European Integration and the Substitution between Offshoring and Immigration *

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Abstract

Following the 2004 EU enlargement, Western European countries progressively and sequentially opened their labour markets to Eastern European workers. We use that event to provide evidence of substitution between employing immigrant workers and production offshoring in Europe. We combine data from the European Labour Force Survey with the World Input-Output Database and use an instrumental variable to tackle potential endogeneity in the trade-migration relationship. We find that, following the openings of labour markets, Western European sectors where Eastern European workers have a larger presence import less value added in intermediate goods from Eastern Europe (i.e. a measure of offshoring). This effect mostly concerns low skilled immigrant workers. We suggest that once labour markets were opened, it became relatively easier for firms to import workers rather than goods and fill in labour market needs. This work is, to our knowledge, the first to provide evidence regarding the effect of the EU enlargement-induced labour mobility on European and global value chain. It also contributes to the literature by looking at the trade-migration relationship at the sector and occupation level.

JEL classification: F13, F14, F22, C36

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1 Introduction

Freedom of movement of goods and workers are two important pillars of the European Union (EU). The consequences of their interaction is still a topic of debate, particularly in Western Europe. The Brexit process is a recent example that embodies these discussions. The original negotiation objective of the United Kingdom to limit immigration from the EU while keeping freedom of movement of goods was the result of a political platform capitalizing on the hostility to Central and Eastern European immigration following the EU enlargements of 2004 and 2007.[1] As far-right parties have been shown to benefit from both trade liberalization (Colantone & Stanig 2018, Dippel et al. 2020), due to its labour market effects, and immigration (Otto & Steinhardt 2014, Barone et al. 2016, Harmon 2018, Edo et al. 2019) across Europe, it seems important to improve our understanding of how both phenomenon interact in Europe.

In this paper, we provide evidence of substitutability between offshoring and immigration, using the progressive opening of Western European labour markets to Eastern European workers after the EU enlargements. Adhesion to the Common Market in 2004 corresponds to the final step in the liberalization of trade in goods, at a period where trade links became more global and fragmented.[2] In the following years, workers from new Member States progressively obtained the right to work in all of the EU, i.e. Western European countries liberalized access to their labour markets in turns. A large increase of immigration of Central and Eastern European citizens ensued (Kahanec 2013, Holland et al. 2011). We exploit the differences in the timing of labour markets' openings to capture the impact of post-opening inflows of Eastern European workers in offshoring decisions (i.e. imports of domestic value added in intermediate goods) towards Eastern countries at sectoral level for 11 Western European economies. The timing of the integration process, i.e. trade liberalization first and labour markets' opening in a sequential fashion, limits the risk of endogeneity of the relationship we aim to estimate. To lessen even more that concern, we also use an instrumental variable strategy based on a shift-share instrument constructed at the sectoral level.

We provide evidence that following the European labour market opening towards New member states (NMS-10) countries, the increase in employment of immigrants involved in manual tasks, reduced offshoring by Western Europeans sectors, ceteris paribus. Dif-

[1] More precisely, 10 Central and Eastern European countries joined the EU in 2004 and then Romania and Bulgaria in 2007, followed by Croatia in 2012.

[2] As stated by De Backer & Miroudot (2014) more than half of world manufactured imports are intermediate goods (primary goods, parts and components, and semi-finished products), whereas more than 70% of world services imports are intermediate services.

ferently from the existing literature, our measure of offshoring consists in imported *value added* in intermediate goods, rather than just gross imports.[3] In the trade-migration nexus literature, one of the mechanisms through which migrants induce trade is the reduction of information frictions, differently known as the network effect (e.g., Gould 1994, Head & Ries 1998, Rauch & Trindade 2002, Felbermayr & Toubal 2012 and Wagner et al. 2002).[4] As a consequence, the established link between trade and migration is bilateral and usually stronger for skilled workers.[5] This study does not focus on such effect. Instead, our hypothesis is that labour market tightness in some Western Europe sectors might explain both recourse to immigration or offshoring and our analysis brings confirmation in two ways. First, we show that sectors employing more Eastern European workers in the post-opening period make a smaller use of overtime hours by natives. As overtime work is more likely to required in case of difficulties to hire, we interpret this result as immigrants coming to occupy unfilled jobs. Second, the post-opening immigration shock does not only reduces offshoring to Eastern Europe but also to other regions of the world. This is expected as we do not consider our main findings to be the result of a network effect and Eastern European workers have no specificity beyond their capability to freely move to Western Europe. Rather, evidence suggests it is caused by the relaxing of a constraint on the recruitment of adequate manual workers, thanks to the opening of Western Europe labour markets to Eastern European workers.

Hence, our work is closely related to the literature about offshoring or immigration. In a classic article Ramaswami (1968) discusses the choice between exporting capital to produce abroad or importing foreign workers to produce domestically. More recently, this relationship has been formalized by Olney (2012) and then extended to native workers by Ottaviano et al. (2013) in a task-based model. However, in the latter work the effect on trade is not explored and offshoring is measured through production input (i.e. number of overseas workers) rather than imported value. Using country-level data, Kugler & Rapoport (2005) and Javorcik et al. (2011) find complementarity between the presence of immigrants and foreign direct investment on the long-term through the effect of migrant networks.[6] Similarly to those studies, we distinguish between different

[3]Indeed, gross imports from Eastern European countries might contain re-exported foreign value. As a consequence, a reduction of gross imports would simply capture a reduction in trade effect, but not a decision to produce less in Eastern countries.

[4]Indeed, migrants play an important role using established networks with their origin country or might create new networks using their comparative advantage of better knowledge of language, legal and institutional arrangements. They could be initiators of new trade chains (in the extensive margin) or enforce the existing ones (intensive margin).

[5]For instance, in Burchardi et al. (2017) US counties with a higher share of the population declaring ancestry from a given country will have more FDI links with that country of origin. In micro-level studies, Hatzigeorgiou & Lodefalk (2016) use firm level data for Sweden and find that there are mostly small firms that benefit from hiring foreign-born workers and that workers' skill is necessary to boost a firm's export performance. Marchal & Nedoncelle (2019) using French firm level data show an overall positive effect, induced mostly by skilled foreign workers.

[6]This is the case particularly for immigrants with higher levels of education.

types of workers, but rather than education, we focus on occupations as they are stronger indicators of the actual economic role. More importantly, we use sectoral-level data: this greater level in dimension allows to precisely check the existence of substitutability for a given sector in production. Barba Navaretti et al. (2008) uses firm-level data to answer the same question and find that immigrants and offshoring are substitutes. However, in industry-related sectors, within firm analysis is likely to miss a part of the picture as we could expect that the shift from offshoring to domestic production takes the form of replacing a foreign supplier by a domestic one.[7] Such change can be better dealt with, by using sectoral-level data.

Another contribution of this paper relies on the use of the imports of value added in intermediate goods as our measure of offshoring, rather than considering trade in gross terms.[8] More precisely, this is equivalent to tracking value added produced in NMS countries incorporated in Western Europe's imports and allows to really understand the effect of the presence of immigrants in a given sector and country on the Eastern European production directed at the same sector-country. To our knowledge, there are very few papers that relate trade under the angle of global value chains with migration. Egger et al. (2019) combine firm level data with precise information on the foreign suppliers of Swiss firms with municipal-level data on the number of foreigners. They find that exposure to immigrants from a given country decreases the number of suppliers from that country and that it increases the stability of the relationship with the supplier and also the volume of imports. These effects are higher for some products which are more relationship dependent (the median number of suppliers is lower). Ariu (2019) look at the role that immigrants in certain Swiss localities had on the supplying side of inputs coming from the origin countries of immigrants. They conclude that migrants reduce trade frictions and help in importing higher quality products from the upstream providers. This paper contributes to this literature, by exploiting a particular context (the EU enlargement) and delving into the mechanisms that relate migrants' presence in different sectors and offshoring decisions.

The integration in European Union of NMS has been studied in several aspect: welfare effects (Caliendo et al. 2017), integration in GVCs (Hagemejer & Ghodsi 2017) or movement of workers in EU (Kahanec 2013). To the best of our knowledge, this work is the first to provide evidence on the effect of labour mobility on European value chains,

[7] Olney (2013) finds that the presence of immigrants stimulates firm creation and expansion at the city level, particularly for low-skill intensive industries.

[8] Recall that looking only at imports of intermediate goods can be misleading in terms of the magnitude of what has truly been offshored in NMS-10, whereas tracing the value that was locally produced by the exporting country provides a clearer picture of what has been truly offshored.

and therefore brings insight regarding the interaction between trade liberalization and freedom of movement of workers. A related work to the context of this paper is Caliendo et al. (2017) that evaluate the effects of the 2004 enlargement on migration and welfare using the EU Labour Force Survey database. To do so, they propose a multi-country general equilibrium model and also make use of the timing of Western Europe labour markets' openings. They find that the enlargement increased the migration of low-skilled worker more than high-skilled individuals. Migration would also have been larger with change in trade policy (joining the single market). By exploring the implication of the liberalization of the movement of workers in terms of offshoring, our work usefully complements the findings of Caliendo et al. (2017).

Finally, this paper relates to a strand of literature that digs into finer effects of migration through occupations (e.g., Borjas 1999, Ortega & Peri 2014, Ottaviano & Peri 2006, Docquier & Lodigiani 2010, D'Amuri et al. 2010, D'Amuri & Peri 2014 or Mitaritonna et al. 2017). We complement the existing literature by exploiting the presence of foreign workers in small cells : sector, origin and occupation. Peri (2016) exposes the main aspects of the impact of immigration on labour markets, illustrating the different effects at local and national level and emphasizes that the level of substitutability among nationals and migrants could change depending on the skill group. Bauer & Kunze (2004) analyze firm level data and find that most workers from EU countries are used to complement high skilled domestic labour, but non-EU migrants are hired to address shortages of high-skilled labour. In this debate, defining the cell used in the analysis is quite important. As suggested by Chiswick & Miller (2009), occupations (rather than education level) provide a better information about the types of jobs that migrants do, given than often their level of education might not coincide with their occupation in the receiving country.

