Diasporas, return migration and comparative advantage: a natural experiment of Yugoslavian refugees in Germany*

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Abstract

During the early 1990s Germany received over half-million Yugoslavians escaping war. By 2000, most of these refugees were repatriated. In this paper we exploit this episode to provide causal evidence on the role migrants play in expansion of the export baskets of their home countries after their return. We find that the elasticity of exports to return migration is between 0.13 and 0.33 in industries were migrants were employed during their stay in Germany. In order to deal with endogeneity issues we use historic rules of random allocation of asylum seekers across different German states to construct an instrumental variable for the treatment. We find our results to be externally valid when expanding the sample to all countries. We also find that the effect is over 10 times stronger for migrant workers in white collar occupations, as opposed to non-white collars. Similarly, the effect is 3 and 4 times larger upon return migration of workers with occupations intensive in analytical and cognitive tasks (as opposed to manual ones) and with high problem-solving content (as opposed to low content), respectively. Our results point to knowledge diffusion as the main channel driving the link between migration and productivity as measured by changes in comparative advantage.

1 Introduction

In 1999, only four years after having returned from Wolfsburg in Germany –Volkswagen's home town– Nijaz Hastor founded the Prevent group: currently one of Bosnia's largest companies. Prevent began manufacturing seat covers in the city of Visoko with a staff of 50, and has since diversified into yacht interiors, protective clothing, brake disks and fashion textiles. By 2016, Prevent Group employed over 6,500 people and operated from about 15 different sites in Bosnia, exporting its products to a number of different destinations across Europe and beyond. Hastor started his career working for a local firm supplying car parts in Sarajevo, but it is likely that the knowhow he acquired while working as an immigrant for the auto industry in Germany had helped him build a world-class company able to manufacture high-end auto parts with high efficiency. In this paper we document how migrants having worked in foreign countries can shape the composition of the export basket of their home countries.

The economic literature has looked at the role of migrants in serving as vehicles of knowhow between countries. For example, migrants play a role in lowering transaction costs associated to trade between countries (e.g., Parsons and Vézina, 2017), or associated to flows of foreign investment (e.g., Kugler et al., 2017). This paper builds on the empirical work by Bahar and Rapoport (2017), who show that countries tend to diversify their export baskets towards goods that are intensively exported in the home countries of its immigrants or destination countries of their emigrants. Bahar and Rapoport (2017) interpret this phenomenon as the ability of migrants to transfer productive knowledge resulting in the emergence of new export sectors. In this paper, we go deeper and document positive changes in the comparative advantage of the same industries where their citizens have worked or are working in while migrants in an advanced economy.

In particular, we estimate changes in exports to the rest of the world as explained by return migration of workers employed in that same sector in Germany. To do so, we start by focusing on one particular case which historical context presents a neat natural experiment for this purpose: the case of refugees of Yugoslavian origin in Germany during the early 1990s. Following the Balkan wars, about seven hundred thousand Yugoslavians migrated to Germany and, for the most part,were allowed to participate in the local labor force.

Most of the Yugoslavian migrants in the first half of the 1990s were given a temporary protection status ("*Duldung*" in German or "toleration" in English). After the Dayton peace agreements were signed in 1995, the protection status and work permits of the temporary migrants were revoked and subsequently they were forced to leave the country. By 2000, about two thirds of migrants with *Duldung* status had left. A large proportion of them, in fact, returned to the countries of the former Yugoslavia. In this paper we exploit the stay of these refugees in Germany and the subsequent massive inflow of return migrants –with experience in the German workforce– into the former Yugoslavian countries, to study sector-specific productivity shifts as measured by exports.[1] To do so we rely on confidential data from the German Institute for Employment Research (IAB), which we use to compute

[1]Following Bahar et al. (2014) and Bahar and Rapoport (2017) we use changes in comparative advantage for a particular product as a proxy for productivity improvements.

the number of Yugoslavian migrants working in a particular 4-digit industries before and after the Balkan refugee crisis. We link this information to standard disaggregated international trade data and employ a difference-in-difference methodology to estimate changes in export values from Yugoslavian countries to the rest of the world caused by return migration of Yugoslavian workers in Germany. In order to address concerns of endogeneity due to self-selection of workers into industries with potential pre-existing growth trends in Yugoslavia, we instrument the actual number of returning workers per industry with the expected number given a spatial dispersal policy that exogenously allocated asylum seekers across the different regions of Germany upon their arrival.

We find that, on average, products with a 1 percent increase in return migration, experienced an increase in exports to the rest of the world of 0.1 to 0.25 percent between 1990 and 2005. In fact, the estimated elasticity increases the more time goes by after the refugees had returned. Our results cannot be explained by an existing previous trend on exports, nor by FDI flows from Germany to Yugoslavian countries during those same years. They cannot be explained either by lower bilateral trade transaction costs as our measure of exports from Yugoslavia to the rest of the world excludes exports to Germany.

We then explore the external validity of our results by expanding our methodology to a multi-country and multi-period setting. In this setting we estimate changes in exports for over 100 countries and close to 800 products as explained by changes in stocks of migrant workers in Germany in two periods: 1990 to 2000 and 2000 to 2010. Through this exercise we estimate elasticities that range from 0.09 to 0.11, remarkably similar to the ones estimated using the Yugoslavian natural experiment.

We interpret this set of results as driven by the diffusion of productive knowledge: migrant workers exposed to industries in Germany bring back knowledge on methodologies or technologies back home that translates into higher productivity in those same industries. This is consistent with a burgeoning literature that looks at migrants (and descendants) as drivers of knowledge diffusion (e.g. Kerr, 2008; Choudhury, 2016; Hausmann and Neffke, 2016; Bahar and Rapoport, 2017), as the transmission of tacit or non-codifiable knowledge requires human interaction (Arrow, 1969; Polanyi, 1966). To further dig into this, we also exploit variation in the characteristics of the different occupations of the migrant workers with the premise that certain types of workers and their occupations are more suited for diffusing productivity-inducing knowhow across borders. The richness of our data allows us to say something beyond aggregated measures of human capital. In particular, we find that workers in "white collar" occupations are about 10 times more "effective" in explaining changes in exports than non-white collars. Similarly, we find that workers in occupations that are intensive in analytical and cognitive tasks or with high problem-solving content are about 3 and 4 times more effective in explaining exports than occupations intensive in manual tasks or with low problem-solving content, respectively. All this put together reinforces the idea that the driving force behind our results is the diffusion of knowledge.

This paper contributes to the literature of international economics and economic development in several ways. First, to the best of our knowledge, is the first study that uses a neat natural experiment as a source of identification to causally estimate changes in exports due to return migration. Thus, our findings suggest that migrants with work experience in an advanced economy are a determinant in the evolution of the comparative advantage of nations (Bahar and Rapoport, 2017). Second, we contribute to the literature that studies international knowledge diffusion by exploring differential effects based on occupation types of workers, adding to the evidence that migrants are, in fact, a powerful driver of the international diffusion of knowledge (Keller, 2004). Third, we contribute to the literature of economic development by linking the role of migrants in the diversification of countries' export baskets, which is evidenced to correlate with economic stability and growth (e.g., Krishna and Levchenko, 2009; Koren and Tenreyro, 2007; Hausmann et al., 2006; Imbs and Wacziarg, 2003; Hausmann and Klinger, 2007; Cadot et al., 2011).

The rest of the paper is divided as follows. Section 2 provides a historical summary of the Yugoslavian refugee crisis. Section 3 details the data sources. Section 4 explains the setting and the empirical strategy. Section (5) present results for the Yugoslavia case. Section 6 extends the results to all countries and explores differential results based on types of migrant workers' occupations. Section 7 concludes.

2 Historical context

2.1 Yugoslav Wars

In June of 1991 the Socialist Federal Republic of Yugoslavia started to disintegrate and these transitions were accompanied by several armed conflicts and ethnic civil wars. Fightings began with the Ten-Day War in Summer 1991 after Slovenia declared its independence. But soon the conflicts spread to Croatia (1991) and Bosnia and Herzegovina (1992) and these lasted until the Dayton Agreement was signed in December 1995.[2]

During the Yugoslavian wars, around 3.7 million people (roughly 16 percent of the population) left their homes to escape the armed conflict. These conflicts in the Balkans fueled the largest migration flow in Europe since the end of the Second World War (Radovic et al., 2005). While many affected by the war became internally displaced (moving to areas dominated by their own ethnic group), about 2 million people resettled outside of the boundaries of the former Yugoslavia as refugees or sought asylum in 3rd countries.

2.2 Migration from Yugoslavia to Germany

As the armed conflicts spread across Yugoslavia, it triggered refugee flows from different parts of the Republic towards Germany. Overall in the first half of the 90s, Germany received roughly 700,000 migrants from Yugoslavia making it the largest recipient country outside the boundaries of former Yugoslavia. First Yugoslavian refugees arrived to Germany during the Croatian War of Independence (1991–1995), when 100,000 Croatians fled the armed conflict between Croat forces and the Yugoslavian army towards Germany (Lederer, 1997). During the Bosnian War (1992–1995), when acts of systematic violence triggered massive outflows from Bosnia and Herzegovina, Germany hosted some 350,000 Bosnian refugees, making it the biggest recipient country (Lederer, 1997).[3] Furthermore, in addition to the civil war refugees, Germany also received another 250,000 Yugoslavians (mainly from Serbia

[2] At the end of the decade from 1998 to 1999 the region was affected by yet another armed conflict, the Kosovo War. For our identification strategy we focus on the first half of the 1990s and therefore mainly discuss the conflicts between 1991 and 1995.

[3] Overall, about 1.2 million Bosnians were forced to leave their homes, some 620,000 settling outside the border of Yugoslavia (UNHCR, 1997)

and Kosovo) who applied for asylum (Lederer, 1997).

2.3 Legal status in Germany

During their stay in Germany, Yugoslavians were mostly hosted as either asylum seekers or *Duldung* holders. Both status have similar but not equal characteristics with regard to their residence status and requirements and labor market access. Asylum seekers have the lowest legal residence status in Germany. They are only allowed to reside (*Aufenthaltsgestattung*) while their asylum application is processed, but this procedure could take years (Liedtke, 2002). If asylum was granted, based on Article 16(a) of the German Basic Law (*Grundgesetz*), it provided the individual right for asylum due to political persecution . Successful applicants had the right for a permanent residence permit, family reunion and equal access to social rights and benefits in Germany (Hailbronner, 2003). People who are not entitled to asylum may still seek humanitarian protection based on the Geneva Convention (non-refoulement) if "his or her life or liberty is threatened due to his or her race, religion, nationality, membership of a particular social group or political convictions." and also covers non-state persecution (Schneider, 2012). Nevertheless, an ethnic civil war neither qualifies for protection according to the Geneva Convention nor Article 16a of the German Basic Law because it requires proof of individual persecution (Dimova, 2006). This is why asylum recognition rates were very low for citizens of former Yugoslavian. For instance, between 1992 and 1995 only 1 percent of Bosnian applicants were granted asylum (Lederer, 1997).[4] Therefore, in the beginning of the 1990s when hundreds of thousands of Yugoslavians sought humanitarian protection in Germany, the government issued a temporary protection, the so called *Duldung.* On the one hand this was a considerable humanitarian gesture of the German government compared to their European neighbors. On the other hand *Duldung,* ("toleration" in english) allows the person to stay in the country although he or she is obliged to leave the country once it is no longer renewed. It is a sort of a suspended deportation order

[4] For a long time, refugees entering Germany asked for asylum. In the second half of 80s, rapid increase in asylum demands started constraining the system. When refugees from Yugoslavia started flowing into Germany suddenly and in large numbers, asking for asylum, the system clogged. In order to alleviate the problem, German government made a constitutional amendment in 1993 which made asylum status less generous and the request conditions harder (see Lederer (1997) and (Liebaut, 2000) for more details).

(Hailbronner, 2003; USCRI, 2000). Legally it does not constitute a residence permit but it has been used to provide some sort of subsidiary protection because a legal status for (civil) war refugees did not exist or could not be applied (Hailbronner, 2003; Bosswick, 2000).[5] This status had to be renewed up to every six months, until return to the home country was possible (Dimova, 2006). Once the permit expired, its holder was obliged to leave the country immediately. Thus, the vast majority of the war zones in Bosnia and Croatia were given *Duldung* as they were not eligible for asylum. For instance, about 80 percent of the Bosnians received a *Duldung*, whereas roughly 20 percent who had relatives were allowed to reside in Germany for exceptional purposes (*Aufenthaltsbefugnis*) a temporary stay permit similar to the *Duldung* (Bosswick, 2000; Focus, 1995).

During the same period, some 250,000 Yugoslavian passport holders, mainly from Serbia and Kosovo, left their country due to wars in neighboring countries and sanctions by the united nations forced thousands of people to leave their country (Dragisic, 2010). As they were not originating from zones actively in battle they applied for asylum as they were not (Lederer, 1997). Despite high application numbers, only 4 percent were given asylum between 1991 and 1995 on average (Lederer, 1997).

2.4 Labor market conditions and mobility

Overall, both *Duldung* holders or asylum seekers from Yugoslavia were allowed a relatively free access to the labor market. *Duldung* holders were entitled to apply for a work permit for a general job permit (*allgemeine Arbeitserlaubnis*) after obtaining their status. They were allowed to work without any geographical nor sectoral limit. Despite such freedom, some *Duldung* holders had difficulty finding a job as their residence permit expired after several months and according to the law *Duldung* holders were allowed to take a job as long as no unemployed German citizens could be. Although stated in the law, there are is a wide range of discretion in its application, varied a lot between federal states and time. Despite these limitations, a considerable number of the civil war refugees manage to integrate into

[5]During the constitutional amendment in 1993 a special status for war refugees was introduced but could not be applied because the Federal Government and the Federal States could not agree on the financing. In fact it was first applied in 1999 for the refugees from Kosovo (Bosswick, 2000).

the German labor force. For instance, in 1992 the number of employed Yugoslavians rose by 380,000 persons or 15 percent within just 12 months Deutscher˜Bundestag (1994).

Asylum seekers who arrived between 1991 and 1997 were also allowed to work.[6] Following their first three months, similar to *Duldung* holders, they were allowed to work while their application was being considered. Those whose application were granted did no longer require a work permit to access the labour market.

