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Abstract

Migrants are commonly thought to foster trade by reducing frictions induced by incomplete information and contracts as well as by transplanting their home bias in preferences into their host countries. While early work provided supportive evidence for a pro-trade effect of migrants, Parsons (2012) finds that the "implementation of [pair fixed effects] removes all of the positive impact of migration on trade" (abstract). Using the same data, but switching from a linear to a Poisson Pseudo Maximum Likelihood (PPML) specification currently recommended in the gravity literature, I restore a positive causal effect of migrants on trade between their home and host countries. Moreover, combining the OECD Database on Immigrants in OECD and non-OECD Countries and the International Trade and Production Database for Estimation (ITPD-E), I provide new evidence that accounts for domestic trade diversion and globalization effects. Finally, I adapt an approach proposed by Heid et al. (2020) to provide new theory-consistent evidence on the effect of migrants from the same host country on trade between their countries of residence.

JEL-Classification: F22, F14

Keywords: International migration, migrant networks, international trade, structural gravity

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1 Introduction

Since 1960, the stock of international migrants has increased from 71 to 281 million, which is almost a quadrupling. Despite this strong increase in the absolute numbers, the share of international migrants in the world population has remained relatively stable at 2.8% to 3.6% between 1990 and 2020. The economics literature emphasizes the role of international migration for international trade.

Migrants may enhance trade through the following channels. First, by creating networks for the transmission of valuable information on foreign sales and sourcing opportunities migrants may help to overcome informational barriers related to language, culture, or institutions (Gould, 1994). Anderson and van Wincoop (2004) argue that the ad valorem tariff equivalent of informational costs is about 6%. Second, migrant networks may work as a device of contract enforcement when institutions are weak (Rauch, 2001; Rauch and Trindade, 2002). Third, immigrants may transplant their "home bias" in preferences into their home countries. They keep their taste for goods from their home countries and foster other residents to acquire a taste for those new goods (Gould, 1994; Combes et al., 2005).

More recently, the literature has discussed further channels. Ottaviano and Peri (2006) argue that migration-induced diversity of the workforce may enhance the productivity level of the country, which may have repercussions on the intensive and extensive margin of trade. Migration and trade can also be negatively associated. First, the Heckscher-Ohlin model predicts that trade and factor flows are substitutes. Second, horizontal foreign direct investment (FDI) and trade can be substitutions. FDI, in turn, may involve migration of high-skilled workers, the so-called expatriates (Bergstrand et al., 2008). Furthermore, migrants may transfer part of their income back to their home countries (remittances), which shapes the overall demand pattern of the two countries.

Separation of these channels is important from a welfare point of view. Trade creation due to the alleviation of informational barriers and frictions constitutes a source of welfare gains for the host and source country. A migration-diversity induced productivity increase is welfare-improving. Trade creation due to the preference channel, in contrast, involves a welfare loss insofar as for immigrants formerly domestic goods are now subject to trade costs.

The trade-migration-nexus is typically studied using the gravity equation of international trade. The gravity equation explains bilateral trade by characteristics of both trading partners (such as GPDs and multilateral resistance terms) and proxies for trade costs (such as geographical distance). Early work for single-anchor countries or single ethnic networks find positive effects of migrants on trade (Gould, 1994; Head and Ries, 1998; Girma and Yu, 2002; Rauch and Trindade, 2002; Wagner et al., 2002). Felbermayr and Jung (2009) provide evidence on the pro-trade of migration in a two-period setting with migration into OECD countries.

Following Felbermayr et al. (2010), I explore the role of the trade cost channel which captures incomplete information and contracts as well as the preference channel in the gravity framework and derive theory-consistent gravity equations. In order to tell the channels apart, I study different types of migrant links. If the trading partners host migrants from the respective partner country, these migrants constitute what is called a *direct* link (Felbermayr et al., 2010). However, the two trading parters might also host immigrants from some third country. These immigrants constitute *indirect* links. Prominent examples of indirect links are the ones created by Chinese ethnic networks (Rauch and Trindade, 2002) or the Jewish diaspora.[1] While the effect of migrants on bilateral trade that operates through direct links compounds the effects of various channels, the effect that operates through indirect links is by construction free of the preference channel. The productivity and the remittances channels are captured by exporter-and-time and importer-and-time effects. The aim of this paper is to quantify the *partial* trade effects of migrant links.

The theoretical gravity framework postulates a multiplicative relationship between bilateral trade and its determinants. While for a long time, the empirical gravity literature has simply log-linearized this relationship in order to make it ready for the estimation by ordinary least squares (OLS), Santos Silva and Tenreyro (2006) warn that this approach is not innocu-

[1] Unlike Rauch and Trindade (2002), the data I use rely on a foreign-born concept. Persons classified as migrants according to the foreign-born concept may hold the nationality of the country they are residing in. The idea is that they carry the same information about their country of birth because they lived part of their live in their country of birth.

ous. The reason is that the moment conditions for the OLS estimation involve deviations of the *log* of the actual trade flows from the *log* of the predicted trade flows. They suggest to estimate the gravity equation in levels using the Poisson Pseudo Maximum Likelihood (PPML) estimator. The moment conditions for the PPML estimation involve deviations of the actual trade flows from the predicted trade flows in levels (Head and Mayer, 2014). Jensen's inequality implies that the two approaches are not the same. Thus, OLS and PPML estimations make different assumptions about the structure of the error term. Yotov et al. (2016) recommend using PPML in empirical gravity analysis.

Using a sample with about 60 countries covering the period from 1960 to 2000 at 10-year intervals and applying a linear specification, Parsons (2012) finds that the "implementation of [pair fixed effects] removes all of the positive impact of migration on trade" (abstract). Using the same data as Parsons (2012), but switching from a linear to a Poisson Pseudo Maximum Likelihood (PPML) specification, I find a positive effect of both immigrant and emigrants on bilateral trade. Thus, the change in the estimator leads to a dramatic reversal of the insights about the trade-migration nexus. The result is robust to accounting for phasing-in of trade agreements and to employing the CEPII Gravity Database (Head et al., 2010; Conte et al., 2021) that covers more countries.

Felbermayr et al. (2014) also apply an alternative estimator – a first difference estimator – but use a dataset that covers more countries than Parsons' original dataset. With these simultaneous changes in the dataset and the estimation method, they find a positive effect of immigrants on imports and no significant of emigrants on countries' imports. As the immigrant effect can be blurred by the preference channel, they cannot provide clear evidence on the prevalence of the trade cost channel. I show that both the trade cost channel and the preference channel are prevalent even in the dataset originally used by Parsons (2012).

Even for the PPML specification, there might be concerns about endogeneity. Anderson (2011) develops a gravity equation for migration. Geographical and cultural distance may drive both trade costs and migration costs. Orefice (2015) explores the relationship between preferential trade agreements (PTA), an important driver of bilateral trade flows, and migrant flows. Modern PTAs may contain provisions that are directly related to migration. Moreover, they may contain provisions related to trade in services, which might a complement or a substitute to trade in goods. Finally, they may contain labor-market provisions, which make the labor market more attractive and foster migration. Panel data approaches allow to include pair fixed effects. In the context of regional trade agreements (RTA) and linear specifications, Baier and Bergstrand (2007) show that pair fixed effects help to overcome the endogeneity problem.[2] They perform a regression-based F-test for strict exogeneity recommended by Wooldridge (2010) and find that it is not possible to reject strict exogeneity of RTAs. In a two-period linear model of trade and migration into OECD countries, Felbermayr and Jung (2009) successfully apply this test to migration. I apply the Wooldridge test to PPML specifications and find that in the preferred specifications, it not possible to reject strict exogeneity of migration.

Felbermayr and Jung (2009) have used data on immigrants from the poor Southern countries into the rich OECD countries in 1990 and 2000 (Docquier and Marfouk, 2006) in order to explore the role of migrants' education. Given that the dataset only contains data on migration from non-OECD into OECD countries but not from OECD into non-OECD countries, immigrants and emigrants countries cannot be included simultaneously in a standard gravity equation of (directed) bilateral trade. In order to circumvent the problem, Felbermayr and Jung (2009) have regressed a geometric average of a OECD country's imports from and exports to the poor countries on immigration. This approach, however, does not allow to separate the trade cost and the preference channel. I basically replicate the analysis, but run two separate regressions, one on imports of OECD countries and one on exports of OECD counties, using linear and PPML specifications. By and large, I affirm the results in Felbermayr and Jung (2009). In light of the PPML estimation, the role of medium-skilled immigrants, however, has to be refined.

Moreover, I use the PPML approach to provide evidence on the direct network effects in more recent years. More specifically, I utilize the OECD Database on Immigrants in OECD

[2] Yotov et al. (2016) demonstrate that this insight also holds for PPML specifications.

and non-OECD Countries (DIOC-E), which contains information on the stocks of immigrants in around 100 countries from 220 countries and territories for the years 2000 and 2010. I merge the migration data with trade data from the International Trade and Production Database for Estimation (ITPD-E) (Borchert et al., 2020). The advantage of this dataset is that it contains information on intra-national trade flows and the domestic-born population. This is an advantage as the theoretical framework suggests to include intra-national trade. Moreover, it allows to control for the effect of international borders on world trade (Bergstrand et al., 2015). Yotov et al. (2016) have coined these "globalization" effects. I find only weak evidence on the prevalence of the preference and the trade cost channel. However, one has to bear in mind that the panel is very short and that the specification includes exporter-and-time, importer-and-time, and asymmetric pair fixed effects, and is thus very demanding.

Finally, the presence of intra-national flows allows us to properly estimate *indirect* network effects. While the theoretical framework commands the inclusion of exporter-and-time and importer-and-time effects, the indirect network effect cannot be identified in these specifications due to collinearity of the immigrant shares with exporter-and-time and importer-and-time fixed effects. Felbermayr et al. (2010) have used country-and-time effects to circumvent the problem, which was popular at that time due to computational constraints (Baier and Bergstrand, 2007). In the presence of intra-national trade flows, however, the effect of country characteristics can be identified. I adapt the approach proposed by Heid et al. (2020) in the context of non-discriminatory trade policy and interact migrant networks with a dummy that indicates international transactions. Out of 217 regressions for each sending country/territory which allow for diversion from domestic sales and control for direct links and globalization effects, I find 63 statistically significant positive indirect networks and 58 statistically significant negative networks.

A PPML panel data approach has been used in the literature to estimate the evolution of the distance effect (Yotov, 2012), the effect of economic integration agreements (Bergstrand et al., 2015), and to carve out the heterogeneity in the effects of economic integration agreements (Baier et al., 2019).[3] In related work, Larch et al. (2019) use a PPML panel data approach to reassess the common currency effect. While they find that the common currency effect vanishes when using PPML, I find that the pro-trade effect of migrant networks revives when using PPML. In the regressions, I include controls for joint membership in economic integration agreements and for a common currency, but focus on the role of migrant networks.

PPML might be inadequate when the elasticities of trade costs are not constant and might be subject to small-sample bias (Head and Mayer, 2014). Using a non-parametric approach, Egger and Lassmann (2018) explore the interaction of the pro-trade effect of migrants with linguistic proximity. I stick to the assumption of constant elasticities of trade in migrant networks and leave the bias correction procedures proposed by Weidner and Zylkin (2020) for further research.

The paper is related to Aleksynska and Peri (2014) who utilize the DIOC-E database in a cross-sectional approach for the year 2000. They do not only have information about the educational attainment of migrants, but also about their occupation in the host country. This allows them to fine-tune the measurement of business migrant networks. They find that the share of immigrants in occupations relevant for international business, conditional on the stock of immigrants, has a large and significant effect on trade. However, information about the occupation is a unique feature of the data for 2000. The DIOC-E database for 2010 does not contain information about the occupation of immigrants. Thus, while I apply panel data techniques that allow us to control for unobserved pair-specific heterogeneity and trade data that include intra-national trade flows, I have to work with a rougher measure of migrant networks.[4]

The remainder of the paper is structured as follows. In section 2, I derive a theory-consistent empirical gravity equation that is suited to identify the trade-effects of direct and indirect

[3]Felbermayr et al. (2010) and occasionally Aleksynska and Peri (2014) also run PPML regressions, but use a cross-sectional approach.

[4]It is important to note, however, that also migrants who are not employed at all or not employed according to their initial training might carry information about business opportunities.

links established by migrant networks. In section 3, I reassess the effect of migrant networks, considering direct links over the period 1960-2000 and exploring the role of eduction. In section 4, I provide new evidence on the trade effect of direct links for the period 2000-2010, taking trade diversion from domestic sales and globalization effects into account. Moreover, I identify the trade effects of indirect links. The final section concludes.

2 Migration networks in the gravity equation

Building on Combes et al. (2005), Felbermayr et al. (2009) incorporate direct and indirect migrant networks in a theory-based gravity model à la Anderson and van Wincoop (2003). This basic gravity model focuses on the demand side, but does not model the production process explicitly.[5]

2.1 A theory-consistent gravity equation

The bare bones of the model. The model features $i = 1..n$ countries. Each country is assumed to be endowed with Q_i units of distinct good $i = 1..n$. The preferences of the representative consumer in each country is represented by the constant elasticity of substitution (CES) utility function

$$C_j = \left(\sum_{i=1}^{n} (a_{ij}(\cdot) c_{ij})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where c_{ij} is demand for good i in country j, $\sigma > 1$ is elasticity of substitution between any goods from different countries, and $a_{ij}(\cdot)$ measures the preference of the representative consumer in country j for good i. The preference parameter will be made a function of the stock

[5] Felbermayr et al. (2014) develop a variant that is based on a monopolistic competition model of international trade. For the derivation of the estimation equation, this does not make a difference. Indeed, there are even more models that yield a gravity equation; see Costinot and Rodríguez-Clare (2014).

of bilateral migrants; see below. The price index dual to (1) is given by

$$P_j = \left(\sum_{i=1}^{n} \left(\frac{P_{ij}}{a_{ij}(\cdot)} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}, \tag{2}$$

where P_{ij} is the price of good i in country j.

The domestic price P_{ii} of good i can be expressed as a function of country i's total income, Y_i, and its endowment: $P_{ii} = Y_i/Q_i$. International transactions are subject to variable trade costs $T_{ij}(\cdot)$, where $T_{ij}(\cdot) \geq 1$ represents the number of units of good i that has to be shipped in order for one unit to arrive at country j. Trade costs will be assumed to be a function of the stock of migrants; see below. In order to rule out arbitrage opportunities, the price of good i in country j must be equal to $P_{ij} = T_{ij}(\cdot) \cdot P_{ii}$.

