'Modelling the accession of the Central and Eastern European Countries to the EU Single Market.'

T.Huw Edwards, Centre for the Study of Globalisation and Regionalisation, Warwick UK. July 2002.

Work for the EPRIEE European Union Framework 5 Project on Economic and Political Union in an Enlarged Europe.

Abstract.

This paper uses a multi-country, static general equilibrium model to assess the potential benefit to the Central and Eastern European Countries (CECs) of accession to the European Union. Since the Europe Agreements of the 1990s effectively removed formal trade barriers between the CECs and EU except in agriculture and foodstuffs, the trade effects of accession will consist of 1) removal of agriculture and food tariffs, 2) harmonisation of external tariffs and 3) most importantly, accession to the Single Market, with its harmonisation and mutual recognition procedures.

Following Baldwin et al (1998) and LeJour et al (2001), accession to the Single Market is assumed to remove significant resource costs to trade, associated with border costs, retesting costs, difficulties over product standards, labelling, legal compatibility etc. Like the former two studies, this paper assumes that these factors are the main reason for the different country bias comparing trade between EU members and trade with non-members, and that joining the Single Market will effectively remove that bias.Unlike the previous studies, I estimate the bias by fitting equations based on a model-consistent Dixit-Stiglitz framework: this implies resource costs of 7-15% on most products on trade between the EU and CECs could be eliminated by the latter joining the Single Market. This compares with Baldwin's guess of 10% and LeJour et al's slightly smaller figures based on a gravity model.

Initially I run the general equilibrium simulation model in a version with fixed firm numbers in each country. Elimination/harmonisation of remaining tariffs is likely to raise welfare in Poland by 2.4%, less for the other CECs and have no effect on welfare within the existing EU states. Entry to the Single Market looks a far more significant step: after both tariff union and entry to the Single Market total trade volumes between the EU and CECs could rise by 50-100% (much more in some commodities), while welfare gains in the CECs could be of the order of 11.5-20%, larger than the previous two studies have suggested. Welfare gains within the EU are around 0.4% of GDP, with all regions gaining but Germany gaining most. Gains are greater where capital is fully mobile.

However, these results are highly dependent on the assumption that observed country bias really does reflect resource costs to trade, and that these can be eliminated by the Single Market. This is contentious, and will be investigated further in subsequent work.

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Introduction.

This paper represents work in progress towards modelling the costs and benefits of EU enlargement into some or all of the Central and Eastern European Countries (henceforth referred to as CECs). It follows similar studies by Brown et al (1995), Baldwin et al (1997) and, recently, LeJour et al (2001).

The latter two of these studies focused not on the removal of tariffs and formal non-tariff barriers, since these have already been removed by the Europe Agreements (except in agricultural products), but, rather, on a further set of less explicit barriers which exist in trade between nations. These have traditionally been estimated by gravity models, and that is the method used by LeJour et al, who then applied adjustments to trade volumes in their Armington general equilibrium study based upon the gravity estimates. Both LeJour et al and Baldwin et al interpret the dummy in a gravity model which produces higher trade between EU members than between members and non-members as reflecting an iceberg trade cost $\phi_{c,cc,}$ representing unspecified costs connected with different product standards, difficulties on cross-border marketing, country risk etc They then contend that entry into the single market significantly reduces these unspecified costs of trade.

This paper carries out a calibrations, but based on a methodology derived from explicitly applying a differentiated goods model with symmetric competition (Dixit-Stiglitz), rather than a more ad hoc gravity model.

It is shown that these implied total trade costs are significant in almost all cases, outweighing the formal trade barriers. I calculate the ‘gravity dummy equivalents’ of the calibration assuming equal costs in both directions between the EU and CEC regions, and find these results are broadly in line with gravity studies. Finally, some simulations are carried out for the effects of accession of Poland, Hungary and the other CECs (but not the Baltics, due to data difficulties) to the European Union. If we assume entry to the single market really does remove large trade costs, as Baldwin et al assume, then an Armington general equilibrium model predicts even larger potential welfare gains for the CECs than the previous studies: in the order of 15-20%. Welfare in existing EU countries improves only slightly – in line with the results of the other studies, and to be expected given the relatively small size of the accession countries.

Work has still to be completed on simulations using a full Dixit-Stiglitz model framework (where the number of firms in an industry in a country is allowed to vary to bring returns down to normal, rather than firm numbers being fixed as in an Armington framework).

In addition, this study suggests that the way we model the trade effects associated with EU membership in gravity studies may be very significant. The large welfare gains predicted in this first draft (and in the Baldwin and LeJour studies) may well reflect contentious assumptions about the effects of harmonising product standards and trading rules – I intend to look in more depth at alternative assumptions, where harmonisation is not costless.

Background.

While early studies of the economic effects of European enlargement into the former Soviet bloc (eg Brown et al, 1995) concentrated on the effects of removal of tariffs and formal non-tariff barriers (NTBs), such issues are no longer at the centre of the enlargement debate, except in agriculture, since the Europe Agreements have largely removed formal trade barriers.

