The Effects of the CEECs’ Accession on Sectorial Trade: A Value Added Perspective*

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Abstract

The structure of international trade has changed markedly due to the processes of increased fragmentation and trends towards economic integration. Production processes are divided across borders and internationally connected through global value chains (GVCs). In this new framework it has become increasingly more important to examine which amount of domestic Value Added (VA) is embodied in final products. Furthermore, the composition of the VA needs to be analyzed to assess nation’s competitiveness in the world economy. We study the implications of economic integration in Europe with new data that account for trade in value added and its sectorial and factorial composition. Specifically, we examine the case of ten Central and Eastern European Countries (CEEC) acceding to the European Union (EU) in 2004. In order to obtain reliable estimates of accession effects, theoretically founded specifications of the well-known gravity model of trade are applied. The results are surprising: While CEEC’s value added are stimulated by EU accession, regional integration disproportionally favors trade in value added by low-skill tasks, slowing down the CEECs’ industrial upgrading process.

Keywords: Economic integration, economic fragmentation, gravity model, international trade (JEL F13, F15).

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1 Introduction

Global economic integration is neither a new phenomenon nor as global as perceived. A spatial separation of production processes and consumption already occurred in the 19th century. New however is the increasing fragmentation of production steps and tasks across countries since the mid-1980’s (Baldwin, 2006). Due to this fundamental change, it becomes less meaningful to use gross trade statistics as the unit of economic analysis. The value added (VA) by domestic labor and physical capital, embodied in gross exports, needs to be examined more closely instead (Daudin et al., 2011; Baldwin and Lopez-Gonzalez, 2013).

An example is the geographical dispersed production chain of the Porsche Cayenne. Its engine and high-end interior and exterior components are manufactured in Germany. These components are assembled into the car in Bratislava, Slovakia, while the final production steps and inspection are again performed in Germany to deliver Porsche Cayennes to German final demand. In a traditional trade perspective, gross trade statistics imply that Germany exports engines and high-end car components to Slovakia, while Slovakia exports nearly finished cars including engines and high-end components (Dudenhöffer, 2005). However, the story is very different from a VA perspective: Germany is not exporting any VA for Slovakian final demand, while Slovakia is only exporting its assembly services and manufacturing products on a medium-skill level. This example stresses the importance of why it matters to distinguish between gross trade and trade in value added.

The nature of fragmentation in the Porsche example points also to another feature of the 21st century world economy. Driven by the intensive emergence of Economic Integration Agreements (EIA), Global Value Chains (GVCs) seem to be increasingly organized regionally (Baldwin and Lopez-Gonzalez, 2013). A pioneer of the EIAs is the European Union (EU), which already emerged in the 1950s and constitutes with its 28 member states the largest single market in the world economy. The EU faced its most comprehensive enlargement in 2004, when ten Central and Eastern European Countries (CEECs) acceded to the EU. Hand in hand with the accession went expectations of the CEECs to promote growth thanks to offshoring and outsourcing from the more developed incumbent countries (EU15) and their firms (Marin, 2006). A fragmented world economy offers countries the
opportunity to participate in existing GVCs, rather than building their own from scratch. In this way technical knowledge accumulates and firms can consequently upgrade to higher VA activities. In this way the growth of GDP, which is by definition the sum of all VA activities in a country, is promoted.

Ten years post-accession, it is worthwhile to investigate whether the CEECs benefited from the opportunities offered by EU membership. This paper approaches the question how the CEECs’ accession to the EU can be assessed while accounting for recent advances in quantifying economic fragmentation. More specifically, the membership effect on gross and VA exports will be examined at both the sectorial and factorial level. We construct a gravity model of international trade using the World Input Output Database (WIOD) (Timmer, 2012). This new database provides extensive GVC data on VA and factor inputs at a sectorial level for the period of 1995-2009.

The remainder of this paper is structured as follows. Section 2 provides an introduction to the literature and theory of economic fragmentation and regional integration. Section 3 discusses the methodology, dataset and our main results. This is followed by a discussion of our findings, their policy implications and future research prospects in section 4. Section 5 concludes.

2 Theory of Economic Fragmentation and Integration

After post-war recovery, in the 1960s, a second wave of globalization gained momentum. It was driven by a widespread industrialization and significant drops in trade cost, causing increasing trade across nations in intermediate goods. As a result the domestic VA share in gross exports seems to have dropped by 10-15 percentage points in the last four decades (Johnson, 2014). This phenomenon was discussed in the trade literature and subsumed under the headline of economic fragmentation (Jones and Kierzkowski, 1990; Krugman and Venables, 1995; Feenstra and Hanson, 1996).

New, however, is the quality of trade integration, which was induced by the revolutions in information and telecommunication technology (ICT). The broad availability of the internet, computers and the mobile-phone opened further avenues of global trade integration. While
formerly production processes were carried out in one specific location, as face to face contact between employees was needed to coordinate complex tasks, ICT facilitated the coordination of tasks across borders. Recent theory implies that in the new paradigm not only value chains, but specific production steps are “unbundled” Baldwin (2006); Grossman and Rossi-Hansberg (2006). Therefore, it is not complete goods and services that are traded internationally anymore, but it is rather tasks, jobs and skills. Formerly the production was allocated to the company or the country, which was able to most efficiently perform the average of all tasks involved in the production of the good.

Therefore, competitive pressure from developing nations on developed states was perceived primarily from low-skilled sectors, while the developed world had an edge in high-skilled sectors as a whole (Feenstra and Hanson, 1996; Krugman and Venables, 1995). In the new paradigm specific tasks can get coordinated across borders. Therefore, although developing countries are not most efficient for the whole production process, individual jobs also in high-skill branches might be challenged by developing countries’ workers (Baldwin, 2006). For catching-up economies this offers various avenues for industrial upgrading, characterized by an increasing usage of human and physical capital (Porter, 1990; Gereffi, 1999).

In order to put numbers to these developments, new empirical measures of trade in VA are needed. A pioneering step in this regard was done by Hummels et al. (2001), who developed the measure of “vertical specialization”. It indicates how much of gross exports’ content is attributable to foreign VA. These calculations were complemented by case studies on specific export goods, indicating the partly surprising division between gross and VA export numbers. Influential examples are Dedrick et al. (2010)’s study on Apple’s iPod and other portable devices as well as the previously named study by Dudenhöffer (2005) on the Porsche Cayenne. These studies provided important insight into the different shares of VA that were captured by firms and nations. However, only specific tradable goods at a specific point in time were investigated, making it impossible to draw in-depth implications of the nature of fragmentation. This just recently became possible, due to an increased establishment of comprehensive multi-country Input Output Tables (IOTs), facilitating fruitful research Timmer et al. (2014).
Johnson and Noguera (2012a) proposed in this regard the measure of Value Added Exports (VAX), which will be also used for the empirical analysis in this paper. VAX exhibits the VA of a source country that is embodied in the final demand of a partner and is therefore a footprint measure. Based on this measure it was found in a gravity model of trade that VA flows are less repressed by physical distance than gross trade (Johnson and Noguera, 2012b).

Moreover, the aggregate VA measure was too broad to make reasonable statements on factorial and sectorial contributions. Data on the factor content of trade (e.g. capital, skill levels) is needed, in order to assess the competitiveness of a country (Trefler and Zhu, 2010). These data are offered by IOTs like WIOD, which is used in this paper. Based on these data, Stehrer et al. (2012) found that according to theoretical predictions advanced countries would be exporters of high-skilled labor. In contrast especially medium-skilled manufacturing jobs would be offshored. As of today not only low-skill, but increasingly medium-skill jobs seem to be sourced from abroad, the catching-up economies might be assumed to shift to higher value adding activities. In this context the paper focuses on the specific example of the ten catching-up CEECs, which acceded to the EU in 2004. In order to examine the effect of trade integration on VAX and its composition it is important to identify the mechanisms that link regional integration processes with the changes in the production structure of member states. Subsequently an overview of economic integration theory and more specifically the integration design of the EU will be given.

In an attempt to resolve the ambiguity in definitions of economic integration, Balassa (1961) describes economic integration as “abolishing discrimination between economic units belonging to different national states (and) [...] the absence of various forms of discrimination between national economies”. This reduction of discrimination consisting of tariffs and non-tariff trade barriers (quotas, local content requirements etc.) is expected to increase trade and specialization in absolute cost advantages following classic economic theory. Ranging from a simple free trade agreement (FTA), over a customs union (FTA plus a common external tariff) until an economic union (a customs union plus a common market for production factors) trade integration can achieve differing degrees, linked to beneficial effects for its members (also see Baier et al., 2014).
Following Viner (1950) these effects were labeled the trade creation effects of a customs union. The economic benefits of trade creation are usually subsumed under the terms (i) allocation and (ii) accumulation effects. The first term (i) allocation effects of trade describes the before mentioned changes towards the comparative cost advantages of countries, as ineffective domestic production is substituted by more effective foreign production. When trade barriers are reduced within the customs union, the partner country’s firms gain improved access to the domestic market, becoming able to make use of their comparative cost advantage, which is now not distorted by tariffs anymore. The effect is increased competition in the domestic market as only the most competitive foreign firms select themselves into internationalization modes. This forces inefficient domestic producers out of the market and releases their productive factors (Altimonte et al., 2011). Consequently, these production factors can be used for more productive courses, for which the home market faces comparative advantages. This reallocation to more efficient domestic and foreign producers leads to economies of scale and increases profits of the effective producers as now foreign and domestic consumers are served. In addition in the long term (ii) accumulation effects are expected to increase welfare even further, in terms of fostering economic agglomerations and competition. Especially the latter increases the incentives to invest in human capital as well as in research and development (Baldwin and Wyplosz, 2012). These accumulation effects towards more advanced production factors (high-skilled labor and capital intensity) will be of interest with regard to the CEECs.

