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Working Papers | 87 | June 2012

Neil Foster

On the Volume and Variety of Intra-Bloc Trade in an Expanded European Union

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This research forms a part of the project on 'The revival of NMS mutual trade after their EU accession: In search of the reasons behind', which is funded by the Jubilee Fund of the Oesterreichische Nationalbank (OeNB).

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On the Volume and Variety of Intra-Bloc Trade in an Expanded European Union

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Summary

This paper examines the development of exports within the expanded European Union over the period 2000-2007. The paper addresses the issues of how and why within-bloc exports have developed following accession. The paper shows that exports within CEFTA and within other accession countries have grown more quickly than those between old EU members, but that after accounting for traditional gravity determinants there has been no significant change in this behaviour following accession in 2004. As such, this is likely to reflect a natural realignment of trade patterns following the communist era, as well as the relatively stronger performance of the new entrants when compared with existing EU members. The results also indicate that much of the increase in exports within the accession countries has been due to an increase in the variety of products traded, rather than an increase in the volume of existing products.

Keywords: *trade, intensive and extensive margins, gravity model, EU accession*

JEL classification: *F15*

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On the volume and variety of intra-bloc trade in an expanded European Union

1. Introduction

Following the accession of ten countries to the European Union (EU) in 2004, bilateral trade flows in the expanded EU have shown some interesting tendencies. A particular example is that mutual trade of the Central European new members has been expanding faster than these countries' trade with the 'old' EU members and also more dynamically than before accession. This is a new development following the collapse of this trade in the early 1990s and its sluggish recovery prior to EU accession. The purpose of this paper is to firstly examine why trade within blocs of EU countries have developed differently, in particular for Central European countries, and secondly, how these changes have taken place. In terms of the former issue we are interested in examining whether the observed changes are due to observed differences in economic performance or to a changing structure of trade flows geographically (possibly due to a movement away from a hub-and-spoke trade arrangement that had developed prior to accession). In terms of the second issue our interest is in whether the changing trade flows have been the result of a change in the volume of products traded, or due to a change in the variety of goods traded.

More than four decades of quasi-isolation from the mainstream world economy after the Second World War had serious detrimental consequences for the Central European former planned economies' (Visegrad)[1] external economic relations. Artificial, non-market prices, rigidities due to the lack of convertible or at least transferable foreign exchange to settle intra-regional payments, and the overwhelming role of state institutions in virtually all aspects of trade in intra-Visegrad (and in Visegrad-Soviet) economic relations led to distorted specialization and enterprise-behaviour patterns that could not be maintained once liberalization had opened up the Visegrad economies to western competition.

Immediately after the political changes in 1989/90, political and economic considerations on the future development of their external economic relations shifted the outlook of Visegrad countries. One aspect was the intention to diminish the dependence on the Soviet Union. The other main motive was to restore traditional relations with the developed western world and with Western Europe in particular. As a result all CEECs signed European Association (EA) agreements with the EU in the 1990s, which practically eliminated all tariffs on imports from the CEECs (exceptions being agricultural and sensitive products). Dates of entry of these agreements were 1992 for the original CEFTA members and 1997 for Slovenia.

[1] In our analysis we consider the original members of CEFTA, i.e. the Czech Republic, Hungary, Poland, Slovakia, as a regional bloc of interest, which are known by the moniker Visegrad countries.

Although less attention was paid to intra-Visegrad relations, one year after the Europe Agreements were concluded an agreement on the establishment of the Central European Free Trade Area (CEFTA) was reached in December 1992. On 21 December 1992, the Czech Republic, Hungary, Poland and Slovakia signed the CEFTA Document, an agreement on the gradual creation of a free trade area concerning trade in industrial goods, and a gradual reduction of certain, but not all, barriers to trade in agricultural goods. CEFTA entered into force in 1993 and by 1997 CEFTA had abolished duties on all industrial goods apart from a minor list of sensitive goods. Most of the restrictions on agricultural and food industry products had also been removed by May 1 2004, and this applies to trade with the EU-15 and intra-regional trade as well. In the following years Slovenia, Romania and Bulgaria joined the agreement, and in 2003, immediately before the founder countries' accession to the EU, Croatia acceded as well. The reasons for shifting focus from intra-Visegrad relations towards western Europe was partly due to such relations being regarded as part of the communist heritage, but also due to concerns that the institutionalization of regional cooperation may delay their accession to the European Union. In the political rhetoric of those years it was not rare to hear arguments from the West that central European countries should first prove that they could cooperate with *each other* and only then seek closer relations with the EU or apply for membership. Measuring such cooperation in terms of the share of intra-bloc trade in total trade was always likely to be a mistake, since Visegrad countries were in the early stages of rearranging their external trade relations, and it was likely that this would bring about a decline in intra-regional trade.

Following the break-up of the Soviet Union mutual trade of the Visegrad partners collapsed, and in most cases such trade remained relatively low prior to these countries accession in to the EU (see Table 5). In the pre-accession period, while the share of exports going to other Visegrad countries was relatively high for Slovakia at 28 percent, in the other countries it was much smaller, being 19 percent for the Czech Republic, and just 7 and 10 percent Hungary and Poland respectively. After the EU accession of the Visegrad countries in 2004 an interesting development was the sudden upturn in mutual trade. This can be seen in Tables 1-4. For each of the Visegrad countries these tables show the levels of exports to other Visegrad countries along with exports to the EU15. Also shown are the annual growth rates and a comparison of the growth rates for the four years prior to and after accession. In 11 out of 12 cases we observe that the growth rate of exports to other Visegrad countries was higher in the post-accession than in the pre-accession period, with these differences ranging from around 0.5 percentage points to around 25 percentage points. The one exception is Poland's exports to Hungary, the growth rate of which was about 2 percent lower in the post-accession period. At the same time, the figures show that the growth rate of exports to the EU15 declined in the post-accession period for Slovakia and Poland. In the case of Hungary the growth of exports to the EU15 increased in the post-accession period, but by a lower amount than exports to other Visegrad countries. Only in the case of the Czech Republic did the increase in the growth of exports to EU15 countries tend to exceed

Table 1

Exports of the Czech Republic

	Hungary		Poland		Slovakia		EU15	
Period	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth
1999	337606300		1.11E+09		1.59E+09		1.33E+10	
2000	461707230	0.368	1.37E+09	0.238	1.98E+09	0.248	1.73E+10	0.306
2001	549682200	0.191	1.48E+09	0.079	2.49E+09	0.258	2.01E+10	0.159
2002	868784960	0.581	1.69E+09	0.145	2.79E+09	0.121	2.17E+10	0.083
2003	838762860	-0.035	1.82E+09	0.073	3.04E+09	0.089	2.29E+10	0.054
2004	1323160710	0.578	2.61E+09	0.435	4.22E+09	0.387	2.90E+10	0.268
2005	1516684380	0.146	3.13E+09	0.200	5E+09	0.185	3.36E+10	0.156
2006	2258419800	0.489	4.27E+09	0.363	6.36E+09	0.273	4.94E+10	0.472
2007	2160032230	-0.044	4.48E+09	0.050	6.67E+09	0.050	4.61E+10	-0.066
pre-accession	679734313	0.276	1.59E+09	0.134	2.57E+09	0.179	2.05E+10	0.150
post-accession	1814574280	0.292	3.62E+09	0.262	5.56E+09	0.224	3.95E+10	0.207

