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Analysis of Border Effects in Transition Countries

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Abstract

Since McCallum's (1995) finding of surprisingly high border effect on trade between US and Canada, there have been a number of studies on other parts of the world, and improvements made to the gravity model to accurately measure this effect. This paper suggests some other modifications to the model, and applies it to a region of the world that presents a distinctly interesting case. Changes in border effects of formerly socialist countries in Central and East Europe, and countries in the former Soviet Union are analyzed during 1976-2002 at country and sectoral levels, and also with respect to blocs of countries. A discussion on cross-country variations in border effects follows the computations.

Key words: Gravity models, integration, disintegration

JEL Classification: F14, F15, P20, P33

1. Introduction

National borders are artificially man made and they do not necessarily follow natural boundaries set by rivers, seas, or mountains. Hence, especially for countries that have free trade agreements, they should not constitute a trade barrier. The empirical literature on border effects started by McCallum (1995) provides contradictory evidence. Quite the opposite is the finding of the empirical research done on different parts of the world. While border effects are shown to get smaller with time, they are significant. Crossing borders still constitutes a cost in terms of trade flows.

Alesina (2002) argues the meaning of national borders is changing as decentralization is under way in many countries, and supernational unions are becoming increasingly common. The former erects legislative barriers within regions of a country due to cross-regional differences in laws and regulations. In contrast, the latter weakens national borders as countries are delegating some of their functions to multinational organizations resulting in harmonization of trade impeding laws and regulations. Within this framework, Wolf (2000) analyzes the regional level border effects to find that regions within countries are not fully integrated.

The formerly socialist countries present an interesting case in the study of border effects. During the last decade or so, they experienced integration and disintegration at the same time at various degrees with different blocs of countries. During socialism, the Council for Mutual Economic Assistance (CMEA) isolated these countries from the rest of the World. However, they were trading without trade barriers with each other. Infrastructure was designed to facilitate intra-CMEA trade. Trade was centrally planned; high degree of specialization was the preference of the planners. As a result, for over 50 years, they traded like one country with substantial limitations on trade with the outside World. With the fall of socialism in late 1980s, Central and

East European countries (CEEC) distanced themselves from the former Soviet Republics (FSR), Russia in particular, and reoriented themselves towards the West with a number of arrangements including the trade liberalizing Europe Agreements. In other words, their disengagement with CMEA countries marched side by side in 1990s with their reintegration with the World (Baldwin 1993, Maurel 1998, and Nilson 2000). Now, eight of these countries are European Union (EU) members. Furthermore, as an extreme case of decentralization, Czechoslovakia (CZSK) broke into two countries, and five independent countries emerged from the ashes of former Yugoslavia. In the East, the Soviet Union broke into 15 independent republics. While three Baltic countries took the same route as CEEC, the others tried to maintain their relationship at various degrees. While raising national borders among FSR due to independence is expected to create a border effect that did not theoretically exist before, the formation of a loose Commonwealth of Independent States (CIS) in early 1990s, and a custom union among few members of CIS (CISCU) in late 1990s were meant to keep this effect to a minimum. Lingering effects of the infrastructure of the past is also shown to have some implications on their current intra-region trade (Kandogan, 1999). Similarly, the Central European Free Trade Area (CEFTA) was formed in the mid 1990s among CEEC. Dates of integration and disintegration of these blocs are given Table 1 for each transition country.

The objective of this paper is to first assess the changes in border effects over time in this region by taking into account the improvements made to the McCallum's model and making its own modifications. A discussion of models from the literature is presented in Section 2. Border effects are measured both at country level and sectoral level. They are also measured against country blocs such as the EU, CEEC, FSR, and former Yugoslav republics (FYR) to observe how reintegration and disintegration are shaping over time. A discussion follows the measurements in Section 3.

2. Gravity models

The regression model based on McCallum (1995) takes the following form:

$$ln(X_{ij}) = \alpha + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \rho \ln d_{ij} + \gamma_j \lambda_{ij} + \varepsilon_{ij} \qquad (1)$$

where X_{ij} is the exports of partner country i to country j. Y_i and Y_j are their gross domestic products, respectively. d_{ij} is the distance between their capitals. For domestic trade of the importer country, a measure of internal distance is used. Natural logs of these variables are used in the analysis. λ_{ij} is the home-country dummy variable, which is 1 for domestic trade when i equals j. Separate home-country dummy variables are used for each importer country. Their domestic trade is computed by subtracting the value of exports from the value of production. The border effect is obtained by taking the exponential of the home-country dummy variable's coefficient. This effect represents the ratio of domestic trade to international trade of a country after controlling for distance and size of the partners' economies. McCallum applied this model to Canada to compare inter-provincial trade to international trade. Researchers who adopted McCallum's model typically carried out separate regressions for each year to observe the changes in the border effect across time.

In the absence of provincial or state level data, one needs to find an alternative way of measuring the internal distances. Gravity models provide more accurate results if other aspects linked to the existence of border effects are controlled and measured accurately. In this respect, the measurement of internal distance is particularly important. If internal distances are overestimated relative to international distances, border effects will be inflated. Helliwell (1998) finds that border effect estimates are very sensitive to the definition and measurement of internal distance.