Let X_{ij} denote the total value of country j's imports from country i. Given CES utility, bilateral trade flows satisfy

$$X_{ij} = \left(\frac{T_{ij}(\cdot)}{a_{ij}(\cdot)} \frac{P_{ii}}{P_j} \right)^{1-\sigma} E_j = \frac{\left(\frac{T_{ij}(\cdot)}{a_{ij}(\cdot)} \right)^{1-\sigma} \left(\frac{Y_i}{Q_i} \right)^{1-\sigma}}{\sum_{\ell=1}^{n} \left(\frac{T_{\ell j}(\cdot)}{a_{\ell j}(\cdot)} \right)^{1-\sigma} \left(\frac{Y_\ell}{Q_\ell} \right)^{1-\sigma}} E_j, \tag{3}$$

where $E_j = \sum_{i=1}^{n} X_{ij}$ denotes country j's aggregate expenditure. Equation (3) can be rewritten as

$$X_{ij} = \left(\frac{T_{ij}(\cdot)}{a_{ij}(\cdot)} \right)^{1-\sigma} S_i \cdot M_j, \tag{4}$$

where $S_i \equiv (Y_i/Q_i)^{1-\sigma}$ is an exporter-specific term and $M_j \equiv E_j / \sum_{\ell=1}^{n} \left(\frac{T_{\ell j}(\cdot)}{a_{\ell j}(\cdot)} \right)^{1-\sigma} \left(\frac{Y_\ell}{Q_\ell} \right)^{1-\sigma}$ is an importer-specific term. Thus, equation (3) fits into the typical definitions of a gravity equation (Head and Mayer, 2014), with the main difference being that the bilateral term includes not only trade costs, but also the preference parameter. Following Anderson and Wincoop (2003), one could derive the general equilibrium version of equation (4). In a multi-period version of the model, all variables in equation (4) but the elasticity of substitution additionally have a time index.

The gravity equation. Before the trade cost and preference channels are specified, we introduce exporter-and-time and importer-and-time fixed effects, ν_{it} and ν_{jt}. In the regressions, these fixed effects capture all time-varying exporter-specific and importer-specific characteristics, S_{it} and M_{jt}.

Additionally, (asymmetric) pair-specific fixed effects, ν_{ij}, are included. The pair fixed effects capture all time-invariant pair-specific characteristics that are observable such as geographical distance and common language as well as those that are essentially unobservable such as common cultural roots. Controlling for pair-specific heterogeneity is known to be important in the estimation of gravity equations. In the context of trade policy analysis, Baier and Bergstrand (2007) show accounting for pair-specific heterogeneity by means of pair fixed effects solve the problem caused by the potential endogeneity of regional trade agreements (RTA). Felbermayr and Jung (2009) demonstrate that the same argument also applies to migrants.

Finally, let $\boldsymbol{\zeta}_{ijt}$ denote the vector of time-varying determinants of bilateral trade costs such as common membership in a free trade agreement and a common currency and let $\boldsymbol{\beta}$ be the vector of the corresponding (semi-)elasticities. Then, the gravity equation emerges as

$$X_{ijt} = \exp\left\{(1-\sigma)\ln\left(\frac{\tilde{T}_{ijt}(\cdot)}{\tilde{a}_{ijt}(\cdot)}\right) + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}. \tag{5}$$

In this version of the gravity equation, the preference parameter $\tilde{a}_{ijt}(\cdot)$ and trade costs $\tilde{T}_{ijt}(\cdot)$ are "purged" from any time-varying exporter-specific and importer-specific characteristics (which are captured by ν_{it} and ν_{jt}), from time-invariant pair-specific characteristics ν_{ij}, and from the time-varying gravity controls $\boldsymbol{\zeta}_{ijt}$. In the analysis below, the terms $\tilde{a}_{ijt}(\cdot)$ and $\tilde{T}_{ijt}(\cdot)$ are supposed to be only functions of migrants. In gravity applications without migrants, the terms $\tilde{a}_{ijt}(\cdot)$ and $\tilde{T}_{ijt}(\cdot)$ are not present.

2.2 Migrant networks

Preference channel. The (purged) preference parameter $\tilde{a}_{ijt}(\cdot)$ is assumed to be a function of immigrants N_{ijt}. The presence of importer-and-time fixed effects ν_{jt} implies that only the *share* of immigrants from i in the population of the destination country j at time t matters.

Following Combes et al. (2005) and Felbermayr (2010, 2014), the preference parameter is assumed to be iso-elastic in immigrants

$$\ln \tilde{a}_{ijt}(N_{ijt}) = \alpha \ln N_{ijt}, \tag{6}$$

where α measures the elasticity of the (purged) preference parameter in immigrants N_{ijt} and is expected to be positive. With $\alpha > 0$, the strength of the preferences of country j's representative consumer for good i is increasing in the number of immigrants from i. The stock of migrants N_{ijt}, conditional on exporter-and-time and importer-and-time fixed effects ν_{it} and ν_{jt}, pair fixed effects ν_{ij}, and trade policy controls ζ_{ijt}, is supposed to be exogenous to the model.

The (purged) variable trade costs $\tilde{T}_{ijt}$ are assumed to be inversely related to the availability of information on trading opportunities between countries i and j, $\tilde{I}_{ijt}$. The availability of information, in turn, might be a function of migrants which is to be specified below.

Trade cost channel: Direct links. First, consider a specification based on migration between the two trading partners i and j and take the perspective of the importing country j. Emigrants (from j to i) may stay in contact with residents of their countries of origin and make the importing country's population aware of import opportunities from the source country i. Similarly, they they make residents of their host countries aware of exporting opportunities. Similarly, immigrants (from country i into j) make residents of their home countries aware of import opportunities or residents of their home countries of export opportunities. In both cases, people from the same country of birth establish *direct* links between two the two trading partners. These networks may increase the stock of available information $\tilde{I}^{\text{dir}}_{ijt} \equiv \tilde{I}^{\text{dir}}_{ijt}(N_{jit}, N_{ijt})$. The presence of exporter-and-time and importer-and-time fixed effects controls for the sizes of the two trading partners, such that effectively shares enter the equation.

An alternative interpretation of the direct links would be related to the enforcement of contracts in the presence of weak institutions. Migrants may guarantee that buyers and sellers do not engage in opportunistic behavior against each other.

It is a priori unclear whether immigrants or emigrants are more important for trade. Moreover, immigrants and emigrants can affect bilateral trade independently from each other. Suppose that the information generated is

$$\ln \tilde{I}^{\text{dir}}_{ijt}(N_{jit}, N_{ijt}) = \theta^{em} \ln N_{jit} + \theta^{im} \ln N_{ijt}. \tag{7}$$

Let $\ln \tilde{T}_{ijt} = -\ln \tilde{I}^{\text{dir}}_{ijt}$. Using equations (6) and (7) to substitute out $\tilde{a}_{ijt}(\cdot)$ and $\tilde{T}_{ijt}(\cdot)$ from equation (5), the empirical gravity equation can be rewritten as

$$X_{ijt} = \exp\left\{ \underbrace{(\sigma-1)\theta^{em}}_{\varrho^{\text{em}}} \ln N_{jit} + \underbrace{(\sigma-1)(\theta^{im}+\alpha)}_{\varrho^{\text{im}}} \ln N_{ijt} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij} \right\}. \tag{8}$$

The coefficient on emigrants, ϱ^{em}, captures the trade cost channel, while the coefficient on immigrants, ϱ^{im}, comprises both the trade cost and the preference channels. It would be tempting to conclude from $\varrho^{\text{im}} > \varrho^{\text{em}}$ that the preference channel is active. However, the theory does not make a prediction on how θ^{em} relates to θ^{im}, which deprives this consideration of its basis. Put differently, observing $\varrho^{\text{im}} > 0$ only allows to conclude that immigrants boost imports through the preference channel, through the trade cost channel, or through both channels

Trade cost channel: Indirect links. The problem with immigrant networks is that one cannot separate their effects through the preference channel and the trade cost channel; see equation (8). The second specification of the relationship between the stock of available information and migrants which is introduced now does not suffer from this problem. Immigrants from a third country k residing in the countries i and j establish an *indirect* link between the two trading partners. Again, migrants can alternatively be supposed to facilitate contract enforcement. In any case, the network can only be active when migrants from country k reside in both countries, i and j. To model this relationship, let

$$\ln \tilde{I}_{ijt}^{\text{indir,k}} = \theta^k \ln \left(N_{kit} N_{kjt} \right). \tag{9}$$

Imposing $\ln \tilde{T}_{ijt} = -\ln \tilde{I}_{ijt}^{\text{indir,k}}$, using equation (9) to substitute out $\tilde{T}_{ijt}$ from equation (5), and ignoring the preference channel for the moment, the gravity equation can be rewritten as

$$X_{ijt}^k = \exp \left\{ \underbrace{(\sigma - 1)\theta^k}_{\varrho^k} \ln \left(N_{kit} N_{kjt} \right) + \boldsymbol{\beta}' \boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij} \right\}. \tag{10}$$

It is easy to see that the terms N_{kit} and N_{kjt} are essentially characteristics of the exporter and the importer. Also, the product of the two terms does not bear a bilateral dimension.[6] Thus, the variable $\ln \left(N_{kit} N_{kjt} \right)$ will be dropped from an estimation of equation (10) including exporter-and-time and importer-and-time effects, such that ϱ^k can not be identified.

In order to circumvent this problem, Felbermayr et al. (2010) have worked with country-and-time effects. While this approach was common at that time due to computational issues (Baier and Bergstrand, 2007), it is theory-consistent only under the assumption that trade costs and preference parameters are symmetric. Here, I suggest an alternative, theory-consistent approach. Heid et al. (2020) show that including *intra*-national trade flows allows to identify the effects of non-discriminatory trade policy. Extending their approach, one may

[6] Note the difference to a situation where one considers the effect of joint membership in the World Trade Organization (WTO). Then, a dummy for joint membership takes the value 1 only if both countries are WTO members, but not if only one country is WTO member. Thus, the country characteristics do not determine the dummy variable in an additive way.

rewrite the empirical gravity equation as

$$\begin{aligned} X_{ijt} = & \exp\left\{\underbrace{(\sigma-1)\theta^{em}}_{\varrho^{\text{em}}}\ln N_{jit} + \underbrace{(\sigma-1)(\theta^{im}+\alpha)}_{\varrho^{\text{im}}}\ln N_{ijt} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt}\right\} \\ & \exp\left\{\underbrace{(\sigma-1)\tilde{\theta}^{k}}_{\tilde{\varrho}^{k}}\ln\left(N_{kit}N_{kjt}\right)\times INTER_{ij}\times I_{i,j\neq k} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}, \end{aligned} \tag{11}$$

where $INTER_{ij}$ is a dummy variable for international transactions and $I_{i\neq k}$ an indicator variable for pairs where the exporting country i does not coincide with the migrant home country k under consideration. For pairs where $i = k$, the trade effect should be loaded to the immigrant coefficient ϱ^{im}, which captures both the trade and the preference channel. The coefficient $\tilde{\varrho}^k$ represents the effect of migrant network k on international trade *relative* to intra-national trade. This does not mean that migrants from k do not have an effect on intra-national trade flows. However, the exporter-and-time and the importer-and-time fixed effects preclude the identification of of the overall effects of migrants from k (international and intra-national) trade. A positive $\tilde{\varrho}^k$ can be interpreted as a pro-trade effect of migrant networks that works through the trade cost channel.[7]

[7] Another alternative specification of equation (11) is

$$\begin{aligned} X_{ijt} = & \exp\left\{\underbrace{(\sigma-1)\theta^{em}}_{\varrho^{\text{em}}}\ln N_{jit} + \underbrace{(\sigma-1)(\theta^{im}+\alpha)}_{\varrho^{\text{im}}}\ln N_{ijt} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt}\right\} \\ & \exp\left\{\sum_k \underbrace{(\sigma-1)\bar{\theta}^{k}}_{\bar{\varrho}^{k}}\ln\left(N_{kj}\right)\times INTER_{ij}\times I_{k\neq i} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}, \end{aligned} \tag{12}$$

where coefficient $\bar{\varrho}^k$ captures the differential impact of importer migrant networks on international relative to domestic trade. In a setting where only exporters i that host immigrants from k are included, one has $\bar{\varrho}^k = 2\tilde{\varrho}^k$. Equivalently, the share of migrants in the exporting country could be used to identify $\bar{\varrho}^k$. This is an application of a result in Beverelli et al. (2018). They consider the effect of institutional quality on trade as an example of a country-specific characteristic. In the present setting, the share of immigrants from country k is the country-specific characteristic.

3 Reassessing the migrant network effects

3.1 Direct links

I now reassess the panel data evidence on direct links created by migrant networks provided by Parsons (2012), replicating his dataset. He employed the Global Bilateral Migration Database provided by the World Bank that contains information on bilateral stocks of migrants for the years 1960, 1970, 1980, 1990, and 2000 (Özden et al., 2011) and data on international trade flows published by Feenstra et al. (2005). While the migration data include information for a square matrix of 226×226 countries, the trade data only covers 72 countries or territories that report trade with 178 countries. After the necessary adjustments are made, one ends up with 63 countries, see Table A1 in the Appendix.[8] The potentially 63×62 country pairs account for a substantial share of world trade.[9] The final sample essentially resembles Parsons' (2012) "sample 1", which he uses in his baseline regressions. The dummies for common membership in a regional trade agreement (RTA) and a common currency come from CEPII's Gravity Data, which is based on Head et al. (2010).

Table 1 shows the results for different specifications to estimate the gravity equation (8). In all specifications, comprehensive sets of exporter-and-time and importer-and-time effects are included. Standard errors are clustered at the level of country pairs.[10]

In columns (1)-(3), a log-linear specification is employed. More precisely, column (1) dis-

[8]Belgium and Luxembourg only report separate trade figures for 2000, while for earlier years, only the aggregate figure is available. Thus, I also take the aggregate for 2000. This reduces the country count by 2. I aggregate up trade figures for the Czech Republic and Slovakia to "Czechoslovakia" for 2000, which reduces the country count by 2. For 2000, only trade for the Russian Federation and Kazakhstan is observed, but not for the other succession states of the USSR. The Former USSR is thus not included in 2000. The country count reduces by 2. For 2000, trade for Slovenia is observed, but not for other succession states of Former Yugoslavia. Former Yugoslavia is thus not included in 2000, which reduces the country count by 1. For 2000, trade for South Africa is observed, but not for the other member states of the South African Customs Union (which is reported as an aggregate for 1960-1990). The South African Customs Union is not included in 2000. This reduces the country count by 1. I link the data for West Germany and Germany, which reduces the country count by 1. The number of countries included thus shrinks from 72 to 63.

[9]Note that this dataset does not include intra-national trade.