Table 2

Exports of Hungary

	Czech Republic		Poland		Slovakia		EU15	
Period	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth
1999	2.75E+08		3.84E+08		1.78E+08		1.33E+10	
2000	3.58E+08	0.302	4.95E+08	0.288	2.13E+08	0.192	1.68E+10	0.265
2001	4.45E+08	0.244	5.05E+08	0.020	2.73E+08	0.284	1.71E+10	0.015
2002	5.74E+08	0.290	5.86E+08	0.160	3.99E+08	0.460	1.97E+10	0.153
2003	5.89E+08	0.026	6.37E+08	0.086	4.93E+08	0.236	1.83E+10	-0.068
2004	7.78E+08	0.321	9.26E+08	0.454	6.29E+08	0.276	1.95E+10	0.066
2005	1.17E+09	0.500	1.08E+09	0.166	9.87E+08	0.571	2.32E+10	0.185
2006	1.85E+09	0.585	2.17E+09	1.006	1.86E+09	0.879	3.36E+10	0.449
2007	1.77E+09	-0.045	2.08E+09	-0.040	1.66E+09	-0.104	2.84E+10	-0.154
pre-accession	4.92E+08	0.216	5.56E+08	0.139	3.44E+08	0.293	1.8E+10	0.091
post-accession	1.39E+09	0.340	1.56E+09	0.396	1.28E+09	0.405	2.62E+10	0.137

Table 3

Exports of Poland

	Czech Republic		Hungary		Slovakia		EU15	
Period	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth
1999	8.29E+08	11.460	4.02E+08	0.242	2.8E+08	-0.084	1.48E+10	
2000	1.11E+09	0.339	6.21E+08	0.546	4.09E+08	0.460	2.07E+10	0.399
2001	1.35E+09	0.212	7.5E+08	0.207	5.01E+08	0.225	2.34E+10	0.133
2002	1.6E+09	0.189	9.18E+08	0.225	5.59E+08	0.117	2.70E+10	0.152
2003	1.77E+09	0.108	1.03E+09	0.124	6.84E+08	0.2237	2.94E+10	0.089
2004	2.48E+09	0.396	1.42E+09	0.374	1.01E+09	0.481	3.76E+10	0.280
2005	3.12E+09	0.261	1.94E+09	0.369	1.29E+09	0.278	4.35E+10	0.155
2006	4.89E+09	0.565	2.68E+09	0.382	1.85E+09	0.426	5.62E+10	0.292
2007	4.9E+09	0.002	2.39E+09	-0.110	1.88E+09	0.018	5.38E+10	-0.042
pre-accession	1.46E+09	0.212	8.3E+08	0.276	5.38E+08	0.256	2.51E+10	0.193
post-accession	3.85E+09	0.306	2.11E+09	0.254	1.51E+09	0.301	4.78E+10	0.171

Table 4

Exports of Slovakia

	Czech Republic		Hungary		Poland		EU15	
Period	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth	Exports (€)	Export growth
1999	1.15E+09	41.436	2.7E+08	0.610	3.67E+08	-0.429	4.39E+09	-0.599
2000	1.41E+09	0.224	3.95E+08	0.465	4.75E+08	0.294	5.90E+09	0.346
2001	1.53E+09	0.081	5.03E+08	0.272	4.98E+08	0.049	6.41E+09	0.087
2002	1.99E+09	0.305	6.9E+08	0.372	6.68E+08	0.340	7.75E+09	0.208
2003	2.12E+09	0.063	7.7E+08	0.117	7.14E+08	0.069	9.88E+09	0.276
2004	2.69E+09	0.270	1.04E+09	0.347	1.05E+09	0.468	1.13E+10	0.143
2005	3.27E+09	0.215	1.3E+09	0.257	1.42E+09	0.355	1.24E+10	0.095
2006	4.46E+09	0.366	1.89E+09	0.450	2E+09	0.409	1.89E+10	0.529
2007	4.57E+09	0.023	2.18E+09	0.151	2.16E+09	0.082	1.88E+10	-0.006
pre-accession	1.76E+09	0.168	5.89E+08	0.307	5.89E+08	0.188	7.49E+09	0.229
post-accession	3.75E+09	0.218	1.6E+09	0.301	1.66E+09	0.328	1.54E+10	0.190

the increase in the growth of exports to other Visegrad countries. Overall, these figures point to a significant growth in intra-Visegrad trade that on the face of it is difficult to explain, since most tariff barriers between Visegrad countries had been removed prior to 2004. Was this change due to the relatively strong economic performance of these countries leading to an increase in demand, or was it a process of realignment due to natural trading patterns, possibly as a result of a movement away from a hub-and-spoke trade pattern in the EU? Alternatively, it may be that although trade policy barriers were low prior to EU accession that other non-policy barriers remained, examples including differences in legal frameworks, political risk, and other administrative costs of trading (see Hornok, 2009).

Table 5

Share of exports to EU15 and CEFTA

	PRE-EU15	POST-EU15	EU15	PRE-CEFTA	POST-CEFTA	CEFTA
AT	0.837458	0.818932	-0.01853	0.13279	0.146617	0.013827
BE	0.972707	0.960834	-0.01187	0.025126	0.032911	0.007785
CY	0.947653	0.954477	0.006825	0.037784	0.027139	-0.01064
CZ	0.795463	0.769171	-0.02629	0.186915	0.2148	0.027884
DE	0.871964	0.854698	-0.01727	0.112846	0.129005	0.01616
DK	0.950506	0.93733	-0.01318	0.033183	0.043958	0.010775
EE	0.827705	0.750383	-0.07732	0.023969	0.041315	0.017346
ES	0.960966	0.95478	-0.00619	0.030096	0.034805	0.004709
FI	0.872195	0.869077	-0.00312	0.048211	0.055479	0.007267
FR	0.951233	0.939422	-0.01181	0.037403	0.048247	0.010844
GB	0.959218	0.952075	-0.00714	0.030944	0.034824	0.00388
GR	0.852061	0.832255	-0.01981	0.039567	0.041221	0.001654
HU	0.912831	0.845422	-0.06741	0.070192	0.132085	0.061893
IE	0.978491	0.983333	0.004842	0.017947	0.01463	-0.00332
IT	0.912806	0.89599	-0.01682	0.063041	0.074846	0.011805
LT	0.73036	0.629572	-0.10079	0.0778	0.109601	0.031801
LU	0.970604	0.953751	-0.01685	0.024432	0.035698	0.011266
LV	0.794988	0.615314	-0.17967	0.035434	0.065553	0.03012
MT	0.976036	0.950969	-0.02507	0.019529	0.043573	0.024043
NL	0.965864	0.945141	-0.02072	0.029894	0.047017	0.017124
PL	0.858798	0.831598	-0.0272	0.095927	0.127567	0.031641
PT	0.984741	0.979883	-0.00486	0.012305	0.016653	0.004348
SE	0.928316	0.91873	-0.00959	0.046494	0.054947	0.008453
SI	0.885004	0.843566	-0.04144	0.108228	0.150065	0.041837
SK	0.704757	0.673229	-0.03153	0.277617	0.306314	0.028697

Table 5 provides further evidence on the change in export behaviour following the accession of 2004. In particular, this table shows the shares of each of the EU25 countries' exports to the EU15 and the Visegrad countries in the pre- and post-accession periods, along with the change in this share. Here we see that all of the Visegrad countries saw a decrease in the share of exports going to the EU15 following accession. The table also reveals that all of the Visegrad countries experienced an increase in the share of exports

going to other Visegrad countries, with the increase in the shares ranging from 2.8 (Czech Republic) to 6.2 (Hungary) percent.

