European Integration and the Trade-off between Offshoring and Immigration *

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Abstract

This paper investigates the link between East-West migration flows in Europe and global value chains after the 2004 European enlargement. We combine data from the European Labor Force Survey with the World Input-Output Database to provide evidence of substitution between employing immigrant workers and production offshoring in Europe after the EU enlargement of 2004. Our identification strategy relies on the staggering of the opening of Western Europe labour markets to Eastern Europeans workers and on an instrumental variable, hence tackling potential endogeneity in the trade-migration relationship. We find that Western European sectors with larger post-liberalization migration shocks import less intermediate goods from Eastern Europe. This effect mostly concerns the immigration of low skilled workers. We explain that once the movement of labour restrictions were removed, it became relatively easier for firms to import workers rather than goods. This resulted in an increased presence of low occupation Eastern European workers in Western Europe and lower offshoring, ceteris paribus. This work is, to our knowledge, the first to provide evidence regarding the effect of the removal of freedom of movement restrictions in Europe on global value chains. We also to contribute 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

Commitment to important reforms of countries once part of Communist blocks with centralized and closed economies led to an integration in the European Union.[1] This integration deeply affected the two sides of the trade-migration nexus. Joining the European community ensures economic freedom such as free movement of goods, services and capital and free movement of workers. In that regard, the integration of Eastern countries in the European Union constitutes a shock on the economy of both blocks of countries, but especially that of the new member states. First, the 10 new member States (*hereafter* NMS-10) joined the Common Market, which corresponds to a total liberalization of trade in goods. As a matter of fact, the enlargement of the EU coincides also with trade links becoming more global and fragmented.[2] Second, workers from NMS-10 obtained the right to work in all of the EU i.e. Western European countries liberalized access to their labour markets. A large increase of immigration of NMS-10 citizens ensued. This work aims at understanding the impact of this labour market liberalization on European value chains by using the difference of timing in the openness of labour markets in Western European countries.

After the integration, NMS countries could benefit from tariff-free trade for intra-European flows, meaning lower costs of trading intermediate goods – an incentive to increase participation in European value chains.[3] In a world where production is sequential, the exporting country produces only a part of the value that it exports. Indeed, it has been documented that after the integration some Eastern countries became more upstream whereas EU-15 countries have been using more foreign intermediates (Rahman & Zhao 2013, Amador et al. 2015, Hagemejer & Ghodsi 2017). Trade liberalization was followed by one important pillar of EU integration which is the free movement of workers. As pointed out by Favell (2008) the European migration system changed the context of migration towards developed countries. Joining the EU permits citizens of NMS-10 to travel and reside in the enlarged European Union.[4] The enlargement resulted in a substantial rise in the population from new EU countries after 2004 (Kahanec et al. 2013, Holland et al. 2011).

The literature relating migration and offshoring questions the substitutability that

[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.

[3] As known in the literature on GVCs, fragmented production is realized by participating in sequential stages of production *tasks* (Grossman & Rossi-Hansberg 2008).

[4] Even though the liberalization and establishment of free movement of workers was delayed by some old member states, it does not seem to have retarded the start of the increase of migrant flows but mostly diverted it to some specific countries.

might exist between employing migrants and offshore workers (Ottaviano et al. 2013). It highlights the role of skill-cell or occupations in this trade-off. Empirical studies show complementarity between the presence of immigrants and foreign direct investment, through network effects (Kugler & Rapoport 2005, Javorcik et al. 2011). The integration in European Union of NMS countries 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 et al. 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, i.e trade of between offshoring production of value or producing it domestically.

Considering all the above mentioned, integration in EU for Eastern countries constitutes an interesting setup to look at how the presence of migrants influenced value chains. More precisely, we analyse how migrants from Eastern countries present in EU-11 during 2004-2013 period, affected European trade in intermediate goods. To do so, we exploit the differences in the timing of EU-11 labour market openings to Eastern European workers. We complement the existing literature by exploiting foreign workers' presence in the sector dimension and specific occupations and looking at their effect on trade in value in Europe, after labour market opening. We provide evidence that labour market opening in the West shifted the trade-off between offshoring production and employing immigrants involved in manual tasks, resulting in lower offshoring by Western Europeans sectors. This result holds when we tackle endogeneity using an instrumental variable strategy based on a shift-share instrument. Our results hint that the change of trade-off is caused by the relaxing of a constraint on the recruitment of cheap or adequate manual workers, thanks to the opening a Western Europe labor markets to Eastern European workers.

