Disintegration scenarios in the European Union: a case study of Eastern European economies

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Abstract

This paper examines the progress of countries' integration within the EU, and the expansion to include many Eastern European countries in this phenomenon. We create a multisectoral and multiregional input-output model (MRIO) to study a group of "counterfactuals" to evaluate the economic integration/ disintegration phenomenon in this context. As an initial experiment, we conduct a study of the "non-integration" of Eastern European countries. On the basis of the MRIO model and, inspired by the synthetic indicators methodology and hypothetical extraction methods, we first study the trends in their trade relationships and technological and structural composition. Second, we design hypothetical scenarios based on the behavior observed in these trends to analyze the contribution of the disintegration process to economic growth and structural specialization. We find that Eastern Europe is highly vulnerable to the effects of trade with other European countries; the impact of a possible exit of Eastern countries would be almost three times greater for those countries than for the rest of Europe.

JEL codes: F43, O50, R15

Keywords: Multiregional input-output model, hypothetical extraction method, economic growth, European Union, Eastern European countries, economic integration.

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1. INTRODUCTION

The phenomenon of economic integration, which promotes the benefits of greater trade by the reduction in tariffs and administrative barriers, has been the dominant development mantra for many decades. Since the mid twentieth century, several economic areas have formed; the European Union exemplifies integration that extends beyond economics to include politics. However, there are clear differences between European countries; this yields a group with quite different dynamics and capacities for adapting to change in the global (and European) economic environment (see Fagerberg and Verspagen, 2014). In addition, the effects of the international economic crisis of 2008 triggered a clear divergence between European countries (see Bolea et al. 2018). In this sense, the phenomenon of integration and its consequences for the social, political, and economic characteristics of countries has been a central topic in the literature, and its evaluation continues to attract great academic interest (European Commission, 2007; 2015).

The creation of the European Union and its subsequent enlargements have been well studied in the literature. The economic outcomes from these enlargements have not been monotonically positive. In 2004, a group of Eastern countries became part of the European Union (with the exception of Bulgaria and Romania, which would enter in 2007). From that moment, the EU became a bloc of much more heterogeneous countries, and it was not clear whether the benefits of development would be equally spread across all countries. The process of the EU's enlargement actually began in 1993, however, when the so-called "European agreements" with the Czech Republic, Slovakia, Hungary, Poland, Bulgaria, and Romania were enacted. These trade agreements established a path to accession to the EU as the final objective. Therefore, from that date until the beginning of the twenty-first century, the Eastern bloc awaited entry into the EU. In 2004, the "extension to the East" meant a change that was not only political but also economic; eight of the 10 new states that entered the EU had belonged to the Soviet bloc, which meant allowing entry to a group of countries whose economies and cultures differed significant from those of other EU countries.

In addition, as a consequence of the 2008 global financial crisis, individual EU countries responded in very different ways, which caused serious imbalances in the real economies. A first insight into the economic growth path in Europe can be gained by analyzing the evolution of the GDP from 1957 when the European Coal and Steel Community was

founded to the last recent year of our study, 2014. Figure 1 shows the GDP per capita in EU countries over that period.

"Figure 1 about here."

In 1957, the founding countries—Belgium, France, Germany, Italy, Luxembourg, and the Netherlands—had closely similar levels of income per capita (the differences between quartiles are minimal); Luxembourg's levels were the highest. In 2000, with the incorporation of some Central European countries and the Mediterranean countries, a small increase in heterogeneity can be observed. In the last year of our analysis, 2014, and despite the process of income convergence over time, significant income differences are still present among EU members (a detailed analysis of the income convergence can be found in Bolea et al. (2018)).

Figure 1 shows, as demonstrated in the literature, the divergence between countries that were initially part of the EU (Belgium, France, Germany, Italy, Luxembourg, and the Netherlands) and those countries that joined in recent years (see Sonis et al., 1993). This is also the case for Eastern European countries that became members in 2004 (the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, and Slovenia). These countries shared certain economic characteristics and political interests with other EU countries, but also differed in many respects in terms of economic structure, production and trade specialization, and income inequality. In this general context, it seems relevant to employ methodologies that allow us to assess how the process of economic integration has strengthened the productive structures, and advanced structural and technological change. Estimating the contribution is not trivial, because diverse concurrent economic, political, historical, and social factors underlie the economic trajectories of countries[†].

Today, economic growth requires recognition of the multisectoral and multiregional nature of economies and their involvement in so-called global and regional value chains (see Escaith and Inomata, 2013). In this global context, multiregional input-output models (MRIO) have been shown to be powerful instruments in quantifying the role

[†] However, and despite the fact that the data do not appear in Figure 1, the evolution of GDP per capita in recent years, up to the present, seems to follow a different dynamic from that shown in the figure. Eastern European countries show a slight growth in GDP per capita, accompanied by their increase in intra-European trade. On the other hand, Central European countries show a decreasing evolution in GDP per capita (based on data from the Eurostat database).

intersectoral and interregional links play in different scales of economic evolution (see for instance Bolea et al. 2020; Fan and Liu, 2020; Duarte et al. 2018; Zhang et al. 2017).

More specifically, on the basis of an MRIO model developed for the world economy, we analyze the effects of the possible non-adhesion of Eastern bloc countries in the European Union. To do this, we also use synthetic indicators methodology, and hypothetical extraction methods, to develop some scenarios/counterfactuals. These will be tested using an MRIO model to evaluate the effects on these countries, as well as on the rest of the EU and the world, by comparing current trajectories and those projected under the "counterfactual" paths.

To the best of our knowledge, there is a lack of studies that analyze the hypothetical scenarios/counterfactuals from a multiregional and multisectoral perspective to understand the dependence of countries on intra-EU trade flows and the exposure of long-term economic growth in different EU areas to these processes. MRIO models have proven to be highly effective in quantifying the role of intersectoral and interregional links in the evolution of countries' economic growth. More specifically, using scenario analysis, we examine the global effects of hypothetical scenarios of the non-adhesion of Eastern European countries in the European Union, taking advantage of the full map of intersectoral and interregional relationships throughout the full supply chain captured by MRIO models. This analysis allows us to obtain some valuable insights into the interdependence of EU economies, and their potential exposure to changes in demand from other EU countries.

The paper is organized as follows. Section 2 presents a brief literature review. Section 3 describes the methodology used, based on an MRIO model, from 1995 to 2014, and explains in detail each of the scenarios considered. Section 4 presents our results for each of the hypothetical situations, and the behaviors observed in different countries and sectors, and Section 5 concludes.

2. LITERATURE REVIEW

The role played by intra- and extra-EU trade in boosting overall EU growth has received renewed interest in the literature in the context of the intense globalization of supply chains. Input-output multiregional and multisectoral (MRIO) models have been increasingly used to study the effects of economic growth and trade expansion. These models allow us to analyze both direct and indirect effects of these phenomena, studying

the interlinked trade patterns among regions and countries, and allowing a comprehensive evaluation of the so-called global value chains (see for instance Hummels et al. 2001, Los et al. 2015, Chen et al. 2016). This approach has recently been extended to capture related phenomena in previous works such as Johnson and Noguera (2012) and Antràs and de Gortari, (2020)). Amendolagine et al. (2019) use an MRIO input-output model to study how the effect of the participation and position in the global value chains (GVCs) of host countries is associated with local sourcing by foreign investors. Bahar et al. (2019) make use of input-output related indexes to explore the degree to which export take-offs are more likely to occur in sectors that are upstream of already competitive export industries in the developing world. More recently, Fan and Liu (2020), using a multi-regional input-output framework, present a model of global supply chains to capture the macro production relationships among major world economies in the first decades of this century.

Despite the power of these models to quantify both direct and indirect interrelationships and dependencies among countries and regions, few papers have used this methodology to examine the consequences of integration or disintegration processes. Some exceptions are Chen et al. (2017), who explore the degree to which EU regions and countries are exposed to the negative trade-related consequences of Brexit, using an MRIO. The results from this model are transformed into an index that summarizes the effects of this phenomenon. In similar fashion, Los et al. (2016) carry out a hypothetical extraction method to assess the impacts of the exposure of EU regions to Brexit. Bailey and De Propris (2017) analyze the same phenomenon through global value chains, taking into account both domestic and international input-output relationships between countries, finding that the UK exposure is four times higher than that of other EU countries, with the exception of Ireland.

In this paper, we aim to approximate a complementary perspective that provides a longer-term view of these effects. In order to do this, and inspired by the synthetic control methodology, we extend this multiregional and multisectoral framework to propose counterfactuals or different scenarios to analyze the effect of certain economic shocks that originate from the process of cohesion or disruption engendered by the Global Recession.

