Welfare Impact of European Integration

SUMMARY

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 79 countries, and compare welfare in the 2000s to a counterfactual scenario in which East European countries are closed to trade. For West European countries, the mean welfare gain from trade integration with Eastern Europe is 0.16%, ranging from zero for Portugal to 0.4% for Austria. For East European countries, gains from trade are 9.23% at the mean, ranging from 2.85% for Russia to 20% for Estonia. For Eastern Europe, comparative advantage is a key determinant of the variation in the welfare gains: countries whose comparative advantage is most similar to Western Europe tend to gain less, while countries with technology most different from Western Europe gain the most.

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Comparative advantage and the welfare impact of European integration

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1. INTRODUCTION

The fall of the Iron Curtain 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 total inflation-adjusted exports of the East European countries between 1962 and 2007, expressed as an index number relative to 1990. The nearly eight-fold expansion in East European exports between 1990 and 2007 far outpaces the growth of overall world trade. For geographical, historical and political reasons, Western Europe is the region most affected by the integration of ex-communist countries. Figure 1(b) plots the share of Eastern

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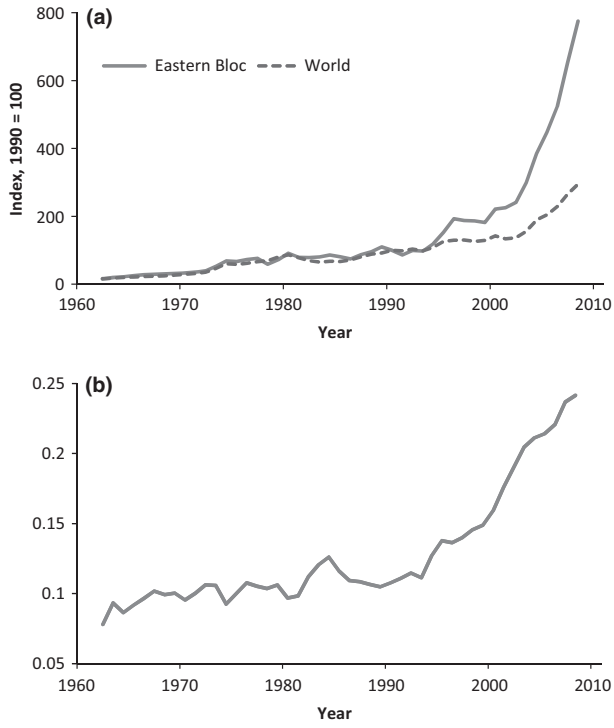

Figure 1. International trade in Eastern Europe, 1962–2007: (a) East European and World Trade, Index Number, 1990 = 100; (b) Share of imports from Eastern Europe in total West European imports

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 from the rest of the world, 1962–2007.

Source: UN COMTRADE.

Europe in total West European imports from the rest of the world. After remaining stable at about 10% from the early 1960s to the early 1990s, it reached 24% by 2007.

Such episodes of rapid trade integration of large regions are relatively rare, and provide an important 'laboratory' for a quantitative study of the welfare gains from trade. This paper provides a comprehensive quantitative assessment of the welfare gains from the post-Cold War European trade integration. The analysis extends the quantitative framework recently developed by Levchenko and Zhang (2011). We build a multisector Ricardian-Heckscher–Ohlin model that incorporates a number of realistic features, such as 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. We use the model to estimate sector-level productivities – comparative advantage – for 19 manufacturing sectors and a sample of 79 countries that includes 17 West European and 14 East European countries, as well as virtually all important economies in the rest of the world.

The key advantage of our multi-sector framework is that unlike quantitative assessments based on one-sector models (e.g. Eaton and Kortum, 2002; Alvarez and Lucas, 2007; Arkolakis *et al.,* 2012), we can 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 for welfare gains from European integration in particular.

We first use our sectoral productivity estimates to document that there is indeed a great deal of variation in relative technology among the different countries in our sample. Correlations of sectoral productivities range from 0.16 between Russia and the Netherlands, to virtually 1 between Finland and Poland. Among the West European countries, average (GDP-weighted) correlations in sectoral technology with the Eastern bloc countries as a group range from 0.285 and 0.417 for the Netherlands and Ireland to 0.928 and 0.926 for Switzerland and Finland. Similarly, for Eastern Europe, GDP-weighted average correlations with Western Europe range from 0.533 and 0.537 for Estonia and Kazakhstan to 0.921 and 0.916 for Poland and Slovenia.

We then quantify the welfare gains from the trade integration of Eastern Europe, by comparing welfare in each West and East European country to a counterfactual scenario in which Eastern Europe is closed to trade. For each East European country, this comparison reveals the total gains from trade relative to autarky. The mean gain for Eastern Europe is 9.23%, ranging from 2.85% for Russia to 20% for Estonia. Ricardian comparative advantage plays an important role in explaining the variation in welfare gains in Eastern Europe. Controlling for country size and average trade costs, East European countries that are similar in relative technology to Western Europe – the wealthier Central European countries – tend to gain less. The most technologically different countries – Estonia and Kazakhstan – gain the most. The impact of similarity in comparative advantage is significant in magnitude: a one-standard deviation change in similarity to Western Europe increases the welfare gains for an East European country by 2.4%, all else equal.

For Western Europe, the mean gain from East European trade integration is 0.16%, ranging from zero for Portugal to 0.4% for Austria. Technological similarity to Eastern Europe does not help account – in the least-squares sense – for the variation in the gains to Western Europe. Trade costs with the East European countries are the predominant determinant of the variation in gains.

Not surprisingly, West European gains are much smaller, since 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. Even at the peak, imports from Eastern Europe take up only a quarter of total West European imports

from outside the region. Probing further, the main reason for the negligible role of comparative advantage is that the rest of the world has very similar sectoral productivity to the East European countries as a group. The simple correlation of average sectoral productivities in Eastern Europe with average sectoral productivities in the other countries serving the West European market – the Americas, Asia and the Pacific, the Middle East and sub-Saharan Africa – is in excess of 0.9. Thus, from the perspective of Western Europe, taken as a group Eastern Europe looks much like the rest of the world economy with which it trades. This is not to say that individual East European countries are not very different from the rest of the world – they are. But on the whole, Eastern Europe is a collection of diverse economies that looks quite similar to the world as a whole in terms of comparative advantage.

As a result, when Western Europe opens to trade with the East European countries, its imports from all other regions decrease somewhat and total West European imports expand by a modest 5%. Opening to trade with Eastern Europe also has a negligible effect on the sectoral structure in the West: value added shares of individual sectors never change by more than a fraction of a percentage point. This implies that Western Europe's gains come largely from within-industry specialization. Thus, part of the reason for small welfare gains in Western Europe is that without East European trade Western Europe easily substitutes towards other source countries, and its industrial structure remains largely unchanged.

We place our analysis in a broader context by evaluating the impact of other policy experiments in the European economy, benchmarking the main results and informing the policy priorities. Our first exercise compares deeper trade integration within Western Europe and the EU to broader but shallower trade integration with countries farther afield. For the West European countries the welfare gains from greater intra-West European integration are on average 16 times larger than the gains from integration with Eastern Europe.[1] In addition, more than two-thirds of the West European gains from East European trade are due to the EU accession countries. Both of these results suggest that deeper integration brings much greater welfare gains than shallower integration with more distant economies.

Next, we compare the welfare benefits of different types of integration. Western Europe gains far less from the observed productivity growth in Eastern Europe than from trade integration *per se*. This suggests that the West derives negligible welfare benefits from technology transfer to Eastern Europe, and that the majority of those benefits accrue to the East European countries. Finally, we examine the impact of barriers to factor reallocation. Our results reveal an important role for the cross-sectoral reallocation of labour and capital in Eastern Europe. When factors of produc-

[1] Indeed, the welfare gains from the observed fall in trade costs within Western Europe from the 1960s to the 2000s are equivalent to more than half of the total West European gains from trade relative to complete autarky in the 2000s. Put simply, for a West European country the majority of the total benefits from international trade come from trading with other West European countries.

tion cannot reallocate across sectors, East European gains from trade integration are reduced by 14%. Equally important as the impact on aggregate gains, trade opening without sectoral reallocation can have dramatic distributional effects. The policy implications are twofold. In order to reap the full gains from trade, opening must be accompanied by policies that promote smooth functioning of both labour and capital markets. And, since wages and returns to capital can fall dramatically in some import-competing sectors, it is essential to supplement trade opening with appropriate social safety net programmes, especially in cases where trade liberalization is expected to lead to large cross-sectoral reallocations of resources.

This paper relates to the broad line of research that studies regional economic integration using quantitative models (see Baldwin and Venables, 1995, for a survey). With respect to its focus on Europe, our analysis is most closely related to computable general equilibrium (CGE) assessments of the welfare impact of East European trade integration (e.g. Baldwin *et al.*, 1997; Brown *et al.*, 1997; Hertel *et al.*, 1997; Baourakis *et al.*, 2008), and to the quantitative industry equilibrium studies of West European integration under imperfect competition (e.g. Smith and Venables, 1988; Ottaviano *et al.*, 2009; Corcos *et al.*, 2012).

The average magnitudes of the welfare effects in our paper are broadly in line with existing literature. For instance, Baldwin *et al.* (1997) find that the welfare gains from East European integration are about 0.1–0.2% for Western Europe, and 1.5–18.8% for Eastern Europe. Similarly, Brown *et al.* (1997) find that the gains from integration of Central Europe are well under 0.5% for Western Europe, and 4–7% for Central European countries themselves. Our main contribution to this literature is to focus on a neglected determinant of the gains from trade: Ricardian comparative advantage. We thus build on the CGE approach by incorporating the multi-sector Eaton and Kortum (2002) structure explicitly into a global general equilibrium framework. Our results are more complementary to the industry equilibrium investigations of Smith and Venables (1998), Ottaviano *et al.* (2009), and Corcos *et al.* (2012). While we ignore the pro-competitive effects of liberalization on firm scale, mark-ups and firm selection, we explicitly model cross-industry Ricardian specialization. Methodologically, our work builds on recent quantitative welfare assessments of trade integration and technological change in multi-sector Ricardian models (Shikher, 2011; Caliendo and Parro, 2010; Costinot *et al.*, 2012; Hsieh and Ossa, 2011; Levchenko and Zhang, 2011; di Giovanni *et al.*, 2012). This paper is the first to apply this type of analysis to the trade integration of Eastern Europe.

