, followed by EFTA (in which Finland is particularly strongly represented), the EC and other industrial countries in that order. It is striking that while Eastern European trade with developing countries broadly matches its potential, the shortfalls with other industrial countries, of which the USA and Japan are the principal components, are by factors of 20 and 30. The latter factors are given in Appendix Tables A.2 and A.3, which extend the results to the major industrial countries individually.

Predicting strong trade expansion at current levels of income in

Table 3

East European Countries' Imports,1985 (1)
(Actual and Potential)

$ billions

	EC	EFTA	Other Ind.	Dev.	Sum(4)	EE
Bulgaria(2)	1.34	0.38	0.28	0.70	2.69	10.07
	2.71	0.69	1.99	0.62	6.01	2.66
Czechoslovakia	1.64	0.52	0.19	0.57	2.93	13.36
	15.68	2.38	4.59	1.33	23.98	7.17
E.Germany(3)	4.29	0.50	0.31	1.14	6.24	24.08
	23.90	4.34	6.79	1.71	36.74	8.39
Hungary	1.76	0.84	0.44	0.72	3.75	4.03
	6.90	1.06	2.66	0.98	11.60	4.08
Poland	2.07	0.56	0.45	1.06	4.14	6.37
	13.93	3.07	6.92	1.71	25.64	9.51
Romania	0.84	0.17	0.43	1.64	3.08	3.71
	5.84	1.53	3.68	1.31	12.36	4.56
Total Excl USSR	11.93	2.97	2.10	5.82	22.83	61.62
	68.95	13.08	26.63	7.66	116.32	36.38
USSR	10.29	4.67	7.76	9.51	32.22	40.25
	72.71	17.65	43.27	10.73	144.36	16.43
EE and USSR	22.22	7.65	9.86	15.33	55.05	101.87
	141.67	30.73	69.90	18.39	260.68	52.81

Note: 1. The GDP data come from Heston-Summers (1988).
2. The first line is actual trade, the second one is potential.
3. E.Germany data with W.Germany are collected from PlanEcon.
4. Sum of trade with 76 partner countries identified in gravity model.

Source:
Actual: IMF "Direction of International Trade" 1989
PlanEcon 1987
Predicted: Authors' calculations

Table 4

East European Countries' Exports, 1985(1)
(Actual and Potential)

$ billions

	EC	EFTA	Other Ind.	Dev.	Sum(4)	EE
Bulgaria(2)	0.40	0.06	0.07	0.58	1.12	9.86
	2.52	0.60	1.74	0.74	5.61	2.65
Czechoslovakia	1.53	0.60	0.20	1.20	3.33	12.54
	15.22	2.20	4.18	1.71	23.30	7.41
E.Germany(3)	4.73	0.70	0.15	1.15	6.72	25.00
	23.63	4.06	6.39	2.20	36.28	8.99
Hungary	1.33	0.75	0.26	0.89	3.23	4.46
	6.51	0.92	2.36	1.20	10.10	4.10
Poland	2.50	0.69	0.34	1.36	4.89	6.00
	12.65	2.63	5.92	2.00	23.21	9.15
Romania	2.60	0.30	0.78	1.94	5.62	4.02
	5.25	1.28	3.11	1.51	11.14	4.36
Total Excl USSR	13.09	2.40	1.81	7.92	25.21	61.88
	65.78	11.70	23.70	9.36	110.53	36.67
USSR	14.08	4.58	1.74	4.67	25.08	33.40
	66.87	15.34	37.65	12.75	132.61	16.11
EE and USSR	27.17	6.97	3.55	12.59	50.28	95.24
	132.60	27.04	61.35	22.11	243.15	52.78

Note: 1. The GDP data come from Heston-Summers (1988)
2. The first line is actual trade, the second one is potential.
3. E.Germany data with W.Germany are collected from PlanEcon.
4. Sum of trade with 76 partner countries identified in gravity model

Source:
Actual: IMF "Direction of International Trade" 1989
PlanEcon 1987
Predicted: Authors' calculations

Eastern Europe clearly implies large increases the openness of these economies. Table 5 reports the reported actual shares of exports in GDP in 1985 along with those predicted by our model. The 'adjusted' figures make allowance both for the inadequate treatment of null trade flows by the gravity model and the omission from our sample of certain countries - see Wang and Winters (1991) for details. The reported "actual" data are exaggerated by any tendency to over-value intra-Comecon trade, and so the required increases in openness are probably greater than are suggested by the table.

TABLE 5 ABOUT HERE

The results in Table 5 indicate the importance of international trade to the emergent economies - and imply than any failure to realise the potential increases in trade could have serious implications for their generation of income or satisfaction of demand. Certainly the figures suggest that sound international trade relations are likely to offer a far greater stimulus to the Eastern economies than could any conceivable aid flow.

Table 6 looks at the results from the perspective of the East's major trading partners in the EC, USA and Japan. The relative success of West Germany in Eastern European markets (other than the USSR) is clearly evident; the difference between actual and potential trade is "only" 2½ or 3½ times actual trade in aggregate, and, in fact, Germany's ratio of actual to potential exports exceeds the corresponding ratio for the EC as a whole for every Eastern European partner - compare Tables 4 and A.3. The

Table 5

East European Countries' Openness Ratio

Exports as Percentage of GNP (X/GNP Ratio)			
	Report	Crude	Adjust
Bulgaria	0.24	0.18	0.21
Czechoslovakia	0.14	0.26	0.28
E.Germany	0.19	0.31	0.33
Hungary	0.14	0.25	0.31
Poland	0.06	0.17	0.19
Romania	0.11	0.16	0.23
USSR	0.03	0.08	0.09

corollary of this success is that German exports will benefit proportionately less from liberalisation than will those from other countries. This is not such bad news, however, for, as a large economy close to Eastern Europe, Germany's trade with the East is already absolutely large. Hence in absolute terms, and also relative to existing (1985) levels of trade in aggregate, Germany is one of the principal beneficiaries of liberalisation. Of course, part of these gains - those with East Germany - will now count as internal German trade, but they are real enough, and even without them German trade receives a strong stimulus. Germany's trade with the USSR also looks set for a large expansion; it records the largest proportionate increases and the second largest absolute increases.

TABLE 6 ABOUT HERE

Turning to the other countries in table 6 it is plain that the USA also has a very large stake in the liberalisation of Eastern trade, and even Japan, by far the least affected major country in absolute terms, has increases amounting to 6% and 4% to total imports and exports respectively[9]. Such figures suggest strong adjustment pressures in the industrialised countries. We can not expect the achievement of potential trade volumes to take less than two or three decades, however, and so even for the USA and West Germany we are considering increases in the growth rates of trade of perhaps only 1% per annum.

To put the figures in a different perspective, Tables 3 and 4 suggest that rather than accounting for a mere 7% of world

Table 6

Increase in Exports to and Imports from Eastern Europe and the USSR
(Potential-Actual)

	France	Germany	Italy	UK	Japan	USA
Exports						
Difference (Potential-Actual $ billions)						
Eastern Europe	9.96	18.14	8.34	7.33	3.88	17.89
USSR	8.95	24.60	6.80	7.60	3.10	28.86
Difference as multiple of actual trade						
Eastern Europe	9.7	2.5	7.4	7.7	5.9	17.6
USSR	2.8	6.2	4.0	10.1	1.0	10.8
Difference as percentage of exporter's total exports in 1985						
Eastern Europe	9.8	9.9	10.6	7.0	2.2	8.4
USSR	8.9	13.4	8.6	7.5	1.7	13.5
Imports						
Difference (Potential-Actual $ billions)						
Eastern Europe	9.32	16.80	7.55	7.07	3.67	15.45
USSR	7.78	21.37	5.37	7.13	4.19	26.84
Difference as multiple of actual trade						
Eastern Europe	8.1	3.4	4.3	5.9	14.0	12.1
USSR	3.4	5.0	2.0	8.4	3.2	66.6
Difference as percentage of importer's total imports in 1985						
Eastern Europe	8.6	10.6	8.3	6.5	2.8	4.3
USSR	7.2	13.5	5.9	6.5	3.2	7.4

merchandise trade, Eastern Europe and the Soviet Union could, even at their current levels of income, have accounted for 18% (after adjusting our results for excluded countries.

Moreover, if, as one hopes and expects, liberalisation boosts Eastern incomes, their trade potential will increase correspondingly. Every 1% on GNP will boost imports by 1% and exports by 1.2%, see Table 2, so that had these countries realised Western European levels of incomes in the mid-1980s their shares of world trade would have been much higher than our tables suggest.

2.2.3. Other predictions It will take a long time to discover if these long-run predictions are fulfilled. It is interesting, however, to compare them with other approaches to the same problem. Collins and Rodrik (1991) conduct an exercise with similar objectives but different methodology to our own. They fit relationships for aggregate exports and imports with respect to countries' GNP and population and apply these to Eastern European data to obtain total trade potential. After adjusting our own results to allow for our incomplete country coverage and our treatment of null trade flows, we find the two studies fairly similar in this dimension.

When it comes to the direction of trade, however, there is a marked contrast between our results and those of Collins and Rodrik. The latter estimate partners' shares in each Eastern European country's total exports by updating a 1928 trade matrix.

For a sample of six comparator countries - Austria, Finland, Germany, Italy, Portugal and Spain - they explain each partner country's share in total exports in 1989 as the sum of a fraction of its share in 1928 plus an effect specific to the partner but common to all sample countries[10]. They then apply this model to Eastern Europe's 1928 export shares to generate shares for 1989. They conduct a similar exercise for imports.

