SHORTER PAPER & COMMENTS

Estimating Regional Trading Bloc Effects with Panel Data

Peter Egger

University of Innsbruck

Abstract: This paper suggests using a trick when estimating regional trading bloc effects on bilateral trade volumes with panel data. Trading bloc dummies exhibit small variation over time. They should enter the specification twice, once in their original form and once as the between-effects component. Then, one obtains long-run and short-run effects of trading blocs on trade volumes. The paper suggests three different models to tackle this problem. JEL no. C33, F14, F15
Keywords: Gravity model; trading bloc effects; panel econometrics

1 Introduction

Since their very early stage, gravity models have been used to assess the importance of regional trading blocs for bilateral trade; Greenaway and Milner (2002) and Winters (1996) provide an excellent overview concerning theory and empirical applications. Traditional work concentrates on cross-section analysis (see Tinbergen 1962, Linnemann 1966, Nilsson 2000, and others), which is subject to inherent problems such as omitted variables, multicollinearity, etc. (see Baltagi 2001 for an overview). Therefore, an increasing number of recent contributions applies panel data techniques to overcome the shortcomings of cross-section empirics and exploit the variation from richer data sets (Mátyás 1997, Cheng and Wall 2001, Glick and Rose 2002). Current research follows three different lines when assessing regional trading bloc effects.

First, Mátyás (1997) argues that the properly formulated panel data gravity model is one with fixed time, exporter and importer effects, where the latter two capture all regional trading bloc effects. This might be misleading,

Remark: Please address correspondence to Peter Egger, Department of Economic Theory, University of Innsbruck, Universitätsstrasse 15, A-6020 Innsbruck, Austria; e-mail: Peter.Egger@uibk.ac.at

since the more adequate structure of the model is one with time and bilateral effects,[1] and regional trading blocs are changing over time, so that the country-specific variables capture only a part of this effect.[2]

Second, Cheng and Wall (2001) suggest estimating a panel data model with fixed bilateral and time effects. Although this wipes out all cross-sectional variation, the parameters of regional trading bloc dummies can nevertheless be estimated, since these dummies exhibit some time variation. This approach is sound from an analysis of variance perspective, but it restricts its interest to the contemporaneous short-term effects of joining a regional trading bloc.

Third, Krueger (1999) estimates a model with fixed time and regional trading bloc × time effects. This seems arbitrary and yields parameter estimates which are difficult to interpret.[3] In contrast, a model with fixed bilateral and time effects provides an interpretation of the parameters which is similar to a model in first differences. Without any doubt, the potential appeal of Krueger's approach is the allowance for a time-varying impact of regional trading blocs, but the question remains how important the time-variant determinants of trade volumes are as compared to their time-invariant counterparts.

Table 1: *Analysis of Variance of Log of Bilateral Exports*

Source	Partial sum of squares	Degrees of freedom	F-statistics
Covariates altogether	68.3	8	1368.10***
Exporter × time	49.8	206	4.84***
Importer × time	63.3	235	5.39***
Exporter × importer (bilateral)	4,677.6	1,176	79.63***
Residual	196.8	3,939	
Overall	26,097.8	5,566	

*** significant at the 1 percent level.
Note: Compare Footnote 5 for more details on the country sample and Table 2 for more details on the covariates. Constant not reported. R^2 is 0.993.

[1] Cheng and Wall (2001) suggest such an estimator. Egger and Pfaffermayr (2003) demonstrate that the Mátyás model is nested in the more general model with time and bilateral effects. Compare also Table 1 below.

[2] Exporter and importer effects measure a country's propensity to trade with respect to all partner countries. Therefore, they do not capture any deviation from this due to bilateral agreements.

[3] See also Soloaga and Winters (2001) for a discussion.

Table 1 provides a comprehensive description of the variance structure of typical bilateral export data from a large panel underlying the empirical analysis below (compare Footnote 5 for more information on the country sample) and casts doubt on the appropriateness of this third approach.[4] It demonstrates that the large bulk of export data variation is due to the bilateral rather than the exporter × time or the importer × time dimension (the main exporter, importer, and time effects are nested in these three interaction terms). The latter two dimensions are of only minor importance and relatively well explained by the inclusion of the traditional time-variant variables as accounted for in gravity models. In the example, the bilateral, time-invariant dimension explains about 96 percent of the contribution of the three interaction terms. However, observable time-invariant factors usually account only for a portion of the bilateral effects. Not controlling for unobserved bilateral cultural, economic, geographic, and other influences considerably increases the risk to obtain biased estimates due to a possible correlation between the observed explanatory variables and the unobserved influences, captured by the error term.