In the literature, the measures of internal distance fall under three categories: Portion of distance between capital and nearest capital (Wei, 1996; Wolf, 2000), area based measures (Nitsch, 2000; Redding and Venables, 2000; Head and Mayer, 2000), and weighted average measures (Helliwell and Verdier, 2001). Wei (1996) uses ¼ of distance between the capital and the nearest capital of neighboring countries to measure the internal distance. Area based measures assume that the economic center is at the center of a circle. Accordingly, the internal distance is 0.67 times the square root of the ratio of area to π. However, the selection of the economic center is a source of bias, if the country is large and has multiples of economic centers. Furthermore, both of these measures suffer from using a different technique for measuring internal distances and international distances. Helliwell and Verdier (2001) use average weighted distance for the five largest cities for both distances using GDP shares (or population shares) as weights. It is obtained as follows:

$$d_{ij} = \sum_{c_i} \sum_{c_j} s^i_{c_i} s^j_{c_j} d_{c_i c_j} \quad \text{where} \quad \sum_{c_i} s^i_{c_i} = 1 \text{ and } \sum_{c_j} s^j_{c_j} = 1 \qquad (2)$$

$s^i_{c_i}$ is the share of city c_i in GDP of partner *i*. $s^j_{c_j}$ is the share of city c_j in GDP of partner *j*. $d_{c_i c_j}$ is the distance between cities c_i and c_j.

Other than the measurement of internal distance, McCallum's and other similar models, suffer from a lack of theoretical foundation. Anderson (1979) asserts that trade between two regions is decreasing relative to bilateral and multilateral resistances. Trade resistance is decomposed into bilateral trade barriers between partner countries, and each country's multilateral resistance to trade with all of their partners. McCallum's model does not include any form of these resistances. Some empirical models derived from McCallum use an atheoretical remoteness variable based on distance for multilateral resistance such as Manchin and Pinna (2004). However, without theoretical foundation, their results are biased due to omitted variables. In fact, border effects are expected to be lower if a theoretically grounded gravity equation is used.

Within this framework, Anderson and van Wincoop (2001) argue that McCallum's unexpectedly large border effect is a consequence of omitted variable bias and the small domestic economic size of Canada. They modify McCallum's equation by adding multilateral resistance variables for both partners to address resistance in each to trade with all of their partners. Additionally, they assert that in a theoretically grounded gravity model, income elasticities should be one. Hence, the regression equation becomes:

$$ln(X_{ij}/Y_iY_j) = \rho \, ln \, d_{ij} + \gamma\lambda_{ij} + ln(\tilde{P}_i)^{\sigma-1} + ln(\tilde{P}_j)^{\sigma-1} + (1-\sigma)\varepsilon_{ij} \quad (3)$$

where $(\tilde{P}_i)^{\sigma-1}$ is the multilateral resistance term for country *i*. These resistance terms are computed using non-linear least squares estimation to minimize sums of squares of errors under constraints. Anderson and van Wincoop (2001) apply this method to compute the border effects, which turn out to be much smaller than those of McCallum as expected.

Although this technique consistently and efficiently estimates a theoretical gravity equation, it is computationally heavy. It requires custom programming to solve for the resistance terms from a system of equations. Furthermore, price indexes are used in estimation which do not accurately reflect the true border effects. An alternative is to replace multilateral resistance terms with source and destination country specific fixed effects as in Harrigan (1996), Hummels (1999), Redding and Venables (2000). They control for origin and destination price levels and any other regional idiosyncrasies by importer and exporter country fixed effects. These country fixed effects are used to control for the countries' heterogeneity. Omitting them would overestimate the border effect due to model misspecification. Their model is similar to the following of Feenstra (2002):

$$ln(X_{ij}/Y_i Y_j) = \beta_1 \delta_i + \beta_2 \delta_j + \rho \ln d_{ij} + \gamma_j \delta_{ij} + \varepsilon_{ij} \quad (4)$$

where δ_i and δ_j are the fixed effects for the exporter and the importer countries, respectively. Separate home-country dummy variables are used for each importer country.

This approach estimates the border effects without explicitly dealing with resistance terms. It also leads to consistent estimates of the model's parameters. The main advantage is that ordinary least squares can be used without any need for complicated computations. While using resistance terms would result in more efficient estimates, Feenstra (2002) asserts that this benefit is small compared to computational simplicity of fixed effects approach.

In the empirical literature, separate regressions are carried out to observe changes in border effects over time. This goal could be achieved more simply in one regression with the addition of year fixed effect variable that are interacted with home-country dummy variables to the model, and thus obtaining separate home-country dummy variables for each country-year pair.

Furthermore, the empirical models in the literature do not accurately account for the bilateral resistance term of Anderson (1979). Some models attempt to do this by adding common border and language dummy variables or incorporate historical ties, but they still suffer from omitted variable bias due to the atheoretical nature of these variables. In another framework, Egger, Peter and Michael Pfaffermayr (2003) suggest adding bilateral fixed effects to the model to control all influences to the trade of a country pair in addition to those mentioned above, including agreements between the two countries. This approach could also be applied to a gravity model for the purpose of measuring the border effects. Note however that this approach will have a generally increasing impact on border effects since trade promoting bilateral factors are now controlled. The increase will be more substantial for countries that primarily trade with partners that are culturally close, whether that cultural proximity is due to being a neighboring country, or speaking the same language or having similar institutions resulting from having historical ties.

With the addition of separate home-country dummy variables for each country-year pair and the bilateral fixed effects, the model becomes:

$$ln(X_{ijt}/Y_{it}Y_{jt}) = \beta_1\delta_i + \beta_2\delta_j + \beta_3\delta_{ij} + \rho\, ln\, d_{ij} + \gamma_{jt}\lambda_{ijt} + \varepsilon_{ijt} \quad (5)$$

where δ_{ij} is the bilateral fixed effect between countries *i* and *j*. λ_{ijt} represents the home-country dummy variables for each country-year pair, obtained by interacting the home-country dummy variables with year fixed effect variables. Note that year fixed effects variables by themselves are not included so that the changes in border effects over time can be accurately measured.