Related literature This paper is related to a vast literature that looks at the effects of migration on trade. 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).[5] Burchardi et al. (2017) establishes a causal effect of ancestry composition in the US on FDI to origin countries. 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

[5]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.

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.

Another channel through which migrants affect economic performance of receiving countries is by boosting productivity through knowledge diffusion or skills.[6] Indeed, this paper is also related 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 Mitaritonna et al. 2017). The question whether migrants are substitutes or complements with domestic workers is quite large and deserves particular attention. Similar to our findings, Ottaviano & Peri (2012) discuss about the imperfect substitutability in production. Peri (2016) exposes the main aspects of the impact of immigration on labor markets, illustrating the different effects at local and national levels. Furthermore, it emphasizes that the level of substitutability among nationals and migrants could change depending on the skill group. Bauer & Kunze (2004) analyse 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 labor. In this debate, defining the cell 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 the occupation in the receiving country. By exploiting data on occupations and the role of migrants in local labour markets, we aim to understand what stays behind migration-trade in intermediates link.

This paper relates strongly with the literature on the trade-off between offshoring and 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. The former paper finds that offshoring is more advantageous than immigration, to native workers. However, this results is based on the hypothesis that immigrant and native workers are similar. Observing that native workers and immigrant workers in the US are used at the opposite ends of the tasks spectrum. Ottaviano et al. (2013) find that the compe-

[6] Regarding the knowledge diffusion channel, see Keller 2004, Bottazzi & Peri 2003, Bahar et al. 2014 and Bahar & Rapoport 2018

tition is mostly between offshore workers and both native and immigrant workers. The existence of the trade-off between immigrants and offshoring has been tested empirically. 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.[7] Similarly to those studies, we distinguish between different types of workers, but rather than education, we focus on occupations as they are stronger indicators of the actual economic role. We use sectoral-level data: this greater level of precision allows to precisely check the existence of substitutability for a given type of production. In that regard, 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 part of the picture as we could expect that the shift from offshoring to domestic production takes the form of replacing a foreign suppliers by a domestic one.[8] Such change can be better dealt with using sectoral level data. Another limitations of that work is the lack of consideration for tasks and skills.

A close work to the context of this paper is Caliendo et al. (2017) who evaluate the effects of the 2004 enlargement on migration and welfare using the Labor force survey database (LFS). To do so, they propose a multi-country general equilibrium model. The effect of migrant inflows is twofold. First, higher productivity (scale effect) and increase in supply of workers positively affect production and welfare. Second, migration leads to congestion effects (because of local fixed factors increasing in prices) and degradation of trade term (because of lower wages). They find that the enlargement increased the migration of low-skill worker more than high-skill individuals. Migration would also have been larger with change in trade policy (joining the single market). Regarding welfare effects, they are large and positive for NMS, small for EU-15.

Finally, even though there is a rich literature that considers the development of EU gross trade and the role of migrants, there a lack of works that relate global value chains with migration. To our knowledge there are very few papers that consider this aspect. 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

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

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

more relationship dependent (the median number of supplier 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 in 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, by exploiting value chains links between NMS countries and EU-11. More precisely, our measure of offshoring is captured by tracking value added produced in NMS countries incorporated in EU-11 imports.

The reminder 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 analyze the mechanisms behind the trade off between immigration and offshoring. Section 6 concludes.

2 Data and Stylized Dacts

2.1 World Input-Output Tables

We use the World Input Output table (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. In a global value chains context, gross exports contain parts from foreign suppliers or domestic value that has been re-exported, thus gross trade data is limited in the context of production fragmentation. 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 Labor 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 Labor Force Survey (EU-LFS) provided by Eurostat. 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.[9] We include a set of 11 Western European countries.[10] We remove four countries due to limited data availability. We exclude Germany from the sample because there is no information for the country of birth of foreign workers.[11] 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[12] and cases of inactive population or when there is no information on the professional status of the worker.[13] 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.[14] 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

[9] Before 2004, most countries only differentiates foreign-born individuals between those from the EU-15 and those from the rest of the world. We need to identify more precisely the place of origin of the workers.

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

[11] 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.

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

[13] 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.

[14] The sample of foreign-born workers includes naturalized citizens.