Nevertheless, later studies (eg Baldwin et al, 1997, or LeJour et al, 2001) assume EU membership for Central and Eastern European Countries (henceforward CEECs or CECs) would still have large effects upon their trade with the EU, due to accession to the single market. It is generally believed that differences in product standards, trade law etc form barriers to trade in many cases larger than formal trade barriers[1]. Baldwin et al assumed rather arbitrarily that joining the single market would mean a reduction in trade costs (real terms costs, assumed to be measured as an iceberg cost – a loss of value of all goods traded between exporting country c and country cc of fraction $\phi_{c,cc}$) of 10 per cent across the board.

The standard justification for the existence of such costs is from the empirical gravity modelling literature. It has long been demonstrated that trade between two countries is usually roughly proportional to the product of the size of their two economies, corrected for distance and formal trade barriers. However, there are some residual differences, which we shall henceforth call *residual country bias* or *residual border effects*. Most notable is home bias: the preference of consumers in one country for produce of that country, rather than any other, which seems empirically to be very strong, even when a country joins the EU's single market. Beyond that is a general bias, to a lesser, but still significant degree, towards produce of other countries within the same trade bloc.

These biases are usually picked up in gravity equations of the form:

$$X_{ijs} = a_s + b_{1s}.D_{EU}{}^{ijs} + b_{2s} d_i j + g_{1s} Y_i + g_{2s} y_i + g_{3s} Y_j + g_{4s} y_j + \sum_d d_{ds} Dd + n_{1s} TM_{ijs} + n_{2s} TE_{ijs} + e_{js}$$

Where all variables are in logs. X_{ijs} is exports from country I to j in industry s, Y is GDP and y is GDP per capita, d is distance between capitals of the countries I and j. Dd is a set of dummies for border effects, with D^{EU} set to 1 if both I and j are EU members, otherwise set to zero. T_{mijs} is the import tariff on imports of s from country I to country j. T_{eijs} is the export tariff levied by country I on country j. For example LeJour et al estimated such a set of equations for a number of European countries, and estimated the European dummies as follows:

[1] McCallum (1995) found a national border effect reducing trade between Canadian provinces and neighbouring US states by a factor of 22 compared to between Canadian provinces.

EU dummies in gravity equations (LeJour et al)

Sector	EU dummy	Trade increase %
Agriculture	1.25 *	249
Raw materials	-0.1	
Food processing	0.66 *	94
Textiles and leather	0.85 *	134
Non-metallic minerals	0.73 *	107
Energy-intensive products	0.13	
Other manufacturing	0.08	
Metals	-0.1	
Fabricated metal products	0.44 *	56
Machinery and equipment	0.31 *	37
Electronic equipment	0.58 *	79
Transport equipment	0.66 *	94
Trade services	0.76 *	113
Transport and communication	0.03	
Financial service	-0.14	
Other services	0.27 *	31

The economic interpretation LeJour et al attach to these dummies stems from the well-known link (following Bergstrand, 1989) with a general equilibrium trade framework based upon an imperfectly competitive framework[2] (though in fact LeJour et al use an Armington rather than Dixit-Stiglitz model for simulations). The rather strong assumption made by both the LeJour et al and the Baldwin et al studies is that this residual border effect of EU membership corresponds to an unspecified set of trade costs (hencforth referred to here as the 'residual border trade cost'), whose assumed removal or reduction by joining the single market is a sizeable source of potential economic benefit for the CEECs. However, it must be stressed that there are plenty of alternative explanations other than iceberg-style trade costs for residual border effects in empirical models (such as differences in consumer preferences – companies producing goods suited, say, to French rather than British taste would be more likely to set up in France rather than the UK).

[2] Though Deardorff (1998) points out that a frictionless Heckscher-Ohlin model and an Armington model (which may be the result of countries specialising on sub-categories within the measured goods categories of a H-O model) will also produce gravity relationships.

Despite these doubts, this paper proceeds, at least initially, upon the assumption that residual border effects do indeed reflect residual trade costs. Nevertheless, the approach here differs somewhat from the gravity approach used by LeJour et al. First of all, in this paper derive border effects by calibrating a theoretical Dixit-Stiglitz model directly on observed trade data, rather than first estimating a gravity equation which, while theoretically of roughly the form produced by a Dixit-Stiglitz model may not actually be fully consistent with the model subsequently calibrated.

Secondly, the calibration exercise calibrates residual border effects for imports and exports between each pair of countries (though 'averages' are then constructed for inter-EU trade using model-consistent CES functions for aggregation). Since gravity studies typically use a much more parsimonious set of dummies (eg just a home dummy and a second dummy if both countries are EU members) they are effectively constraining many residual border effects to be equal – yet just by comparing two different calibrations we show that the choices of which prior restrictions to make on border effects has a potentially very large effect on the putative impact of EU membership on countries' trade patterns. This is perhaps a topic not sufficiently explored in the gravity literature.

The third difference from standard gravity approaches is that more specific account is taken of the importance of output prices in countries (gravity modellers usually ignore this issue completely – or see output prices as being roughly linked to GDP per head, justifying its inclusion as a regressor). While we do not know exactly what the relative costs of production in different countries are (particularly when quality is corrected for) we can calibrate for revealed comparative costs once a certain set of restrictive assumptions has been made about border effects. But the interrelationship between calibrated residual border effects and calibrated revealed comparative advantage is a close one, and different restrictions on border effects will greatly affect our picture of the underlying competitiveness of the CEECs in different industries.