[10]Recent work suggests multi-way clustering at the exporter, importer, and year dimension (Egger and Tarlea, 2015). This approach requires at least 50 units in each dimension. While the dataset has more than 50 exporters and importers, the number of time periods is limited to 5. Thus, I refrain from multi-way clustering.

Table 1: Reassessment - Direct links (1960-2000)

	FE			FD			PPML		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Immigrants)	0.005		0.005	0.047**	0.047**		0.047***	0.048***	
	(0.015)		(0.015)	(0.020)	(0.020)		(0.010)	(0.010)	
ln(Emigrants)	-0.016	-0.016		0.025		0.026	0.029***		0.031***
	(0.013)	(0.013)		(0.017)		(0.017)	(0.011)		(0.011)
RTA	0.566***	0.565***	0.569***	0.455***	0.455***	0.453***	0.377***	0.372***	0.371***
	(0.059)	(0.059)	(0.059)	(0.085)	(0.085)	(0.085)	(0.045)	(0.045)	(0.046)
Common currency	0.634***	0.633***	0.637***	-0.022	-0.021	-0.017	-0.059	-0.070	-0.080*
	(0.113)	(0.114)	(0.113)	(0.172)	(0.171)	(0.173)	(0.047)	(0.047)	(0.047)
(Pseudo) R-squared	0.910	0.910	0.910	0.512	0.512	0.511	0.991	0.991	0.991
F-test (p-value)	0.392	0.416	0.125	0.956	0.885	0.720	0.283	0.463	0.072

Notes: Results from estimating of equation (8) using different methods: Fixed effects (FE), First Differences (FD), Poisson Pseudo Maximum Likelihood (PPML). All regressions include a comprehensive set of exporter-and-time and importer-and-time effects (63 exporters and importers). FE and PPML include pair-fixed effects ($3,071$ pairs). In FD, pair-specific effects are eliminated by first differencing the data. Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 12,793$ observations in FE and PPML and $N = 9,365$ in FD. The last line reports the p-value of an F-test for (joint) significance of $\ln(Immigrants)_{t+10}$ and/or $\ln(Emigrants)_{t+10}$ in an expanded regression.

plays the estimates obtained from a Fixed Effects (FE) estimation with (asymmetric) pair fixed effects. In column (1), immigrants and emigrants are included simultaneously. The effect of immigrants on imports is 0.005 with a standard error of 0.015. The elasticity of imports in emigrants is -0.016 with a standard error of 0.013. In columns (2) and (3), only immigrants and emigrants, respectively, are included. The coefficients obtained are the same. Hence, it seems that migrant networks do not have a significant effect on trade. This is the main conclusion of Parsons' (2012) analysis. I also perform an F-test on (joint) significance of the leads of the immigrant and/or emigrant variable. According to these tests, strict exogeneity of the migrant variable(s) cannot be rejected.

In columns (4)-(6), still log-linear specifications are employed, but the model is estimated in first (time) differences. This approach has been used in Felbermayr and Jung (2009) and Felbermayr et al. (2014). The elasticity of imports in immigrants is estimated to be about 0.047 (with a standard error of 0.020), while emigrants do not seem to have a significant impact on imports. This result also occurs in specifications that include either immigrants or emigrants. Thus, there is evidence that immigrants do affect imports through the preference and/or the trade cost channel, while the trade cost channel based on emigrants seems to be inactive.

This finding is in line with Felbermayr et al. (2014). They, however, relied on a larger sample.[11] Again, based on the F-test, strict exogeneity of the migrant variable(s) cannot be rejected.

I now estimate equation (8) in its multiplicative form. Columns (7)-(9) presents the results from a Poisson PML specification. The elasticity of imports in, respectively, immigrants and emigrants are estimated to be 0.047 (with a standard error of 0.010) and 0.029 (with a standard error of 0.011). These magnitudes are in line with the FD results, the difference being that the emigrant effect is now estimated more precisely. Columns (8) and (9) show that the results are robust to the omission of the emigrant and immigrant link, respectively. This implies that immigrant and emigrant networks are, conditional on the battery of fixed effects and the controls, essentially uncorrelated. Based on the F-test, strict exogeneity of the migrant variable(s) cannot be rejected for the specifications that either include immigrants and emigrants or only immigrants.

Note that all estimation methods yield a positive coefficient on common membership in a regional trade agreement (RTA). The estimated coefficient is largest for the FE estimator, slightly lower for the FD estimator, and lowest for the Poisson PML estimator. The latter estimates imply that the trade among members of the same RTA is about $e^{0.37} - 1 \approx 45\%$ larger than trade among non-members. While I obtain a large and significant positive common currency effect from the FE estimator, all other estimation methods yield a small negative and mostly insignificant common currency effect, resembling the findings of Larch et al. (2018).

Baier and Bergstrand (2007) argue that RTAs phase in over a period of five to ten years. Thus, replicate the analysis, including a ten-year lagged RTA dummy. Table 2 shows the results. In the linear specification, the migrant coefficients turn positive, but remain small and statistically insignificant. The migrant coefficients in the PPML specification remain stable, and all specifications pass the test for strict exogeneity of migrant variables.

Summing up, I report robust evidence on the pro-trade effects of migrant networks through the trade cost channel and/or the preference channel. These effects arise even in the small

[11] I also replicate the analysis using trade data from the most recent version of the CEPII Gravity Database (Head et al., 2010) and find the same pattern as reported in Table 1; see below.

Table 2: Reassessment – Direct links (1960-2000) – Phasing-in of RTAs

	FE			PPML		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Immigrants)	0.008	0.008		0.044***	0.045***	
	(0.017)	(0.017)		(0.011)	(0.011)	
ln(Emigrants)	0.013		0.013	0.028**		0.030***
	(0.016)		(0.016)	(0.011)		(0.011)
RTA	0.536***	0.534***	0.535***	0.334***	0.328***	0.326***
	(0.061)	(0.061)	(0.061)	(0.044)	(0.045)	(0.045)
RTA t-10	0.272***	0.269***	0.271***	0.145***	0.146***	0.149***
	(0.077)	(0.077)	(0.077)	(0.032)	(0.032)	(0.033)
Common currency	0.400***	0.398***	0.399***	-0.081*	-0.092**	-0.101**
	(0.087)	(0.087)	(0.087)	(0.047)	(0.047)	(0.046)
(Pseudo) R-squared	0.913	0.913	0.913	0.990	0.990	0.990
F-test (p-value)	0.134	0.033	0.449	0.788	0.685	0.455

Notes: Results from estimating of equation (8) using different methods: Fixed effects (FE), First Differences (FD), Poisson Pseudo Maximum Likelihood (PPML). All regressions include a comprehensive set of exporter-and-time and importer-and-time effects (63 exporters and importers). FE and PPML include pair-fixed effects (3, 071 pairs). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 12,793$ observations. The last line reports the p-value of an F-test for (joint) significance of $\ln(Immigrants)_{t+10}$ and/or $\ln(Emigrants)_{t+10}$ in an expanded regression.

sample and even when sophisticated panel data techniques are used that properly control for multilateral resistance terms and unobserved, pair-specific heterogeneity. This result is in contrast to Parsons (2012) who concludes that “the implementation of [pair fixed effects] removes *all* of the positive impact of migration on trade” (abstract). The present estimates imply that doubling the stock of immigrants and emigrants raises bilateral trade by, respectively, $2^{0.047} - 1 \approx 3.3\%$ and $2^{0.027} - 1 \approx 1.8\%$.

The country coverage of the Feenstra et al. (2005) trade data is limited. As a robustness check, I work with trade data from the CEPII Gravity Database (Head et al., 2010), which – in combination with the migration data – allows to include 167 exporting and 153 importing countries into the analysis. Table 3 shows that the results. In the larger sample, the PPML specifications command to account for phasing-in of RTAs. The estimated coefficients for immigrant and emigrant effects are relatively symmetric, implying that doubling the stock of immigrants or emigrants raises imports by approx. 2.3%.

Table 3: Reassessment – Direct links (1960-2000) – Large sample

	FE		PPML	
	(1)	(2)	(3)	(4)
ln(Immigrants)	0.002	0.002	0.032***	0.030***
	(0.010)	(0.012)	(0.010)	(0.010)
ln(Emigrants)	0.010	0.017	0.034***	0.035***
	(0.009)	(0.011)	(0.010)	(0.010)
RTA	0.623***	0.552***	0.403***	0.344***
	(0.050)	(0.055)	(0.045)	(0.044)
RTA t-10		0.193***		0.175***
		(0.072)		(0.033)
Common currency	0.445***	0.560***	0.101*	0.076
	(0.105)	(0.122)	(0.052)	(0.051)
(Pseudo) R-squared	0.902	0.908	0.991	0.992
F-test (p-value)	0.471	0.594	0.057	0.152

Notes: Results from estimating of equation (8) using different methods: Fixed effects (FE) and Poisson Pseudo Maximum Likelihood (PPML). All regressions include a comprehensive set of exporter-and-time and importer-and-time effects and pair-fixed effects ($7,945$ pairs). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 27,478$ observations. The last line reports the p-value of an F-test for (joint) significance of $\ln(Immigrants)_{t+10}$ and/or $\ln(Emigrants)_{t+10}$ in an expanded regression.

3.2 The role of education

In order to explore the role of migrants' education for the operation of migrant networks, I revisit Felbermayr and Jung (2009). They used data from Docquier and Marfouk (2006) on migration links between 21 receiving OECD member countries (North) and 114 sending non-OECD countries (South) for the years 1990 and 2000.

By construction, the matrix of migration is not symmetric. As only migration from the South to the North is observed, one cannot include the number of immigrants and emigrants in the same regression. In order to capture immigrant and emigrant networks at the same time, Felbermayr and Jung (2009) take the perspective of a country located in the North, compute the geometric average of imports and exports, and relate this to the stock of immigrants. Averaging trade flows, however, may blur up the structure of the error term. Moreover, it does not allow to separate the channels through which migrant networks may affect trade. In order to avoid these problems, I run two separate regressions, one on imports and one on exports. From an econometric perspective this approach is unproblematic when immigrant and emigrant networks are uncorrelated. Table 1 suggests that this is indeed the case.[12]

The dataset includes information on the total number of migrants aged 25 or above and on the number of migrants by educational attainment e. There are three broad categories: migrants with tertiary education (high-skilled), secondary education (medium-skilled), and primary eduction (low-skilled) as their highest levels of educational attainment. In order to explore the role of educational attainment for the formation of migrant networks, conditional on the stock of immigrants, I include the share of migrants of the different education categories in addition to the total stock of immigrants. Let N and S denote the set of countries located in the North and South, respectively. Then, the estimation equations read

$$X_{ijt} = \exp\left\{\sum_e \varrho^{\text{im,e}} \ln\left(\frac{N^e_{ijt}}{N_{ijt}}\right) + \varrho^{\text{im}} \ln N_{ijt} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}, i \in S, j \in N \quad (13)$$

$$X_{jit} = \exp\left\{\sum_e \varrho^{\text{em,e}} \ln\left(\frac{N^e_{ijt}}{N_{ijt}}\right) + \varrho^{\text{em}} N_{ijt} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}, i \in S, j \in N, \quad (14)$$

where $e \in \{\text{high, medium, low}\}$. The variable X_{ij} denotes country j's imports and X_{ji} country j's exports.

The role of education for the formation of migrant networks is a priori unclear. Regardless of their education, migrants may increase imports via the preference channel. One could expect that high-skilled workers are particularly important for the formation of networks that enhance trade through the trade cost channel. However, it is not clear whether high-skilled immigrants end up in adequate occupations in their host countries (Aleksynska and Peri, 2014). Moreover, also medium- and low-skilled immigrants may increase the stock of available information and enable contract enforcement through informal channels.

I use the dataset from Felbermayr and Jung (2009). Trade data come from Feenstra et al. (2005). In order to reduce measurement error and enhance the number of non-missing observations, bilateral trade is averaged over three years around the survey year.

Table 4 shows the results of log-linear specifications of equations (13) and (14).[13] In columns

[12]In a similar setting, Aleksynska and Peri (2014) also take this approach.

[13]With just two periods, the Fixed Effects and the First-Difference estimators yield the same results; see

Table 4: Reassessment – The role of education (1990-2000) – OLS

	(1) Imp.	(2) Exp.	(3) Imp.	(4) Exp.	(5) Imp.	(6) Exp.	(7) Imp.	(8) Exp.	(9) Imp.	(10) Exp.
ln(Immig.)	0.123**	0.100**	0.128**	0.108**	0.135**	0.099**	0.121*	0.101**	0.145**	0.108**
	(0.063)	(0.044)	(0.064)	(0.045)	(0.063)	(0.044)	(0.063)	(0.044)	(0.065)	(0.045)
ln(Sh. high-skilled)			0.049	0.080					0.133	0.069
			(0.080)	(0.055)					(0.093)	(0.062)
ln(Sh. med.-skilled)					-0.261**	0.009			-0.253**	-0.013
					(0.107)	(0.085)			(0.112)	(0.087)
ln(Sh. low-skilled)							0.111	-0.053	0.116	-0.030
							(0.073)	(0.058)	(0.083)	(0.064)
Non-recipr. PTA	0.003	-0.526*	-0.000	-0.531*	-0.025	-0.525*	0.012	-0.530*	-0.023	-0.534*
	(0.386)	(0.303)	(0.386)	(0.302)	(0.391)	(0.303)	(0.385)	(0.303)	(0.388)	(0.303)
PTA	0.157	0.263**	0.158	0.265**	0.165	0.263**	0.135	0.273**	0.145	0.271**
	(0.144)	(0.132)	(0.144)	(0.132)	(0.144)	(0.132)	(0.144)	(0.132)	(0.144)	(0.132)
FTA	0.570***	0.430***	0.570***	0.429***	0.571***	0.430***	0.568***	0.431***	0.568***	0.430***
	(0.197)	(0.151)	(0.198)	(0.152)	(0.197)	(0.151)	(0.196)	(0.151)	(0.199)	(0.152)
Euro	0.407**	0.347**	0.398**	0.331**	0.483***	0.345**	0.422**	0.341**	0.469**	0.333**
	(0.166)	(0.157)	(0.166)	(0.159)	(0.183)	(0.160)	(0.171)	(0.164)	(0.187)	(0.164)
R-squared	0.970	0.977	0.970	0.977	0.970	0.977	0.970	0.977	0.970	0.977

Notes: Results from estimating equations (13) and (14) using Fixed effects (FE). First-difference (FD) estimator yields the same coefficients as the number of periods is equal to $T = 2$. All regressions include a comprehensive set of exporter-and-time effects (112 exporters), importer-and-time effects (20 importers), and pair-fixed effects (1, 192 pairs). The policy controls are a non-reciprocal preferential trade agreement (PTA), a PTA, common membership in a free trade agreement (FTA), common membership in the Euro zone (Euro). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 2,384$ observations.