[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.

region of the world (foreign-workers) over all workers of a specific country and industry. We add 0 for all sectors for which we do not have information on foreign workers from a specific origin country.[16]

Although the EU-LFS also makes it possible to look at migrations flows before 2004[17], we prefer to concentrate on stocks for two reasons. First, immigrant stocks seem a more pertinent indicator when looking at trade as any effect should come from the presence of foreigners. It seems also more precise as 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 surveyed, leading to greater noise if we were to use that variable.

We explore data on occupations of workers to look at the mechanism 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 rev1 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, differently characterized as *backward participation* or *offshoring*. They incorporate the foreign value to produce final goods or other inputs, that are further used in the chain of production. In a forward looking perspective, participation in global value chains is identified through exports of value, further used to produce other goods in the importing

[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.

[17] As in (Caliendo et al. 2017)

[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.q

[19] See Table B2. We aggregate some NACE rev1 sectors to account for the change in classification in 2008 and we drop sectors P and Q 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 restricte sample we use for our regressions.

country. Using value added decomposition of trade flows, the creation of value chains between EU-11 and NMS-10 can be traced through value added that is imported by EU-11 sectors from NMS-10 or exported from EU-11 sectors to NMS-10 for the production of final goods. We focus on imports of value originating from NMS-10 imported by EU-11 (backward participation) and exports of value added produced in EU-11, exported in NMS-10 to produce final goods (forward participation), at the sectoral level. In order to have a clearer understanding, figure 1 shows the direction in which European value chains between West and East countries have evolved after the integration of NMS-10 countries in the EU in 2004. It presents the growth of imports of value added (in orange) and exports of value added (in blue) 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. Clearly, imports grew faster than exports over the whole period for most sectors. This figure also pinpoints to the observation that the enlargement made a much greater difference for exports.[21] It seems that the benefits brought by the enlargement regarding trade were largely anticipated by EU-11 firms aiming at importing goods from Central and Eastern Europe and less so for exports.[22]

Fact 2: An increasing and heterogeneous participation of NMS-10 economies in GVCs and of NMS-10 nationals in EU-11 labour markets. The increase in imports and immigration from NMS-10 countries to the EU-11 is established since the start of the century. However, information about the heterogeneity in this growth is less abundant. This paragraph presents the evolution of trade and migration between these two groups of countries at the sector level. Overall, it assesses an increasing importance of Eastern Europe in EU-11 economy and the relevance of country and sector-level data in examining this trend.

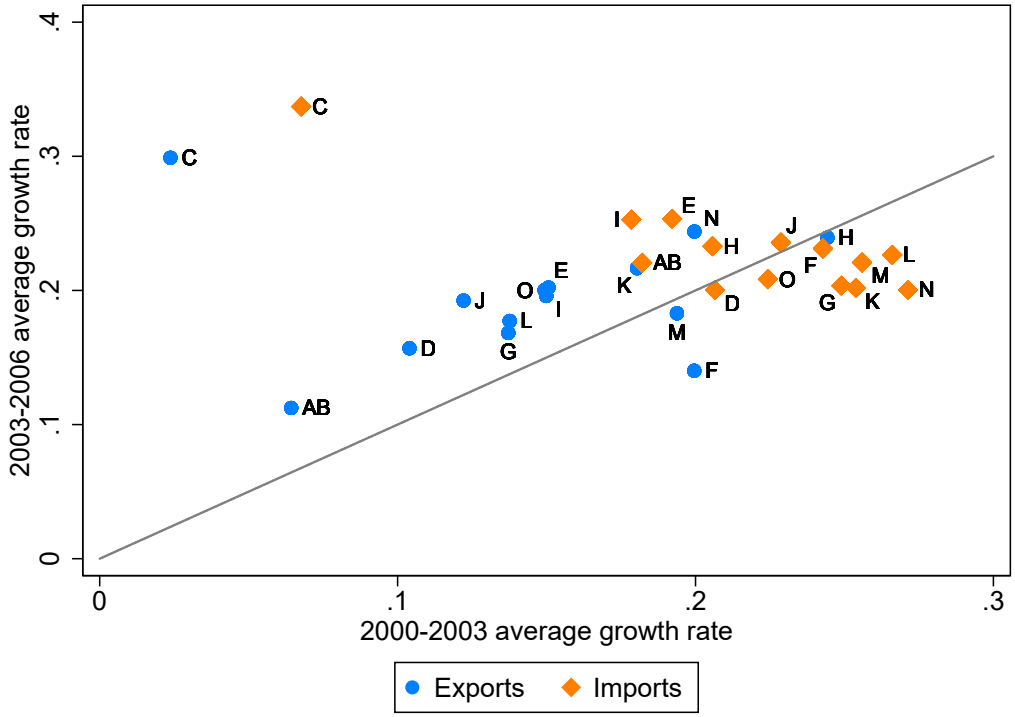
GVC participation looks at the extent to which a country provides/supplies value from/to other countries of the production chain (Hummels et al. 2001). The presence of exported foreign value is an evidence of production sharing, for instance through imports of foreign inputs.[23] In order to look at the participation of NMS-10 in European value chains, we consider the share of exported foreign value added and returned domestic