The remainder of this paper is organized as follows. In Section 2 we describe data and some stylized facts. Section 3 explains the empirical strategy. Section 4 presents the main results. In Section 5 we analyse the mechanisms behind the trade off between immigration and offshoring. Section 6 concludes.

2 Data and Stylized Facts

2.1 World Input-Output Database

In the context of production fragmentation using gross trade data provides limited information. Indeed, gross exports contain parts from foreign suppliers or domestic value that has been re-exported. We use the World Input-Output Database (WIOD) to trace different value added components in trade flows. This database contains information about all input-output entries for 43 main economies and the rest of the world (2000-2014) in 56 sectors. Several metrics have been developed to measure trade in value added. In order to decompose gross exports in multiple components, we use the breakdown of Wang et al. (2013). It splits bilateral gross exports into 16 value added components which can broadly be divided into domestic and foreign value added: domestic value added (hereafter DVA) absorbed abroad, DVA in intermediate exports absorbed by direct importers, DVA in intermediate exports re-exported to third countries, DVA in intermediate exports used to produce final goods in third countries, intermediate exports re-exported to third countries as final goods, intermediate goods re-exported to third countries to be exported afterwards, DVA returning home, foreign value added (in final and intermediate exports), pure double counting from domestic and foreign source. From these data one can trace intermediate good exports from NMS-10 to EU-11 (backward linkages) and more particularly one can distinguish domestic value added from NMS-10 countries contained in imports of intermediate goods of EU-11 countries. More information about the decomposition methodology can be found in the Appendix A.

2.2 Labour Force Survey

In order to merge input-output information with migration data, we need a data source on foreign workers by origin in Western Europe at the sectoral level. We use the European Labour Force Survey (EU-LFS) provided by Eurostat.[9] The LFS is a representative survey of households conducted on a yearly-basis in all EU countries. It contains demographic information (region of birth, age, gender, education) and information related to jobs (employment status, occupation, economic sector of the company). We start the sample in 2004 because there is no sufficiently precise information on the country of birth of foreign workers before that date.[10] We include a set of 11 Western Euro-

[9] See https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey

[10] Before 2004, most countries only differentiate foreign-born individuals between those from the EU-15 and those from the rest of the world, without providing precisely the place of origin of the workers.

pean countries.[11] We remove four countries due to limited data availability. Germany is excluded from the sample because there is no information for the country of birth of foreign workers.[12] Similarly, Italy does not provide this information in 2004. We also exclude Sweden and Finland because foreign workers originating from NMS-3 or NMS-10 countries are grouped in one category. We also drop all observations without information on the country of birth of foreign workers[13] and cases of inactive population or when there is no information on the professional status of the worker.[14] The total number of worker-level observations is 7,698,273 for the period 2004-2013.

We use foreign-born workers as our measure of migrant's stock, therefore including naturalized citizens in the foreign workforce. Foreign born workers in EU countries originate from different countries which are grouped in 9 blocs: EU-15, NMS-10 (new member states from the 2004 enlargement), NMS-3 (New member states from the 2007 and 2013 enlargements), Europe outside EU28, East Asia, South and South-East Asia, Latin America, North America and Australia as shown in Table B1.[15] We use such information to compute the share of individuals born in a specific region of the world (foreign-workers) over all workers of a specific country and industry. We add 0 for all sectors with missing information on foreign workers from a specific origin country.[16]

Although the EU-LFS also makes it possible to look at migration flows before 2004, we prefer to concentrate on stocks for two reasons.[17] First, immigrant stocks seem a more pertinent indicator when looking at trade as any effect should come from the presence of foreigners. In addition, it seems more precise to use stock because flows can vary a great deal every year and do not necessary have a lasting impact on the workforce. Second, for some countries, flows decomposed by economic sector and region of origin are very small in the EU-LFS and a slight variation might greatly affect the ratios we are looking at. This is of particular concern as recent arrivals are likely to be less well

[11] Austria, Belgium, Denmark, Finland, France, Ireland, Luxembourg, Netherlands, Portugal, Spain and United Kingdom.

[12] There is only a national/foreigner distinction available for Germany. The consequence of the EU enlargement of 2004 on the German economy and the development of value chains in Central Europe has been highlighted by the literature. Germany might constitute an outlier as its geographical situation could explain both immigration and value chain developments.

[13] Only 1.16% of the observations of the raw sample do not contain any information on the country of birth of foreign workers.

[14] The share of foreign workers that we will create later, will be based on the total active population so we do not need the inactive one. We should make a decision whether to consider the missing values, but as we cannot be sure whether these individuals are active or not, we decide to drop them.

[15] This is also a drawback due to data limitation. As it has been illustrated by several works, integration of Eastern countries in GVCs has been quite heterogeneous. Kersan-Škabić (2017) show that Hungary has been the most integrated country where a huge part of value added originates from the EU member states. But we are restricted due to data composition to use NMS countries as a single block.

[16] We make the assumption that the information in the survey is quite representative and the missing foreign workers are a sign of no workers from a specific origin. One concern with the EU-LFS survey has to do with the cells to which the weights given corresponds. We look at relatively precise information (country-origin-sector-year level). and it could be possible that some of those categories are missing due to the imprecision of the survey and that weights could not adequate redress those imperfections. Table B6 shows that the number of Easter European workers present in our survey is not too remote from what is expected, even before weight are applied.

[17] Considering migration flows in this context can be found works like (Caliendo et al. 2017).

surveyed, leading to greater noise if we were to use that variable.

We explore data on occupations of workers to look at a finer cell when linking immigration and trade. We compute the share of foreign-born in several occupations, based on the ISCO-88 and ISCO-08 classifications. Indeed, the change of classification in 2011 forces us to design a concordance between the two versions. We aggregate those occupations in three groups : high (managers and professionals), medium (associate professionals and clerks) and low (crafts workers, labourers and plant workers).[18] Merging trade and migration data has the caveat of aggregating several sectors. We end up with 13 sectors mainly based on the NACE rev.1 classification.[19] We end up with a balanced panel of 1,287 triplets importer-exporter(block)- NACE sector and a total number of 12,870 observations.[20]

2.3 Stylized Facts

Fact 1: Backward and forward linkages differ in their response to the 2004 EU enlargement. Countries may participate in global value chains through imports of foreign inputs, i.e *backward participation* or *offshoring*. Alternatively, *forward participation* in global value chains is identified through exports of value, then used to produce other goods in the importing country. Figure 1 shows the direction in which trans-European value chains have evolved after the integration of NMS-10 countries in the EU in 2004. It presents the growth of EU-11 imports and exports of value added (in orange) from and to NM-10 countries at the sectoral level for the 4 years preceding and the 4 years following the enlargement. For all sectors above the 45° line, growth has been higher after 2004 than before. General patterns clearly differ between imports (in orange) and exports (in blue). Exports growth was much faster in the post-enlargement period for most sectors. In contrast, intermediate goods imports growth is higher only for a limited number of sectors (agriculture, electricity, transport,...) which benefited from the removal of the last remaining trade restrictions. This divergence can be explained by the fact that tariffs were already reduced substantially for most sectors in the years preceding the actual enlargement and regulations were progressively brought to EU-11 standards during the negotiation process, allowing Western companies to offshore before the enlargement. It seems that the benefits brought by the enlargement regarding trade

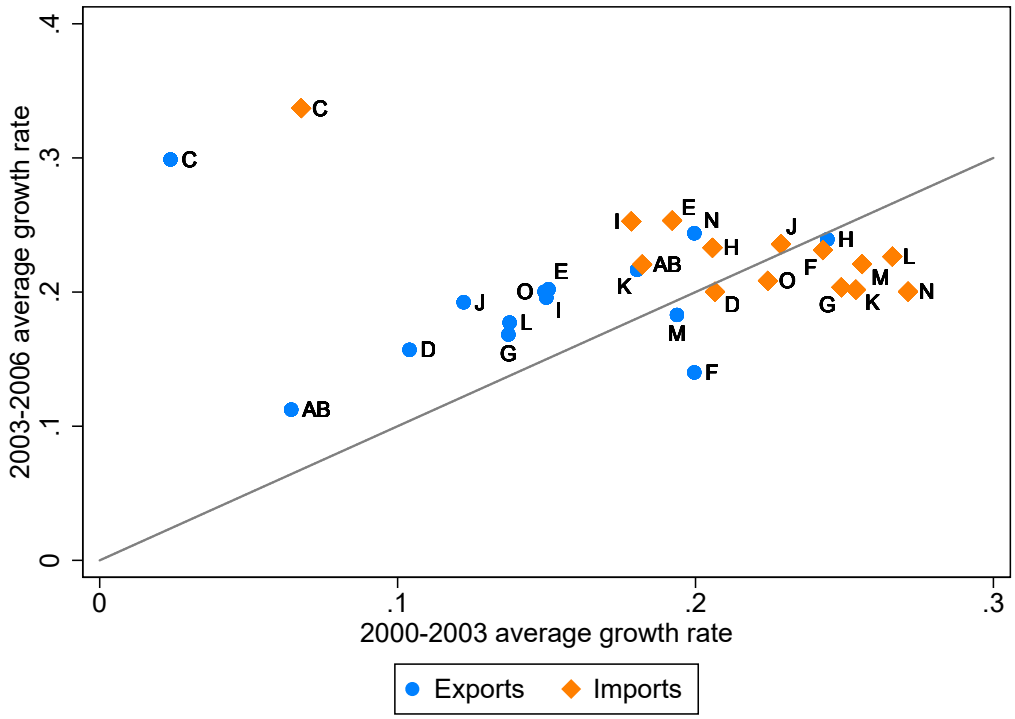
[18] For 5.17% of our individual level sample, information on occupation is missing. Such individuals are therefore not considered in the construction of the ratio of foreign worker by occupation.

[19] See Table B2. We aggregate some NACE rev.1 sectors to account for the change in classification in 2008 and we drop sectors P (*"Activities of private households as employers and undifferentiated production activities of private households"*) and Q (*Extraterritorial organizations and bodies*) from our sample as these are considered non-tradable in most countries.