(1) and (2), controls for the shares of educational groups are not included. The elasticity of imports and exports in immigrants is 0.123 (with a standard error of 0.063) and 0.100 (with a standard error of 0.044). The sizes of these coefficients are centered around the estimate for the elasticity of average trade in immigrants, which is 0.112 (Felbermayr and Jung, 2009, Table 4, column (1)). In columns (3) to (8), only one educational group and the total stock of immigrants are considered. While in all regressions the total stock of immigrants entails positive effects on imports and exports, conditional on the total stock of immigrants, immigrants of a particular educational group do not seem to have an extra effect on imports and exports. If anything, medium-skilled immigrants seem to have a lower than average effect on imports. This result is robust to the inclusion of all shares of immigrants of a particular educational group; see columns (9) and (10).

Table 5 reports the results of PPML estimations. In the specifications where the compo-

Wooldridge (2010).

Table 5: Reassessment – The role of education (1990-2000) – PPML

	(1) Imp.	(2) Exp.	(3) Imp.	(4) Exp.	(5) Imp.	(6) Exp.	(7) Imp.	(8) Exp.	(9) Imp.	(10) Exp.
ln(Immigrants)	0.090	0.070	0.094	0.075*	0.082	0.066	0.089	0.069	0.081	0.076*
	(0.060)	(0.045)	(0.061)	(0.045)	(0.057)	(0.044)	(0.059)	(0.045)	(0.056)	(0.045)
ln(Sh. high-skilled)			0.037	0.132***					0.052	0.160**
			(0.070)	(0.051)					(0.081)	(0.066)
ln(Sh. med.-skilled)					0.178**	0.084			0.208**	0.044
					(0.090)	(0.070)			(0.105)	(0.072)
ln(Sh. Low-skilled)							0.071	-0.025	0.141**	0.067
							(0.071)	(0.056)	(0.068)	(0.065)
Non-recipr. PTA	0.201	-0.624***	0.193	-0.641***	0.264	-0.608***	0.230	-0.626***	0.321	-0.630***
	(0.303)	(0.233)	(0.305)	(0.226)	(0.314)	(0.230)	(0.312)	(0.232)	(0.337)	(0.225)
PTA	0.222**	0.148	0.224**	0.156*	0.201*	0.139	0.207*	0.154*	0.171	0.138
	(0.112)	(0.090)	(0.112)	(0.091)	(0.114)	(0.091)	(0.112)	(0.090)	(0.117)	(0.092)
FTA	0.635***	0.272**	0.634***	0.269**	0.601***	0.257**	0.634***	0.272**	0.593***	0.260**
	(0.136)	(0.127)	(0.136)	(0.126)	(0.129)	(0.129)	(0.136)	(0.128)	(0.128)	(0.125)
Euro	0.363***	0.206*	0.353***	0.175	0.339**	0.197	0.344***	0.211*	0.285*	0.152
	(0.125)	(0.113)	(0.131)	(0.113)	(0.162)	(0.121)	(0.116)	(0.116)	(0.149)	(0.116)
Pseudo R-squared	0.996	0.995	0.996	0.995	0.996	0.995	0.996	0.995	0.996	0.995

Notes: Results from estimating equations (13) and (14) using Poisson Pseudo Maximum Likelihood (PPML). All regressions include a comprehensive set of exporter-and-time effects (112 exporters), importer-and-time effects (20 importers), and pair-fixed effects (1,192 pairs). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 2,384$ observations.

sition of the stock of migrations is not controlled form, it does not entail a significant effect on imports and exports; see columns (1) and (2). The sizes of the coefficients, however, are similar to the ones obtained from the log-linear specification. Controlling for the share of high-skilled immigrants renders the effect of immigrants on exports significant. Moreover, conditional on the stock of immigrants, exports are increasing in the share of high-skilled immigrants; see columns (4) and (10). This is evidence for a pro-trade effect of emigrant networks through the trade cost channel. Moreover, conditional on the stock of immigrants, imports are increasing in the share of medium-skilled migrants; see columns (5) and (9). Thus, networks of medium-skilled immigrants work through the preference and/or the trade cost channel. This result contrasts the finding of the log-linear specifications. Conditional on the shares of high- and medium-skilled as well as the total stock of immigrants, low-skilled immigrants have a positive effect on imports, which operates through the preference and/or trade cost channel.

Overall, the PPML results provide a more nuanced picture of the role of educational attainment than the FE results. The log-linear specifications do not detect a particular role for any educational group. If anything, they show that the effect of medium-skilled is below average. The PPML results imply that is important to consider the composition of the stock of immigrants. A large share of high-skilled immigrants particularly increases exports. Thus, high-skilled immigrants help to overcome informational frictions related to their countries of birth. Large shares of medium- and low-skilled immigrants particularly increase imports through the preference and/or the trade cost channel.

4 New evidence

The analysis so far relates to the period from 1960 to 2000. By design, it does not cover the dissolution of the Eastern Bloc, which gave rise to "new" countries.[14] Moreover, it misses the effects of the integration of China into the world economy in the aftermath of its accession to the World Trade Organization (WTO) in 2001. I now focus on the period 2000-2010. This period is characterized by a deeper integration, mainly along global value chains (GVC). According to the WTO, the number of regional trade agreements in force has increased from 82 to 213 over this period. The overall share of GVC trade in total trade has increased from 45% in 2000 to more than 50% in 2010, with a peak in 2008 and fall short of 50% in 2009 (Antràs, 2020). The period has also been marked by the financial crisis in 2008.

Whether migrant networks have become less or more important during this period is a priori unclear. The rise in the number of economic integration agreements and the deepening of existing GVCs suggests that the institutional setting has been improved. Then, informal links have become less important. However, the opposite would be true when the institutional setting does not improve sufficiently fast.

4.1 Data

I let the data speak to these questions and consider direct and indirect links. The OECD Database on Immigrants in OECD and non-OECD Countries (DIOC-E) contains information

[14]This follows from the fact that I only observe data at 10-year intervals and engage in a panel data approach.

on the stocks of immigrants in around 100 countries from 220 countries and territories for the years 2000 and 2010. For the identification of the effect of direct links, one needs the stock of immigrants from and the stock of emigrants to the exporter simultaneously, see equation (8). Thus, the analysis is limited to the countries that report immigrants. As a panel data approach is used, only countries countries that report immigrants in both years can be included.

Table A2 in the Appendix displays the number of persons aged 15+ born in a given country but not residing in this country (Emigrants). If information on domestic-born persons aged 15+ is available, it also shows the number of persons born in a given country (Total). The largest potential network is the one of the Mexicans, of whom more than 11.3 mio reside abroad in 2010. However, the network is not spanned equally around the world. More than 11.1 mio Mexicans reside in the USA. The second largest potential network is the one of Ukrainians with more than 4.4 mio residing abroad. 60% reside in Russia, followed by the USA (7%), Israel (6%), Poland (5%), Italy (4%), and Germany (4%). With respect to the absolute numbers of emigrants, China (3.9 mio), the UK (3.9 mio), India (3.8 mio), and Germany (3.7 mio) are comparable.

I merge the migration data with trade data from the International Trade and Production Database for Estimation (ITPD-E) (Borchert et al., 2020). The information is available at a very detailed sectoral level. I aggregate up to trade in the manufacturing sector. The dataset includes information on intra-national (manufacturing) trade flows in both years for 75 countries.

In the estimation of direct links, I want to take trade diversion from domestic sales and globalization effects into account. In order to make results obtained from regressions that do not include intra-national trade comparable to those that do, I restrict the sample to the countries for which domestic sales can be observed. In combination with the requirement to observe the stock of immigrants and emigrants in both years, I am left with 45 countries. Table A3 in the Appendix lists the countries included in the analysis of direct links.[15]

The estimation of indirect links strongly depends on the variation between domestic and

[15]China and the US are not included because domestic trade is not observed for, respectively, 2000 and 2010.

international transactions; see equation (12). Thus, only importers j for which domestic sales are observed are included in the analysis. Thus, I have at most 75 importers. I estimate equation (12) separately for each country of birth. The number of importers (and exporters) included in these regressions depends on the availability of the stock of immigrants from that country in j and the trade data and therefore varies.

4.2 Direct links

In order to account for so-called "globalization" effects (Yotov et al., 2016), equation (8) is slightly modified:

$$X_{ijt} = \exp\left\{\varrho^{\text{em}} \ln N_{jit} + \varrho^{\text{im}} \ln N_{ijt} + INTER_{ij,2010} + \boldsymbol{\beta}'\boldsymbol{\zeta}_{ijt} + \nu_{it} + \nu_{jt} + \nu_{ij}\right\}. \qquad (15)$$

In this specification, $INTER_{ij,2010}$ is a dummy variable for international transactions in the year 2010 (Bergstrand et al., 2015). This dummy captures the effect of international borders on world trade, relative to the base year 2000. Note that the level of the border effect is captured by the pair fixed effect.

Table 6 reports the results of estimating equation (15) using the preferred estimation method, namely PPML. I proceed in three steps. In columns (1)-(3), only international trade flows are included, as in all previous specifications. In columns (4)-(6), intra-national trade flows are included. In columns (7)-(9), globalization effects are controlled for.

In the specification without intra-national trade flows, the elasticity of imports in immigrants is 0.074 (with a standard error of 0.026); see column (1). The coefficient is almost twice as large as the one obtained from the corresponding PPML regression for the period 1960-2000; see Table 1, column (7).[16] Doubling the number of immigrants then increases imports by almost $2^{0.074} - 1 \approx 5.3$%. The coefficient is a bit larger in the regression where emigrant links are excluded; see column (2).

[16]Note that the set of countries included in the regressions differs due to data availability.

Table 6: New evidence – Direct links (2000-2010) – PPML

	Inter			Intra			Globalization		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Immigrants)	0.074***	0.080***		0.161***	0.233***		0.076	0.096**	
	(0.026)	(0.026)		(0.060)	(0.058)		(0.047)	(0.042)	
ln(Emigrants)	0.024		0.048*	0.145**		0.230***	0.051		0.084**
	(0.023)		(0.025)	(0.062)		(0.056)	(0.048)		(0.041)
INTER2010							0.226***	0.232***	0.235***
							(0.035)	(0.036)	(0.035)
RTA	0.198***	0.192***	0.187***	0.056	0.057	0.052	-0.143*	-0.147*	-0.152*
	(0.071)	(0.071)	(0.073)	(0.070)	(0.072)	(0.075)	(0.086)	(0.089)	(0.089)
Common currency	0.159	0.167	0.175	0.253*	0.282**	0.270**	0.164	0.172	0.168
	(0.154)	(0.155)	(0.156)	(0.133)	(0.129)	(0.128)	(0.120)	(0.118)	(0.117)
Pseudo R-squared	0.996	0.996	0.995	0.999	0.999	0.999	0.999	0.999	0.999

Notes: Results from estimating equation (15) using Poisson Pseudo Maximum Likelihood (PPML) on different samples/controls: on international trade (Inter), on international and intra-national trade (Intra), and including a globalization control (Globalization). All regressions include a comprehensive set of exporter-and-time and importer-and-time effects (45 exporters and importers) as well as pair fixed effects (986 and 1031 in Inter and Intra/Globalization, respectively). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 1,972$ observations for Intra and $N = 2,062$ for Inter and Globalization.

The coefficient on emigrants is 0.024, which is slightly lower than the one obtained from the corresponding PPML regression for the period 1960-2000; see Table 1, column (7). The standard error is now 0.023, such that the effect on imports is not statistically significant. In the regression not conditioning on immigrants, the coefficient on emigrants is twice as large and turns significant. Thus, conditional on the battery of fixed effects and controls, there seems to be a correlation between the stock of immigrants and emigrants, which is not present in the sample for 1960-2000; see Table 1, columns (7)-(9).

When migrant networks divert trade from domestic to international transactions, the estimates of the migration variables that are based on international trade only might be biased downward. In columns (4)-(6), intra-national trade is include to allow for diversion from domestic sales. Indeed, the estimated coefficients on immigrants (0.161) and emigrants (0.145) are larger – and both significant – in these specifications. This can be seen as evidence for the hypothesis that migrant networks enhance trade at the expense of intra-national trade. In the specifications not conditioning on the migration network that operates in the other direction, the estimated coefficients are even larger.

However, the coefficients from specifications that include intra-national trade might be biased upward because they also capture globalization effects, such as technology and innovation. In order to control for globalization effects, in columns (7)-(9) a dummy variable for international transactions in the year 2010 is included. Indeed, the coefficient on this dummy variable is highly significant, which implies that international relative to domestic trade is larger in 2010 compared to 2000. The coefficient on immigrants shrinks. The size of the coefficient (0.076) is comparable to the one obtained in a specification without intra-national trade and globalization effects, but the standard error is now 0.047. The coefficient on emigrants also shrinks (0.051), but is now twice as large as in the specification without intra-national trade flows. However, it is also not statistically significant (standard error: 0.048). In the regressions not conditioning on the stock of migrants in the opposite direction, the coefficients turn out to be larger. This is a pattern that can also be observed in the absence of intra-national trade flows and the control for globalization effects. They also become significantly different from zero, which is a pattern that can also be observed for the emigrant coefficient in the regressions with intra-national trade, but without the globalization control.

While the pair fixed effects in equation (15) capture all time-invariant pair-specific characteristics, the effects of time-invariant proxies for trade costs on trade may change over time. In the specifications that include intra-national trade flows, I can take this time variation into account. Baier et al. (2015) include interaction terms of time-invariant trade cost proxies with year dummies. I follow their approach.

Table 7 shows the results. Almost all interaction terms show up significantly. The exceptions are the language dummy for 2010 (column (3)) and the contiguity dummy for 2010 when the other controls are included as well (column (5)). The size of the coefficient on $INTER_{ij2010}$ depends on the other controls included. This finding differs from the result reported in Baier et al. (2015). They concluded that in their sample, the interactions of the border dummy with the year dummies capture all variation in pair-specific effects.