However, the removal of trade barriers between the contracting parties equals a relative increase of the trade barriers vis-á-vis third countries as well. Thus, although EIAs lead to an increase of world welfare in specific cases, a Pareto-optimum vis-á-vis absolute free trade is never reached (Lipsey, 1957; Balassa, 1961). Therefore, bilateral and regional trade integration, in contrast to world free trade, is only seen as the second best solution. Nevertheless, almost 350 bilateral and multilateral trade agreements have been implemented in the post-WWII world (Kohl, 2012). This is due to the fact that a global consensus about world trade policy is hardly imaginable, as a result of the seemingly endless WTO trade rounds. Consensus seems to be only possible, if trade integration is also accompanied by political integration, which is an outstanding attribute of the EU (Baldwin and Wyplosz,
The EU’s internal market, guaranteeing free mobility of goods and services as well as capital and labor, is supported by an European competition policy and a currency union, which however does not include all CEECs to this date. What is more, the EU has its own executive (European Commission), legislative (European Parliament, Council of the European Union) and judicial branch (Court of Justice of the EU) and important decisions are increasingly made in Brussels, Strasbourg and Luxembourg.

Already the foundational Treaty of Rome from 1957 expressed the desire “to ensure the development of the . . . prosperity” for its member states. Prosperity enhancing integration was specifically desired as a means to an end of a peaceful Europe. In this context the EU faced both a historical chance and challenge regarding the accession of ten CEECs in 2004: On the one hand the incumbents were able to win the CEECs for the European idea after the end of the Soviet hegemony. On the other hand the union also faced its largest expansion in terms of countries, enlarging the EU from 15 to 25 members and by circa 75 million citizens. Additionally, the developmental gap between entrants and incumbents was partly sizeable (see Figure A.1 in the Appendix). While in 2004 the CEEC exhibited an average GDP p.c. of circa €12,500, EU15 inhabitants earned with €24,500 nearly twice as much. Also marked income differences existed among entrants, reaching from close to €10,100 p.c. in Latvia, to €19,600 in Cyprus. For this reason the accession of CEEC was phased-in gradually and liberalization already took place partly within the framework of the Europe Agreements during the 1990s, lowering additional benefits of full membership.

Notwithstanding, was it expectable that the entry gave further impetus to CEEC’s growth for following reasons: Full EU membership equals a further reduction of trade frictions in terms of abolished border controls and product standard harmonization, which formerly increased trade costs by circa 10 percent without producing benefits for the importing countries. Furthermore, CEECs might have benefited from increased financial inflows due to political stabilization in combination with integration into production networks of the EU15 (Baldwin et al., 1997). For instance, in the framework of gravity estimations Martínez-Zarzoso et al. (2015) found that the CEEC became deeper integrated into joint EU production networks, considering both the extensive and intensive margin of trade. Hornok (2010), focussing on manufacturing trade with different partners within the EU,
found that it is mainly the trade between 2004 entrants that was positively affected by EU accession. In this context the paper wants to examine following research hypotheses:

**Hypothesis 1** The EU membership of the CEEC led to more trade between the entrants and other member states.

The EU accession led to significant reductions of impediments to trade. Thus, increased bilateral trade among the 10 CEECs as well as among CEECs and the EU incumbents is assumable.

**Hypothesis 2** The EU membership of the CEEC led to more VA Exports between the entrants and other member states.

It is possible that the increase in gross trade is attributable either to an increase of domestic VA activities or an increasing use of foreign inputs (Dedrick et al., 2010). Due to the integration in European GVCs an increase of VAX is suggested.

Regarding the question to what extent the increase of VAX can be attributed to the EU membership, research gave contradicting findings. Baldwin and Lopez-Gonzalez (2013) suggested that GVCs are built on a rather regional level, specifically regarding the EU: The headquarter economies of Germany, France, UK and to a lesser extent Italy would source and re-import goods and increasingly services from the factory economies of the CEECs, especially Poland and the Czech Republic. Based on the same data, Los et al. (2015) depict a more nuanced picture: In their study Hungary and Latvia seem to have become increasingly oriented towards their region. In contrast the factory economies Poland and the Czech Republic show a clear trend towards globalization of VA flows between 1995 and 2009. However, for both groups of countries regional VAX flows increased. With regard to technological catching-up, Benkovskis et al. (2013) found, using WIOD data, that total factor productivity increased significantly in the CEECs’ export-oriented sectors, linked to convergence towards Western Europe. This complements the findings of a study by Timmer et al. (2013), which revealed the increase of high-skill intensive service sector jobs within European GVCs.

In this regard, above the analysis of quantititative accession effects, this paper wants to examine if the 2004 accession has enhanced CEECs’ VA exports qualitatively by investigating
the following hypotheses.

**Hypothesis 3a** *The increased VA in trade due to EU members' final demand embodies a shift to more advanced production factors (e.g. high-skilled labor and capital).*

The largest share of VA is captured by technology intensive activities located in pre- and post-production of goods and services (Baldwin and Evenett, 2012). These activities mainly involve highly skilled workers and larger amounts of capital. This paper seeks to answer whether the accession induced a stronger contribution of these factors to CEECs’ exports for EU members’ final demand.

**Hypothesis 3b** *The increased VA in trade is induced by outsourcing of routine tasks to the CEECs from other EU member states (e.g. low-skilled labor and a decrease in capital-intensity).*

In contrast, it is also imaginable that the EU accession of CEECs led to increased exports for other members’ final demand, which are mainly based on the use of low-skill labor from the CEECs. In this scenario VA exports might increase quantitatively due to an increased export of low-skill tasks. However, the CEEC economies would be left stuck in low VA activities. The growth prospects in this scenario would be comparatively lower.

Especially due to the “depth” of European integration, a qualitative difference in the factorial composition of VAX is assumable. For this purpose this paper seeks to combine the work done by Johnson and Noguera (2012b) on VAX in a gravity setting with studies on factorial decomposition by examining VAX not only on an aggregate level, but by analyzing its factorial composition. Subsequently, both methodology and data will be explained in more detail.

### 3 Empirical Approach

#### 3.1 Methodology

For the empirical analysis of the accession effects a gravity model of trade was chosen. The model dates back to a seminal work by Tinbergen (1962), who as a trained physicist
applied Newton’s law of universal gravitation in the framework of trade. The model builds on following basic equation, which can be written in panel data style as follows:

\[ E_{ijt} = a_0 \times Y_{i,t}^{a_1} \times Y_{j,t}^{a_2} \times D_{ij}^{a_3} \times G_{ij,t}^{a_4} \]  

(1)

where the \( E_{ijt} \) stands for the respective flow between two countries i and j. \( Y_{i,t} \) and \( Y_{j,t} \) signify the respective gross domestic products of the trade partners, \( D_{ij} \) describes the bilateral distance and \( G_{ij,t} \) stands for the gravitational constant, explaining all other relevant bilateral characteristics. The exponents \( a_1-a_4 \) signify that the explanatory power of the independent variables differs, while \( a_0 \) is a constant, which scales the measurement units of the other variables (Tinbergen, 1962). The rationale behind this equation is that the higher the product of the two GDPs is, the higher will be the predicted trade flow. Whereas the higher the distance, the lower the trade flow. Consequently, the economic trade literature included further constant as well as time varying determinants of trade. The most prominent among them are common language, coastal access, colonial history and trade policies (e.g. EIAs). For the latter partly ambiguous outcomes were found (for an overview of the literature with regard to the effects of WTO membership, see Kohl, 2015). The gravitational constant \( G_{ij,t} \) is actually not a constant term. It depends on the bilateral relation examined, varies over time and more importantly it is correlated to unobserved trade policy variables, leading to omitted variable bias - a topic covered later in this section (De Benedictis and Taglioni, 2011).

In order to make the gravity model computable in the standard Ordinary Least Squares (OLS)-regression design, the basic model is often log-linearized, yielding:

\[ \ln E_{ijt} = \ln a_0 + a_1 \ln Y_{i,t} + a_2 \ln Y_{j,t} + a_3 \ln D_{ij} + a_4 \ln G_{ij,t} + e_{ij} \]  

(2)

For an overview of gravity’s theoretical and empirical evolution, see Head and Mayer (2015). Important contributions to the gravity model have been made since 2000 regarding the remoteness to trade and the endogeneity of trade agreements. These extensions, which are taken into consideration in the data analysis of this paper, are outlined briefly in the following paragraphs.
3.1.1 Multilateral Resistance

Anderson (1979) and Bergstrand (1985) indicated that above bilateral trade costs, the trade between two partners will be determined also by the average barrier to all other international partner countries. Still, trade economists ignored this finding for several years. This explains for example a border effect estimation of a 2,200% difference between US interstate trade and trade between US states and Canadian provinces by McCallum (1995). It was not possible to account for the relative average trading costs, labeled ‘multilateral resistance’ or remoteness, until Anderson and Wincoop (2003) (AvW) introduced a new modelling approach. They formulate a basic gravity model:

\[
x_{ij} = \frac{y_i y_j}{y_w} \times \frac{t_{ij}}{P_i P_j}^{1-\sigma}
\]

where \(x_{ij}\) is the trade flow and \(y_i\) and \(y_j\) are GDPs of countries i, j. They are divided by the world GDP \(y_w\). The following term describes the relative trade resistance of the two countries (assuming symmetric trade barriers), where \(t_{ij}\) is the bilateral resistance and \(P_i\) and \(P_j\) constitute the price indexes of the respective countries. Theoretically the bilateral resistance factor \(t_{ij}\) is unobservable, but might be estimated via observables. Examples for these observables are geographical distance, adjacency or linguistic identity. Econometrically it is more viable to include these unobservables via country-specific fixed effects as they can be estimated easily in an OLS setting. However, estimates with the monadic fixed effects can be less efficient (than using proxies) and the specification error might be correlated with the observable determinants of trade costs (Anderson and Wincoop, 2003).