This approach has two implications. First, because the comparator countries all experienced strong European integration between 1928 and 1989, this is built into their predictions for Eastern Europe. Second, their method tends to predict similar shares for all Eastern European countries, because the only thing that varies between countries - the 1928 share - is multiplied by a fraction before entering the 1989 share. The remaining component of the 1989 share - the partner effect - is common to all countries. As a result, Collins and Rodrik predict a rather greater concentration of Eastern trade on the EC than we do. For example, according to Collins and Rodrik the EC share of Eastern imports falls below 50% only for Hungary, and for exports only for Hungary and Czechoslovakia. In our own work on their subset of countries, on the other hand, only Czechoslovakia records EC shares of 50%, followed by Hungary and the USSR at around 44% and other countries below 40%, see Tables 3 and 4. Moreover, if we adjust our data to allow for the countries excluded from our sample of 76, EC shares in the total range from 45% for Czechoslovakia down to 23% for Romania. Concomitant with the differences in predicted EC trade shares are those with other

countries - especially the USA. Our approach suggests considerable potential for the USA to expand its trade with Eastern Europe[11].

2.2.4. Implications for OECD Countries The changes we have predicted are dramatic for Eastern Europe, but they are also important for Western Europe and the other market economies. First, and most obviously, the long-term increases in OECD countries' total trade are huge - exports rise by 24% for West Germany, 22% for the USA, and 15% for the UK and imports by similar amounts. Such increases offer scope for new specialisation and economies of scale on a scale approaching the opening up of the new world, only quicker.

Second, our model suggests that given their current levels of income the Eastern countries should expect in equilibrium to have an excess of imports over exports - i.e. to run small trade deficits. As they grow relative to other countries, however, these will gradually correct themselves. The predicted imbalances are small relative to total trade and so would raise no serious financing difficulties. Their emergence also presupposes that macroeconomic policies are compatible with them, but that, of course, is an assumption common to all long-run real equilibrium models of this sort. Such models offer broad and trends patterns, not precise indications of year-by-year developments.

Third, consider trade between Eastern Europe and the

industrialised market economies of OECD: in view of their very small initial shares, Japan and the USA will eventually increase their shares of this trade at the expense of those of EFTA and the EC (especially Germany). This will not indicate failure or the need for policy response on the latter's part.

Fourth, a weakness of the gravity model is that the increased trade we predict between, say, the UK and Poland, has no implications in our model for the UK's other trade: it apparently neither diverts imports from other sources nor absorbs exports destined for elsewhere. This implies that the new imports displace only domestic sales, while the new exports are met by curtailing domestic sales or increasing output. This is not necessarily a bad approximation - see, for example, Winters (1984) or Brenton and Winters (1990), in which random shocks to imports from one source appear to impinge almost wholly on domestic sales rather than on imports from elsewhere - but it is rather extreme. Hence overall we should expect some spillover from the growth of Eastern European trade to declines in intra-industrial country flows. That is, market economies may find that they face extra competition in export as well as home markets.

An obvious implication of the deficits noted above is that while the opening up of Eastern Europe offers great opportunities for industrial country producers to expand their sales, it offers those countries' consumers the corresponding opportunity to expand their purchases. Moreover, while we have analysed only

goods trade, the same arguments apply with equal force to services trade, with labour-intensive services such as transportation and tourism flowing one way and sophisticated ones flowing the other.

It can not be over-emphasised that these opportunities for buying and selling cannot be decoupled. Any attempt by industrial countries as a whole to sell in Eastern markets without accepting their output in return is destined either to fail or to degenerate into the provision of goods in return for financial assets. Direct foreign investment will, of course, support some such imbalance, but nothing on the scale of our results, and there are no sound arguments for financing export surpluses with the East by merely running up debt. Hence Western economies must offer decent market access to the East if either they themselves are to benefit from liberalisation, or if, indeed, the East is to progress to new market institutions or levels of affluence. Moreover, this entails not only freeing markets now - including sensitive sectors such as agriculture and steel - but also accepting large volumes of imports of goods whose export we cannot now even envisage. The consequent changes in the sourcing of western production and consumption will require a high degree of flexibility and adjustment in both exportable and importable industries. They will, however, be spread over long periods of time, for it seems unlikely that Eastern countries could realise their trading potential in less than twenty years. Moreover, the largest shocks emanate from the USSR, which seems likely to be among the slowest to emerge from communism.

Nevertheless, the shifts are significant, and since they will not be spread evenly across commodities, we turn now to examine selected aspects of the commodity composition of Eastern European trade.

3. EASTERN EUROPEAN AGRICULTURE[12]

3.1 Introduction

The previous section analysed the volume of trade. In the remainder of the paper we look into the possible composition of Eastern European trade.

Historically Eastern Europe and Russia were large agricultural exporters, and the inefficiency of Eastern European agricultural production since World War II is notorious. Both observations suggest that Eastern Europe will almost certainly be able to increase its output of agricultural produce significantly. This section aims to throw light on the economic mechanism and interactions that might occur when Eastern Europe starts exploiting the possibility of a comparative advantage in agricultural production. An obvious tool in such an analysis is a computable partial equilibrium model of international trade in agricultural commodities. Here we use a modified version of the well-known model by Tyers and Anderson (1986, 1988, 1992). The actual numbers that come out of the simulations should be treated with caution, but we believe that the basic message is robust.

Two important conclusions emerge from this analysis. First, for agriculture both in Eastern Europe and the European Community the

effects of changes in trade regimes are more important than productivity catch-up or income growth. Even if the assumed GNP growth and agricultural productivity growth were twice as large as assume here, the dominant impact would still come from changes in existing protectionist trade regimes.

Second, the liberalization of Eastern Europe is another nail in the CAP's coffin. Even if Eastern Europe was denied free market access to the EC, the farmers of the Community would still face lower domestic prices as additional Eastern output forced world market prices down. The Community could avoid such an outcome only by spending more of its budget on export subsidies, incurring yet stronger protests from other GATT members. Conversely, if Eastern Europe is allowed free market access to the food markets of the EC, the Community's farmers will face lower prices and greater competition. Thus is both cases Community farming output will fall and Community consumers will gain through lower prices. We now develop more carefully the basis for these conclusions.

3.2 The Model

The Tyers and Anderson (TA) model is a comparative static 7-commodity simulation model of world trade in agriculture among 30 countries/country groups. The commodities are rice, wheat, coarse grains, sugar, dairy products, beef and pigs/poultry. Here we concentrate on the four most important European agricultural commodities, viz wheat, dairy products, beef and pork. Among the 30 countries and country groups, the Soviet

Union constitutes one and Eastern Europe (Poland, Czechoslovakia, Hungary, Romania and Bulgaria) another. The model aims at capturing the interaction of consumption and production in each region, as well as the cross effects between the markets for the seven commodities.

For each country and commodity there is a production and a consumption equation. The long-run production levels are assumed to depend on two factors: a trend term reflecting the growth in agricultural productivity, and changes in the real prices that farmers receive for their output. Consumption reflects both direct and indirect consumption: in addition to consumer's direct demand for food there is the demand for fodder in animal production. Consumers' demand is determined by the long-run price and income elasticities of demand, and by population growth. Consumption of fodder (maize, barley and oats) is modelled as an input into the production of dairy, beef and pig/poultry, and depends on (1) the long-run price elasticity of demand for the final commodity in question, (2) the quantity of commodity i (a fodder) in the production of one unit of dairy, beef, and pig/poultry, respectively, (3) the fraction of the livestock product in question that is fodder fed (grazing can be an alternative), and (4) the long-run productivity growth in the production of dairy, beef and pig/poultry. The details of the model appear in Appendix 1 of Tyers and Anderson (1992).

The model is partial equilibrium in the sense that exchange rates are exogenous and changes in export earnings are assumed neither

to influence the countries' real exchange rates nor demand. This would be an awkward assumption if agriculture constituted a major part of Eastern European trade. However, for Central and Eastern Europe and the USSR agricultural products accounted for just 9 percent of the total value of exports, and 12 percent of total imports (1988, GATT 1990). National figures for the three major Eastern European economies are given in Table 7.

TABLE 7 ABOUT HERE

For each country the link between the domestic and world market price is captured by a price transmission equation. The "nominal protection coefficient" in that equation measures, crudely speaking, how protectionist the importing country is. However, some of the change in world prices can filter through the trade barriers and cause changes in the domestic price. The second component of the price transmission equation captures the change in the domestic price in response to a change in the world price (the "insulation coefficient").

3.3 The scenarios

Our two scenarios can be characterized as "re-runs of history" with and without liberalization. The question we ask is: What would Eastern European production, consumption and trade have been with and without an economic liberalisation of the kind that eventually began in 1990?

We consider consumption, production, exports and prices and focus on the differences in these variables relative to a reference

Table 7 The Commodity Composition of CMEA Trade
(percentages of Total Exports or Imports)

Commodity class (SITC code)	Trade with Nonsocialist countries			Trade with Socialist countries		
	Czecho-slovakia	Hungary	Poland	Czecho-slovakia	Hungary	Poland
Exports						
Food etc. (0,1,4)	10.7	17.7	15.9	1.5	17.6	3.2
Imports						
Food etc. (0,1,4)	13.4	9.6	20.8	4.7	3.3	4.3

Source: Kenen, P.B., "Transitional Arrangements for Trade and Payments Among the CMEA Countries", IMF Working Paper, Sept. 1990. National Trade Statistics. Czechoslovak data for 1989; Hungarian data for 1987; Polish data for 1988. Detail may not add to total because of rounding.

scenario reflecting the late 1980s in the absence of liberalization. In the reference scenario ("without liberalization") we assume that the agricultural part of Eastern Europe's economy would have experienced its actual productivity levels of the 1980s. In all the alternative ("liberalization") scenarios, however, we assume that Eastern Europe is able to take advantage of a 15 percent productivity catch-up from the import of western technology and organizational skills. This assumption is motivated in more detail in the Appendix. The elasticities of demand and supply for each sector's products are assumed to be equal to those of the USA in the 1980s. The motivation for this choice is our ambition to try and model the eventual behaviour of a market-oriented agricultural sector.