[20] Descriptive statistics of the main variables are available in Table B3, both for the full sample and the restricted sample we use for our regressions.

were largely anticipated by EU-11 firms aiming at importing goods from Central and Eastern Europe (and less so for exports.)[21]

Figure 1: EU enlargement and value added trade of intermediate goods



Source: Authors' computation using WIOD data. The corresponding sectors are Agriculture, hunting and forestry, Fishing (AB); Mining and quarrying (C); Manufacturing (D); Electricity, gas and water supply (E); Construction (F); Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (G); Hotels and restaurants (H); Transport, storage and communication; Real estate, renting and business activities (IK); Financial intermediation (J); Public administration and defence; compulsory social security (L); Education (M); Health and social work (N); Other community, social and personal service activities (O).

Fact 2: An increasing and heterogeneous participation of NMS-10 economies in GVCs and of NMS-10 nationals in EU-11 labour markets. This paragraph presents the evolution of trans-European trade and migration at the sector level and points to an increasing importance of Central and Eastern Europe in the EU-11 economy and the relevance of using country and sector level data due to the large sectoral heterogeneity of this trend.

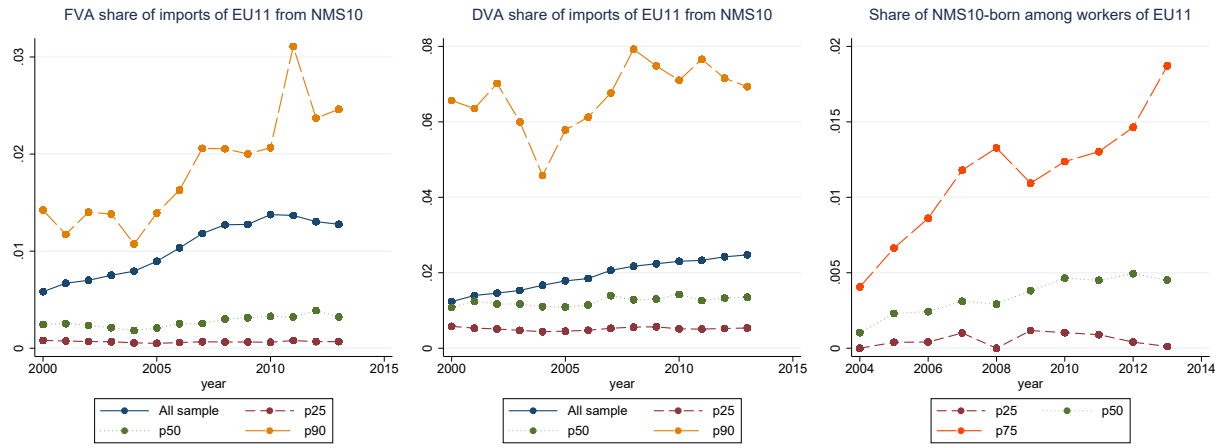
GVC participation looks at the extent to which a country provides/supplies value from/to other countries of the production chain (Hummels et al. 2001). The presence of exported foreign value is an evidence of production sharing, for instance through imports of foreign inputs. Hence, we consider the share of exported foreign value added and returned domestic value added of NMS-10 over all imports of EU-11 to assess its participation in European values chains in the left-hand side of Figure 2. The blue

[21] In addition, trade agreements preceding the enlargement were asymmetrical in the level of market opening, to the advantage of Central and Eastern Europeans countries.

line shows the evolution of NMS-10 foreign and returned (hereafter RDV) value added in total imports of EU-11.[22] It has been steadily increasing until the Great Recession and stagnating afterwards, in line with the view that GVCs grew strongly over most of the 2000-2011 period. As the participation in GVCs can be heterogeneous depending on sectors, we compute this ratio at the country-sector level. The orange, green and red lines presents the distribution of these country-sectors at the 25^{th}, the 50^{th}, 90^{th} percentiles for each year. It appears that most of the increase of the participation of NMS-10 in European value chains comes from the very top of the distribution of country-sectors : for the 10% of sectors with the highest ratio, the level of integration is largely higher than for the median country-sector and the variations are also more acute.

We want to be sure that this increase in integration is not only due to NMS-10 countries acting as simple hub for exporting to Western Europe, but to actual value originating in NMS-10 and being exported to EU-11. The middle graph of Figure 2 reproduces a similar exercise, but now we restrict EU-11 imports to domestic value added in intermediate goods from NMS-10, excluding re-exported value added.[23] A similar pattern as in the left-hand side graph appears: in the aggregate (in blue), imported value added originating from NMS-10 to EU-11 increases, but most of the variation concentrates at the top of the distribution of country-sectors (in orange). For the bottom half of the country-sectors, the rise in imports of value added from NMS-10 stagnates.

Figure 2: Global value chain's participation and NMS-10 migrant's distribution



Notes: Authors' computation from WIOD and EU-LFS data.

The heterogeneous participation in GVCs of EU-11 countries and specific sectors is

[22] The returned value added in exports of NMS-10, makes reference to NMS-10 domestic value added that has been exported, then returned and is being re-exported again, in this case to EU-11.

[23] We focus on value added traded through intermediate goods, as they are more characteristic of GVCs.

not a result of bilateral historic trade relations or sector specificity: excluding Austria and/or the construction sector, both of which are over-represented in the top 10% of country-sectors, does not affect tnhe patterns presented above.[24]

The right-hand side of Figure 2 illustrates a similar pattern for the presence of NMS-10 workers in country-sectors in EU-11.[25] In order to trace the same sector-countries in specific percentiles throughout the period in Figure B1 we repeat the same graphs but we fix the sector-countries of certain percentiles in 2000 and follow them in time. Results show that indeed, in the top distribution there is more variability in terms of country-sectors concerning the presence of value added originating from NMS-10 exported through intermediate goods in EU-11. Likewise, most of the increase is due to a minority of country-sectors hiring a large share of NMS-10 in their workforce. We control for this possibility in the next section, using econometric techniques.

Fact 3: Increasing presence of NMS-10 workers in EU-11 labour market As presented in the previous sub-section, the increase in the share of NMS-10-born among EU-11 workforce was steady over the period 2004-13, but heterogeneous with respect to the concerned countries and sectors. We show here that one element of explanation of this heterogeneity is the timing of labour market opening to NMS-10 workers. As NMS-10 migrants could be directed toward a specific sector where they have an advantage over other workers, both native and foreign. we asbtract from sectoral composition effect by estimating the following equation :

$$Migrant_{jst} = \gamma_{js} + \sum_{t=05}^{t=13} \beta_t \mathbb{1}(t) + \varepsilon_{jst} \tag{1}$$

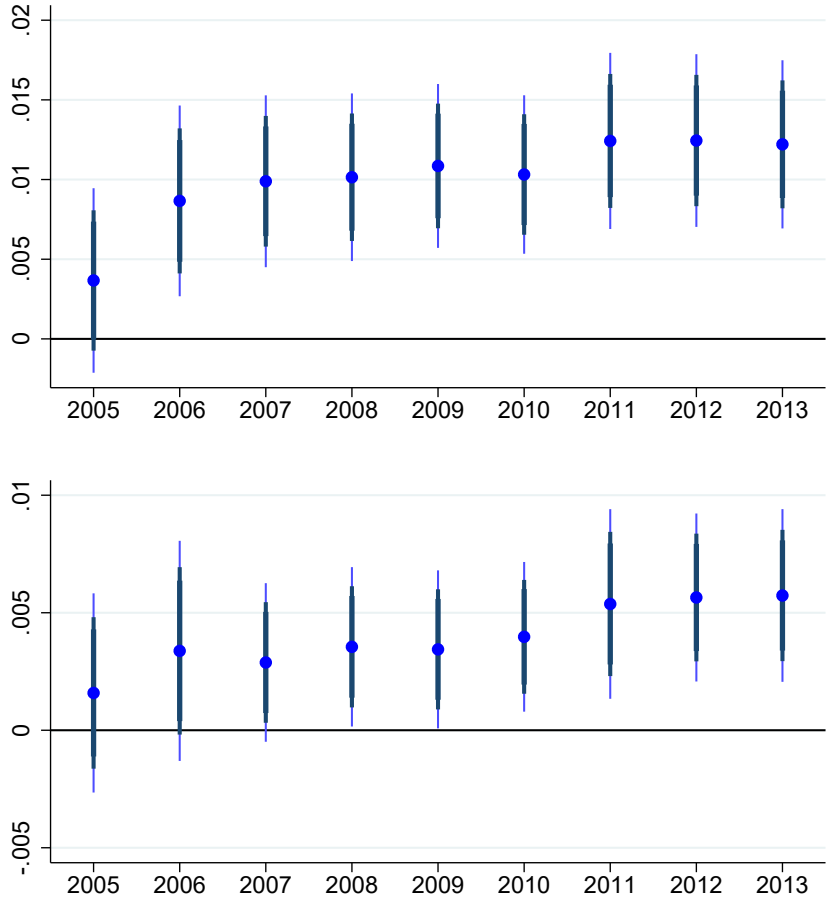
The dependent variable is the share of workers from NMS-10 block in country j in sector s and year t. $\mathbb{1}(t)$ is an indicator function taking the value of 1 in each year. The coefficient of interest β shows the change in migration share of NMS10 migrants in EU-11 countries compared to the base year 2004. δ_{js} is the fixed-effect that takes into account the sectoral distribution of NMS-10 workers in each EU-11 countries.

Figure 3 presents the coefficients β_t and their interval of confidence. The upper part shows a significant increase in the presence of NMS-10 workers, irrespective of the sector and the bilateral link. The increase is progressive after 2004 and really

[24] For some sectors trade is more intense whatever the country, due to comparative advantages for instance. The construction sector is one likely suspect.It is the only one part of the top 10% of country-sector pairs for each country at least one year.

[25] It starts in 2004 as the LFS does not contain information about birthplace of individuals for previous years. The orange line corresponds here to the 75^th percentile. The evolution of the 90^{th} percentile is similar but the share of NMS-10 workers in these country-sectors is so large that it tends to tamp down the other lines and reduces the readability of the graph.