Notwithstanding, Head and Mayer (2015) underline the importance of introducing country fixed effects, as they control for further unobservables (like being a regional export hub, which can fundamentally bias gross export numbers). Additionally, if country-specific fixed effects are used, it is arguable that time fixed effects should also be added to the regression model in order to account for unobservable changes in the world economy (Anderson and Wincoop, 2003; Head and Mayer, 2015).
3.1.2 Accounting for Endogeneity

Baier and Bergstrand (2007) and Baier et al. (2007) point out that further unobservables should be considered in order to avoid endogeneity bias of EIA estimates. This involves following issues: (i) The decision to select into an EIA might be endogenous, because countries selecting into a common EIA would share similar characteristics that are not accounted for in the gravity equation (omitted variables). States are more likely to select into a common EIA, if they share unobservable properties that make trade integration especially beneficial, e.g. complementary differences in factor endowments or a mutual high regulatory intensity. While the measurement or instrumenting of complementary differences in factor endowments is still econometrically viable, a measure of differences in internal policies for a large subset of countries can barely be conceptualized. Nevertheless, particularly the latter could induce a large bias for following reasons:

Assume high regulatory barriers in a specific bilateral trade relation, e.g. the rigid competition policy of post-Communist CEECs. If now a country selects into an EIA, it is imaginable, that the EIA induces in addition to tariff reduction also a convergence of national regulations, e.g. in terms of the EU’s regulatory body. This convergence enhances the prospects of trade due to reduced trade frictions. Policy makers anticipate this and for this reason the probability to select into an EIA is positively influenced. Therefore, the mutual high regulatory differences are both positively correlated with the selection into an EIA and the magnitude of the EIA effect. Its inclusion would be then negatively correlated to the error term, as a larger share of the variance would be explained. In contrast, the exclusion of an internal regulatory variable, leads to a larger error term and to an underestimation of the EIA effect–omitted variable bias is induced (Baier et al., 2007).

Baier and Bergstrand (2007) suggests that the EIA-selection-decision of trade policy makers is based on the levels of trade flows and not on recent changes. Therefore, the selection would take place on a cross-sectional level. With panel data this assumption makes it possible to mitigate the selection-bias via an estimation model based on dyadic and country-time fixed effects. Although mitigating potential endogeneity bias, dyadic fixed effects are perfectly collinear to the time-invariant variables in the gravity model. These
time-invariant characteristics include geographical distance and bilateral properties like a common colonial history. Due to the collinearity, these variables have to be excluded from the estimation.

Beyond fixed effects, the first-differencing approach proposed by Wooldridge (2002) can help to mitigate the endogeneity issues, outlined in this paragraph. In the framework of this approach, first differences of all dependent and independent variables are taken. This leads to an exclusion of the time-invariant country-pair characteristics, whereas the time-differing country characteristics can be measured via country-time fixed effects in the model. The methodology seems to offer two additional benefits. Firstly it can be assumed that trade flows do follow unit-root processes, thus are non-stationary. Fixed effects, however, are similar to a differencing around the mean in terms of the fixed effects acting as a level. In this regard they assume stationarity of trade flows. Thus, if fixed effects are used in long panels, spurious-regression issues could arise. In contrast first differencing induces a stationarity of the variables as they depict the differences from the previous period. In effect the first differenced data fit the model better. This reduces concerns of spurious regressions. Secondly, in panels with a long time-series component problems might especially arise if the error of the fixed effects model is correlated over time. In effect bias due to serial correlation would arise, which might be mitigated via the use of first differences (Wooldridge, 2002). Therefore, a model based on first differences will be used in the main part of this paper. Complementary, the previously proposed fixed effects estimators will be provided in the appendix.

Another issue arises in terms of (ii) reversed causality or respectively the ambiguous causation between dependent and independent variables (Wooldridge, 2002). The basic gravity model specified above assumes that bilateral trade is explained among other factors by the GDP and the existence of trade agreements between the partners. There seems to be evidence that the latter two independent variables are partly explained by the size of bilateral trade flows (dependent variable).

Firstly, following classical trade theory free commerce is enhancing economic growth by specialization on country-specific advantages. Thus, countries with higher trade flows might have on average also a higher GDP. This makes the interpretation of causation ambiguous
(simultaneity bias). Frankel (1997) examined this issue in an instrumental variable (IV) approach. GDP mass variables were instrumented in a gravity setting with past income levels. His results pointed out that the endogeneity of GDP and gross exports causes little bias. Nevertheless, to avoid a dependent variable misspecification in the new paradigm of a fragmented world economy, VAX instead of gross trade data are used for most specifications of this paper (Baldwin and Taglioni, 2011). In this framework endogeneity issues can become more severe. This is due to the fact that GDP depicts the sum of VA produced for domestic and foreign use in a specific country. Regressing GDP on VAX resembles therefore a circular reasoning. Country-time fixed effects proposed by Wooldridge (2002) can account for this, as they capture the GDP component completely. This acts as a further reason why this specification is used for most of the paper’s estimations.

Secondly, the selection into an EIA might be driven by the initial amount of bilateral trade flows. The reasoning is that countries tend to have an interest in liberalizing trade with countries that are already important partners, rather than with countries, with which no cooperation is established. For this reason it is suggested that selection into an EIA is driven by initial trade flows, leading to a further endogeneity bias in the basic equation. To control for this issue in a subsequent section of this paper, pre-integration trade flows will be regressed on the future EIA-dummy (Baier and Bergstrand, 2007; Magee, 2008; Frankel, 1997). This follows the intuition that future trade liberalization cannot have effects on pre-integration trade flows, whereas the latter might have an impact on the selection into an EIA. This endogeneity test will then reveal if the trade flows between the EU15 and CEECs, in e.g. the year 2000, had an impact on the decision to select into the EU by 2004.

In this manner it is also possible to suggest that future EIA dummies depict theoretically founded anticipatory effects, which might not be linked to endogeneity. This can be imagined especially, if exporters anticipate that a trade agreement comes into place and deepen links to the future partner country. Regarding the 2004 EU accession round another reasoning for anticipation exists: Countries with a prospect of EU membership were granted preferential terms in the framework of the European Agreements (EAs), reducing trade barrier in the pre-accession phase. Statistically significant lead variables might also be attributable to this context.
Accounting in this framework for future EIA terms, it is also imaginable that EIAs induce long-term post-enlargement effects, exceeding the initial level effect in the entry year. For example some rules need to be phased-in and exporters require some transition period to get accustomed to the new regulatory framework and develop links to importers. Therefore, recent research suggests using lagged terms of the EIA-dummies in order to capture the full effect of selection into trade agreements (Baier and Bergstrand, 2007; Kohl, 2014). This will be done in the framework of this paper, based on the time-series data of the World Input Output Database (WIOD). The database will be, among the other data sources used, subsequently explained.

3.2 Data, Variables and Stylized Facts

In order to assess bilateral commerce via the previously described gravity model, data on trade as well as on country and country-pair characteristics are needed. For the specific purpose of this paper the VA trade data of the dependent variable were derived from WIOD. It is a comprehensive source, offering data on the Input Output structure of 40 countries from 1995 to 2009. The included countries are depicted in Table 1.\(^1\) Its 40 economies account for circa 85% of world GDP, making it truly an international Input Output table (Timmer, 2012). The Rest of the World (RoW) acts as a residual for the missing 15% of world GDP.\(^2\)

In this regard it needs to be mentioned that further international Input Output tables are offered by other organizations as well. However, the profound statistical basis of WIOD, the countries included and especially the European focus of the database in combination with its annual time coverage, make it particularly applicable for the research question investigated.

Data on VA can be attributed to sectors and its contributing factors via WIOD’s socio-economic satellite accounts. Concerning this, WIOD distinguishes between physical capital and three labor types, which are characterized by their educational attainment. Using the

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\(^1\) Full use was made of the 15 years included in WIOD. Sensitivity analysis revealed that the included time and country-time fixed effects accounted sufficiently for the effects of the global financial crisis 2008/09 and results were robust to exclusion of this period.

\(^2\) An overview about the countries covered by WIOD can be found in the appendix.
International Standard Classification of Education, WIOD differentiates between high-skill, medium-skill and low-skill labor. In this context low-skilled labor depicts all workers, which have attained at the maximum lower secondary education. Medium-skill labor comprises educational attainments including post-secondary, but non-tertiary education. Finally, the class of highly skilled workers describes the tertiary educated workforce, including holders of a Ph.D. (Timmer, 2012). Based on the data it is possible to calculate measures related to the research question, like for example the VA from medium-skilled workers in Lithuanian service industries, which is embodied in Lithuanian exports to Finland. The measures which will be used for the dependent variables in the gravity models of the empirical examination are namely (i) VA exports (VAX). As previously outlined, the (i) VAX concept was developed by Johnson and Noguera (2012a) and describes the foreign VA footprint of domestic final consumption, e.g. how much Hungarian VA is embodied in Dutch consumption. A more detailed description of the measures and how to derive them from WIOD data can also be found in the appendix.

To complement VA data (iii) bilateral trade data in gross terms was computed based on WIOD dataset, which makes them compatible with the other trade measures. Information on membership and entry into the EU and European Monetary Union (EMU) was obtained from European Commission DG Economic and Financial Affairs (2014). In the following section some descriptive statistics of the gross and VA export data will be given, motivating the more in-depth empirical analysis.

