

Comparative Advantage and the Welfare Impact of European Integration*

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March 2, 2011

Abstract

This paper investigates the welfare gains from European trade integration, and the role of comparative advantage in determining the magnitude of those gains. We use a multi-sector Ricardian model implemented on 75 countries, and compare welfare in the 2000s to a counterfactual scenario in which Eastern European countries are closed to trade. For Western European countries, the mean welfare gain from trade integration with Eastern Europe is 0.1%, ranging from zero for Portugal to 0.35% for Austria. Comparative advantage is a key determinant of the variation in these welfare gains: countries whose comparative advantage is most similar to Eastern Europe tend to gain the least, while countries with technology most different from Eastern Europe gain the most.

JEL Classifications: F11, F43, O33, O47

Keywords: comparative advantage, European integration, Ricardian models of trade, welfare

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1 Introduction

The fall of the Iron Curtain some 20 years ago led to one of the largest episodes of abrupt trade integration in postwar history. It brought some 375 million people of the former communist bloc out of the politically imposed isolation and into the world trading system. Indeed, trade integration has been rapid. Figure 1(a) plots the total inflation-adjusted exports of the Eastern European countries between 1962 and 2007, expressed as an index number relative to 1990. The growth in international trade over the 15 or so years ending in 2007 is nothing short of spectacular, rising 8-fold. Through trade expanded all over the world in this period, the integration of Eastern Europe has been much more dramatic than the world average: over the same period world trade grew by a factor of 3. For geographical, historical, and political reasons, Western Europe is the region most affected by the arrival of ex-communist countries. Figure 1(b) plots the share of West European imports that come from Eastern Europe. After remaining stable at about 4% from the early 1960s to the early 1990s, it reached 10% by 2007.

Such episodes of rapid trade integration of large regions are relatively rare, and provide an important “laboratory” for quantitatively studying the welfare gains from trade. This paper uses the the post-Cold War European trade integration to examine the role of an often neglected determinant of welfare gains from trade: the Ricardian comparative advantage. Standard theories tell us that while trade integration should be beneficial to the countries involved, *how much* countries gain depends on the nature of comparative advantage. Generally, countries that are very different from each other will tend to gain more from trade opening than similar countries. Though qualitatively this idea is well-understood, quantitatively we still do not have a clear understanding of the role that Ricardian comparative advantage plays in general, and in for welfare gains from European integration in particular.

This paper quantifies the welfare gains from trade integration between Western and Eastern Europe, taking explicit account of the patterns of comparative advantage in each country in each group. The analysis is based on the quantitative framework recently developed by Levchenko and Zhang (2011). That paper estimates sectoral productivities – comparative advantage – in a sample of 75 countries and 19 manufacturing sectors using a fully specified multisector Ricardian model with Heckscher-Ohlin features. To do so, it expands the methodology of Eaton and Kortum (2002) to allow for multiple sectors, multiple factors of production, an explicit non-traded sector, the full specification of input-output linkages between the sectors, and both inter- and intra-industry trade. The model is estimated on the world economy, and thus features both the European countries and their main trading partners in the rest of the world.

We first use the sectoral productivity estimates from Levchenko and Zhang (2011) to document that there is indeed a great deal of variation in how different countries are in relative

technology. Correlations in sectoral productivities range from -0.083 between the UK and Kazakhstan, to 0.985 between Germany and Poland. Among the West European countries, average (GDP-weighted) correlations in sectoral technology with the Eastern bloc countries as a group range from 0.113 and 0.218 for Iceland and Ireland to 0.781 and 0.801 for Spain and Germany. Thus, there are large differences among Western European countries in how similar they are in comparative advantage to Eastern Europe.

Second, we quantify the gains from trade from the opening up of Eastern Europe, by comparing welfare in each West European country to a counterfactual scenario under which Eastern Europe is closed to trade. For each East European country, this comparison reveals the total gains from trade relative to autarky. For each West European country, this comparison represents the gains from the ability to trade with Eastern Europe, given that it trades with the rest of the world as well. We find that for Western Europe, median gain is 0.1% , ranging from zero for Portugal to 0.35% for Austria. For Eastern Europe, mean gain is 5% , ranging from 1.4% for Russia to 9.2% for Bulgaria. Not surprisingly, since we are comparing to autarky, gains to a typical East European country are much larger.

Importantly, comparative advantage plays an important role in explaining the variation in welfare gains for Western Europe. Controlling for average trade costs, countries that are similar in relative technology to Eastern Europe tend to gain less. These tend to be peripheral Western European countries such as Portugal, Spain, or Greece. By contrast, most different countries – such as Ireland, Austria, and Netherlands – gain the most. The impact of similarity in comparative advantage is important quantitatively: moving from the 75th to the 25th percentile in similarity to Eastern Europe – a change in GDP-weighted correlation from 0.76 to 0.34 – roughly doubles welfare gains from East European integration, all else equal.

The paper then examines the impact of East European trade integration on industrial structure in Western Europe and the pattern of global trade. Overall, we do not find a large impact of the arrival of Eastern Europe on the broad sectoral structure in the West. The exceptions include the Basic Metals and Fuels sectors, which would have been substantially larger in many West European countries in the absence of trade with Eastern Europe. Sectors that tend to expand in the West following East European integration are Paper and Paper Products, Chemicals, and Transport Equipment.

When it comes to the pattern of global trade, we find that in each of the broad world regions, imports from all the regions except Eastern Europe fall when Eastern Europe opens to trade. This trade diversion effect is modest, however, with reductions rarely more than a few percent. Total imports (including from Eastern Europe) expand the most in Western Europe, with other regions experiencing only modest increases of 0.2% to 3.8% .

Our paper follows up on the Computable General Equilibrium (CGE) assessments of East

European trade integration (e.g., Brown, Deardorff, Djankov and Stern 1997, Hertel, Brockmeier and Swaminathan 1997). Unlike the traditional CGE approach, our quantitative framework is based on Eaton and Kortum (2002)'s Ricardian model of trade with endogenous specialization both within and across sectors, and the focus of the study is on the role of comparative advantage. In this respect, our paper is related to recent quantitative welfare assessments of trade integration and technological change in multi-sector models (Shikher 2004, Caliendo and Parro 2010, Costinot, Donaldson and Komunjer 2010, Hsieh and Ossa 2011).

The rest of the paper is organized as follows. Section 2 lays out the theoretical framework, and describes the estimation procedure and the data. Section 3 examines the welfare implications of European integration, paying special attention to the role of comparative advantage. Section 4 concludes.

2 Theoretical Framework

2.1 The Environment

The world is comprised of N countries, indexed by n and i . In the numerical implementation below, there are 17 West European countries, 10 East European countries, and 48 non-European countries. There are J tradeable sectors, plus one nontradeable sector $J + 1$. Utility over these sectors in country n is given by

$$U_n = \left(\sum_{j=1}^J \omega_j^{\frac{1}{\eta}} (Y_n^j)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1} \xi_n} (Y_n^{J+1})^{1-\xi_n}, \quad (1)$$

where ξ_n denotes the Cobb-Douglas weight for the tradeable sector composite good, η is the elasticity of substitution between the tradeable sectors, ω_j is the taste parameter for tradeable sector j , Y_n^{J+1} is the nontradeable-sector composite good, and Y_n^j is the composite good in tradeable sector j .

Each sector j aggregates a continuum of varieties $q \in [0, 1]$ unique to each sector using a CES production function:

$$Q_n^j = \left[\int_0^1 Q_n^j(q)^{\frac{\varepsilon-1}{\varepsilon}} dq \right]^{\frac{\varepsilon}{\varepsilon-1}},$$

where ε denotes the elasticity of substitution across varieties q , Q_n^j is the total output of sector j in country n , and $Q_n^j(q)$ is the amount of variety q that is used in production in sector j and country n . Producing one unit of good q in sector j in country n requires $\frac{1}{z_n^j(q)}$ input bundles.

Production uses labor (L), capital (K), and intermediate inputs from other sectors. The cost

of an input bundle is:

$$c_n^j = \left(w_n^{\alpha_j} r_n^{1-\alpha_j} \right)^{\beta_j} \left(\prod_{k=1}^{J+1} \left(p_n^k \right)^{\gamma_{k,j}} \right)^{1-\beta_j},$$

where w_n is the wage, r_n is the return to capital, and p_n^k is the price of intermediate input from sector k . The value-added based labor intensity is given by α_j , and the share of value added in total output by β_j . Both vary by sector. The shares of inputs from other sectors, $\gamma_{k,j}$ vary by output industry j as well as input industry k .

Following Eaton and Kortum (2002, henceforth EK), productivity $z_n^j(q)$ for each $q \in [0, 1]$ in each sector j is random, and drawn the Fréchet distribution with cdf:

$$F_n^j(z) = e^{-T_n^j z^{-\theta}}.$$

In this distribution, the absolute advantage term T_n^j varies by both country and sector, with higher values of T_n^j implying higher average productivity draws in sector j in country n . The parameter θ captures dispersion, with larger values of θ implying smaller dispersion in draws.

The production cost of one unit of good q in sector j and country n is thus equal to $c_n^j/z_n^j(q)$. Each country can produce each good in each sector, and international trade is subject to iceberg costs: $d_{ni}^j > 1$ units of good q produced in sector j in country i must be shipped to country n in order for one unit to be available for consumption there. The trade costs need not be symmetric – d_{ni}^j need not equal d_{in}^j , and will vary by sector. We normalize $d_{nn}^j = 1 \forall n$ and j .

All the product and factor markets are perfectly competitive, and thus the price at which country i supplies tradeable good q in sector j to country n is:

$$p_{ni}^j(q) = \left(\frac{c_i^j}{z_i^j(q)} \right) d_{ni}^j.$$

Buyers of each good q in tradeable sector j in country n will only buy from the cheapest source country, and thus the price actually paid for this good in country n will be:

$$p_n^j(q) = \min_{i=1, \dots, N} \left\{ p_{ni}^j(q) \right\}.$$

2.2 Characterization of Equilibrium

The **competitive equilibrium** of this model world economy consists of a set of prices, allocation rules, and trade shares such that (i) given the prices, all firms' inputs satisfy the first-order conditions, and their output is given by the production function; (ii) given the prices, the consumers' demand satisfies the first-order conditions; (iii) the prices ensure the market clearing conditions for labor, capital, tradeable goods and nontradeable goods; (iv) trade shares ensure balanced

trade for each country.