With regard to Eastern Europe, we reduce the cross price supply elasticities to 30 percent of those used by TA. The reason for this modification is that in the original version of the model, the reported cross price elasticities mean that major price increases induce very substantial changes in the mix of products. Since these effects are not generally well estimated and our interest is more in the overall output of agricultural products than the mix, we felt it best to attenuate these distracting effects. A side effect of the changes made is that the overall elasticities of supply are increased somewhat from TA's estimates. Details are given in Appendix Table A.4.

Eastern European economic and political liberalization will lead to increased production in Eastern Europe and to demands for

market access to Western Europe. How should EC policy makers respond to this challenge? In the agricultural sphere the most important question is whether or not the EC should give Eastern Europe free access to the EC's food market.

Scenario one: The effects of integrating Eastern Europe into the CAP. First, we assume that Eastern Europe liberalizes its trade in agricultural commodities, while at the same time experiencing a productivity increases of 15 percent (catch-up) and a GNP increase by 10 per cent. The lower increase in GNP is motivated by caution; we do not want to run the risk of being too optimistic regarding the income growth[13].

The effects of these changes are shown in Table 8. Production in Eastern Europe increases except for dairy products and net exports increase except for dairy and beef. World prices are depressed for three commodities, which forces the European Community to reduce its production and net exports, except for dairy products, even though there is no change in the Community's Common Agricultural Policy.

TABLE 8 ABOUT HERE

In the next phase - Table 9 - it is assumed that the liberalized Eastern Europe is integrated into the CAP in the sense that CAP-prices are assumed to face farmers and consumers in Eastern Europe, and that free access is granted to Eastern European agricultural products in the Community. To avoid the possibility that the EC's budget constraint for the CAP is violated it is

Table 8 -- Productivity and income shift in a unilaterally liberalized Eastern Europe with unchanged trade regimes in the rest of the world

EASTERN EUROPE

	CHANGE IN PER CENT					CHANGE IN METRIC TONS[3] (000s)			Change in world market price, percent
	Price to farmers	Production	Consumption	Net export	Price to consumers	Production	Consumption	Export	
Wheat	11	24	0	219	11	10,346	-63	10,410	-5
Dairy	-28	-12	15	-360	-28	-6,495	7,043	-13,538	+10
Beef[1]	-9	7	8	-4	-9	201	214	-12	-1
Pork[2]	21	42	-12	452	21	4,088	-1,037	5,123	-5

EUROPEAN COMMUNITY

Wheat	-1	-0	0	-3	-1	-330	205	-536	
Dairy	3	2	-1	26	3	-1972	-1505	3477	
Beef	-0	1	-0	776	0	50	-17	67	
Pork	-4	-4	3	-85	-4	-742	614	-1356	

1 Includes beef and veal

2 Includes pork, poultry, lamb and mutton

3 For dairy, milk equivalents

assumed in Table 9 that the combined net export volume of each commodity from Eastern Europe and the EC is the same as in the reference scenario.

TABLE 9 ABOUT HERE

The resulting price increases for Eastern European farmers would be significant - e.g. 40 percent for wheat and over 80 percent for beef - that is, almost the entire price effect comes from Eastern Europe joining the CAP.

As a result of the higher CAP-prices Eastern European farmers increase their supply between one quarter (dairy) and almost 80 percent (beef), and prices to Eastern European consumers increase by between 15 and 85 percent. As a consequence consumption of beef and pork is reduced between 13 and 23 percent while consumption of wheat and dairy products remain almost unchanged. Table 9 also presents the export volume increases in percent (between +15 and 85 for Eastern Europe), as well as in absolute terms.

Turning to the European Community, the accession of Eastern Europe reduces farm prices in Western Europe by 10 to 26 percent, depending on the commodity, and also causes agricultural production to fall - most for wheat (-21 percent) and least for dairy products (-5 percent). In addition the EC's net exports fall significantly (remember the hard budget constraint on the CAP!) Apart from Eastern European farmers, the "winners" are EC consumers: because of the domestic price falls - between 12 and

Table 9 -- Integration of a growing Eastern Europe in CAP

	EASTERN EUROPE								
	CHANGE IN PER CENT					CHANGE IN METRIC TONS[3] (000s)			Change in world market price, percent
	Price to farmers	Production	Consumption	Net export	Price to consumers	Production	Consumption	Export	
Wheat	+41	+47	-2	+450	+41	+20,700	-900	+21,600	0
Dairy	+16	+26	0	+370	+15	13,600	-100	+13,700	0
Beef[1]	+85	+78	-23	+1,030	+85	2,300	-600	+2,900	0
Pork[2]	+32	+54	-13	+570	+32	5,200	-1,200	+6,400	0
	EUROPEAN COMMUNITY								
Wheat	-26	-21	+11	-103	-29	-15,700	+5,900	-21,600	
Dairy	-10	-5	+6	-101	-12	-7,000	+6,700	-13,700	
Beef	-19	-18	+14	-528	-20	-1,700	+1,200	-2,900	
Pork	-17	-17	+17	-453	-17	-3,000	+3,400	6,400	

1 Includes beef and veal

2 Icludes pork, poultry, lamb and mutton

3 For Dairy, milk equivalents

29 percent - they can afford to increase their consumption between 6 percent (dairy) and 17 percent (pork).

Scenario two: The effects of a successful GATT round on Eastern Europe. Suppose the ongoing Uruguay Round of multilateral trade negotiations results in a liberalization of world trade in agriculture. Would that bring benefits to Eastern Europe, and, if so, of what magnitude? This is the type of question focused upon in scenario two.

We assume that the OECD countries and Eastern Europe liberalize their agricultural trade (i.e. apply zero import barriers), and that Eastern Europe experiences the agricultural productivity catch-up and GNP growth discussed above. Unlike scenario one, however, there is now no constraint on European net exports.

Table 10 presents the first part of this scenario, the OECD and Eastern Europe (GATT) liberalization. The new world prices mean price increases to Eastern European farmers. These cause Eastern European production and net export to increase. The opposite effect occurs in the European Community: farmers face lower output prices and hence reduce production. The Eastern European consumers suffer from the world price increases, of course, while EC consumers enjoy significant price falls on a large part of their total consumption of food.

TABLE 10 ABOUT HERE

When one additionally assumes the productivity and income

Table 10 -- Liberalization of OECD and Eastern European trade in agriculture

	CHANGE IN PER CENT					CHANGE IN METRIC TONS[3] (000s)			Change in world market price, percent
	Price to farmers	Production	Consumption	Net export	Price to consumers	Production	Consumption	Export	
EASTERN EUROPE									
Wheat	36	25	-3	252	36	10,893	-1,245	12,138	16
Dairy	16	12	-4	223	16	6,195	2,045	8.241	80
Beef[1]	35	23	-12	356	35	682	-326	1,008	48
Pork[2]	39	43	-21	537	39	4,200	-1,816	6,016	10
EUROPEAN COMMUNITY									
Wheat	-30	-22	12	-113	-33	-16,985	6,601	-23,587	
Dairy	-11	-5	6	-108	-13	-7,428	7,255	-14,684	
Beef	-42	-40	42	-1,322	-42	-3,670	3,581	-7,280	
Pork	-13	-11	12	-291	-14	-1,881	2,212	-4,092	

1 Includes beef and veal
2 Includes pork, poultry, lamb and mutton
3 For dairy, milk equivalents

increases for Eastern Europe discussed earlier the price increases to farmers in Eastern Europe are reduced slightly. However, the differences made by such growth to production and consumption are marginal in both Eastern European and the European Community. (See Appendix Table A5.)

Leaving the model aside for a moment one can ask just how competitive Eastern European agriculture can reasonably be expected to be in the next few years. Our results are rather more optimistic than some other studies, e.g. Hughes and Hare (1991), but we feel that there are several reasons for optimism provided that Eastern Europe is allowed access to Western European markets. First, there is considerable scope for productivity increases, not only on the farms themselves but also with regard to the supporting infrastructure (communications, schooling and extension services, etc; see the Appendix). Second, as price reforms are instituted in Eastern Europe the input-output coefficients of the agricultural production processes will change, with the new techniques of production reflecting world (relative) prices. Third, for some considerable time yet rural wages in Eastern Europe will be low compared with wages among most major producers in Western Europe; this is particularly true of wages in Poland, Romania and Bulgaria. Fourth, if Eastern Europe were given access to Western European markets it would have the clear advantage relative to overseas competitors (especially with regard to perishable products) of being situated right on the doorstep of one of the world's most affluent and densely populated markets.

To conclude, not only is the cold war over and are nations re-born as free societies after half a century of oppression, but as a side effect, perhaps the most inefficient of all western economic institutions seems to be approaching its demise. It is no disadvantage that a successful GATT round would help to speed up this process and stimulate increased agricultural production and incomes for the large farming communities of Eastern Europe.

4. EASTERN EUROPEAN SCHOOLING

In CEPR (1990) we argued that, contrary to the popular view, Eastern European comparative advantage lay not in simple labour intensive goods - or, at least, not for very long - but rather in more sophisticated goods. The basis of this claim was a series of human capital statistics which placed Eastern Europe between Southern Europe and the NICs on the one hand, and Western Europe on the other; for example, in the proportion of the work-force in professional occupations, the percentage of the work-force with particular levels of educational qualification, enrolment ratios in primary and secondary education, the share of the work-force under-taking research and development tasks and the share of GDP devoted to education.

This section takes up that theme and considers two aspects of schooling in Eastern Europe in a more detail - the quality and quantity of secondary school outputs. First we consider the levels of achievement in science in Polish and Hungarian schools and find the latter very competitive indeed. We also show that, at least for the small sample of countries with appropriate data,

such achievements correlate with comparative advantage in sophisticated products. Second, we briefly consider the strongly positive role of skilled labour in economic development and the apparent importance of secondary education in providing that labour. We then show how in terms of the proportion of the population receiving secondary schooling Eastern Europe already apparently challenges the West.