Figure 3: Progressive increase of the share of NMS-10 workers in EU-11 (top) and EU-9 (down) after 2004



Notes: Authors' computation from EU-LFS data. The upper figure shows migration flows from NMS regressed on sector and year fixed effects. It includes 12 European countries. The bottom graph excludes United Kingdom and Ireland.

kicks in after the removal of movement restrictions by countries that implemented them. Indeed, the liberalization of movement for Eastern Europeans was subject to restrictions implemented by most EU-11 countries. In our sample, only Ireland and the United Kingdom did not implement such restrictions, and they witnessed larger flows than other EU-11 countries. Restrictions were progressively removed over the following year. The bottom graph of Figure 3 presents the same exercise but with UK and Ireland removed from the regression sample. It underlines the impact of the difference in timing of labour market openings. The increase in the share of NMS-10 in the workforce starts later. It is still significant and progressively increasing as more countries liberalize their labour market.[26]

[26] We can also compute similar coefficients for migrants from the rest of the world. On both samples, the coefficients attached to the rest of the world are small and not significant, showing that there was no general increase in immigration from the rest of the world in the period following 2004.

Table 1: Share of migrants from NMS-10 by occupation and country (in %)

Country	2004			2013		
	High	Medium	Low	High	Medium	Low
Austria	1.58	1.05	1.46	2.13	1.40	2.91
Belgium	0.12	0.11	0.25	0.48	0.45	1.58
Denmark	0.25	0.27	0.13	0.68	0.78	1.26
France	0.19	0.07	0.23	0.16	0.05	0.28
Greece	0.34	0.18	0.47	0.17	0.13	0.43
Ireland	0	0	0	2.07	3.68	11.75
Luxembourg	0.32	0.16	0.33	3.43	0.74	1.35
Netherlands	0.19	0.19	0.21	0.49	0.51	0.88
Portugal	0	0	0	0.03	0.01	0.01
Spain	0.11	0.01	0.36	0.17	0.11	0.35
United Kingdom	0.42	0.30	0.50	0.94	1.78	4.47
EU-11	0.28	0.19	0.36	0.61	0.74	1.87

Source: Authors' computation from WIOD data.

Another dimension of heterogeneity regarding migration concerns occupation. Table 1 shows the share of citizens from NMS-10 among the high, medium and low occupation groups of workers of each EU-11 country and for the aggregate zone in 2004 and 2013. As it can be noticed, the comparison of the situation at the beginning and the end of our sample shows an increase in the share of NMS workers among every skill group on average. Even if this increase is quite present in all skill groups, the surge concerns foremost low-skilled workers on aggregate.

These facts are coherent with our story : post-enlargement migration substituted with offshoring and reduced growth of imports of intermediate goods by Western European sectors and countries. As presented by stylized facts 2 and 3, the share of NMS-10 workers progressively increased in the workforce of EU-11 and this increase was particularly important for low occupation jobs. This increase was not specific to one country or one sector, hinting that immigrants from NMS-10 went to work in different sectors in each country, possibly according to local labour needs. Moreover, Figure 1 highlights the lack of shift in the trend of intermediate imports' growth after the 2004 enlargement. That variable is commonly used as a proxy for offshoring and therefore brings support to the assumption that sectors that offshored did so in part due to a lack of an available labour force in EU-11 before the opening of their labour markets to NMS-10 migrants. Our hypothesis is that once the restrictions were removed, it became easier for firms to import workers rather than goods and this translated in a rise of presence of low occupation NMS-10 workers in EU-11. Low occupations worker are more likely to be involved in offshorable activities. The opening of Western Europe labour markets would

therefore affect the substitutability between offshoring and employing immigrants. With the purpose of testing this idea, we turn to an econometric approach.

3 Empirical Specification

Our empirical analysis tries to shed light on the link between the increasing presence of Eastern workers in Western Europe labour markets and the development of West-East value chains between 11 European countries and the 10 new members of the EU (NMS-10). The empirical analysis is conducted at the importer-exporter-sector-year level, matching migration stock from survey information with value added trade data. We make use of the differences in the timing of labour market openings of EU-11 countries to understand the role of NMS-10 workers in East-West trade. Finally, we delve into the different mechanisms that could explain our results, using data on occupations and labour market needs.

3.1 Timing of the Labour Market Opening and Offshoring

The enlargement of 2004 is a major change of policy on the two aspects we are concerned with : trade and immigration. In fact the change of immigration policy was staggered compared to trade policy as temporary labour market restrictions continued to be applied for Eastern European migrants.[27] Even if the principle of free movement for EU workers was one of the pillars of EU integration, in practice countries that directly removed controls on employment of NMS-10 citizens in 2004 were very few. Only the UK, Ireland and Sweden opened their labour markets as they totally liberalized trade with NMS-10. As a consequence, these countries experienced a significant increase in immigration from Eastern Europe, although all countries were concerned to some extent as shown by the third stylized fact presented above. Other old members of the EU chose different dates to remove their restrictions on NMS-10.[28] This gap between increased liberalization of trade and freedom of movement allows us to look at the way in which immigration affected trade after the total liberalization of movement. Therefore, we focus on the sample workers in EU-11 from NMS that joined the EU after 2004 and exploit the heterogeneity of destination countries regarding the opening of their labour markets to NMS citizens.

[27] We refer indistinctly to freedom of movement or labour market liberalization in the paragraph as we interested in the freedom of movement of workers.

[28] In our sample, the UK and Ireland do not impose any restrictions. Others removed their restrictions progressively over the following year : Greece, Portugal, Spain in 2006; Luxembourg and Netherlands in 2007; France in 2008; Belgium and Denmark in 2009; Austria in 2011.

As aforementioned, due to data restrictions, information about the origin of foreign workers is provided in country blocks. One weakness of a specification with only one country-block of origin is the absence of any country of origin controls, despite the fact that one could expect most of the effect to come from NMS-10 countries. It could be that countries entering the EU in 2004 were simultaneously affected by a shock that concerned both migration and trade. To this purpose, we consider another origin related to the particularities of the European context that is NMS-3 country block.[29] This block of origin provides the advantage to blend easily in our method of identification based on the timing of labour market liberalization. Indeed, similar restrictions to the employment of NMS-3 workers were implemented after the 2007 enlargement as for NMS-10 countries.[30]

To look at the effect of migrants' presence from NMS after labour market liberalization, on imported value added in intermediates originating from NMS to EU-11 countries, we estimate the following equation:

$$ln(DVA\_inter)_{ijst} = \beta_0 + \beta_1\ Mig\ Sh_{ijst} + \beta_2\ Lib_{ijt} + \beta_3\ Lib_{ijt}\ \text{x}\ Mig\ Sh_{ijst} + \gamma_{ij} + \delta_{ist} + \lambda_{jst} + \varepsilon_{ijst} \tag{2}$$

The dependent variable, DVA_inter_{ijst}, indicates the imports of domestic value added in intermediate goods originating in NMS countries. This variable captures the real value contained in intermediate goods imports that has been produced in the exporting country i in sector s, serving as our measure of *offshoring*. For example, if Germany offshores a part of its production to Poland in the automotive industry, domestic value added in intermediate good imports from Poland to Germany, contains all value that has been added by workers in Poland, and not elsewhere from more upstream stages of production. The exporters of value added i can be either NMS-10 or NMS-3 workers. Lib_{ijt} is now a dummy equal to 1 starting in year t when country j liberalized its labour market for citizens of i. It shows how a change in migration stock before and after labour market liberalization, captured by the interaction Lib_{ijt} x $Mig\ Sh_{ijst}$, induces a change in domestic value added intermediate goods imports of sectors of EU-11 countries. In order to account for specific immigration relationship between countries and potential sector-level shocks we introduce importer-exporter (γ_{ij}) that captures any particularity

[29] NMS-3 countries are Romania, Bulgaria and Croatia that joined the EU respectively in 2007 and 2013.

[30] EU-11 imposed some restrictions on Romanian and Bulgarian workers after the 2007 enlargement (Croatia integrated the EU in 2013 and is not taken into account here). Restrictions were removed in 2009 by Greece, Denmark and Portugal; in 2012 by Ireland. Spain removed its restriction in 2009 but reintroduced them for Romania in 2011 and kept them until 2014. As most NMS-3 workers present in Spain are Romanian we consider the dummy to be equal to 1 in 2009 and 2010 and 0 otherwise.

related to bilateral links that we do not control for, importer-sector-year (λ_{jst}) and exporter-sector-year (δ_{ist}) fixed effects control for exporter and importer unobserved characteristics.

This method tackles potential endogeneity in the trade-migration relationship : the liberalization of the labour market constitute a migration shock, that is largely exogenous to trade matters. Indeed countries implemented these restrictions due to fear of immigration and not on commercial considerations. Because trade liberalization had already largely occurred in 2004 our method is able to separate trade from migration shocks. Even though before the integration of NMS-10 tariffs were close to 0, in most sectors (as also seen in Table 1) the enlargement did not lead to a shift in the trend of intermediate imports' growth (as for exports). Firms importing from NMS-10 likely anticipated largely the enlargement while the removal of labour market restrictions was more uncertain because individual EU-11 countries had large leeway in the choice of the date and their potential reintroduction afterwards.[31]

Heterogenous Effects of Labour Market Liberalization As presented by stylized facts 2 and 3, the share of NMS-10 workers progressively increased in the workforce of EU-11. This increase did not only concern one specific country or sector, suggesting that immigrants from NMS-10 went to work in different sectors in each country, likely according to local labour needs. Moreover, Figure 1 highlights the lack of shift in the trend of intermediate good imports' growth after the 2004 enlargement. That variable is commonly used as a proxy for offshoring and therefore brings support to the hypothesis that sectors that offshored did so in part due to a lack of an available labour force in EU-11 before the opening of their labour markets to NMS-10 migrants. Most of the increase in the presence of NMS-10 workers concerns low occupations, that are more likely to be offshored in the first place. Our hypothesis is that labour market liberalization reduced the cost of using immigrant workers compared to offshoring and therefore led to a *substitution* between imports of value added in intermediates (offshoring) and employment of NMS-10 workers in low occupation jobs in EU-11.

To straighten out the mechanism linking trade and immigration we extract data on occupations and compute the share of foreign-born workers in given occupations. Indeed, it is unlikely that different types of workers affect trade in the same way. As white and blue collar workers accomplish different types of tasks, they are expected

[31] Only one country re-introduced restrictions after removing them : Spain liberalized its labour market to Bulgarian and Romanian workers in 2009 but came back on its decision in 2011. It was liberalized again in 2014.

to have different effects on trade, depending on their occupation type. We re-estimate equation (2) but by considering the share of migrants from zone i in a specific occupation for a given sector, year and EU-11 country. There are three main occupation blocks that we consider: high-skilled (professionals), medium skilled occupations (associate professionals and clerk) and low-skilled occupations (all the rest) using the ISCO-88 and ISCO-08 classifications that are used in the EU-LFS. This allows to capture the effects of migration in specific occupations on trade.