The set of prices includes the wage rate w_n , the rental rate r_n , the sectoral prices $\{p_n^j\}_{j=1}^{J+1}$, and the aggregate price P_n in each country n . The allocation rules include the capital and labor allocation across sectors $\{K_n^j, L_n^j\}_{j=1}^{J+1}$, final consumption demand $\{Y_n^j\}_{j=1}^{J+1}$, and total demand $\{Q_n^j\}_{j=1}^{J+1}$ (both final and intermediate goods) for each sector. The trade shares include the expenditure share π_{ni}^j in country n on goods coming from country i in sector j .

2.2.1 Demand and Prices

It is well known that the price of sector j 's output is given by:

$$p_n^j = \left[\int_0^1 p_n^j(q)^{1-\varepsilon} dq \right]^{\frac{1}{1-\varepsilon}}.$$

Following the standard EK approach, define the “multilateral resistance” term

$$\Phi_n^j = \sum_{i=1}^N T_i^j \left(c_i^j d_{ni}^j \right)^{-\theta}.$$

This value summarizes, for country n , the access to production technologies in sector j . Its value will be higher if in sector j , country n 's trading partners have high productivity (T_i^j) or low cost (c_i^j). It will also be higher if the trade costs that country n faces in this sector are low. Standard steps lead to the familiar result that the price of good j in country n is simply

$$p_n^j = \Gamma \left(\Phi_n^j \right)^{-\frac{1}{\theta}}, \quad (2)$$

where $\Gamma = \left[\Gamma \left(\frac{\theta+1-\varepsilon}{\theta} \right) \right]^{\frac{1}{1-\varepsilon}}$, with Γ the Gamma function. The consumption price index in country n is then:

$$P_n = B_n \left(\sum_{j=1}^J \omega_j (p_n^j)^{1-\eta} \right)^{\frac{1}{1-\eta} \xi_n} (p_n^{J+1})^{1-\xi_n},$$

where $B_n = \xi_n^{-\xi_n} (1 - \xi_n)^{-(1-\xi_n)}$.

Both capital and labor are mobile across sectors and immobile across countries, and trade is balanced. The budget constraint (or the resource constraint) of the consumer is thus given by

$$\sum_{j=1}^{J+1} p_n^j Y_n^j = w_n L_n + r_n K_n, \quad (3)$$

where K_n and L_n are the endowments of capital and labor in country n .

Given the set of prices $\{w_n, r_n, P_n, \{p_n^j\}_{j=1}^{J+1}\}_{n=1}^N$, we first characterize the optimal allocations

from final demand. Consumers maximize utility (1) subject to the budget constraint (3). The first order conditions associated with this optimization problem imply the following final demand:

$$p_n^j Y_n^j = \xi_n (w_n L_n + r_n K_n) \frac{\omega_j (p_n^j)^{1-\eta}}{\sum_{k=1}^J \omega_k (p_n^k)^{1-\eta}}, \text{ for all } j = \{1, \dots, J\} \quad (4)$$

and

$$p_n^{J+1} Y_n^{J+1} = (1 - \xi_n) (w_n L_n + r_n K_n).$$

2.2.2 Production Allocation and Market Clearing

The EK structure in each sector j delivers the standard result that the probability of importing good q from country i , π_{ni}^j is equal to the share of total spending on goods coming from country i , X_{ni}^j / X_n^j , and is given by:

$$\frac{X_{ni}^j}{X_n^j} = \pi_{ni}^j = \frac{T_i^j (c_i^j d_{ni}^j)^{-\theta}}{\Phi_n^j}.$$

Let Q_n^j denote the total sectoral demand in country n and sector j . Q_n^j is used for both final consumption and intermediate inputs in domestic production of all sectors. That is,

$$p_n^j Q_n^j = p_n^j Y_n^j + \sum_{k=1}^J (1 - \beta_k) \gamma_{j,k} \left(\sum_{i=1}^N \pi_{in}^k p_i^k Q_i^k \right) + (1 - \beta_{J+1}) \gamma_{j,J+1} p_n^{J+1} Q_n^{J+1}$$

for tradeable sectors $j = 1, \dots, J$, and

$$p_n^{J+1} Q_n^{J+1} = p_n^{J+1} Y_n^{J+1} + \sum_{k=1}^{J+1} (1 - \beta_k) \gamma_{j,k} p_n^k Q_n^k$$

in the nontradeable sector. That is, total expenditure in sector $j = 1, \dots, J$ of country n , $p_n^j Q_n^j$, is the sum of (i) domestic final consumption expenditure $p_n^j Y_n^j$; (ii) expenditure on sector j goods as intermediate inputs in all the traded sectors $\sum_{k=1}^J (1 - \beta_k) \gamma_{j,k} (\sum_{i=1}^N \pi_{in}^k p_i^k Q_i^k)$, and (iii) expenditure on the j 's sector intermediate inputs in the domestic non-traded sector $(1 - \beta_{J+1}) \gamma_{j,J+1} p_n^{J+1} Q_n^{J+1}$. These market clearing conditions summarize the two important features of the world economy captured by our model: complex international production linkages, as much of world trade is in intermediate inputs, and a good crosses borders multiple times before being consumed (Hummels, Ishii and Yi 2001); and two-way input linkages between the tradeable and the nontradeable sectors.

In each tradeable sector j , some goods q are imported from abroad and some goods q are exported to the rest of the world. Country n 's exports in sector j are given by $EX_n^j = \sum_{i=1}^N \mathbb{I}_{i \neq n} \pi_{in}^j p_i^j Q_i^j$, and its imports in sector j are given by $IM_n^j = \sum_{i=1}^N \mathbb{I}_{i \neq n} \pi_{ni}^j p_n^j Q_n^j$, where $\mathbb{I}_{i \neq n}$ is the indicator function. The total exports of country n are then $EX_n = \sum_{j=1}^J EX_n^j$, and total imports are

$IM_n = \sum_{j=1}^J IM_n^j$. Trade balance requires that for any country n , $EX_n - IM_n = 0$.

Given the total production revenue in tradeable sector j in country n , $\sum_{i=1}^N \pi_{in}^j p_i^j Q_i^j$, the optimal sectoral factor allocations must satisfy

$$\sum_{i=1}^N \pi_{in}^j p_i^j Q_i^j = \frac{w_n L_n^j}{\alpha_j \beta_j} = \frac{r_n K_n^j}{(1 - \alpha_j) \beta_j}.$$

For the nontradeable sector $J + 1$, the optimal factor allocations in country n are simply given by

$$p_n^{J+1} Q_n^{J+1} = \frac{w_n L_n^{J+1}}{\alpha_{J+1} \beta_{J+1}} = \frac{r_n K_n^{J+1}}{(1 - \alpha_{J+1}) \beta_{J+1}}.$$

Finally, the feasibility conditions for factors are given by, for any n ,

$$\sum_{j=1}^{J+1} L_n^j = L_n \text{ and } \sum_{j=1}^{J+1} K_n^j = K_n.$$

Given all of the model parameters, factor endowments, trade costs, and productivities, the model is solved using the algorithm described in Levchenko and Zhang (2011). This model is used to estimate the sector-level technology parameters T_n^j for a large set of countries. First, and most relevant to this study, are estimates of the technology parameters in the tradeable sectors relative to the a reference country (the U.S.) using data on sectoral output and bilateral trade. The procedure relies on fitting a structural gravity equation implied by the model. Intuitively, if controlling for the typical gravity determinants of trade, a country spends relatively more on domestically produced goods in a particular sector, it is revealed to have either a high relative productivity or a low relative unit cost in that sector. The procedure then uses data on factor and intermediate input prices to net out the role of factor costs, yielding an estimate of relative productivity. This step also produces estimates of bilateral trade costs at the sectoral level over time. The second step is to estimate the technology parameters in the tradeable sectors for the U.S.. This procedure requires directly measuring TFP at the sectoral level using data on real output and inputs, and then correcting measured TFP for selection due to trade. The taste parameters for all tradeable sectors ω_j are also calibrated in this step. Third, we calibrate the nontradeable technology for all countries using the first-order condition of the model and the relative prices observed in the data. The detailed procedures for all three steps are described in Levchenko and Zhang (2011) and reproduced in Appendix A.

2.3 Calibration

In order to implement the model numerically, we must calibrate the following sets of parameters:

(i) preference parameters ω_j , ξ_n , and η ; (ii) production function parameters ε , α_j , β_j , $\gamma_{k,j}$ for all

sectors j and k ; (iii) moments of the technology distributions T_n^j and θ ; (iv) trade costs d_{ni}^j ; and (v) country factor endowments L_n and K_n . We discuss the calibration of each in turn.

The share of expenditure on traded goods, ξ_n in each country and decade is sourced from Yi and Zhang (2010), who compile this information for 30 developed and developing countries. For countries unavailable in the Yi and Zhang data, values of ξ_n are imputed based on fitting a simple linear relationship to log PPP-adjusted per capita GDP from the Penn World Tables. In each decade, the fit of this simple linear relationship was typically quite good, with R^2 's of 0.30 to 0.80 across decades. The taste parameters for tradeable sectors ω_j were estimated by Levchenko and Zhang (2011) by combining the model structure above with data on final consumption expenditure shares in the U.S. sourced from the U.S. Input-Output matrix. The elasticity of substitution between broad sectors within the tradeable bundle, η , is set to 2. Since these are very large product categories, it is sensible that this elasticity would be relatively low. It is higher, however, than the elasticity of substitution between tradeable and nontradeable goods, which is set to 1 by the Cobb-Douglas assumption.

The production function parameters α_j and β_j are estimated using the UNIDO Industrial Statistics Database, which reports output, value added, employment, and wage bills at roughly 2-digit ISIC Revision 3 level of disaggregation. To compute α_j for each sector, we calculate the share of the total wage bill in value added, and take a simple median across countries (taking the mean yields essentially the same results). To compute β_j , take the median of value added divided by total output.