The aim of this study is to examine and understand how trade of particular blocs within the expanded EU developed following accession. In particular, we will consider the development of intra-Visegrad exports, as well as intra-EU15, intra-EU10 and intra-OTHEU (i.e. the remaining six accession countries). The starting point for our analysis will be the familiar gravity model of international trade. The addition of various bloc dummies and their interactions with dummies for the post-accession period will allow us to examine how and whether intra-bloc exports have developed differently, or indeed whether the changes highlighted in tables 1-5 can be explained solely by standard gravity variables.

The focus on gravity and the changes in intra-bloc trade is related to the existing literature on hub-and-spoke trade agreements. The large increases in intra-Visegrad exports for example could be explained in this context if Visegrad – EU-15 trade displayed some tendency towards a hub-and-spoke pattern prior to the 2004 enlargement, and that since accession this effect has now been reduced, or eliminated altogether. It is reasonable to assume that the EU15 being a large and rich market would attract the flows of goods and services originated by the opening up of the East European economies, leading to a hub-and-spoke arrangement. This need not be the case however, with other factors such as Preferential Trade Agreements (PTAs) playing a role. De Benedictis et al. (2005) note that the rise in income per capita levels in East Europe could also play a role through increased imports, which could come from the EU15 or other CEECs. They further show that although a number of East European countries increased the share of their exports going to the EU15 between 1993 and 2005, others – including Hungary, Poland and Slovenia – decreased their shares. According to theoretical contributions on hub-and-spoke trading patterns, for instance Deltas et al. (2006), the classical reason why such a structure would arise in a three-country setting would be if one country had a PTA with the other two, while the latter do not have a similar agreement with each other. In the case of the Visegrad – EU-15 case, this would have occurred if the EU-15 had had preferential trade agreements with each of the Visegrad countries while trade agreements between the Visegrad countries were of a weaker nature. While we know that the formation of CEFTA led to a reduction in trade barriers, and their near elimination by 1997, other institutional arrangements may have limited the effectiveness of this PTA. Such institutional factors may have been due to the concerns mentioned above that intra-regional cooperation may delay EU accession. Once accession was confirmed these concerns also disappeared. In addition, as discussed by Hornok (2009) there may have been trade barriers in place other than those associated with trade policy, examples including technical barriers to trade, waiting time at border crossings, the administrative costs of trading, differences in legal frameworks and political risk. Differences in the extent of these costs between Visegrad countries and between Visegrad and EU-15 countries may have led to the development of a hub-and-spoke trading arrangement.

A second aspect of our work will be to examine how exports have developed in the post-accession period and in particular whether the changing trade patterns are due to countries exporting a greater variety of products or a larger volume of existing products. To do this we will construct bilateral measures of the intensive and extensive margins of exports, where the intensive margin refers to changes in the volume of trade in a given set of products and the extensive margin refers to changes in the variety of products exported. Calculating the two margins for the EU25 will allow us to examine whether the two margins have developed differently for intra-Visegrad trade and Visegrad-EU15 trade, and whether these developments differ between the pre- and post-accession period. Of particular interest is the question of whether developments in mutual trade between Visegrad countries since 2004 have occurred along the intensive (i.e. increasing volume) or extensive (i.e. increasing variety) margins. The intensive and extensive margins will be calculated for each of the EU-25 countries over the period 1999-2007 using data from the COMEXT database. Developments in the two margins can then be described, in particular developments across time and developments in the margins for both intra-Visegrad and Visegrad-EU15 trade. The descriptive analysis will feed into the empirical analysis, the aim of which is to follow an approach similar to Felbermayer and Kohler (2006) who reformulate the gravity equation to take account of the dual margins of international trade, albeit using alternative definitions of the intensive and extensive margins. Employing the gravity model along with the use of interaction terms and dummy variables will allow us to examine whether exports and the two export margins have developed differently for the different blocs of EU countries considered.

The remainder of this study is laid out as follows. In the next Section we briefly discuss the existing literature on hub-and-spoke trade agreements (Section 2.1) and that on the intensive and extensive margins of exports (Section 2.2). Section 3 discusses the data used in the subsequent analysis, including the measurement of the intensive and extensive margins of exports. Section 4 describes our empirical methodology, while Section 5 describes our main results. Section 6 provides some overall conclusions.

2. Existing literature

2.1. EU accession and hub-and-spoke effects

The issue of whether global trade patterns are developing in to a hub-and-spoke system has been addressed both empirically and theoretically in recent years. Deltas et al. (2006) for instance argue that the reason for such a system appearing in a three-country setting would be if one country had a PTA with the other two, while the latter do not have a similar agreement with each other. Hur et al. (2010) note that the proliferation of PTAs and the overlapping nature of PTAs allows some countries to become hubs in the network of PTAs. On the one hand, relative to non-hub countries a PTA-hub gains preferential access to more markets and thus enjoys improved export competitiveness. To the extent that such

an advantage translates in to more exports, the hub-and-spoke feature of PTAs will have a positive impact on trade. On the other hand, Lloyd and MacLaren (2004) point out that in a PTA-hub country exporters and importers face multiple sets of rules of origin (RoO), which can lead to costs related to the verification of RoO. Such costs can restrain trade.

A number of papers empirically address the hub-and-spoke effect, with early studies including Wonnacott (1975, 1982) for Canada and Kowalczyk and Wonnacott (1992) for NAFTA. More recently, De Benedictis et al. (2005) consider such effects for the EU15 and CEEC countries, while Deltas et al. (2006) examine such effects for Israel and Chong and Hur (2008) consider Singapore, Japan and the USA. Recently Lee et al. (2008) and Hur et al. (2010) have considered the issue of hub-and-spoke arrangements for a large cross-section of countries. Lee et al. (2008) consider hub-and-spoke effects for up to 175 countries over the period 1948-1999, employing the gravity equation for their analysis. They show that overlapping PTAs are undesirable for global trade due to the dominance of the trade diversion effect. Hur et al. (2010), on the other hand, find that a PTA has a positive effect on the PTA-hub country's exports. They use data on 96 trading partners and five-year averages over the period 1960-2000. In particular, they find that under a hub-and-spoke PTA exports of a PTA-hub grows by 5.7 percent per year and doubles after 12 years.

A number of papers have examined the issue of hub-and-spoke arrangements in the context of EU expansion.[2] Laaser and Schrader (2002) employ a gravity model to consider the trade of Estonia, Latvia and Lithuania. They find that in the case of these three countries that regional integration is much more intense than is normally observed. Their results indicate that the role of distance is much more important in shaping their regional trade pattern than the institutional integration in to the EU. Damijan and Masten (2002) show that the effect of PTAs takes time to accrue. Considering the case of Slovenia in the period 1993-1998 they show that tariff reductions become effective in the second to third year after enforcement of the PTA. The results show further that being part of CEFTA increased the exports of other CEECs towards Slovenia by 18.5%. Adam et al. (2003) explore the effectiveness of CEFTA and the Baltic Free Trade Agreement (BFTA). Results from gravity models support the view that both agreements helped expand regional trade and limit the emergence of a 'hub-and-spoke' relationship between the CEECs and the EU. The result that the parameter estimates for the EAs is smaller than those for CEFTA and BFTA leads the authors to conclude that the bulk of the increase in EU-CEEC trade was due to a return to a normal trading pattern rather than to specific trade advantages offered by EAs.