An important difference between the two statuses concerned mobility. *Duldung* holders did not face any geographical limitation, and were thus free to move and settle across Germany. Asylum seekers however were subjected to mandatory residency (*Residenzpflicht*) while their application was considered. They were obliged to stay within the region in which their application was processed. Once they were granted refugee status, they would be free to relocate. If the asylum application was rejected, as was the case for the vast majority of Yugoslavians, the person had to leave the country. However, if he or she can prove the life threatening conditions back home, the deportation is postponed and the person receives a *Duldung* status as well.

Due to these differences, while asylum seekers were distributed according to the quota system, *Duldung* holders enjoyed free movement, which created a very unequal distribution of refugees across the country. For instance, compared to their population, city states Berlin and Hamburg, as well as the federal states of Baden-Württemberg and Bavaria received many war and civil war refugees Lederer (1997).

2.5 Return to Yugoslavia

Each group's stay in Germany was determined by the conditions back at home (i.e. length of respective wars) and their status as refugees.

Croatians were first to arrive and first to leave. Following the start of the war in 1991, Croatians started arriving to Germany. Following the Vance Plan in January 1992 that

[6]Labor market access conditions for asylum seekers changed a few times. Until 1991, immediate access to labor market was possible. Between 1991-1997, a waiting period of three months were enacted. Modifications in the law in 1997 banned asylum seekers from the labor market. This changed in 2001 when 1-year waiting time was introduced. For more details see Liedtke (2002).

ended armed conflicts, the arrivals to Germany slowed in 1993 and starting in 1994 reversed. By end of 1994 almost all of the refugees had returned to Croatia (Lederer, 1997).

Both arrival and departure of Bosnians were very rapid. Between 1992-1995 some 350,000 Bosnians had arrived to Germany. Only a day after the signing of the Dayton Peace Accord on December 14 of 1995, Germany developed a repatriation plan through which *Duldung* refugees were gradually forced to leave the country (Dimova, 2006). To accomplish this, the authorities revoked refugees' work permits and rolled out assisted repatriation programs (Bosswick, 2000).[7]

In early 1997 the governments of Germany and Bosnia-Herzegovina signed a treaty to accelerate the repatriation of migrants. Forced repatriation was planned in two main phases. The first phase targeted single adults and childless couples as well as people with family back in Bosnia-Herzegovina. The second phase targeted the rest of the refugees. By the summer of 1996 letters requesting announcing deportation were sent and the first actual deportation took place by the end of 1996. While majority of the refugees left by 1998, returns continued until 2000. Some 20,000 refugees, who were traumatized by the war and persons older than 65 without any relatives in Bosnia and Herzegovina were allowed to remain in Germany (Nenadic et al., 2005).[8]

Ethnic Serbians lived across former Yugoslavian territories.[9] Throughout the 90s as one war followed the other, ethnic Serbians located in each future republic, had to leave as well. This created continuous inflows and outflows of Serbians throughout the period. Moreover, many Serbians had entered Germany as asylum seekers. As most of the asylum requests were rejected, this added to the flows as the person whose request was rejected had to leave the country immediately.

Following their departure from Germany, most of the Yugoslavians returned home. Al-

[7]Voluntary returns were mainly realized as a part of the program of German Government through REAG (Program for Reintegration and Emigration for Claimants of Asylum in Germany) and GARP (Government Program of Assistance to Repatriation) which was implemented in cooperation with International Organization for Migrations (IOM) whose target was to support voluntary return. Both programs were completed in 2001 (Nenadic et al., 2005).

[8]It is estimated that some 3,000 of refugees were diagnosed with trauma which enabled them and their family members (some 9,500 persons) to remain in Germany.

[9]Here we consider those who had exchanged their Yugoslavian passport with that of Serbia as ethnic Serbians.

most totality of the Croatian refugees returned back to Croatia including ethnic Serbs (Lederer, 1997). Following the peace treaty, almost all of the *Duldung* holders from Bosnia and Herzegovina also left Germany and returned back home. According to German government statistics, by the end of 2000 the number of civil war refugees from Bosnia and Herzegovina reduced to 30,000. Most returned to Bosnia and Herzegovina (260,000), while a minority migrated to other countries (50,000) such as USA, Canada and Australia (Ruhl and Lederer, 2001).

3 Data and sample

Data on exports comes from bilateral trade data compiled from UN Comtrade by Feenstra et al. (2005) with extensions and corrections suggested by Hausmann et al. (2014). The data covers the period 1984-2014. In most cases our dependent variable is exports by product from each country to the rest of the world excluding Germany (where migrant workers are located). We do this so that our results are not confounded with an increase in trade driven by lower transaction costs caused by migrant networks (e.g., Rauch and Trindade, 2002; Parsons and Vézina, 2017).

Products are defined using the 4-digit Standard Industry Trade Classification (SITC) revision 2.[10] This product classification provides a disaggregation level that enables a meaningful discussion about export diversification patterns. Some examples of products in this level of disaggregation are, for example, "Knitted/Crocheted Fabrics Elastic or Rubberized" (SITC 6553), or "Electrical Measuring, Checking, Analyzing Instruments" (SITC 8748). Following Hausmann et al. (2014), we exclude countries below 1 million citizens and total trade below USD $1 billion in 2010. Other variables created using trade data are explained as they are introduced into the analysis.

The data on migrant workers in Germany are based on records from the German social security system and comprise all persons employed subject to social securtiy contributions,

[10]The words product, good, sector and industry interchangeably refer to the same concept throughout the paper.

with the execption of self-employed and civil servants.[11] The records indicate the industry in where the workers are employed. For data privacy reasons, our sample is restricted to 40% random draws of foreign nationals observed on June 30 of each year from 1975 to 2014 augmented by the employment history of each individual for our sampling period. This amounts to about 2.4 million workers per year on average, which is a large enough amount for the random draws to be form a representative sample. Moreover, since we can observe the full employment history, we can determine whether an individual was employed before or after any given year in Germany, which we exploit to construct our treatment. Beyond individual information such as age, nationality, and educational attainment, the data includes also detailed occupational codes categorized in more than 300 different occupations.[12]

For the first part of the paper, focused on Yugoslavia, we collect other data from different sources. First, we collected information on direct investments of German firms in former Yugoslavia sent to us by the German Central Bank (*Deutsche Bundesbank*) upon request. We use this data to compute German FDI stocks in former Yugoslavian countries at 2-digit SITC level between the years 1990-2010, to serve as a control. Second, in order to construct an instrument to deal with endogeneity issues, we used data on asylum applications in Germany, which comes from the German Federal Office for Migration and Refugees (*Bundesamt für Migration und Flüchtlinge, BAMF*) sent to us upon request. We also use inflow quotas mandated by the government that defined the the regional distribution of asylum seekers (*Königsteiner Schlüssel*). These quotas are determined yearly by the Joint Science Conference (*Gemeinsame Wissenschaftskonferenz, GWK*). The yearly data between 1990 and 2016 have been sent to us by the GWK upon request.

With these datasets we are able to match the exports of each country to the rest of the world in a given year for each country-product combination to the number of foreign workers in Germany linked to that country-product.[13] The final sample encompasses 123 countries

[11] These records have been assembled by the Institute of Employment Research (IAB) into the Employment History (BeH) data file (IAB, 2015). The data or variants of it have been used to study a variety of labor market aspects, (e.g., Card et al., 2013; Cornelissen et al., 2017; Dustmann and Glitz, 2015; Dustmann et al., 2017).

[12] See more details on this dataset in Online Appendix Section A.

[13] Using our employment sample we compute the number of workers in Germany by nationality, product and year for all tradable industries. We use the nationality of the worker based on the passport recorded at his or her first appearance in the database. We rely on the work by Dauth et al. (2014) to match German

and 4-digit 786 products. In Section 4 we limit our sample to the former Yugoslavian countries to exploit the natural experiment provided by the historic context described above. Section 6 uses all countries in the sample to externally validate the results of the natural experiment as well as to exploit a much larger variation on workers' characteristics.

4 Natural Experiment: Yugoslavian Refugees

We start by exploring the role of return migration using the case of Yugoslavian migrants in Germany as a natural experiment. As pointed out in Section 2, around 700,000 migrants from the former Yugoslavia arrived to Germany in the first half of the 1990s, who joined a country that had already a sizable population of Yugoslavian migrants. Figure (1) summarizes these numbers. In 1980 there were already about 600,000 Yugoslavians residing in Germany. This stock remained steady until the late 1980s where the net inflow of Yugoslavian migrants started to grow at a rate of 25,000 per year, until the year 1990. This rate skyrocketed to 168,000, 250,000 and 165,000 during 1991, 1992 and 1993, respectively. The sharp increase in the net inflow of migrants was fueled by refugees escaping the war. We also see an sharp incrase in asylum requests from Yugoslavian citizens during the same years.

[Figure 1 about here.]

The number of Yugoslavians in Germany sharply declines starting in 1995, after the Dayton treaty was signed. By 2000 close to 250 thousand Yugoslavians had left the country. While some of them left to a third country, it has been estimated that about 76 percent of them returned to countries of the (by then) former Yugoslavia (UNHCR, 2005; Ruhl and Lederer, 2001). Our natural experiment is based on this sharp inflow of Yugoslavian migration into Germany and their subsequent outflow. Our data allows us to identify the 4-digit industries where these migrants worked at during their stay in Germany, which we link to exports from Yugoslavia to the rest of the world in the years to come.

3-digit WZ industry codes to 4-digit SITC products. Further details on the employment sample, variable descriptions and auxiliary data are provided in Online Appendix Section A.

4.1 Empirical strategy

We explore the effect of return migrants from Germany on the export basket of former Yugoslavian countries through a difference-in-difference estimation. Given that the German data does not allow us to distinguish which is the region of origin of the refugees within Yugoslavia (we only see they entered the labor force with a Yugoslavian passport), our unit of analysis is the combined exports by product of all countries in the former Yugoslavia. That is, the trade data includes export by product of Yugoslavia as a nation until 1991, and we complement this by simply adding up exports by product of all countries that formed Yugoslavia post 1992: Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia and Slovenia.[14] We end up having a balanced-panel of exports by product for the former Yugoslavia from 1984 until 2014, which is the main input to construct our dependent variable.

On the migration side, the treatment, we look at the number of return migrants post 1995, when the Dayton Accords were signed and when Germany started encouraging Yugoslavian refugees to leave. In particular we compute the number of former Yugoslavian workers who (i) have been employed in Germany in 1995, (ii) but have not been recorded in our data in 1990 or before, and (iii) have not been recorded in our data in 2000 or thereafter.[15] Therefore, we measure only relatively short employment episodes of former Yugoslavian migrants in Germany, and although we cannot measure return migration directly, we reduce the likelihood of capturing migrants from former guest worker episodes considerably. Furthermore, we cannot distinguish whether these workers with Yugoslavian passport that left the labor force indeed returned back to the former Yugoslavia. Thus, in our calculation of return migration we are including workers who, for instance, stayed in Germany working in the informal sector or went to a third country. Yet, all these possibili-

[14] Very few persons left Slovenia while almost none left Macedonia as both countries obtained their independence with limited or no armed conflict. Both, however, had very different economic structure. While Slovenia was the republic with highest GDP per capita and had a much more diversified export basket than the rest of the countries to begin with, Macedonia was one of the poorest republics of the former Yugoslavia with little exports. Our results are robust to excluding both Slovenia and Macedonia from the exports data (see Online Appendix Section E).

[15] If we find no entry for a person in our data implies that this person was not employed in any job, industry, or occupation subject to social security contributions on June 30 of any given year.

ties work against us in our estimation, and thus our estimates are understating the effect of return migration.

Figure 2 describes the treatment variable. It plots the number of Yugoslavian workers by 4-digit product in German workforce in the tradable sector in 1995 (horizontal axis) against the ones who also have a job in 2000 (vertical axis). We consider this drop to be an exogeneous shock. This allows us to construct a continuous treatment which is quite heterogenous across different products. Graphically, the constructed treatment for each product is the difference between the dot and the 45 degree.

[Figure 2 about here.]

Our estimation exploits changes in Yugoslavian exports by product to the rest of the world (excluding Germany) given different levels of return migration. Before we turn to the econometrics, we look at whether products associated with a larger reduction of workers in Germany experienced more exports. Figure 3 visualizes the cumulative value of exports of products linked to return migrants from Germany (by 2000) with different levels of treatment, year after year. Clearly, it shows that while all sets of products start at similar levels, products in third and fourth quartiles in terms of return migration diverge quite significantly from the first two quartiles.

[Figure 3 about here.]

In fact, a descriptive exercise, visualized in Figure 4, comparing the exports of Yugoslavia and of Germany across time shows us that their export baskets became more similar across the years during the period of study, as measured by the export similarity index by Bahar et al. (2014).

[Figure 4 about here.]

So far, of course, we have only described the data and found some interesting correlations. Next, however, we explore the relationship in detail focusing to establish a causal effect. To do so, we turn to explore this result using regression analysis and estimate the following:

$$exports_{p,t} = \beta^{DID} treat_p \times after_t + \beta^{fdi} fdi_{p,t} + \eta_p + \alpha_t + \varepsilon_{p,t} \quad (1)$$

Where subscripts p and t representproduct andyear, respectively. The left-hand side variable ($exports_{p,t}$) measures the value of exports from the former Yugoslavia to the rest of the world excluding to Germany for product p during year t. We start by estimating this regression using two periods, 1990 (before the war) and 2005 (five years after most of the Yugoslavians returned). In fact, to avoid our results being driven by noise in a particular year we use average exports between 1988 and 1990 for the 1990 value, and for the 2005 value we use average exports bewteen 2003 to 2005.[16] The variable of interest $treat_p$ is number of workers that left the German labor force in product p between 1995 and 2000 according to our definition earlier. β^{DID} represents the change in exports caused by changes in returnees ($treat_p$) by the end period ($after_t$), in a typical difference-in-difference setting. Given that migrants could also reduce transaction costs and facilitate foreign direct investment (Kugler et al., 2017), we control for the stock of FDI from Germany to the combined Yugoslavian countries in the specification. We do so in order to rule out the possibility that the increase in exports is driven by the inflow of FDI in the same industries the migrants worked at while in Germany. Why would we want to rule out this possibility? Actually, we don't necessarily want to rule it out, given that this would be one mechanism through which migrants can induce a productivity shift in their industries back home: if migrants can help in driving FDI, and this results in higher productivity, then this does not necessarily rules out the role of migrants in this process. However, by including this control we simply rule out this mechanism, and instead focus on the idea that migrants, regardless of their ability to bring in investment, can explain changes in the composition of the export basket of their home countries.