The intermediate input coefficients $\gamma_{k,j}$ are obtained from the Direct Requirements Table for the United States. We use the 1997 Benchmark Detailed Make and Use Tables (covering approximately 500 distinct sectors), as well as a concordance to the ISIC Revision 3 classification to build a Direct Requirements Table at the 2-digit ISIC level. The Direct Requirements Table gives the value of the intermediate input in row k required to produce one dollar of final output in column j . Thus, it is the direct counterpart of the input coefficients $\gamma_{k,j}$. Note that we assume these to be the same in all countries.¹ In addition, we use the U.S. I-O matrix to obtain the shares of total final consumption expenditure going to each sector, which we use to pin down taste parameters ω_j in traded sectors $1, \dots, J$; as well as α_{J+1} and β_{J+1} in the nontradeable sector,

¹di Giovanni and Levchenko (2010) provide suggestive evidence that at such a coarse level of aggregation, Input-Output matrices are indeed similar across countries. We implemented two robustness checks to assess how restrictive is the assumption of a single I-O matrix across countries and over time. In the first, we collected U.S. I-O matrices for each decade going back to the 1960s, and re-calculated all the sectoral productivities using decade-specific matrices. For all the decades, the correlation between the productivities implied by the decade-specific matrices and the baseline values reported in the paper is extremely high: across all the countries in the sample, the median correlation is above 0.99, with the lowest correlation across all countries and decades of 0.91. Second, we collected country-specific I-O matrices from the GTAP database. Productivities computed based on country-specific I-O matrices were again very similar to the baseline values. In our sample of countries, the median correlation was 0.98, with all but 3 out of 75 countries having a correlation of 0.93 or above, and the minimum correlation of 0.65.

which cannot be obtained from UNIDO.² The elasticity of substitution between varieties within each tradeable sector, ε , is set to 4.

The technology parameters T_n^j and trade costs d_{ni}^j were estimated by Levchenko and Zhang (2011), who use data on bilateral trade to fit a structural gravity equation, and use the resulting estimates along with data on input costs to back out underlying technology. We assume that the dispersion parameter θ does not vary across sectors. There are no reliable estimates of how it varies across sectors, and thus we do not model this variation. We pick the value of $\theta = 8.28$, which is the preferred estimate of EK.³ It is important to assess how the results below are affected by the value of this parameter. One may be especially concerned about how the results change under lower values of θ . Lower θ implies greater within-sector heterogeneity in the random productivity draws. Thus, trade flows become less sensitive to the costs of the input bundles (c_i^j), and the gains from intra-sectoral trade become larger relative to the gains from inter-sectoral trade. We repeated the entire analysis in the paper assuming instead a value of $\theta = 4$, which has been advocated by Simonovska and Waugh (2010) and is at or near the bottom of the range that has been used in the literature. Overall, the results are remarkably similar. The correlation between estimated T_i^j 's under $\theta = 4$ and the baseline is above 0.95, and there is actually somewhat greater variability in T_i^j 's under $\theta = 4$. Appendix A describes the Levchenko and Zhang (2011) procedures to estimate T_n^j , d_{ni}^j , and ω_j .

The total labor force in each country, L_n , and the total capital stock, K_n , are obtained from the Penn World Tables 6.3. Following the standard approach in the literature (see, e.g. Hall and Jones 1999, Bernanke and Gürkaynak 2001, Caselli 2005), the total labor force is calculated from the data on the total GDP per capita and per worker.⁴ The total capital is calculated using the perpetual inventory method that assumes a depreciation rate of 6%: $K_{n,t} = (1 - 0.06)K_{n,t-1} + I_{n,t}$, where $I_{n,t}$ is total investment in country n in period t . For most countries, investment data start in 1950, and the initial value of K_n is set equal to $I_{n,0}/(\gamma + 0.06)$, where γ is the average growth rate of investment in the first 10 years for which data are available.

All of the variables that vary over time are averaged for the period 2000-2007 (the latest available year), which is the time period on which we carry out the analysis. Appendix Table A1

²The U.S. I-O matrix provides an alternative way of computing α_j and β_j . These parameters calculated based on the U.S. I-O table are very similar to those obtained from UNIDO, with the correlation coefficients between them above 0.85 in each case. The U.S. I-O table implies greater variability in α_j 's and β_j 's across sectors than does UNIDO.

³Shikher (2004, 2005, 2010), Burstein and Vogel (2009), and Eaton, Kortum, Neiman and Romalis (2010), among others, follow the same approach of assuming the same θ across sectors. Caliendo and Parro (2010) use tariff data and triple differencing to estimate sector-level θ . However, their approach may impose too much structure and/or be dominated by measurement error: at times the values of θ they estimate are negative. In addition, in each sector the restriction that $\theta > \varepsilon - 1$ must be satisfied, and it is not clear whether Caliendo and Parro (2010)'s estimated sectoral θ 's meet this restriction in every case. Our approach is thus conservative by being agnostic on this variation across sectors.

⁴Using the variable name conventions in the Penn World Tables, $L_n = 1000 * pop * rgdpch / rgdpwok$.

lists the countries used in the analysis, separating them into Western Europe, Eastern Europe, and the rest of the world.⁵ Appendix Table A2 lists the sectors along with the key parameter values for each sector: α_j , β_j , the share of nontradeable inputs in total inputs $\gamma_{J+1,j}$, and the taste parameter ω_j .

3 The Welfare Impact of European Integration

3.1 Basic Patterns

Table 1 reports the matrix of correlations of T_n^j in the tradeable sectors $j = 1, \dots, J$ between all pairs of East and West European countries. In order to focus on differences in comparative rather than absolute advantage, we compute the correlations on the vectors of T_n^j demeaned by each country's geometric average T_n^j . It is clear that the differences in sectoral similarities between country pairs are pronounced. In Eastern Europe, countries most similar to the West are Slovenia, Poland, and Czech Republic, while Kazakhstan and Romania are on average the most different. Among the West European countries, those that tend to have most similar comparative advantage to Eastern Europe are Ireland and Iceland. Figure 2 presents these correlations graphically, using a contour plot with darker shades representing higher correlations.

We expect such pronounced differences in technological similarity to have an impact on the magnitude of the welfare gains from European integration. This proposition is explored in the next subsection.

3.2 Welfare Analysis

This section compares welfare in the baseline model to a counterfactual scenario in which all East European countries are in autarky. The baseline model implementation uses trade costs d_{ni}^j estimated on data for 2000s, and thus assumes the level of trade costs that prevails today, rather than complete frictionless trade. Table 2 reports, for each West and East European country, the percentage welfare gain from European integration (that is, the proportional difference in welfare between the benchmark model for 2000s and the counterfactual model in which all East European countries are in autarky).

The gains to Western Europe are not large: the mean welfare increase is 0.1%, and the range is between zero for Portugal to 0.35% for Austria. This is not surprising: even at the peak to

⁵Due to lack of required data, a number of East European countries are missing. The missing countries include the Baltic countries (Estonia, Latvia, Lithuania), all but one of the countries comprising former Yugoslavia (Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, and Serbia), the trans-Caucasus countries (Armenia, Azerbaijan, Georgia), Belarus, and Moldova. These countries together account for 16% of total Eastern bloc population and 12% of its GDP, but less than 10% of its exports.

date, imports from Eastern Europe are only about 10% of overall Western European imports, so we would not expect the gains to be much larger than a fraction of a percent.

For Eastern Europe, gains are much larger, since in this case we are comparing complete autarky to trade.⁶ The median change in welfare is 5%, ranging from 1.4% for Russia to 9.2% for Bulgaria. Not surprisingly, larger and farther away countries (Russia, Ukraine) tend to gain much less than smaller ones, such as Czech Republic or Bulgaria. Note that these are gains from trade with all of the world, not just Western Europe.

How much does comparative advantage affect the magnitude of these gains? We regress the total welfare change on both average d_{ni}^j and the correlation between the T 's, to see if comparative advantage remains significant even after controlling for trade costs. To account for the well-known role of country size, these specifications also include total GDP. Table 3 reports the results, for three ways of weighting d_{ni}^j 's and correlations of T 's: equal-weighted, GDP-weighted, and population-weighted. All the left-hand side variables and the regressors are in logs throughout.⁷ The R^2 of these regressions are between 0.47 and 0.74, indicating that these three variables account for the bulk of the cross-country variation in welfare gains. While for the equally-weighted case, sectoral similarity is not significant, for the population- and GDP-weighted cases, it is significant at the 1% level. Similarity also explains a sizeable share of the variation in the West European welfare gains: the partial R^2 associated with GDP-weighted similarity is 39%, roughly half of the total R^2 in the regression. The magnitude of the coefficient is sizeable. Moving from the 75th to the 25th percentile in similarity – from a GDP-weighted average correlation of 0.76 to 0.34 – roughly doubles the welfare gains from integration of Eastern Europe.

Figure 3(a) plots, for the sample of West European countries, the partial correlations between the welfare gain from East European integration and the GDP-weighted correlation between a country's T 's with Eastern European countries, after netting out the impact of average trade costs and country size. There is a pronounced negative relationship: welfare gains are smaller for more similar countries. At one extreme are peripheral Western European countries, such as Portugal and Greece, exhibiting the highest similarity with Eastern Europe, and the lowest gains from trade. At another are Netherlands and Austria, that are among the most different in their comparative advantage, and have some of the highest gains. We would expect the gains to be affected by trade costs as well. Figure 3(b) presents the partial correlation between the gains from European integration against the GDP-weighted average d_{ni}^j to Eastern Europe, after netting out

⁶Assuming complete autarky in this counterfactual for every country may over-estimate the gains, since there was some trade among the Eastern bloc countries, as well as between those countries and the rest of the world. This model is not suited to evaluate the welfare gains of trade among the communist bloc countries, since those were command economies in which all international exchange was centrally planned rather than driven by market forces.

⁷None of the average correlations or welfare gains are negative, so taking logs does not lead to dropped observations. Estimating these relationships in levels delivers similar results.

technological similarity and country size. There is a clear negative relationship: not surprisingly, countries farther from Eastern Europe tend to benefit less.

3.3 Changes in Sectoral Structure

So far we have examined the impact of European integration on welfare. Of independent interest is the changes in industrial structure brought about by European integration. In this subsection, we compare sectoral structure implied by the baseline model to the counterfactual sectoral structure that would have prevailed had Europe not been integrated.

Figure 4 presents the percentage changes in shares of value added in each sector and each country. Some immediate patterns emerge. First and foremost, the broad sectoral structure would remain very similar had East European countries remained in autarky. The vast majority (87.35%) of percentage changes in shares of value added across all sectors and countries is below 1%. This is part because, as mentioned above, Eastern Europe still represents only about 10% of all West European imports, and partly because much of trade is intra-industry.

Second, the sector most often experiencing large reductions in Western Europe is Basic Metals, followed by Coke, Refined Petroleum Products, Nuclear Fuel. This is not surprising, in light of the large metallurgic and energy output of Russia and Ukraine. The sector most often seen to expand is Paper and Paper Products, followed by Chemicals and Transport Equipment. Appendix Figure A1 presents the changes in value added and employment shares for each West European country separately.

3.4 Trade Creation and Trade Diversion

We next examine the implications of East European integration on the pattern of global trade. By construction, when Eastern Europe opens to trade, exports from Eastern Europe to all other countries rise. But what happens to exports from other regions, in particular to Western Europe? As Eastern Europe takes up a substantial share of Western European imports, do imports to Western Europe from other regions fall, and if yes, by how much?