The estimated coefficients on immigrants range between 0.071 and 0.099 and are thus of similar size as in the specifications without further time-varying trade-cost controls; see Table 6, columns (7) and (8). Those coefficients that are statistically significant are close to

Table 7: New evidence – Direct links (2000-2010) – PPML – Time-varying trade cost effects

	(1)	(2)	(3)	(4)	(5)
ln(Immigrants)	0.091**	0.099**	0.072	0.071	0.090**
	(0.045)	(0.046)	(0.047)	(0.047)	(0.044)
ln(Emigrants)	0.069	0.080*	0.047	0.052	0.073
	(0.046)	(0.047)	(0.048)	(0.047)	(0.046)
INTER2010	0.446***	0.158***	0.235***	0.232***	0.372***
	(0.057)	(0.031)	(0.035)	(0.035)	(0.061)
DIST2010	-0.150***				-0.111***
	(0.024)				(0.026)
CNTG2010		0.167***			0.093
		(0.050)			(0.058)
LANG2010			-0.057		-0.108**
			(0.049)		(0.052)
CLNY2010				-0.704***	-0.482***
				(0.122)	(0.147)
RTA	0.015	-0.082	-0.148*	-0.153*	-0.010
	(0.088)	(0.080)	(0.087)	(0.086)	(0.087)
Common currency	0.153	0.152	0.155	0.161	0.132
	(0.128)	(0.125)	(0.120)	(0.119)	(0.130)
Pseudo R-squared	0.999	0.999	0.999	0.999	0.999

Notes: Results from estimating equation (15) using Poisson Pseudo Maximum Likelihood (PPML) on international and intra-national trade. Includes interactions between a time dummy for 2010 and dummies for international transactions (INTER), contiguity (CNTG), common language (LANG), colonial ties (CLNY) as well as (population-weighted) geographical distance (DIST). All regressions include a comprehensive set of exporter-and-time and importer-and-time effects (45 exporters and importers) as well as pair fixed effects (1031). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. $N = 2,062$.

the estimates obtained from the specification that does not include the stock of emigrants; compare Table 7, columns (1), (2), and (5) to Table 6, column (8).

A similar conclusion can be drawn for the coefficient on emigrants; see Table 6, column (9). However, it is only significant in the specification with a control for contiguity in 2010. The point estimate then is 0.080; see column (2). In the specification with controls for all trade-cost proxies, the coefficient on emigrants is of similar size, but statistically insignificant (with a p-value of 0.113).

All in all, there seems to be some (albeit weak) evidence for a positive effect of immigrant and emigrant networks on trade. The immigrant network effect comes out most clearly (in terms of precision of the estimated coefficient) in the specification where trade diversion from domestic sales and globalization effects are not taken into account; see Table 4, column (1). This might be interpreted as evidence for the fact that the preference channel dominates the effect of immigrant networks on imports. Preferences for goods produced in their countries of birth increase imports, but not at the cost of domestic consumption.

The emigrant network effect, in contrast, only comes out most clearly in specifications that account for trade diversion from domestic sales. It is robust to the inclusion of controls for globalization only when one does not control for immigrant links or additionally control for border effects. Information on import opportunities seems to divert trade away mostly from domestic transactions, not from other international transactions.

Finally, I now explore the effect of migrant networks at a more disaggregated level. Rauch (1999) argues that networks more important for so-called “differentiated” products than for products traded on organized exchanges. While the literature on the trade-migration nexus typically considers aggregates of these categories, I run regressions at the industry level. I focus on specifications that account for domestic trade diversion and globalization effects. The number of countries included in the regressions differ. I restrict the sample to countries for which I observe domestic trade flows in order to facilitate a meaningful identification of trade diversion and globalization effects.

Table 8 shows the results for agricultural industries. Agricultural products such as wheat,

Table 8: New evidence – Direct links (2000-2010) – PPML – Agricultural industries

	ln(Immigrants)		ln(Emigrants)		INTER2010		Pseudo	Number of			
Industry	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	R-sq.	Exp.	Imp.	Pairs	Obs.
Wheat	-0.157	(0.422)	0.446	(0.320)	0.283	(0.174)	0.991	45	42	508	1016
Rice (raw)	1.360	(1.930)	1.860	(1.764)	0.833**	(0.422)	0.999	28	27	147	294
Corn	0.375	(0.273)	-0.743*	(0.408)	0.403*	(0.209)	0.998	42	39	435	870
Other cereals	-0.287	(0.250)	0.764***	(0.237)	0.297***	(0.114)	0.989	51	50	660	1320
Soybeans	1.122**	(0.559)	-1.129***	(0.422)	-0.959**	(0.470)	0.997	24	22	140	280
Other oilseeds (excluding peanuts)	-0.455***	(0.160)	-0.111	(0.200)	-0.017	(0.148)	0.996	50	50	820	1640
Raw and refined sugar and sugar crops	3.018	(3.164)	1.658	(1.532)	-0.204	(1.043)	0.996	23	19	92	184
Other sweeteners	0.420***	(0.144)	-0.326*	(0.177)	1.002***	(0.136)	0.968	38	37	421	842
Pulses and legumes, dried, preserved	-0.124	(0.191)	0.227	(0.181)	0.294***	(0.093)	0.985	47	46	599	1198
Fresh fruit	0.097	(0.106)	-0.033	(0.100)	0.578***	(0.058)	0.996	53	52	883	1766
Fresh vegetables	0.539***	(0.139)	-0.117	(0.084)	0.432***	(0.061)	0.998	61	60	1049	2098
Nuts	-0.493**	(0.201)	0.062	(0.138)	0.080	(0.138)	0.989	32	32	366	732
Eggs	0.339	(0.339)	0.052	(0.306)	0.822***	(0.157)	0.995	53	49	519	1038
Other meats, livestock products, and live animals	0.137	(0.207)	-0.238	(0.253)	-0.053	(0.143)	0.937	34	33	406	812
Beverages, nec	-0.935**	(0.430)	0.000	(.)	0.000	(.)	0.994	4	4	10	20
Cotton	3.835*	(2.075)	-4.776**	(2.102)	0.228**	(0.104)	0.995	10	9	48	96
Spices	-0.575	(0.476)	0.463	(0.349)	0.794**	(0.326)	0.974	21	22	149	298
Other agricultural products, nec	-0.021	(0.133)	-0.005	(0.135)	0.090	(0.161)	0.988	33	33	478	956

Notes: Results from estimating equation (15) sector by sector using Poisson Pseudo Maximum Likelihood (PPML) on international and intra-national trade. All regressions include a comprehensive set of exporter-and-time and importer-and-time effects as well as pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

raw rise, and corn, are likely to be traded on organized exchanges, leaving no role for migrant networks. Indeed, there is not much evidence for effects of migrant networks on trade in agricultural products. For 3 (out of 18) industries, there are significantly positive effects of immigrants on imports, and for 4 industries, these effects are statically negative. Emigrant networks turn out to have significantly negative effects for 5 industries.

For the same reasons, I do not expect effects of migrant networks on imports in mining industries. This is indeed what can be found; see Table A5 in the Appendix.

For the manufacturing industries, the picture is more nuanced; see Table 9. There are some positive effects of immigrants on imports in food industries (meat, fish, fruit & vegetables, cocoa chocolate and sugar confectionery). In these industries, there does not seem to be a significant effect of emigrants on imports. The positive effect of immigrants is likely to represent the preference channel. For prepared animal feeds, there is a positive effect of immigrants and emigrants, which indicates that the trade cost channel is active.

There is also evidence of a positive effect of emigrants on imports of diary products, textiles, chemicals, engines and turbines, pumps compressors taps and valves, and machine tools. Interestingly, also the effect of emigrants on imports of basic iron and steel is statistically positive, although basic iron and steel seems to be a homogeneous good.

Table 9: New evidence – Direct links (2000-2010) – PPML – Manufacturing industries

