EU Integration and Trade: a Look from the Outside of the EU Eastern Border.

Oleksandr Shepotylo[*],

Kyiv School of Economics and Kyiv Economics Institute

August, 2009

Abstract:

This paper adds to the literature by developing a methodology for estimating potential costs and benefits of a trade policy change based on the estimation of the gravity equation for disaggregated data that takes into account zero trade flows and a firm level heterogeneity.

In particular, the paper measures the opportunity costs of 2004 EU enlargement from the standpoint of Ukraine – a country that has been left on the sideline. This angle allows estimating the costs of non-integration that occurred due to trade diversion and forgone opportunity to carry our structural changes in the Ukrainian economy.

According to the results, even though the EU integration would not increase significantly the cumulative aggregate export of Ukraine in 2000-2007, it would dramatically change the composition of its exports by almost doubling exports of manufactured goods by 2007. The costs of non-integration accumulate towards the end of the investigated period. Projecting the results into the future clearly indicates that the benefits of EU accession for Ukraine would have been unambiguously positive.

By showing that costs of non integration are high, the results shed some light on the debates over the benefits of EU integration for the newly accepted states. They also give some guidance on the potential gains from signing a deep FTA between EU and Ukraine which is currently discussed by policymakers and from potential EU accession of Ukraine in the future.

JEL categories: C33, F12, F17

Keywords: gravity model, EU enlargement, Ukraine, CIS, heterogeneous firms, trade policy

1 Introduction

The studies of European Union (EU) enlargement mostly focus on the impact of the enlargement on the current and new EU members (e.g. Bussière et al. 2008, Nilsson, 2000, Baldwin, 1995 and 1997, Gros and Gonciarz 1996). This paper looks at the impact

[*] oshepotylo@eerc.kiev.ua

of EU enlargement from a different angle and estimates the costs of non-integration. It argues that the costs of non-integration should be measured relative to an alternative scenario when a country which is currently not an EU member did integrate into the EU. In theory, when an additional country joins a regional trade bloc it imposes additional costs on outsiders due to trade and investment diversion. Importantly, the costs of non-integration are growing when more countries join the bloc, which in turn increase incentives for other countries to join the bloc – it is a so-called domino effect introduced by Baldwin (1993). For example, the enlargement of the European Economic Community (EEC) – a process that started in 1960s – induced integration of the members of the European Free Trade Agreement (EFTA) into the EEC:

> The 1960s saw rapid discriminatory liberalisation with the EEC and EFTA. This had a dramatic effect on trade patterns. The EEC's share of trade with itself rose from 30 to 50 per cent. The share of EEC imports from other European nations stagnated or fell. This discrimination meant lost profit opportunities for exporters in both groups, but since the EEC market was more than twice the size of EFTA's market (and growing faster), the EEC club was far more attractive to exporting firms. This generated new political economy forces within the EFTA nations – forces that pushed for EEC membership. (Baldwin, 2008)

Currently, a similar process involving the EU and Commonwealth of Independent States (CIS) trading blocs is evolving. The differences in size and level of development between EU and CIS imply that the EU bloc is more attractive and the opportunity costs of not-integrating into the EU are higher. What are the costs for the CIS countries of not integrating into EU? Empirically, this question has not been studied and the primary goal of this paper is to evaluate the *ex post* costs of non-integration.

Specifically, the focus is on the Ukraine for the following reasons. It is an eligible candidate for enlargement based on geographical criteria. It is an important trading partner that moves towards EU politically and economically. Finally, in February 2008 the Ukraine has started a round of FTA negotiations with EU which is the next step towards the EU integration. The launch of negotiations followed the finalization of Ukraine's WTO accession process on February, 5 2008[1], which was a prerequisite for FTA talks. Therefore, the advantages of looking at the Ukraine are twofold: it is

[1] Ukraine submitted the application on November 20, 1993. On 5 February, 2008 it has been announced that Ukraine would become a member of the World Trade Organization (WTO) on June 4, 2008 after almost 15 years of negotiations

interesting from a historical perspective and important as guidance for policymakers of the EU and the Ukraine for the decision on the future of the EU enlargement process.

How Ukrainian exports would look like if the country joined EU in 2004? To answer these questions, this paper develops a methodology that allows predicting trade patterns of Ukrainian exports in such a hypothetical situations. The offered method assumes that the main differences between being an EU member and being a typical CIS country stem from the changes in behavioral relationships of the parameters of the gravity equation rather than from the changes in factors that represent the gravity forces *per se* (see Egger, Pfaffermayr, and Schmidt 2006). By setting its regulatory framework in line with the EU standards, signing a deep FTA with EU, and, in the long run, achieving its final goal of becoming a full-fledged EU member, the Ukraine would gradually evolve from being a part of the CIS trading bloc with its distinct reliance on export of raw materials towards being a part of the EU trading block with a high degree of intra-industry trade in processed goods. Therefore, its trade patterns would become more in line with the trade patterns of the Eastern European countries. The behavioral changes would come from a better access to the EU market and from the changes in the institutional environment, deep reforms of the regulatory framework, and standardization of export and import regulations.

To capture the behavioral changes in the composition of exports, the gravity model is estimated for SITC 2 digit exports from 2000 to 2007 for two samples: one sample includes sixteen Eastern European countries – twelve EU member countries that recently joined EU (EU12)[2] and four countries that are not member of the EU but are considered as candidates for enlargement in the future (EUC4)[3]; the other sample includes nine CIS countries[4].

In addition to evaluating the behavioral change, the novelty of the paper lies in applying an estimation of the disaggregated gravity equation using the two stage procedure developed by Helpman, Melitz, and Rubinstein (2008) (henceforth HMR). The method explicitly deals with a substantial number of zero trade flows, and unobserved

[2] EU12 includes: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia that joined EU in 2004; Bulgaria and Romania that joined EU in 2007.
[3] EUC4 includes: Albania, Croatia, Macedonia, and Turkey.
[4] CIS includes: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine.

firm-level heterogeneity. Unlike the HMR method, we exploit both cross-sectional and time dimensions to remove the pair-specific fixed effects that can bias the cross-sectional results and estimate the impact of the EU accession on bilateral trade flows by the Hausman-Taylor method (Hausman and Taylor, 1981) treating the EU accession as an endogenous decision that correlates with variable and fixed costs of trade.

The model demonstrates that substantial costs of not integrating are present. If the Ukraine had became an EU member in 2004, it would have benefited from an increase in export volumes, redirection of trade from CIS trading partners towards the EU trading partners, and restructuring of exports from industrial products with low value added, primarily exports of raw materials, towards exports of manufactured products with high value added and exports of agriculture and food[5]. The benefits would have come not directly from the EU accession *per se* but from the gradual process of reforms, economic restructuring, and behavioral changes in the bilateral trade relationships with its trading partners. The initial losses from breaking the trade relationships with other CIS countries would be more than compensated later along the development path.

The structure of the paper is as follows. Section 2 compares existing trade patterns of the Eastern European countries with trade patterns of the CIS countries. Section 3 briefly discusses the methodological issues, presents a theoretical model and develops the estimation procedure. Section 4 discusses data. Section 5 presents estimation results for aggregated trade data and discusses advantages of the Hausman-Taylor method. It also presents estimated gains in disaggregated exports from the EU-Ukraine trade integration for two counterfactual experiments. Finally, Section 6 concludes.

2 Trade patterns of EU and CIS countries: first glance at the data

The theory of regionalism and preferential trade agreements stresses that costs of non-integration into a regional trade bloc increase with the size of the bloc which, in turn, induces more countries to join the bloc due to a so-called “domino effect”: a

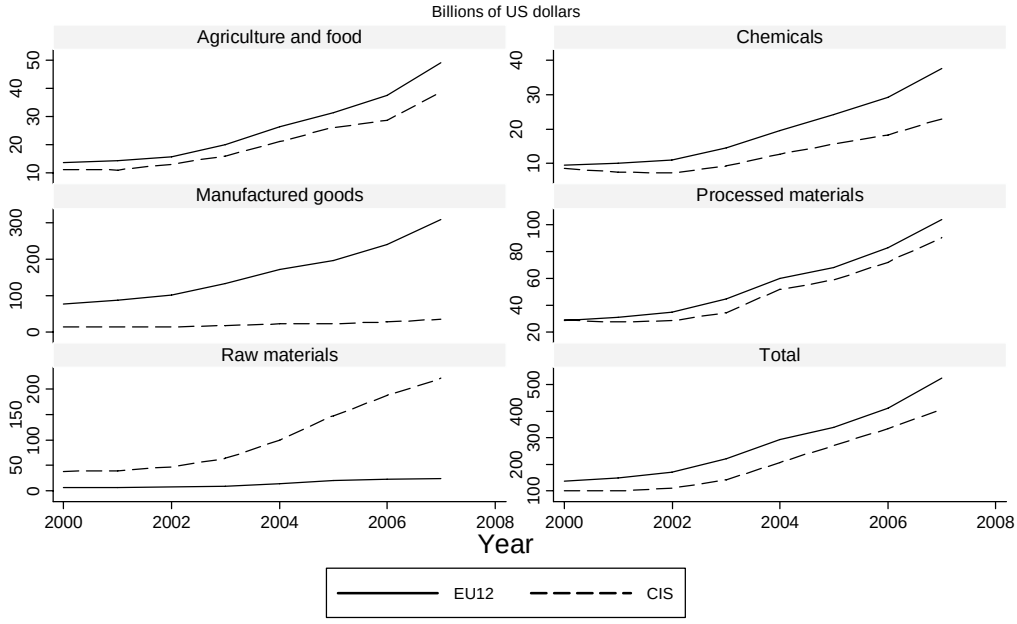
[5] The second conclusion is conditional on the degree of trade liberalization of in agricultural and food products with old the EU members.

discriminatory liberalization of trade within a trading bloc gives an edge to companies located within the bloc over the outsiders and create additional incentives for multinational companies (MNC) to reduce trade barriers and gain better market access by moving their activities inside the free trade zone. It creates an additional pressure for inclusion on outside countries (Baldwin, 1993, Baldwin et al. 2006). Hence, once started, the process of regionalization captures ever-growing number of countries. The story of the latest EU enlargement nicely illustrates this point.