Before describing the comparison between the counterfactual and the benchmark, we check how well the model reproduces the cross-regional trade shares. To do so, we compute, in both the data and the benchmark model, the shares of total extra-regional imports going to each region. That is, we take the total imports from the rest of the world to, say, Western Europe, and compute what is the share of those imports captured by Eastern Europe, as well as every other region. The regions we consider are non-Europe OECD countries (which for us are the United States, Canada, Japan, Australia, and New Zealand); Latin America and the Caribbean; Middle East and North Africa; East and South Asia; and Sub-Saharan Africa. Figure 6 presents the scatterplot of those

shares in the data (on the x-axis) against the model, along with a 45-degree line. All in all, the model matches the cross-regional import shares remarkably well. The correlation between model and data shares is 0.96, and with the Spearman rank correlation of 0.96 as well.

Next, Table 4 presents the matrix of percentage changes in cross-regional trade volumes from the counterfactual to the benchmark. The table omits Eastern Europe from both the rows and the columns of the table because in the counterfactual Eastern Europe is in autarky, and thus percentage changes between the counterfactual and the benchmark are infinity. Two features of the table stand out. The first is that all of the entries are negative: since East European imports increase to all regions, each region reduces its imports from all the other regions. Second, the entries are rather small: for Western Europe, the percentage changes range from -1.12% from non-Europe OECD to -3.06% from the Middle East/North Africa region. Non-Europe OECD imports from other regions tend to be least affected, presumably because these countries tend to be the farthest from Eastern Europe. The last column of the table reports the total change in imports for each region. Even though all the non-East European imports fall, when Eastern European imports are included each region experiences a rise in imports, which is not surprising. The impact on Western Europe is by far the largest, relative to other regions.

4 Conclusion

Ever since the original formulation of the Ricardian model in the nineteenth century, it has been understood that the magnitude of the relative differences in technology – “the strength of comparative advantage” – matters for the size of the gains from trade. Broadly speaking, stronger comparative advantage leads to larger gains from trade. However, the importance of this effect has not been assessed quantitatively.

This paper uses the trade integration of Eastern Europe after the fall of the Iron Curtain as a laboratory for evaluating the role of comparative advantage in the gains from trade. Our model uses estimated sector-level productivities to document that differences in relative technology do indeed vary a great deal among the Western and Eastern European country pairs. Some countries, such as Germany or Spain, are much more similar to the East European countries than others, such as Ireland or the Netherlands. Using a multi-sector, multi-factor quantitative model of trade and these sectoral productivity estimates, we evaluate the gains from European integration for each country. Though the gains for a typical Western European country from integrating Eastern Europe tend to be modest, the quantitative exercise reveals an economically important role of comparative advantage in explaining the cross-country variation in these gains.

Appendix A Procedure for Estimating T_n^j , d_{ni}^j , and ω_j

This appendix reproduces from Levchenko and Zhang (2011) the details of the procedure for estimating technology, trade costs, and taste parameters required to implement the model. Interested readers should consult that paper for further details on estimation steps and data sources.

A.1 Tradeable Sector Relative Technology

We now focus on the tradeable sectors. Following the standard EK approach, first divide trade shares by their domestic counterpart:

$$\frac{\pi_{ni}^j}{\pi_{nn}^j} = \frac{X_{ni}^j}{X_{nn}^j} = \frac{T_i^j (c_i^j d_{ni}^j)^{-\theta}}{T_n^j (c_n^j)^{-\theta}},$$

which in logs becomes:

$$\ln \left(\frac{X_{ni}^j}{X_{nn}^j} \right) = \ln \left(T_i^j (c_i^j)^{-\theta} \right) - \ln \left(T_n^j (c_n^j)^{-\theta} \right) - \theta \ln d_{ni}^j.$$

Let the (log) iceberg costs be given by the following expression:

$$\ln d_{ni}^j = d_k^j + b_{ni}^j + CU_{ni}^j + RTA_{ni}^j + ex_i^j + \nu_{ni}^j,$$

where d_k^j is an indicator variable for a distance interval. Following EK, we set the distance intervals, in miles, to [0, 350], [350, 750], [750, 1500], [1500, 3000], [3000, 6000], [6000, maximum). Additional variables are whether the two countries share a common border (b_{ni}^j), belong to a currency union (CU_{ni}^j), or to a regional trade agreement (RTA_{ni}^j). Following the arguments in Waugh (2009), we include an exporter fixed effect ex_i^j . Finally, there is an error term ν_{ni}^j . Note that all the variables have a sector superscript j : we allow all the trade cost proxy variables to affect true iceberg trade costs d_{ni}^j differentially across sectors. There is a range of evidence that trade volumes at sector level vary in their sensitivity to distance or common border (see, among many others, Do and Levchenko 2007, Berthelon and Freund 2008).

This leads to the following final estimating equation:

$$\ln \left(\frac{X_{ni}^j}{X_{nn}^j} \right) = \underbrace{\ln \left(T_i^j (c_i^j)^{-\theta} \right)}_{\text{Exporter Fixed Effect}} - \underbrace{\ln \left(T_n^j (c_n^j)^{-\theta} \right)}_{\text{Importer Fixed Effect}} - \underbrace{\theta d_k^j - \theta b_{ni}^j - \theta CU_{ni}^j - \theta RTA_{ni}^j}_{\text{Bilateral Observables}} - \underbrace{\theta \nu_{ni}^j}_{\text{Error Term}}.$$

Estimating this relationship will thus yield, for each country, an estimate of its technology-cum-unit-cost term in each sector j , $T_n^j(c_n^j)^{-\theta}$, which is obtained by exponentiating the importer fixed effect. The available degrees of freedom imply that these estimates are of each country's $T_n^j(c_n^j)^{-\theta}$ relative to a reference country, which in our estimation is the United States. We denote this estimated value by S_n^j :

$$S_n^j = \frac{T_n^j}{T_{us}^j} \left(\frac{c_n^j}{c_{us}^j} \right)^{-\theta},$$

where the subscript us denotes the United States. It is immediate from this expression that estimation delivers a convolution of technology parameters T_n^j and cost parameters c_n^j . Both will of course affect trade volumes, but we would like to extract technology T_n^j from these estimates. In order to do that, we follow the approach of Shikher (2004). In particular, for each country n , the share of total spending going to home-produced goods is given by

$$\frac{X_{nn}^j}{X_n^j} = T_n^j \left(\frac{\Gamma c_n^j}{p_n^j} \right)^{-\theta}.$$

Dividing by its U.S. counterpart yields:

$$\frac{X_{nn}^j/X_n^j}{X_{us,us}^j/X_{us}^j} = \frac{T_n^j}{T_{us}^j} \left(\frac{c_n^j p_{us}^j}{c_{us}^j p_n^j} \right)^{-\theta} = S_n^j \left(\frac{p_{us}^j}{p_n^j} \right)^{-\theta},$$

and thus the ratio of price levels in sector j relative to the U.S. becomes:

$$\frac{p_n^j}{p_{us}^j} = \left(\frac{X_{nn}^j/X_n^j}{X_{us,us}^j/X_{us}^j} \frac{1}{S_n^j} \right)^{\frac{1}{\theta}}. \quad (\text{A.1})$$

The entire right-hand side of this expression is either observable or estimated. Thus, we can impute the price levels relative to the U.S. in each country and each tradeable sector.

The cost of the input bundles relative to the U.S. can be written as:

$$\frac{c_n^j}{c_{us}^j} = \left(\frac{w_n}{w_{us}} \right)^{\alpha_j \beta_j} \left(\frac{r_n}{r_{us}} \right)^{(1-\alpha_j) \beta_j} \left(\prod_{k=1}^J \left(\frac{p_n^k}{p_{us}^k} \right)^{\gamma_{k,j}} \right)^{1-\beta_j} \left(\frac{p_n^{J+1}}{p_{us}^{J+1}} \right)^{\gamma_{J+1,j} (1-\beta_j)}.$$

Using information on relative wages, returns to capital, price in each tradeable sector from (A.1), and the nontradeable sector price relative to the U.S., we can thus impute the costs of the input bundles relative to the U.S. in each country and each sector. Armed with those values, it is

straightforward to back out the relative technology parameters:

$$\frac{T_n^j}{T_{us}^j} = S_n^j \left(\frac{c_n^j}{c_{us}^j} \right)^\theta.$$

A.2 Complete Estimation

So far we have estimated the levels of technology of the tradeable sectors relative to the United States. To complete our estimation, we still need to find (i) the levels of T for the tradeable sectors in the United States; (ii) the taste parameters ω_j , and (iii) the nontradeable technology levels for all countries.

To obtain (i), we use the NBER-CES Manufacturing Industry Database for the U.S. (Bartelsman and Gray 1996). We start by measuring the observed TFP levels for the tradeable sectors in the U.S.. The form of the production function gives

$$\ln Z_{us}^j = \ln \Lambda_{us}^j + \beta_j \alpha_j \ln L_{us}^j + \beta_j (1 - \alpha_j) \ln K_{us}^j + (1 - \beta_j) \sum_{k=1}^{J+1} \gamma_{k,j} \ln M_{us}^{k,j}, \quad (\text{A.2})$$

where Λ^j denotes the measured TFP in sector j , Z^j denotes the output, L^j denotes the labor input, K^j denotes the capital input, and $M^{k,j}$ denotes the intermediate input from sector k . The NBER-CES Manufacturing Industry Database offers information on output, and inputs of labor, capital, and intermediates, along with deflators for each. Thus, we can estimate the observed TFP level for each manufacturing tradeable sector using the above equation.

If the United States were a closed economy, the observed TFP level for sector j would be given by $\Lambda_{us}^j = (T_{us}^j)^\frac{1}{\theta}$. In the open economies, the goods with inefficient domestic productivity draws will not be produced and will be imported instead. Thus, international trade and competition introduce selection in the observed TFP level, as demonstrated by Finicelli, Pagano and Sbracia (2009a). We thus use the model to back out the true level of T_{us}^j of each tradeable sector in the United States. Here we follow Finicelli et al. (2009a) and use the following relationship:

$$(\Lambda_{us}^j)^\theta = T_{us}^j + \sum_{i \neq us} T_i^j \left(\frac{c_i^j d_{us,i}^j}{c_{us}^j} \right)^{-\theta}.$$

Thus, we have

$$(\Lambda_{us}^j)^\theta = T_{us}^j \left[1 + \sum_{i \neq us} \frac{T_i^j}{T_{us}^j} \left(\frac{c_i^j d_{us,i}^j}{c_{us}^j} \right)^{-\theta} \right] = T_{us}^j \left[1 + \sum_{i \neq us} S_i^j \left(d_{us,i}^j \right)^{-\theta} \right]. \quad (\text{A.3})$$

This equation can be solved for underlying technology parameters T_{us}^j in the U.S., given estimated

observed TFP Λ_{us}^j , and all the S_i^j 's and $d_{us,i}^j$'s estimated in the previous subsection.