The evaluation of economic policies, or certain shocks, through the generation of counterfactuals has previously been used in the literature (see for instance Abadie and

Gardeazabal, (2003) for an analysis of the economic effects of terrorism in the Basque Country; Campos et al. (2015) for a comparison of European economic and political integration). Badinger (2005) and Crespo et al. (2008), using the synthetic counterfactual method, estimate the evolution of GDP per capita in the European Union, paying special attention to intra-EU trade flows, and finding that the GDP per capita generated in the EU would be lower today if integration had not taken place. Garrett-Peltier (2017), in an input-output framework, evaluate whether the public and private spending in clean energy sectors is more efficient than spending on fossil fuels.

This methodology, as well as the hypothetical extraction method, inspires our scenario analysis. Scenario analysis is commonly used to explore how counterfactual changes in demand composition and trade, holding other things constant, alter the values in input-output tables, thereby affecting equilibrium values and the participation of countries in the global and European production chains. Although the scenarios can be seen as extreme in nature, they are useful for understanding certain distinctive features of the framework. In consequence, our approach should be seen as an accounting exercise, providing quantitative information about the extent to which GDP in EU countries is exposed to changes in demand from other EU and non-EU countries (see for instance Antràs and de Gortari, (2020), Costinot and Rodríguez-Clare, (2015); and Chen et al. (2017) for other applications of scenario analysis and input-output on different research topics).

In recent years, new literature has highlighted the role of governance and European funding, explaining part of the divergent economic paths observed in EU countries (Cruz and Marques, 2017 and Caldas et al. (2018)) and the effects of the European Cohesion Policy and the associated economic funds, which, without doubt, has been central in explaining the recent evolution of all EU countries, and the industrial transformation of East-EU economies.

Thus, in line with prior literature, and acknowledging the multisectoral and multiregional character of global production flows, our objective is to focus on the possibility of defining a type of synthetic indicator, building "counterfactuals" and alternative scenarios to evaluate the impact of the "non-integration" of Eastern European countries in the European Union (we will it call "the EE-EXIT"), from a multiregional and a multisectoral perspective.

3. METHODOLOGY

From the empirical point of view, we make use of the IO tables from the World Input Output Database (WIOD, Release 2013, and Release 2016[‡]) in current prices, denoted in current millions of United States dollars and data from the EORA database to complete our work. The choice of the period is mainly conditioned by the availability of comparable data, but it is of notable economic interest in itself, insofar as it includes a 13-year period with positive growth (it includes the years of the Great Moderation), as well as the subsequent period of international economic crisis of 2008 and beyond.

As mentioned above, the IO methodology is a powerful instrument to evaluate the role of interregional links in the evolution of economic growth. Using the MRIO tables from the World Input-Output Database[§] (WIOD, Release 2013, 2016) for the world economy, and using the methodology for the development of MRIO in Isard (1953) and Miller and Blair (2009), we study the political and economic effects of the hypothetical case of non-integration of Eastern European countries in the EU, in three different scenarios. Our sample contains 41 countries: 27 European countries and 14 non-European countries (including the Rest of World) from 1995 to 2014.[**] We examine the effects of changes in GDP embodied in trade flows as well as in the domestic production of Eastern Europe to themselves, to the rest of Europe, and to the rest of the world. In addition, we make use of certain information from the EORA database (to be explained in detail later).

In what follows, we present the main features of our methodological approach. First, in Table 1, the structure of the MRIO model used in this work is presented. The distribution of the table is compatible with the study because we order the MRIO table of WIOD according to the importance of countries in our analysis.

"Place Table 1 here."

where the terms Z_{ij}^{RS} represent inter-industry sales by sector *i* of region *R* to all sectors *j* of region *S* (including itself, when *j=i* and *R=S*). Y_i represents the final demand by sector and country, with the super index being the origin of that final demand ("E" represents countries of the East bloc, "RoEU" the countries of the rest of European Union, "RoE" the countries of the rest of Europe, and "RoW" the countries of the Rest of World). X is

[‡] See Timmer et al. (2015)

[§] The WIOD's WIOTs are expressed in current millions of United States dollars

[**] The WIOD Release 2013 is taken into account for the analysis of the period prior to integration and WIOD Release 2016 to extend the post-crisis period.

the total output by sector and country; and VA is the vector of value added generated by sector and country of the sample. As can be seen in the table, we develop a multiregional accounting system, divided into four clearly different regions, including the Eastern European countries, the Rest of the European Union, the Rest of Europe (Russia and Turkey) and the Rest of the World (RoW) that incorporates the 14 non-European regions that WIOD contains.

Thus an extended MRIO model can be estimated on the basis of this information, following the procedure of the input-output framework.

$$\mathbf{x} = \mathbf{Zi} + \mathbf{y} \tag{1a}$$

$$\mathbf{x} = \mathbf{Ax} + \mathbf{y} \tag{1b}$$

Eq.1a represents the equilibrium in a multiregional context, with *r* countries and *n* sectors, where $\mathbf{Z} = \left(z_{ij}^{rs}\right)$ (an ($r \times n$) × ($r \times n$) matrix) is the inter-industry transactions or intermediate consumption matrix, where each row indicates the sales made by each productive sector to the rest of the sectors; **x** (an ($r \times n$) × 1 vector) denotes the total output; *i* is a unitary column vector whose number of rows corresponds to the columns of the post-multiplying matrix; and we denote by $\mathbf{Y} = (\mathbf{y}^{rs}) = (y_i^{rs})$ the (*r* x *n*) x *r* matrix of total final demand, whose elements y_i^{rs} show the demand of commodity *i* of country *r* to meet the final demand of country *s*, with $\mathbf{y}^{rs}$ the *n*x1 vector of goods from *r* included in final demand of *s*. We also denote by $\mathbf{y} = (y_i^r) = (\sum_s y_i^{rs})$ the *r* x *n* vector of global final demand incorporated in (1a).

From equation 1a, we arrive at equation 1b, where $\mathbf{A} = \left(a_{ij}^{rs}\right)$ is the ($r \times n$) × ($r \times n$) matrix of multiregional technical coefficients and represents the technology of the intermediate input-output structure, with each of its representative elements a_{ij}^{rs} indicating the volume of intermediate input *i* of a country *r* necessary to produce a unit of output *j* in country *s*.

This equation (1b) can also be represented in terms of the well-known Leontief inverse **L**, an ($r \times n$) × ($r \times n$) matrix, defined for the whole multiregional economy.

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{Ly} \tag{2}$$

When we pre-multiply (2) by a diagonalized vector of direct value-added unitary coefficients, we obtain (3) that shows all VA flows in the global economy associated with

the production of goods traded among countries, as well as for each country's domestic production.

$$\mathbf{GDP} = \mathbf{\Omega} = \left(\omega_{ij}^{rs}\right) = \hat{\mathbf{v}}\boldsymbol{L}\hat{\mathbf{y}} = \begin{pmatrix} \boldsymbol{\omega}^{\mathbf{11}} & \boldsymbol{\omega}^{\mathbf{12}} & \cdots & \boldsymbol{\omega}^{\mathbf{1r}} \\ \boldsymbol{\omega}^{\mathbf{21}} & \boldsymbol{\omega}^{\mathbf{22}} & \ldots & \boldsymbol{\omega}^{\mathbf{2r}} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{\omega}^{\boldsymbol{r1}} & \ldots & \ldots & \boldsymbol{\omega}^{\boldsymbol{rr}} \end{pmatrix} =$$

$$\begin{pmatrix} \hat{\mathbf{v}}^{\mathbf{11}} & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \hat{\mathbf{v}}^{\mathbf{22}} & \ldots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \ldots & \ldots & \hat{\mathbf{v}}^{\boldsymbol{rr}} \end{pmatrix} \begin{pmatrix} \mathbf{L}^{\mathbf{11}} & \mathbf{L}^{\mathbf{12}} & \cdots & \mathbf{L}^{\mathbf{1r}} \\ \mathbf{L}^{\mathbf{21}} & \mathbf{L}^{\mathbf{22}} & \ldots & \mathbf{L}^{\mathbf{2r}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{L}^{\boldsymbol{r1}} & \ldots & \ldots & \mathbf{L}^{\boldsymbol{rr}} \end{pmatrix} \begin{pmatrix} \hat{\mathbf{y}}^{\mathbf{11}} & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \hat{\mathbf{y}}^{\mathbf{22}} & \ldots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \ldots & \ldots & \hat{\mathbf{y}}^{\boldsymbol{rr}} \end{pmatrix} \quad (3)$$

As mentioned above, $\mathbf{\Omega}$ represents all VA flows in the global economy associated with the production of commodities among countries, as well as with the domestic production of each country. Each element of matrix $\mathbf{\Omega}$ is a block (*n* x *n*) and represents the VA generated in any sector of a country *r* to meet the final demand of a country *s*.