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<td>8.667</td>
<td>10.92</td>
<td>15.83</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>157.98</td>
<td>166.3</td>
<td>350.5</td>
<td>102.2</td>
<td>178.6</td>
<td>481.8</td>
</tr>
<tr>
<td>Mean</td>
<td>3842</td>
<td>2722</td>
<td>1129</td>
<td>482.9</td>
<td>784.6</td>
<td>326</td>
</tr>
<tr>
<td>Median</td>
<td>456.9</td>
<td>340.6</td>
<td>143.4</td>
<td>44.41</td>
<td>81.58</td>
<td>38.16</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>13316</td>
<td>9547</td>
<td>4464</td>
<td>1804</td>
<td>2922</td>
<td>1149</td>
</tr>
<tr>
<td>Coeff. of Var.</td>
<td>3.47</td>
<td>3.51</td>
<td>3.95</td>
<td>3.74</td>
<td>3.72</td>
<td>3.53</td>
</tr>
</tbody>
</table>

Note: LabHS depicts high-skilled labor, LabMS and LabLS medium- and low-skilled labor respectively.
Table 1 depicts some basic descriptive statistics of the main variables of interest, namely the gross and VA exports and the decomposition of latter concept in its factor content. The values of the assessed variables are in Mio. US$. For all the variables 23,400 observations were compiled, depicting 15 years (1995-2009) for 40 countries with 39 potential partners (15×40×39=23400). Regarding the mean, as well as the maxima and minima values, it can be seen that the main contributions of VAX are attributable to capital and medium-skill labor (VAX LabMS). Gross exports and the VAX contribution by capital exhibit zero or negative values. However, this is only a minority of observations, namely 0.06% regarding VAX by capital (13 of 23,400 observations) and 0.026% regarding gross exports (6 of 23,400 observations). Zero-trade observation, which are usually a problem in large gravity datasets seem therefore not to be pervasive. This might be attributable to WIOD’s focus on the EU plus advanced and emerging nations with comprehensive trade linkages and functioning statistical agencies. Regarding kurtosis and skewness of the distributions, it is found that the values substantially differ from the values attained in a normal distribution (Kurtosis: 0-3; Skewness: 0-1). For this reason the gross and VA export measures are not normally distributed. This however does not constitute a major problem for later data analysis, as in the framework of the gravity model variables are log-linearized, inducing a normal distribution of the respective values. This finding on non-normality of data is also in line with the large divide between median and mean values. All variables have means, which are larger than the median and therefore exhibit a right-skewed non-normal distribution. While the majority of observations consists of observations around the lower median, a large mean is induced by the large export economies, e.g. China, the US and Germany.

Finally, looking on the ratio of standard deviation and mean (coefficient of variation), it can be found that the dataset comprises a large variation, which will be investigated in the econometric analysis of this paper.

Motivating the empirical research of this paper, Figure 1 describes some stylized facts with regard to the development of gross and VA exports from CEEC countries to all other EU member states (EU27) from 1995 to 2009. Starting with the gross exports in Figure 1, it becomes visible that gross exports experienced a boost around the year 2002, indicated by a steeper slope of the curve. This might be attributed to the successful finalization of CEEC’s
accession negotiations. Thus, before economic liberalization took place *de iure*, anticipatory effects of the EU entry might have been already sizeable. Nevertheless, another salient point of the graph can be found around 2006, two years after the accession. An interpretation could be that accession agreements needed some time to be phased-in and develop their full potential. This is a further notion, which will be controlled for in the empirical analysis of this paper via lagged terms of EU membership. Finally, the graph shows the effects of the global financial turmoil 2008-09, which also did not leave CEEC’s trade unaffected: from 2008 to 2009 gross exports from the new member states to the EU dropped markedly by 22%. This is fairly in line with the impact on CEEC’s exports to non-members, which were even reduced by a quarter of their 2008 value. Nevertheless, although 2009 is included in the analysis, gross exports by the new member states to the EU increased in the 15 year period by approximately 390%.

We now turn attention towards the more meaningful measure of national competitiveness in a fragmented world economy, namely VAX. Figure 1 describes the development of VA exports from CEEC countries to the other EU members from 1995 to 2009. It becomes visible that the trend of the VAX curve is basically in line with the gross exports curve—the first take-off after 2002/03, a further increase two to three years after accession and the effects of the global financial crisis. However, it is noticeable that the trend of the VAX curve is not as steep as for gross flows. This is also reflected in the relatively lower increase of VAX vis-à-vis gross exports in the 1995-2009 period, which was with approximately +300% still noticeably high. While on the one hand VAX increased with a slower pace than gross exports in the observed 15-year period, they were on the other hand also more resilient towards the economic downturn in 2008/09 and dropped “only” by 14%.

**Figure 1** Gross and VA Exports from CEEC to EU27

Source: Own calculations based on WIOD.

**Figure 2** Composition of CEEC’s VAX to EU27

Source: Own calculations based on WIOD.
Making full use of the information provided by WIOD, it is also possible to consider the factorial composition of VAX, which provides important implications for the developmental prospects of EU entrants. WIOD distinguishes between 14 manufacturing and 20 services sectors. Figure 2 depicts in this regard the factorial composition of VA exports in the pre- and post-accession period for these secondary and tertiary sectors. Figure 2 reveals that the composition of VAX in service and manufacturing sectors differs significantly. Service sectors’ VAX build to a larger extent on capital and high-skilled labor. In contrast, manufacturers exporting to the EU27 have a higher medium-skilled labor intensity. Although Figure 2 shows that both sectors tend to increase capital and high-skilled labor intensity in the post-accession period, the changes are of different magnitude. While the shift to a higher capital intensity is more marked for manufacturing firms (+6%), the share of high-skilled labor grows stronger in service exports to the EU27 (+4%). Hence, it could be conjectured that significant differences of accession impacts exist between sectors. Subsequently, in the framework of an econometrical analysis it will be examined in more detail whether significant differences in accession impacts exist.

3.3 Main Results

3.3.1 Gravity Estimates with First Differences

In order to obtain results on the 2004 accession effects, the previously outlined gravity model of trade is used taking gross exports, VAX and its contributing factors as dependent variables. It was stated before that the efficiency of fixed effects estimators might be adversely affected by serial correlation. A test on serial correlation, which is provided in the appendix, reveals that serial correlation is indeed an issue in the fixed effects specification. First differencing seems to mitigate serial correlation issues. For this reason the first differencing technique is used subsequently to examine the research hypotheses. For the specific case examined in this paper, the first differences model can be written as follows:

\[ A summary of the sectors contained can be found in the appendix.\]

\[ First-differencing estimates make use of Stata’s reg2hdfe command, which help to reduce computation times significantly (Carneiro et al., 2012). To save space, country-time fixed effects are not reported.\]

\[ As a robustness check the appendix provides fixed effects estimates of Table 2 as well as a test for anticipation(strict exogeneity.\]
\[ y_{ij,t} - y_{ij,t-1} = \beta_0 (EU_{04ij,t} - EU_{04ij,t-1}) + \beta_1 (MR_{i,t} - MR_{i,t-1}) + \beta_2 (MR_{j,t} - MR_{j,t-1}) + v_{ij,t-(t-1)} \]  

(4)

where \( y_{ij,t} - y_{ij,t-1} \) and \( EU_{04ij,t} - EU_{04ij,t-1} \) exhibit the first differences of the dependent trade variable (e.g. VA or gross exports) and the first differences of the 2004 accession coefficient. The accession effect is modeled in the gravity setting via a dummy variable, which equals one if the exporting country is a 2004 EU entrant trading with an EU member and is zero in all other cases. \( MR_{i,t} - MR_{i,t-1} \) and \( MR_{j,t} - MR_{j,t-1} \) are the respective country-time fixed effects for country i and country j. Latter can be interpreted as the first differences or changes of multilateral resistance terms. Finally, \( v_{ij,t-(t-1)} = e_{ij,t} - e_{ij,t-1} \) depicts white noise (Wooldridge, 2002).\(^6\)

Allowing for phasing-in effects of EIAs will provide more reasonable estimates (Baier and Bergstrand, 2007) Therefore, lags of the first differenced accession data \( EU_{04ij,t-1} - EU_{04ij,t-2} + ... + EU_{04ij,t-5} - EU_{04ij,t-6} \) were added to the model for all the post-accession years in the panel. Additionally, robust standard errors, clustered around the cross-section of country-pairs, were used to mitigate potential bias due to serial correlation and heteroskedasticity.

Table 2 depicts the results of the gravity estimates. In order to save space, the sum of the significant coefficients was computed to obtain the overall average treatment effect (Total ATE). Above that, the results of a joint-significance test for the corresponding variables are reported.

### Table 2 Total ATE for First Differences Model with 5 Lags

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross Exports</td>
<td>VAX</td>
<td>VAX Capital</td>
<td>VAX LHS</td>
<td>VAX LMS</td>
<td>VAX LLS</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.170**</td>
<td>0.2023**</td>
<td>0.1583*</td>
<td>0.1482**</td>
<td>0.1526**</td>
<td>0.1565**</td>
</tr>
<tr>
<td></td>
<td>(0.0401)</td>
<td>(0.0012)</td>
<td>(0.0167)</td>
<td>(0.0032)</td>
<td>(0.0023)</td>
<td>(0.0016)</td>
</tr>
<tr>
<td>Services</td>
<td>-0.398</td>
<td>0.1596**</td>
<td>0.1574**</td>
<td>0.1538**</td>
<td>0.235***</td>
<td>0.2342**</td>
</tr>
<tr>
<td></td>
<td>(0.0743)</td>
<td>(0.0011)</td>
<td>(0.0023)</td>
<td>(0.0012)</td>
<td>(0.0004)</td>
<td>(0.0046)</td>
</tr>
</tbody>
</table>

* \( p < 0.05 \), ** \( p < 0.01 \), *** \( p < 0.001 \)

Note: Robust standard errors, clustered around the cross-section of country-pairs, were used.