This paper addresses the problem of the assessment of regional trading bloc effects with panel data. Starting point are two observations. First, regional trading blocs are usually captured by dummy variables which exhibit some (though not much) variation over time. Second, regional trading bloc parameters from fixed effects analysis only exploit the time-variant information and do not comprehensively reflect the long-run trade creation and trade diversion phenomena usually addressed in theoretical models. I propose three different methods to obtain an overall regional trading bloc effect with panel data: A two-stage fixed effects procedure (hereafter F2SM), a model in the spirit of Mundlak (1978, hereafter MM), and a modified model in the tradition of Hausman and Taylor (1981, hereafter MHTM).

Using bilateral exports of the OECD economies to 47 partner countries,[5] I assess the effects on bilateral export volumes of a NAFTA membership and of a membership in the European Economic Area (EEA) allowing for

---

[4] Noteworthy, all possible static, aggregate panel data gravity models are nested in this framework in terms of their general variance structure: the Mátyás (1997), the Cheng and Wall (2001), the Krueger (1999), the Glick and Rose (2002), the Egger and Pfaffermayr (2003) models. This is simply true, since it consists of all possible interaction terms of the three main effects: the exporter, the importer and the time dimension.

[5] Including the 29 OECD economies, the remaining 7 Central and Eastern European countries, Russia, Ukraine, Algeria, Egypt, Lybia, Morocco, South Africa, Kuwait, Saudi Arabia, China, Hongkong, India, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Argentina, Brasil, Chile, Colombia, Panama and Venezuela.

different effects of an EU membership and intra-EFTA together with EU-EFTA relations (i.e., the rest of the EEA). In a simulation, I demonstrate that according to the estimation results exports within the EU or the remaining EEA would have been about 4 percent smaller without any formation of the EU or the EEA, all else being equal. The establishment of the NAFTA generated overall bilateral trade volume effects, which amount to about 15 percent of overall intra-NAFTA trade. The short-term effects of any free trade agreement under consideration are of negligible importance as compared to their long-term effects. This information could not have been extracted by either of the previously used panel data approaches.

2 Three Possible Ways for Empirical Research

The estimation of (intra or cross) regional trading bloc effects on trade volumes is a problem of parameters of those variables that exhibit close-to-zero (but not zero) variation over time. Since standard panel data techniques (i.e., fixed effects or consistent random effects models) wipe out all cross-sectional variation, one is left only with the time-varying part of the integration dummy variables. As a consequence, the parameters of such variables only reflect the contemporaneous and short-term influence of joining (or leaving) a regional trading bloc. In contrast, the theoretical models on regional trading blocs concentrate on the long-term effects on the volume of trade (and also on welfare). Hence, one would additionally wish to exploit this kind of variation which is a part of the overall residual of the panel data model. The question is how can we extract information on both the short-term and the long-term impact of regional trading blocs on trade altogether within a (even strongly unbalanced) panel data framework?

Principally, there are three ways to tackle this problem. I suggest the following trick. In a panel, any time-varying variable consists of two parts of variation, the time-varying (within) and the time-invariant (between) part. While the former reflects the change, the latter captures the level information. Accordingly, we can split any time-varying variable into these two effects. The between-part of any variable is just the average over all observed periods, and the within-part is the difference between the original variable and the between-part. The three ways to exploit both the long-term and the short-term effects of regional trading blocs together are the following:

First, estimate a two-way panel with fixed time and bilateral effects (the latter has been suggested by Cheng and Wall 2001), including the regional trading bloc dummies. Use the derived within-residuals of the Amemiya (1971) type (consisting of the remainder error *and* the fixed bilateral effects) and run an OLS regression on all time-invariant variables of interest, including necessarily *all* between-effects of the time-variant variables (especially, the between-part of the regional trading bloc dummies) plus other time-invariant controls of interest. From the first regression one obtains an estimate of the short-term effect and from the second-stage regression an estimate of the additional long-term effect of regional trading blocs on bilateral trade volumes (see Baltagi (2001) for a survey).

Second, follow Mundlak (1978) and estimate a model by GLS which includes both the original variables and the between-component of all variables. This yields the short-term and the additional long-term effects of all variables in the model. If the coefficients of the between-components are significantly different from zero, (some of) the variables in the model are correlated with the panel error term (this is equivalent to the information obtained by the familiar Hausman test statistic). The parameters of the short-term influences in the MM are by definition equivalent to the within-estimates as derived in the first stage of the F2SM (Mundlak 1978).