The Council of Mutual Economic Assistance (CMEA) that, by 1989, included fifteen Soviet republics, six Eastern European countries – Bulgaria, Czechoslovakia, East Germany, Hungary, Romania, Poland –, and three other countries – Cuba, Mongolia, and Vietnam generated a substantial intra-bloc trade due to a high degree of economic and political integration[6]. The economic cooperation with the rest of the world was limited at best and in some instances prohibited. Since the beginning of transition, Eastern European countries and Baltic States have rapidly moved away from the Moscow-centered economic gravity towards the Brussels-centered one. As was correctly predicted by some scholars (i.e. Wang and Winters, 1991 Hamilton and Winters, 1992, and Baldwin, 1994), this led to a reorientation of their trade flows away from the CMEA countries towards the EU members. By 1995, Eastern European trade flows did not differ considerably from that of similar Western European countries and mostly exhausted the westward expansion of exports at the extensive margins of trade (Gros and Gonciarz (1996). This view is supported by a more recent World Bank (2005) report which shows that currently most of the EU12 countries trade above their potential or 'normal' level.

[6] Pelzman (1977) has found that the integration of the socialist countries into CMEA has generated a substantial additional intra-bloc trade at the expense of the trade with the rest of the world. He estimated the value of trade creation effect at 13.2 billion of $US in 1970.

Figure 1 Exports of EU12 and CIS in 2000-2007



Source: COMTRADE,2000-2007

EU12 - new EU members in 2004-2007 , CIS - commonwealth of independent states. SITC2 exports at 1 digit level are aggregated into five groups:
Agriculture and Food - SITC 1 digit codes 0,1, and 2; Raw materials - codes 3 and 4; Chemicals - code 5 Processed materials - code 6 Manufactured goods - codes 7 and 8

The accession of the EU12 countries into the EU in 2004 and 2007 finalized the process of integration. It further reduced trade barriers within the EU, mostly between EU12 countries themselves rather than between EU12 and the old EU members, and made the EU12 countries even more attractive destinations of FDI due to a favorable investment climate and convenient location for serving a nearby markets[7]. Looking at the dynamics of exports by industries, presented at Figure 1, reveals a spectacular expansion of exports of manufactured goods[8] from the EU12 countries that exceeded 300 billion US dollars by 2007.

The CIS exports also expanded quite dramatically; however, the driving force of the CIS growth was the expansion of the export of raw materials that grew well over 200 billion dollars by 2007. At the same time, exports of manufactured goods from the CIS stagnated. One of the explanations of the stark differences between EU12 and CIS in terms of industrial composition of exports is that an intra-industry and intra-firm trade

[7] For example, Slovakia is known as Detroit of the East. "Analysts say carmakers are drawn to Slovakia because it has a cheap but skilled work force, low taxes, weak labor unions, good highways and other logistics, and a strategic location in the geographic heart of Europe that's close to emerging markets in Russia, Ukraine and elsewhere in the former Soviet Union."
http://abcnews.go.com/Business/wireStory?id=6360844

[8] Products 7 and 8 of SITC classification at one digit level of aggregation

increased significantly in EU12 between 2000 and 2007. By attracting MNCs for locating their plants, EU12 has substantially increased intra-industry trade in high value added products and became an export platform for serving the CIS markets, while CIS countries failed to integrate into the global chains of production: the share of intermediate exports in the total export reached 20% in EU8[9] and only 6% in CIS[10]:

> "…there has been substantial change over the course of the transition in the commodity composition and factor intensity of trade by the EU-8 and the SEE economies, relatively little has changed in these regards among the CIS countries, which effectively have been frozen in time. The result is that these countries are not active participants in the evolving international division of labor. The existing composition and factor intensity of exports puts the future growth prospects of the CIS at risk." (World Bank, 2005)

Suppose that, contrary to the fact, the Ukraine joined EU in 2004. The accession conditions would require the Ukraine to satisfy a list of certain criteria that include stable democratic institutions, respect for the rule of law, a functioning market economy, and adjustment of administrative structure. The deep political, economic and administrative reforms coupled with better access to the large EU market and proximity of the CIS markets would lead to a significant improvement of investment climate and a consequent behavioral change in the Ukrainian economy, its industrial structure, and composition of export.

To capture the behavioral differences between the CIS countries and EU12 countries, we separately estimate the gravity model at SITC two digit level of aggregation for the EU sample (exports from EU12, EUC4, and the Ukraine to 179 destination countries in 2000-2007)[11], and for the CIS sample (exports from the CIS countries to 179 destination countries in 2000-2007). The time dimension is centered around the 2004 EU enlargement episode. We further predict the Ukrainian exports based on the results for the two different samples and compare them in order to assess the differences in the export patterns.

The main underlying assumption is that if the Ukraine were a part of EU by 2004, its trade patterns were more in line with that of the EU12 members, hence, projecting the

[9] EU8: Eastern European countries that joined EU in 2004 not including Cyprus and Malta
[10] Pradeep Mitra, "Innovation, Inclusion and Integration," World Bank 2008
[11] We follow the "in-sample" approach of projecting trade flows because we capture country fixed effects. It would not be possible if Ukraine is excluded from the sample.

trade patterns of the Eastern and Central European countries on the characteristics and geographical location of the Ukraine would provide us with rough estimates of the potential export patterns under the EU integration scenario. Likewise, projecting the trade patterns of the CIS on the Ukraine, would give us rough estimates of the trade patterns of a typical CIS country.

3 Model and estimation methodology

3.1 Estimation of the gravity model: econometric issues

Due to prevalence of zero trade flows (an average share of non-zero trade flows across industries at SITC two digit level is 22 percent) and importance of distribution of firms within an industry for evaluation of changes in trade policy (e.g. Melitz, 2003; Bernard et al., 2003), we closely follow a modified version of the HMR model that takes into account zero trade flows and heterogeneity of firms. Ignoring zeroes in the bilateral trading matrix leads to the bias in the estimation of the gravity equation due to correlation between fixed costs of exporting and volumes of trade. Ignoring the heterogeneity of firms while evaluating potential gains from integration of the Ukraine into EU would miss the gains stemming from increasing productivity and restructuring of the product composition of exports.

The methodology is different from that of HMR in two important ways. First, we build a disaggregated model that allows for industry-level heterogeneity in trade costs.[12] Looking at the disaggregated data allows us to analyze differences in export patterns of EU12 and CIS countries along the product dimension. We also are able to evaluate costs of non-integration for specific product categories that are important items in the Ukrainian export.

Second, we use a panel of exports in 2000-2007 while HMR evaluate their model on the cross-sectional data. The use of panel data allows looking at the dynamic impact of

[12] Hummels (1999) studied trade costs for 3,000 goods for New Zealand and Latin American imports and over 15,000 goods for US imports and found that trade costs vary significantly across industries. In particular, freight costs for manufacturing are lower than for commodities and agricultural products. For example, importing fruits and vegetables costs approximately 15 percent of the value of shipment, while importing road vehicles costs 2.1 percent.

the EU enlargement. We treat an EU accession decision as an endogenous variable because it is linked to the graphical location of a country correlated with the bilateral trade costs. To deal with the endogeneity problem, we estimate the model by the Hausman-Taylor method. It gained popularity in the trade literature due to its ability to remove biases in the estimation of the gravity equation and possibility to keep country specific time-invariant variables in the estimated equation. Serlenga and Shin (2007) tested performance of the Hausman-Taylor method in estimating the gravity equation of bilateral trade flows among 15 European countries in 1960-2001 and found that it provides more sensible results than fixed or random effect methods. McPherson and Trumbull (2008) used the Hausman-Taylor method to estimate the unrealized US-Cuban trade potential and also found that it is superior to the other popular methods of estimating panel data. Also, the time dimension helps us to remove biases stemming from unobserved industry and country-pair heterogeneity, and estimate the parameters of the model with greater precision.