\(^6\)The first differences of the accession effect are subsequently depicted as \( EU_{04ij,t-(t-1)}. \)
Beginning interpretation with the results for the manufacturing sector, it is indicated that the accession led to an increase of gross exports of CEEC to other EU countries by circa 19%.\(^7\) VAX in Column (2) seems to be affected even stronger, growing by approx. 21%. Interestingly all factors contributing to VAX in Column (3) to (6) rise with a similar pace due to accession (capital, high-skilled and medium-skilled labor +16%; low-skilled labor +17%). Thus, the capital-labor ratio as well as the labor-skill ratio in CEEC’s manufacturing exports can be assumed unaffected by the EU-entry.

Turning now to the estimates for the services sectors, it has to be noted that a negative ATE for gross exports occurs, which is nonetheless insignificant. This might be attributable to the fact that the services include heterogeneous sectors. Contrastingly, VAX exhibit a significant positive ATE of circa 17%, which is based on the positive ATEs of capital (+16%), high-skilled labor (+16%), medium-skilled labor (+24%) and low-skilled labor (+24%). As the ATE of capital rises with a similar magnitude as VAX by all factors, it can be conjectured that the capital-labor ratio in service exports to the EU remained stable after 2004. Yet, the stronger increases by low- and medium-skilled labor indicate a decrease in the labor-skill ratio.

### 3.3.2 Who Matters More?

Investigating the increasing VAX of CEEC due to EU accession and its composition by production factors, it is interesting to ask if it is rather the EU15’s or other CEECs’ demand that stimulates VA exports. For this reason the model used in Table 2 is adapted, by splitting the 2004 accession effect up in one component for exports from CEEC to EU15 countries \((eu04\text{eu15}_{ij,t} - eu04\text{eu15}_{ij,t-1})\) and one component for exports from CEEC to CEEC countries \((eu04\text{eu04}_{ij,t} - eu04\text{eu04}_{ij,t-1})\). Additionally, a dummy for the trade from EU15 to CEEC countries is added \((eu15\text{eu04}_{ij,t} - eu15\text{eu04}_{ij,t-1})\) to investigate whether the 2004’s accession affected exports from incumbents to new entrants.

Analyzing the results of Panel (i) in Table 3, it surprisingly becomes visible that no significant effects on gross and VA exports can be assessed for the manufacturing exports.

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\(^7\)Estimates of percentage changes are for all estimations referring to the summation of baseline and theoretically motivated phasing-in effects. The effects were calculated with following formula: \((\exp(\text{baseline}) - 1) + (\exp(\text{phasing-in}) - 1)\). For this reason results differ slightly from \((\exp(\text{ATE}) - 1)\).
Table 3 First Differences with 5 Lags: Different Accession Impacts

<table>
<thead>
<tr>
<th></th>
<th>(1) Gross Exports</th>
<th>(2) VAX</th>
<th>(3) VAX Capital</th>
<th>(4) VAX LHS</th>
<th>(5) VAX LMS</th>
<th>(6) VAX LLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel (i) Manufacturing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEEC-EU15</td>
<td>0.0000</td>
<td>0.0710</td>
<td>0.0000</td>
<td>0.0725</td>
<td>0.0748</td>
<td>0.0761</td>
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<tr>
<td></td>
<td>(0.6233)</td>
<td>(0.1454)</td>
<td>(0.1005)</td>
<td>(0.1915)</td>
<td>(0.1452)</td>
<td>(0.1130)</td>
</tr>
<tr>
<td>intraCEEC</td>
<td>0.2950***</td>
<td>0.2745***</td>
<td>0.4370***</td>
<td>0.2376***</td>
<td>0.2529***</td>
<td>0.3430**</td>
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<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>EU15-CEEC</td>
<td>0.2175***</td>
<td>0.0998***</td>
<td>0.0803***</td>
<td>0.1435***</td>
<td>0.1494***</td>
<td>0.1503***</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Panel (ii) Services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEEC-EU15</td>
<td>-0.485*</td>
<td>0.1415**</td>
<td>0.1400**</td>
<td>0.0782*</td>
<td>0.1412**</td>
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<td>(0.0169)</td>
<td>(0.0040)</td>
<td>(0.0032)</td>
<td>(0.0110)</td>
<td>(0.0025)</td>
<td>(0.0246)</td>
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<tr>
<td>intraCEEC</td>
<td>-0.364</td>
<td>0.3365**</td>
<td>0.272**</td>
<td>0.3253**</td>
<td>0.3533***</td>
<td>0.3587**</td>
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<tr>
<td></td>
<td>(0.1624)</td>
<td>(0.0014)</td>
<td>(0.0016)</td>
<td>(0.0010)</td>
<td>(0.0008)</td>
<td>(0.0048)</td>
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<tr>
<td>EU15-CEEC</td>
<td>0.000</td>
<td>0.0000</td>
<td>0.0720*</td>
<td>0.0584</td>
<td>0.0602</td>
<td>0.0200</td>
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<tr>
<td></td>
<td>(0.1616)</td>
<td>(0.1347)</td>
<td>(0.0394)</td>
<td>(0.4382)</td>
<td>(0.1983)</td>
<td>(0.0902)</td>
</tr>
</tbody>
</table>

*p*-values of joint-significance of the coefficients in parentheses
* *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001

Note: Robust standard errors, clustered around the cross-section of country-pairs, were used.

from 2004 entrants to incumbents. This stays in contrast to expectations that the CEEC countries would become integrated in incumbent’s value chains and does not correspond to the findings of Hornok (2010), who found significant increases of CEEC-EU15 trade after accession. However, while Hornok (2010) used a bi-yearly panel for the period from 1999-2007 (thus 5 years), our panel comprises 15 years of observations. Therefore, the contradicting findings might be driven by the fact that the significant accession effect on exports from entrants to incumbents was neutralized in subsequent years. Nonetheless, the ATE in the second row of Panel (i) suggests that CEEC’s manufacturing firms rather integrated in intra-CEEC value chains due to EU accession. This is again in line with previous findings of Hornok (2010), who found that the impact of 2004’s EU enlargement was mainly attributable to trade among CEECs, amounting to a gross export increase of more than 40%. This is completely in line with the treatment effect of 41%, which is depicted in row 2 of Panel (i). The estimated ATE for VA exports is slightly smaller, but with +33% still sizeable. This is largely driven by VAX of capital (+50%) and to a
lower extent by low-skilled (+41%), medium-skilled (+32%) and high-skilled labor (+30%). Thus, accession seems to have induced an increase in the capital-labor ratio and a decrease in the labor-skill ratio. Turning now to the trade effects for incumbents, the ATEs indicate that gross exports to CEEC countries grew with 27% faster than VA exports (+12%). As VAX by capital grew by 9% and labor comprising all skill levels by 16-17%, a decreasing capital-labor ratio is assumable, whereas the labor-skill ratio remains fairly stable.

Considering the results on services in Panel (ii), at a first glance, a counter-intuitive, statistically significant, negative accession effect for gross exports from entrants to incumbents amounting to -62.4% is remarkable.\(^8\) However, turning to the more meaningful measure of trade integration in a fragmented world economy—VAX—a positive impact of circa 15% for CEEC’s service sectors can be found. This is attributable to similar growth rates of capital and medium- as well as low-skilled labor, whereas high-skilled labor is also positively affected, but grows only by 8%. Thus, a stable capital-labor and a decreasing labor-skill ratio are assumable. Intra-CEEC trade depicts a negative accession coefficient of gross exports as well, which is however not significant. In contrast, the VA trade in services among entrants seems to be positively affected by EU-accession, rising by circa 36%. This rise can be ascribed mainly to labor: VAX by all skill levels increases by 34% (high-skilled) to 38% (medium- and low-skilled). VAX by capital shows a slightly lower increase of approx. 29%. Thus, both the labor-skill ratio and capital-labor ratio of intra-CEEC trade in services tends to decrease. Finally, with regard to CEEC’s service exports to incumbents only a small increase of VA by capital (+7%) is depicted, whereas gross exports and VAX in general seem unaffected. For this reason, an increase of the capital-labor ratio is suggested.

Wrapping the results of the empirical analysis up, both CEEC’s VAX of manufacturing and services firms are affected positively by the 2004 entry, whereby effects for the former sector were larger. However, marked differences with regard to the contributing factors and the regional orientation between sectors were found in the context of 2004’s EU enlargement. While, all contributing factors in the manufacturing sectors seem to be affected similarly (see Table 3), the labor-skill ratio of service sectors seems to be affected adversely by

\(^8\)The economic and statistical significance of the ATE for service gross exports among CEECs and incumbents is conspicuous. Notwithstanding, no rash conclusions should be drawn from the coefficient as the sectors subsumed under the heading services are very heterogenous.
accession. Intra-CEEC trade seems to be the largest benefiter, irrespectively of sectors under observation. Yet, while entrants’ service companies experienced significant increased VAX to incumbents, no significant accession impact is found for CEEC’s manufacturing VAX to old member states. In contrast, incumbent firms benefit from the opportunity to export manufactured goods to entrants, whereas EU15’s service providers’ VAX to the CEEC remain unaffected. Subsequently, these results are interpreted and discussed in more detail.

