TI 2021-091/VI
Tinbergen Institute Discussion Paper

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Migrants and Global Value Chains: Evidence from Dutch Firms*

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October 2021

Abstract

This paper examines the relationship between migrant workers and global value chain linkages using a rich employer-employee dataset from the Netherlands for 2010-2017. We merge the employer-employee dataset with international trade data and extract firms' country-product specific imports. We use OLS and PPML regressions at the firm-country-year level with high dimensional fixed effects, and find that firms that employ migrants from a specific country are more likely to import inputs from and establish supply chain linkages with that country. Our benchmark specification indicates that a 10% increase in the number of migrant workers raises their employer's probability of sourcing inputs from their origin country by 0.2 percentage points, explaining about a fifth of the average probability of importing inputs from a given country. Results at the intensive margin are qualitatively similar but smaller in magnitude. Digging deeper, we find that the effect is driven by first generation immigrants, and that the second generation immigrants have a marginal impact on their employers' sourcing decisions. Our results indicate that migrants help erode informational barriers and help their employers to integrate into global value chains.

JEL codes: F14, F16

Keywords: immigration, global value chains, employer-employee

*The results in this paper are based on calculations by the authors using non-public microdata from Statistics Netherlands. The results and opinions shown here are the responsibility of the authors and do not necessarily reflect the views of any agency of the Dutch or the Turkish governments.

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1 Introduction

The relationship between migrant workers and trade has been an important area of research for almost three decades. Papers have generally assumed that the direction of influence is from immigrants to trade, and empirical research showed evidence that hiring migrants can be beneficial in numerous ways, from cost advantages to market knowledge that enable firms to export to a specific country. On the other hand, there are very few studies (an exception is Egger et al., 2019) that examine the effect of migrant-specific market knowledge on firms' importing behavior, especially in establishing supply chain linkages. In a world with burgeoning global value chains (see, for example, Johnson and Noguera, 2017), it is imperative to understand the role of migrant workers that help create and sustain these linkages.

In this paper, we examine the relationship between migrant workers and global value chain linkages using a rich employer-employee dataset from the Netherlands for 2010-2017. The Netherlands provides a suitable setting to conduct our analysis. Despite being a relatively small country, the Dutch economy has been an integral part of international trade and global supply chains over the last three decades. The country has liberal economic and social policies providing a favorable commercial environment for all traders. Equally important for our study, the country has a large and wide mix of foreign nationalities with more than four million immigrants, accounting for about a quarter of total population.

First, by linking several micro datasets, we document the role of employees with immigrant backgrounds. We find that 25% of workforce in the Netherlands consist of individuals with a migrant background, with 17.5% growth over 2010-2017. Even though the Indonesian and the Surinamese backgrounds are the most prevalent, there are more than 40 migrant communities with more than 4,000 inhabitants in the Netherlands, with some, such as Bulgarians, Poles, and Romanians, growing more than 100% in numbers during 2010-2017. Thanks to the level of detail in our data, for the first time in the literature, we include both first and second generation immigrants in our "migrants" category, and find that the stock of second generation migrants (around 800,000) is close to the size of the stock of first generation migrants (around 1 million). We also find that among the first generation migrants, most have arrived in the Netherlands between the ages of 19 and 50. Moreover, as Appendix Table A.1 shows, in 2017, the majority of immigrants obtained their residence permits due to family reunification/formation reasons, with only about a third of immigrants migrating for employment reasons. It is also interesting to note that the residence permits granted to asylum seekers more than doubled in 2010-2017.

Second, we turn to the effect of hiring migrants on firms' importing behavior from the origin country of those migrants. Our hypothesis is that workers bring market knowledge to their employers to establish and tighten supply chains with their origin countries. This idea is grounded on earlier studies such as the one by Hiller (2013), who investigates whether firms benefit from hiring immigrants to increase their exports or whether immigrants in the firm's environment affect trade. Her results provide little evidence for the local presence of immigrants to enlarge export sales, while they show much larger effects for firm-level hiring of migrants that possibly help firms access personal and business networks.

To test our hypothesis, we use ordinary least squares (OLS) and Poisson pseudo-maximum likelihood (PPML) regressions at the firm-country-year level with high dimensional fixed effects. We include firm-year fixed effects to close down time-varying firm variables such as productivity shocks, firm-country fixed effects to control for country-specific relationships, and country-sector-year fixed effects that absorb all supply and demand shocks. We expect that our independent variable, the log number of workers with a certain migrant background, has a positive effect on our dependent variable, which is either a binary indicator for importing from a certain country, or the value of imports from that country, depending on the specification. We then focus on the imports of intermediates, classified according to the Broad Economic Categories (BEC), to proxy for supply chain linkages. Our benchmark results use the OLS specification, relying on the linear probability model for the extensive margin regressions. However, we also use PPML regressions to take zeros into account as well as to deal with the potential bias in our estimated coefficients due to heteroskedasticity in the error term (Silva and Tenreyro, 2006). For PPML regressions, we restrict the sample to firms that have above 20,000 Euros worth of annual imports and countries with more than 4,000 migrants in the Netherlands, due to computational difficulties.

We find that firms that employ migrants from a specific country are more likely to import inputs and establish supply chain linkages with that country. Our benchmark specification indicates that a 10% increase in the number of migrant workers raises their employers' probability of sourcing inputs from their origin country by 0.2 percentage points, explaining about a fifth of the average probability of importing inputs from a given country. Results at the intensive margin are qualitatively similar but smaller in magnitude. Digging deeper, we find that the effect is driven by first generation immigrants, and that the second generation immigrants have a marginal impact on their employers' sourcing decisions. Among the first generation immigrants, it is the ones that emigrated when they were between the ages of 19 and 50 that increase their employers' likelihood of importing from their origin countries. Our results indicate that migrants help erode informational barriers and help their employers to establish global value chains.

This paper is mainly related to the empirical literature that examines the effect of migration on trade. This relationship is explained largely by firm-level productivity and cost advantages as a result of hiring immigrants (Hunt and Gauthier-Loiselle, 2010; Ottaviano and Peri, 2012; Peri, 2012; Mitaritonna et al., 2017) or facilitating trade through the superior market knowledge that the migrant workers have about their countries of origin (Gould, 1994; Head and Ries, 1998; Girma and Yu, 2002; Rauch and Trindade, 2002; Wagner et al., 2002; Andrews et al., 2017; Steingress, 2018) or a combination of both (Orefice et al., 2021). Similarly, it is also possible for immigrants to generate additional demand for the importation of ethnic products from their countries of origin, depending on their preferences (Gould, 1994; Head and Ries, 1998; Dunlevy and Hutchinson, 1999). Importantly, the significant part of these studies has been devoted to exports (Peri and Requena-Silvente, 2010; Hiller, 2013; Hatzigeorgiou and Lodefalk, 2016; Parrotta et al., 2016; Andrews et al., 2017; Mitaritonna et al., 2017; Marchal and Nedoncelle, 2019). The few studies that also take into account imports mostly attempt to compare the effectiveness of knowledge and preference channels by contrasting the effect on exports and imports (Gould, 1994; Head and Ries, 1998; Girma and Yu, 2002; Rauch and Trindade, 2002; Wagner et al., 2002; Aleksynska and Peri, 2014; Steingress, 2018).