Methodology for estimating border costs.

Appendix I shows the derivation of the equations for estimating comparative costs and assumed border costs of trade in our study, and how they relate to the more orthodox coefficients in gravity studies.

Basically, we estimate the border iceberg cost on trade in good I from country c to country cc, $\phi_{i,c,cc}$using the equation:

$$(1-f_{i,c,cc}).(1-f_{i,cc,c}) =$$
$$\left\langle E_{i,c,cc}.(1+t_{i,c,cc})^{1-s}.(1+t_{i,c,cc})^{-s} \times E_{cc,c}.(1+t_{i,cc,c})^{1-s}.(1+t_{i,cc,c})^{-s} \,\middle|\, H_{i,c}.H_{i,cc} \right\rangle^{1/(1-s)}$$
(1)

Where $E_{i,c,cc}$ is export value of I from c to cc, τ is transport cost, t is the import duty rate, $H_{i,c}$ is consumption of home-produced I in country c and σ is the constant elasticity of substitution.

Data on sales prices of each country's goods at home, P_c, may not be easy to come by (and anyway, prices may not be directly comparable if quality varies). For that reason, it may be better to use a *revealed comparative advantage* approach, and actually incorporate calibration of P_c into the general calibration. This means we are calibrating the model for both prices and residual border costs.

Calibration.

For calibration, we start with equation (1). In the absence of better data, it may well be most sensible to assume initially average firm size is the same across countries: T_c=T_{cc}=T for all c,cc.

If the only unknowns are the residual border trade costs, $\phi_{c,cc}$, then if we assume

$\phi_{c,cc} = 0$ if c=cc

and $\supseteq$0 if c$\neq$cc

we need only fit for the (probable) non-zero elements of ϕ, where c$\neq$cc.

To model the effects of the single market in terms of these border costs, I make the following assumptions about the structure of (non-tariff and non-transport) border costs:

ψ_{ic} = home bias in country c. This cost is applied to import of good I from any other country cc into c (regardless of whether cc and c are both members of the EU's Single Market).

$\varphi_{I,CEC,EU}$ = additional cost for imports from CEC countries to EU members (compared to imports from other EU members). This means that the total border cost for importing from a CEC country to an EU country is:

$\phi_{I,cc,c} = \psi_{ic} + \varphi_{I,CEC,EU}$

$\varphi_{I,EU,CEC}$ = additional cost for importing from the EU to the CEC. The total border cost for imports from the EU to the CEC is therefore:

$\phi_{I,c,cc} = \psi_{icc} + \varphi_{I,EU,CEC}$

$\varphi_{I,ROW,EU}$

$\varphi_{I,ROW,EU}$ additional costs for imports from the rest of the World to either the CEC or EU countries.

To calibrate, we assume $\varphi_{I,CEC,EU} = \varphi_{I,EU,CEC} = \varphi_I$. It is this cost on trade (which we assume to be the same in both directions) between the EU and CEC which is assumed to be removed once the CEC country joins the Single Market.

The Model for simulations

At present, simulations are carried out using an 8 good by 10 country CGE model. Goods are produced using a Cobb-Douglas aggregate of intermediate inputs and 4 primary factors: Unskilled labour, skilled labour, capital and land. Land is fixed sectorally. Both types of labour are mobile between sectors, but not between

countries. For capital, I investigate two variants, one where it is fixed in total within a country, and one where it is internationally mobile[3].
Intermediate inputs and final consumption goods are CES aggregates of home production and imports from various sources. The elasticity of substitution between different sources of a good is set at 4 in all sectors. There are also transport costs (modelled as iceberg costs), iceberg unspecified trade costs (see above) and tariffs, as well as taxes/subsidies on output and use of a commodity.

Firms both at home and abroad are imperfectly competitive (competing with a Dixit-Stiglitz symmetrical CES function), and charge profit markups dependent on their market shares. The number of firms per industry and per country is however assumed to be fixed in the 'Armington' version of the model (whereas the Dixit-Stiglitz version, which is not yet running, will allow firm numbers to vary so that supranormal profit is eliminated).

The top level of the consumption function, where different industries' products are aggregated, uses a Cobb-Douglas structure.

Data.
I use the GTAP version 5 database. This database has harmonised trade and input-output data for regions across the world in 1997. GTAP potentially has a large number of goods and regions, so for practical purposes we aggregate data into 8 goods and 10 regions, chosen for their relevance to the issue of enlargement.

Goods:
AG agriculture, forestry and fishing
OP other primary
FP food processing
IS iron and steel
TX textiles

[3] In the latter case, capital rents are equated across the world at RBW. A country will then pay a rent at this rate to foreigners if it imports capital. This assumption, which follows Fehr et al avoids some of the problems Rodrik notes in the Baldwin et al model's treatment of changing capital stocks.

MH heavy manufacturing

ML light manufacturing

SV services.

