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GLOBAL VALUE CHAINS, TRADE SHOCKS AND JOBS: AN APPLICATION TO BREXIT

Production processes are becoming increasingly global. Acemoglu (2012) and Johnson (2014) argue that as a result we can no longer consider bilateral trade in isolation when evaluating trade policy. Recent research by Vandenbussche, Connell and Simons (2017) addresses that concern and offers a new approach to evaluate trade policy in the presence of global value networks. They extend a traditional gravity model and include sector-level input-output linkages in production which allows for a more complete assessment of trade policy shocks, such as Brexit. This Vox column summarizes their results. A key insight is that a trade shock affects total production of a country beyond the direct exports to a final destination, but also by indirect shipments via "third" countries. For example, the Belgian steel sector will suffer from Brexit not just through a reduction in bilateral exports of steel from Belgium to the UK, but also through a reduction of Belgian steel exports to Germany where steel is used in German cars which are then subsequently shipped to the UK. These indirect effects are shown to be substantial and important.

Vandenbussche et al. (2017) use their world input-output model to predict the trade impact of the UK's withdrawal from the European Union ("Brexit") on the domestic value added and employment for every individual EU country involved. Under Brexit, the trade impact is arguably the most important channel through which value added and employment can be affected. This is why other channels such as Foreign Direct Investment (FDI) effects, budgetary issues, or potential trade diversion effects are left outside the scope of the study.

In terms of the trade impact of Brexit, the losses vary by EU country depending on its openness to trade, its trade intensity with the UK and vice versa, its sectoral composition and the positioning of its sectors within the global supply chain. Results indicate that there are no winners from Brexit, but only losers. Both parties involved would suffer substantial losses if denied free trade access to each other's market. However, while the current belief surrounding Brexit is that especially the UK has a great deal to lose, a sector-level input-output approach clearly shows that the EU-27 also stands to lose substantially and considerably more than previously thought. The reason is that EU-27 production networks are closely integrated, which implies that tariff changes with the UK do not only just affect direct trade bilateral flows but also indirect trade flows via other EU countries. These indirect effects are significant and important and on average they account for about 25% of the total effect. But their magnitude varies substantially across EU countries. For example for Slovenia the indirect trade effects

account for 50% of the total Brexit-impact while for a country like Malta they only represent 5%. These indirect trade effects substantially reinforce the trade destruction effects resulting from Brexit, especially for the EU-27.

European Network Structure

While the framework is entirely general, Vandenbussche et al. (2017) use it to evaluate the impact of Brexit on the UK and the EU-27. They take the predictions from their world input-output model to the World-Input-Output-Database (WIOD). This database allows for the identification of production networks and current supply chains in the European Union. For every country-sector in the EU-28, WIOD provides total production, the inputs needed from other country-sectors and how its output is subsequently used by other country-sectors in their production process. This allows for a distinction of the "direct" exports to the UK and the "indirect" exports that are shipped via third countries to the UK. Including the indirect exports provides a more complete assessment of Brexit by identifying the European production network and value chains in detail.

To empirically obtain the employment effects of Brexit, trade in domestic value added is considered instead of gross trade. The reason is that only domestic value added embedded in exports, matters for domestic employment.

We consider two hypothetical Brexit scenarios suggested in the literature. Dhingra et al. (2017) quantify the future costs of trade between the EU-27 and the UK in a "soft" and "hard" Brexit scenario. In case of a "soft" Brexit, import tariffs between the UK and the EU-27 remain at zero, whereas Non-Tariff Barriers (NTBs) measuring technical standard divergence among other factors, increase to a 2.77% tariff equivalent. In the "hard" Brexit scenario, import tariffs between the UK and the rest of the EU will be raised to the so-called Most-Favoured Nation (MFN) rates. In addition, NTBs would rise to 8.32% under a "hard" Brexit. The Brexit scenarios are summarized in Table 1.