There is currently concern about the migration of skilled labour from East to West Europe, especially if the latter maintains restrictions on the movement of goods and services trade. Implicit in the analysis of this section, however, is the presumption that such migration does not reach such proportions as effectively to denude the Eastern economies of skills. It is not that we find this possibility inconceivable, but that, as above, we think it useful to ask what trade patterns would be if the West adopts a moderately liberal stance.

4.1 THE LEVEL OF SKILLS

4.1.1 The Supply of Skills The data and interpretation given in CEPR (1990) were subject to two major concerns. First, many of them are input measures, whereas what really matters is the output of skilled and highly skilled services that can be obtained from the work force. Differences in the productivity of skilled workers across countries, however, owe more to the organisation of the economy and incentive systems than to the workers per se once we normalise for their skill levels. Hence while this aspect of the problem lies at the very heart of

Eastern European economic performance, it is also one which is immediately addressed by the liberalisation of their economies. We do not pursue it further here, other than to hypothesise that eventually Eastern European workers with particular skill levels and combinations of other factors to work with should be expected to be, *ceteris paribus,* as productive as those in market economies.

The second concern was about the skill levels themselves. Eastern workers may have particular formal qualifications, it is sometimes argued, but how do we know that these are of comparable levels to western qualifications? Particularly if in the past the education system has been used as a means of social and political engineering, is it not likely that Eastern students lag behind their equivalent western level in terms of productivity knowledge? These are complex and sensitive questions which are not close to resolution even in the West, but exploiting a data source which is, we believe, new to economists we can cast light on one corner of the issue. Our results suggest that for Hungary skill levels may be higher than has previously been suspected. For Poland, on the other hand, they are perhaps lower.

4.1.2 <u>School Science Scores</u> The data we exploit are the scores of school children on a series of internationally standardised science tests. The data have been compiled by the International Association for the Evaluation of Educational Achievement (IEA) in what is almost certainly the largest social

science research project ever undertaken. In the exercise conducted during the 1970s - the latest for which full details are available, Comber and Keeves (1973) - 258 thousand pupils, 50 thousand teachers and 10 thousand schools in nineteen countries were involved. We use preliminary results from a more widespread study conducted in the mid-1980s, - IEA (1988) - which includes both Hungary and Poland in its sample.

The data refer to the scores of students at different stages of their school careers on a standardised science test. The tests are designed, and undergo extensive pre-testing, to try to ensure that they are culture-free and equally difficult for students studying different science curricula. Teachers are extensively involved in the preparation, testing and evaluation of the tests, as well as in the interpretation of the results. It is impossible to guarantee entirely even-handed testing, but the IEA projects do appear to make every reasonable effort.

The remainder of this section very briefly discusses the Hungarian and Polish school systems. It then examines IEA scores for a sample of countries and discusses how they may be related to international trade performance and comparative advantage. Finally, it discusses the implications of the results for Hungary and Poland.

4.1.3. Two Education Systems[14] Hungary has a long tradition of education which came through the socialist period largely unscathed. Compulsory schooling was introduced in 1777 and its

role in social mobility and in economic growth was explicitly recognised by the Communists, the latter leading to some emphasis on scientific and technological education. Explicit also was the importance of general education - which engenders flexibility - rather than vocational training; informally experts express high regard for Hungarian theoretical and formal schooling. In 1978, some 89% of the relevant age cohort graduated from general schools (8th grade), 20% to academic secondary schools (gymnasia) 25% to vocational schools offering general and vocational education, and the remainder to trade schools. The last produce skilled workers, but the first two types of school offer access to tertiary education. In addition, adult education services are open to anyone who dropped out of school.

The Polish education system is much less well established. Its troubled history has bequeathed Poland a fragmented and insecure school and college network. Just after the first world war only 47% of children attended school and only one-third of teachers had been to teacher-training courses. Grammar schools existed but primarily to teach humanities rather than science and technology. The second world war witnessed the extermination or emigration of many intellectuals and the closure of the secondary schools, and in 1948 only 55% of rural children had attended school. Primary education is now virtually universal and around 20% of students proceed from it to grammar schools. During the eighties, however, both the number of students entering higher education and the number of school teachers holding university degrees declined. These trends stemmed from the low returns and

few opportunities for the highly skilled in Poland, and probably also reflected a generally low assessment of the role of education.

4.1.4. Skill Levels and the IEA Scores The IEA studies generate data for each of three levels of schooling. We concentrate on two: their "level 2", roughly 14 to 15 year olds, and their "level 3", which refers to students at broadly the last possible stage of their schooling, i.e., just before they could enter higher education. We interpret the former as a measure of the level of scientific skill and awareness of the work-force at large and the latter as representative of the levels which the upper echelons of the age cohort could achieve. In both cases, but especially in the latter, subsequent training and education could cause countries' relative performances to change, but at all these later stages there is some presumption that the better trained the students are on entry the better they emerge at the end[15].

The basic data are reported in Appendix Table A.6. This shows clearly Hungary's very high levels of achievement in science education - ranked first at level 2, the broader indicator, and third at level 3. Poland is less spectacular but is still in the same league as important western countries - on a par with Norway and dominating Italy, Australia, Finland and Canada at level 3.

4.1.5. Comparative Advantage It remains to be seen whether these measures of educational output can explain any features of

international trade. With such small samples, formal analysis is not likely to be worthwhile, but we consider some simple correlations and graphs in this section. The Economic Commission for Europe (1990) - Economic Survey 1989/90 - provides data on several countries' revealed comparative advantage in engineering exports (relative to all manufactured exports) disaggregated into hi-tech, advanced-tech, medium-tech and low-tech categories. The classification criterion is R&D expenditure as a share of total revenues in the USA during the 1970s, but it is unlikely that other classifications would differ by much.

Our hypothesis is that higher average scientific skills at the compulsory schooling stage (level 2) would confer comparative advantage in medium-tech goods, for they would provide a reasonably trained work-force at large. Higher performance at the specialist level 3, on the other hand, would boost hi and advanced-tech sectors. Low-tech engineering seems unlikely to derive comparative advantage from any type of educational achievement. Note that the definition of technology levels used here does not refer directly to inputs of skilled labour. This is advantageous in the sense that measures based on the latter are essentially quantity measures (the percentage of the work force with post-compulsory education etc), whereas our focus here is on the quality of the labour force.

Table 11 reports the correlations of interest; it offers considerable support to our hypotheses even though not all the coefficients are statistically significant. In particular we

find the level-2 scores well correlated with mid-tech exports, while the level 3 cohort's skills relate well to hi-tech and advanced-tech trade. In all cases the inclusion of Singapore, with its exceptionally high comparative advantage in hi- and mid-tech engineering reduces the correlation coefficients significantly.

TABLE 11 ABOUT HERE

4.1.6. Hungary and Poland Figures 1 to 4 display the relationships graphically for hi- and mid-tech industries and level-2 and level 3 skill levels. The two significant positive correlations in table 11 are evident in the first and last of the figures, and they are also shown to be moderately robust in that they do not depend only on outlying observations. The negative correlations are also detectable but are less precise. The figures indicate where Poland and Hungary fall on the skills axes. The clear indication is that Hungary is likely to be a significant exporter of engineering goods. It appears to have the labour force skills important to both hi- and mid-tech exports. Poland, on the other hand, has less impressive qualifications and seems likely to operate at the lower end of the spectrum of sophistication.

FIGURES 1 - 4 ABOUT HERE, AS A BLOCK

These conclusions should not be taken too literally. There is clearly much more to comparative advantage than the performance of school children in standardised tests. However, these data

TABLE 11: CORRELATIONS BETWEEN SKILL LEVELS AND REVEALED COMPARATIVE ADVANTAGES

	Average science score Level 2	Average of level 3 science students
hi-tech	-0.409	0.584*
advanced -tech	0.002	0.371
mid-tech	0.637*	-0.208
low tech	0.183	-0.346
Number of observations(a)	10	9

* significant at 5%

(a) See Appendix table for countries with the data to be included in these exercises.