4 Discussion, Policy Implications and Future Research

The paper’s empirical analysis sought to address in general the question how economic regionalization can be assessed if fragmentation is accounted for. We examined the case of the CEEC’s entry into the EU. For this research question the first differences approach including country-time fixed effects proposed by Wooldridge (2002) revealed itself as the preferred estimation method. This is namely due to four distinct reasons: (i) Serial correlation and spurious regression issues are reduced, (ii) endogeneity of GDP and VAX is ruled-out, (iii) bias due to inappropriate deflation is addressed and (iv) simultaneity of EIA-effects and VAX is mitigated. In the framework of the first differences approach different specifications related to the 2004-accession were estimated. The results are summarized in Table 4. The models and their outcomes are ordered by the main hypotheses of this paper, which are namely: (i) increasing gross and (ii) increasing VA exports as well as changes in (iii) the capital-labor and (iv) the labor-skill ratio. A (+) exhibits the confirmation of the hypothesis, a (-) the disconfirmation and (N.S.) no significant or ambiguous results.
Starting with the discussion of the main research hypotheses of this paper, the accession impact on CEEC’s exports to the EU27 are of interest (Row (1) and (5)). From Table 4 it can be seen that while gross exports of manufacturers grew, it is not the case for CEEC’s service providers. However, for VA exports positive accession effects can be observed for both sectors. Based on the notion that the share of VA in gross exports recently declined (Johnson, 2014), this is rather a surprising finding. However, this result might be attributable to the fact that services are used largely as inputs for manufacturing products (Timmer et al., 2013). While for instance Czech financial services embodied in the production of Skoda cars are not directly crossing the border, the VA embodied in exported cars is. Another explanation might be the fact that the European internal market for goods is already more liberalized than the market for services. An example is the country of origin principle in the framework of the Bolkenstein directive, which was not implemented. Also the results for exports from incumbents to CEECs suggest that manufacturing products benefited to a larger extent than service sectors. Nonetheless, services sectors (including a significant contribution of high-skill labor) are important drivers of growth in advanced economies (?). During their catching-up process the CEEC might want to change their sectorial focus in VAX. This might cause losers from trade integration in the short run. However, these losers should not be considered by saving jobs and obstructing thereby structural change, but by supporting the workers to develop new opportunities in a transforming economy.
Returning to the initial question of economic impacts of 2004’s EU accession for the new member states, the effect on CEEC’s exports to the EU27 was split-up in Rows (3) and (4) as well as Rows (7) and (8). Thereby, the EU accession effect was divided into one component describing CEEC’s trade with EU15 incumbents and one component for the trade with other entrants. Surprisingly, it was revealed that accession induced no effect on manufacturing VA exports to incumbents (row (3)), whereas intra-CEEC VA trade in manufactures benefited markedly. Although, VA exports in services to incumbents (Row (7)) were affected positively, our results suggested that the effect on intra-CEEC trade flows in services was more than twice as high, when measured in percentages. In a similar way the enlargement of 2004 had neutral to positive effects on gross exports among CEECs, whereas accession seems to have a negative or neutral effect on gross exports from CEEC to incumbents.

CEEC’s export focus on the EU15 prior to enlargement and the relatively higher incomes of incumbents induced the expectation that it is mainly the old member states’ demand that fosters gross and VA export growth (Baldwin et al., 1997). In contrast, this paper’s regressions imply that it is rather demand from new entrants that exerts a high stimulus. It is imaginable that while EU15 demand was already close to its natural level due to pre-accessional liberalization, demand from CEECs increased due to the relatively strong GDP growth in the convergence process, while CEECs’ economies grew in the post-enlargement period on average by 2.9% annually, the incumbents exhibited 1.1% GDP growth per annum (International Monetary Fund, 2014). Moreover, following the Linder hypothesis, it is arguable that large differences in GDP p.c. between trade partners exert a repressive effect on bilateral trade flows. A negative Linder effect might thus be expected due to the GDP p.c. differences among CEECs and EU15 states. In contrast, based on the similar income levels among the new entrants a positive Linder effect can be expected for intra-CEEC trade (Arnon et al., 1996).

Interesting in this regard is also that the major CEECs were already before 2004 members of common EIAs - the Central European Free Trade Agreement (CEFTA) and the Baltic Free Trade Agreement (Baltic FTA). It could be imagined that VAX effects would have been similar if the CEEC would have remained in these EIAs, instead of joining the EU.
Above that the VAX enhancing intra-CEEC effects might be in fact long-term phasing-in effects of trade relations already established in the framework of the Baltic FTA and CEFTA. In contrast, it could also be conjectured that the stabilizing function of EU membership and related institutional improvements have induced the intra-CEEC trade effect. However, as there is no counterfactual world, this is only guessing and provides questions for further research in this area. Finally, regarding changes in the factorial composition of CEEC’s exports to the EU ambiguous results regarding the development of the capital-labor ratio were found. On the one hand the ratio increased in intra-CEEC trade of manufacturers. On the other hand it decreased concerning the exports of service providers to fellow entrants. Yet, the empirical analysis indicated no significant changes of the capital-labor ratio for CEEC’s exports to EU27 states in general (Row (1) and Row (5)), no significant accession effects on the ratio can be assumed.

In contrast, the labor-skill ratio of CEEC’s exports to the EU seems to be affected adversely (Row (4-5) and (7-8)). This is a surprising finding, as the stylized facts in Section 3 indicated that the composition of CEECs’ VAX to the EU shifted towards a higher skill and capital intensity. However, the regression results should not be read per se as an indication of industrial downgrading in VAX within CEEC-EU trade relations: The stylized facts suggested that CEEC’s VAX in general exhibited a shift towards capital and high-skill labor. Therefore, the regression results just imply that industrial upgrading regarding VAX to EU27 was taking place slightly slower than regarding trade with the control group of non-member states in the observed time period. In a first step it could be conjectured that this finding is related to the fact that WIOD’s non-EU control group consists of only thirteen countries (40 minus EU27), with the most advanced among them being the US. It is imaginable that especially the “advanced” demand of the US constitutes a bias towards higher skill and capital intensity in the composition of VAX. However, WIOD also contains the BRIC (Brazil, Russia, India and China) states, which might (partly) compensate for the bias.

Another explanation for this surprising finding might be that VAX of products with low skill intensity are disproportionally favored by the reduction of trade impediments. Referring to Johnson and Noguera (2012b), goods with a high domestic VA content “travel
further” than goods with lower shares. The goods with high domestic VA shares are on average the goods involving high VA activities, related to capital and high-skill labor. Vice versa low VA shares in gross exports are attributable to production steps involving low VA activities, which are rather linked to low-skilled labor. If now trade is liberalized and barriers are reduced, traded tasks do not have to be that profitable anymore in order to justify the trade costs - trade in low-skill tasks benefits over proportionally from trade liberalization. This effect is consequently larger, the further trade liberalization proceeds. Applying these findings to the example of the 2004 entry, the EIA effect of the EU accession can be perceived as comparatively deep vis-à-vis global trade integration (see theory on the EU integration design). Therefore, in intra-EU trade relations low VA activities would be favored over proportionally vis-à-vis trade of EU members with other world regions. The result would be the previously found over proportional increase in low-skill VA exports from the CEECs to the EU. This is not per se bad for the CEEC economies as they seem to be capable of increasing their absolute VAX in the new setting (H2 was confirmed). Nevertheless, in the long run CEEC states might want to foster industrial upgrading processes regarding intra-EU trade, in order to avoid being stuck with the exports of low-skilled activities. This is especially meaningful regarding the relatively high-skilled labor pools in the post-socialist countries and might play especially a role, when further countries join the EU, competing with the CEEC in low- and medium-skill domains.

Notwithstanding, the empirical analysis of this paper involves some caveats, which are linked to future research prospects. Following the structure of this paper, firstly limitations should be indicated considering the theoretical foundations. A main point in this regard is the theoretical underpinning of the gravity model of trade in a fragmented world economy. Especially, the intuition behind distance’s repressing effect on trade becomes ambiguous as VA is delivered partly indirectly via exports of third countries. Nonetheless, like in the work of Johnson and Noguera (2012b) the gravity model fitted the VAX data well.

Moreover, when interpreting the main measure used in this paper–value added exports (VAX)–it has to be considered that comprehensive databases like WIOD have to build on partly strong assumptions. One of them is that the average production structure in an industry is assumed constantly for all products and all firms (Timmer et al., 2013). Firms
that produce for the domestic market however, differ significantly from firms following internationalization patterns, as do their products Helpman et al., 2008; Altimonte et al., 2011. This might exert especially bias in the framework of the VAX focus of this study, considering to a large extent exporting firms. Moreover, it has to be accounted for the fact, that there are differences in data quality within WIOD. Especially, manufacturing data seem to be of better quality than data in the services sectors. Regarding the latter sectors, due to inconsistencies and a lack of data for all countries, the average of the use-structure for imported services was taken over time and across countries (Timmer, 2012). Thus, the comparison of manufacturing and services sectors should be interpreted with care. Above that, as this paper seeks to investigate developmental prospects of the EU entrants, it is a shortcoming that VA by capital cannot be perfectly attributed to the country of origin. This stays in contrast to labor, as it is easier to determine the origin of the worker (Timmer, 2012). As an example specific VA exports to Spain might be attributable to a Lithuanian company’s capital stock, while it remains unclear if the investor of this company is a Lithuanian resident or comes from another country (even outside the EU).

Finally, it has to be pointed out that the results should not be read as claims of economy-wide industrial downgrading of CEEC economies after accession, but outcomes are only focused on the accession impact on bilateral trade relations among CEECs and EU member states. In this regard the results imply a repressive accession effect on economic upgrading processes regarding the VAX of CEEC to the EU vis-à-vis trade with non-members. Notwithstanding, the economies as a whole might have actually upgraded their industries due to internal demand or demand from countries outside the EU. In this context it also has to be stated that the heterogeneity of sub-sectors might make interpretation difficult, as accession gains are probably distributed unequally. For instance, within manufacturing large differences might exist between the sector “Food, Beverages and Tobacco” and “Electrical and Optical Equipment”.