Summing by columns in $\mathbf{\Omega}$ and defining $\mathbf{b}$ as a 1 x *n* vector of ones to aggregate the information by country, we obtain the total VA generated in the total economy and incorporated through the full supply chain to obtain the final demand of country *s* as follows:

$$\mathrm{GDP}_{\boldsymbol{s}} = \sum_{\mathbf{r}} \mathbf{b}'\mathbf{\Omega}\mathbf{b} \quad (4)$$

In this study, we are interested in measuring the potential effect that Eastern European countries would have had on the EU countries' GDP if they had not accepted membership of the EU in 2004. For that reason, and because we apply the changes in the matrix by columns, in the analysis we only take into account the vertically integrated value-added for each of the countries in the sample.

We assume that from the year 2002 (two years before their entry into the EU), there is the beginning of significant effects over all countries. Since 1993, and as a consequence of "European agreements", Eastern Europe had already been informed that its membership in the EU had been accepted, knowing that the integration of these economies had begun earlier. We assume that since 2002 to 2011, the Eastern countries are going to experience certain changes in their GDP evolution.

As a consequence of this, three different hypothetical scenarios are proposed to study which part of the GDP of regions is exposed to EE-EXIT and to compare the effects on GDP under different assumptions.

Scenario 1

In the first scenario, which is our base scenario, we consider that there are no exports between Eastern European countries and the rest of the EU; this becomes the baseline against which the others are contrasted. Following the assumptions of Chen et al. (2017) employed to address Brexit, we estimate the impact of the total elimination of exports from EU countries to Eastern countries, the hypothetical situation in which none of the rest of the EU countries export products to Eastern European regions and therefore, Eastern European countries do not import any product from the EU (both intermediate inputs and final goods). In essence, it is assumed that all bilateral trade is lost and not recovered.[††]

To accomplish this, and following the structure of Table 1, we apply the hypothetical extraction method on the matrix of intermediate inputs $\mathbf{Z} = \mathbf{A}\hat{\mathbf{x}}$, and on the matrix of final demand **Y**, taking into account direct and indirect effects of the trade generated between these two regions. Thus, the part of the matrix **Z** and final demand **Y** that corresponds to exports from European countries to Eastern countries is set to zero, as shown in equations (5) and (6):

$$\mathbf{Z^1} = \begin{pmatrix} \mathbf{Z}^{\mathbf{E,E}} & \mathbf{Z}^{\mathbf{E,RoEU}} & \mathbf{Z}^{\mathbf{E,RoE}} & \mathbf{Z}^{\mathbf{E,RoW}} \\ \mathbf{0} & \mathbf{Z}^{\mathbf{RoEU,RoEU}} & \mathbf{Z}^{\mathbf{RoEU,RoE}} & \mathbf{Z}^{\mathbf{RoEU,RoW}} \\ \mathbf{Z}^{\mathbf{RoE,E}} & \mathbf{Z}^{\mathbf{RoE,RoEU}} & \mathbf{Z}^{\mathbf{RoE,RoE}} & \mathbf{Z}^{\mathbf{RoE,RoW}} \\ \mathbf{Z}^{\mathbf{RoW,E}} & \mathbf{Z}^{\mathbf{RoW,RoEU}} & \mathbf{Z}^{\mathbf{RoW,RoE}} & \mathbf{Z}^{\mathbf{RoW,RoW}} \end{pmatrix} \tag{5}$$

$$\mathbf{Y^1} = \begin{pmatrix} \mathbf{Y}^{\mathbf{E,E}} & \mathbf{Y}^{\mathbf{E,RoEU}} & \mathbf{Y}^{\mathbf{E,RoE}} & \mathbf{Y}^{\mathbf{E,RoW}} \\ \mathbf{0} & \mathbf{Y}^{\mathbf{RoEU,RoEU}} & \mathbf{Y}^{\mathbf{RoEU,RoE}} & \mathbf{Y}^{\mathbf{RoEU,RoW}} \\ \mathbf{Y}^{\mathbf{RoE,E}} & \mathbf{Y}^{\mathbf{RoE,RoEU}} & \mathbf{Y}^{\mathbf{RoE,RoE}} & \mathbf{Y}^{\mathbf{RoE,RoW}} \\ \mathbf{Y}^{\mathbf{RoW,E}} & \mathbf{Y}^{\mathbf{RoW,RoEU}} & \mathbf{Y}^{\mathbf{RoW,RoE}} & \mathbf{Y}^{\mathbf{RoW,RoW}} \end{pmatrix} \tag{6}$$

where $\mathbf{Z}^{\mathbf{RoEU,E}}$ and $\mathbf{Y}^{\mathbf{RoEU,E}}$ are equal to zero since they represent the part of exports (imports) from European Union (East) to the Eastern European countries (EU) of both intermediate inputs and final goods. As noted earlier, the first scenario is taken as the

[††] We assume that it is an unrealistic scenario, since the lost trade is not recovered by any of the countries, and therefore it is like "building a wall" between them.

most extreme alternative to compare with the rest of scenarios. Once the changes in the matrices have been made, the new GDP is calculated as follows:

$$\mathbf{GDP^1} = \mathbf{\Omega_1} = (\boldsymbol{\omega}_1^{rs}) = \hat{\mathbf{v}}\,\mathbf{L^1}\hat{\mathbf{y}}^{\mathbf{1}} \tag{7}$$

In consequence, VA generated in the total economy and incorporated to obtain the final demand of country *s* as:

$$GDP_s^{\mathbf{1}} = \sum_{\mathbf{r}} \mathbf{b}'\mathbf{\Omega_1}\mathbf{b} \tag{7bis}$$

To quantify the part of GDP exposed to this hypothetical situation in country *r* on final demand and intermediate inputs (following Los et al., 2017 and Chen et al., 2017), we apply the index described in (8):

$$IE^1 = \frac{(\mathrm{GDP_S^1} - \mathrm{GDP_S^0})}{\mathrm{GDP_S^0}} * 100 \tag{8}$$

where the superscripts "0" and "1" represent the real and first hypothetical situations, respectively.

Scenario 2

In the second scenario, and with the aim of being more realistic, we again assume that European Union countries export nothing to Eastern European countries, but in this case, those exports are reallocated to other countries. As a consequence, we propose two different related cases. First, we assume that, as a consequence of non-entry into the EU, the Eastern bloc decides to relocate all that trade to the Rest of World, that is, a *substitution of imports*. And in the second case, as a consequence of non-entry into the EU and knowing that Eastern economies can also decide to increase their domestic production, we assume that EU-East trade is *gradually distributed* between non-EU production and domestic production. This means that it will be assumed that each year (since 2003[‡‡]) the Eastern bloc gradually increases[§§] its domestic production trade with the Rest of World. That is, due to the elimination of EU-East trade, Eastern countries increase their domestic production and non-European trade gradually, according to these proportions. To summarize the re-allocations, Table 2 shows the distribution of the East-EU trade after the "non-adhesion" process.

[‡‡] In 2002 it is assumed that 100% is imported from the rest of the world.
[§§] We consider that East bloc increases their domestic production by 2% each year of their trade with the European Union that now is eliminated.

"Place Table 2 here."

In this scenario, it is assumed that the EU-East trade is reallocated to each part (domestic production and trade with RoW) according to the weight of each sector within each country, with respect to the total of that sector in the EU-East bloc. Thus, equations (9) and (10) show the procedure to share the EU-East trade in the different scenarios.

$$Z_{ij}^{RS*} = Z_{ij}^{RS} + \left[\frac{Z_{ij}^{RS}}{\sum_{j=1}^{n} Z_{ij}^{RS} + \sum_{j=1}^{n} Z_{ij}^{TS}} * b_j\right] * a_Z \tag{9}$$

$$Z_{ij}^{AS*} = Z_{ij}^{AS} + \left[\frac{Z_{ij}^{AS}}{\sum_{j=1}^{n} Z_{ij}^{AS} + \sum_{j=1}^{n} Z_{ij}^{BS}} * b_j\right] * (1 - a_Z) \tag{10}$$

with $b_j = Z_{ij}^{CS} + Z_{ij}^{DS}$ and a_Z being the parameter indicating the proportion assigned to each part (see table 2). In those equations, *S* represents a country from the East; *R* and *T* are non-EU countries (belonging to RoE or RoW); *A* and *B* represent other Eastern countries; *C* and *D* represent EU countries outside the East bloc. In this way, we can see that the EU-East trade is divided between imports from the rest of the world and domestic production, according to the weight of each sector of each country with respect to the total weight of each sector in the corresponding bloc.