Third, estimate a model in the spirit of Hausman and Taylor (1981), which uses the regional trading bloc dummies in their original form *and* their between-parts together and the other variables as usual. Basically, this is a random type effects model. However, it takes into account that the standard random effects model in many applications yields inconsistent estimates,[6] since (some of) the explanatory variables are correlated with the error term, and applies instrumental variable methods to overcome this problem. The endogeneity of the between-component of regional trading bloc effects is underpinned in Baier and Bergstrand (2002).[7] In the best (and testable) case, the MHTM eliminates the correlation problem between the explanatory variables and the panel error term and this model yields consistent and efficient estimates of all effects, including the regional trading bloc time-invariant long-term effects.

---

[6] As mentioned above, this can be shown either by the familiar Hausman (1978) test or by testing the restriction of zero parameters of the between-components in the MM.

[7] Of course, the endogeneity of regional trading bloc effects invalidates the between-effects in the F2SM and the MM.

The procedure is the following. Estimate a fixed effects model as mentioned above. Following Cornwell et al. (1992), I refer to (time-variant and time-invariant) variables which are correlated with the bilateral effects as *singly exogenous* and to the uncorrelated ones as *doubly exogenous*. Use the within-residuals of the Amemiya (1971) type and regress them on all time-invariant variables (including the between-components of the regional trading bloc dummies) in the model in a second-stage. This second-stage regression is an instrumental variables model, where the *singly exogenous* time-invariant variables have to be instrumented by the *doubly exogenous* time-variant ones. The remainder errors from the first-stage (fixed effects) regression and from the second-stage IV regression yield an estimate of the variance components which are used in the GLS transformation of the data. Finally, the transformed data are applied in an IV regression, where all transformed variables (including the transformed original and between-component integration dummies) enter as such. The within-parts of all time-variant variables and the between-parts of all *doubly exogenous* variables are used as the instruments (see Hausman and Taylor 1981 for more details, and Egger 2002a for an application in a different context).

3 Data and Estimation Results

The panel of bilateral exports from OECD countries covers the period 1986–1997 and is unbalanced. Nominal exports in current US dollars (from OECD, *Monthly Statistics of International Trade*; IMF, *Direction of Foreign Trade*; and the Vienna Institute of Comparative Economic Studies, hereafter WIIW), export price indices (IMF, *International Financial Statistics*; OECD, *Economic Outlook*; and WIIW) and exchange rate indices (IMF, *International Financial Statistics*; and WIIW) are used to obtain real figures with 1995 as the base year. Nominal GDP in US dollars (OECD, *Economic Outlook*, and *National Accounts*, Volume 1; IMF, *International Financial Statistics*; and WIIW), GDP deflators (same sources as GDP) and exchange rate indices serve for the calculation of real GDP figures. Population data are from OECD (*Economic Outlook*, and *National Accounts*, Volume 1), IMF (*International Financial Statistics*) and WIIW. Data on school enrollment are from OECD (*Education at a Glance*) and *World Development Indicators*. I calculate a proxy for the high-skilled to low-skilled labor ratio based on the relation between the share of people in at least the secondary school enrollment. The capital-labor ratio is proxied by GDP per capita. These variables

are used to construct a set of determinants motivated by the Heckscher–Ohlin theory of endowment-based trade. I closely follow Helpman and Krugman (1985) in the construction of variables and use the sum of bilateral GDP, the similarity in country size, the distance in relative capital-labor ratios, and the distance in high-skilled to low-skilled labor ratios in the regressions. Transport costs are approximated by the c.i.f./f.o.b. ratio. Three economic freedom variables are used for the exporters and the importers each, which are provided by Economic Freedom Network (*Economic Freedom of the World*) and account for additional export and import impeding or enforcing determinants (i.e., trade costs in a wide sense).[8] Some of these variables are based on (zero-to-ten) ratings and some on continuous data. The corresponding variables are viability of contracts, rule of law, and taxes on trade as a percentage of exports and imports. All variables are in logs. In the regression analysis, I come up with 5,567 observations. All regressions include time dummies.

In general terms, the estimated models read

$$E_{ijt} = \beta_0 + X_{ijt}\beta + \mu_{ij} + \lambda_t + \varepsilon_{ijt}; \quad \hat{\mu}_{ij} = Z_{ij}\delta + \eta_{ij} \tag{1}$$

$$E_{ijt} = X_{ijt}\beta + \bar{X}_{ij.}\pi + \lambda_t + \bar{\lambda}_t + u_{ijt}; \quad u_{ijz} = \zeta_{ij} + \varepsilon_{ijt} \tag{2}$$

$$E^*_{ijt} = \beta_0 + X^*_{ijt}\beta + Z^*_{ij}\gamma + u^*_{ijt}, \tag{3}$$

where E denotes the log of real bilateral exports, $X = (X_1, X_2)$ are the time-variant variables and Z the time-invariant ones.[9] The present paper assumes that there is no correlation between the explanatory variables (X, Z) and the remainder error term (ε). The MM is a GLS model, where the error term still contains a random bilateral effect, ζ_{ij}. The between-effects of the time dummies take place $(\bar{\lambda}_t \neq 0)$, whenever the underlying panel is unbalanced.