3.2 Model of Bilateral Export

We modify the HMR set up by adding sectors indexed $k = 1,...,K$. Each country i=1…C has N_k^i firms that produce differentiated products in sector k. Let c_{kl}^{ij} denote total consumption in country j of a good l that is produced by sector k in country i.

3.2.1 Consumers

A representative consumer located in country j has the utility function of the following form:

$$U^j = \sum_{k=1}^{K} \left(\int_{l \in B_k^j} c_{kl}^{j\,\frac{\sigma-1}{\sigma}} dl \right)^{\theta_k} \qquad (1)$$

where $\sigma > 1$ is the elasticity of substitution across different products. θ_k is the expenditure share of industry k in total consumption. B_k^j is the set of industry k goods that are available for consumption in country j.

The optimal consumption derived from the optimization problem is:

$$c_{kl}^{j} = \frac{\theta_k Y^j}{P_k^j}\left(\frac{p_{kl}^j}{P_k^j}\right)^{-\sigma} \quad (2)$$

where Y^j is the gross domestic product of country j that is equal to the total expenditures of country j.

$$P_k^j = \left(\int_{l\in B_k^l} (p_{kl}^j)^{1-\sigma}\, dl\right)^{\frac{1}{1-\sigma}} \quad (3)$$

is the price index of industry *k*.

3.2.2 Producers

A country *i* firm produces one unit of output with $w^i a$ units of labor.[13] w^i is country specific, reflecting the differences in institutions, technology, and factor prices. Following Melitz (2003), we specify *a* as a firm-specific parameter with the cumulative distribution function $G_k(a)$ over support $[a_{k\min}, a_{k\max}]$. Each firm is a monopolist over the production of a distinct good, but is small relative to the size of the market. A standard formula for monopolistic pricing implies that the firm charging the mill price as a constant mark-up over the marginal cost:

$$p^i = \frac{\sigma}{\sigma - 1} w^i a \quad (4)$$

There are variable and fixed costs of delivering products to consumer markets that vary across industries. T_k^{ij} is a melting iceberg transportation cost with $T_k^{ij} > 1, T_k^{ii} = 1$. F_k^{ij} is a fixed cost of exporting that is country-pair and industry specific with $F_k^{ij} > 0, F_k^{ii} = 0$. If the firm chooses to export its product to country *j*, consumers in country *j* pay $p_k^{ij} = \frac{T_k^{ij}\sigma w^i a}{\sigma - 1}$. It follows that the profit of the firm exporting to country *j* is:

$$\pi_k^{ij}(a) = \frac{\theta_k}{\sigma}\left[\frac{\sigma T_k^{ij} w^i a}{(\sigma-1)P_k^j}\right]^{1-\sigma} Y^j - F_k^{ij} \quad (5)$$

[13] We consider a partial equilibrium model with fixed capital during the period being investigated. Labor is the only input that is perfectly mobile across industries, but immobile across countries.

The firm exports only if it receives positive operating profits, which is more likely if the productivity of the firm ($\frac{1}{a}$) is high, the input price (w^i) is low, and the fixed costs of exporting (F_k^{ij}) are low. The least productive firm that exports to country *j* has the productivity level $1/a_k^{ij}$ determined as:

$$\pi_k^{ij}(a_k^{ij}) = 0 \Leftrightarrow \frac{\theta_k}{\sigma}\left[\frac{\sigma T_k^{ij} w^i a_k^{ij}}{(\sigma-1)P_k^j}\right]^{1-\sigma} Y^j = F_k^{ij} \quad (6)$$

3.2.3 Aggregation

Out of N_k^i firms that operate in country *i* in industry *k*, only $N_k^i G_k(a_k^{ij})$ firms export to country *j*. The aggregate export in industry *k* from exporter *i* to country *j* is:

$$X_k^{ij} = N_k^i G_k(a_k^{ij}) E\left(p_k^{ij}(a) c_k^{ij}(a) \mid \pi_k^{ij}(a) > 0\right) = N_k^i \theta_k Y^j V_k^{ij} \left(\frac{\sigma T_k^{ij} w^i}{(\sigma-1)P_k^j}\right)^{1-\sigma} \text{ if } \quad a_k^{ij} > a_{\min} \quad \text{and}$$

$X_k^{ij} = 0$ otherwise, where $V_k^{ij} = \int_{a_{\min}}^{a_k^{ij}} a^{1-\sigma} dG_k(a)$.

The equation can be further simplified by using the equilibrium constraint on the output of sector k produced by country i which leads to the following export equation:

$$X_k^{ij} = s_k^i Y^i Y^j V_k^{ij} \frac{\left(\frac{T_k^{ij}}{P_k^j}\right)^{1-\sigma}}{\sum_{j=1}^{C}\left(\frac{T_k^{ij}}{P_k^j}\right)^{1-\sigma} Y^j V_k^{ij}} \quad (7)$$

3.3 Parameterization and Estimation

3.3.1 Selection of firms

Define a latent variable as:

$$\Psi_{kt}^{ij} = \frac{\frac{\theta_k}{\sigma}\left[\frac{\sigma T_k^{ij} w_t^i a_{k\min}}{(\sigma-1)P_{kt}^j}\right]^{1-\sigma} Y_t^j}{F_{kt}^{ij}} \quad (8)$$

A positive export is observed if $\Psi_{kt}^{ij} \geq 1$ that is determined by the ratio of firm level profits to the fixed costs of exporting. Other things being equal the level of the fixed costs plays the crucial role in defining trading partners with positive trade flows. We assume that the fixed costs are country-pair specific but not firm-specific even though they can vary from one product to another. Suppose that fixed costs have the following functional form $F_{kt}^{ij} = \exp(\kappa_1 \phi_k^i + \kappa_2 \phi_k^j + \kappa_3 \phi_k^{ij} - \theta_{kt}^{ij})$, where ϕ^i represents fixed costs specific to the exporting country, ϕ^j represents fixed costs specific to the importing country, ϕ^{ii} represents country-pair-specific fixed costs, and θ_{kt}^{ij} represents country-pair-specific random components.

Trade costs associated with the shipping of a unit of good from country *i* to country *j* are modeled by assuming the commonly used functional form:

$$(T_{kt}^{ij})^{\sigma-1} = (dist^{ij})^{\rho_k} \exp(Z\gamma_k - u_{kt}^{ij}),$$

where $dist^{ij}$ is the distance between countries *i* and *j*, *Z* is a set of additional variables that determine trade costs, γ_k is the vector of coefficients associated with *Z*, and u_{kt}^{ij} is the error term that include all unobservable trade costs that are allowed to change over time. In particular, we assume that one of the determinants of trade costs is the current status of exporting county with respect to EU membership, EU_t^i. It captures the effect of the integration process in terms of country's exports. Also, we introduce a bilateral indicator variable $bothEU_t^{ij}$ that takes value of 1 if both trading countries are full EU members and zero otherwise. It captures the effect of the EU accession on trade within EU relative to trade that is external to EU.

u_{kt}^{ij} includes all time varying and pair specific trade costs that are not directly controlled for in the gravity equation. Trade costs change over time as a result of integration processes in Europe and Central Asia region. Countries that are willing to joined EU are required to satisfy certain economic, geographical, and political criteria and carry out wide range of economic reforms. Political reasons play an important role in determining trading pairs and products especially in CIS[14]. All those considerations do

[14] Russian Federation uses trade policies as a tool of political influence particularly frequently. For example, it banned exports of wine form Georgia and Moldova in 2006, exports of fish from Lativa in

not allow us to treat EU related variables as endogenous and require corrections to the estimation procedure that are discussed later.

Taking logs of both sides of equation (8) yields:

$$\begin{aligned}\psi_{kt}^{ij} = \ln \Psi_{kt}^{ij} = \zeta_0^k + \ln Y_t^j - \rho_k \ln dist^{ij} - Z\gamma_k + \\ (1-\sigma)\ln w_t^i - \phi_k^i - \phi_k^j - \kappa\phi_k^{ij} + \lambda_{kt}^{ij}\end{aligned} \quad (9)$$

where $\lambda_{kt}^{ij} = -(1-\sigma)\ln P_{kt}^j + \theta_{kt}^{ij} + u_{kt}^{ij} = d^i + d^j + d_t + \mu_{kt}^{ij}$ Finally, we assume that $\mu \sim N(0, \sigma_{k\mu}^2)$.

Under normality, both sides of equation (10) are divided by $\sigma_{k\mu}$ to normalize the selection equation:

$$\begin{aligned}\rho_{kt}^{ij} = \text{Prob}(\text{X}_{\text{kt}}^{\text{ij}} > 0 \mid \Psi_{\text{kt}}^{\text{ij}}) = \Phi(\zeta_0^k + \ln Y_t^j - \rho_k \ln dist^{ij} - Z\gamma_k \\ + (1-\sigma)\ln w_t^i - \kappa_1\phi^i - \kappa_2\phi^j - \kappa_3\phi^{ij} + d^i + d^j + d_t + \mu_{kt}^{ij})\end{aligned} \quad (10)$$

where $\Phi(\cdot)$ is the unit-normal cdf.