Before moving on to the description of the model and the results, we outline some limitations of our analysis. Though our estimates of capital stocks and productivity are taken from the data, our counterfactuals ignore any endogenous responses of factor endowments and technology to trade opening. For instance, our analysis abstracts from endogenous cross-border movements of capital in response to trade opening, and any resulting impacts on factor prices. Similarly, we do not model the possibility that trade opening was itself responsible for technology transfer from West to East,

and thus in the absence of trade productivity would be lower in Eastern Europe.[2] Similarly, it may be that trade openness will also result in changes in institutions, such as contract enforcement, property rights, or financial development. Our counterfactual exercises abstract from this potential indirect benefit of trade integration. In addition, because the model has no aggregate uncertainty, it also cannot be used to study the welfare benefits of improved international risk sharing.

The rest of the paper is organized as follows. Section 2 describes the basic features of the model and the quantitative implementation. Section 3 examines the welfare implications of East European integration, paying special attention to the role of comparative advantage. Section 4 performs a number of other policy experiments and discusses the policy implications of the results. Section 5 concludes. The Appendices collect the formal statement of the model equations, the description of the productivity estimation procedure, and the details of data collection.

2. ANALYTICAL AND QUANTITATIVE FRAMEWORK

The model is comprised of 79 countries, including 17 West European countries, 14 East European countries, and 48 non-European countries. The sample of countries is listed in Appendix Table A1.[3] There are 20 large sectors: 19 tradable manufacturing sectors, and one non-tradable sector. The sectors along with a number of salient sectoral characteristics in production and consumption are listed in Appendix Table A2.

Utility in each country aggregates consumption of these sectors. In our model, taste parameters associated with each sector are different, allowing for the possibility that some sectors (such as Food Products) carry a large weight in consumption, while others, such as Basic Metals, are not used much in final consumption. In addition, the share of tradables in the total consumption expenditure differs across countries according to income, to capture the well-known empirical regularity that the share of tradables in consumption tends to be higher in poorer countries. The parameters of the utility function are estimated based on country and sector-level consumption data, as detailed in the Web Appendix.

Each large sector aggregates a large number (formally a continuum) of varieties unique to each sector.[4] Each country can in principle produce each individual variety in each sector, but productivities will differ across countries, and be drawn from a country-specific random productivity distribution. In each individual sector, some

[2] The *cross-border* impact of technology transfer is quantitatively negligible, as we show in Section 4.2. Technology transfer accompanying trade opening may have a large impact on the country receiving the technology, but not on its trading partners.

[3] Due to lack of required data, a number of East European countries are missing. The missing countries include all but two of the countries comprising former Yugoslavia (Bosnia and Herzegovina, Croatia, Montenegro and Serbia), the trans-Caucasus countries (Armenia, Azerbaijan, Georgia), Albania, Belarus and Moldova. These countries together account for 14% of total Eastern bloc population and 10% of its GDP, but less than 6% of its exports.

[4] For instance, we can think of the Wearing Apparel sector as comprising of a large number of different garments.

countries will be on average more productive than others, and these relative differences in sectoral average productivity across countries – for which we adopt the shorthand 'Ricardian comparative advantage' – are central to our analysis. Countries that are on average relatively more productive in a particular sector will tend to be net exporters in that sector, as basic trade theory would predict. At the same time, because of the random nature of productivity draws in each country, even the relatively unproductive countries will produce and export some varieties in each sector. Because of this, the model will exhibit two-way, intra-industry trade between countries, which is a prominent feature of the data. The attractive feature of our model is that we can speak of classical, Ricardian predictions of trade theory while at the same time matching the observed, intra-industry trade between countries.

Following Chor (2010), we adopt a broad interpretation of sectoral productivity. Countries differ in a variety of ways, for instance in the quality of contract enforcement and property rights, financial development, and labour market institutions, among others. Recent empirical and theoretical literature has shown that all of these are sources of comparative advantage in international trade. Our paper adopts a reduced-form approach, under which institutions, financial development, and other country characteristics manifest themselves in productivity. For instance, countries with worse contracting institutions will have lower productivities in the more institutionally intensive sectors. Chor (2010) provides empirical evidence that sector-level trade patterns can indeed be modelled this way. We follow this approach by necessity, since it would be impractical to explicitly incorporate all of these various sources of comparative advantage into a quantitative framework of this scale.

All factor and goods markets are competitive. International trade in goods is subject to *ad valorem* ('iceberg') trade costs, while factors of production are immobile internationally. Production in each sector uses capital, labour and intermediate inputs from (potentially) all the sectors of the economy. Several features of the production structure are worth noting. First, labour (and conversely capital) intensity will differ across sectors, introducing a factor-proportions (Heckscher–Ohlin) motive for trade. On average, more capital-abundant countries will export in more capital-intensive sectors. Second, intermediate input usage will also differ across sectors. There will be variation in the overall intensity of intermediate input usage relative to value added. In addition, the pattern of intermediate input usage across sectors will be governed by an input–output matrix taken from the data. Third, there are extensive input–output linkages into and out of the non-tradable sector: tradables use non-tradable inputs, and vice versa. And fourth, because the input varieties are traded internationally, our model features the complex international production linkages that have become so prominent in global trade in recent years: a good in sector X may be initially produced in country A, exported to country B, where it is used as an intermediate in the production of sector Y, and the output of sector Y can then be exported back to country A (or some other country C), either for final consumption or further processing. Our model thus features the complete global production and consumption chain.

Appendix Table A2 lists the sectors along with the key production function parameter values for each sector: labour intensity (α_j), intermediate input intensity (β_j), the share of non-tradable inputs in total inputs ($\gamma_{\mathcal{J}+1,j}$), and the taste parameter in the utility function (ω_j).

In equilibrium, given all the exogenous parameter values, prices adjust so that all goods and factor markets clear. Importantly, factor market clearing involves optimal allocation of capital and labour across sectors (in Section 4 we explore a specific-factors variant of the model in which factors cannot move across sectors). Goods market clearing is obtained by imposing balanced trade.

The model has two principal uses. The first is to estimate sectoral productivity (denoted by T^j_n for country n in sector j from now on) for a large set of countries. The technology parameters in the tradable sectors relative to a reference country (the US) are estimated 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, sector-level trade costs (denoted by d^j_{ni} for shipping from country i to country n in sector j). The next step is to estimate the technology parameters in the tradable sectors for the US. 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. Third, we calibrate the non-tradable technology for all countries using the first-order condition of the model and the relative prices of non-tradables observed in the data. The detailed procedures for all three steps are described in Levchenko and Zhang (2011) and reproduced in Web Appendix B.

The second use of the quantitative model is to perform welfare analysis. Given the estimated sectoral productivities, factor endowments, trade costs, and model parameters, we solve the system of equations defining the equilibrium under the baseline values, as well as under counterfactual scenarios, and compare welfare. The algorithm for solving the model is described in Levchenko and Zhang (2011).

3. THE WELFARE IMPACT OF EUROPEAN INTEGRATION

3.1. Basic patterns

Table 1 reports the matrix of correlations of T^j_n in the tradable sectors $j = 1,\ldots,\mathcal{J}$ 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^j_n demeaned by each country's geometric average $\overline{T^j_n}$. It is clear that the differences in sectoral similarities between country pairs are pronounced. In East-

Table 1. Country-pair correlations

	BGR	CZE	EST	HUN	KAZ	LTU	LVA	MKD	POL	ROM	RUS	SVK	SVN	UKR	Mean
AUT	0.761	0.795	0.584	0.594	0.530	0.846	0.907	0.918	0.902	0.829	0.735	0.902	0.912	0.719	0.757
BLX	0.559	0.582	0.371	0.357	0.273	0.683	0.745	0.765	0.766	0.725	0.580	0.738	0.760	0.488	0.585
CHE	0.985	0.973	0.720	0.796	0.795	0.867	0.965	0.951	0.975	0.901	0.926	0.980	0.987	0.975	0.928
DEU	0.903	0.832	0.474	0.544	0.524	0.745	0.901	0.889	0.984	0.976	0.933	0.923	0.959	0.830	0.880
DNK	0.869	0.895	0.674	0.704	0.660	0.898	0.967	0.970	0.960	0.878	0.824	0.968	0.973	0.841	0.845
ESP	0.946	0.884	0.545	0.619	0.609	0.783	0.931	0.916	0.997	0.978	0.955	0.952	0.979	0.888	0.912
FIN	0.969	0.928	0.622	0.697	0.689	0.828	0.956	0.941	0.998	0.956	0.950	0.974	0.993	0.930	0.926
FRA	0.861	0.827	0.512	0.562	0.525	0.789	0.912	0.908	0.968	0.939	0.875	0.927	0.955	0.797	0.846
GBR	0.715	0.770	0.593	0.592	0.519	0.846	0.883	0.901	0.864	0.776	0.677	0.876	0.881	0.680	0.714
GRC	0.959	0.989	0.798	0.852	0.840	0.929	0.991	0.984	0.959	0.857	0.870	0.994	0.986	0.966	0.905
IRL	0.377	0.458	0.357	0.306	0.201	0.638	0.636	0.669	0.608	0.537	0.372	0.614	0.621	0.328	0.417
ISL	0.684	0.576	0.178	0.228	0.187	0.531	0.711	0.707	0.848	0.898	0.791	0.736	0.795	0.562	0.698
ITA	0.937	0.862	0.502	0.581	0.571	0.752	0.911	0.896	0.993	0.984	0.959	0.936	0.969	0.870	0.905
NLD	0.246	0.426	0.506	0.412	0.296	0.685	0.582	0.628	0.454	0.315	0.159	0.539	0.507	0.256	0.282
NOR	0.737	0.711	0.411	0.437	0.380	0.725	0.838	0.842	0.897	0.879	0.773	0.848	0.879	0.658	0.744
PRT	0.847	0.968	0.956	0.982	0.971	0.957	0.922	0.921	0.792	0.622	0.670	0.908	0.860	0.922	0.779
SWE	0.801	0.761	0.439	0.480	0.434	0.742	0.870	0.869	0.937	0.921	0.834	0.884	0.917	0.724	0.798
Mean	0.823	0.807	0.533	0.575	0.537	0.782	0.886	0.884	0.921	0.879	0.820	0.895	0.916	0.772	