Therefore, following the earlier procedure, we have the following matrices:

$$\mathbf{Z^2} = \begin{pmatrix} \mathbf{Z^{E,E}} & \mathbf{Z^{E,RoEU}} & \mathbf{Z^{E,RoE}} & \mathbf{Z^{E,NoEU}} \\ \mathbf{0} & \mathbf{Z^{RoEU,RoEU}} & \mathbf{Z^{RoEU,RoE}} & \mathbf{Z^{RoEU,NoEU}} \\ \mathbf{Z^{RoE,E}} & \mathbf{Z^{RoE,RoEU}} & \mathbf{Z^{RoE,RoE}} & \mathbf{Z^{RoE,NoEU}} \\ \mathbf{Z^{NoEU,E}} & \mathbf{Z^{NoEU,RoEU}} & \mathbf{Z^{NoEU,RoE}} & \mathbf{Z^{NoEU,NoEU}} \end{pmatrix} \tag{11}$$

$$\mathbf{Y^2} = \begin{pmatrix} \mathbf{Y^{E,E}} & \mathbf{Y^{E,EU}} & \mathbf{Y^{E,RoE}} & \mathbf{Y^{E,NoEU}} \\ \mathbf{0} & \mathbf{Y^{EU,EU}} & \mathbf{Y^{EU,RoE}} & \mathbf{Y^{EU,NoEU}} \\ \mathbf{Y^{RoE,E}} & \mathbf{Y^{RoE,EU}} & \mathbf{Y^{RoE,RoE}} & \mathbf{Y^{RoE,NoEU}} \\ \mathbf{Y^{NoEU,E}} & \mathbf{Y^{NoEU,EU}} & \mathbf{Y^{NoEU,RoE}} & \mathbf{Y^{NoEU,NoEU}} \end{pmatrix} \tag{12}$$

where $\mathbf{Z^2}$ and $\mathbf{Y^2}$ represent the new initial IO matrix and the new final demand, respectively. In the first case (*substitution of imports*), the part assigned to domestic production is multiplied by $(1 - a_Z) = 0$ since all trade is imported from non-EU countries and a_Z is always equal to 1. However, in the second case (*gradual assignment*), each part is multiplied by the corresponding percentage, depending on the year of analysis (see table 2). Once we have the new initial IO matrix, the Generalized RAS method (GRAS[***]) is applied (see Junius and Oosterhaven, 2003; Lenzen et al., 2007; Temurshoev et al., 2013) to match the IO matrix with the results from these changes, taking into account that the sum of the columns of final demand is maintained. As noted earlier, we are analyzing the changes in GDP generated in the economy and incorporated through the full supply chain, to obtain the final demand (all the value-added embodied in a good consumed, i.e. the demand perspective). For that reason, and because the lost trade is reallocated throughout the same column of each East country, we calculate the GDP exposed to these EE-EXIT scenarios as in (8).

Scenario 3

In the last scenario, probably the most realistic situation, we assume that Eastern countries maintain, both in output and VA, the same trend they had from 1990 to 2001 (the period prior to EU integration) and the average of the trend of countries most similar to them within the sample, in terms of output and VA generation. We calculate these trends with simple moving averages (SMA). This means that both the new output vector and the new VA vector are obtained according to the following equations:

$$\mathrm{x}^{R}_{2002} = \mathrm{t\_x}^{R}_{1990-2001} + average(\mathrm{t\_x}^{S}_{1990-2001})$$

$$VA^{R}_{2002} = t\_VA^{R}_{1990-2001} + average(t\_VA^{S}_{1990-2001}) \quad (13)$$

where superscript *R* represents an Eastern European country, and superscript *S* is the group of countries that are similar to *R* in terms of output and VA in the years prior to integration. In (13), the calculations are shown for the year 2002, but since it is a structural mobile average (SMA), for the year 2003 the trend will be taken for the period 1991-2002. The EORA database is used to complete this task, from which the output and VA data were obtained from 1990 to 1994 (WIOD has data from 1995 onwards).

[***] Following the Matlab programming developed by Andre F.T. Avelino (2017). This procedure is used to adjust a matrix, with a minimum loss of information, to a required sum of columns and rows when positive and negative entries are present.

Therefore, we obtain a new output vector and a new VA vector.[†††] Taking into account the new values of these vectors, it is necessary to apply the GRAS method to balance the initial IO matrix and the corresponding part of final demand year by year. It is well-known that a new column vector must be obtained *u* [(r x n) x 1] (corresponding to the sum of the columns of each row) and a new row vector *v* [1 x (r x n)] (corresponding to the sum of the rows of each column). The first, vector *u*, is obtained assuming that, maintaining the proportions of each country for its final demand, the total of the new vector of VA is equal to the total of the final demands of the countries ($\sum_{i=1}^{n} VA_{ij}^{RS} = \sum_{j=1}^{n} y_j^{RS}$). In this way, the vector *u* (column vector of the sum by rows of the matrix) is composed of the new output vector plus the total of the new VA vector, and the vector *v* (row vector of the sum by columns of the matrix) is composed of the new output vector plus the new final demands, whose sum is equal to the total of the new VA vector. In addition, and in the same way that the trend of the previous years is applied, it is assumed that the productive structure of the countries, year by year, is maintained according to the balanced matrix of the previous year (except in the case of 2002, where the productive structure of 2001 is maintained).

In this situation, the GDP generated in the total economy and incorporated through the entire global value chain is calculated as follows:

$$\mathbf{GDP^3} = \mathbf{\Omega_3} = (\boldsymbol{\omega}_3^{rs}) = \hat{\mathbf{v}}^3 \, \mathbf{L}^3 \hat{\mathbf{y}}^3 \tag{14}$$

Similarly, the VA generated in the total economy and incorporated to obtain the final demand of country *s* is:

$$GDP_s^3 = \sum_{\mathbf{r}} \mathbf{b}' \boldsymbol{\omega}_3^{rs} \mathbf{b} \tag{15}$$

Equation (15) shows the new GDP generated in the new economy with Eastern European countries outside the EU. Again, to calculate the ratio of GDP exposed to the hypothetical situation of EE-EXIT, (8) is used.

[†††] Note that those vectors only change in the part corresponding to the countries of Eastern Europe, the rest remains the same.

4. RESULTS

4.1. Factors that explain the VA embodied in bilateral trade flows: 2000-2014

From the creation of the integration group of countries, to the incorporation, in 2004, of the East bloc, the European Union has gone through many changes in its composition. As seen in figure 1, the heterogeneity between European countries (see Fagerberg and Verspagen, 2014) has been growing over the years, leading to a more varied Europe.

Therefore, we consider necessary to determine the factors that could be causing these changes. Figure 2 shows, for each of the countries of Eastern Europe, its evolution with intra-European and extra-European trade and the domestic component. In this way, the aim is to offer, in the first place, a descriptive analysis of the effects of the new integrations in the European Union.

"Place Figure 2 here."

In Figure 2, we can see that the domestic demand (in blue) of the 8 East countries has been the main contributor to income growth in recent years, although on average its weight shows a slight decreasing trend (see Bolea et al. 2018). However, we can observe how the weight of trade with non-European countries (in green) increases over time, to the detriment of intra-European trade (in red) and the domestic part (in blue), with Estonia and Lithuania being the clearest cases of these changes. The results show that Estonia and Lithuania are increasingly dependent on extra-European trade and particularly on their trade relationships with Russia and the bloc of countries in the Rest of the World. For example, in figure 2.a. which corresponds to Czech Republic, we can observe the evolution of the three main components. The domestic demand represents around 65% of all the analyzed period, but it is in 2003 when the domestic production begins to slowly decrease, until it reaches 60% of the total by the end of the period. When we focus on the pink part (intra-EU trade), we can see that this component represents around 20% of the total, but from 2003 to the end of the period, it is gradually increasing. The extra-EU trade component corresponds to the green part and represents around 15%. This is the component with the least weight, although we can observe its growth as the period progresses. Therefore, when we focus on the individual situation of each of the countries, we can see that Hungary (figure 2.c.), Slovakia (figure 2.g), and Slovenia (figure 2.h) are the countries most dependent on intra-EU trade, throughout the analyzed period. In addition, as we can see in the figure, the last two graphs show the behavior of these three components (domestic, intra-EU, and extra-EU trade) in the EU without Eastern countries

(figure 2.i) and in the total European Union (figure 2.j). When we compare the results of these two graphs with the rest of the figures, we can observe that the weight of the extra-EU trade component is greater when the Eastern countries are not taken into account (Rest of European Union). However, in the last graph, we can see that, by showing the EU average taking into account the Eastern bloc, the components of domestic production and intra-EU trade are higher again. Thus, we can conclude that all the European countries show a clear trend towards increasing shares of extra-European trade, although the Eastern bloc is comparatively most focused on trade within the European Union.