[2] Hornok (2009) also examines the effect of EU accession on trade flows using a difference-in-difference analysis. Estimation is based on the gravity theory and a difference-in-difference identification strategy, with country-pairs involving at least one new member being the treatment group and country-pairs of EU15 countries the control group. She finds that EU membership increased trade in the treatment group by 14%

De Benedictis et al. (2005) examine the effects of PTAs in Europe in terms of boosting trade flows between the core and the CEECs and among the CEECs themselves. In particular, they examine whether the formation of CEFTA and the BFTA exerted a significant impact on intra-European trade, effectively reducing the influence of the EAs in shaping the European trade structure as a hub-and-spoke system – with the EU-15 being the hub and the CEECs the spokes. De Benedictis et al. (2005) estimate a gravity model using panel data and a system GMM estimator. The model is estimated for 8 CEEC reporting countries and the EU15 plus the 8 CEECs as partners, with data over the period 1994-2002. Introducing dummies for PTAs among the CEECs and then for PTAs among the CEECs and the EU they show that being part of a PTA among periphery countries – compared to not being part of it – increases bilateral trade by around 16%. They find no evidence of an effect of the EAs, which they put down to the fact that trade between CEECs and the EU had been quite intense for some time due to existing reductions in trade barriers. The authors interpret the results among the CEECs as follows: firstly prior to 1989 trade relations between CEECs were not driven by economic factors and were not as intense as they should have been. With the start of the integration process in to the EU trade flows were redirected towards the EU market. At the beginning of the new century, the role of the EU-15 as a hub still exists, but the EAs are no longer reinforcing the hub-and-spoke structure of intra-EU trade. The establishment of PTAs among CEECs restored and developed trade flows between CEECs and have limited the reinforcement of a hub-and-spoke relationship between CEECs and the EU.

2.2. EU accession and the intensive and extensive margins of exports

Recent research in international trade has emphasized the distinction between the intensive and extensive margins of trade, with the intensive margin capturing the volume of traded goods and the extensive margin the variety of goods traded. This interest followed important contributions from Feenstra (1994) and in particular Hummels and Klenow (2005) who decompose 1995 exports from 126 countries into the intensive and extensive margin examining the impact of economic size on the two margins. Following these contributions a branch of research has developed addressing the importance of the two margins and in particular the extensive margin for trade and productivity.

From a theoretical point of view models of trade based upon monopolistic competition (for example, Krugman, 1979) emphasize the importance of variety, with larger trade volumes being driven by an increase in the number of products traded. Related to these models are models of vertical differentiation (for example, Flam and Helpman, 1987) whereby richer countries trade a higher quality of good, rather than a larger variety. Grossman and Helpman (1991), amongst others, show how trade in such variety or quality can enhance growth. Hummels and Klenow (2005) and Broda and Weinstein (2006) also discuss how the distinction between trading a greater variety of products (the extensive margin) and a

greater volume of each product (the intensive margin) has important implications for welfare.[3] Hummels and Klenow (2005) for example, argue that to the extent that larger countries export more, the impact of their higher exports on welfare will depend upon whether this is due to an increase in variety or an increase in the volume of each good. In particular, if higher export volumes are due to the intensive margin then the prices of the country's exports would be expected to be lower, with a consequent reduction of welfare for larger countries. If, on the other hand, larger countries higher exports were due to the extensive margin, then there is no need for their export prices to be lower or their welfare to be lowered.

Hummels and Klenow (2005) examine why it is that larger countries export more. In particular, they consider whether larger countries trade more due to trading larger quantities of each good (the intensive margin), a wider set of goods (the extensive margin) or higher quality goods. To do this they construct measures of each of these aspects of trade using disaggregated trade on about 5000 products for 126 exporting countries to 59 importing countries. While it is not possible to directly observe quality in their data, they make inferences on the importance of quality by considering whether larger countries trade large quantities at high prices. The results they obtain indicate that the majority (around 60%) of the higher exports of larger economies are due to the extensive margin, that is, from exporting a wider variety of products. They find that the intensive margin is driven by higher quantities, rather than higher prices, a result consistent with larger countries exporting higher quality goods.[4]

Their result that the greater exports of larger countries are due to expansion along the extensive margin has been questioned by other research. Brenton and Newfarmer (2007) find that most export growth for 99 developing countries over the period 1995-2004 came through intensifying growth of existing products to existing markets. Along the extensive margin, they find that growth was mainly driven by diversification into new markets rather than through the introduction of new products. Evennett and Venables (2002) find that a third of the growth of exports of developing countries between 1970 and 1997 can be attributed to the expansion of the extensive margin. Felbermayr and Kohler (2006) find that the extensive margin played a larger role in the growth of world trade between 1950 and 1970 and again in the mid 1990s, while the intensive margin was more important in the intervening years. Helpman, Melitz, and Rubinstein (2006) find the majority of the growth of trade between 1970 and 1997 is attributable to the intensive margin rather than the extensive margin.

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[3] In the literature there are a number of ways in which a country's trade has been decomposed along these two lines (see Felbermayr and Kohler, 2006).

[4] Schott (2004) finds evidence consistent with this last result.

A further line of research addresses the productivity effects of product variety. It has been shown that increased product variety – both vertical and horizontal – can enhance economic growth, and that international trade by increasing the variety of products available can enhance growth through this channel (see for example Grossman and Helpman, 1991; Jones, 1995). Exporting a wider variety of products may also lead to gains from trade and increased growth by increasing the size of the market, which may encourage learning by doing and increase the returns to innovation (see Funke and Ruhwedel, 2002).

Trade in variety can also facilitate the diffusion of knowledge and technology, thereby increasing the stock of global knowledge. A literature beginning with the seminal study of Coe and Helpman (1995) models TFP as depending on the cumulative domestic R&D effort of an economy as well as on the foreign technological knowledge, transmitted through trade. The assumption is that countries trading primarily with partners having high levels of technological knowledge will benefit more from spillovers than countries whose trading partners have comparatively low levels of technological knowledge. The framework has been extended by Keller (2002) in order to study these spillovers across industries. He finds that the productivity of an industry depends not only on its own R&D, but also on the R&D of other manufacturing sectors and that these spillovers are also transmitted internationally via trade in intermediates. Given the increased availability of highly disaggregated data on trade flows, and given advances in the measurement of product variety (see for example Feenstra, 1994) empirical work on the gains from product variety has emerged in the last few years. One strand of this literature has been to examine whether trade in variety is associated with higher productivity growth. Feenstra and Kee (2008) for example, develop and test a model in which the variety of exports – which is used as a measure of the total variety of products available to an economy – is a determinant of productivity growth. Testing their model on 48 countries over the period 1980-2000 they find that the total growth in export variety is associated with an increase in productivity of 3.3%. Broda et al. (2006) consider the importance of import variety for productivity, finding that around 20 (5) percent of a typical developing (developed) country's productivity growth can be explained by new imported varieties. Other papers employ more standard regression-type models of productivity growth with a measure of product variety included as an explanatory variable. Funke and Ruhwedel (2001) find evidence that product variety (both import and export variety) helps explain relative per capita GDP levels in the OECD, while Funke and Ruhwedel (2005) find similar results for transition economies. Nguyen and Parsons (2009) consider indicators of import variety for 21 industries in Japan and find that while the results differ across industries many industries benefit in terms of productivity from higher import variety.