Table 1: Brexit scenarios from the literature

	Tariff	**Non-Tariff Barriers**
Soft Brexit	0%	2.77%
Hard Brexit	MFN tariffs	8.31%

Reference: Dhingra et al. (2017)

Domestic Value added and Employment losses under Brexit

For every EU-28 country, in Figure 1 we report the job losses for each Brexit scenario when both the UK and the EU-27 would raise their barriers. The bars indicate the normalized job losses as a percentage of a country's active population. Figure 1 additionally reports the absolute job losses by EU country in the worst case e.g. the "hard" Brexit scenario (in brackets).

Our results clearly indicate that the UK is hit relatively harder than the rest of the EU-27 (except for Ireland and Malta) in both the "soft" and "hard" Brexit scenario.

In either scenario, Brexit leads to a relative reduction in economic activity in the UK. The UK job losses in the event of a hard Brexit amount up to 526,830 UK jobs lost. This is about four times the job losses that the UK would entail under a soft Brexit. In terms of domestic value added, a "hard" Brexit corresponds to a loss of 4.47% as a percentage of UK GDP. Under a "soft" Brexit the loss in UK value added would be about four times smaller (1.21%).

These UK losses are high and in relative terms they are about three times higher than for the EU-27 as a whole.

Our results also indicate that for the EU-27 the losses are higher in absolute numbers. Under a "hard" Brexit scenario, the EU-27 would face up to 1,209,470 EU jobs lost. This is about four times the EU job losses that would occur under a "soft" Brexit. In terms of domestic EU value added, a "hard" Brexit corresponds to a loss of 1.54% as a percentage of EU GDP and 0.38% for a "soft" Brexit. These losses differ substantially across EU-27 member states. The EU-27 countries that lose relatively most are those with close historical and geographical ties to the UK (e.g. Ireland, Malta) and small open economies (e.g. Belgium, the Netherlands and the Czech Republic). While Germany would suffer the largest absolute job losses (291 930), once we normalize for country size by expressing the job losses as a percentage of the total active population in Germany, its relative losses are more moderate when compared to the other EU-27 countries.

Figure 1: Total Job losses under Brexit
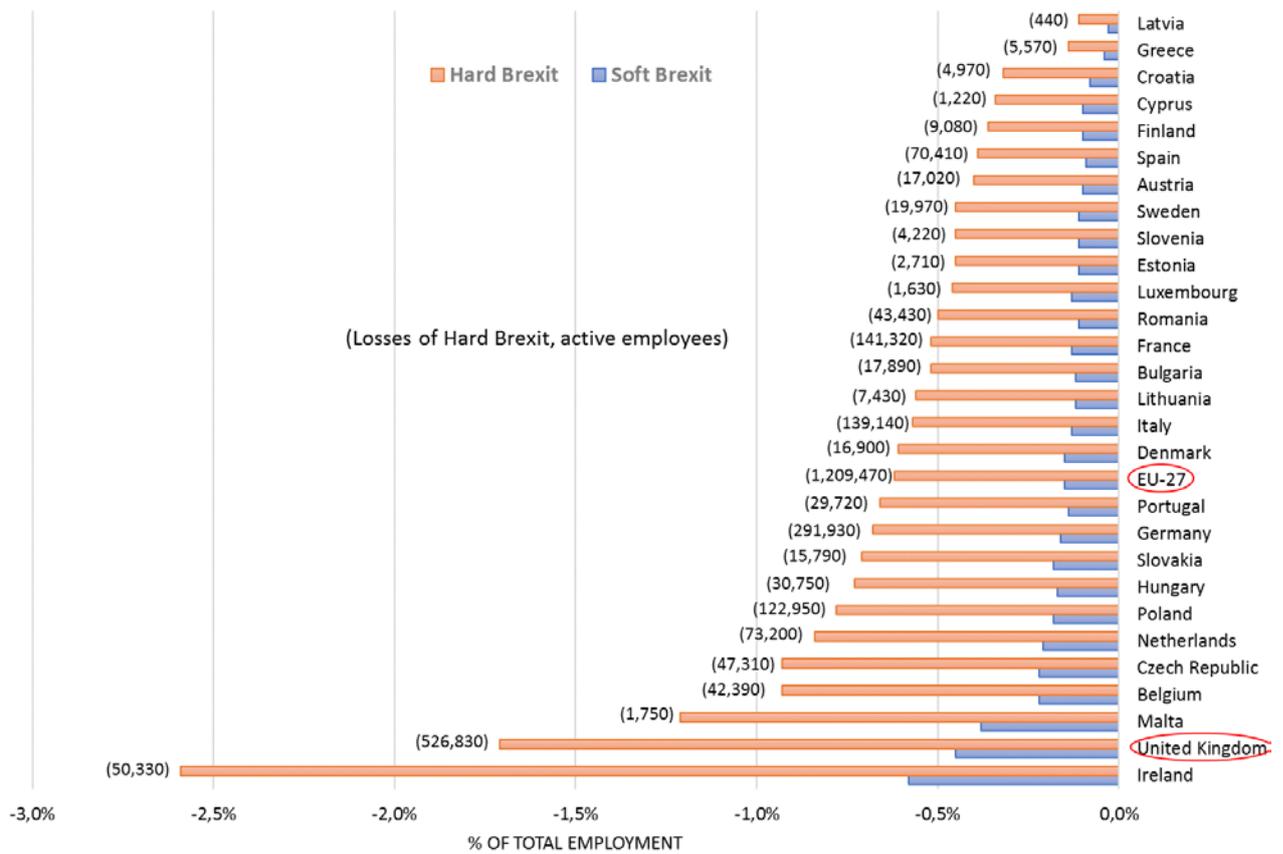
For each EU country, Table 2 shows which sector will be most affected under a "hard" Brexit scenario. For Germany, most jobs will be lost in "Motor Vehicles", while for Belgium job losses are highest in the "Food" sector. But for some countries like France, most jobs are lost in services such as "Administrative and support Activities".