Notes: This table reports the correlations in sectoral technological similarities between each West European-East European country pair. The correlations are between $\dot{T}_n^i$'s demeaned by the country-specific geometric average $\dot{T}_n^i$. The last column and last row report GDP-weighted average correlations.
Source: Authors' calculations.

ern Europe, countries most similar to the West are Poland, Slovenia and Slovakia, while Estonia and Kazakhstan are most different from the West. Among the West European countries, Finland and Switzerland have the most similar comparative advantage to Eastern Europe, while the Netherlands and Ireland are the most different.

3.2. Model fit

Our model matches quite closely the relative incomes of countries as well as bilateral and overall trade flows observed in the data. Table 2 compares the wages, returns to capital, and the trade shares in the baseline model solution and in the data. The top panel shows that mean and median wages implied by the model are very close to the data. The correlation coefficient between model-implied wages and those in the data is above 0.99. The second panel performs the same comparison for the return to capital. Since it is difficult to observe the return to capital in the data, we follow the approach adopted in the estimation of T^j_n, and impute return to capital r_n from an aggregate factor market clearing condition: $r_n/w_n = (1-\alpha)\, L_n /(\alpha\, K_n)$, where α is the aggregate share of labour in GDP, assumed to be 2/3, w_n is the wage rate, K_n is the capital endowment, and L_n is the labour endowment. Once again, the average levels of r_n are very similar in the model and the data, and the correlation between the two is 0.95.

Next, we compare the trade shares implied by the model to those in the data. The third panel of Table 2 reports the spending on domestically produced goods as a

Table 2. The fit of the baseline model with the data

	Model	Data
Wages		
Mean	0.390	0.351
Median	0.133	0.150
Corr (model, data)	*0.994*	
Return to capital		
Mean	0.896	0.939
Median	0.674	0.698
Corr (model, data)	*0.950*	
π^j_{nn}		
Mean	0.614	0.569
Median	0.676	0.609
Corr (model, data)	*0.922*	
$\pi^j_{ni,\ i\neq n}$		
Mean	0.005	0.006
Median	0.000	0.000
Corr (model, data)	*0.910*	

Notes: This table reports the means and medians of wages relative to the US (top panel); return to capital relative to the US (second panel), share of domestically produced goods in overall spending (third panel), and share of goods from country i in overall spending (bottom panel) in the model and in the data. Wages and return to capital in the data are calculated as described in Web Appendix B.
Source: Authors' calculations.

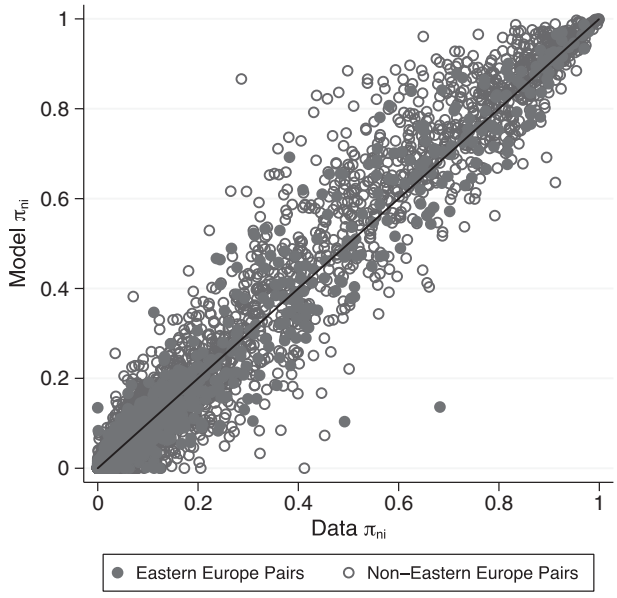

Figure 2. Benchmark Model vs. Data: p^j_{ni} for Eastern Europe and the Rest of the Sample

Notes This figure displays the model-implied values of p^j_{ni} on the y-axis against the values of p^j_{ni} in the data on the x-axis, where p^j_{ni} is defined as the share of spending on goods produced in country i in total sector j spending in country n. Solid dots depict p^j_{ni} in which either n or i is an East European country. Hollow dots represent the non-Eastern Europe p^j_{ni} 's. The line through the points is the 45-degree line

share of overall spending in country n and sector j, denoted by π^j_{nn}. These values reflect the overall trade openness, with lower values implying higher international trade as a share of absorption. Though we under-predict overall trade slightly (model π^j_{nn} tend to be higher), the averages are quite similar, and the correlation between the model and data values is 0.92. Finally, the bottom panel compares the international trade flows in the model and the data. The averages are very close, and the correlation between the model and data values is 0.91.

Figure 2 presents the comparison of trade flows graphically, by depicting the model-implied trade values against the data, along with a 45-degree line. Solid dots indicate cross-border trade shares (π^j_{ni}) that involve Eastern Europe, that is, trade flows in which an East European country is either an exporter or an importer. All in all the fit of the model to trade flows is quite good. Eastern Europe is unexceptional when it comes to the fit of the model, with East European trade flows clustered together with the rest of the observations.

3.3. Welfare analysis

This section evaluates the welfare gains from trade integration of Eastern Europe. To do so, we first compute welfare in the baseline model under the actual trade costs d^j_{ni}

estimated on data for the 2000s. We next compute the welfare in a counterfactual scenario in which all East European countries are in autarky.[5]

It is worth emphasizing precisely what our counterfactual exercises do, and correspondingly what effects would be missing from the welfare calculations presented in this paper. In the main counterfactual scenario, capital and labour endowments and all parameters characterizing technology are fixed at their baseline values, and only trade costs change (going from infinite to estimated values in Eastern Europe). This welfare comparison captures the static gains from goods trade for the countries involved. It does not, however, capture the possibility that this reduction in trade costs also caused endogenous cross-border movements of capital or labour, or endogenous changes in technology in the countries involved, for instance through technology transfer from West to East. Our counterfactuals also do not incorporate the possibility that trade opening caused changes in institutions for the countries involved. Section 4 will present some results on the welfare impact of technology and capital accumulation in Eastern Europe, that can be used to shed some light on the possible welfare impact of those types of changes as well, but a comprehensive assessment of the indirect effects of trade opening through factor endowment, technology or institutional changes remains outside the scope of this paper. Note also that while the precise numerical values for the welfare changes reported below may be the subject of some scepticism, the ranking of gains across countries and across sectors is both equally important, and probably more robust than the absolute numbers.

Table 3 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 the 2000s and the counterfactual model in which all East European countries are in autarky). All throughout, welfare is defined as the indirect utility function. Straightforward steps using the CES functional form can be used to show that indirect utility in each country n is equal to total income divided by the price level. Since the model is competitive, total income equals the total returns to factors of production. Expressed in per capita terms welfare is thus:

$$\frac{w_n + r_n k_n}{P_n} \tag{1}$$

where $k_n = K_n/L_n$ is capital per worker, and the consumption price level P_n comes from Equation (A.3) in the Web Appendix.

The gains to Western Europe are not large: the mean welfare increase is 0.16%, and the range is between essentially zero for Portugal and 0.4% for Austria. This

[5] In the counterfactual, each individual East European country is in autarky, that is, it does not trade with other Eastern bloc countries. Assuming complete autarky in this counterfactual 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. Our model is not suited to evaluate the welfare gains from 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.

Table 3. Welfare gains in Western and Eastern Europe

West	Δ Welfare (%)	East	Δ Welfare (%)
Austria	0.400	Bulgaria	12.571
Belgium–Luxembourg	0.131	Czech Republic	6.152
Denmark	0.202	Estonia	19.858
Finland	0.273	Hungary	8.117
France	0.074	Kazakhstan	9.654
Germany	0.226	Latvia	15.396
Greece	0.150	Lithuania	10.725
Iceland	0.211	Macedonia, FYR	10.914
Ireland	0.154	Poland	4.078
Italy	0.134	Romania	7.580
Netherlands	0.154	Russian Federation	2.855
Norway	0.116	Slovak Republic	8.220
Portugal	0.027	Slovenia	7.308
Spain	0.063	Ukraine	5.792
Sweden	0.177		
Switzerland	0.078		
United Kingdom	0.075		
Mean	0.156	Mean	9.230

Notes: This table reports the percentage changes in welfare due to the trade integration of Eastern Europe. It compares welfare in the baselines scenario under the estimated trade costs in the 2000s to a counterfactuals scenario in which each and every East European country is in autarky.
Source: Authors' calculations.

result is not surprising. First, in the 2000s imports from Eastern Europe were only about 22% of overall West European imports from outside Western Europe, and only 8% of total West European imports (including from within the region). In addition, our counterfactual takes into account the fact that in the absence of Eastern Europe, the total West European imports would not fall by 8%: Western Europe will increase imports from all other regions to partially substitute for East European imports. In fact, as we discuss in detail in Section 3.4, in the complete absence of Eastern Europe, total West European imports would only fall by 4.7%.