To estimate the taste parameters $\{\omega_j\}_{j=1}^J$, we use information on final consumption shares in the tradeable sectors in the U.S.. We start with a guess of $\{\omega_j\}_{j=1}^J$ and find sectoral prices p_n^k as follows. For an initial guess of sectoral prices, we compute the tradeable sector aggregate price and the nontradeable sector price using the data on the relative prices of nontradeables to tradeables. Using these prices, we calculate sectoral unit costs and Φ_n^j 's, and update prices according to equation (2), iterating until the prices converge. We then update the taste parameters according to equation (4), using the data on final sectoral expenditure shares in the U.S.. We normalize the vector of ω_j 's to have a sum of one, and repeat the above procedure until the values for the taste parameters converge.

Finally, we estimate the nontradeable sector TFP using the relative prices. In the model, the nontradeable sector price is given by

$$p_n^{J+1} = \Gamma(T_n^{J+1})^{-\frac{1}{\theta}} c_n^{J+1}.$$

Since we know the aggregate price level in the tradeable sector p_n^T , c_n^{J+1} , and the relative price of nontradeables (which we take from the data), we can back out T_n^{J+1} from the equation above for all countries.

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Table 1. Country-Pair Correlations

	POL	HUN	CZE	SVK	SVN	ROM	BGR	RUS	UKR	KAZ
GBR	0.703	0.270	0.390	0.445	0.600	0.135	0.352	0.320	0.191	-0.083
FRA	0.898	0.570	0.776	0.688	0.915	0.367	0.657	0.666	0.577	0.131
DEU	0.985	0.435	0.774	0.806	0.915	0.522	0.826	0.863	0.669	0.139
ITA	0.930	0.406	0.826	0.875	0.983	0.559	0.779	0.839	0.645	0.144
NLD	0.531	0.291	0.500	0.488	0.707	0.116	0.218	0.181	0.144	-0.027
BEL	0.664	0.268	0.617	0.696	0.840	0.322	0.393	0.416	0.301	0.006
AUT	0.681	0.393	0.452	0.396	0.595	0.103	0.366	0.286	0.251	0.014
CHE	0.786	0.832	0.898	0.535	0.859	0.312	0.763	0.717	0.795	0.401
NOR	0.879	0.060	0.593	0.932	0.859	0.628	0.693	0.815	0.478	-0.024
SWE	0.820	0.342	0.748	0.833	0.943	0.480	0.596	0.650	0.480	0.049
FIN	0.896	0.638	0.889	0.754	0.953	0.467	0.800	0.814	0.744	0.264
DNK	0.974	0.478	0.791	0.800	0.912	0.505	0.802	0.836	0.654	0.146
ESP	0.940	0.498	0.872	0.848	0.967	0.566	0.833	0.870	0.727	0.218
PRT	0.624	0.910	0.823	0.328	0.666	0.196	0.672	0.570	0.765	0.479
GRC	0.694	0.593	0.785	0.586	0.868	0.254	0.507	0.454	0.490	0.221
IRL	0.515	0.174	0.390	0.496	0.627	0.138	0.176	0.157	0.081	-0.082
ISL	0.318	0.108	0.362	0.433	0.575	0.116	0.053	0.034	0.009	-0.039

Notes: This table reports the correlations in sectoral technological similarities between each West European-East European country pair. The correlations are between T_n^j 's demeaned by the country-specific geometric average T_n^j .

Table 2. Welfare Gains in Western and Eastern Europe

West	Δ Welfare	East	Δ Welfare
United Kingdom	0.058 %	Poland	3.398 %
France	0.009 %	Hungary	6.234 %
Germany	0.200 %	Czech Republic	7.902 %
Italy	0.109 %	Slovak Republic	6.054 %
Netherlands	0.136 %	Slovenia	5.127 %
Belgium-Luxembourg	0.084 %	Romania	3.727 %
Austria	0.347 %	Bulgaria	9.155 %
Switzerland	0.119 %	Russian Federation	1.365 %
Norway	0.062 %	Ukraine	2.772 %
Sweden	0.111 %	Kazakhstan	4.663 %
Finland	0.266 %		
Denmark	0.088 %	Mean	5.040 %
Spain	0.035 %		
Portugal	0.005 %		
Greece	0.027 %		
Ireland	0.052 %		
Iceland	0.103 %		
Mean	0.107 %		

Notes: This table reports the percentage changes in welfare due to the trade integration of Eastern Europe.

Table 3. Welfare Gains, Technological Similarity, and Trade costs

	(1)	(2)	(3)
	Equal-Weighted	Population-Weighted	GDP-Weighted
Dep. Var.: Change in Welfare			
Technological Similarity	-0.742 (0.553)	-0.930*** (0.278)	-1.034*** (0.297)
Trade Costs	-12.620*** (3.555)	-15.163*** (3.049)	-15.445*** (2.925)
Total GDP	0.031 (0.165)	0.250** (0.101)	0.253** (0.093)
Constant	4.134 (4.552)	1.445 (2.912)	1.410 (2.751)
Observations	17	17	17
R ²	0.472	0.707	0.738
Partial R ²	0.095	0.354	0.390

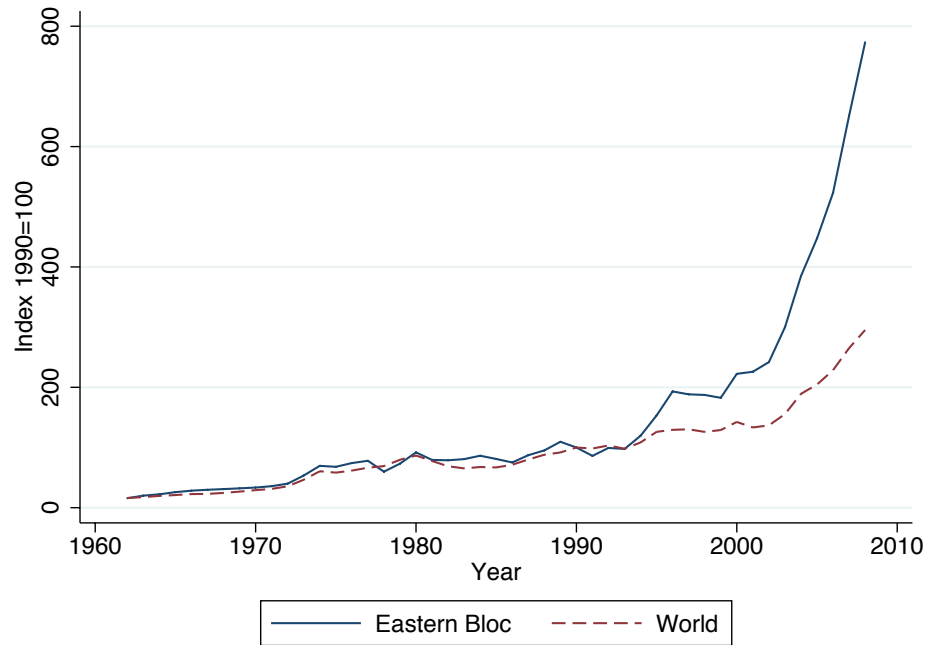
Notes: Standard errors clustered at the country level in parentheses; ***: significant at 1%; **: significant at 5%. All left-hand side and right-hand side variables are in natural logs. The sample is of West European countries. “Equal-Weighted,” “Population-Weighted,” and “GDP-Weighted” refers to how Technological Similarity and Trade Cost variables are averaged for each West European country across East European trading partners. “Partial R²” reports share of the variation explained by the Technological Similarity variable, after netting out the explanatory effect of the other regressors. Variable definitions and sources are described in detail in the text.

Table 4. Percentage Changes in Cross-Regional Trade Volumes

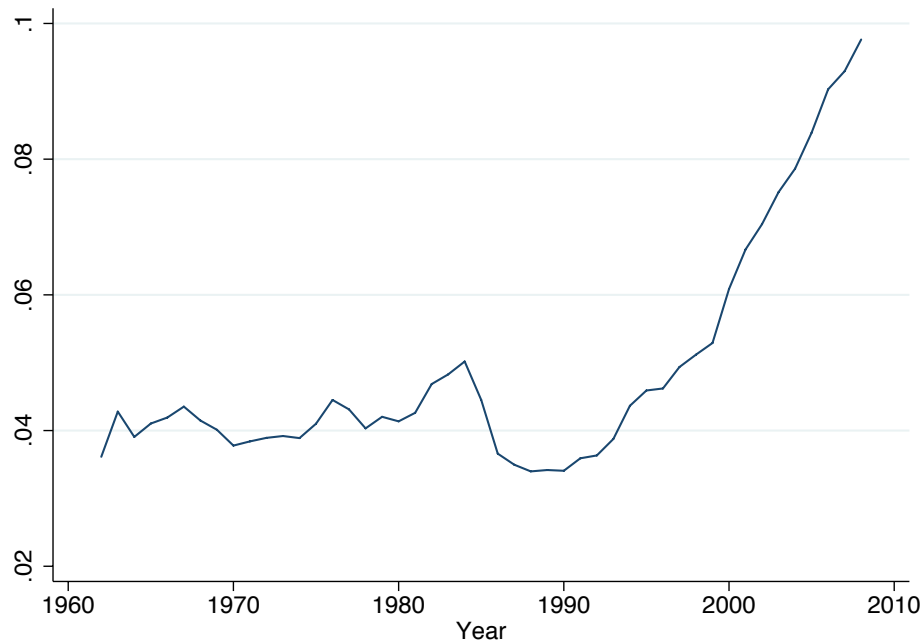
Destination country groups	Source country groups					
	Western Europe	Non-Europe OECD	Latin America /Caribbean	Middle East /North Africa	East and South Asia	Sub-Saharan Africa
Western Europe		-1.123	-2.005	-3.064	-1.398	-3.005
Non-Europe OECD	-0.819		0.014	-0.030	-0.136	1.032
Latin America/Caribbean	-0.797	-0.312		-0.663	-0.165	0.057
Middle East/North Africa	-2.584	-1.670	-4.456		-1.605	-3.992
East and South Asia	-1.539	-0.595	-1.806	-1.354		-1.775
Sub-Saharan Africa	-3.760	-2.188	-7.274	-10.280	-2.809	
						1.509
						2.797
						3.808
						0.179
						1.882
						29.671

Notes: This table reports the percentage changes in imports from regions in the columns to regions in the rows. The last column reports the percentage changes in total imports for each region in the row. That value includes the East European imports.