Especially for countries that are experiencing integration and/or disintegration, it would be interesting to measure changing border effects with their old partners or new partners. For that purpose, the model in equation (5) can be modified to allow border effects against country blocs, representing old or new partners, rather than border effects against all partners. This can be done by adding bloc dummy variables specific for partners in a country bloc, in addition to the usual home-country dummy variables against all partners. Bloc dummy variables take the value of 1 if the trade is with a partner from a bloc *b*, and 0 otherwise.

$$ln(X_{ijt}/Y_{it}Y_{jt}) = \beta_1\delta_i + \beta_2\delta_j + \rho\, ln\, d_{ij} + \gamma_{jt}\lambda_{ijt} + \gamma^b_{jt}\lambda^b_{ijt} + \varepsilon_{ijt} \quad (6)$$

where border effects of country *j* against bloc *b* countries can be obtained by taking the exponential of the difference in coefficients of λ_{ijt} and λ^g_{ijt}. In other words, -λ^g_{ijt} measures border effects of *j* with bloc *b* relative to *j*'s other partners. Note that bilateral fixed effects are removed from this model to eliminate multicollinearity with bloc dummy variables.

Lastly, Chen (2002) examined the border effects at the sector level to find significant variation in border effects across sectors. Modifying the above model, sector level border effects could be obtained using the following:

$$ln(X^{s}_{ijt} / Y_{it}Y_{jt}) = \beta_1\delta_i + \beta_2\delta_j + \rho \ln d_{ij} + \gamma^{s}_{jt}\lambda^{s}_{ijt} + \varepsilon^{s}_{ijt} \quad (7)$$

3. Results

In this section, the regression models discussed earlier are applied to imports of transition countries. Trade data is obtained from the UN COMTRADE database. Production data comes from the World Bank production database and UNIDO, and the OECD. Data on gross domestic product is obtained from the UN common database. International and domestic distances are obtained from CEPII. The availability of the data on trade and production were restrictive in determining the period of analysis as data did not exist for all countries for every sector for every year. The period of analysis for each transition country is given in Appendix 1.

Different industrial classification systems are used in the two sources of production data (ISIC revisions 2 and 3 at three- and four- digit levels), and in the source for trade (SITC revision 1 at 4 digit level). Therefore, some conversions are needed before the analysis can be carried out. The conversions between different classification systems are based on the guidelines provided by the UN Statistics Division, which can be found in Appendix 2. In computing the internal trade, two-digit level ISIC sectors are used. These are then aggregated to obtain the country level figures.

Figure 1 shows the changes in border coefficients across time in six of the former Soviet republics using various measures of internal distance in McCallum's (1995) model. Separate regressions are run for each year. It is observed that the overall pattern across time and relative magnitudes of border coefficients are more or less similar in three measures of internal distance.

However, using ¼ of the distance between the capital of a country and the nearest capital of a neighboring country implies significantly lower border effects. Using this measure, border effects are especially underestimated for Kazakhstan and Kyrgyzstan which have capitals fairly close to each other. The difference in coefficients obtained using the area based measure of internal distance and its weighted distance measure produce quite similar values for border coefficients. The area based measure seems to work particularly well in comparison to weighted measure for small Baltic States. However, the selection of the economic center city is a source of bias for large countries in especially FSR. Furthermore, given that same formula is used for both internal and external distances, weighted distance measure is chosen in the following analyses.

According to McCallum's (1995) model, right after the Soviet Union dissolved, border effects in its republics were quite high, ranging from almost 2300 in Kyrgyzstan to 192 in Estonia in 1992. All three Baltic States which broke their ties with the Russian Federation and reoriented their trade towards the West not only had the lowest border effects during the whole period of analysis, but also experienced a steady decrease in its size. While other FSR also experienced a decrease at first, the downward trend reversed itself during the mid 1990s. In 2001, the border effects in the Baltic States were between 11 and 15. It ranged from 11 (Armenia) to 20 (Azerbaijan) in European republics; and from 54 (Turkmenistan) to 188 (Tajikistan) in Central Asian republics; and it was 53 in the Russian Federation, and 97 in Ukraine (1999 figure).

Figure 2 depicts how the border coefficients change using various models suggested in the literature and this paper's suggested model in equation (5). Panels (a) and (b) give the border coefficients for CEEC using McCallum's (1995) model and Feenstra's (2002) model. Panel (c) gives the coefficients based on the model in equation (5) that adds bilateral fixed effects to

Feenstra's model and also has the advantage of only one regression rather than separate regressions every year.

Comparison of border coefficients in panel (a) and (b) provides empirical evidence for Anderson and van Wincoop (2001)'s prediction that larger border effects result when there are omitted variables in the model. Results of McCallum's (1995) model are smaller than the results of Feenstra's (2002) model for all transition countries. This is due to the fact that the latter controls for multilateral resistance terms with the help of importer and exporter country fixed effects while the former omits these terms. Feenstra's (2002) model resulted in particularly lower border effects for Bulgaria, and Hungary and the Czech Republic.