Regions*:

PLD Poland

HUN Hungary

OCEC Other CECs (Cz Rep, Slovakia, Slovenia, Romania, Bulgaria)

UK United Kingdom

GER Germany

OEUN Other EU Northern

OEUS Other EU Southern (Italy, Spain, Portugal, Greece)

FSU Former Soviet Union

ODX Other OECD excluding EU and CECs

LDC rest of the world (mostly less developed countries)

*note GTAP version 5 has only 3 CEC regions.

For trade and protection we use 4 principal data series from GTAP for these countries and regions:

VXMD exports at market (ie domestic prices),

VXWD exports at world prices,

VIWS imports at world prices,

VIMS imports at market prices (ie sales prices in the importing country before indirect tax).

The difference between VXWD and VIWS is taken to be the transport cost margin.

VXWD – VXMD is a value for XTAX: net export taxes and subsidies, and the GTAP estimates of the tariff equivalent of some quantitative trade restrictions whose revenue accrues to the exporting country.

VIMS – VIWS is the value for MTAX: net import taxes/subsidies and the tariff equivalent of remaining NTBs.

Correction is made for some data errors in the GTAP Version 5. In particular, I have removed tariffs on trade between the EU and CECs other than in agriculture and food processing, as these had been abolished under the Europe Agreements.

Results of the calibrations for border costs.

Table 1 shows the formal trade barriers (tariffs and tariff equivalent of NTBs) in existence between the EU and CECs in 1997. These are CES weighted averages over the various EU component regions (UK, GER and OEU). As can be seen, imports from the CECs into the EU faced sizeable barriers in agriculture and food processing, but barriers elsewhere had been removed by 1997 under the Europe Agreements.

Table 1:

NET FORMAL TRADE BARRIERS TARIFF EQUIVALENT

INDUSTRY	OCEC INTO EU	EU INTO OCEC	HUN INTO EU	EU INTO HUN	PLD INTO EU	EU INTO PLD
AG	0.178	0.107	0.166	0.177	0.308	0.253
OP	0	0	0	0	0	0
FP	0.329	0.248	0.291	0.272	0.536	0.365
TEX	0	0	0	0	0	0
IS	0	0	0	0	0	0
MH	0	0	0	0	0	0
ML	0	0	0	0	0	0
SV	0	0	0	0	0	0

However, even when country size, transport costs and these formal trade barriers are taken into account, there is still a considerable shortfall in imports compared to domestic produce in all cases: our model attributes this home bias to an iceberg cost of trade, $\phi_{c,cc}$.

The table below shows the calibrated comparative costs and country bias based on the calibration assumptions in this paper. In this case, average ‘excess’ EU bias against CEC goods has been set the same as average CEC bias against EU goods. This corresponds to rather lower levels of comparative costs for CEC producers in almost all industries: this calibration suggests the CECs region are low-cost producers compared to the EU in almost all industries, especially services, agriculture, and light and heavy manufactures. Hungary is low-cost in textiles, while the OCEC region is high-cost in iron and steel. The average iceberg costs of trade in both directions varies from slightly negative (for Polish food processing only) to around 15% for Polish manufactures, 10-13% for other CEC manufactures and 9-14 per cent for Hungarian manufactures. For agriculture they are around 7-10%.

Calibrated relative production prices and home/country bias coefficients.

POLAND

COMPARATIVE COSTS AND RESIDUAL COUNTRY BIAS

INDUSTRY	RELATIVE PLD PRICE	INTER-EU HOME BIAS	EU V PLD	PLDC V EU
AG	-0.412	0.683	0.076	0.076
OP	-0.21	0.5	0.201	0.201
FP	-0.351	0.681	-0.005	-0.005
TEX	-0.297	0.548	0.093	0.093
IS	-0.006	0.556	0.158	0.158
MH	-0.402	0.591	0.135	0.135
ML	-0.405	0.529	0.166	0.166
SV	-0.376	0.821	0.062	0.062

HUNGARY

COMPARATIVE COSTS AND RESIDUAL COUNTRY BIAS

INDUSTRY	RELATIVE HUN PRICE	INTER-EU HOME BIAS	HUN V CEC	HUN V EU
AG	-0.35	0.683	0.098	0.098
OP	-0.495	0.5	0.334	0.334
FP	-0.406	0.681	0.051	0.051
TEX	-0.347	0.548	0.057	0.057
IS	-0.138	0.556	0.185	0.185
MH	-0.452	0.591	0.139	0.139
ML	-0.385	0.529	0.092	0.092
SV	-0.451	0.821	0.062	0.062

OTHER CECs

COMPARATIVE COSTS AND RESIDUAL COUNTRY BIAS

INDUSTRY	RELATIVE OCEC PRICE	INTER-EU HOME BIAS	EU V OCEC	OCEC V EU
AG	-0.359	0.683	0.093	0.093
OP	-0.155	0.5	0.304	0.304
FP	-0.41	0.681	0.064	0.064
TEX	-0.196	0.548	0.081	0.081
IS	0.239	0.556	0.125	0.125
MH	-0.31	0.591	0.109	0.109
ML	-0.344	0.529	0.125	0.125
SV	-0.36	0.821	0.038	0.038

Gravity equivalent.