Figure 1. International Trade in Eastern Europe, 1962-2007



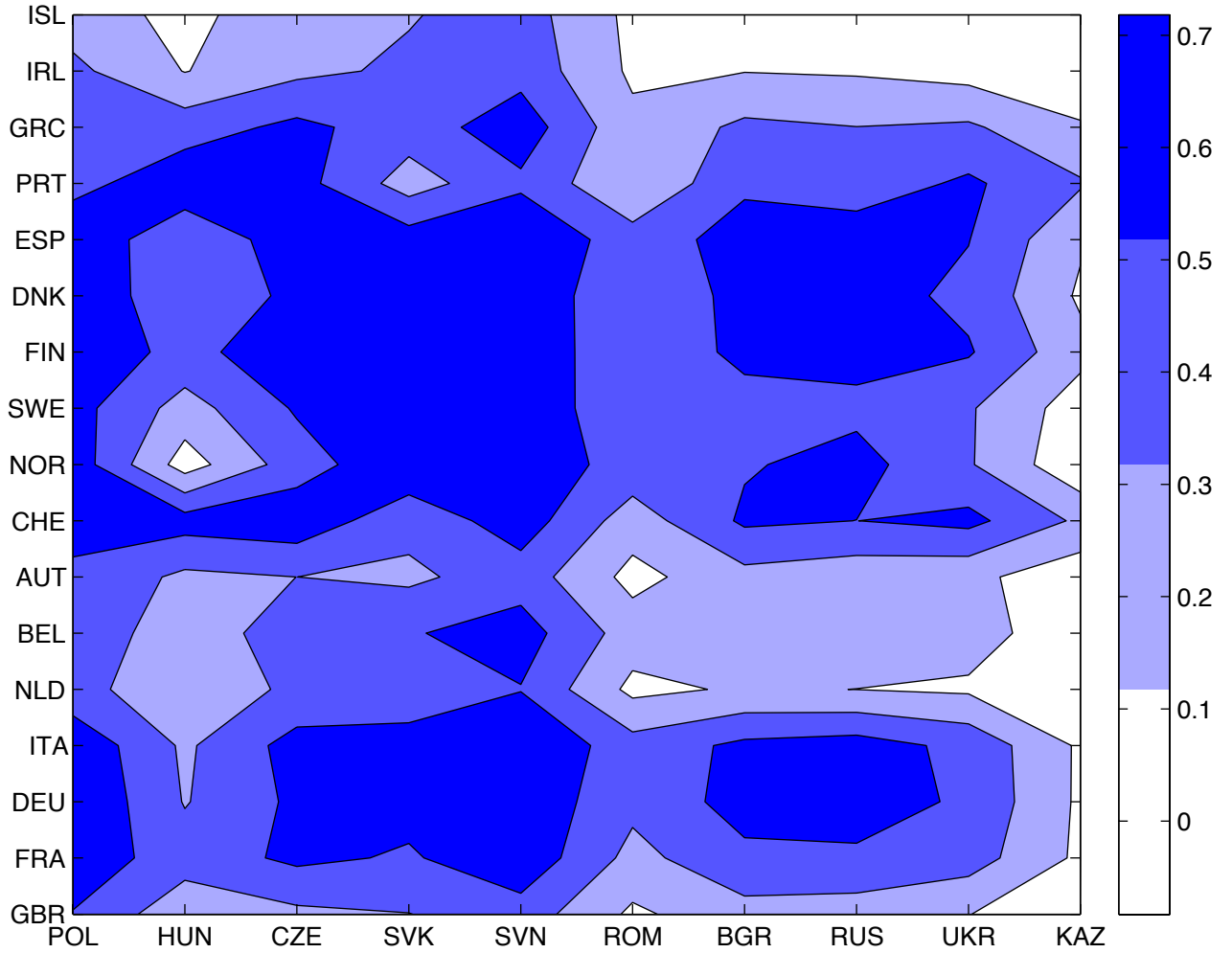
(a) East European and World Trade, Index Number, 1990=100



(b) Share of Imports from Eastern Europe in Total West European Imports

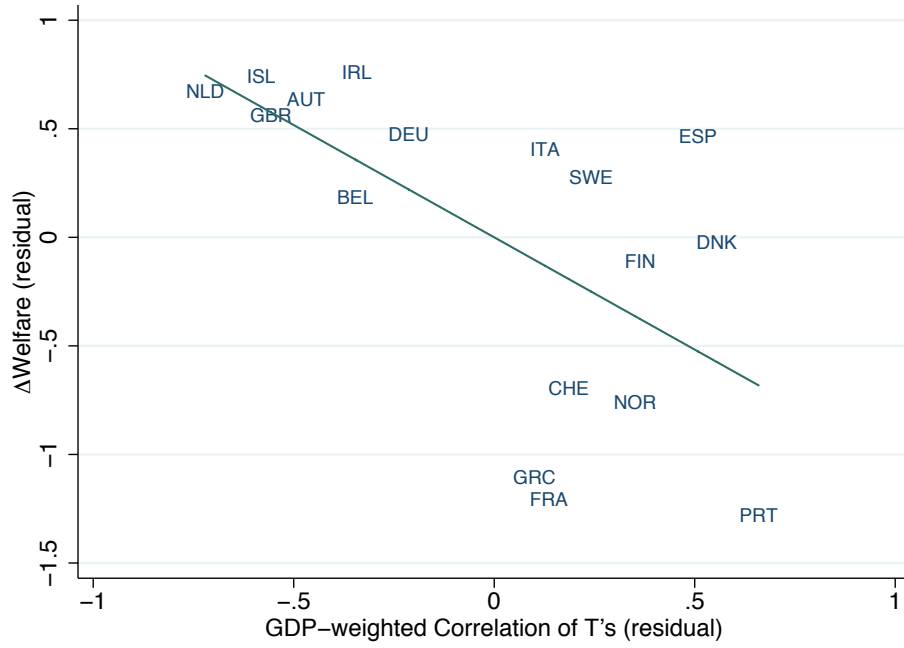
Notes: Figure 1(a) plots the total real (inflation-adjusted) exports from Eastern Europe (solid line), and the total real (inflation-adjusted) world exports (dashed line), for the period 1962-2007. Both series are normalized such that the 1990 value equals 100. Figure 1(b) plots the share of imports coming from Eastern Europe in the total imports of Western Europe, 1962-2007.

Figure 2. Sectoral Similarity, Contour Plot

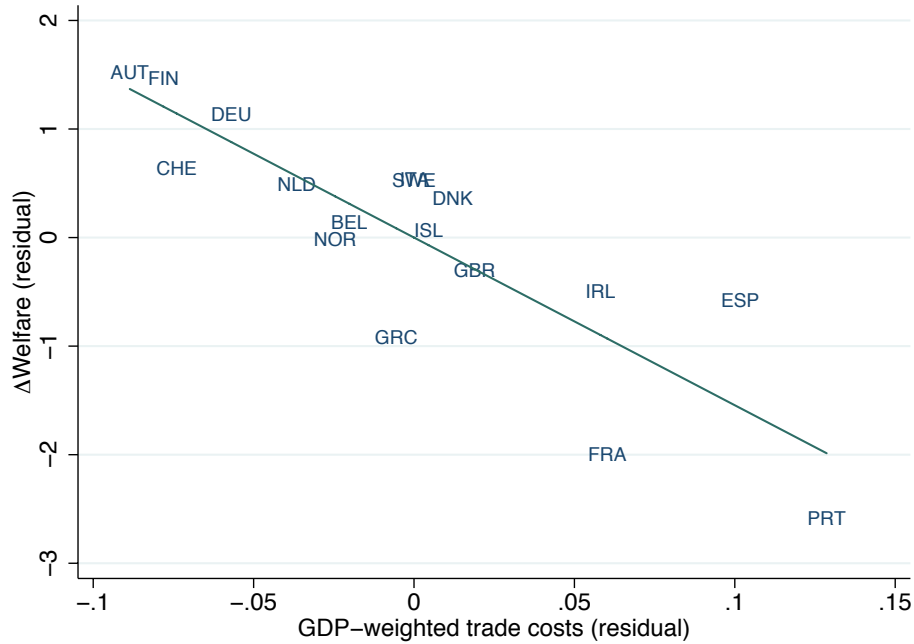


Notes: This figure displays the contour plot of correlations between sectoral T_n^j 's between West European countries (rows) and East European countries (columns). Darker shades indicate higher correlations.