For Eastern Europe, gains are much greater, since in this case we are comparing complete autarky to trade. The median change in welfare is 9.23%, ranging from 2.85% for Russia to nearly 20% for Estonia. Not surprisingly, larger and farther away countries (Russia, Ukraine) tend to gain much less than smaller ones, such as the Baltic countries, FYR Macedonia and Bulgaria. Note that the gains are from trade with the entire world, not just with Western Europe.

How much does comparative advantage affect the magnitude of these gains? To account for the variation in the gains from East European trade, we regress the total welfare change on the average d^j_{ni}, the correlation between the Ts, as well as total GDP to control for the well-known role of country size. Note that we do not seek any kind of causal interpretation of these regressions. Rather, we only want to see which variables correlate with the variation in the welfare gains, and can 'explain' it in the least-squares sense. Table 4 reports the results, for three ways of weighting d^j_{ni} and correlations of T: equal-weighted, GDP-weighted and population-weighted. That is, when the regression is carried out on the

Table 4. Welfare gains, technological similarity, and trade costs

	(1) Equal-weighted	(2) Population-weighted	(3) GDP-weighted
Panel A: Western Europe			
Dep. Var.: Change in Welfare			
Technological similarity	−0.244	−0.060	−0.065
	(0.617)	(0.371)	(0.378)
Trade costs	−6.047***	−5.643***	−5.551***
	(1.386)	(1.536)	(1.503)
Real GDP	−0.456***	−0.500***	−0.491***
	(0.075)	(0.094)	(0.092)
Constant	12.080***	12.581***	12.276***
	(2.574)	(3.052)	(2.972)
Observations	17	17	17
R^2	0.704	0.653	0.650
Panel B: Eastern Europe			
Technological similarity	−0.968***	−0.858***	−0.845***
	(0.262)	(0.256)	(0.251)
Trade costs	−0.182	−0.105	−0.108
	(0.373)	(0.395)	(0.392)
Real GDP	−0.347***	−0.335***	−0.336***
	(0.035)	(0.037)	(0.036)
Constant	8.390***	8.160***	8.173***
	(0.694)	(0.726)	(0.719)
Observations	14	14	14
R^2	0.889	0.880	0.881

Notes: Robust standard errors in parentheses; *** significant at 1%. All left-hand side and right-hand side variables are in natural logs. The sample is of West European countries in Panel A, and of East European countries in Panel B. 'Equal-weighted', 'Population-weighted' and 'GDP-weighted' refers to how Technological similarity and Trade cost variables are averaged for each country across its trading partners in the other region. Variable definitions and sources are described in detail in the text.
Source: Authors' calculations.

sample of West European countries, we compute, for each country, the (weighted) average of its trade cost to each East European country, and the (weighted) average of its technological similarity to each East European country. When the regression is run on the sample of East European countries, these averages are computed across West European countries. All the left-hand side variables and the regressors are in logs throughout.[6]

Panel A reports the results for the 17 West European countries. The R^2 of these regressions is between 0.65 and 0.7, indicating that the three regressors account for the bulk of the cross-country variation in welfare gains. Trade costs and country size are significant at the 1% level in all specifications. By contrast, sectoral similarity has the 'right' sign but the coefficient is close to zero and insignificant.

Panel B reports the results for the 14 East European countries. The same three variables do a better job in absorbing the variation in the welfare gains for Eastern Europe: the R^2 is above 0.88 in all three specifications. Here, by contrast, technolo-

[6] None 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.

gical similarity to Western Europe matters a great deal. Even in such a small sample, the coefficients on similarity are significant at the 1% level, with robust *t*-statistics of about 3.5. The coefficients are also large in magnitude. A one-standard deviation change in GDP-weighted technological similarity increases welfare gains from trade integration by 2.43 percentage points. On the other hand, trade costs do not seem to matter much in accounting for the gains from trade in Eastern Europe, in spite of the fact that the variation in trade costs is very similar in the West and East European samples.

Figure 3 presents the contrast between Western and Eastern Europe graphically. It plots the partial correlations between the welfare gain from East European integration and the GDP-weighted technological similarity (left side), and the GDP-weighted d^{j}_{ni} (right side), after netting out the other variables in Table 4. The

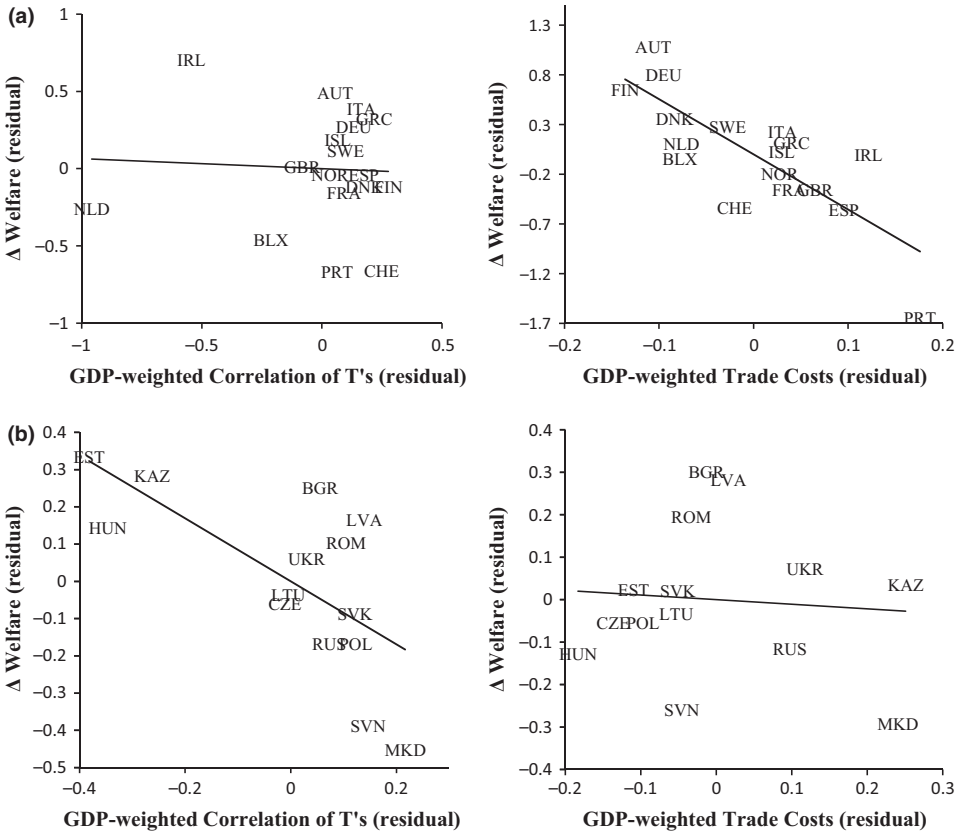

Figure 3. Welfare gains, similarity, and trade costs (a) Western Europe, (b) Eastern Europe

Notes: This figure plots the partial correlations between log welfare gains from European integration and the log GDP-weighted sectoral similarity (left graph), after netting out trade costs and total country GDP, and the partial correlation between log welfare gains from European integration and the log GDP-weighted trade costs, after netting out sectoral similarity and total country GDP (right graph). The top panel depicts these relationships for Western Europe, the bottom panel for Eastern Europe.

Source: Authors' calculations.

top panel reports the results for Western Europe, the bottom panel for Eastern Europe. As shown by the regression estimates, for Western Europe trade costs explain the variation in welfare gains remarkably well, while there is virtually no relationship with technological similarity. For Eastern Europe, trade costs do not do as well, but there is a pronounced negative relationship between similarity and the welfare gains.

This difference in outcomes between Western and Eastern Europe is due to the difference in relative importance of the two groups in each other's total trade. In the period we consider, 72% of Eastern Europe's imports come from Western Europe. Thus, technological similarity with Western Europe is an important determinant of the gains from trade relative to autarky. However, East European countries remain relatively small trade partners for Western Europe, accounting for about 22% of its imports from the rest of the world on average in the 2000s. Thus, for Western Europe, East European trade and technological similarity has to be evaluated in the context of its broader international trade relationships. That is, for Western Europe what should matter is not so much its similarity to Eastern Europe *per se*, but the relative similarity of Eastern Europe to the average country with which Western Europe already trades (see di Giovanni *et al.*, 2012 for a closely related result).

To that end, we compute the average productivity of East European countries in a sector, and correlate it to the average productivity of all the other trade partners of Western Europe (the Americas, Asia, the Pacific, Middle East and North Africa, and sub-Saharan Africa). It turns out that from the perspective of Western Europe, Eastern Europe looks very much like the rest of the world with which it trades. The correlation between the average sectoral productivity in Eastern Europe and in the rest of the world is a remarkable 0.91. Figure 4 presents this result graphically, with average productivities expressed as a fraction of the world frontier (this regularity holds for population- and GDP-weighted averages as well). Of course, individual

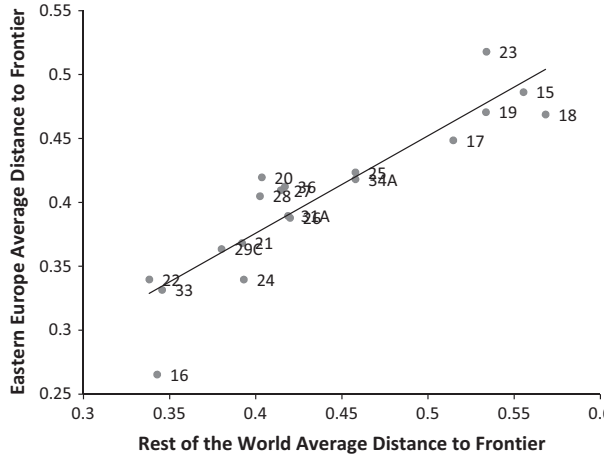

Figure 4. Eastern Europe and rest of world average comparative advantage

East European countries often have a comparative advantage that is very different from the rest of the world. But Eastern Europe contains many diverse countries, and as a group they look much like the rest of the world economy in terms of their relative technology.