It is also possible to convert the iceberg trade costs $\phi_{c,cc}$ into equivalent gravity dummies $(\sigma\text{-}1).\ln(1\text{-}\phi_{c,cc})$. The extra dummies for imports from the EU into CECs and from CECs into the EU (which are both zero or negative in almost all cases) are as follows for calibration 3:

GRAVITY DUMMY EQUIVALENTS OF RESIDUAL BIAS

INDUSTRY	OCEC INTO EU	EU INTO OCEC	HUN INTO EU	EU INTO HUN	PLD INTO EU	EU INTO PLD
AG	-1.041	-1.041	-1.109	-1.109	-0.816	-0.816
OP	-2.807	-2.807	-3.305	-3.305	-1.54	-1.54
FP	-0.665	-0.665	-0.521	-0.521	0.049	0.049
TEX	-0.596	-0.596	-0.402	-0.402	-0.694	-0.694
IS	-0.987	-0.987	-1.615	-1.615	-1.32	-1.32
MH	-0.93	-0.93	-1.244	-1.244	-1.199	-1.199
ML	-0.923	-0.923	-0.65	-0.65	-1.304	-1.304
SV	-0.714	-0.714	-1.28	-1.28	-1.26	-1.26

The dummies for trade between the EU and CEC are broadly of a similar order of magnitude to those found by LeJour et al's gravity model study, which estimated an EU trade dummy of 1.25 for much of agriculture and around 0.7 for most industrial sectors[4].

Enlargement simulations.

The simulation runs are carried out on the 'Armington' CGE model, assuming the number of firms per sector in each country does not vary (and so probably producing smaller welfare effects than would be expected if scale and variety effects of altering firm numbers were included).

The first table shows the effects on consumer welfare in each region resulting from 1) customs union (the removal of the remaining tariffs on agriculture and foodstuffs between the EU and CEC regions and harmonisation of the CEC's external tariffs with those of the EU) and 2) assumed abolition of iceberg unspecified trading costs φ_I when countries join the EU single market. These simulations are carried out for cases where capital is immobile between countries and where it is assumed to be mobile.

[4] The reversal of signs in LeJour et al's formulation compared to mine is just due to the set-up of the model.

The table below shows that the customs union has only small welfare effects, though these generally benefit the accession states by 0-2 ½% while having no significant effect on existing EU members. The former effect is not surprising given the fact that most tariffs have already been abolished, while the latter reflects the small size of the CEC economies relative to the existing EU.

Summary of results: change on 1997 base, calculated consumer utility.
Armington model

	1. EU-CEC customs union		2. CEC trade shares shift in line with intra-EU trade	
	a) National capital stocks fixed	**b) Capital mobile internationally**	**a) National capital stocks fixed**	**b) Capital mobile internationally**
Poland	1.87%	2.44%	15.27%	19.39%
Hungary	0.17%	0.17%	14.62%	17.56%
Other CEC	1.03%	1.21%	11.46%	13.25%
UK	-0.01%	0.00%	0.16%	0.14%
Germany	0.01%	0.00%	0.64%	0.71%
Other EU North	0.00%	0.00%	0.42%	0.44%
Other EU South	0.01%	0.00%	0.37%	0.38%
EU total	**0.01%**	**0.00%**	**0.42%**	**0.44%**
Europe total	**0.06%**	**0.06%**	**0.94%**	**1.09%**
Former Soviet Union	0.07%	0.08%	0.04%	0.09%
Other OECD	0.00%	0.00%	0.00%	0.00%
LDCs	0.00%	-0.01%	0.03%	0.01%
Global total	**0.02%**	**0.02%**	**0.26%**	**0.29%**

Under 2) the CEC trade shares with the EU, and the EU trade shares with the CEC are increased to reflect the supposed removal of trade costs when the CEC countries join the single market. Since it is assumed these costs are real resource costs, it is possible in this case for all countries to gain, and this does indeed seem to be the case. The biggest beneficiaries are the CEC countries, where welfare rises by 10-20% compared to 1997 base. Gains to the existing EU members are small, typically around ½%. While Germany gains most, even the poorer EU countries in the South experience gains of 0.4%, so that the benefits of expansion of trade outweigh the cheap-wage competition effects even for these countries. And the Former Soviet Union and LDCs also see small welfare gains, so that trade diversion effects are outweighed for them by the effects of the overall expansion of the EU and CEC economies.

The next table shows the change in trade volumes: these are typically of the order 50-100% between the EU countries and CECs on accession.

Changes in trade volumes with trade share shifts and mobile capital assumed

Total trade volumes	**Before**	**After**	**% change**
Pld to EU	4.98	9.12	83.35%
Hun to EU	2.62	4.34	65.48%
OCEC to EU	6.05	9.81	61.97%
EU to Pld	1.88	3.77	100.44%
EU to Hun	1.45	2.20	51.03%
EU to OCEC	3.56	5.50	54.52%

Output by industry shows that gains in output are spread widely across all industries in the CEC region, though the biggest gains are to agriculture, food products and manufactures. Within the EU there appear to be few losers, though agriculture and heavy manufactures decline marginally in the UK.