3.2 Endogeneity Issues: Shift-share IV Strategy

Even though the structure of fixed effects proposed in equation (2) is quite restrictive, there are two potential sources of endogeneity for the share of migrants. First, despite the use of several combinations of fixed effects, the estimation might still suffer from potential omitted variables bias. In this case the estimates would be affected if an unobserved factor explains both migration and trade. An unobserved positive productivity shock in a country for instance may simultaneously raise trade flows and attract migrants, which induces a correlation between the error term and the main explanatory variable, biasing the result upward. Another omitted variable problem would arise if there are conflicts in the origin countries which may simultaneously increase migration to EU-11 countries and reduce trade. This induces a correlation between the error term and the main explanatory variable and OLS estimates would be biased downwards.

A second empirical concern regarding the link between presence of foreign-born workers and trade is the direction of causality. The development of trade links between Eastern and Western Europe can be both cause and result of the presence of Eastern Europeans in Western Europe. Migrants might *ex ante* predict sectors where there are more employing opportunities. Also, firms integrating into European value chains might decide to recruit Eastern Europeans for logistical or marketing reasons, to ease their integration in the foreign market or to facilitate the use of foreign inputs in their production process. This would lead the coefficient to be biased upwards.

In order to address potential endogeneity we employ a shift-share instrument as in Card (2001) that is based on past migration distribution in the receiving countries:

$$\widehat{\mathrm{M}}_{ijst} = \frac{M_{ij,00}}{\sum_j M_{ij,00}} * \frac{M_{js,98}}{\sum_s M_{j,98}} * M_{it} \tag{3}$$

The instrument for migration stock in a sector s country j originating from block country i is computed as the product of three elements that employ lagged geographic distribution of immigrants in countries and sectors and control for the fact that the decision to migrate in a certain place is linked to existing networks. The first is the share of migrants in a destination country j originating from block country i in 2000 to control for pre-migration trends. The second element of the shift share is the share of migrants in sector s and destination country j in 1998[32] and finally the number of migrants per year of the considered period in destination country j. Indeed, $\widehat{M}_{ijst}$ is a prediction of the number of migrants from block i that would be working in sector s of country j if the distribution of migrants by origin and country of destination had stayed the same as in 2000 and if the distribution of foreigners between sectors had stayed as in 1998.[33]

This is a hypothetical number of foreigners based on past trends. It is be affected by current trade and should explain a substantial share of today's migrant distribution. In order to use this shift-share in our estimations, we need to construct an instrument similar to the main explanatory variable of the econometric specification. To this purpose we construct the share of the instrumented migrants over total workers' population, by considering that the number of native workers as fixed and equal to that of 2004 as showed below:

$$\widehat{\text{Mig Sh}}_{ijst} = \frac{\widehat{M}_{ijst}}{\sum_j \widehat{M}_{ijst} + Nat_{js04}} \tag{4}$$

Keeping constant the number of native workers, ensures that local labour market dynamics do not interfere in the link that we are exploring. For instance, an increase in the employment of native workers would reduce the share of migrants. In the end, the instrument is the "predicted" share of migrants from country i in sector s of destination j in year t over all migrants of in country j and sector s in year t and domestic workers of 2004. We instrument Mig sh_{ijst} and its interaction with Lib_{ijt} by $\widehat{\text{Mig Sh}}_{ijst}$ and by its interaction with Lib_{ijt}, as showed below :

$$\begin{aligned} ln(DVA\_inter)_{ijst} = \beta_0 + \beta_1 \widehat{Mig\ Sh}_{ijst} + \beta_2\ Lib_{ijt} + \beta_3\ Lib_{ijt}\ \text{x}\ \widehat{Mig}\ Sh_{ijst} \\ +\gamma_{ij} + \delta_{ist} + \lambda_{jst} + \varepsilon_{ijst} \end{aligned} \tag{5}$$

[32] In order to be closer to the sectoral distribution of Eastern Europeans, we exclude foreign workers from EU-15 countries from the computation. Including all migrants does not change the results.

[33] There is no information on the number foreigners at the sectoral level for all countries of the sample for preceeding years of the LFS.

4 Results

Integration in the European Union for NMS countries had the specificity of a difference in the timing of trade and labour market liberalization. Given this context, we investigate the role of NMS workers in value chains of EU-11 countries, more specifically their offshoring decisions. We use differences in the timing of labour market liberalization for the different EU-11 countries and split the sample into three main occupation groups. Together with this specification that exploits a difference-in-difference method, we use an instrumental variable strategy that allows to control for all unobserved differences in the sample for a country-sector-year triplet and avoid endogeneity issues. We present results by looking at the sample of NMS-10 and NMS-3 workers as described by equation (5).

Table 2: Labour market liberalization and DVA imports of intermediate goods from NMS

Dependent variable (in log):	Domestic value added imports of intermediate goods					
Occupation group	All workers			High	Medium	Low
	(1)	(2)	(3)	(4)	(5)	(6)
$Migrant_{ijst}$	0.143***	0.323***	1.203***	-9.112	0.359	0.748***
	(0.037)	(0.058)	(0.450)	(12.158)	(4.345)	(0.173)
$Lib_{ijt}(1/0)$	-0.002	0.154	0.785**	-4.347	0.113	0.685***
	(0.082)	(0.117)	(0.310)	(6.398)	(1.489)	(0.219)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-0.131***	-0.414***	-1.310***	7.535	-1.013	-0.712***
	(0.038)	(0.057)	(0.332)	(12.256)	(4.498)	(0.182)
Observations	2,860	2,860	2,860	2,860	2,860	2,860
R-squared	0.969	0.933	-	-	-	-
KP F-stat	-	-	20.67	0.313	0.215	6.491
Model	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Fixed effects:						
Exporter-year	No	Yes	Yes	Yes	Yes	Yes
Exporter-sector-year	Yes	No	No	No	No	No
Importer-sector-year	Yes	Yes	Yes	Yes	Yes	Yes
Importer-exporter	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of domestic value added in imports of intermediate goods to importer j in sector s from country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in country-block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 or NMS-3. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Table 2 reports the main results, considering domestic value added in intermediate goods imports as the dependent variable. Columns (1) and (2) show results on the full sample of NMS migrants, before splitting it by occupation. Including the full range of fixed effects in column (1), we find that on average throughout the considered period there is a statistically significant positive effect of migrants on imports. But the sign of the coefficient is reversed when we look at the interaction with the liberalization dummy. The direct coefficient is a hint of a network effect, while the interaction coefficient points toward substitution between imports of intermediates goods and employing NMS-10 workers, after the liberalization occurred. The total effect of migration is nonetheless positive. We allow for more variability between origin sectors in column (2) : instead of

adding an exporter-sector-year fixed effect, we look at within exporter-year estimates. The negative effect of the interaction becomes stronger than the direct effect, meaning that on average migration reduces imports after the liberalization. In column (3), we use the 2SLS estimator. To ensure a sufficiently high explanatory power to the instrument, as for column (2), we slighty relax the fixed-effects structure.[34] Results are similar : after the labour market liberalization an increase of the NMS workers by 1% point induces a decrease of imports of intermediate goods by 10.7%.

To dig deeper into this result, we split the sample in three occupational groups and estimate our specification for each of them separately implementing the IV strategy (columns 4 to 6). We find significant coefficients only for low occupation workers. This is not surprising, considering that most of the increase in the share of NMS workers in EU-11 labour market comes from low skill workers (see Table 1). High and medium skilled occupations do not seem to play a role in imports of intermediate goods (column 4 and 5).

These results confirm our hypothesis that labour market liberalization reduced the cost of using immigrant workers compared to offshoring and therefore led to a substitution between imports and employment of NMS-10 immigrants in low occupation jobs.

Quantification exercise In order to have a more precise idea of the results suggested by the baseline estimation, we undertake a quantification exercise where we measure the net effect (in dollars) that labour market liberalization had on offshoring. Indeed, it could be that sectors with the largest increase in foreign workers were not offshoring a lot. Hence, we compute, separately for each country-sector pair, the variation of the share of NMS-10 workers between the first of liberalization and 2013. Then, we use estimates of column 3 of Table 2 to obtain the change of DVA imports expressed in dollars, that resulted from the migration change in the post-liberalization period. We sum the results of the different sectors and countries to have an estimate of the impact of the migration wave on offshoring at the EU-11 level. We find that imports of DVA in intermediate goods from NMS-10 were reduced by 3.4 billion $ due to the labour market opening. A decomposition at the country-level is available in Table 3 of the Appendix.[35] As it can be noticed, there is a large heterogeneity : while trade is reduced by almost 2 billion $

[34] Compared to column (1), this fixed-effects structure does not control for a shock that would affect trade of all EU-11 countries with only one origin block in a specific sector and year. Adding this fixed-effect limits greatly the explanatory power of our instrument, represented by a low Kleinberg-Paap F-statitstics.

[35] The second column present the yearly change. As we only look at the post-liberalization period, the number of year over which the variation in imports is assumed to happen is not identical for each country. It ranges from 10 years for Great-Britain and Ireland to 2 years for Austria.

in Great Britain it actually increases slightly for France.[36]

Table 3: Quantification exercice (in millions of $)

Country	Total variation	Yearly variation
Austria	-341.37	-170.68
Belgium	-195.63	-48.90
Denmark	-119.58	-29.89
Spain	-15.27	-2.18
France	34.56	6.91
Great-Britain	-1894.76	-210.52
Greece	2.50	0.35
Ireland	-612.39	-68.04
Luxembourg	-22.08	-3.68
Netherlands	-207.07	-34.51
Portugal	-1.13	-0.16
EU-11	-3372.25	-

Notes: This table shows the predicted variation in imported DVA in inputs from NMS-10 due to labour market openings (in millions of $). The yearly variation is base on a different number of years for each country. Hence, it cannot be computed at the aggregate EU-11 level.