Turning now to future research prospect, the manufacturing and service sectors could be further decomposed to gain a more nuanced picture of the CEEC’s accession. Also the more general examined topic of VA exports and its sensitivity to political trade impediments offers various interesting fields for future studies. Firstly, concerning the VAX of CEECs future
updates of WIOD would make it possible to assess the long-term impacts of accession. This is especially meaningful as Baier and Bergstrand (2007) indicated that significant phasing-in effects of an EIA can still be found at least ten years after the accession. Secondly, moving away from the evaluation of EU integration effects towards the broader picture of research in the field of VA trade flows, more comprehensive data could be desired. Consequently, larger samples could be researched, allowing for a comparison of different trade agreements. This would be especially helpful in order to derive more general implications for the effects of trade integration on the factor content of trade.

In this regard several interesting research areas can be identified, which attain strong relevance due to the fact that the new paradigm of diverging gross and VA exports is still not sufficiently understood. The call by Baldwin and Lopez-Gonzalez (2013) that much work remains to be done in the nexus of trade in VA should be underlined. WIOD offers vast opportunities in this regard. Concluding this paper, the main results will be summarized in the subsequent section, linked to implications for policy makers in the CEECs.

5 Conclusion and Policy Implications

This paper sought to address the question of the impact of changes in political trade barriers on VAX for the case of the 2004 EU accession round. For this purpose it was made use of a new comprehensive data base, depicting the detailed input output structure of the observed countries - WIOD. The analysis focussed on gross and VA exports and the possible implications for the factorial composition of VA exports. As the preferred empirical specification a first-differencing approach in combination with country-time fixed effects was chosen.

Estimating different specifications, it was found that CEEC’s manufacturing gross exports were significantly increased in the course of EU integration (support for H1). Contrarily, no such significant effect was found with regard to the contributing service sectors. The non-significant treatment effect was even negative. However, a hypothesized stimulus for CEEC’s VA exports was statistically significantly supported in both manufacturing and service sectors (H2). Comparing the secondary and tertiary sectors, it was found that accession’s stimulus was higher for manufacturing than for services sectors. VAX decomposed
into the factorial contributions was in all cases neutrally or positively influenced by EU entry. Nevertheless, positive VAX effects were mainly attributable to low- and medium-skilled workers. This alleviating effect of EU accession is not attributable to absolutely diminishing VAX by capital and high-skill labor. In contrast, VAX by low- and medium-skilled labor seem to have been over proportionally stimulated by EU accession. Moreover, it needs to be accounted for the fact that in the empirical framework of this paper the accession effect was examined vis-à-vis a control group of countries, which did not select into the EU 2004. Therefore, both CEEC-EU15 and CEEC-non-member trade might absolutely exhibit industrial upgrading, but empirical results might indicate a comparative slowing-down of upgrading prospects in intra-EU trade. Thus, the 2004 accession promoted VAX compared to non-members with a comparatively higher contribution of medium- and low-skilled workers. This indeed leads to beneficial effects for CEEC economies in the short run. Nevertheless, while catching-up to the frontier of Western-European peers, the new member states might want to induce gradual change towards more knowledge-intensive tasks in order to preserve competitiveness.

Surprisingly, contradicting the pre-enlargement expectations, the lion’s share of increasing VAX was not attributable to incumbents’ demand for cheap labor from the CEECs. In contrast mainly the fellow entrants induce increasing VAX of the CEEC. It can be conjectured, whether it was in fact the EU accession that promoted CEEC’s VAX or if the stimuli are attributable to the Central European Free Trade Agreement (CEFTA) and the Baltic FTA, to which the major CEECs belonged before 2004. This remains a question for future research. Concluding with this, it should be pointed out, that convergence processes did not come to a halt in the CEEC yet. The concluding accession effects on VA in trade can be assessed with future updates of WIOD, which will open up avenues for interesting research.
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Appendix A

Income Difference Between Incumbents and Entrants

**Figure A.1** Per Capita Income Gap of EU15 and CEEC in €

Source: Eurostat (2014)

Country Coverage of WIOD

<table>
<thead>
<tr>
<th>European Union</th>
<th>Asia and Pacific</th>
<th>North America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Germany</td>
<td>Australia</td>
</tr>
<tr>
<td>Belgium</td>
<td>Greece</td>
<td>China</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Hungary</td>
<td>India</td>
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<td>Cyprus</td>
<td>Ireland</td>
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<tr>
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<td>Lithuania</td>
<td>Russia</td>
</tr>
<tr>
<td>Finland</td>
<td>Luxembourg</td>
<td>Taiwan</td>
</tr>
<tr>
<td>France</td>
<td>Malta</td>
<td>United Kingdom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turkey</td>
</tr>
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</table>
Sectorial Coverage of WIOD

Table A.2 depicts the 14 manufacturing and 20 services sectors contained in WIOD. Together with the sectors “Agriculture, Hunting, Forestry and Fishing”, which was not used for the empirical analysis in this paper, WIOD covers 35 sectors. The sectorial classification is based on Timmer et al. (2013).

Table A.2 Secondary and Tertiary Sectors in WIOD

<table>
<thead>
<tr>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Metals and Fabricated Metal</td>
<td>Air Transport</td>
</tr>
<tr>
<td>Chemicals and Chemical Products</td>
<td>Construction</td>
</tr>
<tr>
<td>Coke, Refined Petroleum and Nuclear Fuel</td>
<td>Education</td>
</tr>
<tr>
<td>Electrical and Optical Equipment</td>
<td>Electricity, Gas and Water Supply</td>
</tr>
<tr>
<td>Food, Beverages and Tobacco</td>
<td>Financial Intermediation</td>
</tr>
<tr>
<td>Leather, Leather and Footwear</td>
<td>Health and Social Work</td>
</tr>
<tr>
<td>Machinery, Nec</td>
<td>Hotels and Restaurants</td>
</tr>
<tr>
<td>Manufacturing, Nec; Recycling</td>
<td>Inland Transport</td>
</tr>
<tr>
<td>Other Non-Metallic Mineral</td>
<td>Mining and Quaering</td>
</tr>
<tr>
<td>Pulp, Paper, Printing and Publishing</td>
<td>Other Community, Social and Personal Services</td>
</tr>
<tr>
<td>Rubber and Plastics</td>
<td>Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies</td>
</tr>
<tr>
<td>Textiles and Textile Products</td>
<td>Post and Telecommunications</td>
</tr>
<tr>
<td>Transport Equipment</td>
<td>Private Households with Employed Persons</td>
</tr>
<tr>
<td>Wood and Products of Wood and Cork</td>
<td>Public Admin and Defence; Compulsory Social Security</td>
</tr>
<tr>
<td></td>
<td>Real Estate Activities</td>
</tr>
<tr>
<td></td>
<td>Renting of M&amp;Eq and Other Business Activities</td>
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<tr>
<td></td>
<td>Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods</td>
</tr>
<tr>
<td></td>
<td>Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel</td>
</tr>
<tr>
<td></td>
<td>Water Transport</td>
</tr>
<tr>
<td></td>
<td>Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles</td>
</tr>
</tbody>
</table>

Estimating Value Added Measures

Leontief (1936) revealed how important it is to account for the Input Output structure of a country in order to assess its competitive advantage. His seminal contribution on the paradox of the US’ capital-intensity in imports occupied economists for several decades (Leontief, 1953). His accounting framework is now increasingly used to account for the
fragmentation of trade. Based on the so called Leontief inverse, it becomes possible to follow up the \(n^{th}\) intermediate production step needed for a final product. This enables to trace back VA contributions from different countries. The intuition is described subsequently.

Figure A.2 shows a basic Input Output table (IOT). Similar to this table, a world Input Output table (WIOT) contains a matrix \(Z\) of direct intermediate inputs for the production of goods for final use \(F\). While the columns of the Intermediate Use matrix \(Z\) describe the inputs for one final demand unit of the respective sector, the rows describe the intermediate exports and the use of domestic intermediate products of the respective countries. As production processes usually not only involve intermediate inputs, but also the use of capital and labor, further value is added. The latter is depicted by the vector of Value Added \(V\). The columns of the Final Use table \(F\) describe the domestic final demand for products worldwide, whereas the rows describe worldwide final demand for domestic products. Summing up \(Z\) and \(F\) row wise or \(Z\) and \(V\) column wise, yields the vector of worldOutput \(X\) or \(X'\) respectively. If we divide the intermediate use matrix \(Z\) and the VA matrix \(V\) by the output matrix \(X\), we derive the matrix of direct inputs \(A\) and the matrix of VA-coefficients, thus VA embodied \(v\) in one output unit of vector \(X\). However, the direct inputs for one output unit involve usually further intermediate inputs, e.g. one unit of French transport equipment, might need 0.3 units of British financial intermediation as an input. The latter might embody Finish Pulp and Paper products as well as British Real Estate activities. Leontief (1936) showed that it is possible to describe this input structure until the \(n^{th}\) tier via the inverse \(L = (I - A)^{-1} = I + A + A^2 + ... + A^n\). The Leontief approach makes it thus possible not only to account for direct inputs, but for the indirect input structure of an economy.
An actual WIOT involves not only three regions, but 40 countries (plus the RoW) with each 35 sectors, yielding 1435 world output sectors $X$ ($1435 \times 1$). Therefore, the Intermediate Input matrix $Z$ has the structure of 1435 intermediate input sectors for 1435 intermediate goods ($1435 \times 1435$). As WIOD distinguishes domestic final demand in five different use categories per region ($5 \times 41$), the Final Use matrix’ dimension is $1435 \times 205$. The Value Added vector describes the aggregated VA by capital and labor in all 1435 sectors and thus is of dimension $1 \times 1435$. 