Change on Base
KEY VARIABLES
OUTPUT BY COUNTRY AND INDUSTRY

INDUSTRY	**AG**	**OP**	**FP**	**TEX**	**IS**	**MH**	**ML**	**SV**
PLD	17.07%	-1.66%	19.52%	10.15%	9.40%	16.51%	26.28%	13.25%
HUN	11.35%	9.08%	18.63%	18.36%	12.80%	26.61%	24.15%	11.76%
OCEC	13.72%	0.85%	18.54%	8.54%	7.75%	12.49%	23.10%	7.33%
UK	-0.03%	0.25%	0.07%	0.45%	0.67%	-0.03%	0.03%	0.07%
GER	0.95%	0.68%	0.72%	2.03%	1.41%	0.90%	0.86%	0.47%
OEUN	0.41%	0.96%	0.49%	1.02%	1.35%	0.68%	0.37%	0.32%
OEUS	0.59%	0.33%	0.30%	0.62%	0.97%	0.16%	-0.11%	0.21%
FSU	0.76%	0.36%	1.23%	-0.22%	-0.89%	-0.15%	-0.15%	0.01%
ODX	-0.07%	-0.07%	-0.02%	0.10%	-0.03%	-0.13%	-0.22%	0.00%
LDC	-0.02%	-0.03%	0.05%	-0.15%	0.15%	0.03%	-0.06%	0.01%

Output prices in the EU generally fall as a result of the saving in costs of inputs (the unskilled wage in Germany is set to 1 in this model, to act as a numeraire). However in Poland output prices generally rise (and the same is true to a lesser degree of some sectors in other parts of the CEC region) as prices rise towards Western European levels.

OUTPUT PRICE BY COUNTRY AND INDUSTRY

AG	AG	OP	FP	TEX	IS	MH	ML	SV
PLD	5.20%	3.39%	6.29%	1.07%	3.13%	4.57%	5.44%	3.89%
HUN	-2.74%	7.07%	-3.07%	-1.31%	2.32%	3.26%	1.01%	1.42%
OCEC	2.71%	1.01%	3.01%	-0.33%	-0.25%	1.28%	0.99%	2.22%
UK	-0.79%	-0.49%	-0.85%	-0.71%	-0.69%	-0.72%	-0.79%	-0.55%
GER	-0.82%	-0.40%	-0.82%	-0.66%	-0.53%	-0.91%	-0.92%	-0.49%
OEUN	-0.78%	-0.36%	-0.88%	-0.76%	-0.75%	-0.91%	-0.90%	-0.51%
OEUS	-0.67%	-0.55%	-0.89%	-0.77%	-0.58%	-0.80%	-0.88%	-0.51%
FSU	-0.10%	-0.12%	0.09%	-0.31%	-0.20%	-0.15%	-0.23%	-0.18%
ODX	-0.48%	-0.46%	-0.52%	-0.57%	-0.59%	-0.54%	-0.54%	-0.47%
LDC	-0.47%	-0.44%	-0.55%	-0.51%	-0.61%	-0.57%	-0.60%	-0.46%

The table of changes in factor returns indicates that relative skilled/unskilled wages do not change greatly in any country, though there are sizeable gains to both types of labour in Poland in particular. The wages quoted are all relative to the German unskilled wage: the slight wage falls in some EU countries are only relative to this (consumer goods prices fall more sharply). The lack of distributional changes between types of labour may partly be because of the Cobb-Douglas production function structure, and partly because the presence of a fixed factor (land) in two sectors absorbs much of the effects of changes in output prices.

Changes in factor returns with trade share shifts and mobile capital assumed.

	Unskilled	Skilled	Capital	Land Ag	Other Prim
PLD	18.95%	18.25%	-0.29%	23.16%	1.68%
HUN	14.71%	14.15%	-0.29%	8.30%	12.70%
OCEC	12.36%	11.08%	-0.29%	16.80%	1.57%
UK	-0.51%	-0.50%	-0.29%	-0.82%	-0.24%
GER	0.00%	-0.01%	-0.29%	0.11%	0.21%
OEUN	-0.23%	-0.22%	-0.29%	-0.37%	0.48%
OEUS	-0.34%	-0.34%	-0.29%	-0.09%	-0.16%
FSU	-0.12%	-0.16%	-0.29%	0.66%	0.25%
ODX	-0.54%	-0.54%	-0.29%	-0.55%	-0.53%
LDC	-0.47%	-0.46%	-0.29%	-0.49%	-0.47%

Cautions.

There are, however, a number of cautions about this approach which need to be borne in mind.

1. There is considerable room for uncertainty over the comparative costs of production of different industries in different regions, and over the associated residual country biases, interpreted as iceberg trade costs $\phi_{c,cc}$, depending on the prior assumptions made in order to carry out the calibration (ie that $\varphi_{I,CEC,EU} = \varphi_{I,EU,CEC} = \varphi_{I}$).

2. It is probable that these prior assumptions are also important in gravity studies. Gravity modellers typically measure residual country bias with a set of trade dummies (eg a dummy set to 1 if both countries are members of the EU and 0 otherwise). The number of these dummies is typically much less than the number of calibrated $\phi_{c,cc}$ coefficients in our study, meaning that the gravity modellers are making far more restrictions on the relative sizes of different country bias effects.

3. Whether accession to the EU would in fact lead to the elimination of the fitted 'bias' against CEC imports into the EU compared to the produce of other EU countries is not certain. Indeed, gravity studies of the single market (Brenton and Vercauteren 2001) cast doubt on the effects to date of institution of the single market.