	ln(Immigrants)		ln(Emigrants)		INTER2010		Pseudo	Number of			
Industry	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	R-sq.	Exp.	Imp.	Pairs	Obs.
Processing/preserving of meat	0.226*	(0.122)	0.113	(0.121)	0.352***	(0.057)	0.998	36	36	640	1280
Processing/preserving of fish	0.421**	(0.174)	-0.016	(0.177)	0.110	(0.128)	0.997	20	20	203	406
Processing/preserving of fruit & vegetables	0.249***	(0.084)	0.065	(0.101)	0.199***	(0.040)	0.996	27	27	385	770
Vegetable and animal oils and fats	0.333	(0.231)	-0.171	(0.231)	0.770***	(0.156)	0.997	18	18	148	296
Dairy products	0.104	(0.111)	0.308***	(0.117)	0.273***	(0.061)	0.998	34	34	553	1106
Grain mill products	0.011	(0.215)	0.226	(0.229)	0.586***	(0.089)	0.997	18	18	152	304
Starches and starch products	0.351	(0.287)	0.236	(0.239)	0.091	(0.091)	0.990	13	13	100	200
Prepared animal feeds	0.351**	(0.138)	0.211*	(0.127)	0.104	(0.069)	0.997	28	28	380	760
Bakery products	0.000	(0.296)	0.055	(0.291)	0.413***	(0.081)	0.999	25	25	277	554
Sugar	-0.182	(0.677)	-0.813	(0.822)	0.632***	(0.214)	0.996	16	16	132	264
Cocoa chocolate and sugar confectionery	0.413***	(0.159)	-0.199	(0.205)	0.390***	(0.080)	0.996	23	22	284	568
Macaroni noodles & similar products	-0.346	(0.274)	0.228	(0.413)	0.589***	(0.139)	0.998	15	15	106	212
Other food products n.e.c.	0.304	(0.197)	0.118	(0.181)	0.281***	(0.099)	0.999	19	19	193	386
Distilling rectifying & blending of spirits	0.141	(0.426)	-0.744	(0.473)	1.196***	(0.230)	0.997	14	14	115	230
Wines	-3.172	(2.162)	2.586*	(1.407)	0.844***	(0.209)	0.998	9	9	37	74
Malt liquors and malt	-0.160	(0.378)	-1.352***	(0.375)	0.594***	(0.113)	0.999	16	16	141	282
Soft drinks; mineral waters	-0.068	(0.297)	0.522	(0.414)	0.514***	(0.115)	0.998	25	25	302	604
Tobacco products	-0.067	(0.270)	0.390	(0.325)	1.855***	(0.387)	0.998	21	21	184	368
Textile fiber preparation; textile weaving	0.211	(0.170)	0.072	(0.166)	0.295***	(0.086)	0.995	16	16	140	280
Made-up textile articles except apparel	-0.120	(0.450)	0.584	(0.429)	0.556***	(0.155)	0.995	15	15	131	262
Carpets and rugs	0.828**	(0.330)	0.005	(0.303)	-0.251*	(0.148)	0.986	17	17	159	318
Cordage rope twine and netting	0.071	(0.325)	-0.523*	(0.316)	0.315***	(0.121)	0.977	15	15	113	226
Other textiles n.e.c.	-0.001	(0.226)	0.470**	(0.238)	0.123	(0.111)	0.992	12	12	108	216
Knitted and crocheted fabrics and articles	-0.206	(0.323)	0.436	(0.532)	0.698***	(0.111)	0.998	8	8	44	88
Wearing apparel except fur apparel	0.081	(0.367)	-0.072	(0.590)	1.567***	(0.203)	0.998	19	19	214	428
Tanning and dressing of leather	0.495*	(0.294)	0.141	(0.263)	-0.124	(0.099)	0.991	14	14	120	240
Luggage handbags etc.; saddlery & harness	1.381*	(0.779)	-0.399	(0.551)	0.449	(0.738)	0.996	5	5	21	42
Footwear	-0.060	(0.263)	-0.522	(0.325)	1.405***	(0.220)	0.997	12	12	95	190
Saw milling and planing of wood	0.025	(0.124)	0.110	(0.118)	0.033	(0.073)	0.995	35	35	630	1260
Veneer sheets plywood particle board etc.	-0.210	(0.191)	0.186	(0.165)	0.369***	(0.076)	0.992	25	25	330	660
Builders' carpentry and joinery	-0.348	(0.250)	0.298	(0.232)	0.068	(0.079)	0.998	21	20	204	408
Wooden containers	-0.012	(0.320)	0.225	(0.288)	-0.204***	(0.069)	0.992	19	19	201	402
Other wood products; articles of cork/straw	-0.038	(0.124)	0.131	(0.209)	0.190***	(0.059)	0.992	19	19	213	426
Pulp paper and paperboard	0.093	(0.108)	0.072	(0.105)	0.445***	(0.060)	0.996	19	19	203	406
Corrugated paper and paperboard	0.192	(0.128)	0.015	(0.122)	0.258***	(0.051)	0.998	28	28	429	858
Other articles of paper and paperboard	0.025	(0.191)	0.224	(0.158)	-0.119*	(0.069)	0.996	22	22	278	556
Printing	-0.058	(0.190)	0.253	(0.237)	0.041	(0.050)	0.999	24	24	322	644
Service activities related to printing	-0.682	(0.543)	-0.446	(0.825)	0.979***	(0.276)	0.998	24	24	244	488
Coke oven products	0.989	(0.909)	-4.874***	(1.596)	3.692***	(1.374)	1.000	9	8	35	70
Refined petroleum products	-0.013	(1.600)	-8.437***	(1.719)	0.882***	(0.083)	1.000	7	7	25	50
Basic chemicals except fertilizers	0.053	(0.204)	-0.124	(0.241)	-0.248***	(0.068)	0.999	11	11	71	142
Fertilizers and nitrogen compounds	-0.273*	(0.154)	0.200	(0.194)	0.472***	(0.101)	0.989	19	19	170	340
Plastics in primary forms; synthetic rubber	-0.344**	(0.168)	-0.261	(0.161)	0.858***	(0.053)	0.997	13	13	87	174
Pesticides and other agro-chemical products	-0.457	(0.434)	0.243	(0.435)	1.299***	(0.093)	0.988	12	12	78	156
Paints varnishes printing ink and mastics	0.100	(0.162)	0.044	(0.092)	0.561***	(0.063)	0.995	26	26	366	732
Pharmaceuticals medicinal chemicals etc.	-0.559***	(0.216)	-0.144	(0.268)	1.918***	(0.149)	0.998	17	17	155	310
Soap cleaning & cosmetic preparations	-0.344	(0.472)	0.142	(0.564)	1.691***	(0.144)	0.996	14	14	108	216
Other chemical products n.e.c.	0.342*	(0.197)	0.469**	(0.189)	0.672***	(0.196)	0.998	9	9	53	106
Man-made fibers	0.463*	(0.269)	0.165	(0.144)	0.046	(0.153)	0.990	13	13	92	184
Rubber tyres and tubes	0.182	(0.353)	-0.520	(0.336)	0.360***	(0.130)	0.987	15	15	123	246
Other rubber products	0.250	(0.165)	0.041	(0.183)	0.336***	(0.048)	0.996	15	15	143	286
Plastic products	0.059	(0.059)	0.011	(0.052)	0.312***	(0.041)	0.998	38	38	688	1376
Glass and glass products	0.012	(0.088)	0.153	(0.093)	0.194***	(0.046)	0.994	34	34	648	1296
Pottery china and earthenware	1.039***	(0.362)	0.035	(0.374)	0.071	(0.096)	0.993	11	11	65	130
Refractory ceramic products	-0.117	(0.213)	0.005	(0.222)	0.339***	(0.080)	0.985	18	18	181	362
Struct.non-refractory clay; ceramic products	-0.063	(0.111)	-0.276***	(0.102)	0.360***	(0.089)	0.993	17	17	166	332
Cement lime and plaster	0.473	(0.503)	0.168	(0.477)	0.172	(0.120)	0.997	19	18	178	356
Articles of concrete cement and plaster	0.078	(0.201)	0.390	(0.251)	0.190	(0.119)	0.999	19	19	181	362
Cutting shaping & finishing of stone	-0.196	(0.268)	0.034	(0.283)	-0.129	(0.102)	0.995	27	27	334	668
Other non-metallic mineral products n.e.c.	0.105	(0.181)	0.111	(0.159)	-0.009	(0.076)	0.993	20	20	236	472
Basic iron and steel	-0.100	(0.062)	0.126**	(0.064)	0.307***	(0.040)	0.998	32	32	572	1144
Basic precious and non-ferrous metals	-0.133	(0.193)	-0.061	(0.120)	0.869***	(0.109)	0.994	17	17	156	312
Casting of iron and steel	0.280	(0.225)	0.187	(0.215)	0.189*	(0.099)	0.996	17	17	177	354
Structural metal products	0.160	(0.133)	0.034	(0.152)	0.125**	(0.060)	0.998	28	27	423	846
Tanks reservoirs and containers of metal	-0.222	(0.187)	-0.131	(0.177)	0.291***	(0.077)	0.993	21	21	276	552
Steam generators	-0.937	(0.573)	0.024	(0.598)	0.980***	(0.145)	0.998	12	11	84	168
Cutlery hand tools and general hardware	0.099	(0.149)	0.268	(0.184)	-0.257***	(0.058)	0.995	19	19	215	430
Other fabricated metal products n.e.c.	-0.194	(0.127)	0.235	(0.159)	0.763***	(0.064)	0.997	19	19	171	342
Engines & turbines (not for transport equipment)	-1.160***	(0.441)	0.979**	(0.468)	-1.068***	(0.162)	0.997	13	13	110	220
Pumps compressors taps and valves	0.497*	(0.280)	0.751**	(0.348)	0.377***	(0.108)	0.994	12	12	88	176
Bearings gears gearing & driving elements	0.242	(0.233)	0.243	(0.271)	0.870***	(0.099)	0.997	7	7	29	58
Ovens furnaces and furnace burners	-0.007	(0.395)	0.211	(0.494)	0.210	(0.130)	0.985	12	12	78	156
Lifting and handling equipment	-0.093	(0.122)	0.157	(0.098)	0.640***	(0.061)	0.994	18	18	194	388
Other general purpose machinery	-0.088	(0.210)	0.270	(0.194)	0.776***	(0.090)	0.996	16	16	154	308
Agricultural and forestry machinery	-0.062	(0.181)	0.304	(0.186)	0.985***	(0.088)	0.989	22	22	249	498
Machine tools	-0.272	(0.183)	0.649***	(0.219)	0.383***	(0.056)	0.996	10	10	56	112
Machinery for metallurgy	0.287	(0.229)	0.012	(0.274)	-0.173	(0.108)	0.993	8	8	56	112
Machinery for mining & construction	-0.153	(0.893)	-0.498	(1.251)	0.104	(0.182)	0.997	7	7	27	54
Food/beverage/tobacco processing machinery	0.083	(0.124)	0.013	(0.178)	0.046	(0.044)	0.994	19	19	248	496
Machinery for textile apparel and leather	-1.743*	(0.965)	0.765	(0.827)	-0.779***	(0.127)	0.978	6	6	28	56
Weapons and ammunition	0.426	(0.340)	0.045	(0.498)	0.274*	(0.148)	0.993	17	16	176	352
Other special purpose machinery	0.100	(0.317)	-0.173	(0.336)	0.652***	(0.140)	0.999	8	8	36	72
Domestic appliances n.e.c.	-0.034	(0.122)	-0.114	(0.129)	0.435***	(0.096)	0.997	23	22	275	550
Office accounting and computing machinery	-1.772**	(0.792)	0.778	(0.593)	-1.600***	(0.351)	1.000	8	7	33	66
Electric motors generators and transformers	-0.066	(0.154)	0.170	(0.174)	-0.864***	(0.094)	0.996	27	27	418	836
Insulated wire and cable	0.131	(0.200)	-0.319	(0.201)	-0.122*	(0.072)	0.995	21	21	235	470
Accumulators primary cells and batteries	0.870***	(0.289)	0.072	(0.370)	0.283**	(0.133)	0.994	13	13	79	158
Lighting equipment and electric lamps	0.106	(0.143)	-0.064	(0.146)	-0.455***	(0.094)	0.993	23	23	276	552
Other electrical equipment n.e.c.	0.690	(0.515)	-0.473*	(0.271)	0.623***	(0.175)	0.999	9	9	55	110
Electronic valves tubes etc.	0.083	(0.439)	0.363	(0.295)	-0.250***	(0.089)	0.999	19	19	195	390
TV/radio transmitters; line comm. apparatus	0.514	(0.509)	-0.751	(0.520)	0.384	(0.357)	0.997	12	12	88	176
TV and radio receivers and associated goods	3.776	(.)	0.000	(.)	0.000	(.)	1.000	3	3	7	14
Medical surgical and orthopedic equipment	-0.300	(0.310)	0.003	(0.222)	0.454***	(0.172)	0.993	15	15	147	294
Measuring/testing/navigating appliances etc.	0.184	(0.238)	0.262	(0.236)	1.128***	(0.103)	0.991	10	10	78	156
Optical instruments & photographic equipment	6.147***	(1.589)	-4.668***	(1.719)	-1.297***	(0.324)	0.986	5	5	17	34
Motor vehicles	0.144	(0.168)	0.311*	(0.171)	0.457***	(0.079)	0.996	24	24	332	664
Automobile bodies trailers & semi-trailers	-0.045	(0.257)	-0.007	(0.162)	0.119	(0.075)	0.995	25	25	311	622
Parts/accessories for automobiles	-0.353	(0.279)	-0.162	(0.211)	0.490**	(0.202)	0.997	18	18	178	356
Building and repairing of ships	-2.682	(1.680)	-8.967***	(1.342)	4.597***	(0.604)	0.994	11	11	83	166
Building/repairing of pleasure/sport. boats	0.960	(0.812)	-0.498	(0.878)	-0.156	(0.181)	0.962	11	11	94	188
Railway/tramway locomotives & rolling stock	-0.632*	(0.323)	0.162	(0.377)	0.884***	(0.234)	0.994	15	15	148	296
Aircraft and spacecraft	3.647**	(1.453)	-3.900***	(1.476)	-0.486*	(0.254)	0.998	6	6	29	58
Bicycles and invalid carriages	-0.991	(1.318)	0.265	(1.567)	0.403*	(0.222)	0.987	10	10	55	110
Other transport equipment n.e.c.	0.625**	(0.297)	0.000	(.)	-0.024	(0.096)	0.995	5	5	13	26
Furniture	-0.010	(0.064)	0.164*	(0.085)	0.464***	(0.054)	0.996	38	38	703	1406
Jewelery and related articles	-0.956**	(0.468)	4.405***	(0.632)	-0.440	(0.501)	0.984	8	8	52	104
Musical instruments	0.535*	(0.282)	-0.884	(0.624)	0.402	(0.425)	0.989	11	11	72	144
Sports goods	-0.154	(0.434)	0.187	(0.564)	0.329	(0.202)	0.978	13	13	122	244
Games and toys	0.384*	(0.224)	0.308	(0.347)	-0.753**	(0.334)	0.970	5	5	21	42
Other manufacturing n.e.c.	0.217	(0.132)	0.212	(0.194)	0.168**	(0.075)	0.997	17	17	133	266

Notes: Results from estimating equation (15) sector by sector using Poisson Pseudo Maximum Likelihood (PPML) on international and intra-national trade. All regressions include a comprehensive set of exporter-and-time and importer-and-time effects as well as pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

The literature on the trade-migration nexus typically focuses on trade in goods. Here, I also consider trade in services. However, there is only a positive effect of immigrants on imports of transport services, while migrant network do not seem to affect service trade in other industries; see Table A5 in the Appendix.

4.3 Indirect links

In order to be able to clearly focus on the trade cost channel, I now turn to indirect links established by immigrants from third countries residing in the exporting and the importing country. In order to do so, I estimate equation (11) separately for all potential countries of birth k. In order to reduce data requirements, I do not include direct migrant links.

Table 10 shows the estimated coefficients $\hat{\varrho}^k$ for 217 potential networks spanned by immigrants born in country k. The countries of birth are ordered by their alpha-3 ISO code. All regressions include a dummy for joint membership in a regional trade agreement (RTA) and a common currency, and an interaction between a dummy for international transactions and a year dummy for 2010 ($INTER_{ij2010}$) as well as a comprehensive set of exporter-and-time, importer-and-time effects, and pair fixed effects (all not shown).

Table 10 displays the number of exporting countries i for which information on the stock of immigrants born in country k (Number of exporters) is available. The number of importing countries j that receive immigrants from country k ranges from 2 (e.g. Guam) to 56 (USA) with an average of appr. 26. Table 10 also displays the number of importing countries j (Number of importers). This number can be smaller than the number of exporters as for importers j it is additionally required that intra-national trade is observed. The reason is that the identification strategy depends on variation across imports and domestic sales. The number of importers ranges from 2 (e.g. American Samoa, Palau) to 41 (e.g. Germany, USA) with an average of appr. 21. The product of the number of importers and exporters is the maximum number of pairs. However, the number of pairs actually observed might be smaller due to missing information. Finally, Table 10 displays the total number of observations of the re-