Figure 3. Welfare Gains Similarity, and Trade Costs



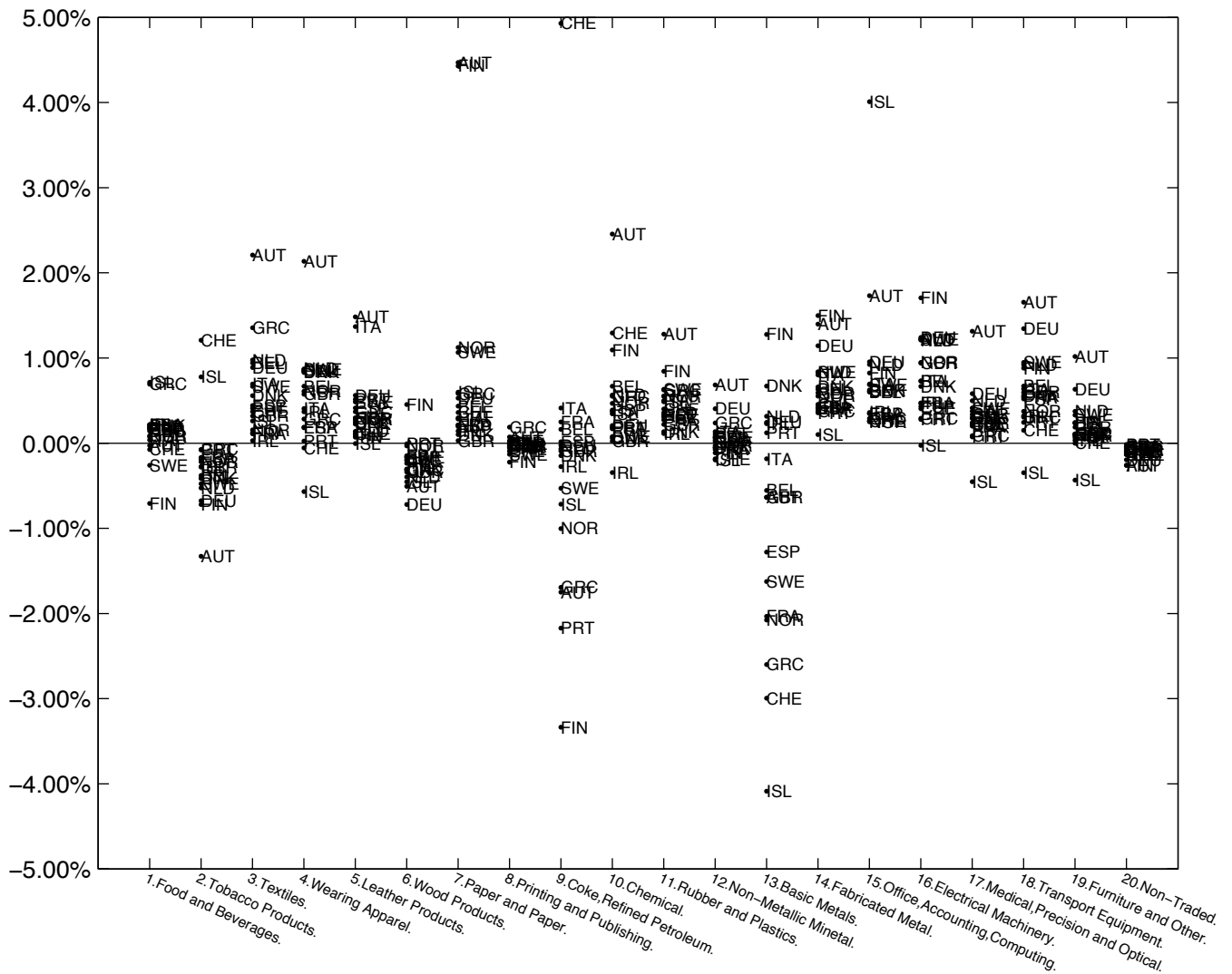
(a) Welfare Gains and Similarity



(b) Welfare Gains and Trade Costs

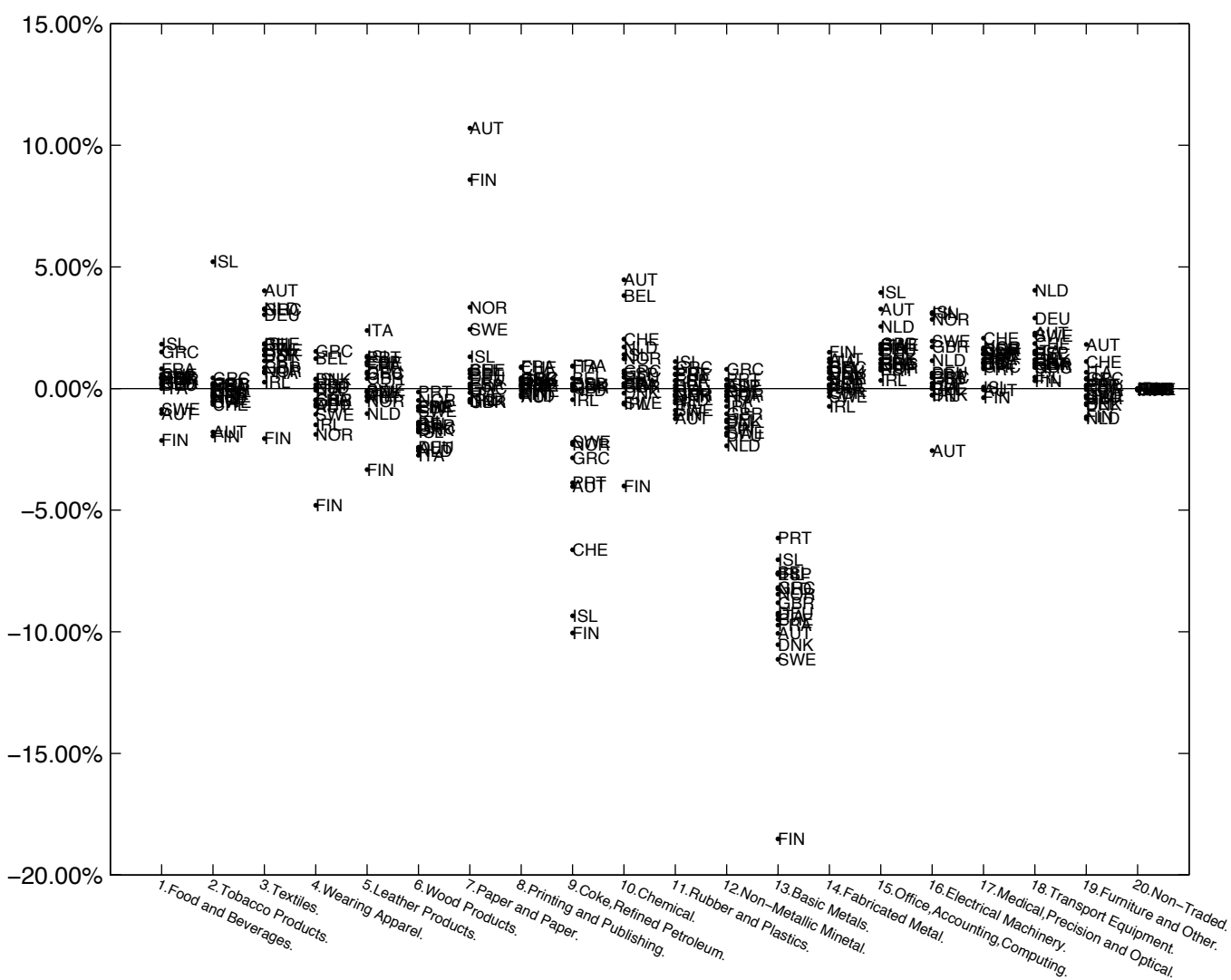
Notes: Figure 3(a) plots the partial correlation between log welfare gains from European integration and the GDP-weighted sectoral similarity, after netting out trade costs and total country GDP. Figure 3(b) plots the partial correlation between log welfare gains from European integration and the GDP-weighted trade costs, after netting out sectoral similarity and total country GDP.

Figure 4. Changes in Sectoral Composition: Shares of Value Added



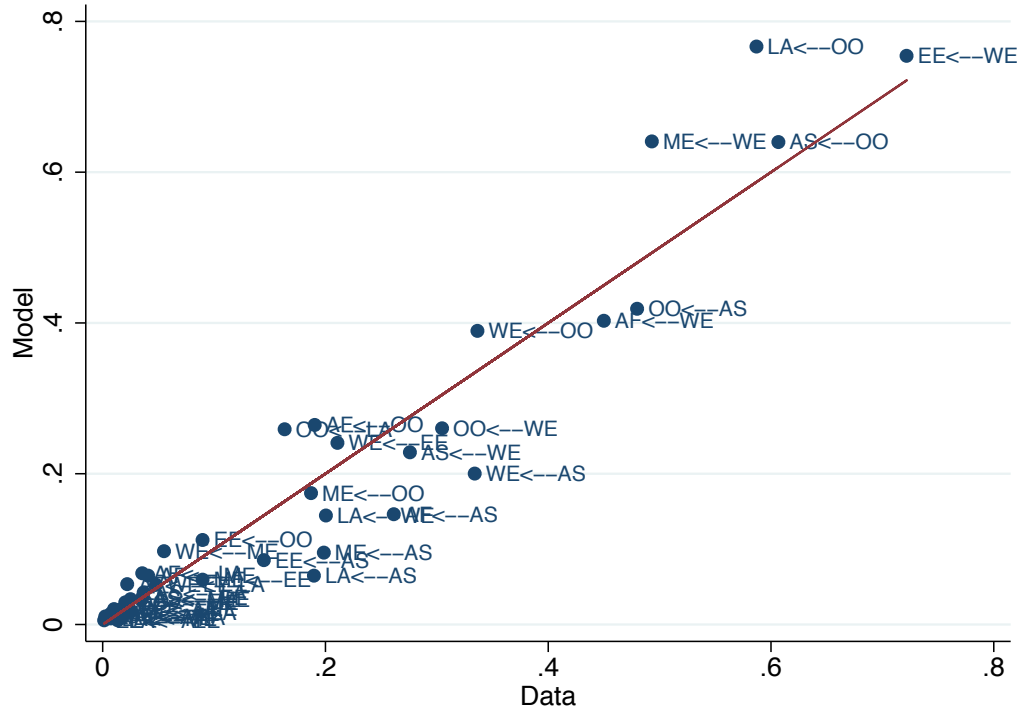
Notes: This figure displays the percentage changes in the shares of value added, for each sector and each country.

Figure 5. Changes in Sectoral Composition: Shares of Employment



Notes: This figure displays the percentage changes in the shares of employment, for each sector and each country.

Figure 6. Shares of Manufacturing Imports: Model vs. Data



Notes: This Figure displays the scatterplot of the share of manufacturing imports from each region to each region in the data (x-axis) against the model (y-axis). For convenience, a 45-degree line is added to the plot. Data labels: WE=Western Europe; EE=Eastern Europe; OO=non-Europe OECD countries; LA=Latin America and the Caribbean; ME=Middle East and North Africa; AS=East and South Asia; AF=Sub-Saharan Africa. The first label represents the importing region, the second label the exporting region (thus, WE←EE is the share of West European imports coming from Eastern Europe).