More specifically, our paper is related to the literature that focuses on the importance of market knowledge for certain trading relationships. For instance, Gould (1994) uses country-level data and tests the hypothesis of immigrant preference for home-country products by focusing on consumer products. Dunlevy and Hutchinson (1999) divide commodities into groups of crude foodstuffs, processed foodstuffs, crude materials, semi-manufactures and manufactures for consumption and examine the differential effects of migrants. Rauch and Trindade (2002) separate goods into three groups as traded on organized exchanges, having reference prices but not traded on organized exchanges, and all others (i.e. differentiated). Peri and Requena-Silvente (2010) classify commodities according to their elasticity of substitution across varieties to distinguish the importance of networks in reducing information costs, which is expected to be more relevant for differentiated than for homogeneous goods. Instead, we classify imported products as intermediate (inputs) versus non-intermediate (mostly final) goods, and unlike the aforementioned papers which use country or regional level data, we use an employer-employee dataset to identify firm-level effects.

The paper closest to ours in terms of its research question is by Egger et al. (2019). They investigate the link between migrants and supply chains by combining firm-level import data with municipality-level migration data from Switzerland. They use narrowly defined product groups by applying two measures defined by Nunn (2007) in order to classify inputs that are neither bought and sold on an exchange nor reference priced as being relationship-specific. Using an instrumental variable approach, they find that firms that are located in municipalities with migrant networks have more stable supply-chain relationships with origin countries of those migrants. They rationalize their finding by building a model where the knowledge emanating from the migrants removes the informational barriers to trade and thereby allows local firms to establish global value chain linkages.

Despite having a similar inspiration, our paper has a different approach from Egger et al. (2019) and the aforementioned studies in several ways. First, we use an employer-employee linked dataset that allows us to observe workers with different backgrounds within a firm and thus measure their effect directly, instead of relying on indirect linkages such as firm location. Second, this paper uses a formal definition of 'immigrant' which is broader than the one used by the previous literature. In earlier studies, the common approach is to assume foreign-born residents as immigrants, which results in including only the first generation. However, this study extends this definition and covers second generation immigrants as well, which almost doubles the size of the migrant workforce. We argue that the level of knowledge of immigrants that facilitates trade is expected to diminish over generations. This process is natural since the first generation has the highest level of knowledge about their countries of origin, whereas the next generations born in the Netherlands are expected to lose this knowledge over time. This approach helps us to analyze the influence of immigrants on trade in the long run through subsequent generations.

Our paper is also related to the literature that examines the heterogeneities of migrants in explaining the migration-trade relationship. Among them are levels of skill or education (Gould, 1994; Hatzigeorgiou and Lodefalk, 2016; Andrews et al., 2017; Marchal and Nedoncelle, 2019), managerial role in the firm (Aleksynska and Peri, 2014; Andrews et al., 2017), duration of stay in the host country (Gould, 1994; Hatzigeorgiou and Lodefalk, 2016), and reasons for migration such as entrepreneurship, family reunification, or refugee status (Head and Ries, 1998). Different from these approaches, we examine whether the age at which immigrants arrive in a host country determines the level of knowledge that affects trade. For example, immigrants who arrive in the country immediately after birth may have less knowledge and business networks with respect to their country of origin than immigrants who migrate later in their lives. Thus, we also take into account different age groups of the first generation immigrants in analyzing the influence of migrants on trade.

Having these distinct features, this paper intends to make three contributions to the literature. First, we find that immigrant employees increase firm-level imports on both the extensive and intensive margins. This effects exists for both imports of intermediates and final goods. Second, although the effects of immigrants on imports are generally positive for all migrants, they are decreasing in magnitude over generations. Third, the age at which immigrants arrive in the host country is a key determinant of the market knowledge effect. We find that the ones arrived in the host country during their prime working age (19-50) drive the positive effect of migrants on firm-level sourcing decisions.

Our results are comparable with the conclusions of Egger et al. (2019) – the only study on the impact of migration networks on the integration of firms to global value chains. They suggest that firms engage in more stable sourcing relationships by reducing the total number of suppliers as a result of rising migration from their respective countries of origin. In other words, immigrants help remove informational barriers to trade, and hence firms deal with a smaller number of suppliers while trading more with each of them. The findings in our paper and the study by Egger et al. (2019) are complementary despite using different datasets and methodologies: whereas they focus on the effect of migrants on reducing the number of suppliers, we show that migrants help their firms establish and tighten supply chain linkages with their origin countries.

This paper is organized as follows. In Section 2 we explain the data in detail and show descriptive statistics. Section 3 presents the estimation strategy and the results with robustness checks. Section 4 concludes and discusses further research.

2 Data

In this study, we use five micro datasets provided by the Dutch Central Bureau of Statistics (CBS). We gather information about employees from two sources: SPOLIS (Jobs and Wages Report by the

Policy Administration) and GBAPERSOONTAB (Report on Personal Characteristics of All Persons Registered in the Municipal Basic Administration) tables. For all employees in the country, SPOLIS provides their employer and wage income, while GBAPERSOONTAB delivers information on their age, generation, and country of origin. We obtain sector and trade information on employers from ABR (General Business Register) and IHG (International Trade in Goods Report) databases, respectively. We merge these datasets using unique identification numbers for workers and firms to create a linked employer-employee database. In the following subsections, we describe the datasets by focusing on statistics that are key for our study.

2.1 Migrants in the Netherlands

Immigrants in the Netherlands are categorized by their generations according to the CBS formulation as illustrated in Table 1. The CBS describes various migrant groups based on their parental country of birth. If the parents were born in a third country, the place of birth determines whether their children can be grouped into the first or second generation migrants. In this case, the next generation is considered as the second generation, unless they were born in another country. On the other hand, if the parents were born in the Netherlands, then their children are assumed to have Dutch background regardless of their place of birth. This formal and more accurate definition of immigrants distinguishes our study from others in which only foreign-born individuals are assumed to be immigrants. In fact, disregarding the second generation immigrants would mean excluding almost half of the 'migrant' population in the Netherlands.

Table 1: Definition of Immigrants by CBS Formulation

Both parents born in the NL?	No	Born in the NL yourself?	No	Migrant background	First Generation
			Yes		Second Generation
	Yes			Dutch Background	Third Generation
					Both Parents Native Dutch

Source: The Dutch Central Bureau of Statistics (CBS).

The Dutch population structure has changed in the last decade with the influx of immigrants. First, as shown by Appendix Table A.2, the Dutch population grew by 3.2% during 2010-2017, which can be entirely explained by the 15.9% rise in the number of immigrants during this period. Digging deeper, the number of first and second generation immigrants grew by 19.8% and 11.9% respectively, and the first generation population became slightly larger than that of the second generation. Overall, the share of immigrants in the population of the Netherlands increased from 20.6% to 23.1% in 2010-2017.