Alternative shift-share instrument Even though the proposed shift-share instrument in Section 3.2 tackles the problem of endogeneity, one potential weakness would be the reference year (2000) of bilateral migration structure which is close to the considered period of the analysis. Indeed, migration patterns of 2000 explain well actual migration flows, without interfering with trade flows, thus respecting the exclusion restriction hypothesis. Nevertheless, in order to dig deeper into an instrumental variable strategy that ensures more powerful results and a stronger explanatory instrument, we use migration patterns of the UN database, in years other than 2000. Results are presented in the first four columns of Table 4. We find that the baseline instrument is stronger and provides similar results to the alternative instrumental variables that consider years 1990 and 1980, as in columns (2) and (3).

Furthermore, we exploit another database that allows us to use sectoral level distribution of migrants prior to 1998.[37] We use the sectoral level distribution of migrants in 1991, provided by IPUMS [38] and re-construct the shift-share instrument as in equation 4.[39] IPUMS-International offers harmonized census data from various countries and years. Results are presented in the last four columns of Table 4. As it can be noticed

[36] Over the period, the share of NMS-10 worker in France increased progressively and then decreased in the aftermath of the Great Recession, such that in 2013 the share is lower than in the year of liberalization.

[37] In LFS database information about the sectoral level distribution of migrants starts in 1998. Migration databases are often limited in terms of sectoral level information, a caveat that impends us to exploit different constructions of the shift-share.

[38] The authors wish to acknowledge the statistical offices that provided the underlying data making this research possible: National Bureau of Statistics, Austria; National Institute of Statistics and Economic Studies, France; National Statistical Office, Greece; Central Statistics Office, Ireland; Statistics Netherlands, Netherlands; National Institute of Statistics, Portugal; National Institute of Statistics, Spain; and Office of National Statistics, United Kingdom.

[39] For France, IPUMS survey is available for 1990, but it is not for 1991. While in the baseline estimations, the instrument includes all non-EU-15 migrants, here we are able to be slightly more precise. We compute the sectoral distribution of Eastern Europeans including only NMS-10, NMS-3 and *Other Europe*.

by the values of the Kleinbergen-Paap test, the instrument has a stronger power of explanation when considering the bilateral migration patterns of 2000. The significant negative coefficient of the interaction term between migration share and liberalization timing still holds for other years. These results confirm our findings that liberalization of the labour market in EU-11, led to substitution from offshoring towards employing migrants.

Table 4: Alternative instrument

Dependent variable (in log):	Domestic value added imports of intermediate goods							
Sectoral distribution	1998				1991			
Mig. destination distribution	2000	1990	1980	1970	2000	1990	1980	1970
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Migrant_{ijst}$	1.203***	-0.364	2.081	8.565	1.253**	0.708	-0.825	0.315
	(0.450)	(2.034)	(1.486)	(68.692)	(0.555)	(1.637)	(0.738)	(0.726)
$Lib_{ijt}(1/0)$	0.785**	0.047	1.208	4.442	0.904*	0.494	-0.584	0.373
	(0.310)	(0.939)	(0.770)	(33.636)	(0.467)	(1.062)	(0.613)	(0.598)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-1.310***	-1.146***	-1.440***	-2.799	-1.240**	-0.885**	-0.193	-1.322**
	(0.332)	(0.394)	(0.510)	(12.083)	(0.488)	(0.417)	(0.469)	(0.652)
Observations	2,860	2,860	2,860	2,860	1,820	1,820	1,820	1,820
KP F-stat	20.67	0.417	0.672	0.00687	10.20	0.411	3.561	4.163
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects :								
Exporter-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Sector-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of the imports of intermediate goods imported by importer j in sector s exported by country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. In columns (1) to (4), we use the sectoral distribution of migrants of the year 1998 (LFS data). In columns (5) to (8), we use the sectoral distribution of migrants of the year 1991 (1990 for France) from IPUMS data. The destination migration year corresponds corresponds to the way migrants from a given origin orient themselves towards specific destination countries. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

4.1 Robustness Checks

We conduct several robustness checks to ensure that the main results hold. First, we test the validity of liberalization timing variable by applying it to other country blocks similar to a placebo test. Second, we look at different samples, excluding some countries or years.

Applying the liberalization timing to other country blocks First, we test the validity of the liberalization timing. In other words, we test whether instead of being specific to NMS-10 block, this variable would not just reflect a general immigration policy of EU-11 countries. We conduct an estimation of equation 5 where we apply the labour market liberalization of NMS-10 block to all other country blocks.[40] This is equivalent to making the hypothesis that EU-11 liberalized their labour market in the same way

[40] We exclude NMS-10 workers from the estimations. NMS-3 migration remain unchanged but the liberalization timing of NMS-10 is applied.

for EU entrants and other countries.

Results are reported in Table 5. In column (1) we inverse the liberalization scheme of NMS-3 and NMS-10. In columns (2) to (8) we apply the NMS-10 labour liberalization timing to other blocks of countries and look at how the share of migrants after the "fictive" liberalization, affects trade in value in intermediate goods between that country-block and EU-11. The interaction coefficient is not statistically significant. The South and South-East Asia exception is driven by the United Kingdom as it liberalized instantly its labour market and is the main receiver of migrants of that origin. Removing it from the regression leads to the absence of effect, as for all other country-blocks. This result ensures that liberalization variable captures efficiently the specificity of labour markets opening to NMS-10 workers.

Table 5: Applying the liberalization timing variable to other country blocks

Dependent variable (in log):	Domestic value added imports of intermediate goods							
NMS-10 replaced by :	Reverse	EU-15	Other Europe	East Asia	S-E Asia	Latin Am.	North Am.	RoW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Migrant_{ijst}$	5.740	-0.022	-0.182***	-0.590*	-0.724**	-0.173	1.579***	-0.331***
	(4.646)	(0.015)	(0.043)	(0.304)	(0.306)	(0.160)	(0.242)	(0.077)
$Lib_{ijt}^{Placebo}(1/0)$	-0.492	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.958)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Migrant_{ijst}$ x $Lib_{ijt}^{Placebo}(1/0)$	-1.841	-0.005	-0.070	0.303	0.548**	-0.047	-0.038	0.039
	(1.755)	(0.011)	(0.046)	(0.243)	(0.241)	(0.118)	(0.211)	(0.051)
Observations	2,860	2,860	2,860	2,854	2,860	2,860	2,860	2,860
R-KP F-Stat	0.842	57.08	155.3	14.53	19.31	31.81	91.80	102.4
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects :								
Exporter-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Sector-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of the imports of intermediate goods imported by importer j in sector s exported by country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{jt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. The sample includes NMS-3 and a different country-block as source of immigrants and exports in each column. In column (1), we reverse the liberalization schemes of NMS-10 and NMS-3. For the sake of clarity, country-blocks are *South & S-E Asia* (*S-E Asia*) and *North Am. & Australia* (*North Am.*). Sectors are at the 1-digit level of NACE rev 1. A few observations are missing in column (4) due to singleton and the lack of imports of DVA in intermediate goods originating from East Asia by the Construction sector of Ireland for a few years. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Effect of migrants considering different sub-samples Second, we look at post-liberalization migration shock excluding Ireland and UK – the two countries that liberalized trade and labour market at the same time, to make sure that the results of the baseline estimation are not magnified by these two countries. Column (1) of Table 6 presents all occupations results and column (2) only includes low-skilled workers. As can be noticed, results of the baseline estimation still hold. In columns (3) to (6), we divide the sample in two periods: before and after the crisis of 2009. Again, the results continue to hold, ensuring that the main findings are not a result of the Great Recession of 2009. Additional results dropping a country and sector a time can be found in Tables B4 and B5.

Table 6: Sub-samples without Ireland and UK and before/after the Great Recession

Dependent variable (in log):	Domestic value added imports of intermediate goods					
Sample	W/o Ireland & UK		2004-2008		2009-2013	
Occupation group	All	Low	All	Low	All	Low
	(1)	(2)	(3)	(4)	(5)	(6)
$Migrant_{ijst}$	1.153**	0.672***	1.458*	0.501**	1.658*	1.287***
	(0.534)	(0.166)	(0.811)	(0.195)	(0.860)	(0.451)
$Lib_{ijt}(1/0)$	0.968***	0.532	0.087	-0.566	1.962**	2.224**
	(0.321)	(0.392)	(0.601)	(0.408)	(0.834)	(1.046)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-1.318***	-0.528*	-1.917***	-0.987***	-1.494***	-1.086**
	(0.345)	(0.269)	(0.726)	(0.280)	(0.506)	(0.445)
Observations	2,340	2,340	1,430	1,430	1,430	1,430
KP F-Stat	9.406	1.779	3.674	5.086	5.958	5.077
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects:						
Exporter-Year	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Sector-Year	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of the imports of intermediate goods imported by importer j in sector s exported by country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{jt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. The sample includes only NMS-10 and NMS-3 country-blocks as exporters and source of immigrants. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

PPML estimation Finally, we also use a different estimator for our baseline regression. In the trade literature, Poisson Pseudo Maximum Likelihood (PPML) is commonly used to address the zero trade issue and as a more robust estimator in the face of heteroscedasticity compared to OLS. Although the former issue is not a concern for us, the latter might be and we therefore reproduce Table 2 using the PPML estimator. Results are presented in Table 7 and very close to our baseline.