The addition of bilateral fixed effects to control for the bilateral resistance terms of Anderson (1979) to the model in panel (c) leads to higher border coefficients as expected. While the relative positions of countries and the trends are more or less the same, the border coefficients in panel (c) are significantly higher than those in panel (b). Note that the impact of bilateral fixed effects has been particularly significant for the Czech and Slovak Republics. As expected, the addition of bilateral fixed effects to the model resulted in larger border effects for countries that tend to trade heavily with countries that are culturally close. The union of these two republics under Czechoslovakia for many decades provided the historical and cultural linkage. Although not shown the Figure 2, border effects under the model with bilateral fixed effects are also computed for other transition countries. The historical linkage under the Soviet Union has left FSR culturally close to each other, and made them natural trade partners. Thus, controlling these with bilateral fixed effects caused much higher border effects especially for FSR. Border coefficients ranged between 8 and 2 under McCallum's (1995) model as given in

Figure 1 panel (c), whereas they range between 16 and 4 under the model with bilateral fixed effects.

In general, the same downward trend is observed in panel (c). Like in figure 1, the trend in FSR, reverses itself in mid 1990s, with the exception of the Baltic States. These states experience the same gradual downward trend observed in CEEC. In 2001, the ratio of domestic trade in CEEC to their international trade ranged from 138 in Hungary to 1440 in Romania. The border effect was 95 in the FYR of Slovenia, and 130 in the Russian Federation. Consistent with the findings in the literature, the border effects in larger countries such as the Russian Federation are much smaller than other smaller countries of the FSR.

Figure 3 gives the relative border effects ($-\lambda_{ijt}^{g}$) in transition countries against country blocs using the model in equation (6). The country blocs considered are the EU, FSR and FYR. Accordingly, as seen in panel (a), above average border effects against the fifteen EU countries in CEEC gradually decreased to be below average by 2001 as reflected by negative coefficients. In other words, the border effects in CEEC against their EU partners are smaller relative to their other partners. Panels (b) and (c) compare the relative border effects against the EU countries in Baltic States of FSR to other FSR. In both sets of transition countries, the trend is downward, and the countries start with above average relative border effects and end up with below average border effects. The notable exception to this downward trend is Russia, which started with below average border effects against the EU relative to its other partners and increased gradually to become above average in 2001. The border effects were much higher in other FSR (especially in Kyrgyzstan) against the EU relative to those in Baltic States in 1992. Furthermore, the decrease in border effects was much sharper for Baltic States, which ended up with significantly below average border effects against the EU relative to their other partners. In 2001, only in Moldova, the relative border effects were somewhat comparable to those in the Baltic States.

Relative border effects against the FSR are compared among Baltic FSR, CEEC and other FSR in panels (d)-(f). FSR borders were and remained above average for all transition countries relative their other partners. The only exception is the Russian Federation, which experienced below average relative FSR borders during the whole period of analysis. For Baltic FSR, relative FSR borders were higher than those observed in other FSR and even higher for CEEC. The trend was increasing at first for CEEC, which becomes slightly decreasing in the second half of the period of analysis. A slightly decreasing trend is observed in the Baltic FSR, whereas the same slightly decreasing trend clearly reversed itself in other FSR in mid 1990s.

FYR border effects of CEEC and FYR relative to their other partners are plotted panels (g) and (h). For both Slovenia and Macedonia, border effects against other FYR were below average at the beginning of the period of analysis. These relative border effects gradually increased throughout. Although by 2001, their relative border effects against the FYR were still below average, their other partners are gradually closing the gap. For CEEC, relative border effects against the FYR remained above average for the whole period of analysis. Although the trend was a relative decrease in early 1990s, the gap in border effects gradually widened with FYR relative to CEEC's other partners.

Lastly, the model in equation (7) is applied to measure sectoral variation in border effects in transition countries with time. While Hungary and Slovenia have the lowest border coefficients in all of the sectors, Romania and Serbia have the highest coefficients among transition countries plotted. Generally speaking, a downward trend in border coefficients observed in earlier results also exists in this sectoral study. FSR like Latvia and Ukraine started relatively high sectoral border coefficients, but experienced sharper decreases, especially Latvia, while Ukraine's border coefficients remained relatively high. Border coefficients are lowest in machinery and equipment, and the textiles and apparel sectors. Resource intensive sectors such as paper, non-metallic mineral, and basic metal sectors still have relatively high border coefficients.

4. Conclusions

The explanations for the existence and size of border effects provided in the literature can be organized under two somewhat related categories: trade costs and behavioral responses to trade costs.

Trade costs consist of trade barriers including tariffs, non-tariff and technical barriers, different standards, custom and regulatory differences, search costs, transaction costs, communication costs, product specific information costs and exchange rate variability. Hillberry (1999) states that none of tariffs, regulations, and communication costs are significant factors on border effects. Head and Mayer (2000) found no correlation between non-tariff barriers and the border effect. Wei (1996) could not relate the exchange rate variability to border effect. However, Chen (2002) found that technical barriers and product specific information costs increase the border effect. Separately, Rauch (1999) found that search costs lead to higher border effects.

Spatial agglomeration of firms, elasticity of substitution among varieties, and availability of products for exports can be counted as factors leading to border effects under behavioral responses to trade costs category. Evans (2001) measured that half of the border effects are due to the fact that fewer goods are available for exports. Similarly, spatial clustering of firms, and a high degree of substitution imply higher border effects.

This paper measured the border effects in transition countries and compared its size across countries, blocs of partner countries and sectors. Although all countries analyzed in this paper were members of CMEA and isolated from the rest of the world for many decades, the legacy of previous integrations and the route they have chosen in disintegration appear as important factors explaining the variation in the size of border effects across countries, especially when the effects are compared across blocs of partner countries and sectors.