As for the other terms: η_p represents product fixed effects while α_t represents year fixed effects (which in the main estimation is equivalent to one dummy variable for the year 2005). The two fixed effects are perfectly multi collinear with the terms $treat_p$ and $after_t$ if added separately. $\varepsilon_{p,t}$ represents the error term. Our estimations cluster standard errors at the

[16] Our results are robust to using only data for the year 1990 and the year 2005.

product level (Besley and Burgess, 2004; Bertrand et al., 2004).

Before we turn to the results, some further comments on methodology and identification are in place.

4.1.1 Dealing with self-selection: instrumental variable

Our identification relies on the exogeneity of arrival and exit of refugees in labor force with regards to export trends back in Yugoslavia. If, however, workers self-selected into industries anticipating (based on private knowledge) future growth of specific industries upon their return, then it would be a potential threat to our identification. In order to reduce such concerns, we use spatial dispersal policy applied to asylum seekers to compute expected worker stocks per industry.

While asylum requests were being processed, asylum seekers were randomly sent to different parts of the country following the Königstein State Convention (*Königsteiner Staatsabkommen*) which was signed in 1949 by all German federal states and defined cost-sharing rules between states in jointly financed projects. Although initially this convention concerned financing of joint science projects, the system was later adopted –among other things– for allocation of asylum seekers in Germany. The dispersal of asylum seekers is regulated at federal level by the Asylum Procedure Act (*Asylverfahrensgesetz*), where each state is allocated certain number of asylum seekers according to its "Königstein Quota" (*Königsteiner Schlüssel*). The quota is based on the weighted sum of population (1/3) and tax revenues (2/3), and it is re-calculated annually. In the absence of substantial regional shocks, this quota does not vary much over time.

Under this policy, a typical asylum seeker arrives in Germany, applies for asylum, and then is placed in a refugee center in anticipation of a residence permit. The location (state) of this first placement for each asylum seeker is made at random based on the system described above. After the first period in reception facilities, which can last up to a maximum of six months, the asylum seekers are placed in a district within the state of the first allocation. The state authorities decide whether to place them in collective accommodations, or whether to grant the applicant a permit to take an apartment. This discretionary decision must take account of both the public interest and the asylum seeker's personal concerns.[17] The residence obligation ends as soon as the Federal Office grants asylum status. The average duration of the application procedure in 2010, for instance, was around two years. An illustration of the quota system can be seen in Figure 5, which shows the share of asylum seekers each of the sixteen German states should have received using the quota system in year 1995. For example, Nordrhein-Westfalen is the state that should have received most of the asylum seekers in 1995, followed by Baden-Württemberg and Bayern, while a states such as Bremen and Saarland received a very small share.

[Figure 5 about here.]

Based on this narrative, we are able to construct a variable to instrument for our treatment variable. To do so, we combine three pieces of data: (1) the yearly inflow of asylum seekers from Yugoslavia in Germany, (2) the asylum quotas for each one of the sixteen German states per year, and (3) the relative size of each industry in each state based in the baseline year of 1990. The resulting variable estimates the number of Yugoslavian asylum seeker workers in Germany per industry. Note that it is an estimate, because it is based on the assumption that the distribution of Yugoslavian workers across industries within each state equals that of the Germans. The following equation reflects the calculation:

$$\underbrace{TreatIV_p}_{\substack{\text{Expected YUG asylum seeker} \\ \text{workers in industry } p}} = \sum_{t=1990}^{1995} \sum_{s} \underbrace{asylumseekers_t}_{\substack{\text{Inflow YUG asylum} \\ \text{seekers in year } t}} \times \underbrace{quota_{s,t}}_{\substack{\text{Quota (share) for} \\ \text{state } s \text{ during } t}} \times \underbrace{shareindustry_{s,p,1990}}_{\substack{\text{Germans employment share} \\ \text{of } p \text{ within } s \text{ year } t}}$$

The instrumental variable is a feasible one under two conditions: first, if it correlates with the treatment and second, if the exclusion restriction holds. In terms of the first condition, we expect a strong correlation between the treatment and the instrumental variable: as explained above, the exogenous geographic allocation for asylum seekers –even if they were

[17] In special cases, for example in cases of family reunification, asylum seekers may also be assigned to a different reception center at their own request. This however, does not happen if the state has already accepted enough number of asylum seekers mandated by the quota system.

a small share of all refugees (as seen in Figure 1)– is presumably a strong determinant of the final destination of all the Yugoslavian refugees (regardless of their actual status) within the country during that period.[18] In fact, Figure 6 shows that such is the case, as it plots $TreatIV_p$ in the horizontal axis against: (i) the actual number of Yugoslavian workers (regardless of the status with which they entered the country) in the labor force by industry in the left panel; and, (ii) the number of Yugoslavian workers that had left the labor force between 1995 and 2000 (our treatment) in the right panel. Each observation in the figure is a product, symbolized by its 4-digit SITC code. It can be seen in the figure that both the stock of actual Yugoslavian workers and the number of workers who left the labor force between 1995 and 2000 in each industry stocks of workers are strongly correlated by stocks that are predicted through spatial dispersal policy.

[Figure 6 about here.]

Our main assumption regarding the second condition –the exclusion restriction– is that both the quota of asylum seekers per state and year defined by the German federal authorities, and the relative size of the German workforce of each industry in each state at the baseline year (1990)[19] are not correlated with future product-specific exports of former Yugoslavian countries to the rest of the world. In fact, given that the quota per state is based on the state share of population and of tax revenues within Germany, and nothing else, we have no reason to think that our assumption is not a valid one.

4.2 Summary statistics

Table 1 presents the summary statistics used for this exercise. Our sample includes 786 products, and since we use two points in time for the differences-in-differences, the initial

[18] The reasoning is the following. First, the geographic allocation of asylum seekers are relevant for all refugees who request for asylum, even if the asylum turns out not to be approved. That is, if many of the refugees that eventually got a *Duldung* status originally requested for asylum, they also had to comply with this random geographic allocation while their asylum status was being reviewed by the authorities. Second, and perhaps more importantly, the random allocation of the small share of Yugoslavians who actually requested asylum might as well be explanatory of the location choice of those who received *Duldung* even if they did not request for asylum to begin with.

[19] We purposedly use employment industry share based only on German workers, as opposed to using the shares computed with Yugoslavian or other foreign workers in order to avoid possible endogeneity concerns.

empirical analysis will use up to 1572 observations. The table presents summary statistics for the main variables in the regression. The first four lines of the table present data for the average export value from Yugoslavian countries to the rest of the world in years 1990, 1995, 2000, 2005 and 2010, all in million US dollars. For the main specification we use the years 1990 and 2005, before and after the war. However, we also present results for a multi-period analysis as well that uses export data for all the years in between, too.

Given the fact that the left hand side is calculated in US dollars, we are required to use a monotonic transformation to deal with the fat-tailed distribution. All of our results are presented using three different transformations: $log(exports_{p,t})$, $log(exports_{p,t}+1)$ and $asinh(exports_{p,t})$. The first one is undefined for values where $exports_{p,t}=0$, and therefore, when using $log(exports_{p,t})$ as the dependent variable the sample size is reduced. The two other transformations deal with the occasions where $exports_{p,t}=0$ by either adding USD $1 before the transformation and by computing instead the inverse hyperbolic sine (asinh), respectively.[20] The inverse hyperbolic sine is defined at zero and behaves similarly to a log-transformation. The interpretation of regression estimators in the form of the inverse hyperbolic sine is similar to the interpretation of a log-transformed variable (see MacKinnon and Magee, 1990).[21]

[Table 1 about here.]

Table 1 also summarizes the treatment. On average, there were about 40 workers in Germany working in each 4-digit product by 1995. Some products in Germany never had Yugoslavian workers in 1995 (as the minimum value is zero), and the maximum number of workers we see in a particular product is almost 1,000. The next three rows of the table summarize the variables that we use as treatment. Our main treatment variable is the number of workers with Yugoslavian passport active in the German labor force in 1995 that dropped from the sample by year 2000. The value for this variable is 13, averaged across all product. Sometimes we use as a treatment the same number but using 2005 and 2010 instead

[20] Since exports are aggregated across al destinations, the number of "zeroes" in the data is not as large as when using bilateral trade data. We explore this in detail in Online Appendix Section B.

[21] The inverse hyperbolic sine ($asinh$) is defined as $log(y_i + \sqrt{(y_i^2+1)})$. Except for small values of y, $asinh(y_i) = log(2) + log(y_i)$.

of 2000. By 2005 this number becomes 15 and by 2010 the number is 18. There is quite a bit of variation across products for these numbers, too, which go from zero to 390 depending on the year used as the end of the period. Unless otherwise stated, all independent variables are transformed using the inverse hyperbolic sine for estimation purposes.

5 Main Results

Results for the estimation for specification (1) are presented in Table 2. For the initial period it uses exports data averaged over 1988 to 1990, and for the end period it uses exports data averaged over 2005 to 2007. The treatment is defined as the number of workers of Yugoslavian origin that left the German labor force in between 1995 and 2000, by product.[22] The estimation includes product fixed effects, such that the results use only within-product variation, and year fixed effects, which in this case is equivalent to a dummy variable for year 2005. The first three column reports results using an OLS estimation, while the last three columns report results using a 2SLS estimation, making use of the instrumental variable described in Section 4.1. The table reports results using $log(exports_{p,t})$, $log(exports_{p,t} + 1)$ and $asinh(exports_{p,t})$ as dependent variables. Since the regressor $treat_p$ is an inverse hyperbolic sine transformation then β^{DID} can be interpreted as an elasticity.

[Table 2 about here.]

In the first three columns, we find all estimates of β^{DID} to be positive and statistically different from zero for all different monotonic transformations of the dependent variable. Before interpreting the numbers a few comments are in place. Note that these are exports from former Yugoslavian countries to the rest of the world, excluding Germany. In that sense, the results are not explained by possible reductions of fixed costs of exporting caused by migrant networks (e.g., Parsons and Vézina, 2017). Furthermore, we interpret increments in exports as product-specific productivity shifts, since by using global exports they describe the evolution of comparative advantage. The standard errors are clustered at the product

[22] Online Appendix Table (A2) replicates the results using different treatments: return migration between 1995 and 2005 and the stock of migrants in 1995. The results are robust to using these different treatments.

level, which is the level of disaggregation of the treatment.

Column 1 of Table 2 presents the estimate when using the natural logarithmic transformation for the dependent variable. The point estimate in the first column is around half the size of those in the other two columns. This is not surprising as the first column excludes zeros and therefore excludes instances in which products are more likely to grow faster if they have a non-zero value in the second period.[23] Yet, this difference says something more: the fact that results are positive and significant in columns 2 and 3 –which include instances where a product was inexistent in the export basket of Yugoslavia by 1995– implies that the effect of return migration on comparative advantage is valid at the extensive margin (e.g., opening a new line of exports) as well as at the intensive margin (e.g., growth of already existing export lines), along the lines of the work by Bahar and Rapoport (2017). In either case, the results show that the elasticity of exports to return workers ranges from 0.1 to 0.15, depending on the transformation of the left hand side variable used (and thus whether zeros are included or not).

Columns 4, 5 and 6 present the analogous 2SLS estimates. For those columns we also report the Kleibergen-Paap F statistics which measures the strength of the first stage. The Kleibergen- Paap F statistics is the right measure to look at when standard errors are not assumed to be i.i.d. as in our case. The high magnitude of the F statistics in all specifications imply that we can reject the possibility of weak instrumentation. The elasticities estimated through 2SLS are positive, statistically significant and qualitatively similar to the OLS results but the point estimates are larger in magnitude. Yet, the standard errors are also estimate to be larger to levels in which we cannot reject the hypothesis that the OLS and the 2SLS estimates are different. Given the setting of the natural experiment, and the use of an instrumental variable, we interpret these results as causal. Thus, based on the 2SLS results, we find that Yugoslavian industries that received 10 percent more return migrants from Germany (that worked in those same industries), resulted in exports that are higher by 1.2 to 2.4 percent in 2005 as compared to 1990.

[23]In fact, Table A3 in the Online Appendix re-estimates columns (2), (3), (5) and (6) of Table 2 excluding observations for with zero exports. In that case, the estimates are exactly the same as in columns (1) and (4) of Table 2.

Note that in all specifications we control for the stock of German FDI in Yugoslavian countries. By controlling for it we rule out the possibility that the effect is driven by the ability of migrants to attract FDI into the same sectors they worked in during their stay in Germany. Yet, we find that variable is negatively correlated with exports, which is puzzling. However, since the data for FDI stock was originally at the 2-digit level (see Section 3), there is little variation left in it after the introduction of product fixed efffects.[24]

Pre-trend and multi-period estimation

Can this result be explained by a previous trend in exports? We explore this, first, by estimating the same specification but this time over the period 1985 to 1990, keeping the same treatment defined for years 1995 to 2000. Both OLS and 2SLS results are presented in Table 3, and in this case the estimates for β^{DID} are either non-significant or negative, except for the fourth column, in which it is significant and positive, but it is an outlier result, as it is not robust across all the different specifications). This implies, for the most part, that if anything the products for which more migrants returned were in a negative growth trend before the war.

[Table 3 about here.]

Second, given the availability of exports data across several years, we turn to estimate the multi-period effect of return migration on the comparative advantage of the products in their home countries. To avoid noise in the estimation, we do this taking 5-year averages for the dependent variable and estimate β^{DID} for 6 different periods, from 10985-1989 to 2011-2014[25]. To do this, we simply re-estimate specification (1), this time substituting the dummy $after_t$ for several dummies each one signaling a 5-year period, along the lines of Autor et al. (2003). In this multi-period setting, α_t are 5-year period fixed effects, and the product fixed effects η_p are maintained allowing for product-specific intercepts. Table 4 reports the 2SLS estimation using the instrumental variable described above (notice we have

[24]Online Appendix Section A1 estimates the correlation between Yugoslavian exports and FDI stocks using the same regression setting, and finds a positive coefficient when not including product fixed effects, which is the sign we would expect in such relationship.