Table 7: Baseline estimation with Poisson Pseudo Maximum Likelihood estimator

Dependent variable (in log):	Domestic value added imports of intermediate goods							
Occupation group	All workers		High		Medium		Low	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Migrant_{ijst}$	0.191***	0.164***	-0.012	0.014	0.064	0.031	0.059***	0.106***
	(0.036)	(0.059)	(0.032)	(0.041)	(0.046)	(0.058)	(0.020)	(0.024)
$Lib_{ijt}(1/0)$	0.149**	0.084	-0.029	-0.042	-0.006	0.013	0.057	0.078
	(0.064)	(0.080)	(0.060)	(0.076)	(0.058)	(0.077)	(0.060)	(0.076)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-0.188***	-0.110*	0.018	0.031	-0.031	-0.125*	-0.052***	-0.066**
	(0.037)	(0.060)	(0.043)	(0.069)	(0.050)	(0.070)	(0.020)	(0.027)
Observations	2,860	2,860	2,860	2,860	2,860	2,860	2,860	2,860
R-squared	0.984	0.972	0.984	0.972	0.984	0.972	0.984	0.973
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Fixed effects:								
Exporter-Year	No	Yes	No	Yes	No	Yes	No	Yes
Exporter-Sector-Year	Yes	No	Yes	No	Yes	No	Yes	No
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Sector-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of the imports of intermediate goods imported by importer j in sector s exported by country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. The sample includes only NMS-10 and NMS-3 country-blocks as exporters and source of immigrants. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

5 Mechanism

Results in the baseline estimation suggest that there is a substitutability between offshoring and hiring immigrants. The main hypothesis is that immigrants go to work in sectors that mostly need them.[41] The reasons behind this allocation could be due to a lack of native workers with adequate skills or to high wages that prevent local firms to hire native labour and give them incentives to offshore a part of their production. In both cases, we expect NMS-10 workers to be complementary rather than substitutes with native workers after the labour market opening. We test these mechanisms in Table 8.

First, we look at the effect of the migration shock on labour needs. This exercise also allows us to verify whether the migration shock was detrimental to EU-11 workers. As before, we use a specification based on the timing of labour market liberalization but with the number of overtime hours worked by native workers in a given sector s of country i and year t, as a dependant variable. A sector where native workers are working a large number of overtime hours is likely to be constrained in terms of available workforce, due to a lack of skills or high wages. We use a different set of fixed-effects due to the loss of the origin dimension in the dependent variable : we only look at native workers' overtime hours.[42] Since it is impossible to control for importer-sector-year shocks we introduce the full set of bilateral fixed-effects. Results are presented in the two first columns of Table 8. We find a negative coefficient associated to the migration shock, meaning that the presence of NMS workers after the enlargement reduces the use of overtime hours done by native workers. This effect is robust to the type of workers (all of them or only low occupations). Such effect is in line with our expectation.

Second, we look at the substitutability/complementarity between all workers (all foreign groups of workers and natives). The dependent variable is now the share of native/foreign workers among low occupations in a given sector, EU-11 country and year. Again, the results are reported in Table 8. In column (3) we check whether native workers are substitute or complement to NMS workers. The coefficient for the post-liberalization migration shock is statistically significant and positive, therefore pointing towards complementary between NMS-10 and native workers.[43] This result is coherent

[41] We already explained how the migration shock was not directed toward a single country or sector but to specific sectors in each country in the third stylized fact.

[42] Looking at the total number of overtime hours would have included hours done by immigrants and therefore risk mixing our shock with the result. Matching overtime hours by origin is meaningless if the goal is two uncover some recruitment constraint.

[43] It is an indication on the change in the relationship before and after the liberalization rather than a general proof: in our specification an increase in the share of NMS workers mechanically results in a decrease of the aggregated other shares. For other origins, the results are clearer as the overall effect is positive, while it should *a minima* be negative if there were

with the hypothesis that NMS-10 immigrants were directed toward sectors with labour force needs. It is also worth noting that the coefficient of the direct effect is negative, hinting to substitutability before the liberalization.

In subsequent columns, we check the relationship between employment of NMS-10 workers and workers of other origins. We use the share of low occupation worker from other country blocks as dependent variable. We find negative coefficients for the interaction when looking at workers from *Other Europe* (including Russia, Turkey and the Balkans), *South and South-East Asia* and the *Rest of the World* (African and Middle-Eastern workers), three blocks that constitute the origin of a substantial number of immigrants in Western Europe. For immigrant workers to be substitutable with one another hints that there is nothing specific to NMS workers *per se* in our results. Rather, what matters is the migration shock that followed the liberalization. From the point of view of Western European companies, NMS workers became cheaper to import or more abundant in supply. The positive and significant coefficient associated to the direct effect of NMS-10 migration also supports the idea that before the liberalization, the employment of immigrants of a given origin was positively correlated to the employment of other immigrant workers.

Table 8: Effect on overtime hours and share of native and other immigrant workers

Dependent variable :	Overtime		Share of workers$_{i'jst}$							
Origin of workers	Natives		Natives	EU-15	Other Europe	East Asia	S-E Asia	Latin Am.	North Am.	RoW
Occupation group	All	Low				Low				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Migrant_{ijst}$	0.076	0.062	-1.981***	-0.136	0.575***	-0.003	0.166**	0.221***	-0.010*	0.307***
	(0.100)	(0.051)	(0.240)	(0.130)	(0.214)	(0.007)	(0.069)	(0.068)	(0.006)	(0.110)
$Lib_{ijt}(1/0)$	0.174**	0.115	-0.018**	-0.001	0.006	-0.000	0.002	0.002	-0.000	0.004
	(0.084)	(0.076)	(0.008)	(0.006)	(0.004)	(0.000)	(0.001)	(0.002)	(0.000)	(0.002)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-0.225**	-0.097*	1.310***	-0.066	-0.498**	0.018*	-0.148**	-0.223***	0.011*	-0.365***
	(0.093)	(0.056)	(0.295)	(0.153)	(0.232)	(0.010)	(0.068)	(0.069)	(0.006)	(0.110)
Observations	2,272	2,272	2,860	2,860	2,860	2,860	2,860	2,860	2,860	2,860
R-squared	-	-	0.725	0.804	0.507	0.558	0.497	0.648	0.248	0.523
KP F-Stat	13.56	18.03	-	-	-	-	-	-	-	-
Model	2SLS	2SLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Fixed effects :										
Sector-Year	Yes	Yes								
Importer-Sector	Yes	Yes								
Exporter-Sector	Yes	Yes								
Exporter-Year	Yes	Yes								
Importer-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Sector-Year			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is in turn: (i) the number of overtime hours worked by native employees of country j, sector s and year t; (ii) the share of workers of sector s in country j and year t that are born in block i. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. The sample includes only NMS-10 and NMS-3 country-blocks as exporters and source of immigrants. For the sake of clarity, the *South & S-E Asia* and *North Am. & Australia* country-blocks are referred as *S-E Asia* and *North Am.* in the second line of the table. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

A corollary of the non-specificity of NMS workers is that offshoring towards other locations should also be affected. The liberalization offers an abundant and cheaper

no complementarity.

labour force to Western European companies that can reduce, ceteris paribus, their use of offshoring elsewhere. To test that idea we estimate our baseline specification but matching the share of immigrants from NMS-10 with the imports from another blocks. Results are presented in Table 9. Different columns correspond to a different matching of NMS-10 workers and EU-11 trade with other blocks. The coefficient associated to the interaction is significant and negative in columns (2), (4), (5) and (6). The NMS-10 migration shock led to a reduction of European offshoring in non-EU Europe, Latin America, North America and other EU-15 countries. The arrival of Eastern European workers therefore reduced offshoring in all of Europe and the Americas. The effect on trade with Asian countries is not significant. Offshoring to that block is encouraged by the very large labour cost gap between Europe and Asia and is unlikely to be filled by the existence of as slightly cheaper workforce in EU-11.

Table 9: Immigration from NMS and offshoring towards the rest of the world

Dependent variable (in log):	Domestic value added imports of intermediate goods					
NMS-10 migrants matched with	East Asia	Other Europe	S-E Asia	Latin Am.	EU-15	North Am.
	(1)	(2)	(3)	(4)	(5)	(6)
$Migrant_{ijst}$	-0.235*	1.276***	0.045	0.479**	1.019***	1.812***
	(0.141)	(0.241)	(0.167)	(0.216)	(0.193)	(0.355)
$Lib_{ijt}(1/0)$	-0.403**	1.205***	0.019	0.488	0.974***	1.922***
	(0.199)	(0.324)	(0.240)	(0.319)	(0.258)	(0.441)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	0.171	-1.121***	0.077	-0.725***	-0.820***	-1.488***
	(0.242)	(0.276)	(0.204)	(0.280)	(0.214)	(0.387)
Observations	2,854	2,860	2,860	2,860	2,860	2,860
KP F-Stat	6.514	6.491	6.491	6.491	6.491	6.491
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects :						
Importer-Sector-Year	Yes	Yes	Yes	Yes	Yes	Yes
Importer-Exporter	Yes	Yes	Yes	Yes	Yes	Yes
Exporter-Year	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of the imports of intermediate goods imported by importer j in sector s exported by country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 and NMS-3. The sample includes only NMS-10 and NMS-3 country-blocks as exporters and source of immigrants. Sectors are at the 1-digit level of NACE rev 1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

6 Conclusion

European enlargements of 2004 and 2007, ensured free movement of goods, services and capital and, at a later date, free movement of workers. In presence of fragmented production, these episodes provide an interesting context to study the trade-migration nexus and more particularly the decision of production location when labour mobility is possible.

In this paper we exploit the differences in the timing of Western Europe labour markets openings to Eastern European workers, to understand the consequences of the migration shock that followed, on European values chains. Using sectoral level data from input-output tables and data for foreign workers at sectoral and occupation level, we contribute to the literature by providing evidence that labour market opening in the West shifted the trade-off between offshoring production and employing immigrants involved in manual tasks. More precisely, we find that low-skilled Eastern European workers that migrated to Western Europe after labour markets liberalization contributed to reducing offshoring towards Eastern Europe. This substitution comes from the relaxing of a constraint on the recruitment of manual workers, thanks to the opening of Western Europe labour markets to Eastern European workers. In other words, low skilled workers filled in needs in the labour market that could have been offshored in another context. Results also show that this migration shock was likely detrimental to other immigrants but not to native Western European workers. Lastly, we find that the effect of the presence of Eastern European workers on offshoring decision is not origin-specific, as imports of value in intermediate goods from other regions of the world were also reduced.