Domestically oriented infrastructure yields high border effects for FSR and FYR against their new partners, but significantly lower effects for their old partners. There were other contributing factors leading high border effects: central planners' preference for specialization and lack of incentives to innovate under socialism. Furthermore, under central planning, enterprises had a very limited impact on their location decisions (Cieslik, 2004). These resulted in spatially agglomerated industries and low quality products which are not marketable, or available for exports, to new partners. Furthermore, especially for FSR, past linkages, such as infrastructure, business networks, production and consumption chains have been important factors (Djankov and Freund, 2000). These and other legacies of socialism, such as technology (resource-intensive production), appear as important factors in the explaining the size of border effects. Considering that technology and infrastructure are slow to change, their impact will be observed for a long period of time.

The route transition countries chose in disintegration vastly differs from one another. Despite being FSR, the Baltic States' efforts in disintegration resulted in significant reductions in their border effects, especially against the EU. Similar observations are made for Slovenia in comparison to other FYR. Product specific information cost and search costs in these countries were significantly reduced by their involvement in EU enlargement. Even within this group of transition countries, the approach to the removal of barriers to trade varies (Manchin and Pinna, 2004). In contrast, the initial general decreasing trend in FSR border effects reversed itself with the formation of CIS and CISCU. These two arrangements seem to have generated a force against the disintegration from the former Soviet Union.

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Table 1. Integration and disintegration of transition countries

Note: For country blocs that ceased to exist, their last year of existence is specified. For newly formed blocs, the first year of existence is listed.

Country	CZSK	FYR	CEFTA	EU	FSR	CIS	CISCU
Armenia					1991	1992	
Azerbaijan					1991	1992	
Belarus					1991	1992	1994
Bosnia and Herzegovina		1991					
Bulgaria			1999	1995			
Croatia		1991					
Czech Rep.	1992		1993	1995			
Estonia				1998			
Georgia					1991	1992	
Hungary			1993	1994			
Kazakhstan					1991	1992	1994
Kyrgyzstan					1991	1992	1997
Latvia				1998	1991		
Lithuania				1998	1991		
Macedonia		1991					
Moldova					1991	1992	
Poland			1993	1994			
Romania			1998	1995			
Russia					1991	1992	1994
Serbia and Montenegro		1991					
Slovakia	1992		1993	1995			
Slovenia		1991	1996	1999			
Tajikistan					1991	1992	1999
Turkmenistan					1991	1992	
Ukraine					1991	1992	
Uzbekistan					1991	1992	

Figure 1. Border coefficients in Former Soviet Republics using various measures of internal distance

ES: Estonia; KY: Kyrgyzstan; KZ: Kazakhstan; LT: Latvia; RU: Russian Fed.; UR: Ukraine