SPOLIS files provide very detailed data on jobs and wages for all Dutch employees for each reporting year. The data comes from wage income tax declarations by all employees working for domestic employers. The definition of "job" underlies an income connection between a natural person employee and an employer. However, an employee may have several income relationships per employer at the same time. These employees are taken into account separately for each firm. As explained previously,

Table 2: Employment by Dutch Natives and Migrants

Domestic Labor	2010	2017	Change (%)	Share in Workforce (%)		Participation Rate	
			2010-2017	2010	2017	2010	2017
I. Total	8,525,290	8,804,535	3.3	100.0	100.0	51.2	51.2
Dutch Background	6,652,910	6,604,318	-0.7	78.0	75.0	50.3	50.0
Migration Background	1,872,380	2,200,217	17.5	22.0	25.0	54.6	55.4
- 1st Generation	893,728	1,037,413	16.1	47.7	47.2	51.5	49.9
– Age under 19	71,064	103,388	45.5	8.0	10.0		
– Age between 19 and 50	323,643	521,704	61.2	36.2	50.3		
– Age above 50	6,586	10,384	57.7	0.7	1.0		
– N.A. (unknown age)	492,435	401,937	-18.4	55.1	38.7		
- 2nd Generation	703,104	825,689	17.4	37.6	37.5	41.6	43.6
- N.A. (unknown gen.)	275,548	337,115	22.3	14.7	15.3		
II. Migrant Groups	1,872,380	2,200,217	17.5	100.0	100.0	54.6	55.4
Indonesian	230,921	198,434	-14.1	12.3	9.0	60.8	54.9
Surinamese	191,362	194,363	1.6	10.2	8.8	55.5	55.3
Turkish	163,098	179,464	10.0	8.7	8.2	41.9	44.4
Moroccan	134,110	155,361	15.8	7.2	7.1	37.7	39.2
German	145,259	131,191	-9.7	7.8	6.0	38.4	37.0
Polish	55,012	125,790	128.7	2.9	5.7	63.0	72.7
Antillianen	74,988	81,336	8.5	4.0	3.7	54.1	53.8
Belgian	48,659	49,492	1.7	2.6	2.2	42.9	41.7
Romanian	6,542	18,070	176.2	0.3	0.8	41.4	61.4
Bulgarian	3,598	14,389	299.9	0.2	0.7	21.2	46.6
Others	818,831	1,053,327	28.6	43.7	47.9	67.9	65.8

Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

employees and employers have unique ID numbers generated by CBS in SPOLIS files, while employers have the same IDs with the firms in ABR and IHG files. The additional data on country of origin, generation and age pertaining to immigrants are available in GBAPERSOONTAB files, which can also be linked with SPOLIS via unique ID numbers. GBAPERSOONTAB files contain demographic background data by residents who appear in the Municipal Personal Records Database (BRP) from 1 October 1994. To be able to merge the database with the countries in the trade data, we create a consistent set of countries that also takes into account changes in country names, and unifications and dissolutions of states.

Table 2 shows key features of the domestic workforce by Dutch natives and major migrant groups. First, immigrants are the driving force of the growing domestic labor stock. The total labor force reached almost nine million workers in 2017 after increasing by 3.3% during 2010-2017. Immigrants substantially contributed to this increase with a rapid growth of 17.5% whereas the number of native employees declined by almost 1%. Accordingly, the share of immigrants in the total labor force increased from 22% in 2010 to 25% in 2017. Second, the stock migrants from some countries employed by firms in the Netherlands more than doubled in 2010-2017. For example, the number of Polish workers exceeded 125,000, with a 129% growth rate. The growth rates of other major migrant groups such as Turks, Moroccans and the Surinamese were less than the average of 17.5%, while the numbers of Indonesian and German employees declined. The overall increase for the rest (28.6%), which is well above the average, is an indication of increasing ethnic diversity among domestic workforce.

The figures in Table 2 also shed light on labor participation of immigrants in the domestic workforce. For instance, the migrants' average labor force participation rate of 55% is higher than that of the Dutch natives of around 50%.[1] There are also considerable differences among migrant groups in terms of participation rates. Some migrant groups such as the Poles and Romanians have above 60% participation rates in 2017. This suggests that these groups meet the excess labor demand in the economy, taking advantage of the free movement of labor in the European Union. Conversely, the employment levels for the groups with a long history of migration in the country are relatively lower among the immigrants. For instance, in 2017, these rates were less than 45% for Belgians, Germans, Moroccans, and Turks.

By separating workers with foreign backgrounds into first and second generations, we reveal that the size of the second generation workforce is almost the same as the size of the first generation workforce, with similar growth rates over 2010-2017.[2] We also group foreign workers into three different age groups: younger than 19 years, between 19 and 50 years old, and older than 50 years. The second generations are not taken into account since they were born in the Netherlands. We find that the majority of first generation migrants emigrated to the Netherlands when they were between the ages of 19 and 50.[3]

2.2 Firms in the Netherlands

By Dutch legislation, all businesses and legal entities in the Netherlands are required to register in the Commercial Register of KVK. There are few exceptions such as foreign companies that neither have a branch nor structurally conduct business activities. The ABR data have some important features. The business units referred to in ABR files are natural persons (e.g. sole traders) or non-natural persons (companies, foundations, etc.) who conduct business activities. They are defined with a unique ID that serves as a linking key with other relevant CBS micro datasets including SPOLIS and IHG.

The data in ABR files are received by CBS from various sources and registrations. The data infrastructure which was established by KVK, Tax Authorities and CBS was abandoned on 1 March 2014, and new sources based on KVK and Tax Authorities have been used since then. As a result of this change and new registration policies, ABR files do not fully cover the social activities without a legal obligation (e.g. international organizations such as embassies, consulates and religious

[1] We also find that 77% of the migrant workforce are employed in the private sector, whereas this figure is only 68% for the Dutch native population.

[2] The N.A. (unknown gen.) category includes workers with foreign backgrounds but unknown generation.

[3] Note that the N.A. (unknown age) category also makes up a sizeable share. These include migrants that migrated before 1994 and thus their birth dates are not registered in the CBS. Even though we do not make an assumption regarding their migration age in our empirical analysis, it is likely that the majority of these migrants were in their prime working age.

organizations) and exclude silent partnerships, also known as cost partnerships, which do not operate as a partnership. ABR files mainly contain data related to the size of the company, the number of employees (also converted to full-time equivalent), the sector or field of economic activity (Standard Business Classification-SBI 2008), legal form, and date of (de)registration.

According to ABR records, there are 1,648,230 registered firms in KVK as of 2017. Despite making the majority of registered firms, we exclude self-employed entrepreneurs since they are investors who work at their own expense and risk with mostly either a one-man business or a private limited company with a share less than 1% in the total trade volume. Thus, we end up with 510,283 firms for 2010 and 553,136 firms for 2017. These figures constitute 40% and 34% of all firms for 2010 and 2017 respectively. Importantly, the data indicates that even though the average number of workers per firm increased only by 6% (from 18 to 19), the average number of workers with a migrant background employed by a Dutch firm increased by 25% (from four to five) in 2010-2017.