[25]For the last period we take a 4-year average due to lack of data for 2015.

in this setting four endogenous variables and four instrumental variables, which correspond to the treatment and the instrument multiplied by four different period dummies). All columns include FDI as a control, though it is not reported in the table. Naturally, the number of observations in this sample is much larger than before, as it includes 6 data points per each of the 786 products totaling up to 4716 observations (except for the first column where observations where $exports_{p,t} = 0$ are excluded).

[Table 4 about here.]

First, is important to notice that across all different dependent variables, our instruments are relevant as reported by th KP F statistic. The estimation presented in Table 4 starts with period 1985-1989, shows that treatment is negative and barely statistically significant prior to the treatment, across the board. Period 1990-1994 is used as the base for the estimation and is thus excluded. The results indicate that the value of the elasticity are positive and statistically different from zero for every transformation of the dependent variable starting in the period 2000-2004. In the first column, the one using a log transformation, the elasticity is estimated to be 0.08 in the firsts period post-treatment. The same elasticity increases to 0.11 (an increase of 37.5%) in period 2005-2009 before decreasing back to 0.06 in the last period. In the other two columns, between 2000 and 2004, the elasticity is estimated to be 0.16, which is much larger than in Column 1. This strengthens our previous finding that the effect is stronger when we take into account the extensive margin. The elasticity grows up to 0.2 in the lastest period along the lines of our results from Table 2.

These findings suggests one more important result: the marginal effect of return migration on the emergence of new exports becomes stronger with time. These results are summarized in Figure 7, which shows in the upper panel the evolution of the expected value of exports (across our three different measures) by 5-year periods for instances where we assume $treat_p = 1$ and instances where we assume $treat_p = 0$. Figures in the lower panel show the difference between the two, and it can be seen how the effect becomes positive and statistically significant in the period 2000 to 2004. Consistently with the results above, the previous trend for both groups is statistically indifferent (as measured by the whiskers representing 95 percent confidence intervals).

[Figure 7 about here.]

Robustness and others

Placebo tests

In this subsection we aim to show that our numbers cannot be explained by other economic processes occuring at the same time, which would also impact other countries or can be explain by other waves of migration. We do so by putting in place two "placebo" tests.

First, we check whether the return migration to (the former) Yugoslavia can explain export changes in other similar countries, which would hint that there our original results are driven by some spurious correlation in the data. In particular, it could speak to a concern that the results are driven by policies undertaken by the former communist block countries around the same time resulting in productivity improvements in the same industries for which most Yugoslavian refugees worked while their stay in Germany. In particular, we look at countries in Eastern Europe with a GDP per capita (in PPP terms) in 2005 that was 15 percent above or below that of the combined Yugoslavian countries. Due to lack of trade data for Former Soviet Union countries, the list is reduced only to Romania and Bulgaria. Specifically, we estimate the same model but with two differences. First, the dependent variable is exports from each one of these two countries to the rest of the World except to Germany (as opposed to exports from Yugoslavian countries); and second, we control for the stock of their respective migrant workers in Germany (e.g., Bulgarian and Romanian workers) for each SITC4 industry and year, given that, naturally, their own emigrants could also explain changes in exports (as shown by Bahar and Rapoport, 2017).

We visualize our results (based on one regression per country) in Figure 8. The figure shows that the treatment is statistically insignificant for both Romania and Bulgaria across almost every specification (it is statistically significant for Romania using the $log(exports_{p,t})$ dependent variable, but it is not robust across all the other transformations).For comparison purposes, the figure also shows the original results for Yugoslavia, which is positive and statistically significant.

[Figure 8 about here.]

A second test is to explore whether changes in the German labor force for other nationalities between 1995 to 2000 can explain the trends we see when looking at Yugoslavian exports. In other words, does the number of French, Italian or Polish workers, for example, that were part of the German labor force in 1995 but not in 2000 explain changes in the Yugoslavian export basket? To do this we focus on the countries with the largest

[Figure 9 about here.]

Heterogeneity analysis

There are a few other issues left to be dealt with which we address in this sub-section in order to reinforce the basic idea of our story: Yugoslavian refugees upon their return were able to increase the productivity of industries they worked in while in Germany thanks to the knowhow they acquired during their time abroad. We proceed to rule out other possible explanations other than this one that could lead into the same results.

We do this by using product characteristics to study whether the results vary and to what extent they do. We do so by re-estimating specification (1), this time interacting the term $treat_p \times after_t$ with three different product characteristics. First, we look at differentiated versus homogenous and reference-priced goods, using Rauch's (1999) definition (i.e., a dummy variable). Second, we use the physical capital intensity level of each product,, as defined by Nunn (2007) using data from the NBER-CES Manufacturing Industry Database (Becker et al., 2016). Third, we use human capital intensity taken from Shirotori et al. (2010) to study whether there is a differential relationship between migrants and products with different knowledge intensity. These last two variables are continous, and we standardize them to have zero mean and a standard deviation of one.

First, we address the possibility that the results are driven by the ability of migrants to lower trade transaction costs, and therefore exports are more likely upon their return. This is what we check in the first three columns of Table 5, which interacts the treatment with a dummy indicating whether the product is differentiated as defined by Rauch (1999). At first, we should not worry much about this possibility, given that our dependent variable already excludes exports to Germany. However, a concern remains if some of these migrants instead of returning to Yugoslavia migrated to third countries, and the increases in exports we are catching are because of the decrease in transaction costs between Yugoslavian countries and, say, Austria or Belgium. However, as can be seen in columns 1 to 3, the effect for differentiated products (those that are more likely to react to changes in trade transaction costs) is not different than for homogenous products (except for column 1 where the interaction under consideration is statistically significant, but this is not robust across the different linear transformations in columns 2 and 3). Thus, we do not have enough evidence to support that this is a story of decreasing trade transaction costs.

Second, according to some trade models, our results could be driven by the fact that an inflow of workers into the economy could result into the export basket shifting towards labor intensive goods (Rybczynski, 1955). Yet, the results are not different for goods at different levels in the scale of capital intensity, as seen in columns 4 to 6 of Table 5.

Lastly, if this is a story of knowledge transmission, then we should expect some differential effects in terms of the knowledge intensity of the good. Interestingly, we find that return migrants explain more export growth in products that are higher in the scale of knowledge intensity (as measured by human capital intensity), as seen in columns 7-9 of Table 5.

[Table 5 about here.]

What is behind these results?

The idea that migrants can play a role in shaping the comparative advantage of countries is part of a growing literature that links migrants and their descendants to the diffusion of knowledge (e.g., Kerr, 2008; Choudhury, 2016; Hausmann and Neffke, 2016; Bahar and Rapoport, 2017), and our results so far are consistent with this idea. Yet, if this were the case, we should be able to see stronger results when looking at migrant workers more suited to acquire and transfer knowledge. This is part of what we explore in the next section, by studying the role of skill accumulation and different types of occupations of migrants in explaining changes in comparative advantage.

6 Expanding to all countries: external validation

After having established the link between migration and comparative advantage, we turn to study the same phenomenon in a multi-country and multi-period setting. In this setting our focus is not on the identification, but rather on externally validating the results, while exploiting a much larger variation allowing us to study differential effects based on the characteristics of the migrants. That is, we expand our difference-in-difference strategy to all countries in the original dataset using as treatment the presence and sizes of their diasporas in Germany working in different 4-digit products.

Our prior for this exercise is that if knowledge diffusion is the mechanisms through which migration explains productivity shifts seen as changes in the comparative advantage of nations, this effect should be stronger among migrants that are skilled and/or work in occupations that are more cognitive and analytical in nature. This is what we explore in this section.

6.1 Empirical strategy and summary statistics

In this section we adapt our difference-in-difference specification to a multi-country multi-period setting. To do that, we follow Besley and Burgess (2004) and estimate the following specification:[26]

[26] Both specifications are equivalent. To see it, suppose the following two specifications, the first one where the treatment is defined as a difference and the second one where the treatment is defined as a level:

$$y_{p,t} = \beta_1 \Delta migrants_p \times after_t + \delta_t + \eta_p + \varepsilon_{p,t}$$
$$y_{p,t} = \beta_2 migrants_{p,t} + \delta_t + \eta_p + \varepsilon_{p,t}$$

Assume there are only two periods, $t = [0, 1]$. According to the first functional form, we have:

$$E(y_{p,t}|t = 1) = \beta_1 \Delta migrants_p + \delta_1 + \eta_p + \varepsilon_{p,1}$$
$$E(y_{p,t}|t = 0) = \delta_0 + \eta_p + \varepsilon_{p,0}$$

It is clear that $E(y_{p,t}|t = 1) - E(y_{p,t}|t = 0) = \beta_1 \Delta migrants_p + (\delta_1 - \delta_0) + (\varepsilon_{p,1} - \varepsilon_{p,0})$. According to the second functional form, we have:

$$exports_{c,p,t} = \beta^{DID} migrants_{c,p,t-10} + \beta^{ge} globalexports_{p,t} + \eta_{c,p} + \alpha_{c,t} + \varepsilon_{c,p,t} \qquad (2)$$

Our dependent variable, $exports_{c,p,t}$, is defined as total export value of product p during year t from country c to the rest of the world, excluding Germany in order to rule out that our results are driven by lower costs to export due to migrant networks. Similarly to the previous section, we present our results for different monotonic transformations of the dependent variable. Our variable of interest, the treatment, in this case is $migrants_{c,p,t-10}$, which is the stock of migrants from country c at time $t-10$ (e.g., we allow for a 10-year lag for the treatment to "kick in") working in product p in the German labor force. We also include a series of fixed effects, crucial for the estimation. Since we have expanded the dimension of our dataset to include countries our unit of analysis becomes now a country-product pair. Thus, we include $\eta_{c,p}$ which is a country-by-product fixed effects, to allow each country-product to have a different intercept and also, in the difference-in-difference setting, allows us to exploit within country-product variation. We also include $\alpha_{c,t}$, a country-by-year fixed effect, which controls for changes at the country level that could explain changes in exports: income, population, institutions, etc. We also include $globalexports_{p,t}$, which in measures the total export value of product p by all countries during year t, to control for total global demand, and as a proxy for the introduction of a technology that explains a global increase in the exports of product p.[27] All of the continuous right hand side variables are monotonically transformed using the inverse hyperbolic sine. Our estimations cluster standard errors at the country-product level (Besley and Burgess, 2004; Bertrand et al., 2004).

As mentioned earlier, the sample for this estimation includes 124 countries and 786

$$E(y_{p,t}|t=1) = \beta_2 migrants_{p,1} + \delta_1 + \eta_p + \varepsilon_{p,1}$$
$$E(y_{p,t}|t=0) = \beta_2 migrants_{p,0} + \delta_0 + \eta_p + \varepsilon_{p,0}$$

Thus, in this case, $E(y_{p,t}|t=1) - E(y_{p,t}|t=0) = \beta_2(migrants_{p,1} - migrants_{p,0}) + (\delta_1 - \delta_0) + (\varepsilon_{p,1} - \varepsilon_{p,0})$. Since $\Delta migrants_p = migrants_{p,1} - migrants_{p,0}$ it follows that $\beta_1 = \beta_2$.

[27] Ideally, we would introduce a product-by-year fixed effect but turns out doing so eliminates most of the remaining variation.

products across two periods: 1990 to 2000 and 2000 to 2010. The IAB data allows us to compute the migrant stock by different categories, and we exploit that variation in this setting. Table 6 summarizes the statistics for the main variables used in this analysis. The first three rows summarize the export value averaged across countries, products and years 2000 and 2010, using three different monotonic transformations; note that the number of observations using a simple logarithmic transformation is reduced due to zeros in the sample.

[Table 6 about here.]

Table 6 shows that the average number of migrant workers in Germany across all countries and 4-digit products for both 1990 and 2000 (e.g., the baseline years) is 8. The number is surprisingly small, but note that this variable has many zeros (in fact, the median value is zero), and there is a mix of countries from many different sizes. This last fact is reflected in both the large standard deviation and upper bound of the variable which reaches a maximum of over 20 thousand workers. The table summarizes data for each category of workers that we will be using in the analysis, which we explain next.

First we separate migrants as skilled and unskilled, where skilled is defined as having achieved education beyond high school (i.e., vocational training, college degree or more) while unskilled is defined as having a high school diploma or less. These categories were constructed from more disaggregated ones defined in the IAB dataset. Second we group migrant workers by whether their occupation is defined as "white-collar" or not, also defined in the IAB dataset. Third, we distinguish migrants with occupations intensive in analytical and cognitive tasks vs. occupations intensive in manual tasks. To do so we use the classification provided by Dengler et al. (2014), which formalizes German occupations into five task categories, similarly to Autor et al. (2003).[28] Lastly, we distinguish migrants by the problem-solving content of their occupations (above and below median, given it is a continuous variable) using a measure created by Nedelkoska et al. (2015).

[28]Spitz-Oener (2006) first applied the task base approach on Germany occupations based on survey data. The classification we use is based on year 2011.

6.2 Results

We start by estimating Specification (2) using all workers, without distinction, as the independent variable. The results are presented in Table 7. The elasticity parameter is estimated to be between 0.08 and 0.11, which falls into the lower range of the the results of Section 4. In this case, the point estimate when the dependent variable is a simple logarithmic transformation is lower than in the other columns where the monotonic transformation does include the zeros. This suggests, also consistently with the results from Section 4, that return migration (this time computed as the difference in the stock) is also explanatory of the extensive margin (e.g., the emergence of new export sectors).

[Table 7 about here.]

Results by Skill Levels

So far we have estimated our specifications using the total number of immigrant workers as the main input. If indeed our narrative is correct, and migrants are instrumental in the diffusion of productive knowledge, then we would expect skilled migrants to have a larger impact, as it is safe to assume that they have a greater ability to transfer such knowledge. Table 8presents the results of the estimation using separately of skilled (Columns 1, 3 and 5) vs. unskilled (Columns 2, 4 and 6) migrants.

[Table 8 about here.]

There are two important findings of this table, that are worth noticing. First is that the elasticity parameter is estimated to be between 0.09 and 0.12 for skilled workers whereas it is lower, around 0.06, for unskilled migrants. But second, the point estimates of Columns 3 and 5 are larger than for Column 1, implying as noted in our previous results, that skilled migrants play a role in explaining the extensive margin, too. Yet, the point estimates in all columns that use unskilled migrants for the estimation don't vary depending on the definition of the dependent variable, implying that unskilled migrants are not explanatory of the extensive margin. In fact, Bahar and Rapoport (2017)show that skilled migrants are about 10 times more "effective" in inducing changes at the extensive margin than unskilled migrants, consistently with this finding.