Source: Based on Timmer (2012).
We now turn back to the initially described measure of VA from Lithuania (Country A) embodied in exports to Finland (Country B). In this context we would like to calculate Country A’s VA of products that are used directly and indirectly for the production of Country A’s exports for Country B’s final demand. Describing Country A by the subscript $a$ and Country B by the subscript $b$, the desired measure is now simply computable as $VAX_{ab} = v_a \times L \times f_b$, where $v_a$ is a vector of the dimension $(1 \times 1435)$, consisting of zeros, except from the $841st$ until $875^{th}$ digit $v_a (1, 841 : 875)$, describing Country A’s (Lithuanian) VA-coefficients in WIOD. The $f_b$ vector would be a summation of the five columns of the $1435$ rows describing country B’s (Finish) use of worldwide outputs $F (1 : 1435, 66 : 70)$. The same framework is used to calculate the VA contribution of capital and labor inputs, by accounting for the shares of capital and different labor skill levels in the sectorial VA.

Another measure used in this paper for the analysis of industrial upgrading are the GVC incomes (GVCI). GVCI measure in contrast to the VA in exports not the VA due to final demand in importing countries, but the VA in the domestic country due to the final production in a foreign country for final use worldwide. An example could be Country A’s (Lithuanian) VA due to Final Production (and not Final Consumption) in Country B.
(Finland). While we looked in a VA in exports perspective on the Lithuanian VA embodied in Lithuanian exports to Finland, we examine in a GVC income perspective the Lithuanian VA embodied in direct and indirect inputs for Finish production for final use worldwide (Finland and all other countries in the world).

This is exhibited by following formula: \( GVICI_{ab} = v_a \ast L \ast f^b \). In the GVCI case, \( v_a \) would again exhibit country A’s VA coefficients. Now however, \( f^b \) describes not the final use of country B, but exports and domestic use of country B’s final products \( F \) (446:480,1:205). In this context it is worthwhile mentioning that a recent contribution by Wang et al. (2013) suggests that forward-linked measures are biased due to double counting. As an example they provide the Indian service industry. Accounting only for forward linkages the export competitiveness of the Indian service sector seems to be favorable.

In contrast, when Wang et al. (2013) include the indirect backward linkages of other Indian industries this picture deteriorates. VAX and GVCI are focused on the final demand or respectively final consumption and are thus forward-linked measures that could be for specific applications biased by double counting. Nonetheless, Leontief’s insights of forward based measures are applicable if foreign ultimate absorption is considered. This is the case for analysis involving VAX, as it depicts the foreign VA that is embodied in other countries’ final demand. For GVCI the notion is not that clear, as only parts of the VA are absorbed in the partner country, whereas other fractions are re-exported (Wang et al., 2013). For this reason VAX measures were used for the main estimations, while GVCI is the dependent variable in a robustness check.

**Autocorrelation**

Table A.3 provides the F-values of the Wooldridge test for serial correlation, both for the fixed effects (Table A.6) and first differenced models (Table 2). It is noticeable that the F-values are markedly reduced in the first differences setting, leading to the assumption that for the given sample the first differencing approach significantly helps in mitigating auto-correlation.
Anticipation and Strict Exogeneity

Following Wooldridge (2002) it is suggestible that EIAs already show effects before trade integration takes place *de iure*. On the one hand reductions of trade could be attributable to the fact that importers anticipate future reductions in trade costs in terms of tariffs and delay imports until the EIA is implemented. This is especially applicable to the 2004 EU enlargement, as accession negotiations started already in the 1990s and were publicly announced. On the other hand significant pre-enlargement effects might be attributable to endogeneity. In order to account for anticipatory effects of trade integration a five-year lead is implemented in the estimation model of Table 2. While Table A.4 depicts no significant leads for manufacturing, Columns (5) and (6) of Table A.5 indicate that two significant lead terms can be found with regard to services. However, as the coefficients of these significant terms are reasonably small and overall treatment effects are not changed dramatically, we would argue that the significant leads point rather to anticipation than to endogeneity.

Fixed Effects Estimates

Beyond first difference estimators, fixed effects are widely used in the literature in order to estimate gravity models of trade that account for endogeneity. Table A.6 depicts a modification of the specification in Table 2, when instead of first differences three high-dimensional fixed effects are used (exporter-/importer-time and dyadic fixed effects). Results change significantly, especially regarding the insignificance of all EU treatment effects on CEEC’s manufacturing sectors. As previous results indicated that first differences estimates are more reliable in terms of serial correlation, it is suggested that the first difference estimates are more reliable than the estimates with fixed effects. Above that tests for strict exogeneity revealed that lead terms are on average larger and of higher significance, when fixed effects estimates are used.
Table A.4 Manufacturing: First Differences with 5 Annual Lags and a 5 Year Lead

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<th>(2)</th>
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<th>(5)</th>
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<td>Gross Exports</td>
<td>VAX Total</td>
<td>VAX Capital</td>
<td>VAX LabHS</td>
<td>VAX LabMS</td>
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<td>21838</td>
<td>21775</td>
<td>21838</td>
<td>21838</td>
<td>21838</td>
</tr>
<tr>
<td>R²</td>
<td>0.202</td>
<td>0.490</td>
<td>0.577</td>
<td>0.521</td>
<td>0.493</td>
<td>0.519</td>
</tr>
</tbody>
</table>

p-values in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
Table A.5 Services: First Differences with 5 Annual Lags and a 5 Year Lead

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>d1eu04eu</td>
<td>0.0762</td>
<td>0.0720 *</td>
<td>0.0556</td>
<td>0.0694 *</td>
<td>0.0977 **</td>
<td>0.0947 **</td>
</tr>
<tr>
<td></td>
<td>(0.362)</td>
<td>(0.023)</td>
<td>(0.079)</td>
<td>(0.020)</td>
<td>(0.003)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>d111eu04eu</td>
<td>-0.0393</td>
<td>-0.0116</td>
<td>-0.0177</td>
<td>-0.0129</td>
<td>-0.000950</td>
<td>0.0104</td>
</tr>
<tr>
<td></td>
<td>(0.672)</td>
<td>(0.707)</td>
<td>(0.565)</td>
<td>(0.690)</td>
<td>(0.976)</td>
<td>(0.767)</td>
</tr>
<tr>
<td>d112eu04eu</td>
<td>0.0230</td>
<td>0.0862 ***</td>
<td>0.0650 *</td>
<td>0.100 ***</td>
<td>0.104 ***</td>
<td>0.108 ***</td>
</tr>
<tr>
<td></td>
<td>(0.742)</td>
<td>(0.001)</td>
<td>(0.012)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>d113eu04eu</td>
<td>0.0484</td>
<td>0.0361</td>
<td>0.0313</td>
<td>0.0317</td>
<td>0.0469</td>
<td>0.0384</td>
</tr>
<tr>
<td></td>
<td>(0.547)</td>
<td>(0.195)</td>
<td>(0.264)</td>
<td>(0.272)</td>
<td>(0.097)</td>
<td>(0.192)</td>
</tr>
<tr>
<td>d114eu04eu</td>
<td>-0.389 **</td>
<td>-0.0312</td>
<td>-0.0389</td>
<td>-0.0432</td>
<td>-0.0175</td>
<td>-0.00299</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.500)</td>
<td>(0.406)</td>
<td>(0.382)</td>
<td>(0.702)</td>
<td>(0.950)</td>
</tr>
<tr>
<td>d115eu04eu</td>
<td>0.00877</td>
<td>0.105 ***</td>
<td>0.110 ***</td>
<td>0.0851 **</td>
<td>0.106 ***</td>
<td>0.123 ***</td>
</tr>
<tr>
<td></td>
<td>(0.904)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.006)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>f5eu04eu</td>
<td>-0.00919</td>
<td>-0.0157</td>
<td>-0.00864</td>
<td>-0.0158</td>
<td>-0.0252 **</td>
<td>-0.0317 ***</td>
</tr>
<tr>
<td></td>
<td>(0.669)</td>
<td>(0.072)</td>
<td>(0.331)</td>
<td>(0.069)</td>
<td>(0.005)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Total ATE</td>
<td>-0.389</td>
<td>0.2632 ***</td>
<td>0.175 **</td>
<td>0.2545 ***</td>
<td>0.2825 ***</td>
<td>0.294 ***</td>
</tr>
<tr>
<td></td>
<td>(0.1078)</td>
<td>(0.0007)</td>
<td>(0.0034)</td>
<td>(0.0006)</td>
<td>(0.0000)</td>
<td>(0.0002)</td>
</tr>
</tbody>
</table>

N = 21772
R² = 0.227

p-values in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Table A.6 Total ATEs for Fixed Effects Models with 5 Lags

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0</td>
<td>0.0843</td>
<td>0.0713</td>
<td>0.0192</td>
<td>0.0226</td>
<td>0.0245</td>
</tr>
<tr>
<td></td>
<td>(0.0926)</td>
<td>(0.1009)</td>
<td>(0.1703)</td>
<td>(0.0637)</td>
<td>(0.0578)</td>
<td>(0.0519)</td>
</tr>
<tr>
<td>Services</td>
<td>-0.398 *</td>
<td>0.1596 **</td>
<td>0.1573 **</td>
<td>0.1538 **</td>
<td>0.1596 **</td>
<td>0.1676 **</td>
</tr>
<tr>
<td></td>
<td>(0.0496)</td>
<td>(0.0027)</td>
<td>(0.0054)</td>
<td>(0.0029)</td>
<td>(0.0010)</td>
<td>(0.0044)</td>
</tr>
</tbody>
</table>

p-values of joint-significance of the coefficients in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001