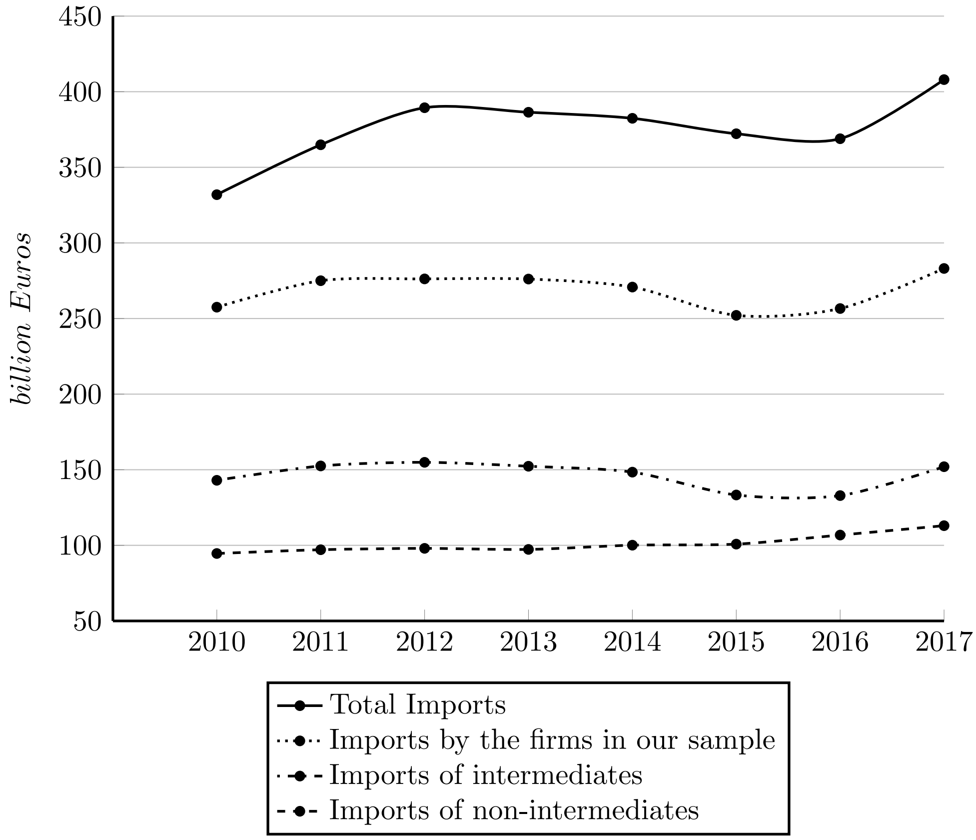
We obtain sector information from the ABR files for each firm according to the Standard Business Classification (SBI) for 2008. SBI is a grouping of economic activities that is used by CBS to categorize business units according to their main economic activity. A business unit or a firm in ABR files may consist of more than one legal unit while as a rule carrying out one economic activity. A SBI sector is allocated for a business unit or a firm according to the center of gravity of activities determined by the number of people employed. This study uses the most detailed SBI classification of the firms which enable us to neutralize time-varying sector-level supply and demand shocks in our estimations. In our estimation sample, we have importers from 872 5-digit SBI sectors that include both tradable (e.g. manufacturers) and non-tradable industries (e.g. construction firms).

Appendix Tables A.3 and A.4 list the top 20 importing 2-digit SBI sectors and provide the number of firms, employment, and imports for each for 2010 and 2017 respectively. Note how the share of migrants in total employment has increased from 26% to 30% in 2010-2017, when almost all sectors experienced an increase in the number of migrant workers. Whereas the share of migrants in total employment by importing firms in some sectors such as SBI 63, *Information service activities*, is striking at 45% in 2010 and 57% in 2017, this share is lower than average for others such as the importing firms in SBI sector 45, *Sale and repair of motor vehicles, motorcycles and trailers*. The tables also indicate that the majority of imports are intermediate goods on average, with close to 100% shares for sectors such as SBI 24 and 35, *Manufacture of basic metals* and *Electricity, gas, steam and air conditioning supply* respectively.

2.3 Trade Data

Dutch firms that have trade in goods and a KVK (Dutch Chamber of Commerce) registration are the focus of our employer-employee dataset. To establish such a dataset, we merge the ABR and IHG files. Both databases define each business unit or firm with a unique ID. IHG files contain data for each firm's imports and exports at the country and Combined Nomenclature (CN) product level. IHG files reveal that the firms traded with more than 200 countries in 2010-2017. As explained earlier,

Figure 1: Imports of the Netherlands



Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

we merge the origin countries of immigrants in other databases to these trading-partner countries to establish our sample. Figure 1 shows the evolution of imports of the Netherlands. It illustrates that firms in our sample make up the majority of imports, and that imports of intermediates are about 50% larger than the imports of non-intermediates.[4]

Having combined the ABR and IHG records, we find that 45,368 firms in 2010 and 56,776 firms in 2017 were engaged in foreign trade. They account for 8.9% and 10.3% of all Dutch firms registered in KVK excluding self-employed entrepreneurs for 2010 and 2017 respectively. Half of these firms have less than 100,000 Euros yearly imports while 40% of them have even less (i.e. 5,000 Euros).

As mentioned before, we expect that the immigrants help their employers to access global value chains through their superior market knowledge. To test this hypothesis we take advantage of the product dimension of our data. Intermediates are used as inputs by firms for production, whereas other

[4]CBS compiles trade data in IHG by using three methods: registration, imputation or estimation. Registration data are received by CBS either directly from companies or indirectly from customs. If CBS has no trade data from registration, then it is possible to deduce the data on the basis of information from the past, which means imputation. If the data from these two sources are not available, CBS estimates the data by using the VAT data of the Tax Authorities. CBS strongly recommends to use IHG files for research purposes from 2010 due to substantial improvement in the data compilation methodology. We find that around 15-20% of the trade value associated with foreign companies have no activities in the Netherlands, and we are not able to link 5% of the trade value to any domestic firm. This means that around 75-80% of the total trade value per year is included in the dataset.

products are mostly imported for final consumption. Thus, we convert 8-digit CN product groups in the IHR database to Broad Economic Categories (BEC) by utilizing the United Nations conversion and correspondence tables. Then, we categorize products into two categories: intermediate goods and the rest (i.e. non-intermediates that include final and capital goods). As a result, we end up with an almost even distribution of 8-digit CN product groups in the IHR database: 55% of products are classified as intermediate goods while the rest are categorized as non-intermediates.

In 2017, the Netherlands' total trade in goods was 876 billion Euros, of which 467 billion Euros were exports and 409 billion Euros were imports. Both exports and imports rose by approximately 25% in 2010-2017. Note that in 2017 the portion of imports in exports was 48%, revealing that global value chains has a pivotal role in Dutch exports (CBS, 2019).

2.4 The Linked Employer-Employee Data and Descriptive Statistics

Our final employer-employee linked dataset contains firm-level data with imports of intermediate and non-intermediate goods by countries, and the number of employees by their countries of origin, age groups and generations for 2010-2017. We exclude some firms from this dataset in line with the purpose our study. As explained earlier, self-employed entrepreneurs are omitted. We also exclude public institutions such as ministries, municipalities, and cooperatives, as well as firms that operate as employment agencies or intermediary companies in the labor market.

Our final dataset has 85,769,390 observations, including between 45,368-56,776 domestic firms and 755,934-980,433 migrant employees depending on the year. The summary statistics for the final dataset over the period of 2010-2017 are presented in Table 3. Table The table presents descriptive statistics for the entire sample (around 86 million observations) with the caveat that the sample we use for our PPML estimations is smaller (around 11 million observations). The minimum and maximum values for the variables are not provided due to microdata regulations of the CBS.

Table 3: Descriptive Statistics

Variables	Description	Mean	SD
$\ln emp_{ijt}$	Natural log of the number of migrant workers +1	0.020	0.165
$\ln \textit{generation 1 } emp_{ijt}$	Natural log of the number of first generation workers + 1	0.012	0.127
$\ln \textit{generation 2 } emp_{ijt}$	Natural log of the number of second generation workers + 1	0.009	0.113
$\ln <19\ emp_{ijt}$	Natural log of the number of migrants arrived at age <19 +1	0.001	0.040
$\ln 19\text{-}50\ emp_{ijt}$	Natural log of the number of migrants arrived at age 19-50 +1	0.006	0.088
$\ln >50\ emp_{ijt}$	Natural log of the number of migrants arrived at age >50	0.0002	0.012
$\ln imp_{ijt}$	Natural log of imports	2.687	3.420
$\ln imp\ inter._{ijt}$	Natural log of imports of intermediates	2.379	3.411
$\ln imp\ non\text{-}inter._{ijt}$	Natural log of imports of non-intermediates	2.198	3.348
imp_{ijt}	Dummy variable for importing	0.020	0.132
$imp\ inter._{ijt}$	Dummy variable for importing intermediates	0.010	0.109
$imp\ non\text{-}inter._{ijt}$	Dummy variable for importing non-intermediates	0.010	0.106