Results by types of occupation

The novelty of our dataset allows us to add another dimension to study, which is the type of migrants' occupations that are more explanatory of the dynamics in comparative advantage in their home countries. We pose that if these results are really being driven by the ability of migrants to transfer knowhow back to their home countries which translates into sector-specific productivity increases, then we should be able to see that this holds for particular types of occupations more than others. In fact, there are two reasons why we choose to include types of occupations in our analysis.

The first reason is that types of occupations might be a better measure of the skill content of a job. Even though educational attainment is considered a very relevant dimension of human capital (e.g., Goldin and Katz, 1996; Acemoglu, 2003), more recent literature argue that it is the type of human capital, rather than the level, what encompasses the most useful information in explaining the causes of the recent trend towards skill upgrading (e.g., Autor et al., 2003; Blinder, 2006). Second, human capital is occupation-specific. In fact, Kambourov and Manovskii (2009) argue that occupational tenure has substantial returns, more so that tenure in an industry or firm, hinting that productive knowledge is occupation-specific.

We start off by estimating Specification (2), this time distinguishing between white collar and non-white collar migrants. White collar jobs –typically linked to management or having technical skills– can be crucial in the diffusion of knowhow. The results of the estimation are presented in Table 9. When using migrants in white-collar occupations as the main regressor the estimated elasticity is between 0.12 and 0.13, and it is somewhat lower for non-white collars ranging between 0.07 and 0.09. While the difference in the point estimates seem trivial, it is important to acknowledge that the sizable differences in the number of white-collar relative to non-white collar workers in the sample. Thus, in measuring the marginal effect we must take into account the distribution of these two different groups. We retake this conversation below.

[Table 9 about here.]

Next, estimate we group migrants by the analytical and cognitive content of their tasks. We distinguish between migrant workers that are doing analytical, cognitive and interactive tasks (either routine or non-routine) and migrants with occupations intensive in manual tasks (both routine and non-routine. The results are presented in Table 10. The elasticity of exports to migrant returnees with occupations intensive in analytical and cognitive tasks is estimated to be between 0.09 to 0.11, while the elasticity for manual tasks is estimated to be between 0.07 and 0.09. Once again our results are consistent with the idea that the channel driving these results is the diffusion of knowledge.

[Table 10 about here.]

Lastly, we perform a test using a continuous measure of problem-solving intensity of the occupation, as a proxy for the ability of migrants to gain and transfer tacit knowledge. We rely on the work by Nedelkoska et al. (2015)who assigns a problem-solving score to each occupation.[29] We divide migrants in two groups, based on whether the problem-solving score of their occupations are above and below the median. Results are presented in Table 11. There, occupations with high problem-solving content are estimated to have a higher elasticity of export value (0.1 to 0.13) than occupations with problem-solving score below the mean (0.07 to 0.09). This adds to the evidence provided above: exposure to problem-solving in a particular sector results in tacit knowledge that boosts productivity in that same sector back home, through human mobility.

[Table 11 about here.]

[29]Nedelkoska et al. (2015) argue that every job is a collection of tasks ("problems") of varying complexity that need to be accomplished. Every task poses a challenge and at the same time provides an opportunity to learn. Thus, jobs create a learning environment, where employees can learn by solving tasks. Just how much they can learn depends on the gap between their current skill level and the level of task complexity. More complex jobs create a better learning environment, as they provide more complex tasks and in larger quantity.In their analysis, first they show that starting salary in complex jobs are higher than simpler ones. More importantly, they show that wages increase faster when the job is complex. They argue that this dynamic effect is due to learning on job.

Marginal Effects

Across the different types of occupations it is important to understand that, ultimately, the marginal effect depends on the distribution of each group, which quite varies. For instance, according to Table (6) there are, on average, 7 white collar migrant workers in each product-year cell, whereas there are in contrast about 121 non-white collars. Thus, a relative increase in those two groups differ very significantly when converted to nominal terms (e.g., number of people). Figure 10 estimates the marginal effect of one migrant worker on exports (using $log(exports_{c,p,t})$ as the dependent variable. There it is clear how when it comes to white collars, for instance, the marginal effect is about 11 times as large as that of non-white collars. Similar differences occur when looking at analytical and cognitive vs. manual tasks as well as for occupations with high problem-solving content compared to occupations with low problem-solving content. The average marginal effect of a migrant in occupations intensive in analytical vs. non-cognitive tasks is about 3 times larger than for a migrant in occupations intensive in manual tasks. Consistently, the marginal effect of a migrant in an occupation with high (above the median) problem-solving content is about 4 times larger than for low (below the median) problem-solving content. Figure 11 replicates the exercise using $log(exports_{c,p,t}+1)$ as the dependent variable, and finds consistent results.

[Figure 10 about here.]

[Figure 11 about here.]

7 Concluding Remarks

In this paper we exploit a natural experiment to show that return migration is a channel for productive knowledge diffusion between host and sending countries, which can be instrumental in expanding the export basket of their home countries. Our main results show that return of Yugoslavian refugees from Germany has been beneficial both for opening new line of exports and accelerating growth of those which already existed.

To externally validate our results, we expand our analysis using a multi-country and multi-period setting, and show they can be generalized. Moreover, by exploiting individual details of our data set, we further show that effect is much stronger when migrants are skilled and/or work in occupations that are more cognitive and analytical in nature.

Our results contribute to a growing literature that emphasizes that migrants can serve as international drivers of productive knowledge and can thus shape the comparative advantage of their home country. It also contributes to literature about human-capital acquisition by exploiting differences in occupational structure.

Our paper gives a clear idea about how a migrant acquires knowledge in host country and bring it with him to home. Still we are limited in our ability to understand the precise mechanisms that drive the documented relationships. Returnee migrants might play a role in knowledge diffusion by bringing new and better labor and/or management techniques to firms that employ them or by becoming entrepreneurs themselves as suggested by Hausmann and Neffke (2016) and Dustmann and Kirchkamp (2002).

Migrants may also play a role in diffusion through their interactions with their contacts back in the sending country, without even returning. Better understanding what those channels are and how they work is an important missing piece for future research.

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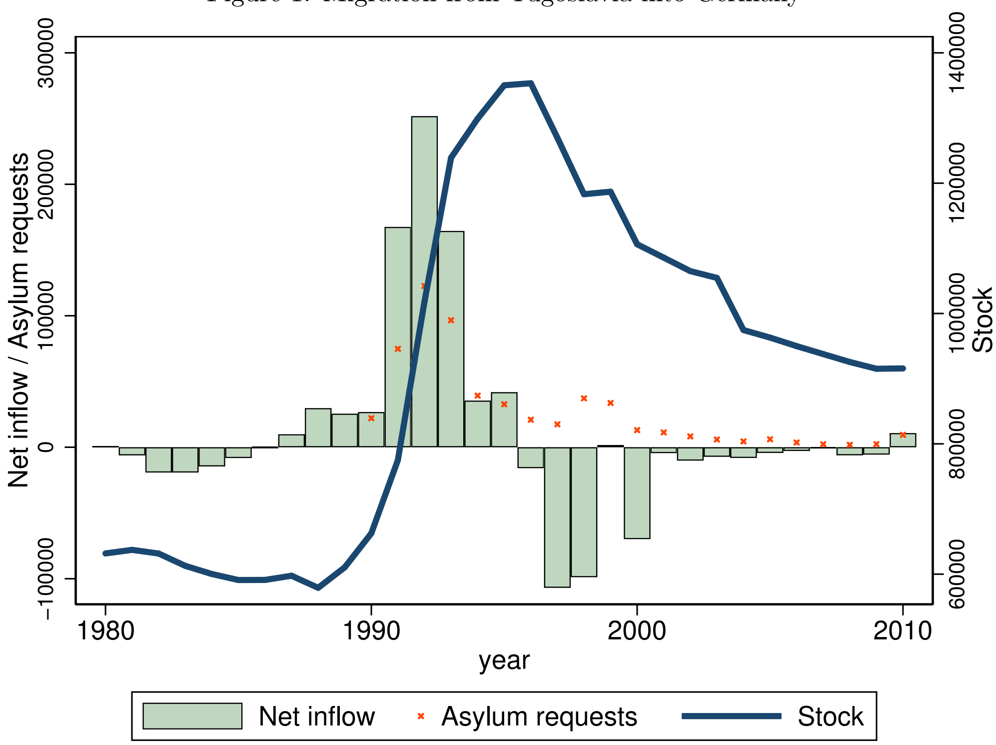
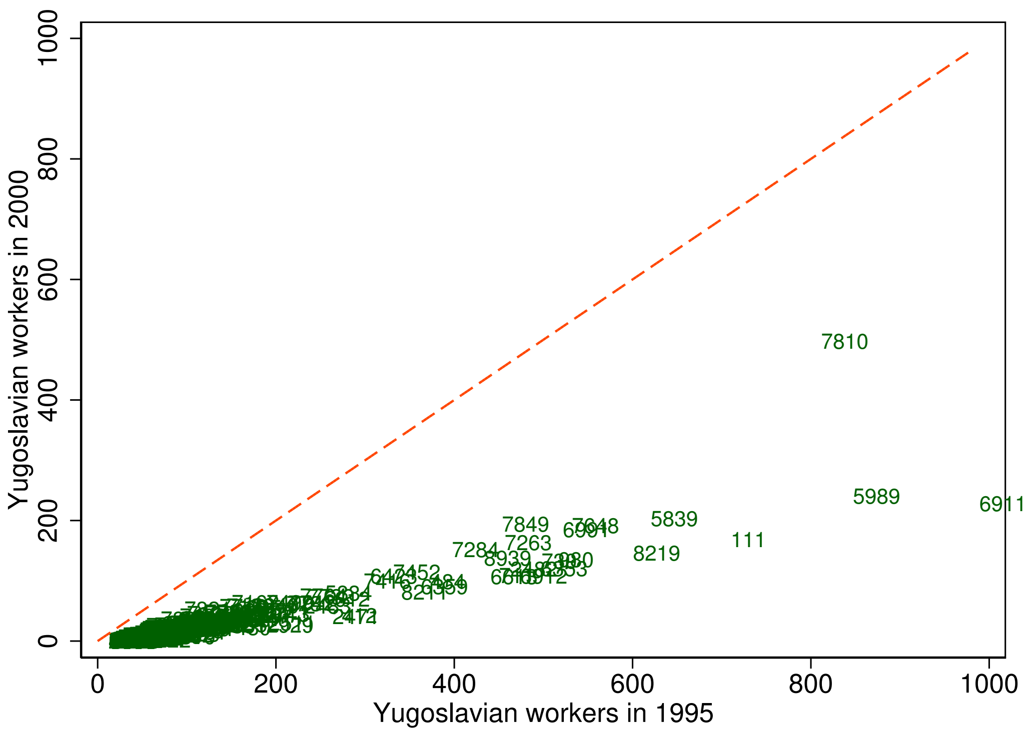
Figure 1: Migration from Yugoslavia into Germany



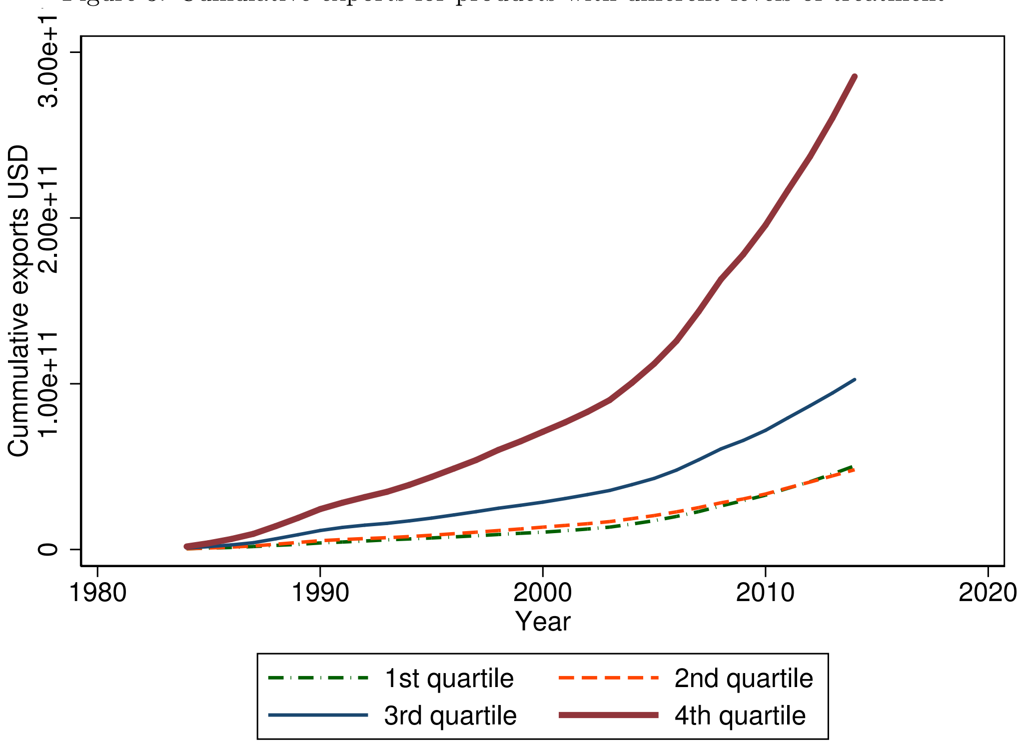
The figure shows the net inflow, stock and asylum requests of migrants from (former) Yugoslavia into Germany, from 1980 until 2010.