4.2. Effects on VA embodied by alternative scenarios

Once the main features of the VA embodied have been presented, we now examine the results for the different scenarios, to quantify the impact of each one in bilateral trade flows, between 2002 and 2014. Table 3 shows the results obtained for the analysis of each of the hypothetical scenarios.

"Place Table 3 here."

Table 3 shows that the effects are much greater in the countries of Eastern Europe and these effects are diluted as the countries are farther away; the effects on the countries of the European Union are greater than the effects on the countries of the rest of the world. For instance, it is notable that the effect is -2.26% on Austria (country belonging to the EU) in the first scenario, and is -0.03% on Canada (-0.03%). These results are in line with the results found for BREXIT for European regions, reported by Chen et al. 2017.[‡‡‡]

The first result is that the effects take different signs depending on the scenario. The results of the three scenarios are compared with the real situation, taken as the base. When we focus on the first row of the table that corresponds to the first country in our analysis, we see different results for Czech Republic. It is clear that the first and third scenario have negative consequences (calculated with (8) as the difference between the hypothetical and real situations) on the Czech economy.

Recall that scenario 1 is taken as the extreme alternative; in this scenario for the Eastern European countries, we see that changes in GDP generated in the global economy (and that each country incorporates in its final demand), are much greater for the Czech Republic, Hungary, Slovakia, and Slovenia. These are the countries that, as we have seen

[‡‡‡] From this study, Chen et al. (2017) obtain that the impact of BREXIT for British regions is 4.6 times greater than for the rest of European regions, with the Irish regions being the second most affected.

in figure 2, show greater dependence on intra-EU trade[§§§]. In addition, it should be noted that the impact in the Eastern European countries would be almost 3 times greater for them than for the rest of the European economies. When we look at the RoEU (Rest of EU countries) bloc, we see that Austria, Bulgaria, and Romania have a more negative effect than the rest. Hence, a shock produced in the Eastern bloc, as is the case of a hypothetical "non-integration," affects its closest neighbors to a greater extent. This could be partially explained both by the proximity of these countries to Eastern Europe and the fact that these three countries have the highest trade with Eastern Europe; clearly, there is strong spatial dependence. On the other hand, the effect in the rest of the world is practically zero in this first scenario.

Focusing on the results of the second scenarios, we see that the effects are very different. In the first case (*substitution of imports*) where all the imports that the East made from Europe, are redirected to the non-European bloc, we see that, again, the Czech Republic, Hungary, Slovakia, and Slovenia, along with Poland, are the countries that show the greatest change. In this scenario, we see in table 3 that the effect of import substitution is positive for all Eastern countries, as for the rest of the European countries and for the rest of the world. However, these positive effects can be misleading, since we are assuming that Eastern countries relocate their trade to the rest of the world, with no consequences for the rest of the economies of the Eastern bloc. We are assuming that there is a redistribution of trade with no consequences for them (more tariffs, taxes, border problems ...). As is well known, the Eastern countries would have to face a higher payment of tariffs and fees for importing from outside the EU. Similar conclusions can apply to the second case (*gradual assignment*), in which the EU-East trade is gradually re-assigned between domestic production and imports from the Rest of the World. When we look at the column corresponding to "*gradual assignment*", it is clear that the results are very similar to the previous case of this second scenario. Again, all countries of our sample have a positive effect after the reallocation of the East-EU trade. Therefore, these results tell us that, whether we reassign 100% of the trade between the East and the EU, or if we assume that this reallocation is done gradually, the consequences for the whole world (inside and outside the Eastern bloc) would be positive. However, as mentioned above, we are assuming that there are no fiscal, administrative, or commercial

[§§§] Bailey and De Propis (2017) show for UK regions that the higher the trade dependence of a country or region on domestic production, the more may be the impact of a possible breaking of the European Union, such as Brexit.

consequences. If these conditions were considered, the results would probably have a negative sign.

Regarding the third scenario, the most realistic, we can see how, again, the Eastern European countries would have the greatest declines in GDP as a result of their non-integration in the European Union, except for Estonia. The case of Estonia is different due to the great weight of its domestic component, but also, undoubtedly, due to its trade with the rest of the world. Estonia is the country in the Eastern bloc that least depends on intra-European trade. This explains their different behavior. It is interesting to see that the consequences for the rest of the EU member countries are heterogeneous. Austria, Belgium, Germany, Denmark, Finland, and the Netherlands are the countries with higher positive effects in the hypothetical scenario of non-integration of Eastern countries. However, Bulgaria, Cyprus, and Romania are the countries with the highest negative effect (-0.24%, -1.42%, and -1.87%, respectively). It is the countries of Central Europe (Austria, Belgium, Germany, Netherlands, among others) that have a positive effect, so one would expect that, due to this shock from the Eastern bloc, Central European countries would be the least affected, with Bulgaria and Romania[****] being the most affected. When we focus on the non-European bloc, some results are surprising. China, Russia, and Indonesia have a higher negative effect than the closest neighbors of the East in the European bloc (-10.97%, -7.46%, and -8.02%, respectively). In the case of China, as is well-known, its entry in November 2001 to the World Trade Organization (WTO) had a positive impact on its global trade position. Since then, Chinese foreign policy began to focus on expansion towards Europe. In 2012 the so-called "Cooperation between China and Central and Eastern European countries (CEE)" was established. In the case of Russia, the EU's political and economic relations have been based on a bilateral Partnership and Cooperation Agreement (PCA) since 1997. Following the conflict in Eastern Ukraine, the bilateral political and commercial dialogue has been affected. However, since Russia joined the WTO, EU-Russia trade relations have increased, focusing on the East bloc of countries as intermediaries of their trade relations with the rest of the EU. Finally, in the case of Indonesia, the relation with the EU has deepened in recent years. Indonesia has been a member of the WTO since 1995 and benefits from trade preferences granted by the EU's Generalized Scheme of Preferences (GSP), under

[****] As mentioned above, these two countries are not considered in this study as the Eastern bloc, for the simple fact that they did not become EU members until 2007.

which about 30% of total imports from Indonesia enjoy lower duties (see https://ec.europa.eu/trade/policy/countries-and-regions/). Therefore, these results could be showing the significant consequences that the breakdown of the EU would have, not only at the European level but also at the global level, due to the strong commercial relations that these non-EU countries have with the European Union bloc as a whole. These results are in line with the arguments of other analyses, such as Dhingra et al. 2017.††††

We also present in Table 3 the average (for the European Union and the total sample) and the standard deviation for the different scenarios. First, scenarios 1 and 3 show the greatest dispersion, suggesting more unequal effects among countries. Moreover, in both scenarios 1 and 3, the negative effects on the whole group of Eastern European countries are far from the European and global average.

Probing the results more deeply, Figure 3 shows the behavior of the GDP in each of the scenarios and in the real case for some countries of Eastern Europe.

"Place Figure 3 here."

For the Eastern countries, the blue line (INT) represents the real evolution of the GDP generated in the total economy and incorporated through the full supply chain, to obtain the final demand of each country; the red line corresponds to the first hypothetical scenario; the orange and rose lines show the evolution of GDP in the two cases of the second scenario; and the green line corresponds to the third scenario. Note that the effects for Eastern European countries differ, depending on the scenario, as expected, because the modifications made in matrices and vectors are very different in each of the scenarios, but also due to the weakness and vulnerability of the Eastern economies to changes and shocks of this type.

It is important to highlight the clearly negative effect that the fact of not belonging to the European Union would have for the countries of the East in Scenario 1 (red line). It can be observed that GDP growth would be much lower over the last few years, showing the weakness of these countries in the case of being alone and not receiving a certain amount of aid from the EU. However, it is important to note the behavior of GDP in the Czech

†††† Dhingra et al. 2017 estimate the changes in UK living standards after the decision of Brexit, and they generate counterfactual scenarios, showing that Brexit could generate future losses in the UK around 2% of GDP in real terms. In addition, they demonstrate that these results could have consequences not only for the European Union, but also at the global level.

Republic, Estonia, Latvia, and Slovenia in the third scenario (green line). At the beginning, the effects of a possible "non-integration" in the EU would be negative for all these countries. However, it can be observed, from the year 2008/2009, the effects for them would begin to be positive. This result may be due to the fact that the consequences of the economic crisis of 2008 would not have been so strong for the Eastern countries in the hypothetical case that the Eastern bloc would not be in the EU. On the other hand, the effects of a possible disintegration of the EU in the third scenario lead to clear negative effects in Hungary, Lithuania, Poland, and Slovakia. The results show that these four Eastern countries present the greatest trade links with the rest of the countries of the European Union, and after the 2008 crisis they would be the most affected by not belonging to the Union. As shown in figure 2, Hungary and Slovakia are two countries that present a large percentage of trade within the European Union, which could explain their negative results in this third hypothetical scenario. The case of Poland is similar because a large amount of its trade is with Germany, France, and the United Kingdom, and around 30% is from intermediate inputs[‡‡‡‡]. Finally, Lithuania is one of the main trading partners of Poland, but also of the United Kingdom and Germany. Its trade is based on the production and export of final products rather than intermediate inputs, but its great dependence on Poland and intra-EU trade would explain the negative effects of a possible disintegration of the EU.