Notes: SD refers to standard deviation. The number of observations in the sample with zeros is 85,769,390.
Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

3 Methodology and Results

3.1 Empirical Specification

In order to examine the effect of migrant workers on firm-level imports, we first rectangularize the dataset and fill in zeros for importer-country combinations that were missing. Then, we estimate the following specification:

$$imp_{ijst} = \beta_0 + \beta_1 \ln emp_{ijt} + \delta_{it} + \mu_{ij} + \Theta_{jst} + \epsilon_{ijst} \tag{1}$$

where imp_{ijst} is the imports in Euros of firm i in sector s from country j in year t (for the extensive margin regressions, imp_{ijst} is a binary indicator), and $\ln emp_{ijt}$ is the natural log of the number of employees of firm i with origin country j in year t.[5] We include firm-year fixed effects (δ_{it}) to control for factors such as productivity shocks that can influence both employment and imports, and firm-country fixed effects (μ_{ij}) to control for country-specific relationships such as foreign ownership. We add country-sector-year fixed effects (Θ_{jst}) that absorbs all supply and demand shocks that are not firm-specific. Even though we are not exploiting a fully exogenous variation in the number of employees to establish a causal interpretation, our set of high dimensional fixed effects helps to control for virtually all potential omitted variables and ground our identification strategy. Finally, ϵ_{ijst} is the error term, and we cluster standard errors at the firm level to allow for correlated shocks across firm-country observations and over time within firms.

We estimate specification (1) first with OLS and then with PPML, to account for zeros and avoid the potential bias due to heteroskedasticity in the error terms following the work of Silva and Tenreyro (2006).[6] For PPML regressions, using the entire set sample is computationally challenging, and thus we a smaller sample that includes firms that have above 20,000 Euros worth of annual imports linked with countries with more than 4,000 migrants in the Netherlands. Again, due to convergence difficulties with the benchmark set of fixed effects that we use in the OLS regressions, we use alternating sets of fixed effects in our PPML estimations. We first examine the impact on total imports, and then separate it into imports of intermediates versus non-intermediates as explained in Section 2.3. We expect that β_1 is positive if migrant workers help their employers to start importing and increase imports from their origin countries.

3.2 Results

Here, we present our results. The extensive margin regressions aim to find out whether immigrants have an influence on firms' decision to start importing from their origin countries. The intensive margin regressions explore whether immigrants increase the volume of bilateral imports. After establishing these results, we turn to first versus second generation immigrants. Finally, we explore whether the

[5]We add 1 to the number of employees before taking the natural log to retain zeros.

[6]To perform these estimations, we use the "reghdfe" and "ppmlhdfe" packages developed by Correia et al. (2019).

age of migration matters for the market knowledge effect.

3.2.1 Extensive Margin

Table 4 has our extensive margin results. Columns 1-3 use the linear probability model with the full sample, whereas columns 4-5 use PPML with the smaller sample.[7] Column 1 uses country-sector-year and firm-year fixed effects and finds a positive and significant coefficient. In column 2, we drop firm-year fixed effects and add firm-country fixed effects and continue to find a positive and significant coefficient, albeit a smaller one. In column 3, we add back the firm-year fixed effects to have the full set of fixed effects, and find that the coefficient barely budges from the one in column 2. This means that firm-year fixed effects do not matter as much for the coefficient of our interest.

Table 4: Estimation Results for Total Imports (Extensive Margin)

	OLS (1)	OLS (2)	OLS (3)	PPML (4)	PPML (5)
$\ln emp_{ijt}$	0.0740***	0.0281***	0.0253***	0.0941***	0.0852***
	(0.0011)	(0.0001)	(0.0001)	(0.0058)	(0.0049)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	No	Yes	Yes	No
Firm-Country FE	No	Yes	Yes	No	Yes
R^2 / pseudo-R^2	0.231	0.598	0.602	0.312	0.142
N	85,698,494	79,368,479	79,368,479	6,572,687	1,505,018

Notes: The dependent variable imp_{ijst} is a binary variable indicating whether firm i in sector s imports from country j in year t. The explanatory variable $\ln emp_{ijt}$ is the log number of hired employees (+1) from country j. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

Table 5: Estimation Results for Intermediate and Non-Intermediate Goods (Extensive Margin)

	Intermediate Goods			Non-Intermediate Goods		
	OLS (1)	PPML (2)	PPML (3)	OLS (4)	PPML (5)	PPML (6)
$\ln emp_{ijt}$	0.0187***	0.1086***	0.0958***	0.0220***	0.1484***	0.0880***
	(0.0000)	(0.0068)	(0.0058)	(0.0010)	(0.0074)	(0.0061)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes
R^2 / pseudo-R^2	0.583	0.314	0.146	0.554	0.550	0.310
N	79,368,479	4,762,220	1,108,378	79,368,479	4,949,080	1,065,784

Notes: The dependent variable imp_{ijst} is a binary variable indicating whether firm i in sector s imports from country j in year t. The explanatory variable $\ln emp_{ijt}$ is the log number of hired employees (+1) from country j. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

The coefficient in column 3 implies that when the number of migrants from a specific country increases by 10%, the probability of importing from that country raises by 0.25 percentage points.

[7]The number of observations might differ across specifications due to the number of singletons caused by the inclusion of different fixed effects.

More specifically, a one standard deviation (0.165) increase in the log number of migrant workers increases the probability of importing from the country of origin by 0.4 percentage points, explaining about a fifth of the average probability of importing (2%). In column 4, we switch to PPML with country-sector-year and firm-year fixed effects, and in column 5 we use the more conservative country-sector-year and firm-country fixed effects. In both cases, we find a positive and significant coefficient, with larger magnitudes when compared to our OLS results.

In Table 5, we do the same exercise by separating imports into intermediate versus non-intermediate goods based on BEC classification. In column 1, we use the linear probability model with the full set of fixed effects and find a positive and significant coefficient. PPML results in columns 2 and 3 corroborate this result. The most conservative coefficient in column 1 indicates that a 10% boost to the number of employees from a certain origin increases the likelihood to start sourcing inputs from that country by about 0.2 percentage points. Interestingly, the estimated positive and significant coefficients with similar magnitudes in columns 4-6 with non-intermediate goods imply that the importing relationship does not hinge on whether the goods are intermediates or not.

3.3 Intensive Margin

In this section, we present the results for the intensive margin of importing. Keeping the structure of our tables the same, we use OLS in columns 1-3, and PPML in columns 4-5. Note that since the log of imports is defined only for positive values, the OLS samples are much smaller than the analogous extensive margin samples. The estimated coefficients in columns 1-3 show that the effect is positive and significant, and the most restrictive specification in column 3 indicates that a 10% increase in the number of migrant workers increases imports by 0.9%, explaining about 0.3% of average log imports. The PPML estimations in columns 4 and 5 take into account zero flows as well and find larger coefficients. The more conservative specification in column 5 with country-sector-year and firm-country fixed effects finds that the analogous effect is 2.1%.

In Table 7, we separate the sample to intermediate versus non-intermediate goods as before. We find that employing workers from a certain origin country increases both intermediate and non-intermediate imports. The OLS estimations with the most restrictive fixed effects in columns 1 and 4 indicate that doubling the number of workers increases intermediate and non-intermediate imports by 9% and 11% respectively. The PPML coefficients are somewhat larger for the non-intermediate good imports. This implies that migrant workers might be providing information about local demand to their employers that can be satisfied by importing final goods from their countries of origin.