Our results on which sectors will be most affected by Brexit can differ from what other studies have found. The reason is that our methodology additionally accounts for input-output linkages between goods and services sectors, and includes both direct and indirect trade with the UK (via "third countries").

Table 2: Most Affected Sectors in the "hard" Brexit Scenario (in value added terms)

Countries	Sectors
Austria	Machinery & Equipment
Belgium	Food Product
Bulgaria	Textiles
Cyprus	Financial Services
Czech Republic	Electronics and Computers
Germany	Motor vehicles
Denmark	Mining and quarrying
Spain	Food Product
Estonia	Wood and Cork
Finland	Paper Products
France	Administrative and sup.
United Kingdom	Administrative and sup.
Greece	Water transport
Croatia	Other services
Hungary	Electronics and Computers
Ireland	Food Product
Italy	Textiles
Lithuania	Petroleum Products
Luxembourg	Financial Services
Latvia	Wood and Cork
Malta	Other services
Netherlands	Wholesale trade
Poland	Wholesale trade
Portugal	Textiles
Romania	Textiles
Slovakia	Real Estate
Slovenia	Metal products
Sweden	Petroleum Products

Conclusion

Our findings indicate that both the UK and the EU-27 would suffer substantial losses if they are denied free trade access to each other's market when Brexit happens. However, while the current belief is that especially the UK has a great deal to lose from Brexit, our sector-level input-output approach clearly shows that the EU-27 stands to lose considerably more than hitherto believed. The reason is that EU-27 production networks are closely integrated, which implies that tariff changes with the UK do not just affect each EU-27 country's direct bilateral trade flow to the UK but also the indirect trade flows (via third countries) that end up in the UK and which also represent employment and jobs but which have not been taken into

account by previous studies. Vandenbussche et al. (2017), estimate these indirect effects to account on average for about 25% of the total Brexit impact. But for some EU countries, these indirect effects make up 50% of the total employment effects. The inclusion of this production network structure substantially reinforces the negative impact of Brexit that we find especially on the EU-27, compared to other studies.

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