5. CONCLUSIONS

The phenomenon of integration and its consequences for the economic structure of countries and regions has been frequently analyzed in the literature. The objective of this paper is to focus on the possibility of defining a type of synthetic indicator, building "counterfactuals" and alternative scenarios to evaluate the impact of the "non-integration" of Eastern European countries in the European Union, from a multiregional and multisectoral perspective. Thus, traditional measures of building alternative scenarios, such as hypothetical extraction methods, have been extended to a multiregional input-output framework that allows us to explore how productivity is translated through the global value chains, as well as the effects on the technological and structural bases of the countries.

[‡‡‡‡] Data obtained from WITS (World Integrated Trade Solutions) and from data of Figure 2.

The results obtained with the three scenarios analyzed allow us to reach some conclusions. It is clear that the countries of Eastern Europe are quite vulnerable to the effects of trade with the rest of the European Union. The effects of global value chains are heterogeneous and the results can change, depending on the scenario proposed. However, it should be noted that the impact of a possible EXIT of Eastern European countries would be almost three times greater for them than for the rest of the economies of Europe (similar results are obtained in Chen et al. (2017) who found that the impact of Brexit impact is 4.6 times greater for British regions than for the rest of Europe). Our results show that the countries closest geographically to the Eastern bloc are the most affected after the shock of non-integration, not only for reasons of geography, but also because they are the countries that maintain a stronger trade with the Eastern European countries.

As mentioned above, the case of Brexit is a clear example of the significant consequences that these shocks would have for the EU as a whole. The empirical evidence of recent papers on Brexit shows that leaving the EU single market is a very significant challenge for most of the UK regions, for the rest of the European countries, and for the rest of the world. It is a complex agreement in legal and procedural terms, and also is a way to generate greater inequalities between countries than already exist. In our case, "the EE-EXIT case," the consequences for the Eastern countries are greater due to the weakness of these economies in social, political, and economic terms.

Based on the empirical findings of this study, we can draw certain policy implications. First, as we previously noted, we find that the impact of a hypothetical disintegration of the European Union could have up to three times greater negative effects for Eastern European countries than for the rest of the countries of the sample, with the effects becoming more diluted with distance from the East bloc. Eastern EU countries are highly dependent on the evolution of trade structures and policies within the EU. Our results also suggest that those countries closer geographically to the Eastern bloc are the most affected after the shock of a possible non-integration. Thus, geographical proximity continues to be a key factor in the configuration of the GVCs. In this sense, and as pointed out in Johnson and Noguera (2012), geographical proximity, as a reflection not only of transport costs but also as a proxy for other unobservable variables (language, culture, ...), determines in an important way the configuration of interregional trade in the world. This fact is even more important in countries such as those studied where the weight of

the intermediate inputs is highly relevant. In this way, the reduction of physical barriers, the improvement of communication infrastructures, continues to be an important channel for boosting trade integration in the European Union.

Despite the potential relevance of the results obtained, some cautions have to be made on the limitations of the analysis. A first limitation of the paper is the sample that we consider as the database we use is constituted by 41 countries with sectoral data but without regional data detail. After the results obtained in this study and due to the heterogeneity between European countries, it could be interesting to study what happens at the regional level to analyze some regional patterns, as well as the evolution of clusters in Europe, which have been highlighted as important in the configuration of global value chains. Therefore, as a future extension we would work with a global input-output regional database (such as EUREGIO[§§§§]) in order to capture in more geographical detail the effects and consequences of the phenomenon of EE-EXIT. Second, the results suggest the importance of the proposed structural changes over time in explaining the global impacts on countries. The consideration of structural and technological change, transforming production relations and affecting substitutability among inputs within the region, or among inputs of different regions, can be better captured on the basis of more flexible models, such as CGE models (which is also a natural extension of this paper). In addition, the hypothetical scenarios presented in this work are first approximations, to estimate the level of exposure of countries to possible changes in trade. In consequence, another clear extension is to go deeper into the underlying drivers of these effects (productive, structural, political, technological, and social in nature). In this line, although the specific study of how different governance models modulate economic trajectories is beyond the scope of this paper, the consideration of these political variables, and the possibility of formulating different scenarios based on certain taxonomies of countries and regions, is also worth pursuing.

All in all, our results show that the disintegration processes would undoubtedly lead to negative effects for the growth of Europe, producing unequal effects for the integrated countries and generating more heterogeneity among them.

[§§§§] See Thissen et al. (2017).

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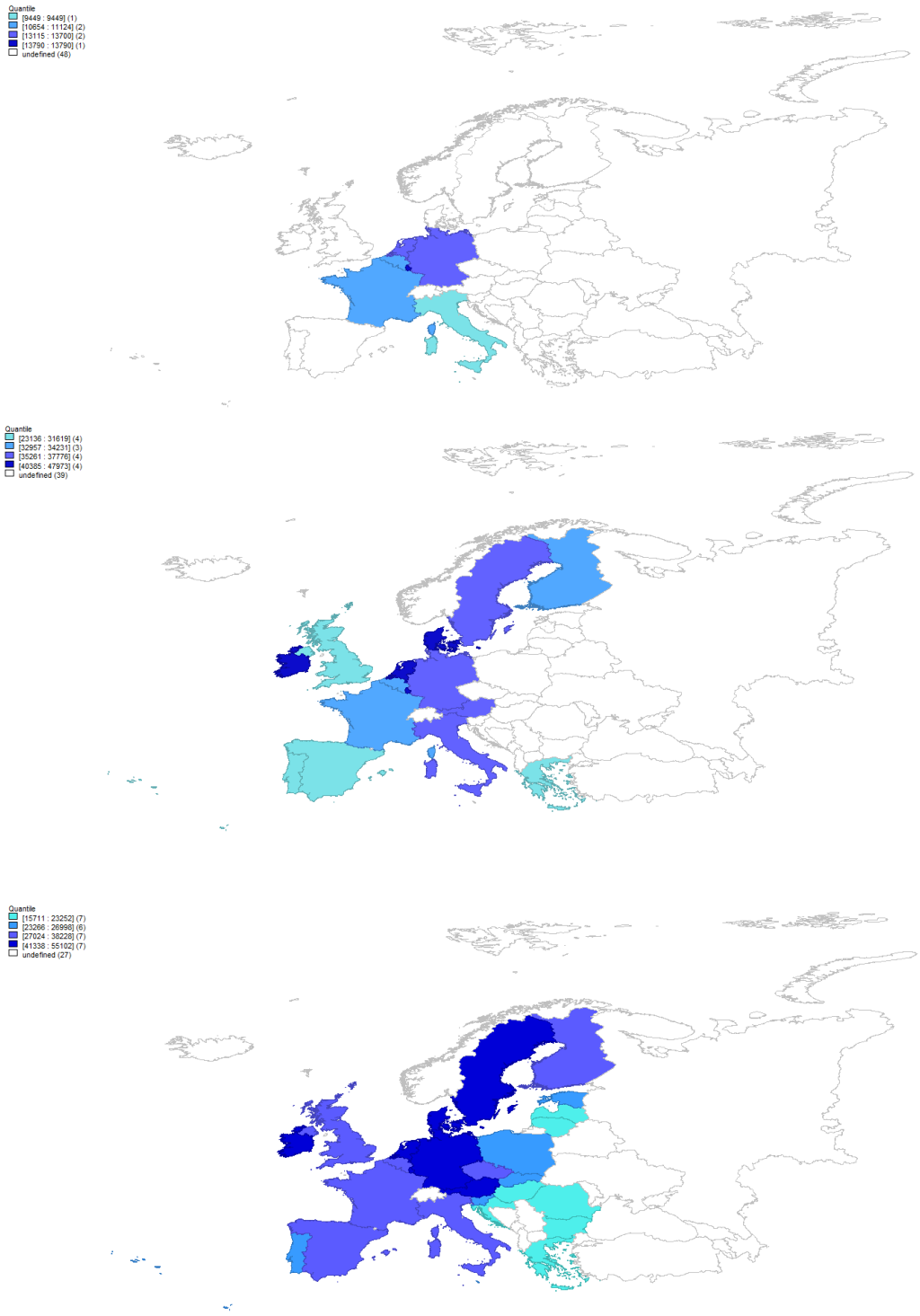
Figures

Figure 1. Changes in GDP per capita generated in Europe (1957, 2000, and 2014)



Source: Elaborated with GEODA (data from Maddison Historical Statistics). GDP per capita is expressed in 2011 US$ per inhabitant. The EU countries have been divided into 4 quartiles: low, medium-low, medium-high and high income, corresponding to colors from least to highest intensity.