Thus, the gains to Western Europe from East European trade come not primarily from trading with technologically different countries, but from the expansion of markets. As a result, trade costs explain very well the variation in the gains from trade for Western Europe, while technological similarity to Eastern Europe does not matter much.

3.4. Global trade volumes

We next explore how East European integration changes 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 West 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 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 5 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 0.98, and the Spearman rank correlation is 0.98 as well.

Next, Table 5 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. Of particular interest is the top row that shows imports into Western Europe. As Eastern Europe opens to trade, imports from all other regions fall, by between –1.45% from non-Europe OECD and –4.09% from the Middle East/North Africa region. As a result, total West European imports – inclusive of Eastern Europe – increase by only 4.7%. This modest change is an illustration of why the gains to Western Europe from the opening up of Eastern Europe are so modest: if Eastern Europe were not there, the Western countries would substitute imports from other world regions for East European imports. The pattern looks similar

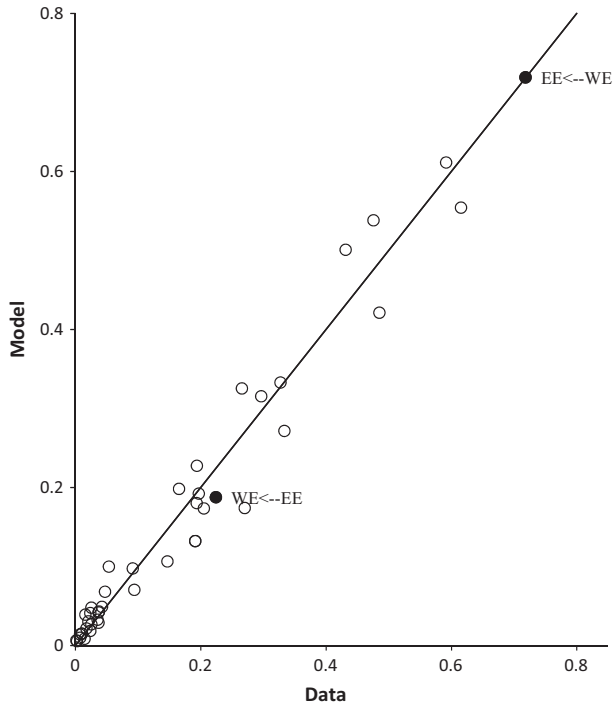

Figure 5. Shares of manufacturing imports: model vs data

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. 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).

Source: Authors' calculations.

elsewhere in the world. Total imports rise, but by less than in Western Europe. Imports from regions other than Eastern Europe fall modestly.

3.5. Changes in sectoral structure

A closely related question is what happens to industrial structure in Western Europe as a result of European integration. In this subsection, we compare sectoral structure implied by the baseline model to the counterfactual sectoral structure that would have prevailed had Eastern Europe not been integrated.

Figure 6(a) presents the absolute changes in shares of value added in each sector and each country as Eastern Europe opens to trade. The most striking result is just how little change in sectoral structure takes place. Aside from the non-tradable sector, in which shares usually decrease and sometimes by as much as 0.0025 (or a quarter of a percentage point), one hardly observes changes in value added shares in excess of 0.0005, or 0.05 percentage points. By and large, industrial structure remains the same as Western Europe opens to trade with Eastern Europe. This lack of effect is in part

Table 5. Percentage changes in cross-regional trade volumes

	Source country groups						
	Western Europe	Non-Europe OECD	Latin America/ Caribbean	Middle East/ North Africa	East and South Asia	Sub-Saharan Africa	Total
Destination country groups							
Western Europe	–	−1.45	−2.85	−4.09	−2.91	−1.95	4.67
Non-Europe OECD	−0.89	–	−0.25	0.3	−0.15	0.34	0.91
Latin America/ Caribbean	−0.83	−0.2	–	−0.06	−0.21	−0.79	0.36
Middle East/ North Africa	−3.63	−1.79	−4.88	–	−2.04	−8.36	3.9
East and South Asia	−1.41	−0.52	−1.84	−0.48	–	−1.84	1.32
Sub-Saharan Africa	−3.59	−1.79	−8.4	−7.92	−2.1	–	0.45

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.
Source: Authors' calculations.

because, as mentioned above, Eastern Europe represents only 22% of all West European imports from outside the region, and in part because Eastern Europe has similar technology to the rest of Western Europe's trading partners. Thus, trade liberalization of Eastern Europe does not represent a significant change in West European comparative advantage vis-à-vis the rest of the world with which it trades.

This lack of change in Western sectoral structure is in sharp contrast with Eastern Europe, depicted in Figure 6(b). Note the difference in scale of the *y*-axis: while for Western Europe, changes in the tradable sector range from –0.0005 to 0.0015, with the non-tradable share falling by less than 0.0025 in all cases, for Eastern Europe the changes in tradable sector shares range from about –0.005 to 0.02, and as much as –0.05 in the non-tradable sector. This is a difference in sectoral share changes of an order of magnitude. Not surprisingly, welfare changes in Eastern Europe are much greater.

4. BENCHMARKING THE GAINS AND POLICY IMPLICATIONS

Are the gains from East European integration produced by our model large or small? Comparing the main welfare results to alternative policy experiments will shed light on where integration of Eastern Europe falls in the ranking of different changes that occurred, or might occur, in the European economy. These differences in impact will then inform the policy priorities, by highlighting economic changes that have relatively large or small welfare pay-offs. This section develops a number of alternative counterfactuals, with an eye on comparing the welfare impact of these alternative changes to the welfare impact of the integration of Eastern Europe.

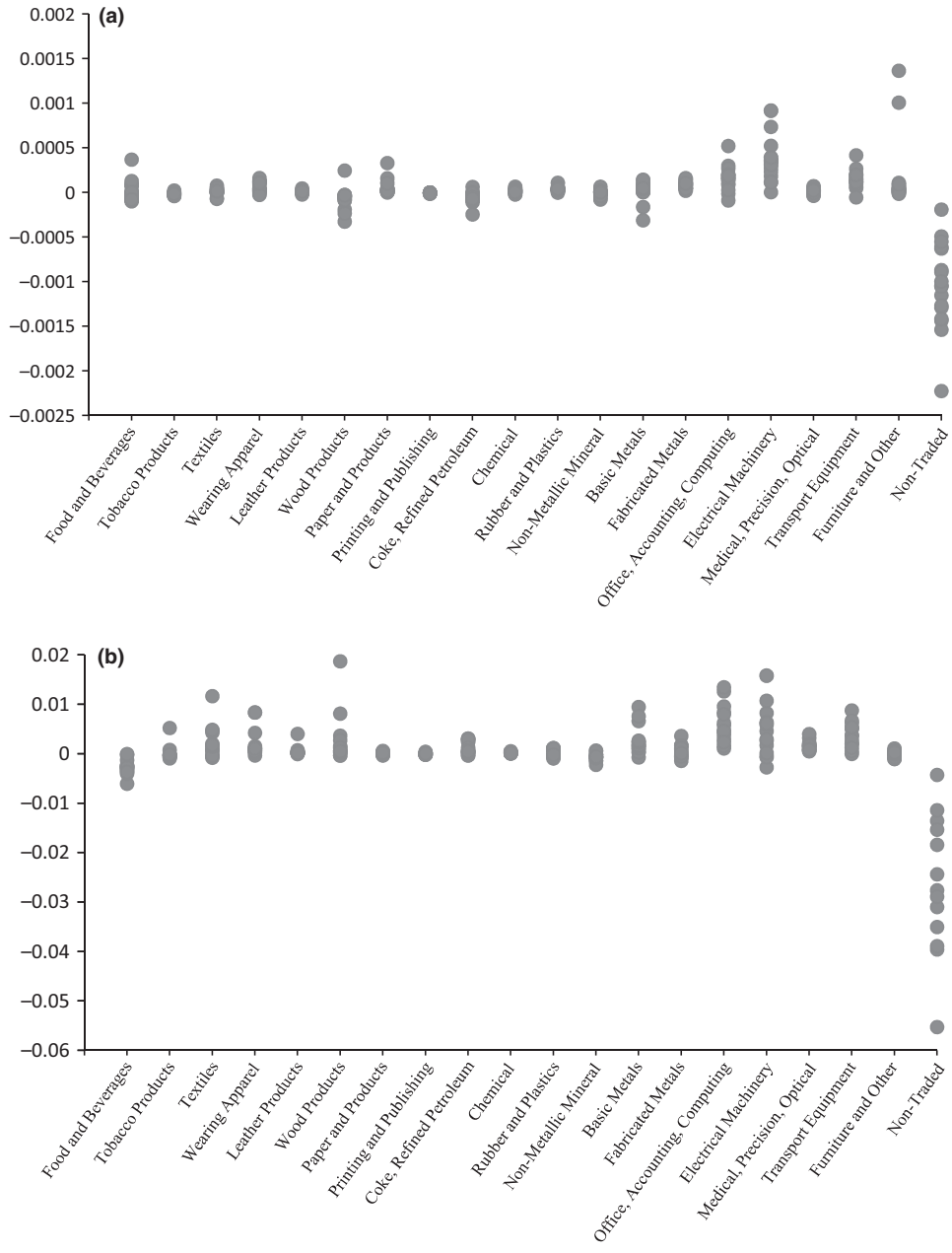

Figure 6. Changes in sectoral composition: shares of value added (a) Western Europe, (b) Eastern Europe

Notes: This figure displays the absolute changes in the shares of value-added when Eastern Europe opens to trade, for each sector and each West European country (top panel) and each East European country (bottom panel).