4. It is possible that the use of transport costs alone may underestimate the effects of distance upon trade (a weakness of the direct calibration approach compared to standard gravity models).An extra regression of estimated $\phi_{c,cc}$ coefficients on distance might be worthwhile, to see if there are additional distance effects at work.

5. The assumption that the residual country bias represents unmeasured trade costs, $\phi_{c,cc,}$ rather than, say, difference in tastes and that these costs would be reduced or removed by countries joining the EU, is a strong one. For one thing, reorientation of production and consumption is unlikely to be costless. Estimates of the savings from double-testing and frontier controls due to the Single Market are more in the order of 1-2% saving on the cost of traded goods, rather than the 15% typically inferred by comparing trade shares. Whether the remainder of the 15 % actually represents other trading costs such as the effects of different product standards, labelling procedures, legal and guarantee systems etc is hard to tell. Whether the harmonisation of product standards in CEC countries to conform to the existing EU standards would benefit the accession countries, or would impose unwanted costs on producers and consumers in the accession countries, is a very important point. This will be investigated further, as will the effects of the two different principal types of mechanism involved in the Single Market (harmonisation and mutual recognition).

6. It is also possible, indeed likely, that over time CEC consumers and producers may become more oriented towards trade with the EU even if the countries do not formally join the single market, so the $\phi_{c,cc}$ coefficients might well reduce over time anyway.

7. It is also likely that in 1997 the CEC countries were far from in equilibrium: real exchange rates and trade barriers would have changed very substantially in just the preceding 4 years. For that reason, export and import volumes might well not be at an equilibrium level relative to prices and trade barriers.

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APPENDIX I: Derivation of border costs and comparative production costs from trade data, based on an assumed Dixit-Stiglitz framework.

In principle it is possible to estimate border effects directly by calibration of a general equilibrium model, rather than relying on indirect methods such as estimation of a gravity model. This is most clearly seen in the case of a Dixit-Stiglitz model.

The theoretical relationship between a Dixit-Stiglitz model, with monopolistic competition between differentiated goods g, each produced in one country c only, is well-established since Bergstrand (1989).

For simplicity, consider a D-S model where goods are consumed in countries $c \in 1..C$ yielding consumer utility. Consumption of good g in country cc is $Q_{g,cc}$. Total consumer utility in country cc is assumed to reflect the function:

$$U_{cc} = \left[\sum_{c} \sum_{g \in c} b.\left(\left(1 - f_{c,cc}\right) Q_{g,cc}\right)^{(s-1)/s} \right]^{s/(s-1)}$$

-(1)

Where σ is the elasticity of substitution between goods varieties, and $\phi_{c,cc}$ is an iceberg cost reducing by a fixed proportion the usable value of all goods from country c consumed in cc.

Differentiating (1) and setting the marginal utility of consumption of g equal to its relative price yields:

$$P_c (1 + t_{c,cc}).(1 + t_{c,cc}) / p_{cc} = b.(1 - f_{c,cc})^{(s-1)/s} .\left[U_{cc} / Q_{g,cc}\right]^{1/s}$$

-(2)

Where $\tau_{c,cc}$ is the proportionate transport cost between country c and cc, and $t_{c,cc}$ is the net contribution of import and export tariffs, subsidies and the tariff equivalents of

NTBs[5]. P_c is the selling price of goods from country c at the point of export (ie prior to trade costs and tariff). π_{cc} is an aggregate consumer price index for country cc.

We can rearrange this equation as:

$$Q_{g,cc} = U_{cc}.\left[b.(1-f_{c,cc})^{(s-1)/s}.\left(p_{cc}/P_c(1+t_{c,cc})\right).(1+t_{c,cc})\right]^s$$
-(2a)

The next step is to rewrite the equation in terms of observable variables. The nominal value of exports from c to cc, $E_{c,cc}$ is the number of goods varieties produced in country c, n_c, times the volume of sales per good, $Q_{g,cc}$ ($g \in c$), (upscaled by $(1+\tau_{c,cc}$ to take account of the assumed iceberg transport cost) times the export price P_c. We can also replace U_{cc} with total expenditure in country cc, Ycc divided by the aggregate price index π_{cc}.

$$E_{c,cc} = b^s.(1-f_{c,cc})^{(s-1)}.n_c.(1+t_{c,cc}).P_c.(Y_{cc}/p_{cc}).(p_{cc}/P_c.(1+t_{c,cc})(1+t_{c,cc}))^s$$

-(3)

Next we can replace n_c with the value of output in country c, X_c, divided by the size of turnover of a 'representative' firm T_c.

$$E_{c,cc} = b^s.(1-f_{c,cc})^{(s-1)}.X_c.Y_{cc}.T_c^{-1}P_c^{1-s}.p_{cc}^{s-1}.(1+t_{c,cc})^{1-s}(1+t_{c,cc})^{-s}$$
-(4)

This equation can of course be rewritten in logarithmic form:

$$\ln E_{c,cc} = s.\ln b + (s-1).\ln(1-f_{c,cc}) + \ln X_c + \ln Y_{cc} - \ln T_c + (1-s).\ln P_c + (s-1).\ln p_{cc}$$
$$+ (1-s).\ln(1+t_{c,cc}) - s.\ln(1+t_{c,cc})$$
-(4a)

It should be clear that this is a very similar functional form to the equations estimated by gravity modellers, but with various parameter restrictions imposed in order to achieve consistency with the general equilibrium Dixit-Stiglitz framework. This is even clearer if we choose to model transport costs as a function of distance $d_{c,cc}$:

$$\ln(1+t_{c,cc}) = a + b\ln d_{c,cc}$$
-(5)

[5] One possible inconsistency in the current analysis is that the tariff equivalent of NTBs has been taken directly from the GTAP database, and so may not necessarily be consistent with the substitution elasticities elsewhere in this paper.