3.3.2 Gravity equation

Taking the logs of both sides of equation (7) and substituting for T_k^{ij} yields:

$$\ln X_t^{ij} = \ln s_k^i + \ln Y_t^i + \ln Y_t^j - \rho_k \ln dist^{ij} - Z^{ij}\gamma_k + \ln V_{kt}^{ij} - (1-\sigma)\ln P_{kt}^j - \ln MRT_{kt}^j + u_{kt}^{ij} \quad (10)$$

where $\ln MRT_t^j = \ln\left(\sum_{j=1}^{C}\left(\frac{T_{kt}^{ij}}{P_{kt}^j}\right)^{1-\sigma} Y_t^j V_{kt}^{ij}\right)$ is the multilateral resistance term, an integral measure of trade barriers of a country vis-à-vis all its trading partners (Anderson and van Wincoop, 2003), which accounts for the endogenous and simultaneous determination of trade flows across all countries. The multilateral resistance term $\ln MRT_k^i$ is not observable, and according to theory is simultaneously determined for all countries. A traditional approach to deal with the multilateral resistance term is by introducing country fixed effects or pair fixed effects (see Baldwin and Taglioni, 2006, for a discussion on the usage of fixed effects in the gravity equation).

2006. The heated disputed over natural gas prices with Ukraine in 2006 and 2008 was also seen by many as a political tool to influence the situation in Ukraine.

Following HMR, we use the information acquired at the first stage of the estimation by identifying $E(\ln V_{kt}^{ij} + u_{kt}^{ij} \mid X_t^{ij} > 0) = b_{0k}\hat{\eta}_{kt}^{ij} + \sum_{m=1}^{3} b_{mk}(\hat{\psi}_{kt}^{ij})^m$, where $\hat{\eta}_{kt}^{ij}$ is the traditional inverse Mills ratio that accounts for the sample selection bias and the polynomial of degree three in $\hat{\psi}_{kt}^{ij} = \hat{\eta}_{kt}^{ij} + \Phi^{-1}(\hat{\rho}_{kt}^{ij})$ corrects for the firm level heterogeneity. As shown by HMR, the polynomial of degree 3 is a sufficiently flexible and accurate approximation of the underlying unknown distribution of productivities, $G(a)$.

Finally, the estimated equation takes the following form:

$$\ln X_{kt}^{ij} = const + \ln Y_t^i + \ln Y_t^j + b_{0k}\hat{\eta}_{kt}^{ij} + \sum_{m=1}^{3} b_{mk}(\hat{\psi}_{kt}^{ij})^m - \rho_k \ln dist^{ij} - Z\gamma_k$$
$$+ d^i + d^j + d_t + \omega_{kt}^{ij}, \mathrm{t} = 1,2...\mathrm{T}$$

4 Data sources and variable definitions

4.1 Dependent Variable

Table 1 presents the definitions of variables and sources of data. In the empirical analysis, we estimate unidirectional bilateral exports from twelve new EU members (EU12), four EU candidate countries (EUC4), and nine CIS countries to 179 destination countries in 2000-2007 at two digit level of SITC classification. The export data measured in current US dollars are acquired from the COMTRADE database. Table A2 in the appendix presents the summary statistics of exports by exporting countries.

4.2 Independent Variables

We differentiate all countries in the sample as non-members, EU candidates, and full EU members. A change in the status from a non-member to a candidate is determined according to the announcements made by the European Commission, which are taken from its website. Based on the acquired information, we construct an $\boldsymbol{EU_{it}}$ variable that indicates the current status of a country with regard to the EU membership. It takes the value of 1 if a country is officially announced as a candidate for accession, 2 if a country is a member of EU, and 0 otherwise. By including this variable, we capture the impact of

the change in the EU status on the overall export within a SITC two digit category. During the investigated period two countries were officially announced candidate countries: Croatia in June 2004 and Macedonia in December 2006. All EU12 countries and Turkey have been announced candidates for accession before 2000 while Albania has not received an EU candidate status by 2007. In addition to the $\boldsymbol{EU_{it}}$ variable, a binary variable $\boldsymbol{bothEU_{ijt}}$ is introduced to indicate whether both trading countries are the EU members or not. It captures the impact of the EU accession on exports within the EU. By including the two variables we can measure the direct impact of the EU integration on exports within and outside of EU.

GDP in current US dollars and ***population*** data were acquired from the 2008 World Development Indicators (WDI). In addition, we include a set of variables that are routinely used in the gravity models to control for trade costs, geographical location, historical ties, and cultural similarities. Geographical characteristics and ***distance*** between countries were collected from the Centre D'Etudes Prospectives et D'Informations Internationales (CEPII) in Paris. ***Colony*** and ***contiguity*** dummies (whether one of the countries in the country-pair was ever a colony of the other country and whether countries are located on the same continent) were used to control for pair-specific trade costs that are not directly related to distance. Finally, ***same religion*** is a binary variable that takes value of 1 if majority of population in both trading countries share the same religion and 0 otherwise to capture the effect of cultural similarities between two nations on trade.

4.3 Selection Variables

For identification of the first stage parameters, we chose two variables that enter the selection equation, but not the gravity equation. The common language dummy controls for the pair-specific fixed costs related to adapting to cultural and linguistic barriers between two countries (translation costs, advertising etc.). To control for country-specific fixed costs related to regulatory quality in exporting and importing countries, we used governance indicators of regulatory quality acquired from the World Bank "Governance matters, 2007" database constructed by Kaufmann, Kray, and Mastruzzi (2007). The

index of the regulatory quality captures the effectiveness of bureaucracy, amount of red tape, and quality of policies and regulations that encourage free trade[15].

The choice of variables can be justified by the fact that the first variable is found as not robust determinant of exports at intensive margin as demonstrated by HMR and Martin and Pham (2008). In addition, we control for cultural differences in the gravity equation by including a common religion dummy. The regulatory quality variable measures effectiveness of government regulations which affects all exporters and is not linked to the volume of export.

Table 1 Definition of variables and data sources

Variables	Description	Sources
Dependent variables		
Export	Export from i to j in sector k, in thousands of current $US. COMTRADE exports data aggregated to two digit SITC2 sectors in 2000-2007	United Nations Commodity Trade Statistics Database
Endogenous variables		
EU	EU is an indicator variable that takes value of 1 if country i was officially announced as a candidate for the EU accession and takes value of 2 if country i is the EU member, otherwise it takes value of 0.	
bothEU	Binary variable that takes value of 1 if trading countries i and j are both members of EU and 0 otherwise	
Independent variables		
s	Sector share in total value added. GTAP sectors are mapped to SITC2 sectors	GTAP Input-output tables
GDP	Gross domestic product, in current $US.	World development indicators
Population	Population	World development indicators
Dist	distance between the biggest cities of countries i and j. dkl is the distance between cities k and l. (Head and Mayer, 2002) $d_{ij} = \sum_{k \in i}(pop_k / pop_i) \sum_{l \in j}(pop_l / pop_j) d_{kl}$	CEPII
Contig	Binary variable indicating whether the two countries are contiguous, 1 or not, 0.	CEPII
Colony	Binary variable set equal to 1 if one of the countries used to be a colony of the other country.	CEPII
Same continent	Binary variable, set equal to 1 if countries i and j located on the same continent. Mapping of countries to continents was taken from CEPII geodata.	Author's calculations
Same religion	Binary variable set equal to 1 if countries i and j share the same religion. Countries are qualified into one ot the six major religions - buddhist, catholic, hindu, muslim, orthodox, protestant - according to the following rule: if at least 50 percent of population in country i are following one of the major religions then the country i has major religion, otherwise the country i is qualified as having no distinct religion affiliation. Data on religious composition of population is taken from CIA - The World Factbook.	Author's calculations
Selection variables		
Common language	Binary variable indicating whether countries i and j share a common language.	CEPII
Reg. quality	Regulatory quality index measures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (Kaufmann, Kraay and Mastruzzi, 2007)	Governance matters, 2007

5 Results

This section has the following goals. First, we calibrate the estimation methodology by comparing how the Hausman-Taylor method performs relative to the OLS and fixed

[15] Since data on regulatory quality before 2002 are available on a biennial basis, we imputed the missing values for 2001 by using average values between 2000 and 2002.

effect methods at the aggregate level. Second, we present and discuss the results estimated by the two stage HT procedure at the level of SITC two digit products. Finally, we calculate export gains form the EU accession of the Ukraine and discuss the main findings.

5.1 Aggregate results

Table 2 reports the estimation results performed by the OLS (columns 1 and 2), two-stage Hausman-Taylor (HT)[16] (columns 3 and 4), and two-stage fixed effect (FE) methods (columns 5 and 6) for the EU and CIS samples. All regressions include exporting- and importing-country fixed effects, time dummies and a constant term. The country-pair cluster-robust standard errors are presented in parentheses. Three points are worth mentioning. First, there are important and statistically significant behavioral differences

[16] In the case of the CIS sample, results of the random effect method are reported because EU and bothEU variables are not included.