X_1 denotes the set of *doubly exogenous* time-variant variables,[10] X_2 is the set of *singly exogenous* time-variant variables,[11] and Z is the set of

---

[8] See also Egger (2002a) for a motivation of these determinants.

[9] In our case only the between-component of the intra-EU trade and the integration dummies for the rest of European Economic Area (i.e., intra-EFTA plus EFTA-EU) and for NAFTA.

[10] Distance in real GDP per capita (proxying the capital-labor ratio, compare Helpman and Krugman 1985); distance in the high-skilled to low-skilled labor ratio; exporter and importer viability of contracts; exporter and importer rule of law; exporter and importer tariffs; within-component of the intra-EU trade and integration dummies for the rest of European Economic Area (i.e., intra-EFTA plus EFTA-EU).

[11] Bilateral sum of GDP; similarity of size index (Helpman and Krugman 1985); transport costs.

singly exogenous time-invariant variables.[12] $\bar{X}_{ij.}$ are the variable means of all time-variant variables and $Z \in \bar{X}_{ij.}$. Further, μ_{ij} and λ_t denote the bilateral effects and the time effects, respectively; ε_{ijt} and η_{ij} are classical error terms. Noteworthy, (1) is the F2SM, (2) corresponds to the MM, and (3) is the properly transformed model as is indicated by "$*$", which yields the MHTM running 2SLS, using the described set of instruments.

The decision of whether a variable belongs to the group of the singly exogenous or the doubly exogenous variables has to be based on a sensitivity analysis, but it is considerably facilitated by an inspection of the interpretation of the panel error term, which in our case captures all time-invariant bilateral relations' level-specific unobserved influences, and all size-related factors are natural candidates thereof.

Table 2 provides the regression results of the MM and the MHTM to obtain an estimate of the short-term and the additional long-term impact of regional trading blocs.[13] To be as simple as possible, I focus on the EEA effect as described earlier. The MM gives short-term and additional long-term parameter estimates for *all* variables. The results reveal that no short-term influence of joining the EU, the EFTA or the NAFTA can be identified. This is a traditional result in panel data applications (compare the outcome in Cheng and Wall 2001). However, all models indicate a considerable positive long-run effect of a membership in either the EU, the EFTA and, especially, the NAFTA.

Researchers are conveniently interested in a quantification of the integration effects. With our regression results at hand, this can most easily be done by computing a counterfactual world scenario without any EU, EFTA, or NAFTA membership and comparing the outcome with the model prediction with the regional trading bloc effects as observed.

Figure 1 summarizes the simulation results and reports changes in intra-EEA (split into intra-EU and intra-EFTA-plus-EU-EFTA trade) and intra-NAFTA trade volumes according to a hypothetical removement of the respective trading blocs. Generally, the differences between the overall (short-term *plus* additional long-term) and the between (additional long-term) effects are not statistically significant. The overall effect of the removement of the EU or EEA amounts to a reduction of the intra-EEA trade volume

[12] There are no time-invariant doubly exogenous variables in our application.

[13] There is no difference between the MM and the F2SM results, so I suppress the latter for the sake of brevity.