Figure 1

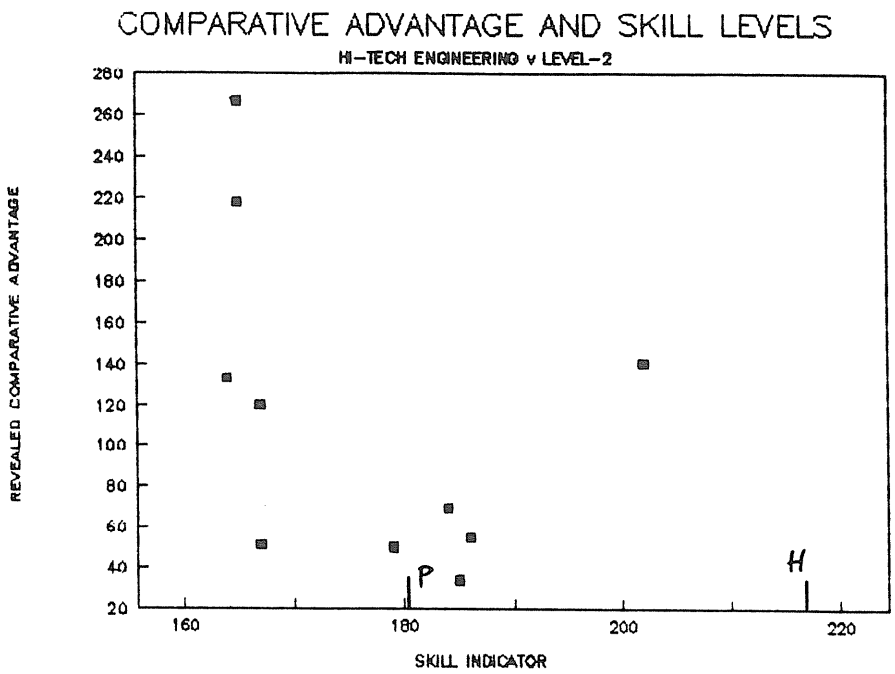


Figure 2

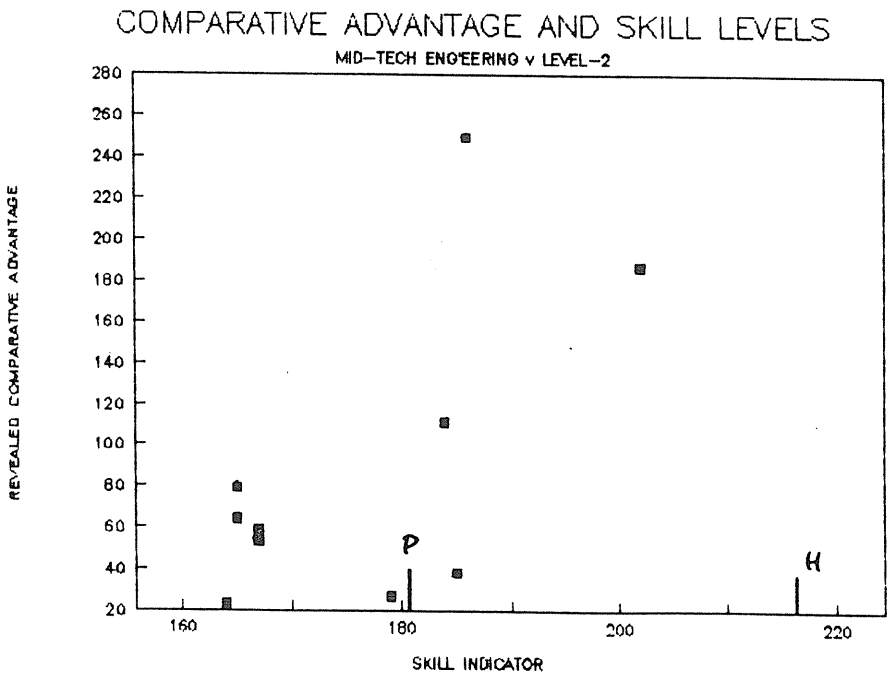


Figure 3

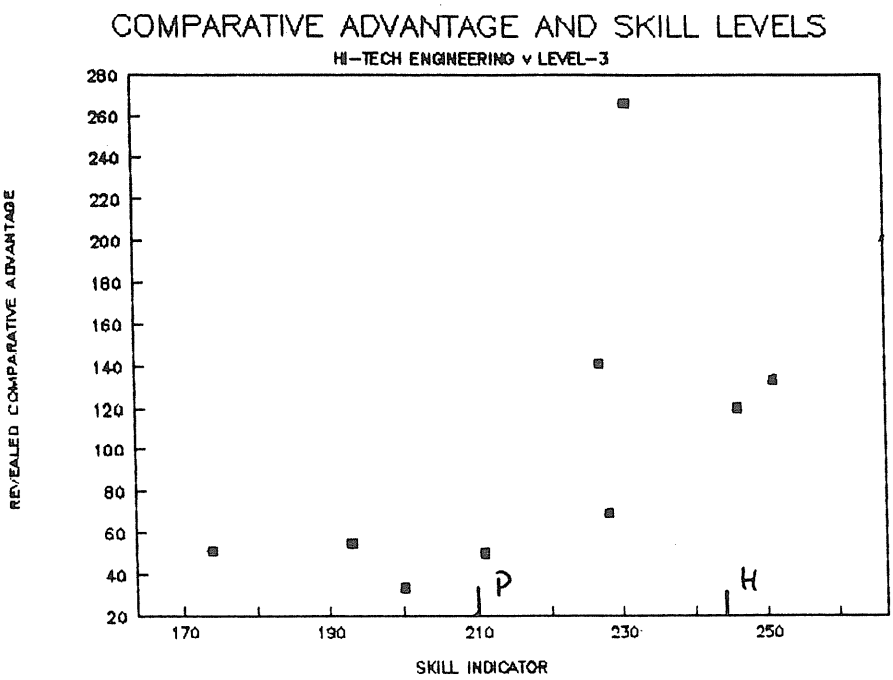
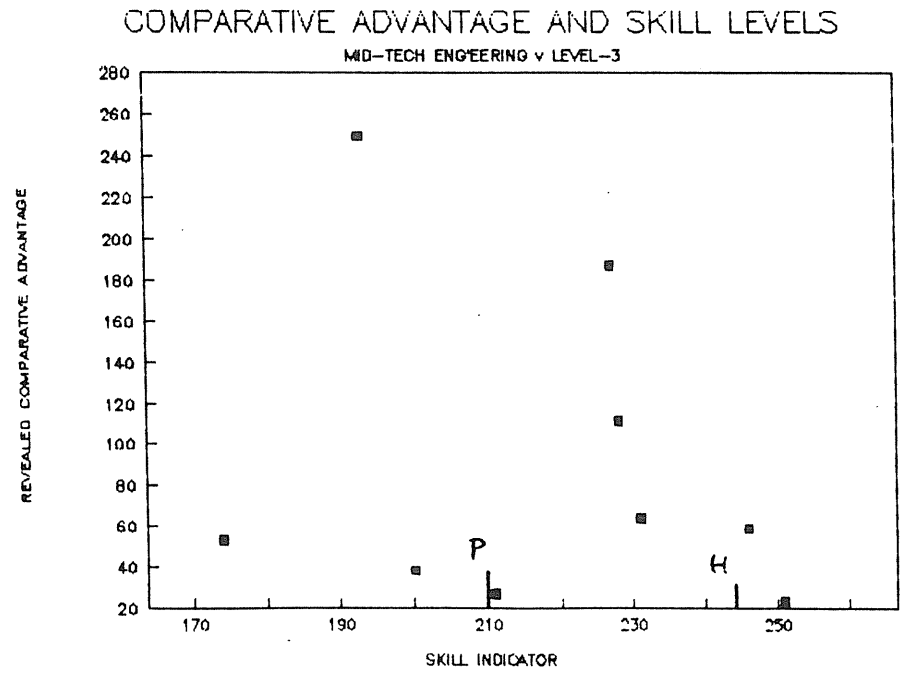


Figure 4



are among the few series really comparable between East and West, and their explanatory power for comparative advantage is, at least to us, surprisingly high. Certainly we believe that the data refute the notion that the Eastern European economies are doomed perpetually to produce simple labour-intensive goods. Hungary in particular appears to have the human infrastructure to become a formidable exporter of sophisticated goods.

4.2. SECONDARY EDUCATION AND ECONOMIC DEVELOPMENT

The importance of secondary education to economic development and hence indirectly to comparative advantage has been emphasised recently by Baumol *et al* (1989). Working on a large sample of countries they explore the determinants of the ability of countries to catch up with the world's technological leaders in terms of real per capita income. They observe a strong tendency to catch up within the group of industrial countries, and discernible tendencies within the groups of centrally planned economies and the upper-middle-income countries. They also note a weak tendency towards it for the sample of these three groups combined. Equally clear, however, is the absence of catch-up within the set of poorer developing countries and between these countries and the rest.

Catch-up has been known as a statistical phenomenon for some time, see the discussion in Baumol (1986), but explanations for its patchy occurrence have taken longer to emerge. De Long (1988), for example, postulated that differences in catch-up ability were related to religion (the protestant work-ethic) or

political institutions, but found little evidence for either hypothesis. In the last few years, however, the hypothesis has been developed that catch-up occurs from technical spill-over (broadly defined), and that richer countries generally have more to teach poorer ones than vice versa[16].

There are two important conditions for effective spill-over, however. First, the receptiveness to new ideas, and the ability to adapt them to local circumstances are argued to be related to an economy's stock of available skills, usually measured by various education indicators. The postulated relationship is held to be positive, but with a positive lower bound. That is, if skill levels lie below some minimum level, imitation and adaptation are too weak to permit catch-up - hence the dismal performance among developing countries. Note that if the key to catch-up is a widespread ability to imitate and adapt rather than to innovate de novo, the critical dimension of skill is likely to be a broad average rather than, say, the level of ability of the single brightest entrepreneur as Murphy, *et al* (1991) postulate in their model of endogenous growth. The second condition is that ideas are likely to flow more smoothly between countries that are similar, not least in the composition and level of their human capital.

Baumol, *et al* (1989) consider the role of education in these two dimensions, and with striking results. The inclusion of educational data restored "orderly behaviour" in the catch-up equations at nearly all levels of income. Specifically,

"countries with similar education levels were shown quite consistently to be converging among themselves, in terms of (real GDP per head), though not catching up with countries whose educational levels were higher". Moreover, the statistical relationship was much stronger using enrolment in secondary education than using that in primary or tertiary education.

Baumol *et al's* results are corroborated in a slightly more formal model by Mankiw *et al* (1990). They add human capital to a traditional Solovian growth model, and find that it improves the model's ability to explain cross-country differences in per capita growth rates and reveals catch-up effects not evident in simpler models. The accumulation of human capital is measured by the ratio of enrolments in secondary education to total labour force. According to their estimates, based on market economies, a 1% increase in this ratio (<u>not</u> a 1 percentage point increase) raises steady-state income per head by 0.7%.

Turn now to Figure 5 which reports enrolments in secondary education for 1986 or thereabouts, taken from The World Bank's <u>World Development Indicators, 1989.</u> Within each of the six groups, countries are ranked by order of GNP per head, except for Eastern Europe (group VI) for which those data are so doubtful; the groups are also conjoined broadly in income order. The figure leaves a clear impression of the link between education and affluence[17]. More relevant from our view-point, it further suggests that the Eastern European countries are more akin to the

industrial countries than to any other group. The very low observation in group VI pertains to Czechoslovakia (39%), and may be erroneous. Otherwise the bulk of the Eastern countries rank along with West Germany, Sweden and the UK in this critical aspect of economic potential - see Table 12 which identifies the countries in groups V and VI.