The results above with the extensive and intensive margins confirm the findings by earlier studies that migrant employees increase trade. We show that this effect exists also for imports, regardless of whether the goods are intermediate products that help firm integrate into global value chains, or non-intermediates such as final goods that suggest demand-driven imports. In the next section, we dig deeper to understand which migrants are driving this market knowledge effect.

Table 6: Estimation Results for Total Imports (Intensive Margin)

	OLS (1)	OLS (2)	OLS (3)	PPML (4)	PPML (5)
$\ln emp_{ijt}$	0.5507***	0.3215***	0.0899***	0.4073***	0.2108***
	(0.0149)	(0.0163)	(0.0152)	(0.0482)	(0.0343)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	No	Yes	Yes	No
Firm-Country FE	No	Yes	Yes	No	Yes
R^2 / pseudo-R^2	0.505	0.807	0.815	0.844	0.962
N	1,259,322	1,185,301	1,046,372	6,572,687	1,505,018

Notes: The dependent variable imp_{ijst} is the log of imports of firm i in sector s imports from country j in year t. The explanatory variable $\ln emp_{ijt}$ is the log number of hired employees (+1) from country j. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

Table 7: Estimation Results for Intermediate and Non-Intermediate Goods (Intensive Margin)

	Intermediate Goods			Non-Intermediate Goods		
	OLS (1)	PPML (2)	PPML (3)	OLS (4)	PPML (5)	PPML (6)
$\ln emp_{ijt}$	0.0857***	0.2725***	0.1319***	0.1074***	0.4718***	0.2269***
	(0.0175)	(0.0540)	(0.0401)	(0.0192)	(0.0578)	(0.0468)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes
R^2 / pseudo-R^2	0.815	0.865	0.965	0.795	0.828	0.958
N	678,467	4,762,220	1,108,378	596,949	4,949,080	1,065,784

Notes: The dependent variable imp_{ijst} is the log of imports of firm i in sector s imports from country j in year t. The explanatory variable $\ln emp_{ijt}$ is the log number of hired employees (+1) from country j. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

3.4 Generations

In this section, we separate firm-country specific workers into first and second generation migrants. This exercise is novel as the existing literature has not taken later generations into account when examining the effect on trade. First generation migrants are born in a foreign country and thus are more likely to bring their market knowledge to their employers. We expect that subsequent generations who were born in their host countries have less knowledge about their origin countries than their parents, and hence they have a smaller impact on firm-level imports, if any.

Table 8 has our results. The top and bottom panels show the extensive and intensive margin results respectively. Columns 1-3 examine total firm-level imports, whereas columns 4-6 and 7-9 focus on intermediate and non-intermediate good imports. Looking at the extensive margin results, we see that the estimated coefficients for both the first and second generation migrant workers are positive and significant, regardless of the type of product. However, in most specifications, the first generation coefficients are significantly larger than the second generation coefficients, as expected. Column 4, for example, indicates that a 10% increase in the number of first generation migrants increases the probability of importing intermediates by 0.2 percentage points, whereas this figure is only 0.1 percentage points for second generation migrants.

The bottom panel of Table 8 shows the intensive margin results. The coefficient on the first generation migrants is always positive and significant, regardless of the type of product. However, the second generation coefficients, which are usually lower in magnitude, are not always statistically significant. Even though the OLS regressions indicate that second generation coefficients have an impact on imports, albeit at a lesser size than the first generation effects, the PPML estimations with firm-year fixed effects tend to make the second generation effects disappear. Overall, the results indicate that even though the first generation immigrants are the driving force behind the effect of migrant workers on firm-level imports, second generation immigrants still play a small positive role, especially in establishing relationships with their origin countries. This highlights that the second generation migrants still retain some market knowledge through their parents. In the next section, we explore heterogeneities within the first generation migrants.

3.5 Age Bins

We expect that immigrants' age when they settle in their host country could be decisive for the effect on firm-level trade. Accordingly, the estimations presented in this section takes into account different age groups of the first generation immigrants. The second generation is not considered since they are born in the host country. In our estimations, we consider three age groups of immigrants: younger than 19 years old, between 19 and 50 years old, and older than 50 years old. We expect that the ones between the ages of 19 and 50 to have the largest effect since the ones younger than 19 spent too little time in their origin countries and thus could be compared to second generation immigrants. On the other hand, migrants that emigrated above age 50 might have accumulated useful market knowledge, but this not be as relevant anymore if business networks deteriorate over time or they have trouble adapting to their new environment.[8]

Table 9 shows the estimation results at the extensive and intensive margins for the effects of migrant employees by age bins on total, intermediate, and non-intermediate imports. Focusing on the top panel that examines the extensive margin, we see that the only robust coefficient across the nine specifications is the one on the number of migrants that arrived in the Netherlands when they were between the ages of 19 to 50. This effect is present for both product groups, and both OLS and PPML specifications. Column 4 indicates that a 10% increase in the number of this type of employees increases the probability of importing intermediates from a country by about 0.3 percentage points. The coefficients of the 'less than 19 year old' employees lose their statistical significance in PPML specifications with firm-year fixed effects. On the other hand, the coefficients of the 'more than 50 year old' employees are robustly significant only for the imports of non-intermediate goods, hinting that these workers might be helpful for firms that sell final goods to migrant populations within

[8]The average number of workers that migrated after the age of 50 is the lowest (close to zero) among the three categories (see Table 3).

Table 8: Estimation Results for Total Imports, Intermediate and Non-Intermediate Goods by Generations (Extensive and Intensive Margins)

	(a) Extensive Margin								
	Total Imports			Intermediate Goods			Non-Intermediate Goods		
	OLS	PPML	PPML	OLS	PPML	PPML	OLS	PPML	PPML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln *generation 1* emp_{ijt}	0.0270***	0.0888***	0.0731***	0.0206***	0.1066***	0.0820***	0.0232***	0.1254***	0.0730***
	(0.0012)	(0.0070)	(0.0056)	(0.0010)	(0.0081)	(0.0066)	(0.0011)	(0.0090)	(0.0069)
ln *generation 2* emp_{ijt}	0.0149***	0.0218***	0.0634***	0.0103***	0.0236***	0.0706***	0.0135***	0.0589***	0.0643***
	(0.0009)	(0.0062)	(0.0056)	(0.0007)	(0.0072)	(0.0068)	(0.0009)	(0.0080)	(0.0069)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
R2 / pseudo-R2	0.602	0.312	0.142	0.583	0.315	0.146	0.554	0.310	0.148
N	79,368,479	6,572,687	1,505,018	79,368,479	4,762,220	1,108,378	79,368,479	4,949,080	1,065,784

	(b) Intensive Margin								
	Total Imports			Intermediate Goods			Non-Intermediate Goods		
	OLS	PPML	PPML	OLS	PPML	PPML	OLS	PPML	PPML
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
ln *generation 1* emp_{ijt}	0.0992***	0.3983***	0.1510***	0.0870***	0.2897***	0.1053**	0.1081***	0.4352***	0.1267***
	(0.0179)	(0.0520)	(0.0377)	(0.0204)	(0.0614)	(0.0485)	(0.0222)	(0.0589)	(0.0478)
ln *generation 2* emp_{ijt}	0.0339*	0.0782*	0.2089***	0.0557***	0.0410	0.1167***	0.0577**	0.0951	0.3056***
	(0.0174)	(0.0449)	(0.0367)	(0.0205)	(0.0492)	(0.0409)	(0.0229)	(0.0623)	(0.0554)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
R2 / pseudo-R2	0.815	0.844	0.962	0.815	0.865	0.965	0.795	0.828	0.958
N	1,046,372	6,572,687	1,505,018	678,467	4,762,220	1,108,378	596,949	4,949,080	1,065,784