Table 2 Gravity model of aggregate trade flows

	OLS EU	OLS CIS	Hausman-Taylor EU	Random effect CIS	Fixed effect EU	Fixed effect CIS
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(GDPi)	0.52**	0.83**	0.46**	0.83**	0.36**	0.59**
	(0.137)	(0.299)	(0.095)	(0.195)	(0.096)	(0.205)
Ln(GDPj)	0.75**	0.23	0.69**	0.16	0.74**	0.14
	(0.078)	(0.185)	(0.058)	(0.133)	(0.059)	(0.134)
Ln(Dist)	-2.40**	-1.61**	-2.10**	-1.42**		
	(0.106)	(0.203)	(0.116)	(0.289)		
Contig. Yes=1	0.42**	0.63*	0.67**	0.89*		
	(0.162)	(0.248)	(0.189)	(0.395)		
Same continent Yes=1	-0.38	-0.66**	-3.25**	-0.79**		
	(0.440)	(0.153)	(0.483)	(0.211)		
Colony Yes=1	0.044	-1.27**	0.33	-0.39		
	(0.286)	(0.362)	(0.242)	(0.621)		
Same religion Yes=1	-0.078	-0.022	-0.073	0.18		
	(0.078)	(0.179)	(0.084)	(0.219)		
EU	0.025		-0.025		-0.0047	
	(0.053)		(0.036)		(0.037)	
bothEU	0.062		-0.0056		-0.072	
	(0.073)		(0.047)		(0.048)	
Inverse Mills ratio, η			1.02*	1.75*	1.69**	2.15
			(0.419)	(0.741)	(0.619)	(1.113)
ψ			1.83**	3.69*	0.57	0.33
			(0.671)	(1.757)	(0.833)	(2.543)
ψ^2			-0.39	-0.70	-0.14	0.20
			(0.201)	(0.588)	(0.244)	(0.846)
ψ^3			0.033	0.039	0.015	-0.048
			(0.020)	(0.062)	(0.023)	(0.089)
Test: $b_1=0$, $b_2=0$, $b_3=0$, $b_0=0$			62.16	51.73	7.15	3.6
p-value			0.000	0.000	0.000	0.006
R-sq overall	0.80	0.73		0.74		
Observations	13149	5872	13149	5872	13149	5872

* p<0.05,** p<0.01

Note: The dependent variable is log of export from country i to country j. The models 1, 3,, and 5 are estimated on sample of EU12 countries, EUC4 countries, and Ukraine. The models 2, 4, and 6 are estimated for 9 CIS countries sample. Cluster robust standard errors are reported in parentheses. Origin and destination country fixed effects, time dummies, and constant term are included but not reported. In model 3, variables EU and both EU are endogenous variables instrumented according to the Hausman-Taylor method.

between the two samples regardless of the estimation procedure. Exports from the CIS countries are less elastic with respect to the size of an importing economy and more elastic with respect to the GDP of an exporting country. CIS exports are less elastic in absolute value with respect to the bilateral distance which reflects a higher geographical concentration of trade EU12 within the EU trade area. Second, the change in the status of

EU integration does not have a significant effect on the aggregate export. Third, coefficients of the polynomial approximating $\ln V_t^{ij}$ and inverse mills ratio η_t^{ij} are jointly significant when the two stage procedure is implemented as indicated by the test at the bottom of the table which stresses the importance of including the first stage variables into the gravity equation.

How well the three estimation methods discussed above can predict the geographical pattern of the aggregate export? Table 3 reports actual and projected exports from the Ukraine to its trading partners in 2000-2007. We report the OLS, two-stage HT, and two-stage FE export projections under three different scenarios: EU1 – Ukraine has been announced an EU accession candidate in 2000, EU2 – in addition to EU1, Ukraine has joined EU in 2004, CIS – Ukraine integrated into CIS trading bloc[17]. The OLS method performs poorly in explaining geographical distribution of export. It predicts that deeper CIS integration of Ukraine would increase aggregate export more than four times relative to the actual export. Export to CIS would have increased more than tenfold! It is hard to imagine what would cause such an explosion of trade. Such an implausible result cast substantial doubts on the applicability of the OLS method to predict export flows. The two-stage HT and FE methods, on the other hand, generate projections that are in remarkable agreement with each other and with the actual data.

According to the two-stage HT results, there are very small differences in exports generated be the CIS and EU integration scenarios which bring a conclusion that at the aggregate level, there are very small benefits of the EU integration. It seems that this result confirms the World Bank (2005) findings that the CIS countries are as well integrated into the global trading system as a typical Eastern European country and therefore further integration with EU would not bring any substantial gains to the exports of the CIS countries. However, more careful investigation of results reveals very interesting dynamics.

[17] The CIS scenario models Ukraine as a typical CIS country.

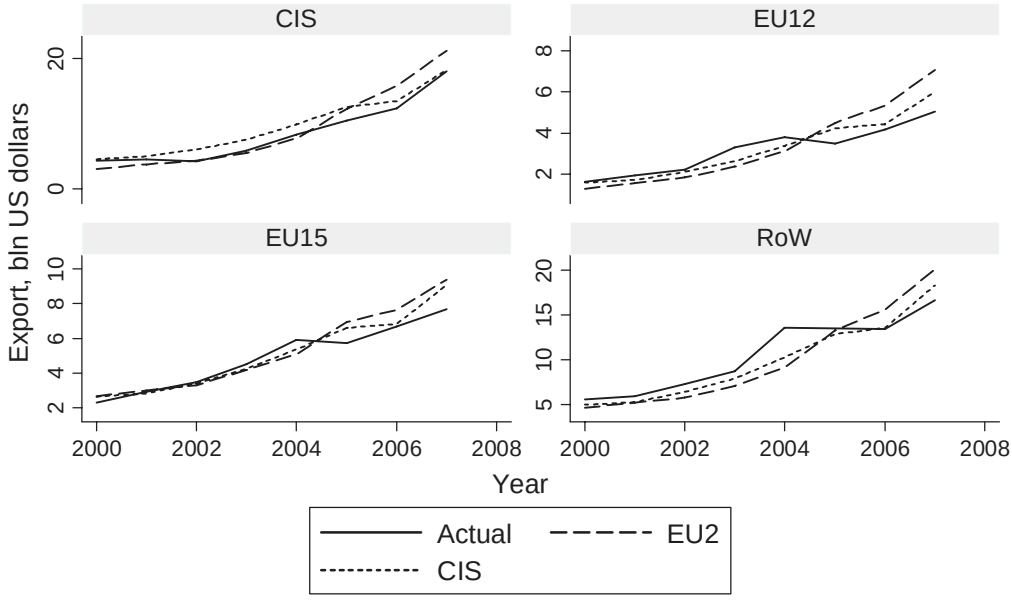
Table 3 Actual and predicted export of Ukraine in 2000-2007

	Cumulative export, billions $US in 2000-2007									
	Actual	OLS method			2 stage HT method			FE		
		EU1	EU2	CIS	EU1	EU2	CIS	EU1	EU2	CIS
Region										
CIS	68.30	73.50	75.00	754.00	74.20	73.70	77.40	76.00	75.90	67.90
China	4.94	3.93	4.01	12.40	5.51	5.47	5.34	5.71	5.71	5.37
EU12	25.70	22.40	23.90	42.40	27.40	27.10	26.10	28.30	27.80	26.60
EU15	39.20	137.00	146.00	164.00	42.50	42.20	40.90	39.90	39.30	39.90
Rest of Europe	10.80	14.70	15.00	41.80	11.20	11.10	11.00	11.40	11.40	10.50
Rest of the world	54.80	54.30	55.30	69.70	50.50	50.20	49.90	52.90	52.90	52.10
Turkey	13.90	13.00	13.20	22.10	14.00	13.90	13.10	14.90	14.90	14.10
Total	218.00	319.00	332.00	1110.00	225.00	224.00	224.00	229.00	228.00	217.00

Note: Total export of Ukraine to its major trading partners is presented in the first column. It is compared with predicted exports computed by OLS method, by two stage Hausman-Taylor method, and by pair fixed effect method. Three different counterfactual scenarios are considered:EU1 - Ukraine has been announced EU candidate, EU2 - Ukraine has become an EU member in 2004, CIS - Ukraine integrates into CIS

Figure 2 reports time series of Ukrainian actual exports as well as predicted exports for EU2 and CIS scenarios to four groups of countries: CIS, EU12, EU15, and the rest of the World. The benefits of the EU integration for the Ukraine would have started playing an important role after 2004 and would accumulate over time. This pattern reflects that integration into EU markets is a long and complex process that does not generates immediate gains, still brings considerable rewards in the long run.