FIGURE 5 ABOUT HERE
TABLE 12 ABOUT HERE

Of course, Eastern European incomes lag far behind those of the comparable group, and will probably take decades to catch up. Baumol *et al* do not estimate speeds of convergence directly but their results suggest that, given education levels, every $1,000 difference in two countries' initial incomes per head (in 1950) raised the poorer's growth rate over the period 1950-81 by 0.8% per annum above the richer's. In today's prices (four times higher than 1950's according to US wholesale price inflation) this would suggest approximately an extra 1% p.a. on the growth rate for every $5,000 difference in income, which suggests that Eastern Europe might grow at some 2% faster than the EC (average per capita incomes being roughly $6,500 and $16,500 respectively). At this rate it would make up half the income discrepancy in about 30 years.

Mankiw *et al* (1990) approach to catch-up is quite different. They estimate that a country might make up slightly below 2% of the gap between its actual and its potential income in any year. (The latter depends on savings behaviour a well as on technology and education.) This is significantly below the convergence

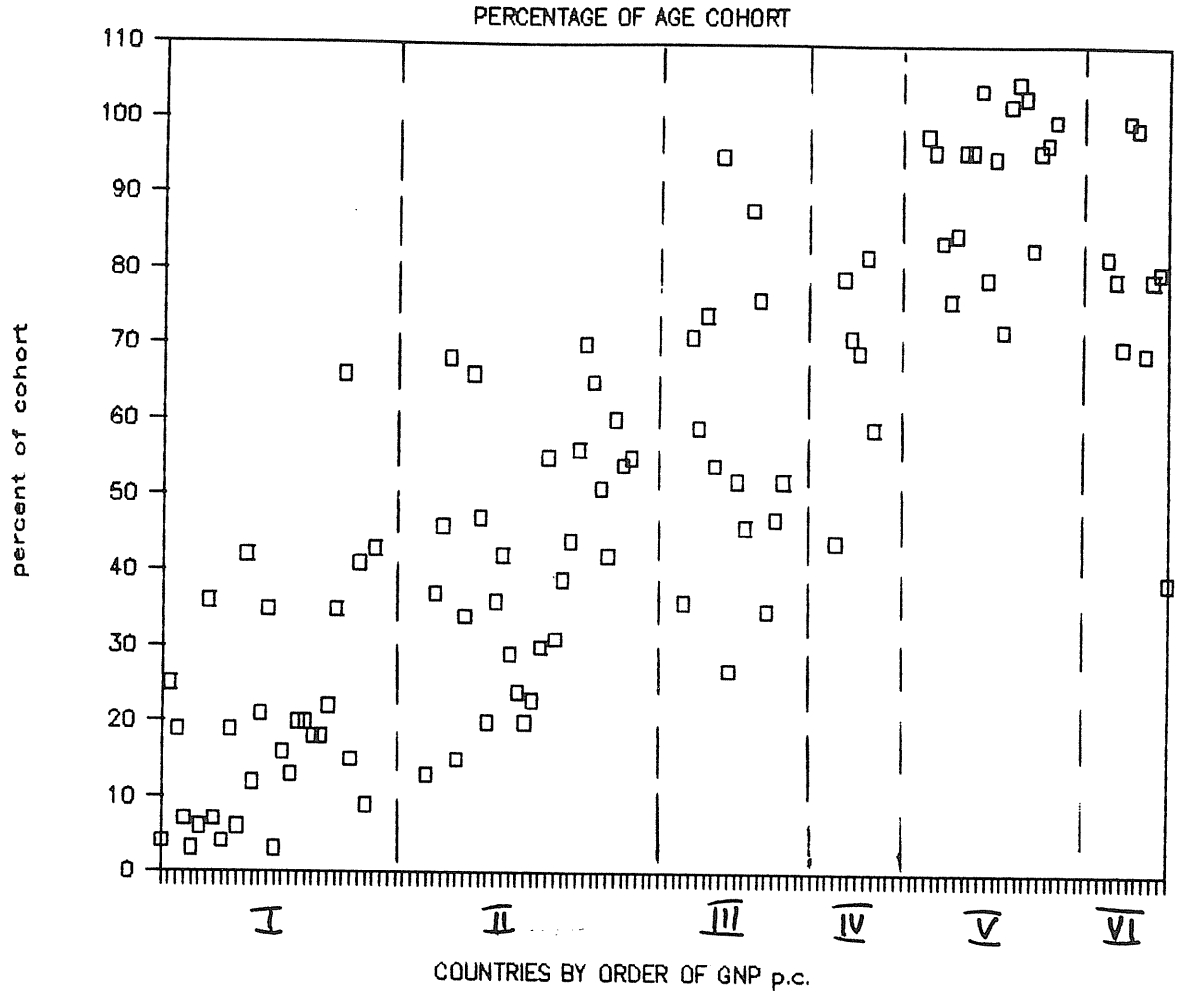
TABLE 12

ENROLLMENTS IN SECONDARY EDUCATION, 1986
percentage of cohort

OECD	EASTERN EUROPE (*)
69% - 85%	
Austria	Albania
Germany, Fed. Rep.	GDR
Italy	Hungary
New Zealand	Poland
Sweden	Romania
United Kingdom	Yugoslavia
95% - 105%	
Australia	Bulgaria
Belgium	USSR
Canada	
Denmark	
Finland	
France	
Ireland	
Japan	
Netherlands	
Norway	
Spain	
United States	

(*) Czechoslovakia reports enrollments of 39%

ENROLLMENT IN SECONDARY EDUCATION, 1986



Definitions of groups:

I Low-income countries

II Lower-middle income countries

III Upper-middle income countries

IV High income countries regarded by the UN or by their own authorities as developing

V Industrial countries

VI Eastern Europe and the Soviet Union

Source: World Bank, World Development Indicators, 1989 and 1988.

speeds usually provided by Solovian models because by including human capital, Mankiw *et al* imply that most economies have far higher capital stocks than is traditionally allowed for. Hence in their model a particular savings rate implies a slower growth rate in total capital stock than is usually presumed[18]. Now if we believe that Eastern Europe already has the human capital stock (essentially unused during communism), savings can be devoted solely to physical capital, and Eastern Europe would catch up faster than the average developing country. On the other hand human capital depreciates, and so even putting aside any investment necessary to update skill levels, merely maintaining them will draw off a large share of savings. Hence net investment (savings less depreciation) will still be lower in this model than in a more traditional one.

Overall then, catching up still looks likely to be long-lived. On the other hand the data reported here, coupled with the results of Baumol *et al* and Mankiw *et al*, offer an optimistic prognosis of Eastern Europe's fundamental ability to do so. In terms of international trade, this evidence further reinforces the view that Eastern European comparative advantage will lie in relatively sophisticated goods.

5. CONCLUSION

It is widely accepted that international openness plays an important role in economic development. It will be even more important for the emergent Eastern European economies as they try

to throw off the yoke of (mis-)managed trade and production. International trade has the potential to generate income, introduce new technologies and organisational skills, stimulate competition, inform tastes and broaden horizons, and probably is a prerequisite for a pluralist society. Eastern European governments now show an appreciation of these benefits, but trade always involves two partners. The changes implicit in Eastern liberalisation are dramatic, even for Western nations, which face potential increases in their trade of some 20% and increased competition - in agriculture and labour-intensive goods in the short and medium runs and in more sophisticated goods in the longer run. Unfortunately the impressive determination for change in the East is not matched by similar examples of determination and statesmanship in the West.

The association agreements to open EC markets to the East - the first of which was signed in November 1991 - are considerably devalued by the EC's prevarication over agriculture and textiles and clothing. The latter are subject to long transitional arrangements while the former remain subject to formal and informal controls. And if agriculture and textiles remain blocked through quantitative restrictions, what are the prospects for other goods which Eastern countries might come to produce?

The EC's armoury of anti-dumping duties and voluntary export restraints - especially as applied to client states[19] - is quite sufficient to stifle the East's incentives to invest in the production of new goods. Having encouraged Eastern Europe to

liberalise, Western Europe is sill in danger of thwarting one of the necessary conditions for that liberalisation to pay a full dividend. The EC bears a special responsibility in this regard; its interventionist stance on international trade suggests to the emerging economies that resistance to change and the management of market forces are acceptable after all. If pandering to special interest groups among producers prevents the EC from opening its markets fully, EC countries will not only fail to reap the benefits that liberalization offers to their own citizens but also heap difficulties on the consumers and producers of Eastern Europe.

Moreover, while attention is currently focused on the EC as the principal partner and closest neighbour of Eastern Europe, other western countries, especially USA, also have opportunities in and responsibilities for the liberalisation. They too should respond positively and openly to the new markets and production that are emerging in the East. Opening up international trade takes political courage, but the alternatives to giving Eastern Europe market access are likely to be more problematic in the long run. Closed western markets will induce increased pressure for (illegal) emigration from East to West and greater political tensions in the East; the latter in turn could engender a political hostility among the populations of Eastern Europe, and call forth authoritarian regimes hostile to the market economy and unable to tackle the pressing problems of efficiency, stability and equity in Eastern Europe. In that scenario we shall all lose.

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APPENDIX

PRODUCTIVITY IN EAST EUROPEAN AGRICULTURE[20]

This appendix considers the possibility that the liberalisation of the East European economies will generate a significant increase in productivity in their agricultural sectors.

Agricultural conditions and organisation vary across Eastern Europe, but there is widespread perception that agriculture is inefficient in every part of the region. For example, the collectivisation of agriculture in Czechoslovakia and the USSR undermines individual incentives, while in Poland, where private ownership prevails, the under-capitalisation of peasant agriculture and the inefficiencies of the distribution of both inputs and outputs keep yields very low. Within the Eastern bloc, only Hungary, which appears to have a moderately well-managed state agricultural sector, comes close to achieving its potential.