Figure 2: Yugoslavians in German workforce, by product



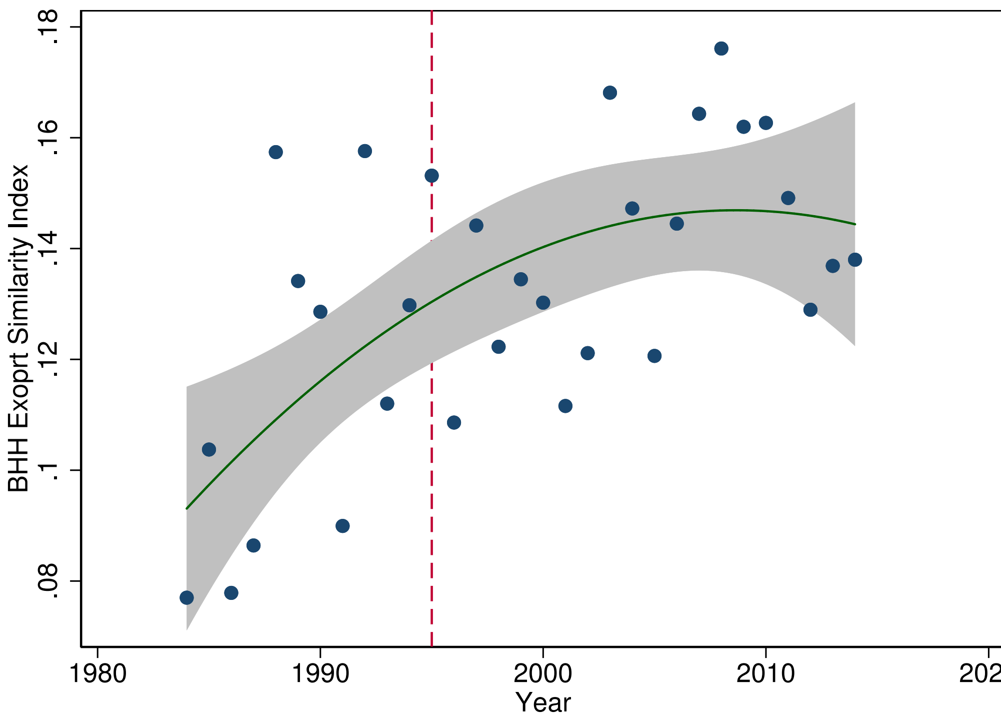
The figure shows the number of Yugoslavian workers in the German workforce by 4-digit product in both 1995 and 2000.

Figure 3: Cumulative exports for products with different levels of treatment



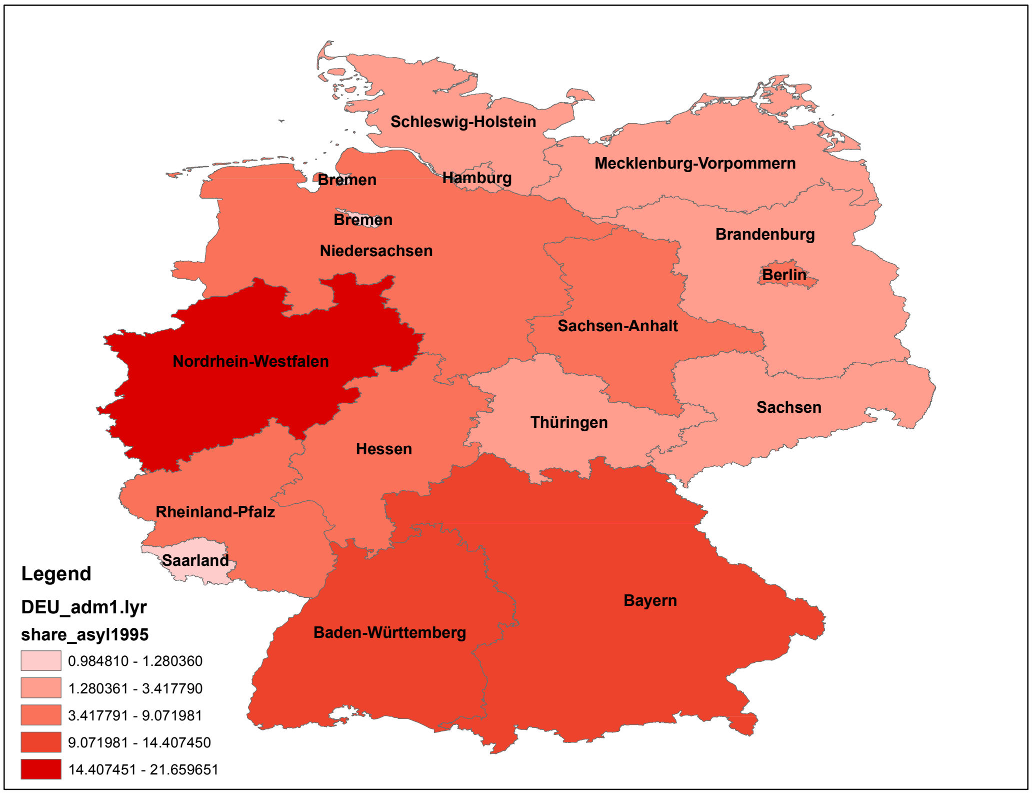
The figure plots the cumulative value of exports of the former Yugoslavia to the rest of the world (vertical axis) across years. Treatment is defined as the number of return migrants from Germany by 2000.

Figure 4: Export Similarity Index between Germany and Yugoslavia, by year



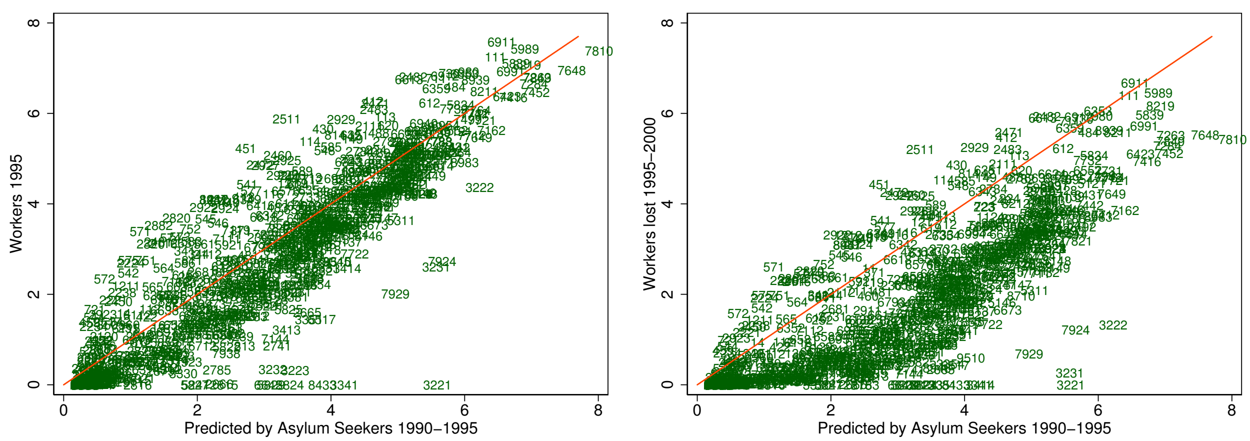
The figure plots the export similarity index (Bahar et al., 2014) between Germany and the former Yugoslavia across time.

Figure 5: Distribution rule of asylum seekers in Germany 1995



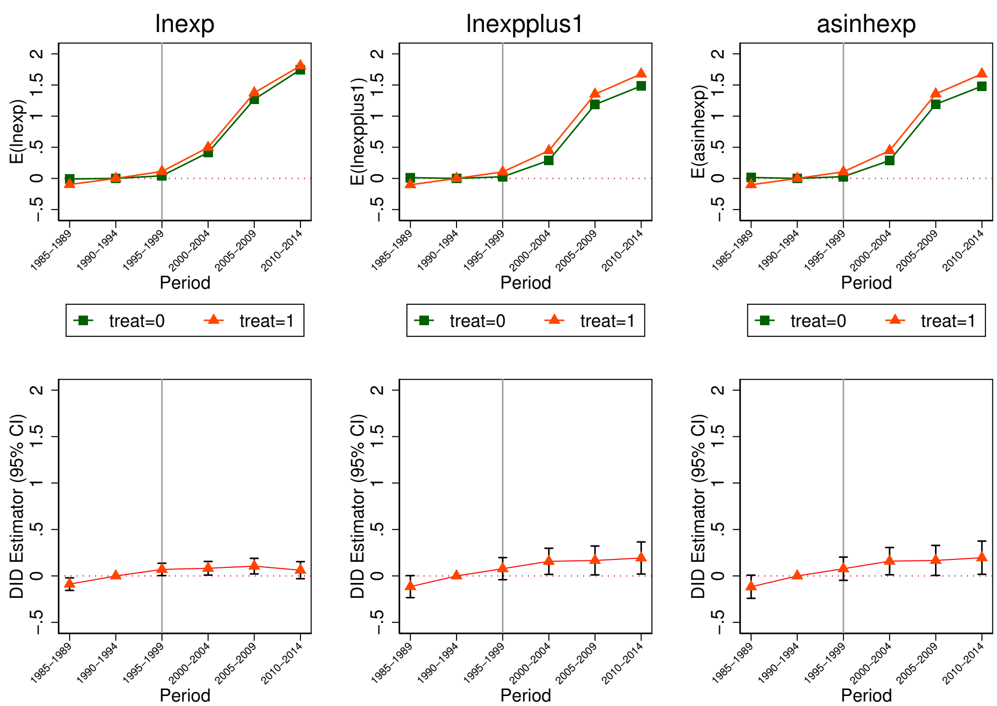
The figure maps the different German states with their shade representing the share of all asylum seekers in Germany they were mandated to receive by law in 1995, based on their population and tax revenues.

Figure 6: Instrumental Variable Relevance



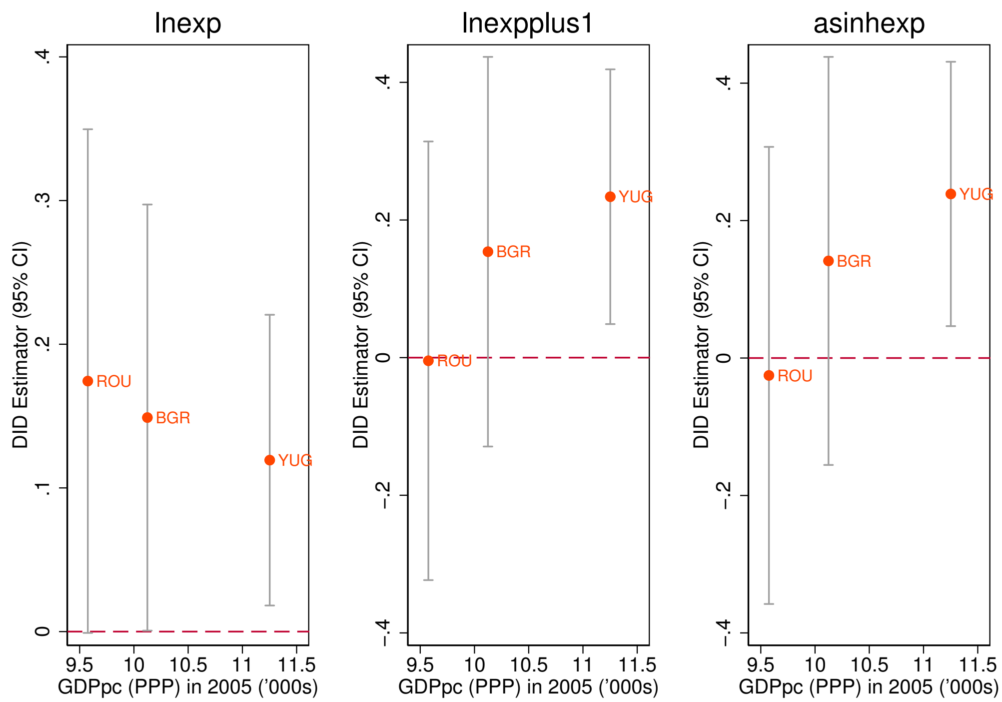
The figure plots the expected number of asylum seekers expected to work in each industry based on their geographic allocation in each state and the employment share of each 4-digit SITC code in that state using data from 1990 to 1995 in the horizontal axis (in logs) against (i) the actual stock of Yugoslavian workers in the German labor force by each 4-digit SITC code in 1995 (in logs) in the left panel, and (ii) the number of Yugoslavian workers who leave the German labor force between 1995 and 2000 by each 4-digit SITC code in the right panel (in logs). The figure represent the first stage of the two stages least squares.

Figure 7: Difference-in-difference, 5 year periods



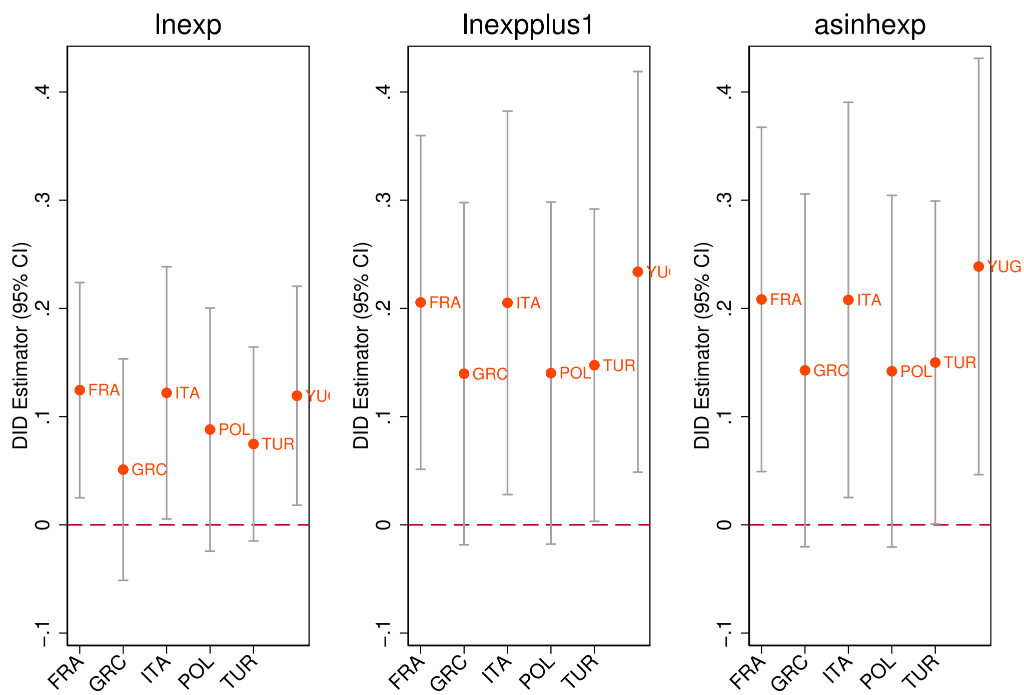
Thefigures above plot export growth over time for both treated ($treat_p = 1$) and untreated ($treat_p = 0$) industries. The dependent variable is the 5-year average of exports (each colunn uses a different linear transformation and the period 1990-1994 is used as the base year). The figures below plot the difference between the treated and untreated industries. The results are estimated using 2SLS and control for FDI. 95% confidence intervals for the estimation are represented by the whiskers.