Figure 2 Actual and predicted exports by regions



Actual exports compared with two counterfactual scenarios: 1 EU - Ukraine became EU member in 2004, 2 CIS - Ukraine integrated in CIS
Destination countries are aggregated into four regions: CIS - countries of commonwealth of independent states, EU15 - countries that became EU members before 2004, EU12 - countries that became EU members after 2004, RoW - all other countries

To summarize the main findings at the aggregate level: The analysis of aggregate trade flows reveals existence of potential long run gains of integration into the EU

relative to CIS scenario. By 2007, the gains in Ukrainian export are uniformly positive across all groups of trading partners. These gains come not as a result of *de jure* EU accession but as a change in the behavioral structure of the economy caused by re-orientation towards the EU markets due to a long process of reforms that are required in order to qualify for the EU membership.

5.2 Impact of the change in the EU status on export at 2 digit SITC level

As the next step, we estimate the gravity model at the level of SITC two digit products for the EU and CIS samples using the two-stage HT method. The HT method is preferred over the FE method because it allows controlling for the endogeneity of the EU accession process while providing results similar to the FE method in terms of predicting trade patterns. The industrial structure is captured by an exporting country fixed effect under assumption that composition of industries does not change significantly over the investigated period[18]. Table 4 reports the point estimates of the coefficients of EU_t^{ij} and $bothEU_t^{ij}$ variables at the first and second stages of the estimation procedure for 24 selected SITC two digit products that are the most important exports of Ukraine in 2000-2007[19]. Unlike on aggregate level, the *de jure* change in the accession status plays a significant role on exports of some products. In general, the effect varies from sector to sector and can be positive or negative. For example, a change in the EU accession status from a candidate to a member reduces probability and volume of the overall trade in diary products and birds' eggs (SITC code 2), while it increases probability and volume of trade within the EU. As another example, a change in the EU accession status increases the overall export volume of road vehicles (code 78), but has no significant effect on probability and volume of trade within the EU.

[18] Alternatively, we constructed shares of the value added of each SITC two digit product in the total value added based on Global Trade Analysis Project (GTAP) input-output tables. It does not have a significant impact on our main findings but have two serious drawbacks. For most countries in the sample, the input-output tables are available for only one year. In addition, Moldova and Macedonia are not in the GTAP7 database. Given the drawbacks, this approach reduces the sample size and precludes us from using of exporting counties fixed effects.

[19] Products were rank according to the total value of export in 2000-2007.

Table 4 Two stage Hausman-Taylor results at SITC 2 digit level

	First stage, Probit				Second stage, HT method			
SITC 2	**eu**	**bothEU**	**chi2**	**Observations**	**eu**	**bothEU**	**chi2**	**Observations**
2	-0.37**	1.03**	2933.5	22559	-1.01**	2.23**	1827.8	5590
4	-0.09	0.17	4334.2	23766	-0.29*	0.61**	2450.7	6873
22	0.04	0.14	1856.5	15759	0.11	0.26	1095	2925
24	0.12*	0.29**	3216.3	20230	-0.11	-0.21	2326.7	6087
27	0.11*	-0.17	3235.6	22678	-0.13	-0.09	2110.9	5605
28	0.00	-0.03	2292.8	15895	0.01	0.34*	1452.1	3900
32	0.26**	-0.18	1415.5	16303	0.41	-0.46*	1080.5	2844
33	0.08	0.01	3999.2	23511	-0.51**	0.39**	2466	7223
42	-0.12	0.34**	2487.6	19975	-0.84**	0.87*	1139	3193
51	-0.12*	0.13	3682.4	22542	0.26**	-0.01	2860.1	7493
52	-0.12*	0.05	2771.3	22287	-0.31	0.28*	2128.4	6691
56	0.12*	0.00	1778.4	19295	-0.25	0.03	1123.2	3221
64	-0.21**	-0.02	3810.6	23783	-0.74**	0.45**	3207.9	9462
66	0.00	-0.22*	3666	24038	0.03	0.2	4714.4	10154
67	-0.06	0.05	3258.5	23511	-0.24**	0.49**	4476.3	9381
68	0.11*	0.30**	3664.3	22151	0.11	-0.21	2728.7	6663
69	0.09	-0.02	3963.1	23766	0.12*	-0.03	7061.5	11778
71	0.04	-0.17	4323.6	23630	-0.18*	0.30*	3700.1	9832
72	0.02	-0.08	4306.8	23766	-0.05	-0.16*	5939.6	9965
74	0.00	-0.22	4135.8	23511	0.00	-0.01	8355.1	12034
77	0.04	0.02	4885.1	24038	0.07	0.02	7972.2	12707
78	0.09	-0.06	3963.3	23766	0.24**	0.13	5880	9447
79	-0.07	-0.06	3496.5	22831	0.15	-0.09	1453.8	6576
84	0.04	0.16	4311.3	23239	-0.22**	-0.03	5952.3	9351

Notes: Table reports estimates of the coefficients EU and bothEU of the probit and Hausman-Taylor regressions for the sample of EU12, EUC4, and Ukraine in 2000-2007 for selected products at SITC 2 digit level. Same variables as for the aggregate two stage HT regression are included but not reported Time-, exporter, and importer fixed effects are included but not reported. For probit, marginal effects are reported. For HT method, EU and bothEU variables are treated as endogenous.
* p>0.05, ** p>0.01

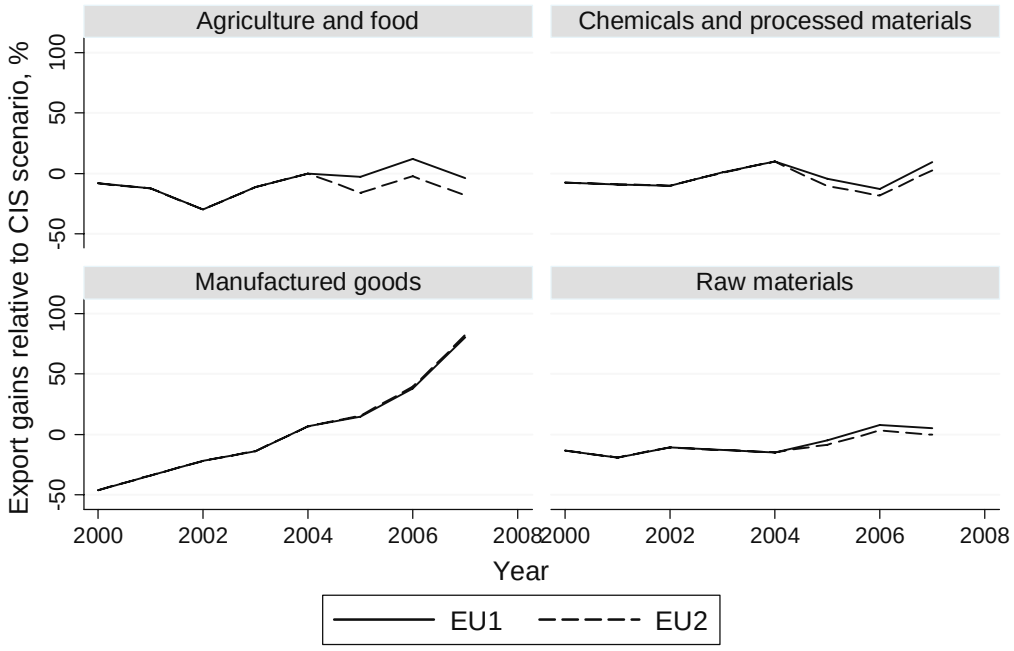
5.3 Forgone export gains due to non-integration at SITC two-digit level

This section calculates and reports forgone gains in the Ukrainian export under the EU1 and EU2 scenarios against the benchmark CIS scenario. First, we generate a dataset with predicted exports of sector k to region j at time t, TE^{j}_{skt}, under the three scenarios:

s={EU1, EU2, CIS}. Next, the percentage changes are calculated according to the following formula: $\Delta_{sk}^{j} = 100\% \frac{TE_{sk}^{j} - TE_{CISk}^{j}}{TE_{CISk}^{i}}, s = EU1, EU2$.

Figure 3 summarizes how the export gains would evolve over time across four large product groups: agriculture and food, chemicals and processed materials, manufactured goods, and raw materials[20]. According to the results, by 2007, Ukraine would have almost doubled export of manufactured goods under the EU2 scenario. This result comes despite the fact that in 2000 the exports of manufactured goods under the EU2 scenario is 50% lower than under the CIS scenario! Other groups of products does not have such a clear trend but tend to have negative gains at the early stages of the integration process and positive gains at the later stages. Also, the EU2 scenario generates slightly higher gains than the EU1 scenario.