Source: Authors' calculations.

4.1. West European integration

The obvious comparison for East European integration is the earlier integration within Western Europe. Unlike the fall of the Iron Curtain that brought about an abrupt integration of Eastern Europe, West European integration has been a much more gradual and continuous process. Starting with the Treaty establishing the European Coal and Steel Community among the original six members that went into effect in 1952, integration both broadened by expanding the EU to 15 West European members, and deepened over time. The major treaties are the Treaty of Rome (went into effect 1958), Single European Act (1987), the Treaty on European Union (also known as the Maastricht Treaty, 1993), and up to the Treaty of Lisbon (signed 2007). In between these major milestones, there were more minor treaties as well. Thus, the basic difficulty in simulating the welfare impact of West European integration is that there is no single year, or even decade, during which integration occurred.

To take the broadest view of this process, we simulate a counterfactual scenario in which trade costs d'_{ni} between West European trade partners are rolled back to their 1960s values. Our estimates for the 1960s show that trade costs within Western Europe are 45% higher in the 1960s compared to today, and this is the change in trade costs that we simulate. This exercise in effect attributes all of the fall in iceberg trade costs within Western Europe from the 1960s to the 2000s to policy measures relating to West European integration, and thus may over-estimate the total impact of policy measures. On the other hand, a great deal of policy barriers to cross-border trade in particular were dismantled prior to 1962 (the earliest year in our data) among the original six members. The fact that we start in the 1960s may thus under-estimate the total sweep of the EU's impact. A fall in trade costs of this magnitude appears to be in a reasonable ballpark for assessing the impact of deep economic integration on trade flows.

The first column of Table 6 presents the results. Precisely, we report the change in West European welfare due to a reduction in intra-West-European trade costs by 45%, the end point of this reduction being today's trade costs. This counterfactual assumes that Eastern Europe stays in autarky throughout, in order to mimic, albeit in a very rough way, historical developments. Western Europe was well on its way towards deep integration within the region when Eastern Europe was integrated. The mean welfare gains to Western Europe from observed within-region integration are 2.53%. These gains are on average 16 times larger than the gains from opening to Eastern Europe. This finding is not surprising, since West European trade partners are far more important for a typical West European country than East European partners.

To probe further, column 2 of Table 6 presents the West European countries' gains from trade relative to complete autarky.[7] The model implies that the mean gains from

[7] In this calculation, gains are computed with respect to the baseline scenario, that is, each West European country goes from trading with no one to trading with everyone including Eastern Europe.

Table 6. Welfare gains in Western Europe, alternative scenarios

	(1) West European integration (%)	(2) Gains from trade (%)	(3) Gains from EU Eastern Europe (%)	(4) Gains from non-EU Eastern Europe (%)	(5) Gains from growth in Eastern Europe (%)
Austria	2.728	4.430	0.329	0.070	0.055
Belgium–Luxembourg	4.551	7.597	0.097	0.034	0.025
Denmark	3.369	5.612	0.150	0.052	0.016
Finland	2.133	3.586	0.156	0.118	0.019
France	1.229	1.950	0.050	0.024	0.021
Germany	1.388	2.680	0.168	0.058	0.045
Greece	1.600	2.727	0.030	0.120	0.067
Iceland	3.766	8.453	0.163	0.047	0.002
Ireland	3.923	9.327	0.096	0.058	0.054
Italy	1.333	2.155	0.080	0.054	0.025
Netherlands	3.874	7.051	0.092	0.061	0.040
Norway	2.181	3.513	0.110	0.006	0.016
Portugal	2.963	3.810	0.018	0.009	0.015
Spain	1.450	2.085	0.040	0.023	0.021
Sweden	2.415	3.741	0.137	0.040	0.023
Switzerland	3.061	5.164	0.051	0.026	0.018
United Kingdom	1.114	3.257	0.044	0.032	0.013
Mean	2.534	4.538	0.107	0.049	0.028

Notes: This table reports the percentage welfare changes. Column 1 reports the welfare impact of reducing the iceberg trade costs between West European countries from their 1960s levels to their 2000s levels. Column 2 reports the welfare gains from trade relative to complete autarky. Column 3 reports the welfare gains from trading with EU East European countries. Column 4 reports the gains from trading with non-EU East European countries, conditional on already trading with EU East European countries. Column 5 reports the welfare impact of observed productivity growth and capital accumulation in Eastern Europe between the 1990s and 2000s.
Source: Authors' calculations.

trade in Western Europe are 4.54%. Strikingly, just a 45% reduction in trade costs with only fellow West European countries accounts for more than half of the total gains from trade for Western Europe. These results speak to the policy trade-off between the benefits of continued 'deep' integration within Western Europe, and the 'shallow' but broad integration with other regions, such as Eastern Europe and beyond. West European economies are relatively large, productive and close to each other. Thus, quantitatively the gains from reductions in trade barriers within that group of countries are an order of magnitude larger than even the gains from integration of large economic blocs such as Eastern Europe, China or India.[8] These results point to a potentially much greater benefit of deeper, rather than broader, integration.

[8] Elsewhere (di Giovanni *et al.*, 2012) we computed the worldwide gains from the trade integration of China. For West European countries, the mean gains from trade with China are 0.09%, with the maximum gain of 0.162%.

The gains from trade relative to autarky in Western Europe can also be compared to the gains for Eastern Europe in Table 3. East European gains from trade are two times larger than Western Europe's gains. Not surprisingly, since East European countries tend to be both smaller in size and less productive, they derive greater benefits from international exchange. From a policy perspective, this suggests that further trade integration in Eastern Europe, especially with its West European neighbours, is likely to have an even larger welfare impact than reductions in West European trade barriers. Thus, policies that improve the links between the two groups of countries, such as investment in infrastructure, are likely to have a larger pay-off in Eastern Europe compared to the West.

4.2. East European integration and productivity growth

Another facet of the trade-off between deeper and broader integration relates to the differing degrees of integration of East European countries with the West. Does Western Europe gain more from deeper integration with the Central European countries currently in the European Union, or from a more arm's-length trade relationship with non-EU countries? The answer is not clear *ex ante*: non-EU countries such as Russia, Ukraine and Kazakhstan are both larger in size, and more technologically different, than the EU-25 countries of Central Europe. Columns 3 and 4 of Table 6 report the gains from integration of EU-member East European countries, and the gains from integration of non-EU East European countries respectively. Of the total mean gains from East European integration, 0.156%, two-thirds (0.107%) are due to integration of the EU East European countries. The remaining one-third (0.049%) is due to non-EU Eastern Europe.[9] Once again, these results are suggestive that economic policies should aim at deeper integration of current EU member countries, rather than broader integration of countries farther afield.

The previous exercises compare our main results to the impact of other types of reductions in trade costs, whether within Western Europe, or for different sets of East European countries. Next, we benchmark the results against another drastic change that took place in the East European economy, namely economic growth. Has Western Europe benefited more from a fall in trade costs with Eastern Europe *per se*, or from the dramatic productivity growth (and the somewhat less dramatic capital accumulation) that took place in Eastern Europe since the fall of the Iron Curtain? To answer this question, we simulate the welfare benefit to Western Europe from the productivity growth and capital accumulation that actually occurred in the East

[9] The EU East European countries are Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia. All of these joined the EU in 2004, in the middle of our sample of years. Bulgaria and Romania joined in 2007, the last year of our sample, and thus we put them in the non-EU group. Adding them to the EU group will make the difference between the welfare impact of EU and non-EU integration even more pronounced.

European countries from the 1990s to the 2000s. Over this period, these economies grew dramatically, with productivity rising 33% over a decade (2.9% growth per annum).[10] Note that, as is well known in the trade literature, a trading partner's productivity growth need not improve a country's welfare (see, e.g., Hicks, 1953; Samuelson, 2004). In addition, quantitative assessments in other contexts have found that the overwhelming majority of welfare benefits from productivity growth accrue to the growing country itself rather than to other countries through trade (Hsieh and Ossa, 2011; di Giovanni *et al.*, 2012).

Column 5 of Table 6 reports the welfare gains to Western Europe from the observed growth in Eastern Europe from the 1990s to the 2000s. These gains are virtually nil: 0.028% (i.e. 0.00028), with a maximum of 0.067%. Thus, it appears that the modest welfare gains to Western Europe from trade integration with the East are still larger than the gains from productivity growth in those countries, even though that productivity growth has been dramatic. This finding suggests that policies favouring eastward technology transfer and foreign direct investment do not have a large aggregate welfare pay-off for the West, even relative to reductions in trade costs with East European countries. Of course, those policies will have a much greater positive welfare impact on the East European countries themselves.

4.3. Importance of factor reallocation

The preceding counterfactuals assumed that the factors of production reallocate optimally in response to each change in trade costs, and thus labour and capital markets clear within each country. A frequently expressed concern with greater integration – be it with Eastern Europe or other regions – is that reallocation of production factors within a country is difficult. Barriers to factor reallocation will both reduce the magnitude of the gains from trade, and create winners and losers even when aggregate gains are positive. To the extent that factor reallocation is required for reaping the benefits of trade, policies that impede that reallocation, such as rigid labour market institutions, may also reduce the gains from trade.

To assess the importance of factor reallocation quantitatively, we compute the welfare gains from East European integration under the assumption that capital and labour in each broad sector are fixed, and when Eastern Europe opens to trade factors cannot move from one sector to another in response. In this exercise, capital and labour can still reallocate between varieties within each sector. That is, we assume that while capital and workers in, say, the Wearing Apparel sector cannot move to the

[10] To be precise, we compare welfare in Western Europe under the 2000s baseline to a counterfactual scenario in which Eastern Europe's trade costs are the same as in the baseline, but East European productivities and capital–labour ratios are as they were in the 1990s. Thus, the counterfactual scenario is a world in which trade integration with Eastern Europe took place, but there was no growth in those countries from the 1990s to today.