The literature on the intensive and extensive margins most related to ours however is that which considers whether and how geographic frictions affect the margins of trade. A great deal of empirical literature has shown that geographic frictions reduce trade. Standard re-

sults in the gravity literature for example indicate that trade declines with distance, while dummy variables for common borders, landlockedness and island economies also tend to be important determinants. Empirical evidence examining the question of why gravity seems to be so important for trade flows is largely absent however. One recent exception is Hillberry and Hummels (2008) who use data on manufacturers' shipments within the US on a very fine grid to examine what parts of trade are reduced most by geographic frictions. They find that the pattern of shipments is extremely localized; shipments within 5-digit zip codes are three times larger than shipments outside the zip code. Decomposing aggregate shipments into extensive (i.e. the number of commodities) and intensive (i.e. the value per commodity) margins, they show that distance and other frictions reduce aggregate trade values primarily by reducing the number of commodities shipped and the number of establishments shipping. As such, the importance of geographic frictions occurs mainly along the extensive margin. They argue that the reason for these results is that firms sort themselves along geographical lines to avoid spatial frictions: that is, firms locate close to up- and down-stream establishments implying that there will be little intermediate goods trade beyond a certain distance. Some support is found for this hypothesis.

Also related to our work is a recent literature examining whether recent increases in the volume of trade is due to increases in the variety of products trade. The extent of international trade has grown rapidly in the recent past. The reasons for this are manifold and include the general reduction in tariff and non-tariff barriers, increasing integration among member states, the increasing importance of regional and preferential trading arrangements, and the growing importance of large trading partners such as China and India. Another important factor, as pointed out by Funke and Ruhwedel (2002) is likely to be the increasing importance of product variety and intra-industry trade in global trade. While the increasing importance of intra-industry trade has been documented for a long time (see Greenaway and Milner, 1986), empirical literature on the importance of and benefits from increasing product variety have only more recently surfaced, largely as a result of the increased availability of highly disaggregated trade data and advances in trade theory. Theoretical models are able to show that allowing for monopolistic competition can explain why much international trade is in similar products (see Helpman and Krugman, 1995). These models usually rely on firms producing differentiated products with increasing-returns-to-scale technology and consumers having a utility function that is increasing in product diversity. Two types of product differentiation are usually considered. Horizontal differentiation (e.g. Krugman, 1979) models tend to rely on a Dixit-Stiglitz type set-up, in which the relative growth of a country's resource base leads to an increasing variety of products produced. The increase in variety leads to an increasing share of world consumption spending for this country, and as such higher exports for this country. The alternative to such models are models of vertical differentiation (e.g. Grossman and Helpman, 1991), in which a country switches production into products with increasing technological content

A small number of papers have examined whether the growth in trade has taken place along the intensive or extensive margin. Funke and Ruhwedel (2002) for example regress the exports of a country on a measure of product variety, the real effective exchange rate and world GDP. Estimating their model for 15 OECD countries over the period 1989-1997 they find that export variety is significantly related to the volume of trade. Kang (2004) using data for South Korea shows the extensive margin plays a more important role in export growth than does the intensive margin. Schott (2004) finds that richer countries export to the US at higher unit prices within narrow categories, as do countries relatively abundant in physical and human capital.

3. Data construction and sources

To undertake our analysis, we require disaggregated data on bilateral export flows between the EU25 members, as well as a number of other country and country-pair specific variables to be used as explanatory variables in our gravity equation. Data on bilateral export flows is from the COMEXT database and is collected for the period 1999-2007. This data is at the CN 8 digit level, which has data on 9576 different product categories. Data on GDP, GDP per capita and population are from the World Bank's World Development Indicators (2009), with GDP measured in constant 2000 dollars. Geographic variables are taken from CEPII.[5] These data include distance between capital cities and dummies for common language and common border. A landlocked dummy is also constructed taking the value 0,1,2 depending on whether none, one or both partners are landlocked respectively.

3.2. Measurement of the intensive and extensive margins of exports

We construct indices of the intensive and extensive margins based upon Feenstra (1994) and in particular Hummels and Klenow (2005). Hummels and Klenow (2005) employ the methodology of Feenstra (1994) in order to decompose exports in to the relevant margins. They define the Extensive Margin (EM) as;

$$EM_{jm} = \frac{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}},$$

where I_{jm} is the set of observable categories in which the exporting country j has positive exports to m, p_{kmi} is the price of a unit of good i exported from reference country k to country m (measured as the unit value, that is $value/quantity$), and x_{kmi} is the quantity of good i exported from reference country k to country m. Reference country k has positive exports to m in all I categories. In our analysis, the reference 'country' k is chosen to be the EU-25 countries (that is, we consider the sum of all EU25 countries exports for reference). EM_{jm} can thus be thought of as a weighted count of j's categories relative to k's categories. If all categories are of equal importance then the extensive margin is simply the

[5] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

fraction of categories in which j exports to m. More generally however, the categories are weighted according to their importance in $k's$ exports to m. Hummels and Klenow (2005) discuss the advantages and disadvantages of this formulation, noting that by evaluating a category's importance without reference to $j's$ exports is that it prevents a category from appearing important just because j and no other country exports a lot in that category. On the other hand, they point out that a country can appear to have a large export margin if it exports a small amount in categories in which k exports a lot.

The intensive margin (IM) compares nominal shipments for country j and k in a common set of goods. It is given by;

$$\mathrm{IM_{jm}} = \frac{\sum_{\mathrm{i}\in \mathrm{I_{jm}}} \mathrm{p_{jmi}x_{jmi}}}{\sum_{\mathrm{i}\in \mathrm{I_{jm}}} \mathrm{p_{kmi}x_{kmi}}}$$

IM_{jm} equals j's nominal exports relative to k's nominal exports in those categories in which j exports to $m(I_{jm})$.

A useful result for the econometric analysis that follows is the following;

$$\frac{\sum_{\mathrm{i}=1}^{\mathrm{I}} \mathrm{p_{jmi}x_{jmi}}}{\sum_{\mathrm{i}=1}^{\mathrm{I}} \mathrm{p_{kmi}x_{kmi}}} = \mathrm{IM_{jm}EM_{jm}}$$

Hummels and Klenow (2005) go on to discuss the decomposition of the intensive margin into a price and quantity index. To do this they use the result of Feenstra (1994) who derives an exact price index for the intensive margin of country $m's$ imports from j relative to k as;

$$\mathrm{P_{jm}} = \prod_{\mathrm{i}\in \mathrm{I_{jm}}} \left(\frac{\mathrm{p_{jmi}}}{\mathrm{p_{kmi}}}\right)^{\mathrm{w_{jmi}}}$$

where w_{jmi} is the logarithmic mean of s_{jmi} and s_{kmi}, which are the shares of category i in country $j's$ exports to m, and country $k's$ exports to m respectively;

$$\mathrm{s_{jmi}} = \frac{\mathrm{p_{jmi}x_{jmi}}}{\sum_{\mathrm{i}\in \mathrm{I_{jm}}} \mathrm{p_{jmi}x_{jmi}}}$$

$$\mathrm{s_{kmi}} = \frac{\mathrm{p_{kmi}x_{kmi}}}{\sum_{\mathrm{i}\in \mathrm{I_{km}}} \mathrm{p_{kmi}x_{kmi}}}$$

$$\mathrm{w_{jmi}} = \frac{\frac{\mathrm{s_{jmi}}-\mathrm{s_{kmi}}}{\mathrm{lns_{jmi}}-\mathrm{lns_{kmi}}}}{\sum_{\mathrm{i}\in \mathrm{I_{jm}}} \frac{\mathrm{s_{jmi}}-\mathrm{s_{kmi}}}{\mathrm{lns_{jmi}}-\mathrm{lns_{kmi}}}}$$

Hummels and Klenow (2005) use these results to decompose the intensive margin into a price and an implicit quantity index;

$$\mathrm{IM_{jm}} = \mathrm{P_{jm}X_{jm}}$$

While our analysis uses the bilateral measures of the extensive and intensive margin as described above Hummels and Klenow (2005) also construct an aggregate measure of each of the above variables for each exporter j. They take the geometric averages of each of the variables for country j across the M_{-j} markets;

$$IM_j = \prod_{m \in M_{-j}} (IM_{jm})^{a_{jm}}$$

$$EM_j = \prod_{m \in M_{-j}} (EM_{jm})^{a_{jm}}$$

$$P_j = \prod_{m \in M_{-j}} (P_{jm})^{a_{jm}}$$

$$X_j = \prod_{m \in M_{-j}} (X_{jm})^{a_{jm}}$$

where the weight a_{jm} is the logarithmic mean of the shares of m in the overall exports of j and W_{-j-m} respectively.