[21] The 2004 enlargement firstly materializes itself by the inclusion of NMS-10 in the common market, which abolished all customs and most differences in regulation. Due to initial restrictions by most EU-11 countries, freedom of movement came later for NMS-10 citizens.

[22] 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.

[23] Whereas the presence of exported returned domestic value added, proves the forward integration in global value chains, by providing value that crosses borders and returns back home. To illustrate this, we can recall the example of the iPhone. Most of the value added in the device stems are from US design and Japanese technology but it is ultimately assembled in China.

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



Source: Authors calculations from WIOD data.

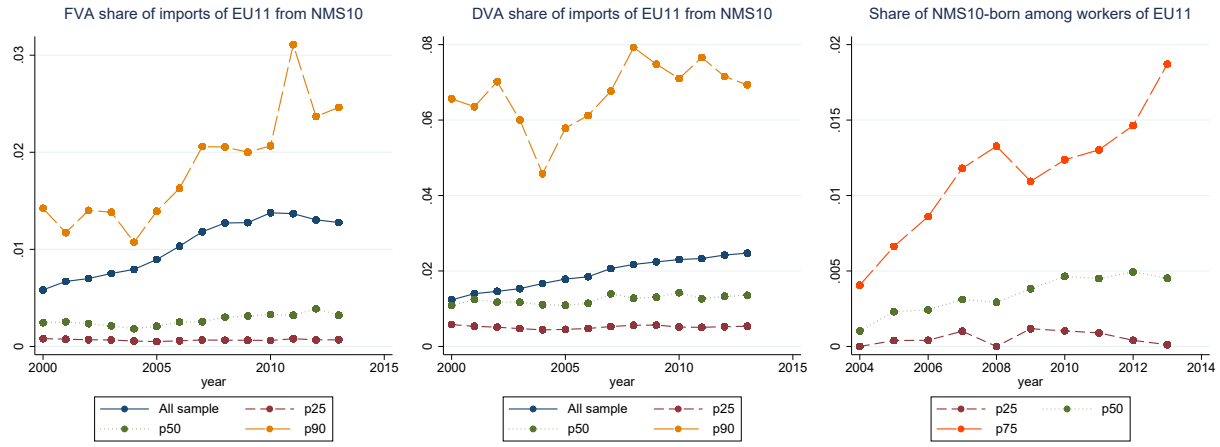
value added of NMS-10 over all imports of EU-11. The left-hand side of figure 2 presents the evolution of the share of foreign and returned value of NMS-10 in EU-11 imports for selected percentiles defined in terms of EU-11 countries-sectors. The blue line shows the evolution of NMS-10 foreign and returned (hereafter RDV) value added in total imports of EU-11.[24] 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 is clear that most of the increase of the participation of NMS-10 in GVCs when exporting to EU-11 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 origination in NMS-10 and being exported to EU-11. Hence, the middle graph of figure

[24]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.

2 reproduces a similar exercise, but we now restrict EU-11 imports of domestic value added in intermediate goods from NMS-10, therefore excluding the share of imports' value that was first imported by NMS-10 countries and then re-exported.[25] Hence, the blue line represents the share of NMS-10 DVA in intermediate goods in all imports of DVA of the EU-11, whereas the orange, green and red line represent the same ratios for different percentiles of country-sectors. A similar pattern as in the left-hand side graph appears: in the aggregate, 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. For the bottom half of the country-sectors, the rise in imports of value added from NMS-10 is very modest and for the bottom 25% of the sample it stagnates.