In CEPR (1990) we approached Eastern agricultural prospects in two ways: first by comparing factor inputs between East and West and second by comparing the evolution of Eastern and Western agriculture since the (relatively undistorted) 1930s. In this section we explore the historical comparison in more detail. Table A.8 presents data on the proportionate increases in the yields of certain crops and in certain agricultural inputs between the 1930s and 1985. It suggests that Soviet arable

agriculture has fared poorly in terms of yields - even relative to the 1930s by which time collectivisation had already taken some toll. It is plain, however, that at least part of the poor performance is explained by the low growth of mechanisation.

Turning to Eastern Europe proper, the story is rather different; arable yields have developed almost in line with those in Western Europe, aided by a slightly faster increase in mechanisation. Labour inputs have not declined as rapidly as in the west, however, which suggests that total factor productivity has not kept pace with western levels. Certainly the table suggests no evidence that Eastern Europe has advanced more rapidly than Western Europe. Since we shall go on to argue that in the 1930s the East was already substantially less efficient than the West for social and economic rather than natural reasons, we believe that the data in the table identify scope for a substantial catch-up in agricultural productivity.

Eastern Europe lagged the West in a number of important respects during the 1930s, all of which help to explain its poor agricultural performance. At the broadest level, per capita incomes were substantially lower in the East - all below $112 per annum in 1938 except for Czechoslovakia at $176, compared with $236 in France and $337 in (combined) Germany (Kaser and Radice, 1985, p532). These differences were reflected in illiteracy rates - exceeding one quarter, except for Hungary (8.8%) and Czechoslovakia (4.1%), compared with 6% in France and 5.6% in Belgium at the higher end of the western range and 0.1% in

Sweden (Kaser and Radice, 1975, p93). As Schultz (1964) has shown, basic literacy offers very high rates of return in agriculture (as in other sectors) and so these differences are potentially very significant.

On a specifically agricultural level, both the quantity of arable land in use and the agricultural labour force were beginning to decline in the West during the 1930s, but were growing in the East. This both reflected and engendered different incentives for mechanisation and modernisation in the two areas. Indeed, with low levels of industrialisation and urbanisation, and a rapid rate of population growth, agriculture was used as a sink for surplus labour in the East. Several commentators have estimated that perhaps one-quarter of the rural labour force was surplus to requirements - Kaser and Radice (1975, p185). These circumstances seem to indicate serious under-capitalisation, but given the dispossession of the major land-owners after the first world war there was little chance of developing the surpluses necessary to address the problem. Associated with these difficulties was the lack of mechanisation (large amounts of arable land per tractor by West European standards) and low fertiliser use - 2 kg of nutritive material per hectare in Hungary and Poland in 1936-38 (the highest in Eastern Europe) compared with 100-300 kg in the West.

A more direct view of the costs of mismanagement in East European agriculture comes from Czechoslovakia. Czechoslovakia was the most advanced and most westernised of the Eastern bloc countries

during the 1930s. As noted above it had a moderately high income per head and high literacy rates, and it was the fourth largest producer of industrial goods in all of Europe. In agriculture Czechoslovakia pursued a western-style policy of agricultural support from the early 1930s and showed the highest crop yields in the region in 1935-38 (Kaser and Radice, 1975, p138). Indeed, by the late 1930s there was little to choose between Czechoslovakian and Western European agriculture.

After the succession of the Communists, Czechoslovakian agriculture was collectivised and rapidly started to diverge from western standards of performance. Czech output stagnated between 1934-8 and 1956 while western output increased by 25%. Part of the difference was explained by Czechs using fewer inputs, but according to Lazarcik (1963) total factor productivity fell by 4% in Czechoslovakia but rose by 12% in the west. Lazarcik argues that such differences are due almost solely to the different organisational structures in the East and in the West. Policy may also have had a role, but either way, the analysis suggests that a significant under-performance relative to what might have been achieved had emerged by 1956. On the other hand, it is also possible that the greater degree of centralisation in Czechoslovakia made its performance atypically bad, so we are cautious about generalising such a rapid rate of relative decline to other countries.

Although the circumstantial evidence is powerful it is still very difficult to estimate the possible improvements in productivity

that will be achieved in Eastern Europe[21]. Cochrane (1990) assumes that Poland could make up half the discrepancy between its yields and that of selected western comparators. This generates increases of 0% for corn (a minor crop), but 15%-30% for other crops. Liefert *et al* (1990) apparently adopt a similar procedure for the USSR - generating 10% increases for grains, 15% for sugar and oil-seeds and 20-25% for meats. CEPR (1990) assumes that Eastern Europe and the Soviet Union could make up two-thirds of the excess growth of western over eastern yields since the 1930s after allowing for the effects of western agricultural policy and acreage reductions. This too suggests 30% increases.

Table A.9 presents comparative yield data for the major grains. It suggests that catch-ups of 15% for Eastern Europe and 20% for the USSR are perfectly reasonable. It is more difficult to assess productivity in meat production, but anecdotal evidence suggests that there is at least as much scope for improvement as in grains, and therefore we adopt the same figures.

APPENDIX TABLES

Appendix Table A.1

Sample Countries

Industrial Countries (19)	Developing Countries (57)				
Industrial	Africa	Asia	Europe	Middle East	West Hemisphere
Canada	Algeria	Burma	Greece	Egypt	Argentina
U.S.A	Cameroon	HongKong	Portugal	Israel	Brazil
	Congo	India	Turkey	Kuwait	Chile
Austria	Ethiopia	Indonesia	Yugoslavia	Jordan	Colombia
Belgium-Luxmburg	Ghana	Korea		Libya	Costa Rica
Denmark	Guinea	Malaysia		Yemen,PDR	Dominican Rep
Finland	Kenya	Pakistan			Ecuador
France	Liberia	P.N.Guinea			Guatemala
Germany,Fed.Rep	Maturitius	Philippines			Haiti
Ireland	Morroco	Singapore			Jamaica
Italy	Mozambique	Sri Lanka			Mexico
Netherlands	Nigeria	Thailand			Nicaragua
Norway	Senegal				Peru
Spain	Somalia				Trinidad&Tobago
Sweden	S.Africa				Uruguay
Switzerland	Sudan				Venezuela
United Kingdom	Tanzania				
	Tunisia				
Australia	Zimbabwe				
New Zealand					
Japan					

Table A.2

East European Countries' Exports to Selected Countries, 1985
(Actual and Potential)

$ billions

	France	Germany	Italy	UK	Japan	USA
Bulgaria	0.05	0.15	0.08	0.03	0.02	0.04
	0.52	0.65	0.46	0.39	0.34	1.17
Czechoslovakia	0.15	0.78	0.20	0.14	0.05	0.08
	2.61	4.76	2.17	1.85	0.80	2.88
E.Germany	0.27	3.55	0.12	0.24	0.04	0.09
	3.43	10.90	2.60	2.61	0.90	4.66
Hungary	0.12	0.68	0.25	0.12	0.03	0.20
	1.12	1.48	1.16	0.80	0.44	1.62
Poland	0.27	0.96	0.28	0.38	0.06	0.23
	1.64	4.64	1.95	1.83	0.85	4.30
Romania	0.30	0.84	0.84	0.30	0.06	0.65
	1.05	1.35	0.97	0.80	0.60	2.10
Total Excl	1.14	6.97	1.76	1.20	0.26	1.28
USSR	10.38	23.77	9.31	8.27	3.94	16.73
USSR	2.27	4.26	2.74	0.85	1.31	0.40
	10.05	25.64	8.11	7.98	5.49	27.25
EE and	3.41	11.23	4.50	2.06	1.57	1.68
USSR	20.43	49.41	16.73	16.26	9.43	43.98

Note: 1.The first line is actual trade ,the second one is potential

2. E.Germany export data with W.Germany are collected from PlanEcon

Source: IMF "Direction of International Trade" 1989

Table A.3

East European Countries' Imports from Selected Countries, 1985
(Actual and Potential)

$ billions

	France	Germany	Italy	UK	Japan	USA
Bulgaria	0.18	0.62	0.19	0.16	0.14	0.11
	0.57	0.73	0.47	0.41	0.38	1.35
Czechoslovakia	0.15	0.90	0.20	0.15	0.06	0.07
	2.72	5.03	2.15	1.84	0.84	3.16
E.Germany	0.23	3.52	0.12	0.09	0.15	0.08
	3.48	11.23	2.52	2.54	0.99	4.99
Hungary	0.15	0.94	0.23	0.16	0.14	0.25
	1.21	1.62	1.19	0.82	0.49	1.83
Poland	0.20	0.97	0.25	0.24	0.07	0.24
	1.83	5.25	2.07	1.96	0.97	5.05
Romania	0.12	0.29	0.15	0.16	0.09	0.27
	1.19	1.55	1.05	0.70	0.87	2.51
EE Excl	1.03	7.26	1.12	0.95	0.66	1.01
USSR	10.99	25.40	9.46	8.28	4.54	18.90
USSR	2.07	3.96	1.70	0.76	3.05	2.67
	11.02	28.56	8.49	8.36	6.14	31.52
EE and	3.10	11.22	2.82	1.71	3.71	3.68
USSR	22.01	53.96	17.96	16.63	10.68	50.42