Table A1. Country Coverage

West European		East European	
United Kingdom	Sweden	Poland	Romania
France	Finland	Hungary	Bulgaria
Germany	Denmark	Czech Republic	Russian Federation
Italy	Spain	Slovak Republic	Ukraine
Netherlands	Portugal	Slovenia	Kazakhstan
Belgium-Luxembourg	Greece		
Austria	Ireland		
Switzerland	Iceland		
Norway			
Rest of World			
United States	Costa Rica	Jordan	Philippines
Canada	Ecuador	Kuwait	Thailand
Japan	El Salvador	Saudi Arabia	Vietnam
Turkey	Guatemala	Egypt Arab Rep.	Ethiopia
Australia	Honduras	Bangladesh	Ghana
New Zealand	Mexico	Sri Lanka	Kenya
South Africa	Peru	Taiwan Province of China	Mauritius
Argentina	Uruguay	India	Nigeria
Bolivia	Venezuela RB	Indonesia	Senegal
Brazil	Trinidad and Tobago	Korea Rep.	Tanzania
Chile	Iran Islamic Rep.	Malaysia	Fiji
Colombia	Israel	Pakistan	China

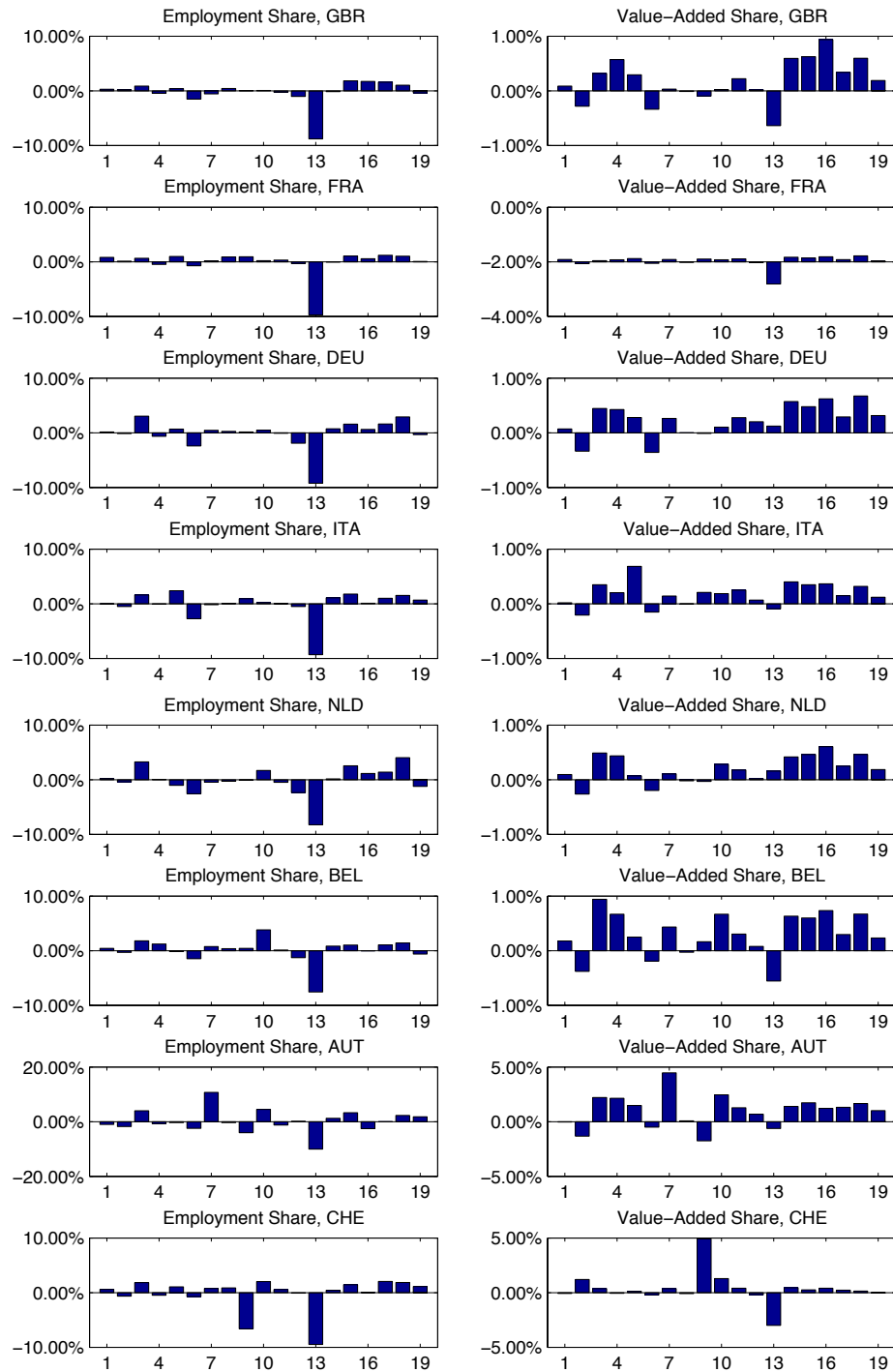
Notes: This table reports the countries in the sample.

Table A2. Sectors

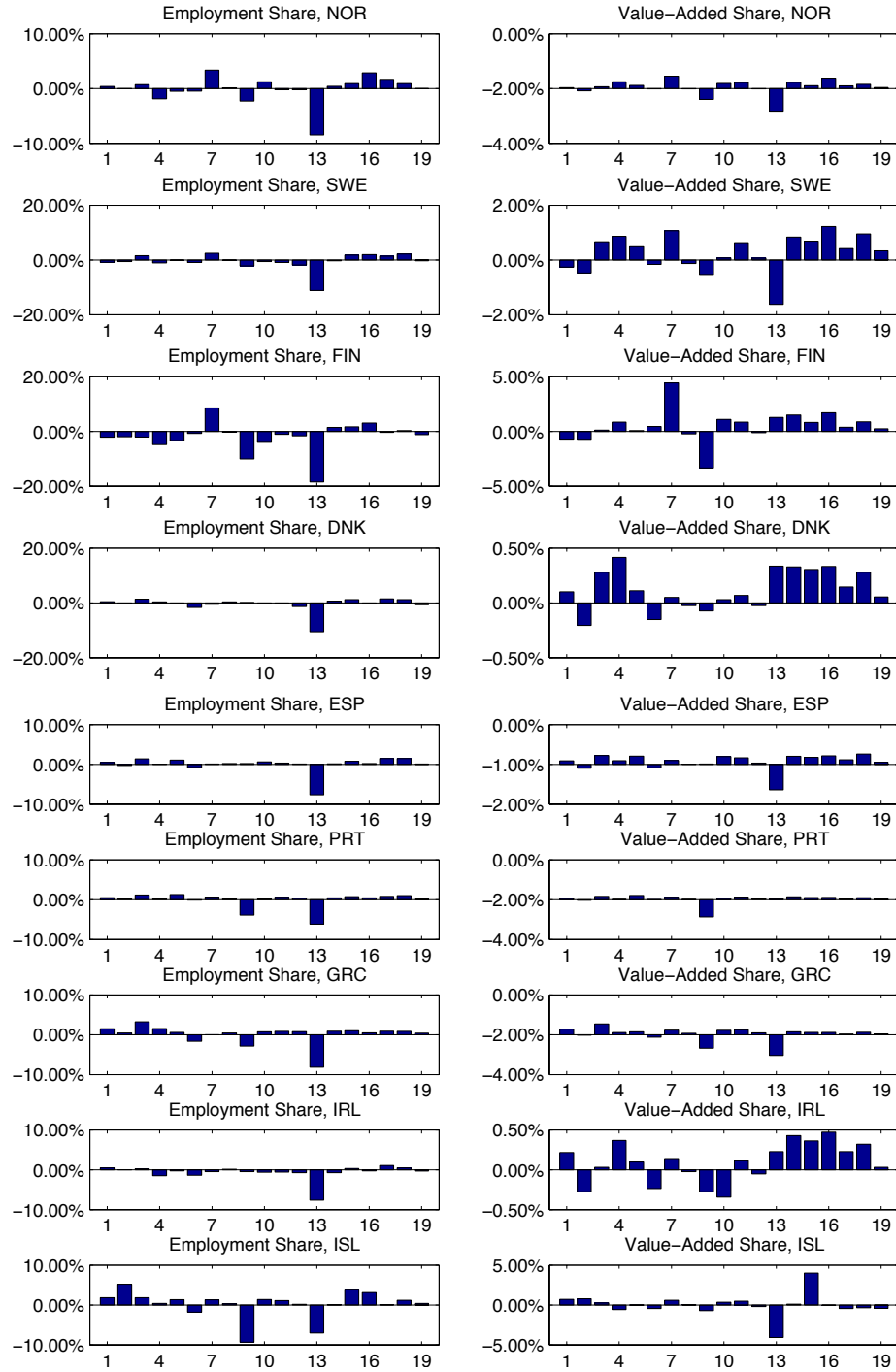
ISIC code	Sector Name	α_j	β_j	$\gamma_{J+1,j}$	ω_j
15	Food and Beverages	0.315	0.281	0.303	0.209
16	Tobacco Products	0.264	0.520	0.527	0.010
17	Textiles	0.467	0.371	0.295	0.025
18	Wearing Apparel, Fur	0.493	0.377	0.320	0.089
19	Leather, Leather Products, Footwear	0.485	0.359	0.330	0.014
20	Wood Products (Excl. Furniture)	0.452	0.372	0.288	0.009
21	Paper and Paper Products	0.366	0.344	0.407	0.012
22	Printing and Publishing	0.484	0.469	0.407	0.004
23	Coke, Refined Petroleum Products, Nuclear Fuel	0.244	0.243	0.246	0.092
24	Chemical and Chemical Products	0.308	0.373	0.479	0.008
25	Rubber and Plastics Products	0.385	0.387	0.350	0.014
26	Non-Metallic Mineral Products	0.365	0.459	0.499	0.071
27	Basic Metals	0.381	0.299	0.451	0.002
28	Fabricated Metal Products	0.448	0.398	0.364	0.012
29C	Office, Accounting, Computing, and Other Machinery	0.473	0.390	0.388	0.094
31A	Electrical Machinery, Communication Equipment	0.405	0.380	0.416	0.057
33	Medical, Precision, and Optical Instruments	0.456	0.428	0.441	0.036
34A	Transport Equipment	0.464	0.343	0.286	0.175
36	Furniture and Other Manufacturing	0.460	0.407	0.397	0.065
4A	Nontradeables	0.561	0.651	0.788	
	Mean	0.414	0.393	0.399	0.053
	Min	0.244	0.243	0.246	0.002
	Max	0.561	0.651	0.788	0.209

Notes: This table reports the sectors used in the analysis. The classification corresponds to the ISIC Revision 3 2-digit, aggregated further due to data availability. α_j is the value-added based labor intensity; β_j is the share of value added in total output; $\gamma_{J+1,j}$ is the share of nontradeable inputs in total intermediate inputs; ω_j is the taste parameter for tradeable sector j , estimated using the procedure described in Section A.2. Variable definitions and sources are described in detail in the text.

Figure A1. Changes in Sectoral Composition, by Country



Notes: This figure displays the percentage changes in value added shares (left panels) and employment shares (right panels) in each West European country under the benchmark compared to the counterfactual in which Eastern Europe is in autarky.



Notes: This figure displays the percentage changes in value added shares (left panels) and employment shares (right panels) in each West European country under the benchmark compared to the counterfactual in which Eastern Europe is in autarky.