Table 6

Changes in the intensive and extensive margins

	PRE-IM	POST-IM	IM	PRE-EM	POST-EM	EM
AT	0.086	0.075	-0.011	0.841	0.877	0.035
BE	0.053	0.050	-0.004	0.699	0.785	0.086
CY	0.007	0.005	-0.003	0.026	0.029	0.003
CZ	0.122	0.137	0.015	0.889	0.925	0.037
DE	0.396	0.368	-0.027	0.955	0.957	0.002
DK	0.019	0.017	-0.002	0.479	0.539	0.060
EE	0.008	0.007	-0.002	0.102	0.148	0.046
ES	0.053	0.035	-0.018	0.586	0.658	0.071
FI	0.018	0.016	-0.002	0.457	0.476	0.019
FR	0.084	0.074	-0.010	0.792	0.854	0.062
GB	0.057	0.042	-0.015	0.721	0.761	0.040
GR	0.014	0.009	-0.005	0.175	0.196	0.021
HU	0.036	0.055	0.018	0.645	0.697	0.052
IE	0.031	0.020	-0.011	0.233	0.204	-0.030
IT	0.112	0.089	-0.023	0.822	0.861	0.039
LT	0.008	0.008	0.000	0.196	0.326	0.130
LU	0.008	0.011	0.003	0.200	0.226	0.026
LV	0.011	0.006	-0.005	0.096	0.152	0.056
MT	0.014	0.011	-0.003	0.011	0.029	0.018
NL	0.056	0.069	0.013	0.738	0.800	0.063
PL	0.066	0.087	0.021	0.785	0.851	0.066
PT	0.010	0.009	-0.001	0.248	0.247	-0.001
SE	0.027	0.026	-0.002	0.621	0.648	0.028
SI	0.018	0.020	0.002	0.470	0.561	0.091
SK	0.050	0.065	0.015	0.749	0.802	0.053

3.3. Descriptive statistics

Table 6 reports the average intensive export margin to Visegrad countries for each of the EU-25 countries in the period prior to (Column 1) and post (Column 2) accession along with the change in this variable in the two periods (Column 3). The final three columns report the same statistics for the extensive export margin. Considering the intensive margin we observe that there was a decline in the intensive margin of exports to Visegrad countries for all countries except the Visegrad countries themselves, along with Slovenia, Lux-

embourg and the Netherlands. This indicates that for most countries there was a decline in the volume of products exported to Visegrad countries in the post-accession period. Visegrad countries experienced an increase in the volume of products exported to other Visegrad countries however. In terms of the extensive margin we observe for all countries except Ireland and Portugal, an increase in the extensive margin in the post-accession period, indicating that countries were exporting a wider variety of products to Visegrad countries in the post-accession period. The largest increases were found for Belgium, Lithuania and Slovenia. The main thing to draw from this table is that the major difference between intra-Visegrad trade and the exports of the other countries to Visegrad countries in the post-accession period is that Visegrad countries tended to export an increased volume of products amongst themselves, while most other countries saw a drop in the volume of products exported to Visegrad countries.

4. Methodology

While the descriptive statistics provide some support for there being significant differences in export performance amongst blocs within the EU and since EU accession, in what follows we address these issues in greater detail using a more formal analytical approach. The aim of this is to follow an approach similar to Felbermayer and Kohler (2006) who reformulate the gravity equation to take account of the dual margins of international trade, albeit using alternative definitions of the intensive and extensive margins. Employing the gravity model along with the use of interaction terms and dummy variables will allow us to examine whether the two margins have developed differently for intra-Visegrad and Visegrad-EU15 trade, as well as address such issues as whether the growth in intra-Visegrad trade since 2004 has occurred along the intensive or extensive margin. To address these issues we make use of the gravity model of trade. Following the early contributions of Linnemann (1966) and Tinbergen (1962) this model has become the workhorse for predicting trade flows. Our starting point is the fairly standard version of the gravity equation:

$$trade_{jmt} = \sum_{z=1}^{Z} \beta_j Gravity_{z\,rct} + \delta_1 VISEGRAD_{rct} + \delta_2 EU15_{rct} + \delta_3 OTHEU_{rct} + \varepsilon_{rct}$$

where $trade$ refers to the level of (bilateral) exports or to the intensive or extensive margin, $Gravity$ refers to standard gravity determinants (which would include distance, the level of GDP of exporter and importer, common border dummy and so on), $VISEGRAD$ is a dummy equal to one if countries j and m are both in Visegrad, $EU15$ is a dummy equal to one if both countries are in the EU-15, while $OTHEU$ is a dummy equal to one if both exporter and importer are in the remaining group of 10 accession countries.[6]

[6] Recent studies using the gravity model have taken more care to account for zero observations, which can bias the results. Santos-Silva and Tenreyro (2006) for example propose the Poisson-pseudo maximum likelihood estimator to deal with this problem, while Helpman et al. (2008) suggest a two-stage Heckman approach. In the current paper we have positive trade flows reported for 5397 out of a maximum of 5400 observations. As such, the issue of the zero trade flows is unlikely to be important.

The model as specified will allow us to examine whether exports and the margins have developed differently for different country groupings, after controlling for standard gravity determinants of trade. The excluded (comparison) group will be bilateral trade flows between members of different blocs (e.g. and EU15 country trading with a Visegrad country and so on). Introducing interaction terms between the bloc dummies and a dummy variable for the post-accession period will allow us to examine whether the development of the margins for the different bilateral relationships behaved differently before and after accession.

There has been some debate on the correct specification of the gravity equation in a panel context, and in particular the set of fixed effects, i.e. dummy variables, to include in the regression model. In the literature, researchers have included time dummies, country (i.e. importer and exporter) dummies, bilateral pair dummies and country-time dummies, or some combination of these. Baldwin and Taglioni (2006) for example argue that one way of dealing with the time-varying multilateral price terms of Anderson and van Wincoop (2004) is to include time-varying country dummies. It can be shown that the inclusion of country dummies removes the correlation between the cross-country price term and the included variables, but does not remove the cross-time correlation. The inclusion of time-varying country effects is however appropriate. Baldwin and Taglioni (2006) go on to argue that while country-time dummies help address the problem of the multilateral resistance term they do not remove the bias resulting from the correlation between included determinants of bilateral trade and unobservable determinants. As such, they propose including time-invariant country-pair dummies in the gravity model. The inclusion of bilateral-pair fixed effects has the drawback that one cannot estimate the coefficients on time-invariant variables such as distance. In terms of the approach we adopt we are limited in our choice of fixed effects to include. When including country-pair and/or country-time fixed effects it is not possible to estimate the coefficients on the bloc dummies (and their interactions) and so results including these fixed effects are not included in the analysis. In various specifications however we include year, exporter and importer fixed effects.