Figure 2. Contribution of domestic, intra-EU, and extra-EU trade, 2000-2014 for Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, and Slovenia.

Figure 2.a.

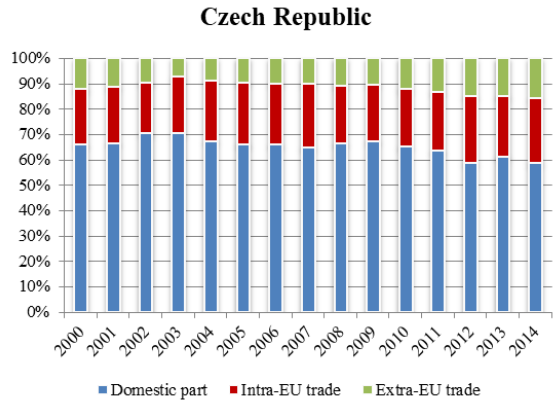


Figure 2.b.

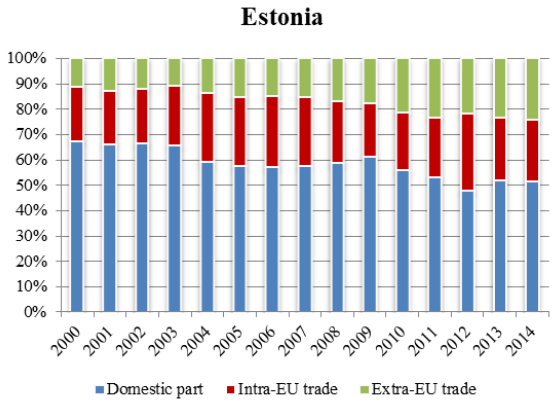


Figure 2.c.

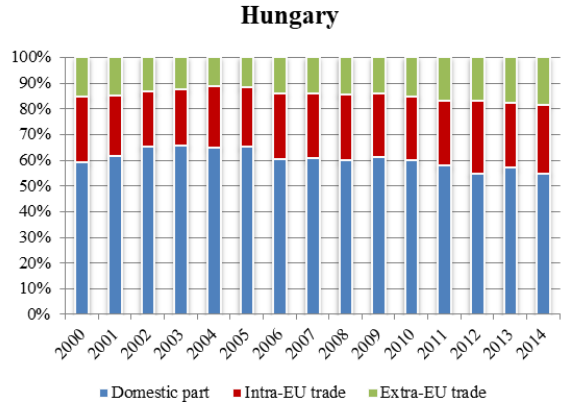


Figure 2.d.

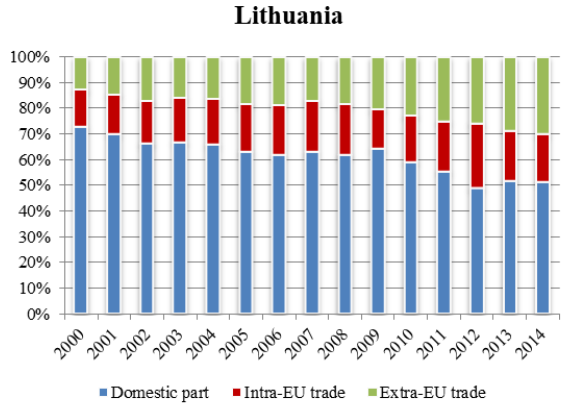


Figure 2.e.

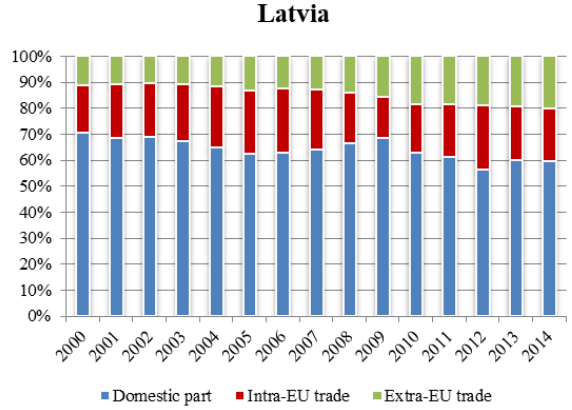


Figure 2.f.

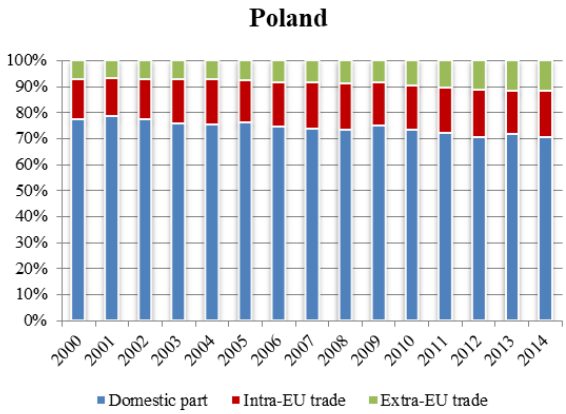


Figure 2.g.

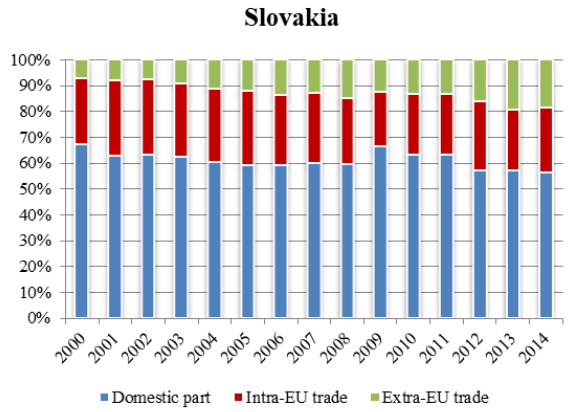


Figure 2.h.

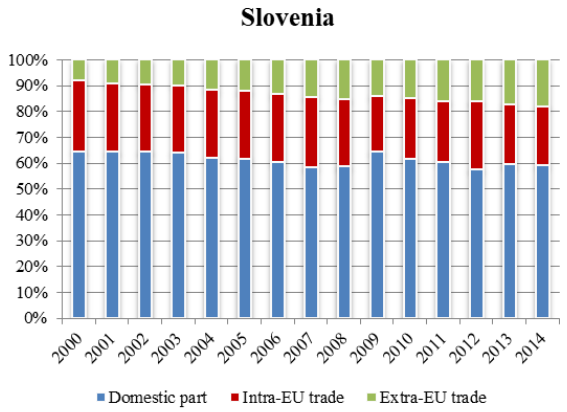


Figure 2.i.