Note: 1. The first line is actual trade,the second one is potential

2. E.Germany import data with W.Germany are collected from PlanEcon

Source: IMF "Direction of International Trade" 1989

Table A.4

Price elasticities: Eastern European Supply of Agricultural Commodities

		Price							Aggregate elasticity without modification	Aggregate elasticity with modification
		Rice	Corn	Wheat	Sugar	Milk	Beef	Pork		
Quantity	Rice	0.75	-0.06	0.00	-0.01	0.00	0.00	0.00	0.52	0.68
	Corn	-0.01	0.80	-0.16	0.00	0.00	0.00	0.00	0.27	0.63
	Wheat	0.00	-0.08	0.75	0.00	0.00	0.00	0.00	0.47	0.67
	Sugar	-0.04	0.00	0.00	0.28	0.00	0.00	0.00	0.24	0.24
	Milk	0.00	0.00	0.00	0.00	0.85	-0.06	0.00	0.65	0.79
	Beef	0.00	0.00	0.00	0.00	0.01	0.72	-0.05	0.53	0.68
	Pork	0.00	0.00	0.00	0.00	0.00	-0.04	1.12	0.99	1.08

Table A.5 -- Productivity and income shift in Eastern Europe with unchanged trade regimes all around

	CHANGE IN PER CENT				CHANGE IN METRIC TONS[3]				Change in world market price, percent
	Price to farmers	Production	Consumption	Net export	Price to consumers	Production	Consumption	Export	
EASTERN EUROPE									
Wheat	-2	14	1	115	-2	5,990	443	5,547	-4
Dairy	-1	14	4	142	-1	7,496	1,953	5,543	-4
Beef[1]	0	15	3	127	0	437	79	358	-1
Pork[2]	0	15	3	103	0	1.418	263	1,155	-1
EUROPEAN COMMUNITY									
Wheat	-1	0	0	1	0	430	148	282	
Dairy	-1	-1	1	-12	-1	-931	696	-1,627	
Beef	0	0	0	6	0	21	-15	36	
Pork	-1	-1	1	-26	-1	-199	162	-361	

1 Includes beef and veal

2 Includes pork, poultry, lamb and mutton

3 For dairy, milk equivalents

Table A.6 -- Liberalization of OECD and Eastern European trade in agriculture and assuming productivty and income growth in Eastern Europe

	CHANGE IN PER CENT				CHANGE IN METRIC TONS[3] (000s)				Change in world market price, percent
	Price to farmers	Production	Consumption	Net export	Price to consumers	Production	Consumption	Export	
EASTERN EUROPE									
Wheat	32	41	-2	387	32	17.805	-776	18,581	13
Dairy	14	27	0	373	14	13,812	19	13.793	76
Beef[1]	34	41	-9	510	34	1,196	-248	1,445	47
Pork[2]	37	62	-18	679	37	6.041	-1,553	7,595	9
EUROPEAN COMMUNITY									
Wheat	-32	-24	13	-120	-35	-17,931	7,129	-25,060	
Dairy	-13	-6	7	-125	-15	-8,662	8,298	-16,960	
Beef	-42	-41	42	-1,342	-43	-3,739	3,652	-7,392	
Pork	-15	-12	13	-323	-15	-2,085	2,461	-4,546	

1 Includes beef and veal
2 Includes pork, poultry, lamb and mutton
3 For dairy, milk equivalents

Appendix Table A.7 Data on education levels and export performance

	Mean science score at		Revealed comparative advantage in engineering exports			
	Level-2	Level-3	hi-tech	adv-tech	mid-tech	low-tech
AUSTRALIA	178	207				
CANADA	186	193	55	79	250	52
ENGLAND	167	246	120	121	59	107
FINLAND	185	200	34	64	38	123
HONG KONG	164	251	133	50	23	43
HUNGARY	217	244				
ITALY	167	174	51	68	53	138
JAPAN	202	227	141	120	187	99
NORWAY	179	211	50	74	27	194
POLAND	181	210				
SINGAPORE	165	231	267	107	64	75
SWEDEN	184	228	70	97	111	128
USA	165		218	148	79	82

Appendix Table A.8

CROP YIELDS AND INPUTS IN 1985 AS PERCENTAGE OF 1938.

	YIELDS				INPUTS(a)		
	WHEAT	BARLEY	MAIZE	RYE	TRACT/LAND	LABOUR	LAND
ALBANIA	2.65	2.65	2.94	0.84			1.68
BULGARIA	2.95	2.18	4.60	1.70	12.66	0.20	0.89
CZECOSLOVAKIA	2.91	2.64	2.58	2.16	7.92	0.38	0.91
HUNGARY	3.46	2.85	3.17	1.73	4.81	0.39	0.87
POLAND	2.35	2.10	3.02	1.93	68.38	0.48	0.86
ROMANIA	2.87	4.69	4.42	0.00	16.05	0.32	1.07
YUGOSLAVIA	3.16	2.78	2.34	2.09	93.20	0.51	0.91
GDR	2.13	2.11	1.54	2.13	5.50	0.54	0.93
TOTAL	2.90	2.73	3.71	2.01	22.26	0.43	0.92
USSR	1.77	1.73	2.71	1.28	6.43	0.35	1.01
AUSTRIA	2.93	2.59	3.26	2.61	34.99	0.25	0.84
FRANCE	3.85	3.49	4.03	2.85	15.05	0.23	0.83
GFR	2.76	2.37	2.22	2.31	15.95	0.28	0.85
ITALY	1.95	3.16	3.39	1.88	44.46	0.25	0.55
BEL-LUX	2.37	2.11		1.77	238.87	0.15	0.70
NETHERLAND	2.19	1.81	6.67	1.67	14.55	0.46	0.83
UK	2.66	2.38		3.99	17.68	0.55	0.96
SWITZERLAND	2.31	2.64	2.84	2.49	6.92	0.44	0.91
SWEDEN	2.07	1.70		1.81	4.19	0.21	0.79
TOTAL	3.12	2.63	3.35	2.34	17.86	0.27	0.77
AUSTRALIA	1.73	1.54	2.02	0.55	0.67	0.86	2.66
CANADA	2.46	2.46	2.44	2.64	1.11	0.49	1.19
USA	2.90	2.37	5.29	2.35	1.29	0.35	1.02

(a) Data for tractors per unit of land ~~and labour~~ refer to 1940-50 averages

APPENDIX TABLE A.9

COMPARATIVE CEREALS YIELDS, 1985

	WHEAT	BARLEY	MAIZE	RYE
EASTERN EUROPE	3869	3799	5247	2677
WESTERN EUROPE	5212	4787	6700	4021
RATIO W/E EUROPE	1.35	1.26	1.28	1.50
USSR	1647	1661	2905	1266
USA	2519	2744	7406	1806
RATIO USSR/USA	1.53	1.65	2.55	1.43

UNITS: KILOGRAMS PER HECTARE

Source FAO Production Yearbook (1985)

[1] The model used in this section was developed by Zhen Kun Wang.

[2] The name gravity model arises from the model's close similarity to the equation in physics which relates the attraction between two bodies to their masses and their distance apart.

[3] The principal omissions are oil exporters, Eastern Europe (except Yugoslavia) and China.

[4] Very small trade flows are recorded as zero in DIT, which creates a problem in log-linear equations. Our solution here is to omit all flows recorded as zero - essentially estimating the size of a trade flow conditional on its being large enough to be recorded. Wang and Winters (1991) consider alternative responses.

[5] For continental Africa, road communication is poor, so that although the road distances may be shorter than the nautical distances, their cost is probably higher. Hence sea distance is used for African counties.

[6] They may, however, gain terms of trade advantages as they receive revenues that would otherwise have accrued to EC coffers.

[7] This choice of year leads us to treat East and West Germany as separate countries.

[8] Imagine an item traded among Eastern-bloc countries for 1 transferable rouble. If it were exported by Poland it would be valued at 201 zloty (201 zloty per rouble) and hence $0.46 (434.6 zloty per dollar). If it were exported by Bulgaria, however, the sequence would be 1.3 leva (1.3 leva per rouble) and $1.26 (1.028 leva per dollar).

[9] These figures may be under-estimated, because Japan has a particularly large trade potential with nearby the areas of Russia which is not adequately accounted for by the gravity model.

[10] Algebraically, Collins and Rodrik estimate the following equation $X89_{ij} = \gamma + \lambda\ X28_{ij} + \beta_j$ where i are sample countries, j partner countries, $X89_{ij}$ j's share of i's exports in 1989, and λ, β_j, λ parameters.

[11] Our results for trade shares approach Collins and Rodrik's if we allow, as they implicitly do, for preferences with the EC. But in that case our total volumes of trade exceed theirs.

[12] Per Lundsjo undertook the modelling work for this section.

[13] GNP can change for two reasons, first productivity growth in the economy, and second, an improvement in the terms-of-trade. What we now observe in Eastern Europe is a temporary, we hope, fall in GNP during the first phase of the transition.

[14] This sub-section draws heavily on The International Encyclopedia of Education (1985).

[15] We experimented with transformations of both data series; adjusting the level-2 data to account for the time between the testing age and the end of compulsory schooling and the level-3 data for the proportion of the school population studying science at post-compulsory levels. The uncertainties surrounding the data used in the adjustments, however, appeared to detract from the quantity of the data, and hence we support results based only on the crud data.

[16] Arguments have also been made that catch-up is a statistical artefact. Countries with low incomes at the start of a period will appear to catch-up either if all countries are converging onto a single world mean income of if incomes are measured with error. In the latter case an artificially low measured starting income will tend to suggest high growth over the following period if the final income is not subject to the same negative error of measurement. To a large extent, Baumol *et al's* statistical analysis is careful enough to dismiss such fears.

[17] There is clearly like to be some reverse causation here - i.e. from GNP p.c. to enrolments - but the plausibility of the theory leaves at least the authors convinced that education boosts GNP p.c.

[18] If the physical capital stock and the human capital stock each equalled annual GDP and net investment was 10% of GDP, analysts considering only physical capital would find capital-deepening occurring at 10% p.a. while those considering both capitals would fix it at 5% p.a.

[19] The Mediterranean and the ACP states, which have special arrangements with the EC, face restrictions to market access in several areas, and the GSP is subject to reservations and safeguards.

[20] We are grateful to Jihe Song for assistance with this section

[21] These productivity changes are additional to any price-induced effects on output, inputs or consumption.