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A Appendix : GVCs decomposition

For the computation of exports in several components, we use the decomposition of Wang et al. (2013), which proposes a framework in country-sector level. The following decomposition in equal to equation 22 in Wang et al. (2013) work. The exports of country k in sector l are decomposed in 16 components as follows:

$$
\begin{aligned}
E^{kl} &= (V^k B^{kk})^T * F^{kl} + (V^k L^{kk})^T * (A^{kl} B^{ll} F^{ll}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tt}) + (V^k L^{kk})^T (A^{kl} B^{ll} \sum_{t \neq k,l}^{G} F^{lt}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} \sum_{u \neq k,t}^{G} B^{lt} F^{tu}) + (V^k L^{kk})^T (A^{kl} B^{ll} F^{lk}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tk}) + (V^k L^{kk})^T (A^{kl} B^{lk} F^{kk}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tk}) + (V^k B^{kk} - V^k L^{kk})^T * (A^{kl} X^l) \\
&+ (V^l B^{lk})^T * F^{kl} + (V^l B^{lk})^T * (A^{kl} L^{ll} F^{ll}) + (V^l B^{lk})^T \\
&+ (A^{kl} L^{ll} E^{l*}) + (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * Fkl \\
&+ (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * (A^{kl} L^{ll} F^{ll}) + (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * A^{kl} L^{ll} E^{l*}
\end{aligned}
\tag{6}
$$

The first terms correspond to the domestic value added in final goods' and intermediate exports. The rest of components correspond to domestic value added re-exported to third countries as intermediate or final use, foreign value added in exports, domestic value added returning home and double counting components. The decomposition has been computed using the algorithm in R provided by Quast & Kummritz (2015). Through this decomposition, we are able to look at exported domestic value added in intermediate goods' exports.

B Appendix : Figures and Tables

Table B1: Block of countries included in the sample

Country block	Countries from WIOD
EU15	EU11, Germany, Italy, Finland, Sweden.
NMS10	Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lituania, Malte, Poland, Slovakia, Slovenia.
NMS3	Romania, Bulgaria, Croatia
Other Europe	Russia, Turkey, Switzerland, Norway
East Asia	China, Japon, Taiwan.
South & South-East Asia	Korea, Indonesia, India.
North America & Australia	USA, Canada, Australia.
Latin America	Mexico, Brazil.
Rest of the World	North Africa, Other Africa, Near & Middle East.
Destination countries (EU11)	Austria, Belgium, Denmark, Spain, France, Great Britain, Greece, Ireland, Luxembourg, Netherland, Portugal.

Notes: The rest of the World in the WIOD is defined as all the rest of the countries apart those represented in the WIOD. In the LFS, we define the rest of the world as an agglomeration of data from North and other Africa, Near middle east.

Table B2: Industries included in the sample

Industry code	Industry description
AB	Agriculture, hunting and forestry ,Fishing.
C	Mining and quarrying.
D	Manufacturing.
E	Electricity, gas and water supply.
F	Construction.
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods.
H	Hotels and restaurants.
IK	Transport, storage and communication; Real estate, renting and business activities.
J	Financial intermediation.
L	Public administration and defence; compulsory social security.
M	Education.
N	Health and social work.
O	Other community, social and personal service activities.

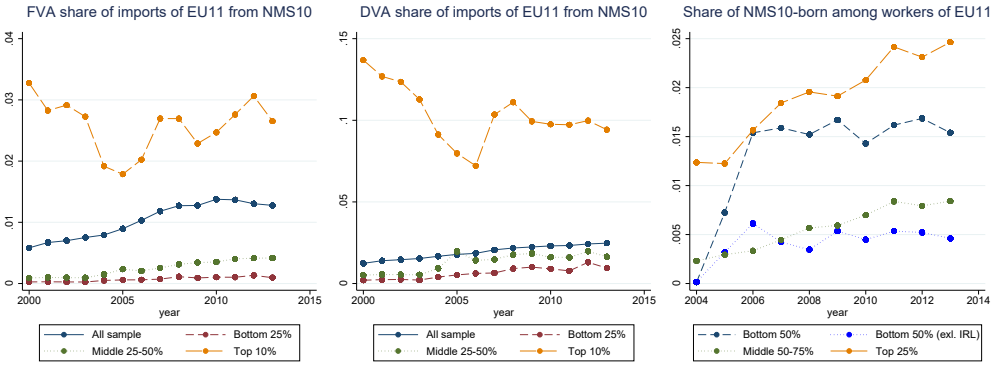
Notes : This classification is based on the need to establish a correspondance between NACE Rev.1, used until 2008, and NACE Rev.2 at the 1-digit level. The number of 2-digits lines that moved from a 1-digit line to another is quite limited, except in the case of telecommunication and business activites. Therefore this two industries had to be merged to avoid discrepancy over time.

Table B3: Sample descriptive statistics

Variable	Mean	Sd	Min	Max
	NMS-10 and NMS-3 sample			
DVA imports (in log)	2,4	2,9	-7,9	9
$Lib_{ijt}(1/0)$	0,4	0,5	0	1
$Migrant_{ijst}$: All	0,8	1,6	0	18,5
$Migrant_{ijst}$: H	0,4	0,9	0	18,7
$Migrant_{ijst}$: M	0,4	1,3	0	26,6
$Migrant_{ijst}$: L	1,2	3,1	0	61,9
	All origins			
DVA imports (in log)	3,2	3,6	-19,9	11,8
$Lib_{ijt}(1/0)$	0,1	0,3	0	1
$Migrant_{ijst}$: All	1,6	4,7	0	100
$Migrant_{ijst}$: H	1,4	4,5	0	100
$Migrant_{ijst}$: M	1,1	3,3	0	63,6
$Migrant_{ijst}$: L	1,9	5,7	0	100

Notes: Authors' computation from WIOD and EU-LFS data

Figure B1: Global value chain's participation and NMS-10 migrant's distribution



Notes: Authors' computation from WIOD and EU-LFS data.

Table B4: Dropping a country at a time

Dependent variable (in log):	Domestic value added imports of intermediate goods											
Dropped country	None	Austria	Belgium	Denmark	Spain	Greece	France	G-B	Ireland	Italy	Netherlands	Portugal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Migrant_{ijst}$	1.203***	0.677	1.175***	1.226***	1.286**	0.423	1.850***	1.266***	1.144***	1.203***	1.152***	1.185***
	(0.450)	(0.412)	(0.438)	(0.450)	(0.620)	(0.747)	(0.499)	(0.488)	(0.441)	(0.450)	(0.439)	(0.444)
$Lib_{ijt}(1/0)$	0.785**	0.268	0.771**	0.795**	0.721**	0.221	1.189***	0.848***	0.891***	0.785**	0.840***	0.903***
	(0.310)	(0.253)	(0.322)	(0.315)	(0.366)	(0.524)	(0.380)	(0.322)	(0.299)	(0.310)	(0.323)	(0.341)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-1.310***	-1.002***	-1.285***	-1.325***	-1.401***	-1.296***	-1.278***	-1.310***	-1.320***	-1.310***	-1.346***	-1.374***
	(0.332)	(0.354)	(0.337)	(0.334)	(0.428)	(0.387)	(0.335)	(0.334)	(0.334)	(0.332)	(0.340)	(0.344)
Observations	2,860	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,860	2,600	2,600
KP F-stat	20.67	20.75	21.35	20.47	14.30	4.967	16.29	16.08	15.44	20.67	21.72	21.19
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects:												
Exporter-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-sector-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of domestic value added in imports of intermediate goods to importer j in sector s from country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in country-block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 or NMS-3. Sectors are at the 1-digit level of NACE rev.1. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Table B5: Dropping a sector at a time

Dependent variable (in log):	Domestic value added imports of intermediate goods													
Dropped sector	None	AB	C	D	E	F	G	IK	H	J	L	M	N	O
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
$Migrant_{ijst}$	1.203***	1.191**	1.376***	1.129**	1.297***	1.888***	1.241***	1.175**	0.773**	1.173**	0.561*	1.358***	1.134**	1.357***
	(0.450)	(0.494)	(0.432)	(0.521)	(0.469)	(0.713)	(0.457)	(0.460)	(0.373)	(0.514)	(0.319)	(0.511)	(0.448)	(0.455)
$Lib_{ijt}(1/0)$	0.785**	0.748**	0.824***	0.769**	0.942***	1.047**	0.844***	0.772**	0.388*	0.871**	0.333	0.952***	0.731**	0.919***
	(0.310)	(0.341)	(0.289)	(0.348)	(0.334)	(0.437)	(0.321)	(0.319)	(0.233)	(0.363)	(0.232)	(0.368)	(0.317)	(0.319)
$Migrant_{ijst}$ x $Lib_{ijt}(1/0)$	-1.310***	-1.359***	-1.393***	-1.343***	-1.460***	-1.861***	-1.337***	-1.274***	-0.736**	-1.360***	-0.666***	-1.443***	-1.292***	-1.372***
	(0.332)	(0.376)	(0.324)	(0.373)	(0.348)	(0.497)	(0.337)	(0.335)	(0.302)	(0.370)	(0.243)	(0.377)	(0.332)	(0.340)
Observations	2,860	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640
KP F-stat	20.67	21.43	22.13	15.43	20.56	11.32	20.07	19.67	16.39	17.79	19.31	19.14	20.76	20.66
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Fixed effects:														
Exporter-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-sector-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer-exporter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is equal to the logarithm of domestic value added in imports of intermediate goods to importer j in sector s from country i in year t. $Migrant_{ijst}$ is the share of workers of sector s in country j and year t that are born in country-block i. $Lib_{ijt}(1/0)$ is a dummy equal to 1 for all years following the opening of the labour market of country j to citizens of NMS-10 or NMS-3. Sectors are at the 1-digit level of NACE rev.1 : see table B2 for sector descriptions. Robust standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels respectively.

Table B6: Number of observations per country

Country	All workers	Eastern Europeans	Share of NMS workers	
			in nb. of obs	using weights
Austria	837,512	20,975	2.50	3.33
Belgium	399,275	3,745	0.94	0.89
Denmark	488,909	2,351	0.48	0.72
Spain	636,604	5,223	0.82	2.00
France	1,495,207	4,570	0.31	0.31
Great-Britain	507,790	8,544	1.68	2.03
Greece	957,513	9,580	1.00	1.09
Ireland	848,549	43,552	5.13	5.92
Luxembourg	126,889	971	0.77	1.07
Netherlands	731,379	2,132	0.29	0.51
Portugal	659,646	1,511	0.23	0.23
Total	7,689,273	103,154	1.34	1.40

Notes: Information from Labor Force Survey database.