Table 7. Welfare gains in Western and Eastern Europe, no factor reallocation

West	Δ Welfare (%)	East	Δ Welfare (%)
Austria	0.388	Bulgaria	10.566
Belgium–Luxembourg	0.119	Czech Republic	6.033
Denmark	0.170	Estonia	17.251
Finland	0.240	Hungary	7.860
France	0.074	Kazakhstan	6.777
Germany	0.213	Latvia	11.931
Greece	0.136	Lithuania	8.911
Iceland	0.180	Macedonia, FYR	8.733
Ireland	0.157	Poland	3.891
Italy	0.126	Romania	6.848
Netherlands	0.120	Russian Federation	2.349
Norway	0.100	Slovak Republic	8.053
Portugal	0.024	Slovenia	6.702
Spain	0.058	Ukraine	5.263
Sweden	0.170		
Switzerland	0.079		
United Kingdom	0.066		
Mean	0.142	Mean	7.941

Notes: This table reports the percentage changes in welfare due to the trade integration of Eastern Europe, under the assumption that factors of production cannot reallocate across sectors. It starts with the counterfactual scenario in which each and every East European country is in autarky, and lowers the trade costs to their levels as of the 2000s, but assuming that factors cannot reallocate across sectors from their counterfactual values.
Source: Authors' calculations.

Precision and Medical Machinery sector, they are free to switch between infinitesimal varieties within the Apparel sector, for instance switch from making shirts to making pants. Table 7 reports the welfare changes in that experiment. As expected, the welfare gains from East European integration are smaller for every country if factors are not mobile across sectors. For Western Europe, the difference is not large in absolute terms: the mean gains are 0.142% instead of 0.156% in the main analysis. For Eastern Europe, however, the welfare gains without sectoral reallocation are significantly smaller in both absolute and relative terms. The mean gain from trade drops to 7.94%, which is 14% less than the 9.23% welfare gain when factors are mobile. The pronounced difference between the two groups of countries in the impact of factor reallocation on welfare gains is not surprising in light of the results in Section 3.5. As Figure 6 makes clear, East European integration induced only small changes in sectoral structure in Western Europe, whereas in Eastern Europe sectoral composition changed much more dramatically.

A distinct but related question is how large are the distributional consequences of trade opening. Understanding the magnitudes of the distributional effects is important in designing the social safety net programmes to cushion the negative consequences of trade opening for import-competing sectors. To address this question exhaustively, one would require a model with explicit frictions in the mobility of factors across sectors. The exercise here represents an extreme case in which factors are

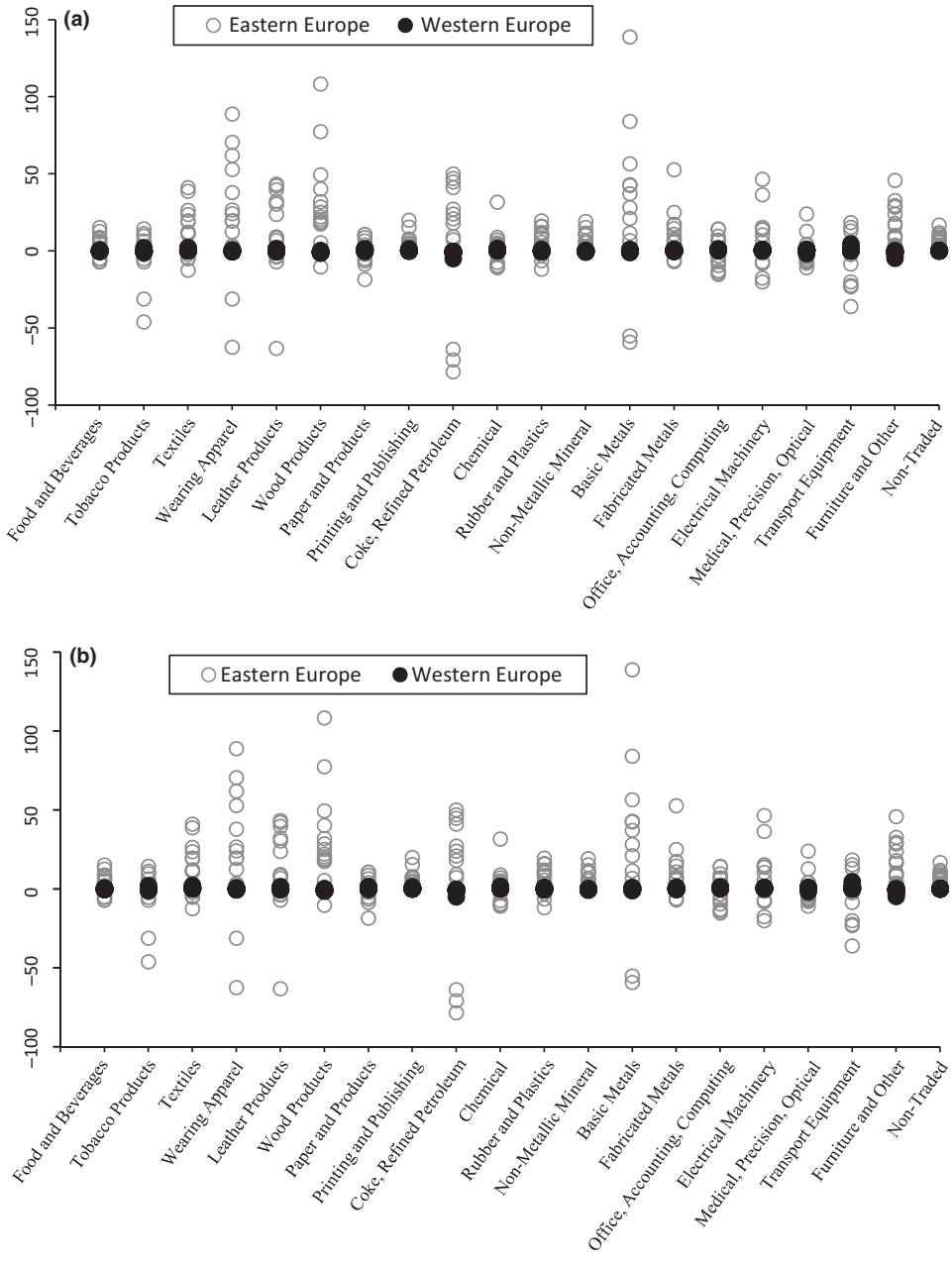

Figure 7. Changes in (a) real wages and (b) real returns to capital, no factor reallocation

Notes: This figure displays the scatterplots of the changes in real wages (top panel) and real returns to capital (bottom panel) in each sector and each country when Eastern Europe opens to trade but factors cannot reallocate across sectors.

Source: Authors' calculations.

not allowed to move at all between sectors. In addition, we do not take an explicit stand on who owns the capital in each sector, and thus we can only compute changes in wages and returns to capital in each sector, rather than in individuals' overall incomes. Nonetheless, analysing the factor price changes can give us a rough sense of the distributional impact of trade opening when factors are immobile across sectors.

Figure 7 presents, for each sector, the distribution of percentage changes in sector-specific real wage (top panel) and real return to capital (bottom panel) when Eastern Europe opens to trade. The solid dots represent Western Europe, and hollow dots Eastern Europe. Two conclusions emerge. First, the variation in real factor returns across sectors dwarfs the magnitude of the aggregate impact. For Western Europe, as we saw above the mean welfare change is 0.142%. By contrast, the changes in real wage and the real return to capital range across sectors from about –1% to 1% in every country, and as much as from –5% to 5% in smaller countries such as Iceland and Ireland. Second, the cross-sectoral dispersion in wage and return to capital changes is far larger in Eastern Europe. It is not uncommon to observe 50% reductions, or 100% increases in the real returns to factors in individual industries.

These results further inform policy priorities. First, in order to both reap the full gains from trade, and to limit the distributional consequences, trade liberalization should be accompanied by efforts to promote smooth functioning of labour and capital markets, especially in trade liberalization episodes that are expected to produce large cross-sectoral reallocations. This may mean policies that allow for flexible hiring and firing of workers. Since human capital is often sector-specific and difficult to redeploy elsewhere at least in the short run, investment in education and programmes that facilitate acquisition of new and more advanced skills are especially important.

At the same time, the finding that the distributional impacts of trade liberalization can be an order of magnitude higher than the aggregate gains points to the primary importance of social safety net programmes. In Western Europe, the absolute welfare changes even in the most import-competing sectors are small, rarely more than 1%. Thus, East European integration is unlikely to have led to a large amount of dislocation in the West. By contrast, East European workers and capital owners in particular sectors can experience very large swings (from halving to doubling of real wages or capital returns). Thus, social safety nets are especially needed in those countries as they open to trade.

Finally, we stress an important complementarity between policies that promote smooth and efficient factor markets and the social safety net programmes. The distributional impacts of trade liberalization will be limited when factors can reallocate easily across sectors. This in turn will place less strain on the redistributive social safety net policies. This suggests that there may be important interactions between rigid labour market policies, social safety nets (and therefore government budgets), and

globalization. To the extent that globalization increases the need for reallocation of resources, rigid factor markets will both reduce the gains from trade, and place additional strain on the social safety net programmes.

5. 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. We estimate sector-level productivities for 19 sectors in 79 countries, and document that differences in relative technology do indeed vary a great deal among the Western and East European country pairs. 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.