Notes: In the top panel, the dependent variable imp_{ijst} is a binary variable indicating whether firm i in sector s imports from country j in year t. In the bottom panel, the dependent variable imp_{ijst} is the log of imports of firm i in sector s imports from country j in year t. The explanatory variables ln *generation 1* emp_{ijt} and ln *generation 2* emp_{ijt} are the log number of first and second generation hired employees (+1) from country j respectively. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

Table 9: Estimation Results for Total Imports, Intermediate and Non-Intermediate Goods by Age Bins (Extensive and Intensive Margins)

	(a) Extensive Margin								
	Total Imports			Intermediate Goods			Non-Intermediate Goods		
	OLS	PPML	PPML	OLS	PPML	PPML	OLS	PPML	PPML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln $<$*19* emp_{ijt}	0.0080***	0.0114	0.0269**	0.0057***	0.0336	0.0384**	0.0066*	- 0.088	0.0236
	(0.0014)	(0.0197)	(0.0125)	(0.0011)	(0.0265)	(0.0162)	(0.0014)	(0.0221)	(0.0144)
ln *19-50* emp_{ijt}	0.0355***	0.0808***	0.0686***	0.0271***	0.1038***	0.0766***	0.0309***	0.1211***	0.0668***
	(0.0017)	(0.0087)	(0.0063)	(0.0015)	(0.0100)	(0.0075)	(0.0016)	(0.0106)	(0.0077)
ln $>$*50* emp_{ijt}	0.0460***	- 0.0999	0.0273	0.0435***	- 0.0438	0.0182	0.0473***	0.1546***	0.0365*
	(0.0088)	(0.0299)	(0.0168)	(0.0091)	(0.0322)	(0.0196)	(0.0083)	(0.0364)	(0.0208)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
R2 / pseudo-R2	0.602	0.312	0.142	0.583	0.315	0.146	0.554	0.309	0.148
N	79,368,479	6,572,687	1,505,018	79,368,479	4,762,220	1,108,378	79,368,479	4,949,080	1,065,784
	(b) Intensive Margin								
	Total Imports			Intermediate Goods			Non-Intermediate Goods		
	OLS	PPML	PPML	OLS	PPML	PPML	OLS	PPML	PPML
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
ln $<$*18* emp_{ijt}	0.0130	- 0.0191	0.3014***	0.0143	0.3960**	0.3286**	- 0.0042	- 0.2199*	0.3009***
	(0.0402)	(0.0111)	(0.0787)	(0.0542)	(0.1563)	(0.1484)	(0.0479)	(0.1230)	(0.0793)
ln *19-50* emp_{ijt}	0.1014***	0.4094***	0.1367***	0.0839***	0.2640***	0.1195***	0.1172***	0.4592***	0.0980***
	(0.0202)	(0.0545)	(0.0388)	(0.0227)	(0.0645)	(0.0466)	(0.0252)	(0.0630)	(0.0555)
ln $>$*50* emp_{ijt}	0.0770***	0.2007	0.0862	0.0134***	0.1089	- 0.0190	- 0.0286	0.0931	0.1549
	(0.0669)	(0.1569)	(0.0688)	(0.705)	(0.1521)	(0.0664)	(0.777)	(0.2136)	(0.1116)
Country-Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Firm-Country FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
R2 / pseudo-R2	0.815	0.844	0.962	0.808	0.865	0.965	0.795	0.826	0.958
N	1,046,372	6,572,687	1,505,018	678,467	4,762,220	1,505,018	596,949	4,949,080	1,065,784

Notes: In the top panel, the dependent variable imp_{ijst} is a binary variable indicating whether firm i in sector s imports from country j in year t. In the bottom panel, the dependent variable imp_{ijst} is the log of imports of firm i in sector s imports from country j in year t. The explanatory variables ln $<$*18* emp_{ijt}, ln *19-50* emp_{ijt}, and ln $>$*50* emp_{ijt} are the log number of migrants (+1) who arrived in the host country at age less than 19, between 19 and 50, and more than 50 from country j respectively. We present R^2 for the OLS specifications, and pseudo-R^2 for the PPML specifications. Robust standard errors clustered at the firm level are in parentheses. The significance levels are ***%1, **%5 and *%10.

Netherlands (i.e. the demand channel).

The intensive margin results presented in the bottom panel of Table 9 paints a largely similar picture. The coefficient of '19 to 50 year old' employees is robustly positive and significant, regardless of the type of good and specification. Column 4 shows that a 10% increase in the number of these employees increases intermediate good imports by 0.8%. In this case, neither the 'less than 19 year old' and 'more than 50 year old' coefficients are robust, indicating that the intensive margin results are driven by the '19 to 50 year old' migrants.

Overall, the results in this section imply that there is a non-linear effect of the age of arrival in the host country on firm-level imports. Immigrants that arrived too young probably do not have much market knowledge to contribute to their employers, and thus can be compared to second generation immigrants. Meanwhile, immigrants who were older than 50 when settling in the host country might have trouble acclimating to their new environment and thus fail to help their employers establish supply chains. Overall, the estimations conducted on both the extensive and intensive margins show that the age of arrival in the host country is an important determinant of the effect of market knowledge on imports.

4 Conclusion

In this paper, we have examined the effect of hiring workers with migrant backgrounds on firms' sourcing behavior from those workers' origin countries. To do so, we first created a sophisticated employer-employee dataset linked with firm-country level imports for the Netherlands in 2010-2017.

Using our dataset, we first documented the importance of migrant-background workers in the Netherlands, showing that the stock of migrant workers rose by 17.5% from 2010 to 2017, making about a quarter of total workforce by 2017. Our analysis showed that Dutch firms have become much more ethnically diverse with the rise of migration during the last decade, especially from Eastern European countries, satisfying the excess labor demand of the Dutch economy. We also showed that the stock of second generation immigrants are almost the same size of the stock of the first generation immigrants in the Netherlands, and thus are crucial to include to comprehend the role of workers with immigrant backgrounds in an economy.

We then analyzed whether migrants help their employers establish supply chains and increase imports from their origin countries. We used OLS and PPML estimations at the firm-country level with high dimensional fixed effects to close down virtually all channels that could include potential omitted variables. Our benchmark estimates indicated that a one standard deviation increase in the number of migrant-workers increased the probability to source inputs from the origin country by 0.4 percentage points, explaining about a fifth of the average probability of importing. The intensive margin results showed similar results with smaller magnitudes. We found that these effects exist not only for sourcing inputs, but also for importing final goods, hinting that demand might also be playing a role.

Digging deeper, we found, for the first time in the literature, that the effects are largely driven by first generation immigrants, with coefficients that are about twice the size of the ones of second generation immigrants. However, the second generation immigrants still have a positive, albeit small, effect on their employers' sourcing decisions, especially at the extensive margin. Among the first generation immigrants, our results indicate that it is the ones that arrived in the Netherlands between the ages of 19 and 50 that matter for the effect on imports. Workers that emigrated younger than 19 or older than 50 do not have a robust effect on their employers' sourcing decisions.