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



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

The heterogenous participation in GVCs of EU-11 countries and specific sectors could be a result of bilateral historic trade relations: some EU-11 countries simply trade more with NMS-10. Indeed, a substantial part of the country-sectors present in the top 10% of the distribution are Austrian. However, the pattern still holds when excluding Austria from the sample altogether. Sectoral specificity could also be a explanation: for some sectors trade is more intense whatever the country, due to comparative advantages for instance. The construction sector is one likely suspect.[26] Again, if we exclude both the construction sector for all countries and Austria, the pattern presented in the two left hand side panels holds: a general increase in imports from NMS-10 which mostly comes

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

[26] It is the only sector which appears at least once in the top 10% of the distribution in combination with all countries. Remember that we are working here with country-sector pairs. In the top 10% of these pairs in terms of ratio of intermediate DVA imports from NMS-10 over all DVA imports, the manufacturing sector of Belgium never appears. Nor does the agricultural sector of Spain for instance. But the construction sector for all countries is part of the top 10% for one year or another.

from a minority of country-sector pairs. The sectors do not behave in the same way in each and every country.

Migration is a possible explanation for this country-sector heterogeneity. The right-hand side of figure 2 shows the evolution of the share of NMS-10 workers in country-sectors in EU-11.[27] 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 labor 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 2004-2013, but heterogeneous with respect to the concerned countries and sectors. NMS-10 migrants could be directed toward a specific sector where they have an advantage over other workers, both native and foreign. To take into account these possibilities and detect the evolution of NMS-10 workers presence in EU-11, we estimate the following equation:

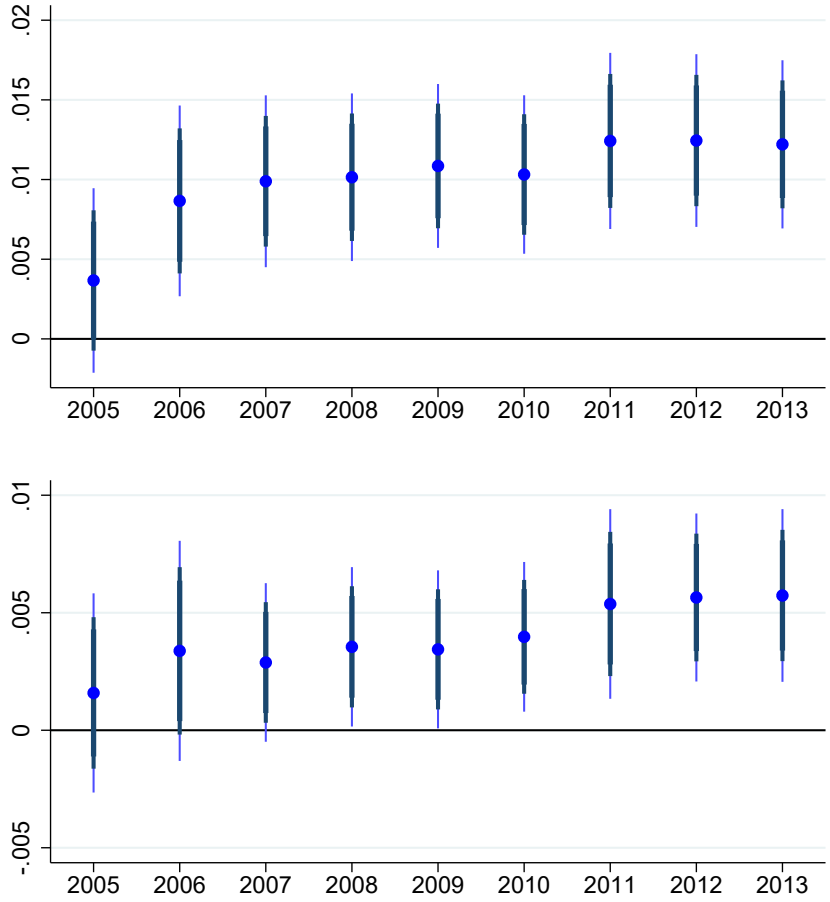
$$Migrant_{jst} = \gamma_{js} + \sum_{t=05}^{t=13} \beta_t \mathbb{1}(t) + \varepsilon_{jst} \tag{1}$$

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 a 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 the evolution of the share of NMS-10 workers compared to the year 2004 in EU-11 countries, after removing the impact of sector-destination specificities. Following the enlargements, there was 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

[27] Differently from the two previous graphs, the considered period in this case is 2004-2013, as we use data from the EU Labour Force Survey. LFS does not contain information about birthplace of individuals before 2004. 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.

really 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 and allows to see more clearly the impact of the difference in timing of labour market opening. The increase in the share of NMS-10 in the workforce starts later as the two countries that opened in 2004 are not included. It is still significant and progressively increasing as more countries liberalize their labour market.[28]

[28] 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

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

Country	2004 High	2004 Medium	2004 Low	2013 High	2013 Medium	2013 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.