Table 2: *Assessing Regional Trading Bloc Effects with Panel Data*

Explanatory variables [a]	Mundlak (1978)		Hausman and Taylor (1981) [b]	
	Within-effects (short-run)	Additional between-effects (long-run)	Within-effects (short-run)	Additional between-effects (long-run)
Bilateral GDP	1.220***	0.412***	1.660***	–
	(0.140)	(0.146)	(0.063)	–
Similarity index	0.744***	0.074	0.792***	–
	(0.101)	(0.111)	(0.052)	–
Relative capital-labor ratio	−0.047	−0.026	−0.111***	–
	(0.067)	(0.079)	(0.036)	–
Relative high-skilled to	−0.055*	−0.196***	−0.060**	–
low-skilled labor ratio	(0.032)	(0.071)	(0.028)	–
Transport costs	−0.531***	−0.304***	−0.537***	–
	(0.015)	(0.076)	(0.015)	–
Exporter viability of contracts	0.057	2.258***	0.139***	–
	(0.054)	(0.237)	(0.050)	–
Importer viability of contracts	0.622***	−0.026	0.560***	–
	(0.037)	(0.170)	(0.033)	–
Exporter rule of law	0.001	−0.327	0.012	–
	(0.043)	(0.202)	(0.041)	–
Importer rule of law	0.083**	0.006	0.112***	–
	(0.037)	(0.123)	(0.034)	–
Exporter trade barriers	0.990***	−1.252***	0.846***	–
	(0.126)	(0.350)	(0.116)	–
Importer trade barriers	−0.365***	0.314***	−0.209***	–
	(0.063)	(0.108)	(0.050)	–
EU integration	0.111	0.431***	0.109	0.501***
	(0.127)	(0.150)	(0.122)	(0.156)
EFTA integration	0.058	0.429**	0.045	0.592***
	(0.127)	(0.174)	(0.122)	(0.192)
NAFTA integration	0.060	3.763***	0.073	3.960**
	(0.137)	(1.410)	(0.132)	(1.933)
Observations	5,567	–	5,567	–
Number of bilateral relations	1,179	–	1,179	–
R^2 [c]	0.995	–	0.972	–
Time effects[d]	194.67***	–	3.87***	–
Hausman test: $\chi^2(24)$	487.05***	–	–	–
Over-identification: $\chi^2(6)$	–	–	4.03	–

***, **, * significant at the 1, 5, and 10 percent level, respectively.

[a] All variables in logs and standard errors in parentheses. – [b] This is a modified Hausman and Taylor (1981) model, where the EU and EFTA integration (dummy) variables enter twice, since they are split into two parts: the time-variant (within) component and the time-invariant (between) component. The time-invariant integration effect, the bilateral GDP, the similarity index and transport costs are treated as singly exogenous (Cornwell et al. 1992), all other variables are treated as doubly exogenous. – [c] The R^2 in the second-stage regression is 0.40. – [d] Distributed as $\chi^2(22)$ in the Mundlak model and as F(10, 5538) in the modified Hausman and Taylor model, respectively.

Figure 1a: *Simulated Integration Effects of an EU, EFTA or NAFTA Membership (Mundlak Model) (counterfactual world simulations)*

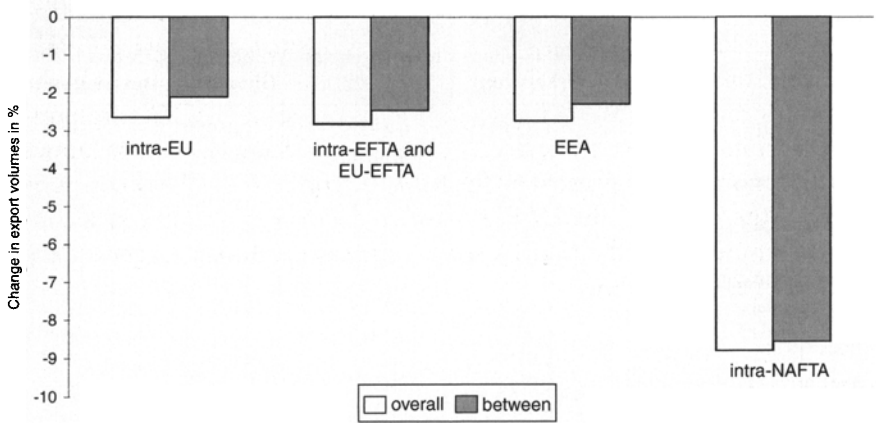
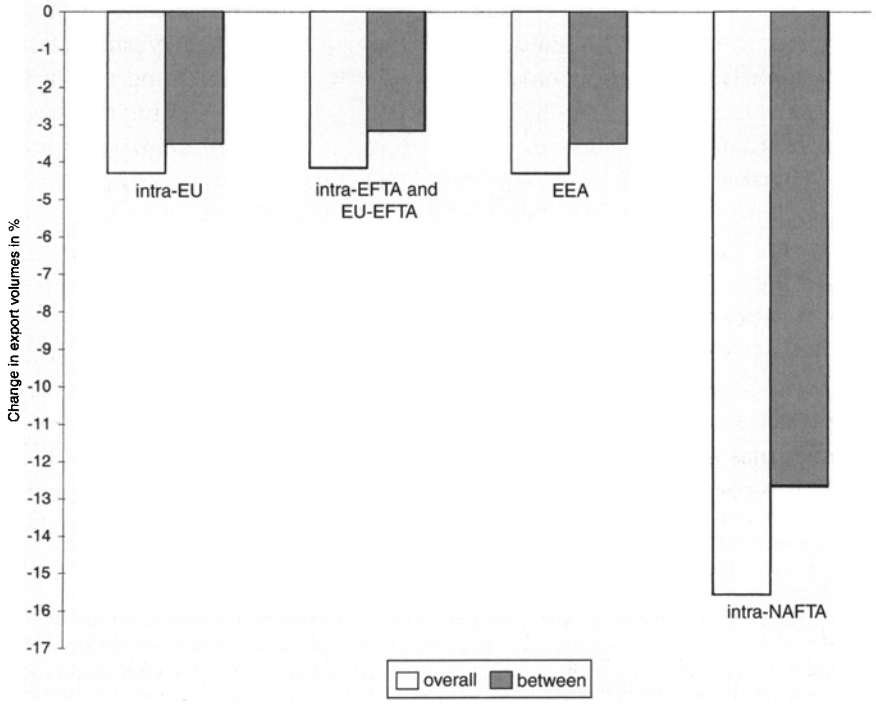