5. Results

5.1. Initial results

As a first step we report for each of our trade measures linear results excluding the particular EU region dummies, but including various fixed results. These results are reported in Tables 7-9. The results when the log of exports is our dependent variable (Table 7) are largely as expected. The coefficients on distance are negative and significant, with a value slightly larger in absolute value than the value of one often found in the literature. The coefficients on common language and common language are positive and significant as expected, while that on landlocked tends to be negative and significant (an exception being when country and time dummies are included). The model as specified explains a large

portion of the variance in exporting, with an R-squared ranging from 0.88 to 0.99 (when country and time dummies are included).

Table 7

Initial results – exports

VARIABLES	(1) EXP	(2) EXP	(3) EXP	(4) EXP
$LDIST$	-1.282***	-1.284***	-1.108***	-1.154***
	(0.0264)	(0.0262)	(0.0244)	(0.0275)
$COMBORD$	0.336***	0.321***	0.452***	0.436***
	(0.0592)	(0.0578)	(0.0559)	(0.0576)
$COMLANG$	0.127*	0.171**	0.267***	0.292***
	(0.0729)	(0.0719)	(0.0820)	(0.0824)
$LOCK$	-0.258***	-0.263***	-0.615***	2.659
	(0.0277)	(0.0274)	(0.0335)	(7.829)
$LGDP - EXP$	0.906***	0.875***	0.989***	1.000***
	(0.0185)	(0.0186)	(0.140)	(0.133)
$LGDP - IMP$	0.655***	0.624***	0.602***	0.935***
	(0.0228)	(0.0232)	(0.0197)	(0.131)
$LPOP - EXP$	1.1.1 0.110***	1.1.2 0.143***	1.1.3 -1.980**	1.1.4 -1.980**
	(0.0217)	(0.0216)	(0.838)	(0.788)
$LPOP - IMP$	0.186***	0.219***	0.234***	-0.237
	(0.0293)	(0.0295)	(0.0242)	(0.714)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.877	0.998	0.998	0.999
F-test	2963	183360	157339	127299

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

When considering the intensive and extensive margins (Tables 8 and 9 respectively) as our dependent variable we find coefficients that are largely consistent with those for total (bilateral) exports. The major exceptions are for the GDP of the importer and the population of the importer when considering the intensive margin, in which cases we tend to find negative (and often significant) coefficients. In terms of the R-squared we observe that the gravity model does not explain as much of the variance in IM or EM as it does total exports, but that the model tends to explain the variation in EM to a greater extent than it does IM.

In the next stage we include the three sets of country-group fixed effects ($EU15$, $VISEGRAD$, $OTHEU$). These results allow us to examine whether our measures of trade have developed differently for the three country groupings over the period studied. The results are reported in Table 10. The coefficients on the gravity variables are largely consistent with those discussed above and are excluded from the tables for reasons of brevity. Turning immediately to the results on the bloc-dummies we find that the results for the

EU15 are mixed, depending upon the specification of the gravity equation employed. For exports we find negative and significant coefficients in Columns 1 and 3, but a positive and significant one in Column 2. When looking at the margins the coefficients are more consistent. In particular, for IM we find a coefficient that is negative when significant, and for EM a negative coefficient that is significant in 3 out of 4 cases. For Visegrad countries the results point to a strong positive impact of the intra-bloc dummy, suggesting that exports between Visegrad countries are higher than would be expected from the gravity model for the whole period considered. The results on the margins indicate that these higher exports are due to a greater variety of goods exported, with the coefficients on the intensive margin being insignificant. The results for the remaining new members are similar to those for Visegrad, with a large positive coefficient found when looking at the level of exports. In general, the size of this coefficient is smaller – though not significantly so – than that for Visegrad exports. Once again, much of the higher exports between CEECs is found to occur through an increase in the variety of products exported. In this case, there are significant coefficients found when considering the intensive margin, but they are positive in two cases (Columns 1 and 2) and negative in two (Columns 3 and 4).

Table 8

Initial results – intensive margin

	(1)	(2)	(3)	(4)
VARIABLES	**IM**	**IM**	**IM**	**IM**
$LDIST$	-0.0219***	-0.0218***	-0.0211***	-0.0287***
	(0.00188)	(0.00187)	(0.00204)	(0.00241)
$COMBORD$	0.0688***	0.0693***	0.0577***	0.0539***
	(0.00542)	(0.00542)	(0.00467)	(0.00469)
$COMLANG$	0.0426***	0.0413***	0.0355***	0.0372***
	(0.00738)	(0.00739)	(0.00675)	(0.00677)
$LOCK$	-0.0291***	-0.0289***	-0.0241***	0.00952
	(0.00160)	(0.00160)	(0.00199)	(0.463)
$LGDP - EXP$	0.0190***	0.0199***	0.0183**	0.0181**
	(0.000759)	(0.000781)	(0.00770)	(0.00760)
$LGDP - IMP$	-0.00660***	-0.00568***	-0.00524***	-0.00591
	(0.000993)	(0.00100)	(0.000815)	(0.00789)
$LPOP - EXP$	0.00321***	0.00223**	-0.0221	-0.0208
	(0.00101)	(0.00102)	(0.0362)	(0.0361)
$LPOP - IMP$	-0.00108	-0.00206*	-0.00208**	0.0105
	(0.00120)	(0.00121)	(0.00100)	(0.0512)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.532	0.699	0.801	0.811
F-test	356.6	394.7	433.9	377.8

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9

Initial results – extensive margin

VARIABLES	(1) EM	(2) EM	(3) EM	(4) EM
$LDIST$	-0.172***	-0.172***	-0.146***	-0.159***
	(0.00365)	(0.00365)	(0.00352)	(0.00372)
$COMBORD$	0.0849***	0.0854***	0.0974***	0.0900***
	(0.00867)	(0.00869)	(0.00873)	(0.00870)
$COMLANG$	0.0181	0.0168	0.0237*	0.0304***
	(0.0114)	(0.0114)	(0.0125)	(0.0112)
$LOCK$	-0.0504***	-0.0502***	-0.0720***	1.668*
	(0.00390)	(0.00390)	(0.00422)	(0.936)
$LGDP - EXP$	0.0996***	0.101***	0.0370**	0.0399**
	(0.00233)	(0.00239)	(0.0187)	(0.0177)
$LGDP - IMP$	0.00567**	0.00663**	0.00530**	0.0816***
	(0.00273)	(0.00284)	(0.00223)	(0.0174)
$LPOP - EXP$	0.0249***	0.0239***	-0.324***	-0.327***
	(0.00254)	(0.00257)	(0.0844)	(0.0795)
$LPOP - IMP$	0.0408***	0.0398***	0.0411***	-0.0713
	(0.00318)	(0.00326)	(0.00244)	(0.0898)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.820	0.951	0.969	0.973
F-test	3099	5548	5000	4519

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results presented above suggest that over the whole period of interest (2000-2007) intra-Visegrad and intra-other new members' exports were higher than would have been expected by considering the gravity equation, while those of the EU15 were either at or below the level expected. The larger exports among Visegrad and other CEECs that are observed are found to have occurred mainly along the extensive margin, with countries exporting a greater variety of products. As yet however, we have not been able to answer the question of whether there were changes in the post-accession period. In the final stage therefore we introduce interactions between the country-group dummies and a dummy variable for the post-accession period (i.e. the variable takes the value one in all years after and including 2004). The coefficients on these variables allow us to examine whether trade has responded differently to accession in certain country-groups, and whether there is evidence of any hub-and-spoke arrangement being diminished following accession. The results on these coefficients are reported in Table 11. Once again, the gravity determinants are largely consistent with those reported above and are not reported in the table for brevity.