The variation in gains to West European countries is mainly accounted for by trade costs, with technological similarity playing little or no role. By contrast, the dispersion in gains to Eastern Europe is well explained by technological similarity to Western Europe. This difference is due to the asymmetry in the relative importance of the two country groups as trade partners. The large majority of East European trade is with Western Europe. For Western Europe, however, Eastern Europe is still a minor trade partner. Furthermore, a comparison of sectoral productivities reveals that as a group, Eastern Europe has a similar comparative advantage as the rest of Western Europe's trade partners. Thus, the gains to Western Europe come mainly from expansion of markets, rather than from technological differences with Eastern Europe.

Placing the East European trade opening episode within a broader context of West European integration allows us to draw out a number of policy implications. Deeper within-Europe integration appears to confer greater welfare benefits than shallower but broader trade integration. Technology transfer from Western to Eastern Europe will benefit East European countries, but have virtually no positive welfare impact on the West. Eastern Europe has likely experienced large distributional effects due to trade opening. Thus, it is imperative that trade integration is accompanied by policies that promote optimal reallocation of factors of production, and ensure a minimum safety net for those displaced by import competition.

We conclude by reiterating that the results presented in the paper, with limited exceptions, reveal the static gains from goods trade. When evaluating the impact of reductions in trade costs, we keep factor endowments and technology constant. Thus, if trade opening in turn caused capital and labour to move across borders, or if it caused technology of the trading countries to change, there will be additional – positive

or negative – effects of reductions in trade costs that are not captured by our analysis. Comprehensive quantitative evaluations of the indirect benefits of trade liberalization remains a fruitful avenue for future research.

Discussion

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This paper performs a rigorous and thoughtful quantitative assessment of the welfare gains produced by trade integration, and improves our understanding of the role played by comparative advantage. There is a lot that we can learn from this paper as the topic is extremely relevant and the analysis is both accurate and sound. Of course, in order to make the quantitative exercise tractable, some factors have been omitted from the analysis. These limitations have been mentioned throughout the paper and do not undermine the validity of the analysis. However, in order to give an appropriate interpretation to the results of the paper, I believe it is important to keep these limitations into proper consideration. My discussion will elaborate on them.

First, sectoral productivities are kept constant when comparing the actual scenario to the counterfactual scenario where Eastern Europe is in autarky. However, trade integration is likely to make competition in the market more intense and, through this channel, to foster incentives to innovate, thereby changing sectoral productivities and shaping the pattern of comparative advantage. The welfare gains associated with trade integration are likely to be larger when one accounts for this effect. For instance, Italy – given the present structure of comparative advantage – is likely to suffer substantially from trade integration with China. However, Italian firms facing tougher competition from Chinese products might be forced to invest in order to produce superior quality/innovation intensive products, thereby making Italian industrial structure more differentiated from the Chinese one and eventually benefiting from trade integration.

This consideration highlights that trade integration needs to go hand in hand with policy intervention aimed at facilitating innovation. Policy intervention may consist of specific policies, such as subsidies to innovation investment or patent policy reforms; it may also consist of broader policies such as financial markets/corporate governance reforms that alleviate financial constraints innovative firms are particularly vulnerable to, or reforms of the education system that increases the supply of high-skilled workers. This consideration also highlights the second limitation of the analysis, that is, the fact that the quality of institutions is kept constant across the actual and counterfactual scenario. More intense competition associated with trade integration may instead prompt governments to undertake reforms that improve the quality of institutions, thereby shaping the pattern of comparative advantage also through this channel.

Third, the model does not incorporate worker heterogeneity and does not allow for factors to move across countries. As a consequence it is not the appropriate model to account for distributional issues. (Still, distributional issues are partially addressed by considering the case where factors cannot reallocate across sectors.) Distributional effects associated with trade integration may be sizeable. After integration with Eastern Europe many West European firms, especially the ones active in labour-intensive sectors, have relocated their activity to Eastern Europe, attracted by cheap labour. At the same time, West European countries have experienced flows of workers from Eastern Europe, attracted by high wages. Both phenomena have represented a serious threat for low-skilled workers in Western Europe, and have generated opposition against trade liberalization. This makes even more compelling the implementation of active labour market policies, such as policies that assist workers in acquiring more advanced skills, of investment programmes in education and, more generally, of social safety net programmes.

My last comment concerns the conclusions drawn from the comparison between a counterfactual scenario where trade costs between West European countries are increased by 45% (rolled back to 1960s values) and a baseline scenario where trade costs are the present ones. Both in the counterfactual and in the base-line scenario Eastern Europe remains in autarky. The (mean) welfare gain for Western European countries is 2.53% (16 times larger than gains from trade opening of Eastern Europe). The authors conclude: 'These results speak to the policy trade-off between the benefits of *continued* "deep" integration within Western Europe and the "shallow" but broad integration with other regions such as Eastern Europe and beyond.' I am not sure that such a conclusion can be inferred from the analysis of the paper. The analysis shows that decreasing trade costs from their value in the 1960s to their present value has benefitted Western Europe. We cannot conclude that decreasing trade costs by the same amount from the present value generates the same welfare gains, unless one assumes linearity in the relationship between trade costs and welfare. On top of this, integration with emerging blocs is to some extent inevitable and the priority of Western Europe should be perhaps to find the proper tools to benefit as much as possible from it.

Panel discussion

Thorsten Beck asked if the authors had to assume that the countries were in steady state in the year 2000 and whether this was a reasonable assumption for some of the transition economies. Second, he enquired if it would be possible to relate differences in welfare gains from trade liberalization in CEE economies to the size of initial distortions (inherited from socialist times). Andrea Ichino wondered if estimates of the losses suffered by non-European countries from the shift in trade by Western Europe could be provided. Next, he asked what the

assumption on the movement of labour is in the paper. Lastly, he wanted to know if the authors' calculations also include the indirect gains from trade (demand size effects). Peter Egger noted that the model employed for estimation may not be the most appropriate for disaggregated data (sectoral level) as the number of bilateral trade zeros may matter significantly in this case. He was also surprised by the size of the estimated welfare gains given the bigger gains reported in some of the previous studies, such as that of Anderson and van Wincoop (2001). Egger noted that if one were to examine the preferential integration of markets, for instance, much larger welfare gains would be observed. Given the relatively small welfare gains, Refet Gürkaynak felt that either countries were already managing to achieve optimal allocations or that the general approach to welfare analysis is fundamentally flawed. Giancarlo Corsetti asked if the aggregate effects of integration are an order of magnitude lower than the distributional effects. Second, referring to Sturm's analysis of the paper, he doubted the increasing role of distance. On the computation of technological similarities, Thierry Tressel raised the point that some sectors across countries may be involved in the same production chain and therefore higher correlations in sectoral productivities may just reflect higher correlations in trade between countries. He wondered how the authors accounted for this in their study.

Andrei Levchenko first stressed that the paper is measuring the gains from trade rather than integration. However, he acknowledged that what is completely missing from the paper is some notion that the opening of trade itself produced productivity improvements, additional investment and movements of orders. He noted that in a reduced form manner they are also measuring any movements in labour and capital and technology transfers to the extent that the data are capturing these flows. Nonetheless, Levchenko added that they do not have a good way of linking these flows directly to trade *per se*. He further explained that to the extent that trade stimulated FDI to Eastern Europe and productivity advances in the region, they can confidently say that the impact of this on Western Europe was almost zero (upper bound in fact) in the context of the model. Conversely, the effect in Eastern Europe was large but more precise estimates would require specifying the connection between trade and the different flows. Levchenko stated that the gains from trade in their paper are much larger than the gains from financial integration and that ultimately what constitutes a large or small gain is in the eye of the beholder. Moreover, he pointed out that the size of the welfare gains can vary greatly depending on which element of the model is tweaked (different policy experiments).

APPENDIX

Table A1. Country coverage

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

Table A2. Sectors

ISIC code	Sector name	α_j	β_j	$\gamma_{J+1,j}$	ω_j
15	Food and Beverages	0.290	0.290	0.303	0.166
16	Tobacco Products	0.272	0.490	0.527	0.014
17	Textiles	0.444	0.368	0.295	0.019
18	Wearing Apparel, Fur	0.468	0.369	0.320	0.105
19	Leather, Leather Products, Footwear	0.469	0.350	0.330	0.014
20	Wood Products (Excl. Furniture)	0.455	0.368	0.288	0.008
21	Paper and Paper Products	0.351	0.341	0.407	0.012
22	Printing and Publishing	0.484	0.453	0.407	0.004
23	Coke, Refined Petroleum Products, Nuclear Fuel	0.248	0.246	0.246	0.175
24	Chemical and Chemical Products	0.297	0.368	0.479	0.009
25	Rubber and Plastics Products	0.366	0.375	0.350	0.013
26	Non-Metallic Mineral Products	0.350	0.448	0.499	0.070
27	Basic Metals	0.345	0.298	0.451	0.002
28	Fabricated Metal Products	0.424	0.387	0.364	0.012
29C	Office, Accounting, Computing, and Other Machinery	0.481	0.381	0.388	0.062
31A	Electrical Machinery, Communication Equipment	0.369	0.368	0.416	0.028
33	Medical, Precision, and Optical Instruments	0.451	0.428	0.441	0.041
34A	Transport Equipment	0.437	0.329	0.286	0.179
36	Furniture and Other Manufacturing	0.447	0.396	0.397	0.066
4A	Non-tradables	0.561	0.651	0.788	
	Mean	0.414	0.393	0.399	0.053

Table A2. (Continued)

ISIC code	Sector name	α_j	β_j	$\gamma_{\mathcal{J}+1,j}$	ω_j
	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 Revision3 2-digit, aggregated further due to data availability. α_j is the value-added based labour intensity; β_j is the share of value added in total output; $\gamma_{\mathcal{J}+1,j}$ is the share of non-tradable inputs in total intermediate inputs; ω_j is the taste parameter for tradable sector j, estimated using the procedure described in Web Appendix Section B.3. Variable definitions and sources are described in detail in the text.
Source: Authors' calculations.

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