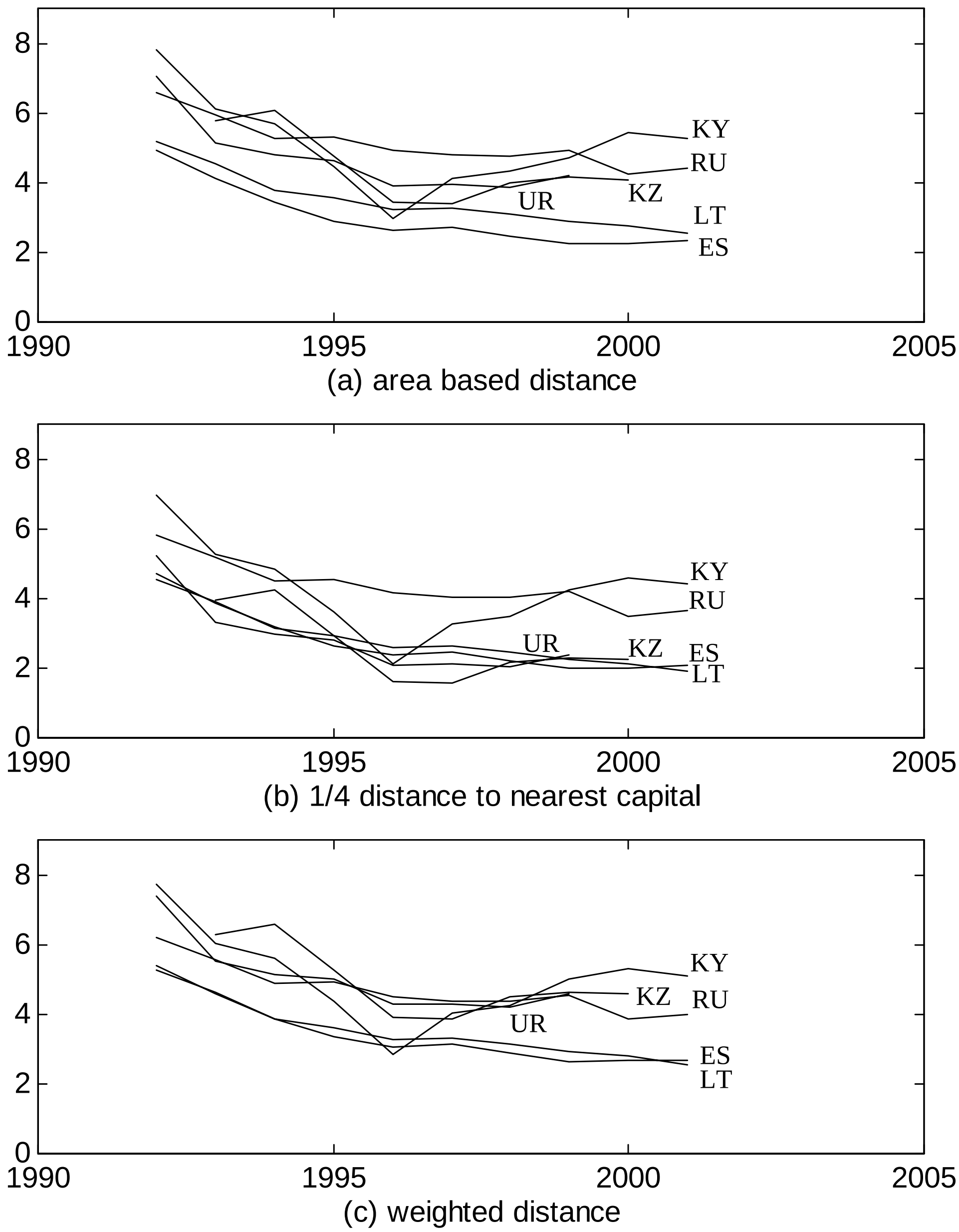
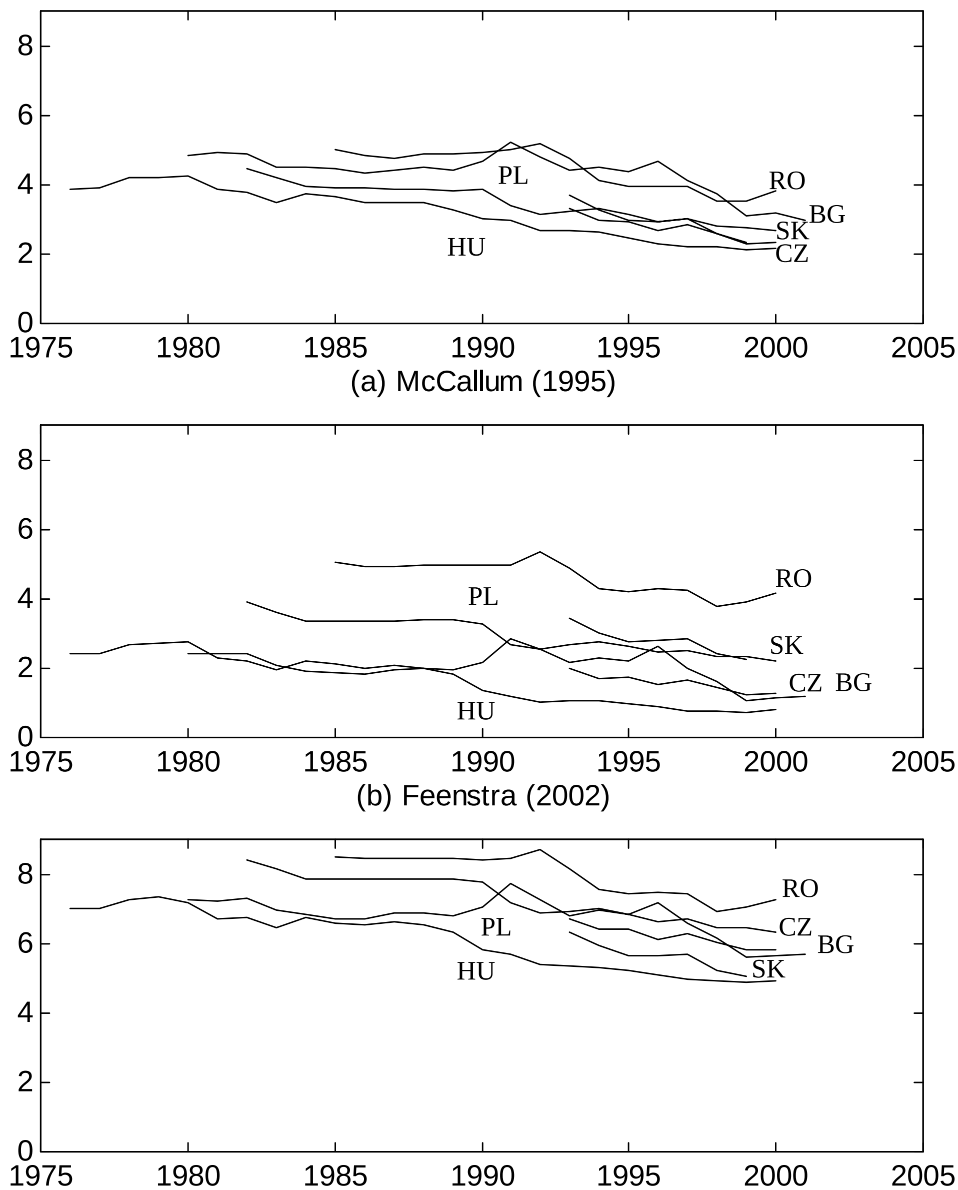


Figure 2. Border coefficients in Central and Eastern Europe under various models

BG: Bulgaria; CZ: Czech Rep.; HU: Hungary; PL: Poland;
RO: Romania; SK: Slovak Rep.



(a) McCallum (1995)

(b) Feenstra (2002)

(c) Model with bilateral fixed effects

Figure 3. Relative border coefficients against country blocs

FSR: Former Soviet Republics; FYR: Former Yugoslav Republics; EU: 15 European Union members; Baltic FSR: Estonia, Latvia and Lithuania; Other FSR: Azerbaijan, Kyrgyzstan, Moldova, Russian Federation and Ukraine; CEEC: Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovak Republic.