Figure 3 Export gains from Ukrainian EU accession across 2 digit SITC2 products



Benchmark CIS scenario is compared with two scenarios of integaration into EU

Table 5 presents results for the 24 most important products to the five groups of countries: CIS, EU12, EU15, RoE (Rest of Europe), RoW (Rest of the world). The highest expected benefits of the Ukraine integrating into EU would have come from a

[20] Agriculture and food (SITC 1 digit codes 0,1, and 2), Chemicals and processed materials (codes 5 and 6), Manufactured goods (codes 7 and 8), Raw materials (codes 3 and 4).

substantial increase in exports of various types of machinery and equipment (codes 71, 72, and 74), road vehicles and transport equipment (codes 78 and 79), and apparel and closing accessories (code 84). These gains would have been virtually uniformly positive across all groups of countries and economically large. As an example, the Ukraine would have increased export of road vehicles (code 78) to the CIS countries by 70 percent under the EU1 scenario and by 88 percent under the EU2 scenario, while export to the EU15 would have been increased by 60 and 82 percent respectively. The export of raw materials, on the other hand, would have either declined as, for example, export of petroleum and its products (code 33) or remained relatively stable as export of iron and steel (code 67). However, the export of manufactures of steel (code 69), one of the most important articles of the Ukrainian export, would have increased uniformly.

Another important group of products where Ukraine could have potentially gained is food and agriculture. The gains would have been positive for exports to the EU countries but mostly negative for exports to other group of countries. Also, gains would have been significantly higher under a more optimistic EU2 scenario. For example, realization of the EU2 scenario would have increased exports of diary products (code 2) and cereals (code4) to EU15 countries by 95 percent and 14 percent under the EU2 scenario and by 38 percent and 4 percent under the EU1 scenario. At the same time, Ukraine would have substantially reduced exports of food and agricultural products to CIS countries under both scenarios of the European integration. For example, in diary products the export to CIS would have reduced by 20 percent under the EU1 scenario and by 31 percent under the EU2 scenario. Given the mixed evidence, there are no apparent benefits of joining EU for the agriculture and food industry.

A disaggregated analysis also agrees with the analysis of the aggregate export on virtually no gains from the EU integration in terms of the cumulative aggregate export in 2000-2007 because the substantial gains in exports of manufactured goods at the later stages of integration are counter-balanced by losses at the early stages. However, the strong upward trend in manufactured goods clearly indicates that over time the benefits of integration accumulate very rapidly.

Table 5 Export gains from EU integration

SITC2	Region									
	CIS		EU12		EU15		RoE		RoW	
	EU1, %	EU2, %	EU1, %	EU2, %	EU1, %	EU2, %	EU1, %	EU2, %	EU1, %	EU2, %
2	-20.3	-31.0	-6.6	33.0	38.2	94.7	-6.1	-11.1	-13.7	-14.8
4	-17.9	-22.0	-0.1	9.2	4.3	13.6	1.8	-3.8	-4.9	-10.5
22	-15.4	-13.0	1.1	10.7	10.0	19.1	11.2	14.2	-3.4	-1.9
24	-11.6	-13.4	-8.6	-12.5	-4.4	-7.1	-3.8	-5.8	2.2	1.2
27	-6.5	-9.3	-1.9	-6.2	19.3	14.8	2.6	-0.6	-1.7	-3.8
28	-1.0	-0.8	-0.2	9.0	0.4	8.3	30.5	30.7	-6.8	-6.7
32	0.9	14.3	-1.1	-2.5	7.4	5.9	-1.2	12.3	16.8	32.7
33	7.5	-8.2	-11.3	-15.2	-11.2	-14.9	-2.9	-18.8	2.1	-12.1
42	-12.0	-25.2	-17.2	-16.6	-32.0	-31.5	-29.8	-37.1	-34.0	-40.3
51	0.4	7.9	-12.0	-6.0	-14.0	-8.9	11.3	20.2	-3.4	3.2
52	-10.2	-15.1	-5.0	-5.8	-2.2	-3.0	9.5	1.9	-2.5	-7.2
56	-9.8	-13.7	-6.5	-10.4	9.7	6.0	15.5	9.6	-10.6	-13.7
64	-20.9	-30.5	-11.9	-16.0	4.0	-0.7	-3.4	-12.3	0.4	-3.4
66	-16.4	-15.8	-3.4	1.9	-6.3	-3.4	-13.4	-12.8	-1.2	-0.8
67	10.6	3.0	-9.6	-3.1	-2.2	3.1	0.1	-5.6	-6.8	-10.8
68	-12.1	-9.3	-5.0	-7.4	-2.9	-4.4	-7.6	-5.1	-8.3	-6.5
69	10.9	16.2	13.8	17.1	5.9	8.2	12.7	17.4	7.7	10.9
71	11.8	5.4	10.5	14.8	26.0	30.0	16.3	10.2	28.2	22.1
72	12.3	10.6	6.1	-0.4	15.4	9.7	4.6	3.1	15.3	13.8
74	16.7	16.6	21.1	20.7	26.3	26.0	19.9	19.8	16.0	16.0
77	18.9	22.3	46.5	51.2	23.5	26.4	29.8	33.0	26.3	29.2
78	70.2	88.4	37.4	59.4	60.4	81.8	52.6	67.8	21.0	29.8
79	-20.7	-17.3	-0.3	1.3	23.1	24.9	14.6	19.7	39.6	45.0
84	27.3	18.9	13.9	6.2	13.7	10.2	11.3	3.6	-1.1	-3.4
Average	0.5	-0.9	2.1	5.5	8.9	12.9	7.3	6.3	3.2	2.8

Notes:Table reports a percentage change in exports of moving from the CIS scenario of integration to the EU1 and EU2 scenarios of integration. The scenarios are EU1 - Ukraine has been announced EU candidate, EU2 - Ukraine has become an EU member in 2004, CIS - Ukraine did not integrate with EU. Only 24 most important exports (in terms of total value of actual exports in examined period) are reported. SITC sectors are described in the Table 1A.

First, total export in sector k in region i, TE^i_{sk} , is computed for each of the three scenarios. Next, the percentage changes are calculated according to the following formula: $\Delta^i_{sk} = 100\% \frac{TE^i_{sk} - TE^i_{CISk}}{TE^i_{CISk}}, s = EU1, EU2$

6 Conclusions

In order to access costs of non-integration for Ukraine in 2000-2007, we estimate a gravity model at the level of SITC two digit products applying a newly developed two stage procedure that accounts for selection of exporters and firm-level heterogeneity. We introduce and measure two different channels of the effect of integration on trade: a direct effect of *de jure* integration and an indirect effect of the behavioral change in the parameters of the gravity equation. Two endogenous variables, EU and bothEU, capture the former, while differences in the coefficients of the gravity equation estimated for the two group of countries capture the latter. The direct effect is found to be important and highly product-specific for disaggregated exports, but non-significant for the aggregate export. The behavioral changes, on the other hand, play an important role in determining export patterns for aggregate as well as disaggregated exports.

We calibrate the estimation method using the aggregate data and show that the two stage HT and two stage pair-fixed effect methods generate similar predictions, while a simple OLS method produce highly implausible results. Moving to the disaggregated data, we estimate the opportunity costs of non-integration at the level of SITC two digit products and find that the most losses in terms of foregone exports are expected in manufactured goods with almost doubled exports in 2007 relative to the CIS scenario. As an example, Ukraine would have increased export of road vehicles (code 78) to the CIS countries by 70 percent under the EU1 scenario and by 88 percent under the EU2 scenario, while export to the EU15 would have increased by 60 and 82 percent respectively. Under the EU2 scenario, Ukraine would have also increased export of diary products and cereals to EU15 countries by 95 and 15 percent respectively, but would have lost CIS markets which make the overall effect of EU integration on agriculture and food exports quite ambiguous.

Literature

Anderson, James E., and Eric van Wincoop.. "Gravity with Gravitas: A Solution to the Border Puzzle." American Economic Review 93.1 (Mar. 2003): 170-192.
Baldwin, Richard, and Daria Taglioni.. "Gravity for Dummies and Dummies for Gravity Equations." (2006). NBER working papers: 12516

Baldwin, Richard E. "Multilateralising Regionalism: Spaghetti Bowls as Building Blocs on the Path to Global Free Trade." World Economy 29.11 (Nov. 2006): 1451-1518

Baldwin, Richard E., Joseph F. Francois, and Richard Portes. "The Costs and Benefits of Eastern Enlargement: The Impact on the EU and Central Europe." Economic Policy: A European Forum (Apr. 1997): 125-170.

Baldwin, Richard E. "The Eastern Enlargement of the European Union." European Economic Review 39.3-4 (Apr. 1995): 474-481.

Baldwin, Richard E. Towards an integrated Europe London, 1994.

Baldwin, R. E. (1993), 'A Domino Theory of Regionalism', NBER Working Paper 4465 (Cambridge). Published as: Baldwin, R. E. (1995), 'The Domino Theory of Regionalism', in R. E. Baldwin, P. Haaparanta and K. Kiander (eds.), Expanding Membership of the European Union (Cambridge: Cambridge University Press).

Bernard, Andrew B., Eaton, J, Jensen, JB, and S Kortum, "Plants and Productivity in International Trade." American Economic Review 93.4 (Sep. 2003): 1268-1290.