Figure 8: “Placebo” test using exports from similar countries



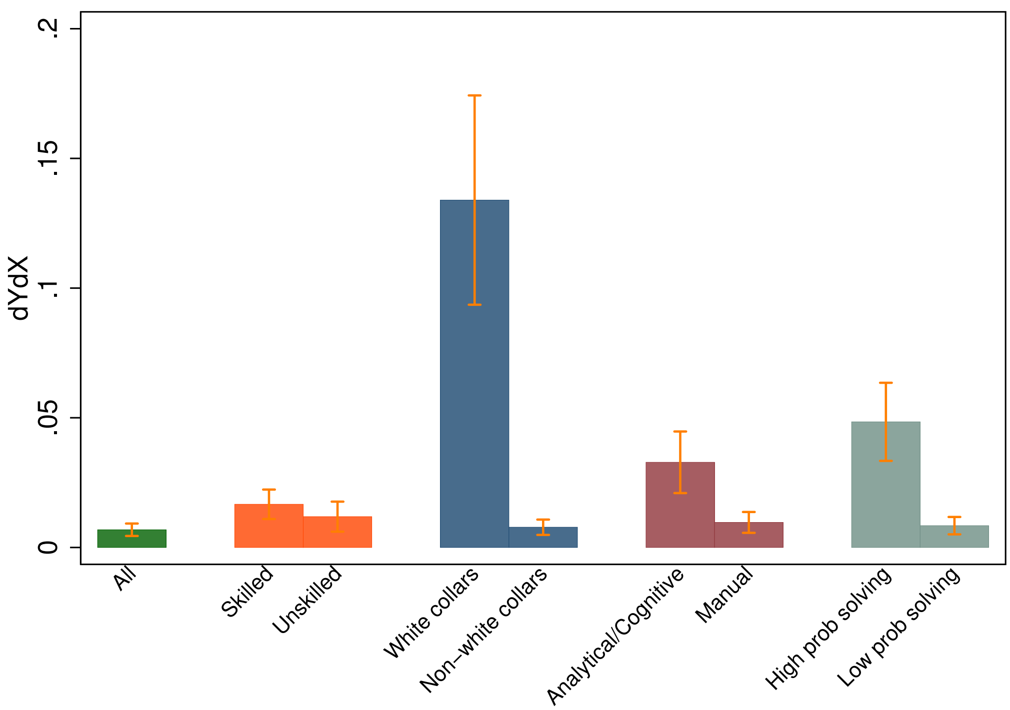
This figure plots coefficients of the estimation for specification 1 for each country, using different monotonic transformations . The estimation uses exports averaged over 1988 to 1990 for the initial year and exports averaged for 2005 to 2007 as the end year. The results are estimated using 2SLS, and controls for FDI and stock of workers from each respective country. 95% confidence intervals for the estimation are represented by the whiskers.

Figure 9: "Placebo" test using return migrants to other countries



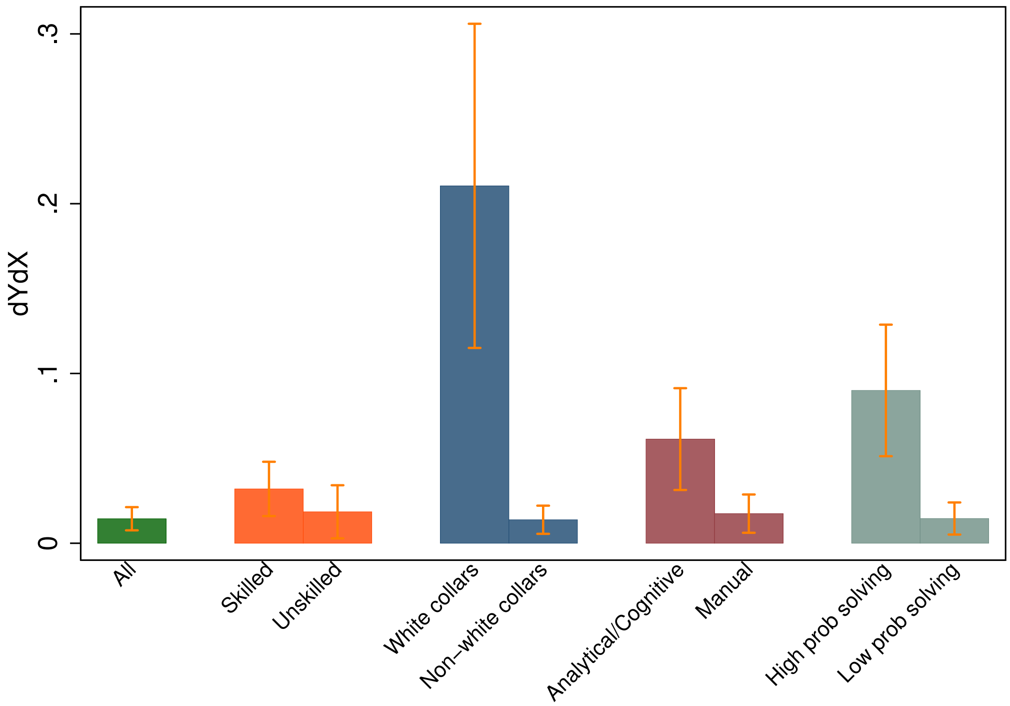
This figure plots coefficients of the estimation for specification 1 for each country, using different monotonic transformations . The estimation uses exports averaged over 1988 to 1990 for the initial year and exports averaged for 2005 to 2007 as the end year. The results are estimated using 2SLS, and controls for FDI and stock of workers from each respective country. 95% confidence intervals for the estimation are represented by the whiskers.

Figure 10: Marginal effect by type of migrant, using $log(exports_{c,p,t})$



This figure plots the estimated marginal effect of 1 migrant returnee on exports from the home country based on the levels of migrants of each type in the sample, using $log(exports_{c,p,t})$ as the dependent variable. Whiskers represent 95 percent confidence intervals.

Figure 11: Marginal effect by type of migrant, using $log(exports_{c,p,t} + 1)$



This figure plots the estimated marginal effect of 1 migrant returnee on exports from the home country based on the levels of migrants of each type in the sample, using $log(exports_{c,p,t} + 1)$ as the dependent variable. Whiskers represent 95 percent confidence intervals.

Table 1: Summary Statistics Yugoslavian Refugees in Germany

Variable	**N**	**Mean**	**sd**	**Min**	**Max**
Exports YUG in 1990, million USD	786	12.472	31.65	0.0	395.0
Exports YUG in 1995, million USD	786	10.037	30.25	0.0	601.0
Exports YUG in 2000, million USD	786	11.924	35.97	0.0	487.0
Exports YUG in 2005, million USD	786	24.458	71.62	0.0	1,090.0
Exports YUG in 2010, million USD	786	38.291	117.67	0.0	1,950.0
YUG Workers 1995	786	38.732	96.89	0.0	976.4
Workers left by 2000	786	12.796	34.76	0.0	392.7
Workers left by 2005	786	15.219	40.79	0.0	469.3
Workers left by 2010	786	18.202	47.85	0.0	546.0

This table presents the sample summary statistics for the variables used to estimate specification (1).

Table 2: Difference-in-difference estimation

Dependent variable: $exports_{p,t}$	OLS			2SLS		
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
treat2000 × after2005	0.0984	0.1510	0.1528	0.1193	0.2338	0.2388
	(0.040)**	(0.066)**	(0.069)**	(0.052)**	(0.094)**	(0.098)**
lnfdi	-0.1576	-0.2688	-0.2735	-0.1588	-0.2740	-0.2789
	(0.066)**	(0.126)**	(0.130)**	(0.066)**	(0.127)**	(0.131)**
N	1496	1572	1572	1496	1572	1572
r2	0.86	0.82	0.81	0.86	0.82	0.81
KP F Stat				1900.69	1855.71	1855.71

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses average exports for years 1988 to 1990 in the initial period and average exports for years 2005 to 2007 in the end period. The first three columns report results from an OLS estimation, while the last three columns report results from a 2SLS estimation. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.
$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 3: Difference-in-difference estimation, previous trend

Dependent variable: $exports_{p,t}$						
	OLS			2SLS		
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
treat2000 × after1990	0.0469	-0.1327	-0.1463	0.0990	-0.0366	-0.0492
	(0.035)	(0.076)*	(0.080)*	(0.042)**	(0.104)	(0.110)
N	1352	1572	1572	1352	1572	1572
r2	0.90	0.83	0.82	0.90	0.82	0.82
KP F Stat				2407.72	2169.72	2169.72

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 1985 and 1990. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.
$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 4: Difference-in-difference (2SLS) 5 year periods

Dependent variable: $exports_{p,t}$			
	lnexp	lnexpplus1	asinhexp
treat2000 × Period 1985-1989	-0.0884	-0.1150	-0.1168
	(0.034)**	(0.060)*	(0.063)*
treat2000 × Period 1995-1999	0.0701	0.0783	0.0776
	(0.034)**	(0.061)	(0.064)
treat2000 × Period 2000-2004	0.0827	0.1570	0.1592
	(0.037)**	(0.072)**	(0.075)**
treat2000 × Period 2005-2009	0.1054	0.1666	0.1669
	(0.043)**	(0.079)**	(0.082)**
treat2000 × Period 2010-2014	0.0618	0.1932	0.1964
	(0.047)	(0.088)**	(0.091)**
N	4585	4716	4716
r2	0.85	0.80	0.79
KP F Stat	408.61	430.73	430.73

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. It estimates the treatment across different 5-year periods. All columns include FDI as control, as well as product fixed effects and 5-year period fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 5: Difference-in-differences (2SLS), heterogeneity analysis

Dependent variable: $exports_{p,t}$	Differentiated			Capital Intensity			Knowledge Intensity		
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
TreatmentXAfter	0.0121	0.1623	0.1694	0.1610	0.1748	0.1735	0.0824	0.1702	0.1737
	(0.070)	(0.126)	(0.131)	(0.058)***	(0.099)*	(0.103)*	(0.051)	(0.090)*	(0.094)*
TreatmentXAfterXDiff	0.1489	0.1269	0.1255						
	(0.056)***	(0.086)	(0.088)						
TreatmentXAfterXKI				-0.0137	-0.0308	-0.0318			
				(0.025)	(0.035)	(0.036)			
TreatmentXAfterXHCI							0.0856	0.1233	0.1252
							(0.028)***	(0.045)***	(0.046)***
N	1356	1408	1408	1328	1364	1364	1488	1562	1562
r2	0.86	0.80	0.80	0.86	0.82	0.82	0.86	0.82	0.82
KP F Stat	624.40	434.38	434.38	419.75	415.71	415.71	903.29	919.72	919.72

This table shows result of the estimation for specification (1), interacting the term $treat_p \times after_t$ with three variables indicating product characteristics: differentiated vs. homogeneous goods (columns 1-3), capital intensity (columns 4-6) and human capital intensity (columns 7-9). Each group of results uses different monotonic transformations for $exports_p, t$ in each column. All columns include FDI as control, as well as product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 6: Summary statistics, all sample

Variable	**N**	**Mean**	**sd**	**Min**	**Max**
Exports (log)	136,684	14.029	3.44	6.9	25.8
Exports (log +1)	179,208	10.700	6.68	0.0	25.8
Exports (asinh)	179,208	11.229	6.95	0.0	26.5
All Migrants	179,208	8.047	127.48	0.0	22,803.5
Skilled	179,208	3.769	63.15	0.0	12,501.7
Unskilled	179,208	4.001	67.83	0.0	11,614.6
White collars	179,208	0.636	7.24	0.0	798.1
Non-white collars	179,208	7.093	121.60	0.0	22,497.6
Analytical & Cognitive tasks	179,208	1.913	26.45	0.0	3,816.8
Manual tasks	179,208	5.531	92.33	0.0	15,918.0
High prob solving	179,208	1.480	21.36	0.0	4,193.2
Low prob solving	179,208	6.273	107.56	0.0	19,721.0

This table presents the sample summary statistics for the variables used to estimate specification (1).

Table 7: Difference-in-difference estimation, all sample

Dependent variable: $exports_{p,t}$			
	(1)	(2)	(3)
	lnexp	lnexpplus1	asinhexp
L10.AllMigrants	0.0846	0.1252	0.1232
	(0.015)***	(0.030)***	(0.032)***
lntotalexp	0.8935	0.4403	0.4595
	(0.016)***	(0.011)***	(0.012)***
N	114288	165060	165060
Adj R2	0.94	0.91	0.90
cpFE	Y	Y	Y

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 2000 and 2010 for exports and 1990 and 2000 for migration. All columns include country-by-product fixed effects and country-by-year fixed effects. Standard errors clustered at the country-product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 8: Difference-in-difference estimation, all sample

Dependent variable: $exports_{p,t}$						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnexp	lnexp	lnexpplus1	lnexpplus1	asinhexp	asinhexp
L10.Skilled	0.0965		0.1298		0.1258	
	(0.017)***		(0.033)***		(0.035)***	
L10.Unskilled		0.0734		0.0801		0.0777
		(0.018)***		(0.035)**		(0.036)**
lntotalexp	0.8938	0.8953	0.4403	0.4411	0.4596	0.4603
	(0.016)***	(0.016)***	(0.011)***	(0.011)***	(0.012)***	(0.012)***
N	114288	114288	165060	165060	165060	165060
Adj R2	0.94	0.94	0.91	0.91	0.90	0.90
cpFE	Y	Y	Y	Y	Y	Y

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 2000 and 2010 for exports and 1990 and 2000 for migration. All columns include country-by-product fixed effects and country-by-year fixed effects. Standard errors clustered at the country-product level presented in parenthesis.