Table 10: New evidence – Indirect links (2000-2010) – PPML

Ctry.	ln(Mig./Pop)xINTxI		Number of				Ctry.	ln(Mig./Pop)xINTxI		Number of				Ctry.	ln(Mig./Pop)xINTxI		Number of			
o. birth	$\hat{\varrho}^k$	std. err.	Exp.	Imp.	Pairs	Obs.	o. birth	$\hat{\varrho}^k$	std. err.	Exp.	Imp.	Pairs	Obs.	o. birth	$\hat{\varrho}^k$	std. err.	Exp.	Imp.	Pairs	Obs.
ABW	-0.082**	(0.041)	12	9	105	210	GHA	0.008	(0.036)	31	24	630	1260	NPL	0.009	(0.021)	29	25	630	1260
AFG	-0.091***	(0.018)	31	26	627	1254	GIB	-0.000	(0.027)	12	10	117	234	NRU	0.118*	(0.071)	5	3	15	30
AGO	0.045**	(0.023)	32	26	742	1484	GIN	-0.055***	(0.017)	25	19	432	864	NZL	0.218***	(0.046)	34	28	771	1542
AIA	-0.048***	(0.016)	6	4	24	48	GMB	-0.082**	(0.032)	22	18	369	738	OMN	0.048*	(0.025)	15	13	190	380
ALB	-0.006	(0.029)	31	26	691	1382	GNB	-0.054***	(0.015)	15	14	207	414	PAK	0.030**	(0.013)	41	35	938	1876
AND	0.017	(0.018)	13	12	142	284	GNQ	-0.162***	(0.045)	9	8	72	144	PAN	0.012	(0.040)	36	25	716	1432
ANT	0.107	(0.107)	10	8	78	156	GRC	0.165***	(0.031)	41	35	991	1982	PER	0.090**	(0.038)	41	31	971	1942
ARE	-0.267***	(0.042)	24	20	461	922	GRD	0.012	(0.020)	18	14	248	496	PHL	0.060**	(0.031)	37	29	773	1546
ARG	0.045	(0.046)	44	33	1035	2070	GTM	0.042	(0.028)	35	26	728	1456	PLW	0.154***	(0.000)	4	2	8	16
ARM	0.027	(0.028)	31	26	630	1260	GUM	0.050***	(0.000)	2	2	4	8	PNG	-0.095***	(0.016)	18	15	256	512
ASM	0.084***	(0.000)	3	2	6	12	GUY	0.035***	(0.008)	24	20	458	916	POL	-0.017	(0.018)	43	37	1058	2116
ATG	0.084**	(0.043)	11	9	98	196	HKG	-0.035	(0.041)	16	14	200	400	PRI	-0.069**	(0.032)	16	9	123	246
AUS	0.251***	(0.070)	44	36	1040	2080	HND	0.026	(0.020)	30	22	549	1098	PRT	-0.043*	(0.025)	36	29	879	1758
AUT	0.064	(0.052)	41	33	1005	2010	HRV	0.022	(0.028)	36	30	846	1692	PRY	-0.006	(0.015)	31	25	671	1342
AZE	-0.013	(0.026)	27	23	484	968	HTI	0.050	(0.035)	28	20	479	958	PSE	0.064	(0.056)	15	12	173	346
BDI	-0.025	(0.017)	24	20	436	872	HUN	0.011	(0.018)	41	34	981	1962	QAT	-0.082***	(0.025)	18	15	266	532
BEL	-0.012	(0.063)	43	34	1034	2068	IDN	-0.043	(0.077)	39	32	874	1748	ROU	-0.027**	(0.012)	44	37	1056	2112
BEN	-0.146***	(0.035)	22	19	383	766	IND	0.105*	(0.056)	48	38	1092	2184	RUS	-0.029***	(0.008)	49	38	1142	2284
BFA	-0.042	(0.033)	19	16	281	562	IRL	0.128***	(0.021)	34	28	822	1644	RWA	-0.023	(0.023)	25	19	429	858
BGD	0.101***	(0.021)	33	27	722	1444	IRN	-0.047	(0.030)	40	34	947	1894	SAU	0.016	(0.021)	31	26	669	1338
BGR	-0.026	(0.017)	40	34	922	1844	IRQ	-0.072**	(0.035)	38	33	902	1804	SCG	0.023***	(0.009)	30	27	637	1274
BHR	-0.018	(0.023)	18	16	274	548	ISL	-0.033	(0.031)	24	20	458	916	SDN	-0.029	(0.024)	27	23	580	1160
BHS	-0.158***	(0.058)	18	13	229	458	ISR	-0.010	(0.032)	42	35	1029	2058	SEN	0.016	(0.044)	25	19	446	892
BIH	-0.070**	(0.028)	33	29	735	1470	ITA	0.052	(0.035)	47	36	1121	2242	SGP	0.140***	(0.039)	33	27	730	1460
BLR	-0.063***	(0.024)	33	28	722	1444	JAM	-0.025	(0.045)	24	19	437	874	SHN	0.042	(0.045)	7	5	35	70
BLZ	-0.085***	(0.024)	17	13	219	438	JOR	-0.010	(0.022)	30	25	671	1342	SLB	0.047	(0.088)	8	7	56	112
BMU	0.048	(0.087)	15	12	171	342	JPN	0.053	(0.039)	46	36	1052	2104	SLE	-0.021	(0.027)	25	22	500	1000
BOL	0.040**	(0.017)	37	29	868	1736	KAZ	-0.054***	(0.020)	32	27	627	1254	SLV	0.011	(0.030)	30	20	512	1024
BRA	0.155***	(0.048)	44	34	1015	2030	KEN	0.055*	(0.032)	35	28	822	1644	SMR	-0.084*	(0.047)	9	7	60	120
BRB	0.001	(0.029)	21	17	344	688	KGZ	-0.045**	(0.021)	24	21	407	814	SOM	0.018	(0.021)	29	25	625	1250
BRN	0.029	(0.026)	13	12	137	274	KHM	-0.129**	(0.058)	23	20	395	790	STP	-0.020	(0.019)	11	9	91	182
BTN	-0.049***	(0.011)	12	10	120	240	KIR	0.040**	(0.017)	12	10	109	218	SUN	-0.198***	(0.020)	7	6	41	82
BWA	-0.041***	(0.015)	18	15	253	506	KNA	0.112***	(0.037)	6	3	18	36	SUR	0.038***	(0.009)	18	15	260	520
CAF	0.038	(0.024)	20	17	303	606	KOR	-1.233*	(0.713)	8	3	19	38	SVK	-0.041***	(0.014)	31	26	700	1400
CAN	0.305***	(0.046)	43	33	1045	2090	KWT	-0.056	(0.040)	28	24	626	1252	SVN	-0.013	(0.018)	30	24	637	1274
CHE	-0.033	(0.036)	42	33	992	1984	LAO	-0.268***	(0.040)	26	19	410	820	SWE	0.047**	(0.021)	38	30	942	1884
CHL	0.117***	(0.028)	40	30	930	1860	LBN	0.058	(0.036)	41	32	933	1866	SWZ	0.006	(0.026)	17	15	250	500
CHN	0.125***	(0.038)	55	41	1208	2416	LBR	-0.051***	(0.016)	24	19	422	844	SYC	0.071***	(0.022)	19	15	275	550
CIV	-0.042***	(0.015)	30	24	647	1294	LBY	-0.045	(0.037)	32	27	728	1456	SYR	-0.002	(0.035)	37	31	867	1734
CMR	0.018	(0.030)	28	22	570	1140	LCA	0.046***	(0.014)	14	11	151	302	TCD	-0.093*	(0.054)	16	14	216	432
COD	-0.006	(0.022)	28	22	547	1094	LIE	-0.009	(0.020)	15	13	181	362	TGO	-0.040	(0.037)	20	16	297	594
COG	0.029	(0.026)	27	21	503	1006	LKA	0.073*	(0.041)	30	26	632	1264	THA	0.046**	(0.019)	36	28	748	1496
COK	-0.198***	(0.006)	4	3	12	24	LSO	-0.173***	(0.036)	13	12	151	302	TJK	-0.154***	(0.036)	22	19	346	692
COL	0.102**	(0.048)	41	31	962	1924	LTU	-0.009	(0.012)	35	29	788	1576	TKL	-1.728***	(0.000)	3	2	6	12
COM	0.027	(0.025)	15	14	203	406	LUX	0.052	(0.038)	25	20	477	954	TKM	-0.128***	(0.019)	23	19	359	718
CPV	-0.017	(0.034)	20	17	331	662	LVA	-0.057***	(0.017)	32	27	695	1390	TLS	-15.185***	(4.085)	4	3	12	24
CRI	0.068*	(0.041)	35	25	711	1422	MAR	-0.186***	(0.063)	36	30	850	1700	TON	-0.077***	(0.025)	14	11	150	300
CSK	-0.332***	(0.019)	4	3	12	24	MCO	0.045	(0.032)	16	13	201	402	TTO	0.063**	(0.028)	25	19	447	894
CUB	-0.118**	(0.049)	42	31	959	1918	MDA	-0.034*	(0.018)	31	26	602	1204	TUN	0.053***	(0.019)	31	27	736	1472
CYM	0.170***	(0.022)	6	4	23	46	MDG	-0.043	(0.073)	26	20	474	948	TUR	-0.038	(0.045)	42	36	1027	2054
CYP	0.041	(0.041)	30	24	591	1182	MDV	0.048	(0.032)	13	10	126	252	TUV	0.037	(0.063)	6	4	23	46
CZE	0.016	(0.020)	34	30	781	1562	MEX	0.105***	(0.036)	43	32	1012	2024	TWN	0.058*	(0.034)	25	20	397	794
DEU	-0.277***	(0.076)	51	41	1221	2442	MHL	0.128***	(0.000)	3	2	6	12	TZA	-0.081**	(0.038)	30	23	575	1150
DJI	-0.061***	(0.019)	16	13	205	410	MKD	-0.084	(0.054)	27	23	512	1024	UGA	0.008	(0.040)	26	20	469	938
DMA	0.039***	(0.012)	17	13	217	434	MLI	-0.077***	(0.025)	22	18	368	736	UKR	-0.014	(0.011)	45	36	1032	2064
DNK	0.051*	(0.029)	39	32	949	1898	MLT	0.032	(0.021)	23	20	436	872	URY	0.125***	(0.026)	37	28	847	1694
DOM	0.088***	(0.022)	32	24	658	1316	MMR	-0.001	(0.021)	26	21	438	876	USA	0.120**	(0.059)	56	41	1180	2360
DZA	-0.080**	(0.037)	34	28	799	1598	MNG	-0.050	(0.033)	24	21	430	860	UZB	-0.036	(0.028)	27	23	480	960
ECU	-0.030	(0.028)	36	27	805	1610	MNP	0.482*	(0.263)	3	2	6	12	VAT	0.096***	(0.003)	4	3	12	24
EGY	0.276***	(0.062)	40	34	961	1922	MOZ	0.211***	(0.065)	28	23	549	1098	VCT	-0.042	(0.047)	13	9	116	232
ERI	0.070***	(0.019)	19	17	310	620	MRT	-0.095***	(0.034)	15	12	170	340	VEN	0.056	(0.034)	41	30	958	1916
ESH	-0.045	(0.114)	5	4	17	34	MSR	-0.019	(0.066)	7	5	35	70	VGB	0.062**	(0.028)	5	3	15	30
ESP	0.060*	(0.032)	48	36	1122	2244	MUS	0.006	(0.024)	24	20	456	912	VIR	1.016***	(0.072)	4	3	11	22
EST	-0.089***	(0.027)	29	24	599	1198	MWI	-0.075***	(0.021)	21	18	332	664	VNM	-0.002	(0.042)	36	29	792	1584
ETH	-0.070**	(0.032)	30	25	645	1290	MYS	0.088***	(0.020)	34	27	718	1436	VUT	-0.022	(0.042)	12	10	114	228
FIN	0.199***	(0.076)	32	27	781	1562	NAM	-0.103**	(0.044)	23	19	419	838	WSM	0.001	(0.025)	15	13	189	378
FJI	0.165**	(0.066)	18	14	242	484	NER	-0.069***	(0.017)	19	16	276	552	YEM	-0.080***	(0.021)	23	20	407	814
FLK	0.080***	(0.018)	5	4	16	32	NFK	2.147***	(0.000)	2	2	4	8	YUG	0.351	(.)	4	4	10	20
FRA	-0.181**	(0.077)	51	39	1177	2354	NGA	0.003	(0.040)	34	27	774	1548	ZAF	0.264***	(0.094)	38	31	888	1776
FSM	0.122	(0.083)	5	3	15	30	NIC	-0.037	(0.024)	30	22	539	1078	ZMB	-0.001	(0.040)	30	26	654	1308
GAB	0.002	(0.043)	17	11	170	340	NIU	1.794***	(0.179)	4	3	12	24	ZWE	0.086*	(0.047)	30	25	633	1266
GBR	0.050	(0.041)	49	40	1141	2282	NLD	0.001	(0.046)	42	33	982	1964							
GEO	-0.031	(0.019)	28	23	498	996	NOR	0.078**	(0.034)	35	28	846	1692							

Notes: Results from estimating equation (11) for each country of birth (ctry. o. birth) k separately. Ordered by alpha-3 ISO country codes. Estimation method: Poisson Pseudo Maximum Likelihood (PPML). All regressions include a dummy for joint membership in a regional trade agreement (RTA), a common currency, the log of emigrants and the log of immigrants, an interaction between a dummy for international transactions and a year dummy for 2010 ($INTER_{ij,2010}$) as well as a comprehensive set of exporter-and-time, importer-and-time effects, and pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). For all regressions, the Pseudo R-squared is 0.998 or higher. Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

gression for migrant network k.[17]

All in all, there are positive effects on trade for 63 networks, negative effects on trade for 58 networks, and no significant effect on trade for 96 networks.

Table A6 in the Appendix displays the statistically significant coefficients, ordered by the magnitude of the effect. The largest significantly positive coefficients occur for the networks of migrants born in Niule (NIE), Norfolk Island (NFK), and Northern Mariana Islands (MNP), but the number of countries that host migrants from these countries does not exceed 4. Moreover, the number of emigrants is small; see Table A2 in the Appendix. The elasticity of imports in the Canadian network is 0.305. Doubling the product of immigrant shares $\frac{N_{CAN,i}}{Pop_i}\frac{N_{CAN,j}}{Pop_j}$ – or, equivalently, doubling the stock of immigrants from Canada in one of the countries – raises bilateral trade by $2^{0.305} - 1 \approx 36\%$. The network of immigrants from South Africa and Egypt have similar trade creating effects. There is also evidence for a trade-creating effect of the networks of Chinese and Danish. Other networks that appeared with positive effects in the cross-sectional analysis of Felbermayr et al. (2010) do not show up with significant effects, such as those of the Ghanan or even show up negatively such as that of the Moroccans. This stresses the importance of controlling for pair-specific heterogeneity.

A substantial number of immigrant networks exhibit a negative effect of trade among host countries, such as those of Germans, French, Romanians, and Koreans. It would be interesting to understand the determinants of the sign and the size of the coefficients. One should also bear in mind that the elasticity of trade in migrants is potentially non-constant (Egger and Lassmann, 2018; Genc and Wesselbaum, 2021).

5 Concluding remarks

I apply state-of-the-art gravity techniques in order to reassess the trade-migration nexus and to provide new evidence on the migrant effect through direct and indirect links. I thus find evidence consistent with the hypothesis that migrant networks reduce informational and/or

[17] The Pseudo R-squared are all close to 1 and therefore omitted from the table.

contractual frictions, which is welfare-improving.

All the specifications include exporter-and-time and importer-and-time effects and control for (potentially unobserved) pair-specific heterogeneity. These specifications demand a lot from the data, in particular in the specifications where only two periods can be included, which may explain why some coefficients are only marginally significant (or "marginally" not significant).

The numbers of countries and years included in the regressions are relatively small due to data limitations. This prevents us from applying multi-clustering approaches to the computation of standard errors (Egger and Tarlea, 2015). However, the robustness of the results to corrections of the small sample bias should be checked, which affects both the point estimates and the standard errors (Weidner and Zylkin, 2020).

It would be interesting to exploit the information on educational attainment available in the OECD Database on Immigrants in OECD and non-OECD Countries. However, the output of preliminary regressions is not very promising. The reasons might that the panel is quite short (two periods) and that the number of countries for which the complete set of information is available is rather small. Moreover, disaggregated numbers of migrants might be prone to measure error.

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A Additional tables

Table A1: Reassessment - Direct links – List of countries (1960-2000)

Algeria	Finland	Malaysia	Singapore
Angola	France**	Mexico	South Afr. Cus. Union*
Argentina	Germany	Morocco	Spain
Australia	Greece	Netherlands	Sweden
Austria	Hong Kong	New Zealand	Switzerland+Liecht.
Belgium+Luxemb.	Hungary	Nigeria	Thailand
Brazil	India	Norway	Tunisia
Bulgaria	Indonesia	Oman	Turkey
Canada	Iran	Pakistan	United Arab Emirates
Chile	Ireland	Peru	United Kingdom
China	Israel	Philippines	USA
Colombia	Italy	Poland	USSR*
Czechoslovakia*	Japan	Portugal	Venezuela
Denmark	Korea	Qatar	Vietnam
Dominican Rep.	Kuwait	Romania	Yugoslavia*
Ecuador	Libya	Saudi Arabia	

Notes: List of countries included in the sample. *: 1960-1990. **: France incl. of Andorra and Monaco.