Substituting from (5) into (4a), we essentially have a gravity model, but unlike the econometrically estimated gravity models the coefficients on industry output in country c and on demand in country cc are constrained to equal 1, while production prices are introduced as exogenous data (rather than being proxied by per capita income, as in many gravity studies), and it is worth noting that the tariff term is $\ln(1+t_{c,cc})$ not $\ln(t_{c,cc})$ as in many gravity models. The number of fitted residual border cost coefficients, $\phi_{c,cc}$, is far greater than the number of dummies estimated in a gravity model. Effectively the gravity modeller is rewriting these as $\phi_{c,cc}= DUM_{c,cc} + f(\varepsilon_{c,cc})$, where $DUM_{c,cc}$ is whatever combination of country dummies happens to apply to trade between countries c and cc, and $\varepsilon_{c,cc}$ is the estimated equation residual. Because there are more coefficients to estimate in our version, there are fewer degrees of freedom, making calibration more appropriate than econometric estimation.

Since we are particularly interested in the fitted residual border cost coefficients, $\phi_{c,cc}$, we rearrange equation (4):

$$E_{c,cc} = b^{s}.(1-f_{c,cc})^{(s-1)}.X_{c}.Y_{cc}.T_{c}^{-1}P_{c}^{1-s}.p_{cc}^{s-1}.(1+t_{c,cc})^{1-s}(1+t_{c,cc})^{-s}$$

To eliminate the consumer price indices, the easiest way is to say that for cc=c we can replace $E_{c,cc}$ with H_{cc} (home use). For Hcc we have a simpler version of equation (4), since $\tau_{cc,cc}=t_{cc,cc}=0$:

$$H_{cc} = b^{s}.(1-f_{cc,cc})^{(s-1)}.X_{cc}.Y_{cc}.T_{cc}^{-1}P_{cc}^{1-s}.p_{cc}^{s-1}$$

-(4b)

And dividing (4) by (4b) gives us:

$$E_{c,cc}/Hcc = ((1-f_{c,cc})/(1-f_{cc,cc}))^{(s-1)}.(X_{c}/X_{cc}).(T_{cc}/T_{c}).(P_{c}/P_{cc})^{1-s}(1+t_{c,cc})^{1-s}(1+t_{c,cc})^{-s}$$

-(6)

We can rearrange this to put $(1-\phi_{c,cc})$ on the LHS, and if we assume $\phi_{c,cc} = 0$ if c=cc we can simplify somewhat:

$$(1-f_{c,cc}) = \{(E_{c,cc}/Hcc).(X_{c}/X_{cc}).(T_{cc}/T_{c}).(P_{c}/P_{cc})^{1-s}(1+t_{c,cc})^{1-s}(1+t_{c,cc})^{-s}\}^{1/(1-s)}$$

-(7)

An interesting result is found if we multiply together these expressions for trade in both directions between a pair of countries, c and cc, since a lot of terms can then be eliminated:

$$(1-f_{c,cc}).(1-f_{cc,c}) = \left\langle E_{c,cc}.(1+t_{c,cc})^{1-s}.(1+t_{c,cc})^{-s} \times E_{cc,c}.(1+t_{cc,c})^{1-s}.(1+t_{cc,c})^{-s} \middle| H_c.H_{cc} \right\rangle^{1/(1-s)}$$

-(8)

or

$$(1-f_{c,cc}).(1-f_{cc,c}) = \left\langle \sqrt{\tilde{E}_{c,cc}.\tilde{E}_{cc,c}} \middle| \sqrt{H_c.H_{cc}} \right\rangle^{2/(1-s)}$$

-(8a) where the tild represents exports adjusted for the effects of tariffs, NTBs and transport costs. Effectively, **if the geometric average volume of trade between two countries, once tariffs and transport costs have been corrected for, is significantly smaller than the geometric mean of home-based consumption in the two countries, then the model implies there must be residual border costs present.**

Once an elasticity of substitution, σ has been chosen, all the other terms on the RHS of (8) are economic variables whose value is known. Effectively, for given data sets, the values for $(1-\phi_{c,cc})$ and $(1-\phi_{cc,c})$ are not independent: their product can be written:

$(1-\phi_{c,cc}) \times (1-\phi_{cc,c}) = K_{c,cc,\sigma}$

-(9)

This means that for a given data set, the higher the value of the trade cost for imports from c to cc, $\phi_{c,cc}$, the lower will be the trade cost in the other direction, $\phi_{cc,c}$.