Our results contribute to the literature on the effects of migrants' market knowledge on firms' trading decisions, especially in terms of supply chain integration. We complement the results of Egger et al. (2019) by estimating firm-country level regressions with detailed migrant background information and show that migrants reduce barriers to market knowledge and help firms tighten their supply chains with other countries. Future research should aim to exploit exogenous migration shocks to firms to test the validity of the estimates found in this paper. Our study also raises potential additional research questions. For example, future research can examine whether migrant workers help their firms sustain global value chain relationships when faced with abrupt negative shocks such as the Covid-19 pandemic.

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A Appendix

Table A.1: Resident Permits by Reason

Reason	2010	2017	Change (%)	Shares in Total (%)	
			2010-2017	2010	2017
Asylum	8,680	25,815	109.0	15.9	47.4
Family reunification/formation	21,565	30,970	36.2	39.6	56.8
Study	10,510	17,240	49.5	19.3	31.6
Work	10,450	17,745	53.0	19.2	32.6
Other	3,275	7,420	81.8	6.0	13.6

Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

Table A.2: Population by Dutch Natives and Migrants

Population	2010	2017	Change (%)	Shares in Total (%)	
			2010-2017	2010	2017
I. Total	16,655,799	17,181,084	3.2	100.0	100.0
Dutch Background	13,228,780	13,209,225	-0.1	79.4	76.9
Migration Background	3,427,019	3,971,859	15.9	20.6	23.1
- 1st Generation	1,735,217	2,079,329	19.8	10.4	12.1
– Age below 19	136,871	170,201	24.4	7.9	8.2
– Age between 19 and 50	1,039,600	1,134,174	9.1	59.9	54.5
– Age above 50	523,280	696,800	33.2	30.2	33.5
– N.A. (unknown age)	35,466	78,154	120.4	2.0	3.8
- 2nd Generation	1,691,802	1,892,530	11.9	10.2	11.0
II. Migrant Groups	3,427,019	3,971,859	15.9	100.0	100.0
Indonesian	380,047	361,594	-4.9	11.1	9.1
Surinamese	344,734	351,681	2.0	10.1	8.9
Turkish	388,967	404,459	4.0	11.4	10.2
Moroccan	355,883	396,539	11.4	10.4	10.0
German	378,581	354,136	-6.5	11.0	8.9
Polish	87,323	173,050	98.2	2.5	4.4
Antillianen	138,636	151,098	9.0	4.0	3.8
Belgian	113,513	118,725	4.6	3.3	3.0
Romanian	15,785	29,417	86.4	0.5	0.7
Bulgarian	16,961	30,899	82.2	0.5	0.8
Others	1,206,589	1,600,261	32.6	35.2	40.3

Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

Table A.3: Imports by SBI Business Activities (2010)

SBI Codes and Business Activities	Number of Firms	Employment		Imports			
		Total	Migrants	Total	Intermediate	Non-Intermediate	% of Imports
Total	45,368	2,667,719	684,176	257,451	142,984	94,594	100.0
Top 20 sectors	31,252	1,306,019	338,719	209,055	110,698	83,099	85.0
46-Wholesale trade (except motor vehicles and motorcycles)	18,129	380,159	89,205	96,508	49,291	43,088	41.3
52-Warehousing and support activities for transportation	786	46,555	14,196	36,902	12,858	19,507	6.5
47-Retail trade (except motor vehicles)	3,318	393,019	119,583	10,967	4,031	6,855	5.2
45-Sale and repair of motor vehicles	1,730	47,764	8,296	10,679	3,074	1,895	5.0
10-Manufacture of food products	695	65,219	17,769	9,126	5,698	3,428	4.2
35-Electricity, gas, etc. supply	57	20,915	3,861	5,514	5,442	71	3.6
20-Manufacture of chemical products	359	33,313	7,347	9,313	8,351	248	3.5
29-Manufacture of motor vehicles	199	13,949	3,384	2,887	2,299	520	2.6
28-Manufacture of machinery and equipment (rest)	1,152	60,986	10,544	5,380	3,969	1,411	2.5
70-Holding companies (not financial)	1,367	58,496	19,827	4,997	2,579	2,408	2.1
26-Manufacture of computers, electronic, etc. products	542	23,469	5,964	3,483	2,215	1,268	1.4
33-Repair and installation of machinery	456	22,071	5,060	1,970	1,509	459	1.4
25-Manufacture of fabricated metal products	1,161	50,254	10,202	2,850	2,603	246	1.3
24-Manufacture of basic metals	85	14,993	3,930	2,989	2,966	23	0.9
22-Manufacture of rubber and plastic products	505	22,449	5,685	1,660	1,437	220	0.8
30-Manufacture of other transport equipment	203	14,052	2,435	1,168	660	508	0.8
27-Manufacture of electrical equipment	314	17,698	4,003	1,780	1,260	517	0.7
63-Information service activities	146	2,328	1,053	362	81	281	0.7
51-Air transport	48	18,330	6,375	520	375	145	0.7
21-Manufacture of pharmaceutical products	91	14,543	3,175	1,693	796	894	0.6
Others	14,025	1,347,157	342,282	46,704	31,490	10,601	14.4

Notes: Imports are in million Euros.
Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).

Table A.4: Imports by SBI Business Activities (2017)

SBI Codes and Business Activities	Number of Firms	Employment		Imports			
		Total	Migrants	Total	Intermediate	Non-Intermediate	% of Imports
Total	56,776	3,016,588	890,016	283,124	151,979	113,032	100.0
Top 20 sectors	36,530	1,503,695	459,246	240,662	119,312	104,643	81.2
46-Wholesale trade (except motor vehicles and motorcycles)	19,747	421,947	114,776	116,859	50,207	61,625	37.5
52-Warehousing and support activities for transportation	996	58,883	22,873	18,494	5,058	10,832	14.3
47-Retail trade (except motor vehicles)	4,964	496,391	183,397	14,705	3,867	10,584	4.3
45-Sale and repair of motor vehicles	2,213	57,956	9,877	14,275	4,138	3,422	4.1
10-Manufacture of food products	688	70,682	21,816	11,768	6,691	5,055	3.5
35-Electricity, gas, etc. supply	86	24,011	4,526	10,088	10,032	56	2.1
20-Manufacture of chemical products	366	32,219	8,095	10,004	8,439	258	3.6
29-Manufacture of motor vehicles	197	16,903	5,132	7,264	6,267	963	1.1
28-Manufacture of machinery and equipment (rest)	1,328	72,205	13,493	7,122	5,607	1,513	2.1
70-Holding companies (not financial)	1,809	53,520	22,702	5,969	3,245	1,989	1.9
26-Manufacture of computers, electronic, etc. products	574	20,707	6,030	3,945	1,287	2,658	1.4
33-Repair and installation of machinery	707	30,537	6,800	3,930	2,775	1,155	0.8
25-Manufacture of fabricated metal products	1,277	52,736	10,562	3,571	3,196	374	1.1
24-Manufacture of basic metals	103	13,871	3,581	2,457	2,439	17	1.2
22-Manufacture of rubber and plastic products	569	25,021	7,044	2,340	2,037	299	0.6
30-Manufacture of other transport equipment	220	13,576	2,477	2,136	988	1,147	0.5
27-Manufacture of electrical equipment	372	16,402	4,558	2,007	1,161	843	0.7
63-Information service activities	259	6,009	3,429	1,879	1,139	740	0.1
51-Air transport	55	20,119	8,078	1,850	737	1,112	0.2
21-Manufacture of basic pharmaceutical products	109	10,778	3,053	1,632	861	770	0.7
Others	20,137	1,502,115	427,717	40,829	31,806	7,619	18.1

Notes: Imports are in million Euros.
Source: Authors' calculations based on data from the Dutch Central Bureau of Statistics (CBS).