Table A2: Number of persons aged 15+ born in a country

	2000		2010			2000		2010			2000		2010	
Ctry. o. birth	Total	Emigrants	Total	Emigrants	Ctry. o. birth	Total	Emigrants	Total	Emigrants	Ctry. o. birth	Total	Emigrants	Total	Emigrants
ABW		6165		16433	GIB		12252		12347	NRU		625	5794	748
AFG		146353		1015864	GIN	3863438	81968		113928	NZL	2563001	417314	2803695	552876
AGO		214002		289839	GMB		24854		48931	OMN		2862		9656
AIA		1909		3157	GNB		36631		42213	PAK		694062		1215345
ALB		526697	3122872	916842	GNQ		12169		25941	PAN	2010518	155896	2450801	171241
AND		4407		6932	GRC	8994846	722672	8686521	656037	PCN		177		366
ANT		15337		82656	GRD		57866		57672	PER	19596506	602150	20044189	1049832
ARE		15254		52964	GTM	6963763	512165		810815	PHL		2198304		3406799
ARG	25071038	516125	28642347	768947	GUM		56581		404	PKR		16094		7575
ARM	2668154	503567	2885583	618409	GUY		318564		373185	PLW		2159	16839	7202
ASM		31371		874	HKG	3489210	410707	6242016	520155	PNG		26069		34717
ATG		24432		25927	HND	3810728	308811		541519	POL	32416530	2382300	35371917	3277829
AUS	10559608	308247	11767210	389662	HRV	3982131	877829	3889505	830066	PRI	3913055	1304043	4130029	1422878
AUT	6166668	411711	4992523	380504	HTI		523077		978045	PRT	9665484	1551901	9783023	1599725
AZE		990762		862081	HUN	8602710	374831	8542069	426971	PRY	3420798	354338	4705808	620208
BDI		132133		49417	IDN	1.41E+08	1035320	1.69E+08	1299915	PSE		24397		42986
BEL	7840443	368741	8036656	403640	IND		2580144		3782371	QAT		3349		11556
BEN	3398731	20350		92486	IOT		56		1	ROU	18610796	1147506	34457124	2647699
BFA	7903755	892720	7276786	70776	IRL	3497127	795516	3617526	739185	RUS	1.04E+08	5904661	98976603	3325357
BGD		344337		619877	IRN		675472	45244149	897554	RWA	4411383	87133	6092500	45222
BGR	7338115	655806	5719644	725960	IRQ	11138337	398287		640801	SAU		37128		113431
BHR		7483		15872	ISL		22943	253721	32390	SCG	6688796	1167595	6051943	624688
BHS		30494		36306	ISR	2852233	172730	3911222	224335	SDN		196832	21847255	122811
BIH		1445472		1478940	ITA	49604699	2733074	49034661	2388279	SEN	5733243	161085		262770
BLR		1319764	8035029	1007254	JAM		792006		935156	SGP		161910		161001
BLZ	152396	44497		49933	JOR	2974342	72682		101412	SHN		2984		2829
BMU		19478		22149	JPN	1.08E+08	690010	1.09E+08	773837	SLB		2125		3033
BOL	5341875	330875		629477	KAZ		3094559		3328900	SLE	2951435	116755		83817
BRA	1.20E+08	695573	1.46E+08	1107917	KEN	15860988	261988	21889402	284162	SLV	4639556	872504	5007195	1241115
BRB		90281		86239	KGZ	3199221	503911		538691	SMR		2985		2921
BRN		11546		13992	KHM	6663283	239873	9270805	465387	SOM		153458		419271
BTN		3034		7931	KIR		2022		4896	SSD				3015
BWA		20854	1300818	26590	KNA		20319		19424	STP		12578		20129
CAF		10526		30502	KOR		988283		49806	SUN		109956		435547
CAN	19633380	1087790	21636368	1154253	KWT		63672		59707	SUR		7522		205492
CCK		14			LAO	2760886	276085		438581	SVK	4164117	366334	4916072	482499
CHE	4771029	432627	4226071	494142	LBN		380368		445073	SVN	1595276	95831	1641406	101212
CHL	11318475	471750	13688687	505394	LBR		136714	2047422	87812	SWE	6575674	204604	6810781	249286
CHN		4522925		3931796	LBY		83064		103650	SWZ		30411		39378
CIV	8886210	407877		531356	LCA		25620		39526	SYC	64684	9432	74424	11294
CMR	9686172	62672	9859455	165575	LIE		3616		1185	SYR		182550		203022
COD		284264		316709	LKA	11996576	322460		567914	TCA		1367		4472
COG		79466		81973	LSO		106942		156828	TCD		7506		73357
COK		17974		18333	LTU	2847550	263643	4979780	398733	TGO		190698	3362635	63654
COL	29458283	1367443	29507540	1340341	LUX	256884	31930	269562	36469	THA	45984598	339256	51319557	587888
COM	348948	18217		35716	LVA	1575205	182895	3088527	246972	TJK		390864	4657671	428857
CPV		90938		141023	MAC	195014	85577		5	TKL		1808		1979
CRI	2436815	88772	2996827	110790	MAR		1669014		2525472	TKM		189051		184182
CSK		129370		46113	MCO		12530		19933	TLS		11219		12892
CUB	9846996	976586		1244643	MDA		520487		591109	TON		41341		50289
CYM		2386		5438	MDG		78663		121419	TTO	1070527	277905	1265272	319010
CYP		145104	560307	159898	MDV		1011		865	TUN		462712		544981
CZE	8232181	268983	8546141	321304	MEX	70795520	8368610	90282085	11343134	TUR	48565657	2127326	49030754	2585607
DEU	58450789	3441501	64438194	3653642	MHL		6205		17373	TUV		1034		2536
DJI		5492		10095	MKD		259123		388615	TWN		462925		482571
DMA		25864		52331	MLI	5587685	394517	7683700	146190	TZA	18459730	161154		163035
DNK	4186485	170257	4290365	179861	MLT		98797	370049	95668	UGA	12934544	335954		153663
DOM	5995196	775976	7350034	1059564	MMR		163815		1543852	UKR	38420953	4295705		4405632
DZA		1327934		1520331	MNG	1600737	29517		45165	URY	2516562	230543	2713132	303625
ECU	8576723	559545	10723890	921630	MNP		3766		10658	USA	1.87E+08	1154360	2.06E+08	1488975
EGY		347963	50001161	437241	MOZ		404536	11035253	503497	UZB		1174340		1206761
ERI		47713		104106	MRT		23879		41609	VAT		217		172
ESH		229		235	MSR		11540		17073	VCT		43240		47558
ESP	33993608	1063548	35282402	878282	MUS	962637	95780	1096312	140000	VEN	14549648	280838		493022
EST	984337	114603	1032557	132683	MWI	5595733	46163	7384037	243227	VGB		2709		7162
ETH		182808		362997	MYS	13291415	233015	18584671	304514	VIR		49388		54575
FIN	4404980	277275	4519688	256345	NAM		44702	1308801	49252	VNM		1599505		1991764
FJI		119057	763420	176440	NER		62445	8283877	69504	VUT		2167		2719
FLK		2050		1643	NFK		254		225	WSM		71794		80490
FRA	43663590	1195411	47008540	1415683	NGA		399780		665031	XXK				378633
FSM		6593		20614	NIC	3622842	431471	3739326	555476	YEM		74059		88978
GAB		17015		32668	NIU		5673		5039	YUG		111822		319607
GBR	46599273	3418263	47839159	3855561	NLD	11872829	599652	12586468	720735	ZAF	29837700	362147	34435662	610844
GEO		970429		743202	NOR	3098440	134664	3625707	137859	ZMB		71778	6786993	152643
GHA	11196939	265374		458691	NPL	13583970	31142		199402	ZWE		208144		903019

Notes: Shows the number of persons aged 15+ born in a given country (i) regardless of their country of residence (Total) and (ii) residing not in their country of birth (Emigrants) for the years 2000 and 2010. The total number of persons born in a country is not shown when information on the stock of domestic-born residing in their country of birth is not included in the database.
Source: Own calculations based on the OECD Database on Immigrants in OECD and non-OECD Countries.

Table A3: New evidence – Direct links – List of countries (2000-2010)

Armenia	Estonia	Luxembourg	Slovakia
Australia	Finland	Malawi	Slovenia
Austria	France	Malaysia	South Africa
Belgium	Germany	Mauritius	Spain
Brazil	Hungary	Mexico	Sweden
Bulgaria	Indonesia	Netherlands	Switzerland
Canada	Ireland	New Zealand	Turkey
Chile	Israel	Norway	United Kingdom
Colombia	Italy	Poland	Uruguay
Czech Republic	Japan	Portugal	
Denmark	Latvia	Romania	
Ecuador	Lithuania	Russia	

Notes: List of countries included in the sample for the estimation of direct links.

Table A4: New evidence – Direct links (2000-2010) – PPML – Mining industries

	ln(Immigrants)		ln(Emigrants)		INTER2010		Pseudo	Number of			
Industry	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	R-sq.	Exp.	Imp.	Pairs	Obs.
Mining of hard coal	6.103**	(2.524)	6.296**	(2.491)	-7.825*	(4.036)	0.994	6	6	27	54
Extraction crude petroleum and natural gas	-7.927	(6.141)	-0.083	(11.520)	0.896	(1.364)	0.988	7	7	32	64
Other mining and quarring	-0.187	(0.253)	0.179	(0.223)	-0.085	(0.115)	0.998	28	28	479	958
Electricity production, collection, and distribution	0.903	(1.323)	0.127	(1.207)	1.237***	(0.229)	0.999	19	19	101	202

Notes: Results from estimating equation (15) sector by sector using Poisson Pseudo Maximum Likelihood (PPML) on international and intra-national trade. All regressions include a comprehensive set of exporter-and-time and importer-and-time effects as well as pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table A5: New evidence – Direct links (2000-2010) – PPML – Service industries

	ln(Immigrants)		ln(Emigrants)		INTER2010		Pseudo	Number of			
Industry	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	R-sq.	Exp.	Imp.	Pairs	Obs.
Transport	0.396*	(0.233)	0.033	(0.245)	0.075	(0.077)	0.998	32	32	604	1208
Travel	1.656	(1.250)	0.894	(1.162)	2.608***	(0.647)	0.999	26	26	324	648
Construction	0.253	(0.516)	-0.012	(0.505)	-0.154	(0.262)	1.000	31	31	422	844
Insurance and pension services	-0.098	(0.551)	0.546	(0.573)	1.286***	(0.249)	1.000	32	32	482	964
Financial services	0.402	(0.458)	0.304	(0.434)	0.997***	(0.147)	0.999	31	31	461	922
Telecommunications, computer, and information services	0.313	(0.343)	0.250	(0.365)	0.850***	(0.204)	0.999	32	32	555	1110
Other business services	-0.095	(0.489)	-0.265	(0.507)	1.131***	(0.211)	0.999	31	31	571	1142
Education services	0.266	(0.535)	0.071	(0.514)	0.367***	(0.115)	1.000	30	30	337	674
Trade-related services	0.842	(0.842)	-0.003	(1.056)	0.140	(0.407)	1.000	32	32	401	802

Notes: Results from estimating equation (15) sector by sector using Poisson Pseudo Maximum Likelihood (PPML) on international and intra-national trade. All regressions include a comprehensive set of exporter-and-time and importer-and-time effects as well as pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table A6: New evidence – Indirect links (2000-2010) – PPML – Significant coefficients

Ctry. o. birth	$\hat{\varrho}^k$	std. err.	Ctry. o. birth	$\hat{\varrho}^k$	std. err.
NFK	2.147***	(0.000)	ROU	-0.027**	(0.012)
NIU	1.794***	(0.179)	RUS	-0.029***	(0.008)
VIR	1.016***	(0.072)	MDA	-0.034*	(0.018)
MNP	0.482*	(0.263)	BWA	-0.041***	(0.015)
CAN	0.305***	(0.046)	SVK	-0.041***	(0.014)
EGY	0.276***	(0.062)	CIV	-0.042***	(0.015)
ZAF	0.264***	(0.094)	PRT	-0.043*	(0.025)
AUS	0.251***	(0.070)	KGZ	-0.045**	(0.021)
NZL	0.218***	(0.046)	AIA	-0.048***	(0.016)
MOZ	0.211***	(0.065)	BTN	-0.049***	(0.011)
FIN	0.199***	(0.076)	LBR	-0.051***	(0.016)
CYM	0.170***	(0.022)	GNB	-0.054***	(0.015)
GRC	0.165***	(0.031)	KAZ	-0.054***	(0.020)
FJI	0.165**	(0.066)	GIN	-0.055***	(0.017)
BRA	0.155***	(0.048)	LVA	-0.057***	(0.017)
PLW	0.154***	(0.000)	DJI	-0.061***	(0.019)
SGP	0.140***	(0.039)	BLR	-0.063***	(0.024)
IRL	0.128***	(0.021)	PRI	-0.069**	(0.032)
MHL	0.128***	(0.000)	NER	-0.069***	(0.017)
CHN	0.125***	(0.038)	BIH	-0.070**	(0.028)
URY	0.125***	(0.026)	ETH	-0.070**	(0.032)
USA	0.120**	(0.059)	IRQ	-0.072**	(0.035)
NRU	0.118*	(0.071)	MWI	-0.075***	(0.021)
CHL	0.117***	(0.028)	MLI	-0.077***	(0.025)
KNA	0.112***	(0.037)	TON	-0.077***	(0.025)
MEX	0.105***	(0.036)	DZA	-0.080**	(0.037)
IND	0.105*	(0.056)	YEM	-0.080***	(0.021)
COL	0.102**	(0.048)	TZA	-0.081**	(0.038)
BGD	0.101***	(0.021)	ABW	-0.082**	(0.041)
VAT	0.096***	(0.003)	GMB	-0.082**	(0.032)
PER	0.090**	(0.038)	QAT	-0.082***	(0.025)
DOM	0.088***	(0.022)	SMR	-0.084*	(0.047)
MYS	0.088***	(0.020)	BLZ	-0.085***	(0.024)
ZWE	0.086*	(0.047)	EST	-0.089***	(0.027)
ASM	0.084***	(0.000)	AFG	-0.091***	(0.018)
ATG	0.084**	(0.043)	TCD	-0.093*	(0.054)
FLK	0.080***	(0.018)	MRT	-0.095***	(0.034)
NOR	0.078**	(0.034)	PNG	-0.095***	(0.016)
LKA	0.073*	(0.041)	NAM	-0.103**	(0.044)
SYC	0.071***	(0.022)	CUB	-0.118**	(0.049)
ERI	0.070***	(0.019)	TKM	-0.128***	(0.019)
CRI	0.068*	(0.041)	KHM	-0.129**	(0.058)
TTO	0.063**	(0.028)	BEN	-0.146***	(0.035)
VGB	0.062**	(0.028)	TJK	-0.154***	(0.036)
PHL	0.060**	(0.031)	BHS	-0.158***	(0.058)
ESP	0.060*	(0.032)	GNQ	-0.162***	(0.045)
TWN	0.058*	(0.034)	LSO	-0.173***	(0.036)
KEN	0.055*	(0.032)	FRA	-0.181**	(0.077)
TUN	0.053***	(0.019)	MAR	-0.186***	(0.063)
DNK	0.051*	(0.029)	COK	-0.198***	(0.006)
GUM	0.050***	(0.000)	SUN	-0.198***	(0.020)
OMN	0.048*	(0.025)	ARE	-0.267***	(0.042)
SWE	0.047**	(0.021)	LAO	-0.268***	(0.040)
LCA	0.046***	(0.014)	DEU	-0.277***	(0.076)
THA	0.046**	(0.019)	CSK	-0.332***	(0.019)
AGO	0.045**	(0.023)	KOR	-1.233*	(0.713)
BOL	0.040**	(0.017)	TKL	-1.728***	(0.000)
KIR	0.040**	(0.017)	TLS	-15.185***	(4.085)
DMA	0.039***	(0.012)			
SUR	0.038***	(0.009)			
GUY	0.035***	(0.008)			
PAK	0.030**	(0.013)			
SCG	0.023***	(0.009)			

Notes: Results from estimating equation (11) for each country of birth (ctry. o. birth) k separately; see Table 10. Only significant effects are displayed. Ordered by the size of the estimated coefficent. Estimation method: Poisson Pseudo Maximum Likelihood (PPML). All regressions include a dummy for joint membership in a regional trade agreement (RTA), a common currency, the log of emigrants and the log of immigrants, an interaction between a dummy for international transactions and a year dummy for 2010 ($INTER_{ij,2010}$) as well as a comprehensive set of exporter-and-time, importer-and-time effects, and pair fixed effects. Lists the number of exporters (Exp.), importers (Imp.), and pairs included in the regression as well as the number of observations (Obs.). For all regressions, the Pseudo R-squared is 0.998 or higher. Standard errors clustered at country pairs in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.