Table 10

Effects of inclusion of intra-bloc dummy variables

Exports

VARIABLES	(1) EXP	(2) EXP	(3) EXP	(4) EXP
$INTRA - EU15$	-0.0145	0.0967**	-0.101**	0.00150
	(0.0431)	(0.0473)	(0.0466)	(0.0591)
$INTRA - VISEGRAD$	1.081***	1.001***	1.068***	1.008***
	(0.0862)	(0.0865)	(0.0861)	(0.0857)
$INTRA - OTHEU$	0.810***	0.719***	1.083***	0.937***
	(0.150)	(0.148)	(0.141)	(0.142)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.881	0.998	0.998	0.999
F-test	2419	160469	157524	133591

Intensive margin

VARIABLES	(1) IM	(2) IM	(3) IM	(4) IM
$INTRA - EU15$	-0.0123***	-0.0189***	0.00192	0.000838
	(0.00248)	(0.00272)	(0.00246)	(0.00225)
$INTRA - VISEGRAD$	-0.00622	-0.00151	0.00605	0.00212
	(0.00667)	(0.00668)	(0.00613)	(0.00627)
$INTRA - OTHEU$	0.00969*	0.0151***	-0.00623	-0.0105*
	(0.00548)	(0.00549)	(0.00533)	(0.00548)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.535	0.702	0.801	0.811
F-test	295.7	347.3	407.9	363.4

Extensive margin

VARIABLES	(1) EM	(2) EM	(3) EM	(4) EM
$INTRA - EU15$	-0.0310***	-0.0489***	-0.0146**	-0.00514
	(0.00578)	(0.00617)	(0.00572)	(0.00555)
$INTRA - VISEGRAD$	0.191***	0.204***	0.213***	0.208***
	(0.0133)	(0.0134)	(0.0118)	(0.0110)
$INTRA - OTHEU$	0.242***	0.257***	0.231***	0.211***
	(0.0132)	(0.0134)	(0.0129)	(0.0135)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.840	0.957	0.974	0.977
F-test	2719	5338	5407	5224

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11

Inclusion of intra-bloc and accession dummy interactions

Exports

VARIABLES	(1) EXP	(2) EXP	(3) EXP	(4) EXP
$INTRA - EU15 \times POST$	-0.149***	-0.156***	-0.129***	-0.120**
	(0.0508)	(0.0507)	(0.0460)	(0.0521)
$INTRA - VISEGRAD \times POST$	0.189	0.194	0.155	0.145
	(0.148)	(0.147)	(0.144)	(0.124)
$INTRA - OTHEU \times POST$	0.255	0.257	0.252	0.254
	(0.279)	(0.278)	(0.258)	(0.255)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.882	0.998	0.998	0.999
F-test	1807	140484	148734	128415

Intensive margin

VARIABLES	(1) IM	(2) IM	(3) IM	(4) IM
$INTRA - EU15 \times POST$	0.00373	0.00407	0.00200	0.00109
	(0.00337)	(0.00337)	(0.00299)	(0.00319)
$INTRA - VISEGRAD \times POST$	0.0179	0.0176	0.0195*	0.0204*
	(0.0122)	(0.0122)	(0.0114)	(0.0112)
$INTRA - OTHEU \times POST$	0.0271***	0.0269***	0.0264***	0.0280***
	(0.00982)	(0.00979)	(0.00924)	(0.00954)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.538	0.703	0.802	0.812
F-test	219.0	303.8	380.0	347.4

Extensive margin

VARIABLES	(1) EM	(2) EM	(3) EM	(4) EM
$INTRA - EU15 \times POST$	-0.00673	-0.00549	-0.0153***	-0.00729
	(0.00743)	(0.00741)	(0.00575)	(0.00611)
$INTRA - VISEGRAD \times POST$	0.00312	0.00198	0.00846	0.000867
	(0.0236)	(0.0234)	(0.0193)	(0.0182)
$INTRA - OTHEU \times POST$	-0.0242	-0.0254	-0.0190	-0.0229
	(0.0249)	(0.0252)	(0.0253)	(0.0254)
Year dummies	No	Yes	Yes	Yes
Exporter dummies	No	No	Yes	Yes
Importer dummies	No	No	No	Yes
Observations	4,945	4,945	4,945	4,945
R-squared	0.841	0.957	0.974	0.978
F-test	2016	4652	5107	5032

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Considering exports we find that the coefficients on the bloc dummies included linearly are consistent with those reported above for Visegrad and the other new members being large, positive and highly significant. For the EU15 we find coefficients that are positive and significant in Columns 1 and 2, but insignificant in the remaining two columns. The coefficients on the interactions of the bloc dummies with the post-accession dummy result in negative and significant coefficients for the EU15, but insignificant coefficients in the other two cases. The results support the view that there has been a decline in intra-EU15 exports in the post-accession period, but that there is no evidence of such a non-linear relationship in the extent of intra-bloc exporting for Visegrad and the new member states. This latter result suggests that after controlling for standard gravity determinants there has been no significant change in export behaviour for intra-Visegrad exports or exports between other new member states, and is consistent with the view that the reason for the observed increase in intra-Visegrad exports in the post-accession period is due to a natural realignment of trade and to the relatively higher growth of Visegrad countries when compared with EU15 countries.

Turning to the results on the intensive margin we observe that there are few significant coefficients when looking at the bloc dummies included linearly. Only in the case of the EU15 (Columns 1 and 2) and the other new member states (Columns 3 and 4) do we find significant coefficients, which in all cases are negative. When interacted with the post-accession dummy we find positive and significant coefficients for Visegrad (Columns 3 and 4) and in all cases for the new member states. These results suggest that at least part of the increase in intra-bloc exports for these countries is due to an increase in the volume of products exported in the post-accession period. When considering the extensive margin we again find negative coefficients (that are significant in two cases) on the EU15 dummy, and consistently positive and significant coefficients for Visegrad countries and the other new members. The results also indicate however that there has been no significant change in behaviour in the post-accession period for these two blocs, with no significant coefficients found on the interaction between the post-accession dummy and the dummies for Visegrad and the other new member states (after controlling for standard gravity determinants).

6. Conclusions

There has been a great deal of heterogeneity in the growth of exports within blocs inside the expanded EU in the recent past. While the growth of exports between old EU members has been rather sluggish, exports between new members has been much faster, in particular for Visegrad countries (Czech Republic, Hungary, Poland, Slovakia). In this paper we try to shed some light on these developments. As a first step we address whether within-bloc exports were affected by the accession to the EU, which could be due to a movement away from a hub-and-spoke trading arrangement, or whether the differences

represented a general trend that could be caused by a natural realignment of export structure following the period of communism or due to the relatively stronger economic performance of the new accession countries. In a second step, we examine whether the observed changes in exports have been due to an increase in the variety of goods traded, or to an increase in the volume of exports of existing products.

The results we present provide little support for there being an effect of the accession date on within-bloc exports. While exports within new accession countries (and within Visegrad countries in particular) have grown relatively quickly over the period considered, and significantly faster than those for old EU members, we find no evidence indicating that the growth rate of exports in accession countries increased significantly following accession in 2004 after controlling for standard determinants of trade. Our results also indicate that the growth in within-bloc exports amongst accession countries has occurred mainly along the extensive margin, indicating that the variety of products exported within this group of countries has increased. The results for the intensive margin tend to be either insignificant or negative, implying that there has been little change in the volume of existing products exported. Overall, our results would tend to support the view that the relatively strong growth of exports among accession countries is due to a natural realignment of exports and to the relatively stronger performance of these economies when compared with the old members of the EU. Given the still relatively low shares of exports currently going to other accession countries, we may expect that these high growth rates of within-bloc exports among accession countries will continue for some time.

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P.b.b. Verlagspostamt 1060 Wien