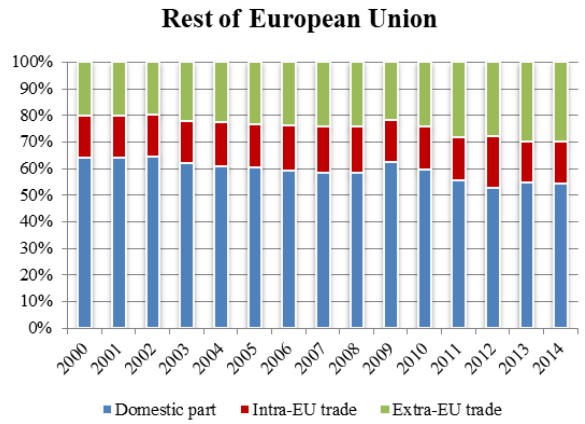
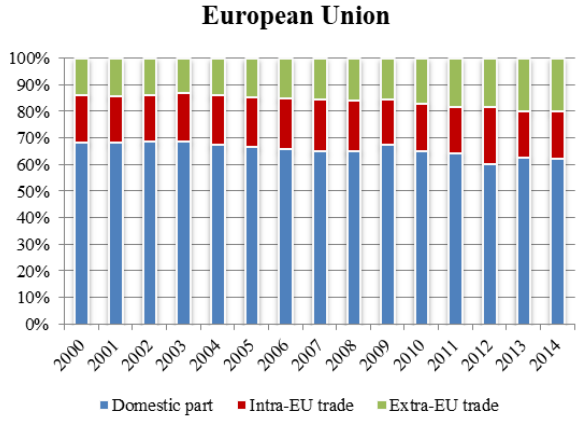
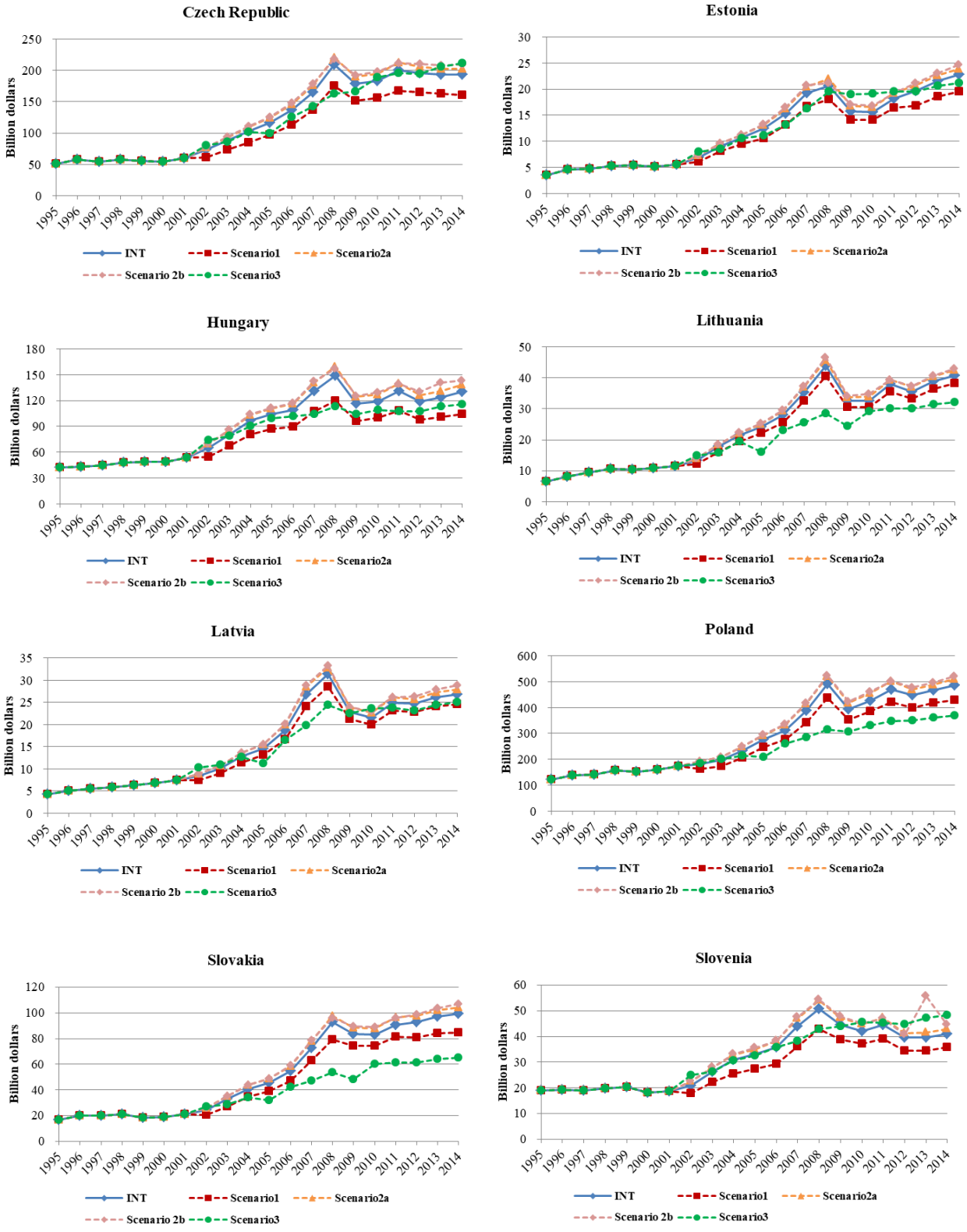


Figure 2.j.



Source: Own elaboration

Figure 3. GDP evolution in Eastern European countries (real and hypothetical cases), 1995-2014



Source: Own elaboration

Tables

Table 1. Economic structure of the MRIO table.

	East	Rest of EU	Rest of Europe	Rest of World	Final demand				X
East	$Z_{ij}^{E,E}$	$Z_{ij}^{E,RoEU}$	$Z_{ij}^{E,RoE}$	$Z_{ij}^{E,RoW}$	Y_1^E	Y_1^{RoEU}	Y_1^{RoE}	Y_1^{RoW}	X^E
Rest of EU	$Z_{ij}^{RoEU,E}$	$Z_{ij}^{RoEU,RoEU}$	$Z_{ij}^{RoEU,RoE}$	$Z_{ij}^{RoEU,RoW}$	. .	. .	. .	. .	X^{RoEU}
Rest of Europe	$Z_{ij}^{RoE,E}$	$Z_{ij}^{RoE,RoEU}$	$Z_{ij}^{RoE,RoE}$	$Z_{ij}^{RoE,RoW}$	. .	. .	. .	. .	X^{RoE}
Rest of World	$Z_{ij}^{RoW,E}$	$Z_{ij}^{RoW,RoEU}$	$Z_{ij}^{RoW,RoE}$	$Z_{ij}^{RoW,RoW}$	. Y_j^E	. Y_j^{RoEU}	. Y_j^{RoE}	. Y_j^{RoW}	X^{RoW}
VA	$VA^{E\prime}$	$VA^{RoEU\prime}$	$VA^{RoE\prime}$	$VA^{RoW\prime}$					
X	$X^{E\prime}$	$X^{RoEU\prime}$	$X^{RoE\prime}$	$X^{RoW\prime}$					

Source: Own elaboration

Table 2. Distribution of EU trade according to the "*gradually distributed*" scenario.

a_z	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EU trade_Domestic production	0%	2%	4%	6%	8%	10%	12%	14%	16%	18%	20%	22%	24%
EU trade_Trade with EU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
EU trade_Trade with non-EU	100%	98%	96%	94%	92%	90%	88%	86%	84%	82%	80%	78%	76%

Source: Own elaboration

Table 3. Evolution of the IE index. Effects of the non-integration of the East in terms of GDP (average 2002-2014, %).

	Scenario 1	Scenario 2		Scenario 3
		Subst. Imports	Gradual assign.	
Czech Republic	-16.36%	6.06%	7.09%	-3.32%
Estonia	-12.34%	5.85%	6.71%	2.68%
Hungary	-17.50%	6.69%	8.23%	-8.98%
Lithuania	-7.71%	4.14%	5.01%	-18.08%
Latvia	-9.23%	5.25%	6.33%	-5.50%
Poland	-10.89%	6.21%	7.06%	-19.03%
Slovakia	-13.78%	6.14%	6.81%	-27.18%
Slovenia	-14.80%	5.97%	9.30%	3.49%
Austria	-2.26%	4.23%	3.92%	3.31%
Belgium	-0.96%	5.40%	5.26%	5.65%
Bulgaria	-1.42%	6.24%	6.11%	-0.24%
Cyprus	-0.54%	2.83%	2.72%	-1.42%
Germnay	-1.57%	4.18%	4.00%	4.33%
Denmark	-0.92%	5.71%	5.61%	3.49%
Spain	-0.46%	4.48%	4.40%	5.03%
Finland	-0.96%	5.94%	5.85%	3.18%
France	-0.45%	4.58%	4.53%	3.48%
Great Britain	-0.36%	5.11%	5.07%	0.43%
Greece	-0.18%	4.25%	4.21%	0.74%
Ireland	-0.75%	4.70%	4.56%	1.31%
Italy	-0.66%	4.58%	4.50%	5.76%
Luxembourg	-0.75%	4.22%	4.12%	-0.15%
Malta	-1.15%	4.32%	4.00%	4.16%
Netherlands	-0.90%	5.07%	4.95%	7.10%
Portugal	-0.26%	6.37%	6.33%	8.48%
Romania	-1.23%	5.38%	5.21%	-1.87%
Sweden	-0.89%	5.80%	5.70%	1.81%
Russia	-0.19%	5.39%	5.34%	-7.46%
Turkey	-0.13%	7.23%	7.27%	-0.82%
Canada	-0.03%	3.04%	3.02%	0.64%
United States	-0.02%	0.87%	0.86%	0.33%
Australia	-0.03%	3.31%	3.31%	-3.41%
China	-0.04%	1.67%	1.67%	-10.97%
Indonesia	-0.03%	1.44%	1.43%	-8.02%
India	-0.03%	4.88%	4.89%	-2.33%
Japan	-0.01%	0.89%	0.87%	3.87%
Korea	-0.04%	5.71%	5.68%	-1.00%
Taiwan	-0.04%	2.82%	2.79%	0.33%
Brazil	-0.03%	8.13%	8.11%	0.07%
Mexico	-0.04%	2.19%	2.19%	-0.73%
Real EU average	-7.00%	1.08%	1.15%	-0.31%
Real average	-2.91%	1.78%	1.86%	1.26%
Standard dev.	0.05	0.02	0.02	0.07

Source: Own elaboration