This exercise confirms that immigration of NMS-10 workers following the EU enlargement of 2004 took place in several sectors and suggests that the timing of the removal of labour market restrictions for NMS-10 citizens matters. More precisely, migrants from NMS-10 countries went to work in different sectors according to the country. Part of the reason behind such heterogeneity between countries could be differences with respect to the type of NMS-10 citizens migrating. In that light, we use the information on the occupation of workers contained in the LFS to create 3 occupation groups. [29]

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 clearly 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. The increase is however different for each country and occupation group.

These facts are evidence of an increase of both trade and East-West migration that are country-sector specific and heterogeneous with respect to occupations, but they cannot tell us much about the link that might exist among them. 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

from the rest of the world in the period following 2004.

[29] High occupations gathers managers and professionals, medium occupations are associate professionals and clerks and low occupations bring together all other occupations (sales and services workers, craft-workers, etc...). LFS data span over a change of ISCO classification. Therefore we use 3-digit occupation group to harmonize both version of ISCO and create these three coherent groups.

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 offshoreable activities. The opening of Western Europe labour markets would therefore affect the substitutability between offshoring and employing immigrants. To the purpose of testing this idea, we turn to an econometric approach.

3 Empirical Specification

The stylized facts presented in the previous section show a rise of labour mobility within the EU after 2004 and at the same time an increase in intermediate flows of EU-11 with NMS-10 countries. Trade in intermediate goods is one of the main features of production fragmentation. 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 ap-

plied for Eastern European migrants.[30] 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.[31] This gap between increased freedom 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.

As aforementioned, due to data restrictions information about the origin of foreign workers is provided in country blocks. Despite the fact that one could expect most of the effect to come from NMS-10 countries, one weakness of a specification with only one country-block of origin is the absence of any country of origin controls. 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.[32] This block of origin provides the advantages 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.[33]

To look at the effect of migrant's presence from NMS after labour market liberalization, on imported value added in intermediates originating from NMS to EU-11

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

[31] 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.

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

[33] 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.

countries, we estimate the following equation:

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

The dependent variable is the imports of domestic value added in intermediate goods from originating from NMS EU-11 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*. 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 $M.\ share_{ijst}$, 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 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 the trade and 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.[34]

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

[34] 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.

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 (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 to have different effects on trade, depending on their occupation type. We re-run 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 input 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 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[35] and finally the number of migrants per year of the considered period in destination country j. Indeed, $\widehat{M}_{ijst}$ is an estimation 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.

This is a hypothetical number of foreigners based on past trends. It should not 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 the total workers population, by considering that the number of native workers is fixed and stays as in

[35] 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..

2004 as showed below:

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

Considering as fixed 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 $Migrant_{ijst}$ and its interaction with Lib_{ijt} by $\widehat{\text{Mig Sh}}_{ijst}$ and by its interaction with Lib_{ijt}.

4 Timing of the Labour Market Opening Estimation 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 (2).

Table 2 reports the main results, considering domestic value added in intermediate goods imports as the dependent variable. Indeed, 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. 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

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.

and employing NMS-10 workers, after the liberalization occurred. The total effect of migration is nonetheless positive. In column (2) instead of adding an importer-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 we relax slighty of fixed-effects structure, as for column (2). 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 mot 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 DVA imports expressed in dollar, 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 B4 of the Appendix.[36] As it can be noticed, there is a large heterogeneity : while trade is reduced by almost 2 billion $ in Great Britain it actually increases slightly for France.[37]

Alternative shift-share instrument Even though the proposed shift-share instrument tackles the problem of endogeneity, one potential weakness would be the reference year 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 3. We find that the instrument baseline instrument is stronger and provides similar results with 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.[38] We use the sectoral level distribution of migrants in 1991, provided by IPUMS[39] and re-construct the shift-share instrument as in equation

[36] 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.