Bussière, Matthieu, Fidrmuc, Jarko and Schnatz, Bernd,EU Enlargement and Trade Integration: Lessons from a Gravity Model. Review of Development Economics, Vol. 12, Issue 3, pp. 562-576, August 2008

Egger, Peter, Michael Pfaffermayr, and Roland Schmidt. "Trade in Western and Eastern Europe in the Aftermath of COMECON: An Assessment of Behavioral Change." Oxford Economic Papers 59.1 (Jan. 2007): 102-126.

Gros, Daniel, and Andrzej Gonciarz.. "A Note on the Trade Potential of Central and Eastern Europe." European Journal of Political Economy 12.4 (Dec. 1996): 709-721.

Hamilton, Carl B., and L. Alan Winters.. "Opening Up International Trade with Eastern Europe." Economic Policy: A European Forum (Apr. 1992): 77.

Hausman, Jerry A., and William E. Taylor.. "Panel Data and Unobservable Individual Effects." Econometrica 49.6 (Nov. 1981): 1377-1398.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein. "Estimating Trade Flows: Trading Partners and Trading Volumes." Quarterly Journal of Economics 123.2 (May 2008): 441-487.

Hummels, David. "Toward a Geography of Trade Costs." (1999). GTAP working paper

Kaufmann, D., Kraay, A., Mastruzzi, M., 2007. Governance Matters VI: Governance Indicators for 1996--2006. World Bank Policy Research Working Paper No. 4280, Available at SSRN: http://ssrn.com/abstract=999979.

Nilsson, Lars. "Trade Integration and the EU Economic Membership Criteria." European Journal of Political Economy 16.4 (Nov. 2000): 807-827.

Martin, W., Pham, C., 2008. Estimating the Gravity Equation when Zero Trade Flows are Frequent. unpublished manuscript.

McPherson, Matthew Q., and William N. Trumbull.. "Rescuing Observed Fixed Effects: Using the Hausman-Taylor Method for Out-of-Sample Trade Projections." International Trade Journal 22.3 (July 2008): 315-340.

Melitz, Marc J. "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity." Econometrica 71.6 (Nov. 2003): 1695-1725.

Mitra, Pradeep. Innovation, Inclusion and Integration: From Transition to Convergence in Eastern Europe and the Former Soviet Union Washington, D.C., 2008.

Pelzman, Joseph. "Trade Creation and Trade Diversion in the Council of Mutual Economic Assistance: 1954-70." American Economic Review 67.4 (Sep. 1977): 713-722.

Serlenga, Laura, and Yongcheol Shin.. "Gravity Models of Intra-EU Trade: Application of the CCEP-HT Estimation in Heterogeneous Panels with Unobserved Common Time-Specific Factors." Journal of Applied Econometrics 22.2 (Mar. 2007): 361-381.

Wang, Z., Winters, L., 1991. The Trading Potential of Eastern Europe. CEPR Discussion Paper no. 610. London, Centre for Economic Policy Research, http://www.cepr.org/pubs/dps/DP610.asp.

World Bank, 2005, “From Desintegration to Reintegration: Eastern Europe and the Former Soviet Union in International Trade,” edited by H. Broadman

Appendix

Table A1 SITC2 codes description

SITC2	DESCRIPTION	SITC2	DESCRIPTION
0	LIVE ANIMALS OTHER THAN FISH	55	ESSENTIAL OILS AND RESINOIDS AND PERFUME
1	MEAT AND MEAT PREPARATIONS	56	FERTILIZERS
2	DAIRY PRODUCTS AND BIRDS' EGGS	57	PLASTICS IN PRIMARY FORMS
3	FISH, CRUSTACEANS, MOLLUSCS	58	PLASTICS IN NONPRIMARY FORMS
4	CEREALS AND CEREAL PREPARATIONS	59	CHEMICAL MATERIALS AND PRODUCTS, N.E.S.
5	VEGETABLES AND FRUIT	61	LEATHER, LEATHER MANUFACTURES, N.E.S.
6	SUGARS, SUGAR PREPARATIONS AND HONEY	62	RUBBER MANUFACTURES, N.E.S.
7	COFFEE, TEA, COCOA, SPICES	63	CORK AND WOOD MANUFACTURES
8	FEEDING STUFF FOR ANIMALS	64	PAPER, PAPERBOARD, AND ARTICLES
9	MISCELLANEOUS EDIBLE PRODUCTS	65	TEXTILE YARN, FABRICS, MADE-UP ARTICLES, N.E.S.
11	BEVERAGES	66	NONMETALLIC MINERAL MANUFACTURES, N.E.S.
12	TOBACCO AND TOBACCO MANUFACTURES	67	IRON AND STEEL
21	HIDES, SKINS AND FURSKINS, RAW	68	NONFERROUS METALS
22	OIL SEEDS AND OLEAGINOUS FRUITS	69	MANUFACTURES OF METALS, N.E.S.
23	CRUDE RUBBER	71	POWER GENERATING MACHINERY AND EQUIPMENT
24	CORK AND WOOD	72	MACHINERY SPECIALIZED FOR PARTICULAR INDUSTRIES
25	PULP AND WASTE PAPER	73	METALWORKING MACHINERY
26	TEXTILE FIBERS AND THEIR WASTES	74	GENERAL INDUSTRIAL MACHINERY, N.E.S.
27	CRUDE FERTILIZERS AND CRUDE MINERALS	75	OFFICE AND AUTOMATIC DATA PROCESSING MACHINES
28	METALLIFEROUS ORES AND METAL SCRAP	76	TELECOMMUNICATIONS AND SOUND RECORDING
29	CRUDE ANIMAL AND VEGETABLE MATERIALS, N.E.S.	77	ELECTRICAL MACHINERY AND APPLIANCES, N.E.S.
32	COAL, COKE AND BRIQUETTES	78	ROAD VEHICLES (INCLUDING AIR-CUSHION VEHICLES)
33	PETROLEUM, PETROLEUM PRODUCTS AND RELATED	79	TRANSPORT EQUIPMENT, N.E.S.
34	GAS, NATURAL AND MANUFACTURED	81	PREFABRICATED BUILDINGS; SANITARY, PLUMBING, HEATING
35	ELECTRIC CURRENT	82	FURNITURE AND PARTS THEREOF; BEDDING, MATTRESSES
41	ANIMAL OILS AND FATS	83	TRAVEL GOODS, HANDBAGS AND SIMILAR CONTAINERS
42	FIXED VEGETABLE FATS AND OILS	84	ARTICLES OF APPAREL AND CLOTHING ACCESSORIES
43	ANIMAL OR VEGETABLE FATS AND OILS	85	FOOTWEAR
51	ORGANIC CHEMICALS	87	PROFSSIONAL, SCIENTIFIC INSTRUMENTS, N.E.S.
52	INORGANIC CHEMICALS	88	PHOTOGRAPHIC APPARATUS; WATCHES AND CLOCKS
53	DYEING, TANNING AND COLORING MATERIALS	89	MISCELLANEOUS MANUFACTURED ARTICLES, N.E.S.
54	MEDICINAL AND PHARMACEUTICAL PRODUCTS		

Table A2 EU12, EUC4, and CIS Exports in 2000-2007

Source country	Number of Positive Exports	As % of All Postitive Exports in the Sample	Mean Export, thosands of $US	Total Export, billions of $US	As % Value of Total Export in the Sample
			A. EU12 and EUC4		
Albania	3 870	1.0	1155	4.5	0.2
Bulgaria	30 947	8.0	2364	73.2	2.7
Cyprus	15 910	4.1	501	8.0	0.3
Czechia	38 788	10.0	13034	506.0	18.3
Estonia	21 214	5.5	2302	48.8	1.8
Croatia	20 002	5.1	2945	58.9	2.1
Hungary	32 408	8.3	12519	406.0	14.7
Lithuania	23 293	6.0	3140	73.1	2.6
Latvia	18 152	4.7	1738	31.6	1.1
Macedonia	9 627	2.5	1484	14.3	0.5
Malta	10 983	2.8	1733	19.0	0.7
Poland	34 990	9.0	16134	565.0	20.5
Romania	27 254	7.0	6419	175.0	6.3
Slovakia	25 799	6.6	8481	219.0	7.9
Slovenia	27 420	7.1	4442	122.0	4.4
Turkey	47 853	12.3	9081	435.0	15.8
EU12 plus EUC4	388 510	100.0	7097	2760.0	100.0
			B. CIS		
Armenia	5 426	4.3	998	5.4	0.3
Azerbaijan	7 448	5.9	3891	29.0	1.7
Byelarus	16 250	12.9	6356	103.0	6.2
Georgia	6 795	5.4	759	5.2	0.3
Kazakhstan	11 465	9.1	14203	163.0	9.8
Kyrgyzstan	5 272	4.2	1002	5.3	0.3
Moldova	7 711	6.1	894	6.9	0.4
Russia	36 876	29.3	30789	1140.0	68.3
Ukraine	28 404	22.6	7773	221.0	13.2
CIS	125 647	100.0	13323	1670.0	100.0

Note: SITC 2 digit exports of EU12, EUC4, and CIS to 179 countries in 2000-2007.
Source: COMTRADE