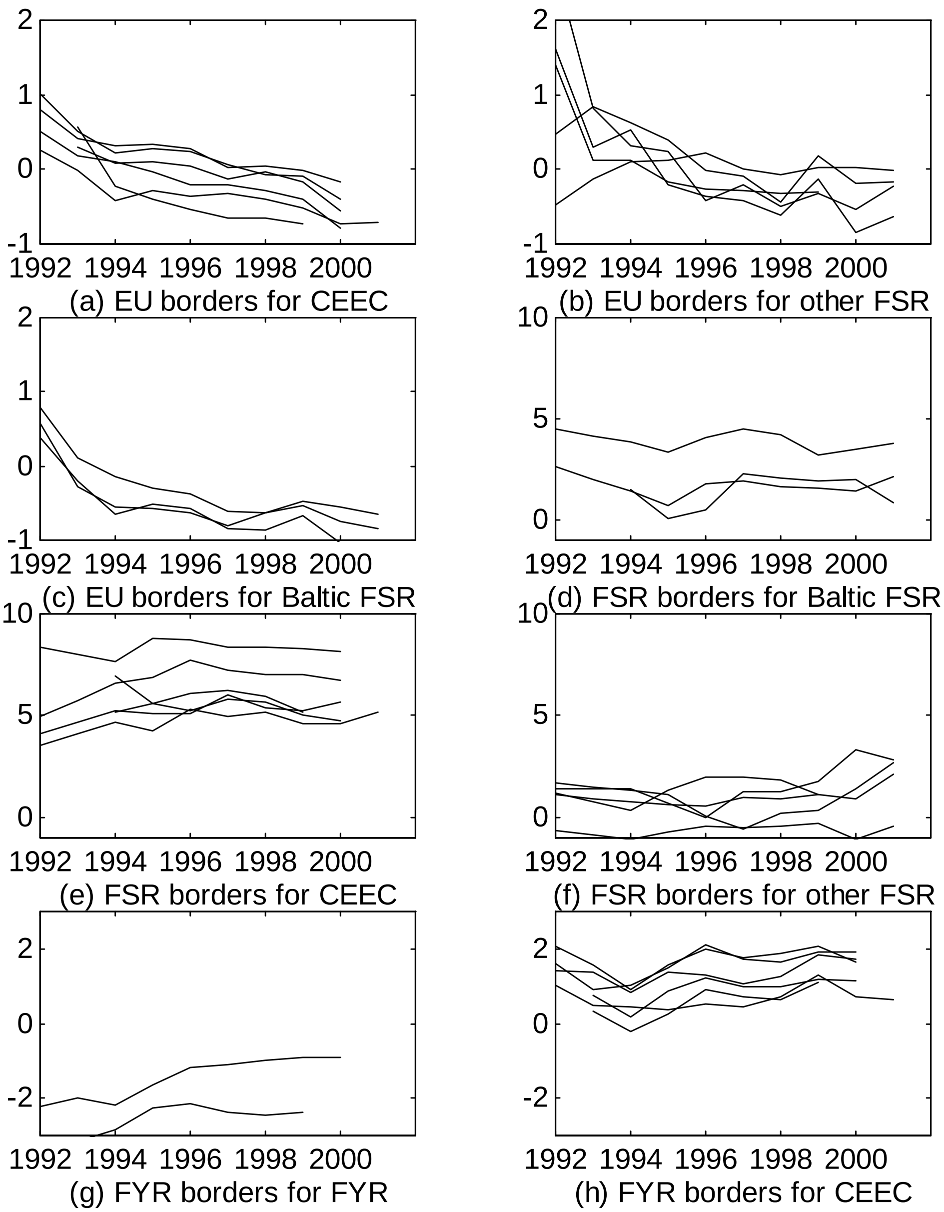
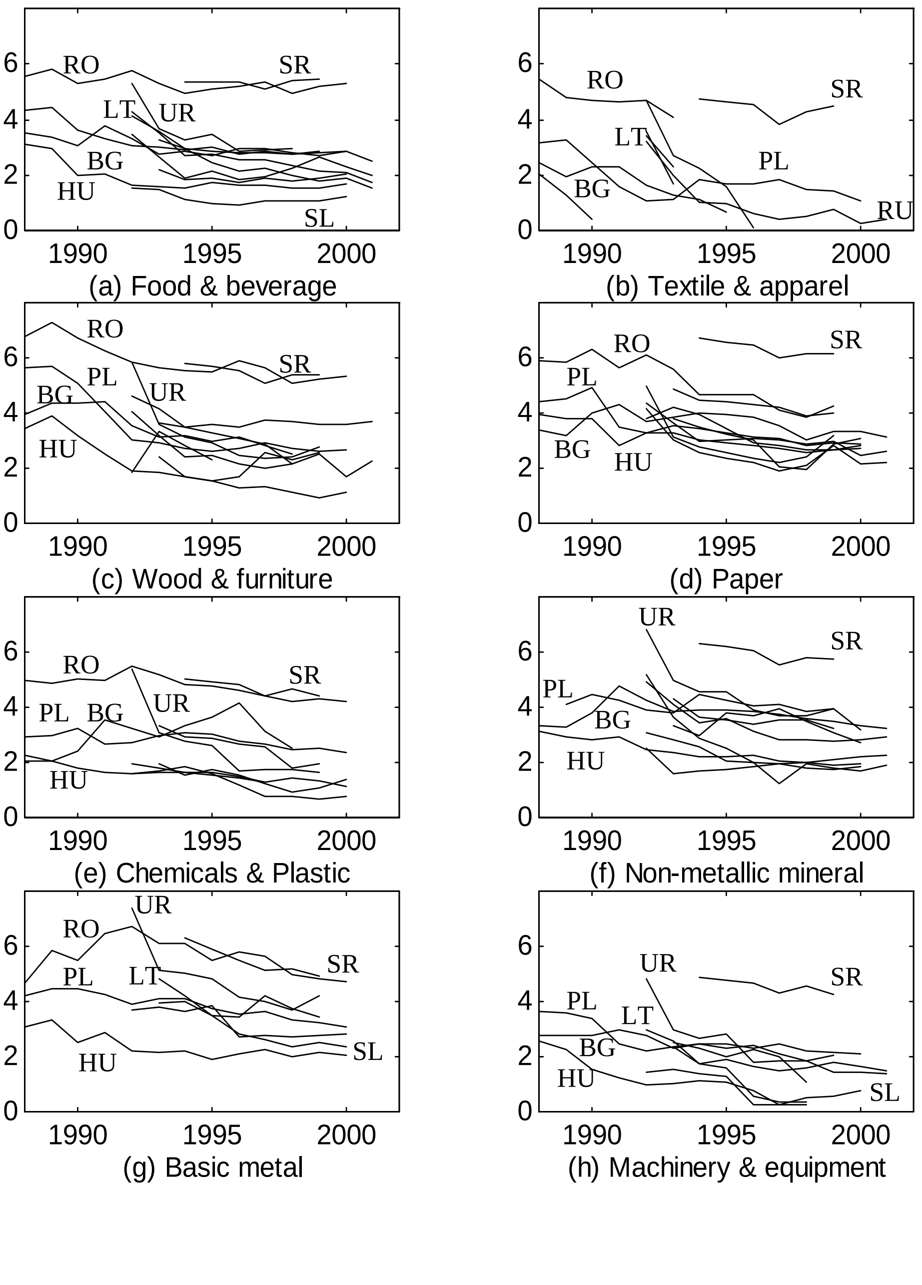