[37] 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.

[38] 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.

[39] The authors wishes 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.

4.[40] IPUMS-International offers harmonized census data from various countries and years. Results are presented in the last four columns of Table 3. As it can be noticed 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 toward employing migrants.

Table 3: Alternative instrument: Labour market liberalization and DVA imports of intermediate goods from NMS

Dependent variable (in log):	Domestic value added imports of intermediate goods							
Sectoral distribution	1998				1991			
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

[40] 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*.

EU-11 countries. We conduct an estimation of equation 2 where we apply the labour market liberalization of NMS-10 block to another country block.[41] This is equivalent to making the hypothesis that EU-11 liberalized their labour market in the same way for EU entrants and other countries.

Results are reported in Table 4. In column (1) we inverse the liberalization scheme of NMS-3 and NMS-10: the effect of the interaction is positive and significant. 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 intermediate goods between that country-block and EU-11. The interaction coefficient is never statistically significant. We are certain that liberalization variable captures efficiently the specificity of labour markets opening to NMS-10 workers.

Table 4: Robustness check : The liberalization timing variable only works for NMS

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)
$Migrant_{ijst}$	0.005	0.022***	-0.001	-0.069	0.129*	0.041	0.120**	-0.016
	(0.019)	(0.008)	(0.016)	(0.056)	(0.067)	(0.056)	(0.052)	(0.033)
$Lib_{ijt}^{Placebo}(1/0)$	0.019	0.007	-0.061	-0.181	0.059	-0.134	0.097	0.125
	(0.082)	(0.082)	(0.079)	(0.127)	(0.122)	(0.133)	(0.092)	(0.092)
$Migrant_{ijst}$ x $Lib_{ijt}^{Placebo}(1/0)$	0.075***	-0.009	-0.026	0.044	-0.025	0.004	0.041	-0.036
	(0.028)	(0.007)	(0.017)	(0.077)	(0.074)	(0.057)	(0.085)	(0.031)
Observations	2,860	2,860	2,860	2,857	2,860	2,860	2,860	2,860
R-squared	0.969	0.979	0.973	0.947	0.950	0.943	0.966	0.978
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Fixed effects :								
Exporter-Sector-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, the *South & S-E Asia* and *North Am. & Australia* country-blocks are refered 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.

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 5 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 results are not the result of the Great Recession.

[41] We exclude NMS-10 workers from the estimations. NMS-3 migration and labour liberalization timing remain unchanged.

Table 5: Robustness check : 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 is also considered more robust than the OLS estimator in the face of heteroscedasticity. Although the former is no concern for us, the latter is and we therefore reproduce Table 2 but using the PPML estimator. Results are presented in Table 6 and very close to our baseline.

Table 6: Robustness check: Baseline estimations 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 most need them.[42] 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 their part of their production. In both cases, we expect NMS-10 workers to be complementary rather than substitutable with native workers after the labour market opening. We test these mechanisms in Table 7.

First, we look at the effect of the migration shock on labour needs, 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. 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. In order to avoid endogeneity, we instrument our explanatory variables with the shift-share instrument. 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.[43] 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 7. 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 7. 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 toward complementary between NMS-10 and native workers.[44] This result is coherent

[42] 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.

[43] 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.

[44] We are using shares as dependent and explanatory variables, therefore we should be cautious in our interpretation of

with the effect on unemployment and the hypothesis that NMS-10 immigrants were directed toward sectors with labour force needs. It is interesting to notice that the coefficient of the direct effect is negative, hinting to substitutability before the liberalization.

In subsequent columns 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* (comprising Russia, Turkey and the Balkans), *South and South-East Asia* and the *Rest of the World* (African and Middle-Eastern workers), three blocks that constitutes 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 7: NMS workers are complement with natives and substitute with other immigrants after the liberalization

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 unemployment ratio variable of country j, sector s and year t defined in equation **??**; (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

the resulting coefficients. An increase in the number of NMS-10 workers should mechanically lead to a decrease of the share of other origins, ceteris paribus. Therefore a negative coefficient does mean with certainty there has been substitution by itself. The magnitude of the coefficient will also depend on the share of the origin of workers.