Figure 1b: *Simulated Integration Effects of an EEA Membership (Hausman & Taylor Model) (counterfactual world simulations)*



by about 4 percent, according to the MHTM.[14] The biased MM points to a smaller importance of the EEA, and suggests that less than 3 percent of intra-EU or intra-EEA trade may be attributed to the establishment of the respective trading bloc. In our example, the Hausman and Taylor (1981) overidentification test reveals the appropriateness of the instruments in the MHTM. According to the MHTM, the formation of the NAFTA is responsible for an intra-NAFTA trade creation effect of about 15 percent (about one-third more than suggested by the MM). Accordingly, we may conclude that both the EEA and the NAFTA have created trade volumes in a considerable amount, but the NAFTA seems triple as productive in generating trade volumes as the EEA.

4 Discussion

Most available estimates of trading bloc effects are based on OLS regressions. However, this is not the first paper to use panel econometric techniques in this context. As mentioned in the Introduction, Cheng and Wall (2001), Glick and Rose (2002) and Pakko and Wall (2001) use panel estimators and control for time-invariant bilateral heterogeneity across country pairs to estimate the effects of trading blocs on trade.[15] Of this work, Cheng and Wall (2001) is closest to the present paper. They also suggest associating the fixed effects estimates with short-run effects. Whereas I suppose to interpret the between-parameters above as the additional long-run impact, Cheng and Wall (2001) do so with the difference between the OLS and the fixed effects parameters. However, there is a difference between the two concepts, which is due to the inconsistency of the OLS parameters and that of the simple additional between-parameters in the Mundlak model or in the second-step regression of the fixed effects on the explanatory variables (Cheng and Wall 2001: 13). The source of this inconsistency is the above-addressed correlation of the cross-sectional dimension of the variables, i.e., an omitted-variables bias in the between-dimension. In fact, it is the advantage of the MHTM to consistently approximate both the short-run *and* the long-run impact of trading blocs on trade (for instance, the between-estimates of the

[14] One would have obtained a similar result for overall intra-EEA trade on the basis of the MHTM.

[15] Though also controlling for the trade-creating effects of free trade areas, Glick and Rose (2002) and Pakko and Wall (2001) mainly concentrate on the impact of currency unions.

long-run integration effects in Table 2 are downward biased). Especially, this is important for the case of strongly unbalanced data, where estimating dynamic models is infeasible or associated with a tremendous loss of observations.

Cheng and Wall (2001) look at lower frequency data and check for the robustness of their short-run parameters when using differenced data of the longest available time span. They argue that using lower frequency data can reveal insights in the dynamic process and the speed of adjustment after integration coming into effect. Hence, they reflect an intermediate-run impact of trading blocs. However, there are two prerequisites for this interpretation to be valid. First, the data should be equally spaced around the integration coming into effect. Hence, the period before and after switching into a trade union should be equally long. If this is not the case, but the change in the trading bloc dummy occurs only in the last part of the covered time period, the estimated parameter nevertheless is only a short-run effect. Second, the data should be relatively balanced. Otherwise, the difference in the trading bloc parameters between high and low frequency data may also capture sample composition effects. However, if the data are relatively balanced, one should immediately estimate a dynamic model to infer short-run and long-run parameters, rather than rely on proxies from fixed effects and between-regressions. For my data set, both prerequisites do not apply: (i) only the formation of NAFTA is in the center of the data, but both the EU and NAFTA change at the end of the covered period, and (ii) the data base is strongly unbalanced. The point estimates of the short-run parameters remain relatively stable and insignificant, irrespective of whether I drop any second (MHTM2 in Table 3) or any second plus third year (MHTM2&3 in Table 3), or I use 1986–1997 differences (last column of results in Table 3). Though I would not say that this is a general property to be expected in all data sets (see Glick and Rose, 2002, for evidence on the contrary), I would always expect long-run trading bloc effects parameters, which are way above their short-run counterparts.