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 9: White vs. non-white collars

Dependent variable: $exports_{p,t}$						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnexp	lnexp	lnexpplus1	lnexpplus1	asinhexp	asinhexp
L10.WhiteCollars	0.1313		0.1443		0.1404	
	(0.020)***		(0.033)***		(0.035)***	
L10.NonWhiteCollars		0.0852		0.1058		0.1026
		(0.016)***		(0.032)***		(0.034)***
lntotalexp	0.8954	0.8936	0.4407	0.4407	0.4599	0.4599
	(0.016)***	(0.016)***	(0.011)***	(0.011)***	(0.012)***	(0.012)***
N	114288	114288	165060	165060	165060	165060
Adj R2	0.94	0.94	0.91	0.91	0.90	0.90
cpFE	Y	Y	Y	Y	Y	Y

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 2000 and 2010 for exports and 1990 and 2000 for migration. All columns include country-by-product fixed effects and country-by-year fixed effects. Standard errors clustered at the country-product level presented in parenthesis.
$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 10: Analytical, Cognitive and Interactive vs. Manual tasks

Dependent variable: $exports_{p,t}$						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnexp	lnexp	lnexpplus1	lnexpplus1	asinhexp	asinhexp
L10.AnalyticalCognitive	0.0970		0.1267		0.1252	
	(0.018)***		(0.032)***		(0.033)***	
L10.Manual		0.0823		0.1040		0.1006
		(0.017)***		(0.034)***		(0.036)***
lntotalexp	0.8957	0.8942	0.4407	0.4408	0.4599	0.4600
	(0.016)***	(0.016)***	(0.011)***	(0.011)***	(0.012)***	(0.012)***
N	114288	114288	165060	165060	165060	165060
Adj R2	0.94	0.94	0.91	0.91	0.90	0.90
cpFE	Y	Y	Y	Y	Y	Y

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 2000 and 2010 for exports and 1990 and 2000 for migration. All columns include country-by-product fixed effects and country-by-year fixed effects. Standard errors clustered at the country-product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 11: Problem-solving content

Dependent variable: $exports_{p,t}$						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnexp	lnexp	lnexpplus1	lnexpplus1	asinhexp	asinhexp
L10.HiProbSolving	0.1107		0.1437		0.1413	
	(0.018)***		(0.032)***		(0.033)***	
L10.LoProbSolving		0.0812		0.0985		0.0954
		(0.017)***		(0.033)***		(0.034)***
lntotalexp	0.8952	0.8942	0.4407	0.4407	0.4599	0.4599
	(0.016)***	(0.016)***	(0.011)***	(0.011)***	(0.012)***	(0.012)***
N	114288	114288	165060	165060	165060	165060
Adj R2	0.94	0.94	0.91	0.91	0.90	0.90
cpFE	Y	Y	Y	Y	Y	Y

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses years 2000 and 2010 for exports and 1990 and 2000 for migration. All columns include country-by-product fixed effects and country-by-year fixed effects. Standard errors clustered at the country-product level presented in parenthesis.

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Online Appendix for

Diasporas, return migration and comparative advantage: a natural experiment of Yugoslavian refugees in Germany

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A Details on data, sample construction and variable description

Sample construction. The employment data in Germany are based on the universe of social security notifications of all employees subject to social security contributions for the years 1975-2014 (IAB, 2015). For data privacy reasons we were not allowed to work with the full BeH data file. The data was provided by the IT Services and Information Management (ITM) of the IAB. A 40% random sample of foreign nationals on June 30 of each year was drawn and matched with all related individual BeH accounts which enables us to follow workers back and forth in time. Then the variable on educational attainment was corrected by ITM using information on past and future values (see more below). We keep all spells subject to social security contributions without specific tokens. Specific tokens are given to e.g. apprentices, employees in partial retirement, marginal part-time workers, seamen, or artists liable to social security. We keep one spell for per person-firm combination and focus on spells in tradable industries only. The BeH contains information on the industry affiliation, but different classifications have been applied over time. Therefore, we use time-consistent industry codes developed for these data by Eberle et al. (2011). In particular we use the German classification WZ 93 which corresponds to the European classification of NACE Rev. 1. When matching German 3-digit industry codes to 4-digit SITC product codes we apply correspondence tables provided by the United Nation Statistical Office and Dauth et al. (2014). If the source category applies to more than one target category we distribute workers according to the shares of German exports of those categories for each year separately.

Education. We distinguish between two skill groups. As unskilled we define workers without post-secondary education and skilled as workers with education beyond high school (i.e., vocational training, college degree or more). To improve consistency of our variable, we correct missing values by using past and future values as developed by Fitzenberger et al. (2006).

Task content. When grouping workers according to the task content of their occupation we distinguish between manual and analytically intensive tasks. Manual tasks are defined as manual (non-) routine tasks and as analytic tasks we classify analytical or interactive non-routine tasks. The classification is based on BERUFENET, which is, similar to O*NET, an expert's assessment of the tasks usually performed in a specific occupation. It covers originally about 3,900 different occupations and has been mapped to our classification codes by Dengler et al. (2014). We use the classification for the year 2011.

Problem-solving content. When distinguishing migrants by the problem-solving content of their occupation, we use the continuous measure developed by Nedelkoska et al. (2015). We define an occupation to be of high problem-solving content if the occupation has a problem-solving factor above the median of all occupations.

B Zeroes in the data

There are 38 products that Yugoslavia does not export in either the pre-treatment period (1988-1990) or the post-treatment period (2005-2007). These products are excluded from our model when we examine log exports, but included in two other specifications. Including these products has a large impact on the magnitude of our estimated treatment effect, doubling the size of the coefficing in our instrumental variable specification (see Table 2 in main text).

For this reason, we look more closely at the prevelance of zero export products in this appendix. If the zeros mostly occur in the pre-treatment period, we might conclude that returning migrants launched new industries in Yugoslavia, which would explain the increased size of the treatment effect. However, this is not the case. Between the pre- and post-periods, 12 product lines were opened and 16 product lines were closed, and the product lines that were closed are much larger than those that opened. Three of the closed product lines are especially large, with exports over $20 million in the pre-period but nothing in the post period. All three of these products are liquid fuels. Our results are robust to the exclusion of these three fuels, and we find that those products alone do not cause the increase in the size of the estimated treatment effect.

Given that Yugoslavia does export 770 of 786 products in the pre-treatment period, we examine the total number of products exported by other countries in that period to ascertain whether Yugoslavia is unusual in having so many export lines. We find that it is in fact not uncommon for countries to export so many products, and several developing markets a comparable levels of GDP per capita have a greater number of exports. This is shown in Figure A1.

[Figure A1 about here.]

We also consider the possibility that, though Yugoslavia exports many products, most of these export lines are small and insignficant. If this were true, our use of product fixed effects means that our results could be produced by sectors that are largely unimportant to the former Yugoslavian economies today. We therefore ran our main results excluding products with fewer than $25,000 in exports in the pre-treatment period. Our results hold using this sub-sample, and we see that just 81 of 786 products have exports of less than $25,000. We therefore conclude that the change in our estimated treatment effect changes when we add products with zero exports does not reflect a larger pattern of zeros driving our results.

C Foreign Direct Investment

The results presented in the paper raise some concerns regarding the negative sign of the estimates of the partial correlation of FDI stocks and export levels. If anything, we would expect this control to have a positive sign. To explore what is that drives this unexpected relationship we reestimate a variation of specification (1) that only includes the FDI variable on the right hand side. That is, we are analyzing the partial correlation between exports and FDI in our setting. The results are presented in Table (A1). Columns 1-3 uses both product and year fixed effects, while columns 4-6 only uses year fixed effects. We can see that when excluding the product fixed effects the partial correlation between exports and FDI is estimated to be a positive one, as expected. This occurs, plausibly, because introducing the product fixed effects leave very little variation to be use in the estimation of the FDI coefficient, particularly because the FDI figures are defined at the 2 digit level, and the fixed effects at the 4-digit level. All in all, we find that when excluding the product fixed effects, products that have more FDI during that period explain larger export growth, as it is to be expected.

[Table A1 about here.]

D Robustness Checks

A2 reports 2SLS estimation for specification (1) using alternatives treatments. The first three columns use the difference in Yugoslavian workers per industry between 2005 and 1995, and the following three columns simply uses the baseline stock of Yugoslavian workers per industry in 1995.

[Table A2 about here.]

Table A3 reports 2SLS estimation for specification (1) using only observations with non-zero exports for the two monotonic transformations of the dependent variable $log(exports_{c,p,t}+1)$ and $asinh(exports_{c,p,t})$.

[Table A3 about here.]

E Excluding Slovenia and Macedonia from the sample

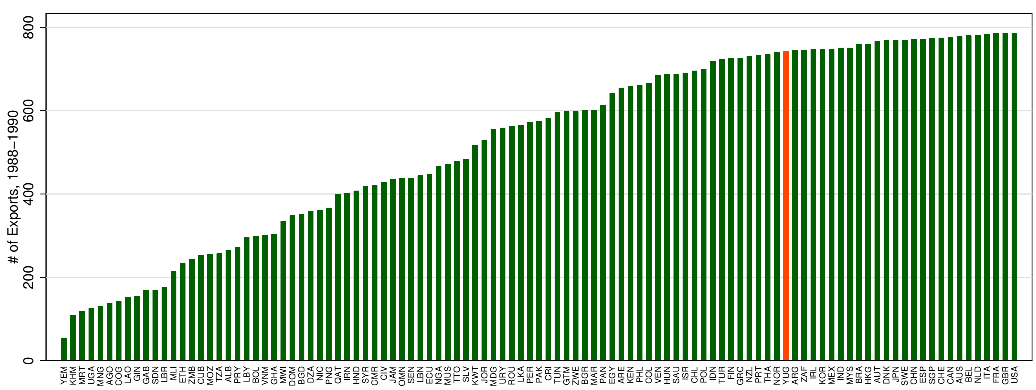
Table A4 replicates the results of Table 4 excluding Slovenia from the sample. Slovenia was the first Yugoslavian republic to secede and did not suffer from a long war nor a massive exile of its inhabitants to other locations. Our results are robust to its exclusion from the left hand side variable.

[Table A4 about here.]

Table A5 repeats the same exercise and excludes Macedonia. Following Slovenia and Croatia, Macedonia held a referendum and declared its independence in late 1991. Unlike others, Macedonia managed to obtain its independencde without going through an armed conflict. This is why, no war refugees from Macedonia went to Germany. Our results are robust to its exclusion from the left hand side variable.

[Table A5 about here.]

Figure A1: Exploration of zeros in our data



The

Table A1: Exports vs. FDI

Dependent variable: $exports_{p,t}$						
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
lnfdi	-0.1518	-0.2594	-0.2640	0.1421	0.2519	0.2573
	(0.066)**	(0.125)**	(0.130)**	(0.062)**	(0.090)***	(0.092)***
N	1496	1572	1572	1524	1572	1572
r2	0.86	0.82	0.81	0.03	0.02	0.02
Product FE	Y	Y	Y	N	N	N

This table shows result of the estimation for specification (1) that only includes FDI stock as the right hand side variable, using different monotonic transformations for $exports_p, t$ in each column. The first 3 columns include product fixed effects and the following 3 columns do not include those product fixed effects. All columns include year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table A2: Difference-in-difference estimation, different treatments

Dependent variable: $exports_{p,t}$						
	lnexp	lnexp	lnexpplus1	lnexpplus1	asinhexp	asinhexp
treat2005 × after2005	0.0882		0.2363		0.2416	
	(0.049)*		(0.123)*		(0.129)*	
lnfdi	-0.0707	-0.0756	-0.1856	-0.1976	-0.1901	-0.2024
	(0.068)	(0.068)	(0.149)	(0.151)	(0.155)	(0.157)
treat1995level × after2005		0.0711		0.1873		0.1916
		(0.040)*		(0.097)*		(0.102)*
N	1428	1428	1572	1572	1572	1572
r2	0.01	0.01	0.01	0.01	0.01	0.01
KP F Stat	1448.35	3044.57	1736.97	3632.82	1736.97	3632.82

This table shows result of the 2SLS estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column. The estimation uses two other different definitions of treatment: (i) return migrants between 1995 and 2005, and (ii) the stock of migrant workers in 1995. The estimation uses exports between 1990 and 2005. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table A3: Difference-in-difference estimation, no zeros

Dependent variable: $exports_{p,t}$	OLS		2SLS	
	lnexpplus1	asinhexp	lnexpplus1	asinhexp
treat2000 × after2005	0.0852	0.0852	0.0926	0.0926
	(0.039)**	(0.039)**	(0.052)*	(0.052)*
lnfdi	-0.0691	-0.0692	-0.0696	-0.0696
	(0.067)	(0.067)	(0.068)	(0.068)
N	1428	1428	1428	1428
r2	0.01	0.01	0.01	0.01
KP F Stat			1284.71	1284.71

This table shows result of the 2SLS estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column, excluding observations for which there were zero exports in either period. The estimation uses years 1990 and 2005. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table A4: Difference-in-difference estimation, excl. Slovenia

Dependent variable: $exports_{p,t}$						
	OLS			2SLS		
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
treat2000 × after2005	0.1136	0.2056	0.2093	0.1861	0.3165	0.3222
	(0.040)***	(0.062)***	(0.064)***	(0.052)***	(0.086)***	(0.089)***
lnfdi	-0.1369	-0.1984	-0.2015	-0.1324	-0.1924	-0.1955
	(0.042)***	(0.068)***	(0.070)***	(0.042)***	(0.068)***	(0.070)***
N	1520	1572	1572	1520	1572	1572
r2	0.86	0.81	0.80	0.86	0.80	0.80
KP F Stat				1997.92	2083.42	2083.42

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column, excluding exports from Slovenia as one of the former Yugoslavian republics post 1992. The estimation uses years 1995 and 2005. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$

Table A5: Difference-in-difference estimation, excl. Macedonia

Dependent variable: $exports_{p,t}$						
	OLS			2SLS		
	lnexp	lnexpplus1	asinhexp	lnexp	lnexpplus1	asinhexp
treat2000 × after2005	0.1232	0.2176	0.2215	0.1713	0.2931	0.2984
	(0.040)***	(0.062)***	(0.064)***	(0.052)***	(0.087)***	(0.090)***
lnfdi	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(.)	(.)	(.)	(.)	(.)	(.)
N	1520	1572	1572	1520	1572	1572
r2	0.86	0.80	0.80	0.86	0.80	0.80
KP F Stat				2071.72	2169.72	2169.72

This table shows result of the estimation for specification (1) using different monotonic transformations for $exports_p, t$ in each column, excluding exports from Macedonia as one of the former Yugoslavian republics post 1992. The estimation uses years 1995 and 2005. All columns include product fixed effects and year fixed effects. Standard errors clustered at the product level presented in parenthesis.

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$