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 8. 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 reduces offshoring in all of Europe and the Americas. There is not significant effect on trade with Asian countries. Offshoring there is made 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 8: Immigration from NMS reduces offshoring to 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

The literature linking trade and migration is quite rich and exploits several channels such as productivity through skills, complementarity depending on tasks, networks effect, etc. In this paper we exploit the differences in the timing of Western Europe labour markets liberalization to Eastern European workers to understand the consequences of the migration shock that followed on European values chains. We contribute to the literature by exploiting sectoral level data in the context of global value chains, by using occupation data and by providing evidence of a substitution between offshoring and employing immigrant workers in Europe. We find that low occupation Eastern European workers that migrated to Western Europe after labour markets liberalization contributed to reducing offshoring to Eastern Europe. Indeed, immigrants directed primarily towards sectors who could not satisfy domestically their labour needs. The liberalization of labour market reduced the cost of using immigrants relative to offshoring production abroad. Finally we find, that this migration shock was likely detrimental to other immigrants but not to native Western European workers.

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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 of WWZ paper (Wang et al. (2013)). The exports of country k in sector l are decomposed in 16 components as follows:

$$
\begin{aligned}
E^{kl} &= (V^k B^{kk})^T * F^{kl} + (V^k L^{kk})^T * (A^{kl} B^{ll} F^{ll}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tt}) + (V^k L^{kk})^T (A^{kl} B^{ll} \sum_{t \neq k,l}^{G} F^{lt}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} \sum_{u \neq k,t}^{G} B^{lt} F^{tu}) + (V^k L^{kk})^T (A^{kl} B^{ll} F^{lk}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tk}) + (V^k L^{kk})^T (A^{kl} B^{lk} F^{kk}) \\
&+ (V^k L^{kk})^T * (A^{kl} \sum_{t \neq k,l}^{G} B^{lt} F^{tk}) + (V^k B^{kk} - V^k L^{kk})^T * (A^{kl} X^l) \\
&+ (V^l B^{lk})^T * F^{kl} + (V^l B^{lk})^T * (A^{kl} L^{ll} F^{ll}) + (V^l B^{lk})^T \\
&+ (A^{kl} L^{ll} E^{l*}) + (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * Fkl \\
&+ (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * (A^{kl} L^{ll} F^{ll}) + (\sum_{t \neq k,l}^{G} V^t B^{tk})^T * A^{kl} L^{ll} E^{l*}
\end{aligned}
\tag{5}
$$

The first term correponds to the domestic value added in final exports. The rest of components correpond to domestic value added re-exported to third countries as intermediate or final use, foreign value added in exports and domestic value added returning home and double counting components. The decomposition has been computed using the algorithm in R provided by Quast & Kummritz (2015).

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

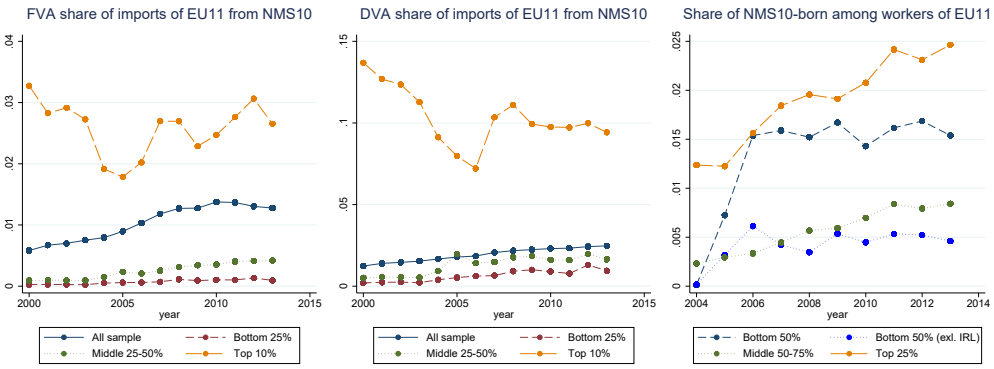
Industry code	Industry description
AB	Agriculture, hunting and forestry ,Fishing.
C	Mining and quarrying.
D	Manufacturing.
E	Electricity, gas and water supply.
F	Construction.
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods.
H	Hotels and restaurants.
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 Rev1, used until 2008, and NACE Rev2 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

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



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

Table B4: Predicted variation imported DVA in inputs from NMS-10 due to labour market openings (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 : 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.