However, the results from this exercise can be summarized as follows. The MHTM approach is a valid estimation procedure to derive approximate values of the short-run and long-run trade creation effects of trading bloc membership with strongly unbalanced data. First differencing is never a solution to obtain an estimate of the long-run impact of trading blocs if there is a between-effect in the data-generating process. Then, neither the fixed effects estimator nor the first-difference estimator are helpful to gather information on the long-run impact, since any time-invariant impact is dif-

Table 3: *Robustness of the Parameters with Lower Frequency Data*

Explanatory variables[a]	MHTM2: Hausman and Taylor (1981)[b] Dropping any second year		MHTM2&3: Hausman and Taylor (1981)[b] Dropping any second and third year		1987–1997 differences
	Within-effects (short-run)	Additional between-effects (long-run)	Within-effects (short-run)	Additional between-effects (long-run)	(short-run)
Bilateral GDP	1.639***	–	1.499***	–	1.644***
	(0.074)	–	(0.088)	–	(0.461)
Similarity index	0.814***	–	0.726***	–	1.684***
	(0.058)	–	(0.067)	–	(0.319)
Relative capital labor ratio	−0.129***	–	−0.115**	–	0.128
	(0.041)	–	(0.047)	–	(0.191)
Relative high-skilled to low-skilled labor ratio	−0.111***	–	−0.104**	–	−0.140
	(0.042)	–	(0.052)	–	(0.108)
Transport costs	−0.658***	–	−0.572***	–	−0.931***
	(0.022)	–	(0.028)	–	(0.100)
Exporter viability of contracts	0.097	–	0.360***	–	0.221
	(0.069)	–	(0.075)	–	(0.343)
Importer viability of contracts	0.695***	–	0.629***	–	−0.103
	(0.054)	–	(0.063)	–	(0.121)
Exporter rule of law	0.051	–	0.029	–	0.570
	(0.057)	–	(0.075)	–	(0.673)
Importer rule of law	0.095*	–	0.209***	–	0.644*
	(0.054)	–	(0.063)	–	(0.340)
Exporter trade barriers	1.153***	–	1.057***	–	0.138
	(0.206)	–	(0.267)	–	(0.118)
Importer trade barriers	−0.374***	–	0.059	–	0.935
	(0.102)	–	(0.086)	–	(0.674)
EU integration	0.116	0.421**	0.077	0.626***	0.123
	(0.140)	(0.171)	(0.048)	(0.098)	(0.101)
EFTA integration	0.062	0.495**	0.047	0.519***	0.075
	(0.140)	(0.199)	(0.147)	(0.106)	(0.094)
NAFTA integration	0.070	4.385**	0.029	3.668**	0.141
	(0.171)	(2.153)	(0.258)	(1.611)	(0.210)
Observations	3,074	–	2,139	–	307
Number of bilateral relations	1,101	–	1,084	–	307
R^2	0.984	–	0.989	–	0.373
Time effects[c]	3.37***	–	2.05	–	–
Hausman test: $\chi^2(24)$	–	–	–	–	–
Over-identification: $\chi^2(6)$	3.63	–	1.49	–	–

***, **, * significant at the 1, 5, and 10 percent level, respectively.

[a] All variables in logs and standard errors in parentheses. – [b] This is a modified Hausman and Taylor (1981) model, where the EU and EFTA integration (dummy) variables enter twice, since they are split into two parts: the time-variant (within) component and the time-invariant (between) component. The time-invariant integration effect, the bilateral GDP, the similarity index and transport costs are treated as singly exogenous (Cornwell et al. 1992), all other variables are treated as doubly exogenous. – [c] Distributed as F(5, 1954) in MHTM2 and as F(3, 2119) in MHTM2& 3, respectively.

ferenced out or captured by the fixed effects. Using lower frequency data (i.e., dropping time periods) is also not a solution to this problem. Rather, the latter is associated with an unjustified waste of information. Anyway, in the present example such as in Cheng and Wall (2001) the difference between the various short-run parameter estimates is relatively small (compare the within-parameters of Table 3 with their counterparts in Table 2). OLS (the between-estimator) or the random effects model are likely affected by the so-called problem of endogenous unobserved effects (Baltagi 2001; i.e., an omitted-variable bias in the between-dimension). In these circumstances, MHTM is able to provide consistent estimates of both the short-run and the long-run parameters.