Figure 4. Sectoral border coefficients in select transition countries
Note that Czech and Slovak republics, and Estonia are also plotted.
BG: Bulgaria; HU: Hungary; PL: Poland; RO: Romania; LT: Latvia;
RU: Russian Fed.; SL: Slovenia; SR: Serbia and Montenegro;
UR: Ukraine



Appendix 1. Availability of data

Country	Trade	Production	Period of analysis
Armenia	1992-2004	1994-2000	1994-2000
Azerbaijan	1992-2004	1990-2001	1992-2001
Belarus	1992-2004	N.A.	N.A.
Bosnia Herzegovina		1990-1991	N.A.
Bulgaria		1980-2001	1980-2001
Croatia	1992-2004	1986-1992	1992
Czech Rep.		1980-1989 &1993-2000	1993-2000
Estonia	1992-2004	1992-2001	1992-2001
Georgia	1992-2004	1998-2000	1998-2000
Hungary	1976-2004	1963-2000	1976-2000
Kazakhstan	1992-2004	1993-2000	1993-2000
Kyrgyzstan	1992-2004	1989-2001	1992-2001
Latvia	1992-2004	1986-2001	1992-2001
Lithuania	1992-2004	1992-2001	1992-2001
Macedonia	1993-2004	1987-1999	1993-1999
Moldova	1992-2004	1986-2001	1992-2001
Poland	1982-2004	1982-84, 1989-2000	1982-84, 1989-2000
Romania	1985-2004	1985-2000	1985-2000
Russian Fed.	1992-2004	1992-2001	1992-2001
Serbia & Montenegro	1992-2004	1994-2000	1994-2000
Slovak Rep.	1992-2004	1993-1999	1993-1999
Slovenia	1992-3004	1992-2000	1992-2000
Tajikistan	1992-2004	1992-2002	1992-2002
Turkmenistan	1992-2004	1996-2000	1996-2000
Ukraine	1992-2004	1992-1999	1992-1999
Uzbekistan	1992-2004	N.A.	N.A.

Appendix 2. Manufacturing Sectors

ISIC-rev 2	ISIC-rev 3	SITC- rev 1	Description
31	1511-4, 1520, 1531-3, 1541-4, 1549, 1551-4, 1600	01, 02, 03, 04, 05, 06, 07, 08, 09, 11, 12	Manufactures of food, beverages and tobacco
32	0140, 1711-2, 1721-3, 1729-30, 1810-1820, 1911-2, 1920, 2430	61, 65, 83, 84, 85	Textile, apparel, and leather
33	2010, 2021-3, 2029-3610	63, 82	Wood, wood products, and furniture
34	2101-2, 2109, 2211-2, 2219, 2221-2	64	Paper, paper products, and publishing
35	1010, 1020, 2310, 2320, 2330, 2411-3, 2421-4, 2429, 2511 2519-20, 3140	32, 33, 51, 52, 53, 54 55, 56, 57, 58, 59, 62	Chemicals, petroleum, coal, rubber, and plastic
36	1030, 2610, 2691-6 2699, 2720, 5239	66	Non-metallic mineral
37	2710, 2720, 2731-2 2891-2, 3710	67, 68	Basic metal industries
38	2213, 2230, 2811-3 2893, 2899, 2911-5 2919, 2921-6, 2929, 2930, 3000, 3110, 3120, 3130, 3150, 3190, 3210, 3220, 3230, 3311-3, 3320 3330, 3410, 3420, 3430, 3511-2, 3520, 3530, 3591-2, 2599, 3694, 7250	69, 71, 72, 73, 74, 75 76, 77, 78, 79, 87, 88	Fabricated metal products, machinery, and equipment

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