5 Conclusions

This paper assesses the problem of the estimation of short-term and long-term regional trading bloc effects with panel data. It proposes three models which are different from previously used frameworks and may comprehensively account for these effects. Basically, the paper motivates a variable splitting method where regional trading bloc dummies enter the regression twice, using the original dummies and their between-components separately. The proposed models are a fixed effects two-stage procedure, a Mundlak (1978) model framework and a modified set-up in the spirit of Hausman and Taylor (1981). Only the latter is recommended for simulation analysis, since it is able to overcome the potential endogeneity of the long-term impact of a regional trading bloc membership, as mentioned in the recent theoretical literature. In the exemplary application, the Hausman and Taylor model seems to perform best.

I focus on the potential integration effects of the European Economic Area allowing for possible differences in the effects between intra-EU trade, trade within the remaining European Economic Area, and intra-NAFTA trade volumes. According to the results, joining a regional trading bloc does not exert any significant short-term impact on trade volumes. However, I find a considerable long-term trade creation effect. According to the estimation results, a hypothetical removement of the EEA accounts for a reduction of intra-EEA real trade volumes by about 4 percent. The establishment of the NAFTA is responsible for a triple as large effect, accounting for about 15 percent of overall trade between the current NAFTA members. A similar result together with the distinction between the short-

term and the long-term consequences of joining a regional trading bloc by concept could not have been derived by the previously used panel data approaches.

References

Amemiya, T. (1971). The Estimation of the Variances in a Variance-Components Model. *International Economic Review* 12 (1): 1–13.

Baltagi, B. H. (2001). *Econometric Analysis of Panel Data.* Chichester: John Wiley.

Baier, S., and J. H. Bergstrand (2002). Is Bilateralism Good? On the Economics of Free Trade Agreements. Unpublished manuscript, University of Notre Dame.

Bergstrand, J. H. (1985). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *Review of Economics and Statistics* 67 (3): 474–481.

Cheng, I.-H., and H. J. Wall (2001). Controlling for Heterogeneity in Gravity Models of Trade. Research Division Working Paper 99–010. Federal Reserve Bank of St. Louis, St. Louis.

Cornwell, C., P. Schmidt, and D. Wyhowski (1992). Simultaneous Equations and Panel Data. *Journal of Econometrics* 51 (1–2): 151–181.

Egger, P. (2002a). An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials. *The World Economy* 25 (2): 297–312.

Egger, P. (2002b). Alternative Techniques for Estimation of Cross-Section Gravity Models. *Review of International Economics*, forthcoming.

Egger, P., and M. Pfaffermayr (2003). The Proper Econometric Specification of the Gravity Equation: A Three-Way Model With Bilateral Interaction Effects. *Empirical Economics* 28 (3): 571–580.

Glick, R., and A. K. Rose (2002). Does a Currency Union Affect Trade? The Time-Series Evidence. *European Economic Review* 46 (6): 1125–1151.

Greenaway, D., and C. Milner (2002). Regionalism and Gravity. *Scottish Journal of Political Economy* 49 (5): 574–585.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica* 46 (6): 1251–1271.

Hausman, J. A., and W. E. Taylor (1981). Panel Data and Unobservable Individual Effects. *Econometrica* 49 (6): 1377–1398.

Helpman, E., and P. R. Krugman (1985). *Market Structure and Foreign Trade.* Cambridge, Mass: MIT Press.

Krueger, A. O. (1999). Trade Creation and Trade Diversion under NAFTA. NBER Working Paper 7429. National Bureau of Economic Research, Cambridge, Mass.

Linnemann, H. (1966). *An Econometric Study of International Trade Flows.* Amsterdam: North-Holland.

Mátyás, L. (1997). Proper Econometric Specification of the Gravity Model. *The World Economy* 20 (3): 363–368.

Mundlak, Y. (1978). On the Pooling of Time Series and Cross-Section Data. *Econometrica* 46 (1): 69–85.

Nilsson, L. (2000). Trade Integration and the EU Economic Membership Criteria. *European Journal of Political Economy* 16 (4): 807–827.

Pakko, M. R., and H. J. Wall (2001). Reconsidering the Trade-Creating Effects of a Currency Union. *Federal Reserve Bank of St. Louis Review* 83 (5): 37–45.

Soloaga, I., and L. A. Winters (2001). Regionalism in the Nineties: What Effect on Trade? *North American Journal of Economics and Finance* 12 (1): 1–29.

Tinbergen, J. (1962). Shaping the World Economy: Suggestions for an International Economic Policy. New York: The Twentieth Century Fund.

Wall, H. J. (2002). Has Japan Been Left Out in the Cold by Regional Integration? *Bank of Japan Monetary and Economic Studies* 20 (2): 117–134.

Winters, L. A. (1996). Regionalism versus Multilateralism. CEPR Discussion Paper 1525. Centre for Economic Policy Research, London.