How migrants' food tastes shape international agro-food trade*

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Abstract

We identify and quantify the effect of food tastes on international trade flows. Based on a novel data set including all ingredients in the national dishes of 171 countries, we construct a measure for similarity in food tastes between countries. We identify the effect of tastes on bilateral food trade flows by exploiting that migrants' tastes differ from the tastes of their host country. Our results show that the effect of migration on trade decreases the more similar tastes are between a migrant's country of origin and her host country. Thus, we can show that tastes do matter for international trade flows, and are able to quantify their effect.

JEL classification: F1
Keywords: preferences, international trade, migration, food

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1 Introduction

Dis-moi ce que tu manges, je te dirai ce que tu es.
(Jean Anthelme Brillat-Savarin, Physiologie du goût, 1825)

Tell me what you eat, and I will tell you what you are! This famous proverb was coined by the French lawyer, politician and gastronome Jean Anthelme Brillat-Savarin in the early 18th century. It summarizes the fact that food is to a large extent what defines us not only as individuals but also as societies. In fact, most countries have an official or unofficial national dish. The food an individual grows up with shapes her tastes for the rest of her life (Birch 1999). Thus, when individuals migrate they bring their food tastes to the host country. In this paper, we exploit that migrants' tastes might differ from the food tastes of their host country in order to identify and quantify the effect of tastes on international agro-food trade. In particular, we construct a measure of food tastes at the country level based on a novel data set including all ingredients of the national dishes for 171 countries. This allows us to measure the similarity of migrants' food tastes with the food tastes of their host country. Thus, our paper contributes to the empirical literature on the effects of tastes or preferences on international trade.

2 Data and food similarity measures

We use data of bilateral food trade flows in current million USD between 171 countries for the 5 years 1998, 2000, 2005, 2010 and 2015 (food stuffs are recorded in HS categories 1 to 24). The data set is prepared by the Centre d'études prospectives et d'informations internationales (CEPII), and based on the UN Comtrade Database (Gaulier and Zignago, 2010). Data on migration comes from United Nations (2015), measured as the stock of foreign-born people by destination and origin for all countries and years in the sample. Note that migration data is only available in 5-year intervals.

In order to measure food tastes at the country level, we compile a novel data set on national dishes for 171 countries. We retrieve all ingredients in the recipe of a country's national dish from the websites foodpassport.com or nationalfoods.org, which both provide comprehensive databases on recipes.[1] The literature on the development of food preferences, surveyed in Birch (1999), finds that adults' tastes favor the foods consumed as a child. This implies that food tastes are persistent. Thus, we focus in our analysis on place of birth rather than nationality of people in a given country.

We construct dyadic food tastes similarity measures using (i) the Manhattan distance and (ii) latent semantic analysis. The Manhattan distance between any two national

[1] The data set is available upon request from the authors.

dishes from countries i and j is given by

$$w_{ij} = \frac{1}{K_{ij}} \sum_{k=1}^{K} |z_i^k - z_j^k|, \tag{1}$$

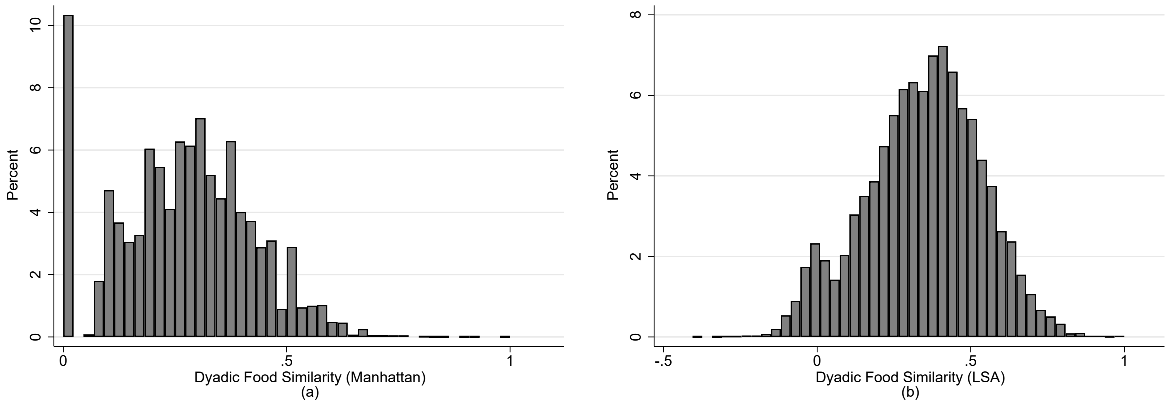
where z^k is an indicator variable taking the value 1 if the national dish of a country uses ingredient k. The distance, or absolute value, between any two ingredients is equal to 1 if only one national dish uses this ingredient, and zero if either both national dishes use it or both do not use it. The Manhattan distance sums these distances over all ingredients k for every country pair. This sum is large if two national dishes are dissimilar, and vice versa. We standardize the sum by dividing with the total number of ingredients K_{ij} used in both national dishes of countries i and j. Finally, we define the dyadic food tastes similarity measure $FS_{ij} \equiv 1 - w_{ij}$ such that the measure is high if national dishes are similar, and low if national dishes are dissimilar.

Latent semantic analysis (LSA) is primarily used in text analysis for comparing and assessing the similarity of documents based on words (see Landauer et al. 1998). In our context, we compare the recipes of national dishes (documents) based on ingredients (words). First, we construct an ingredient-recipe matrix with either ones (ingredient is used in a given recipe) or zeros (ingredient is not used in a given recipe). Second, LSA finds a low-rank approximation to this sparse ingredient-recipe matrix characterized by few ones and many zeros using singular-value decomposition (SVD). The entries of this matrix contain inferred frequencies of ingredients for each recipe. Intuitively, SVD infers how likely it is that ingredient X appears in national dish Y. Third, based on the approximated ingredient-recipe matrix, we calculate the cosine distance between all national dishes to estimate their similarity. The dyadic similarity measure based on LSA takes values between 1 (recipes are identical) and -1 (recipes are completely different).

The Manhattan distance does only pairwise comparison of ingredients without taking into account whether those ingredients are very common or not. Intuitively, two dishes using both relatively uncommon ingredients should be more similar than two dishes using both relatively common ingredients. We prefer the LSA similarity measure because it takes this into account.

Figure 1 shows the distributions of the dyadic food tastes similarity measures based on (a) the Manhattan distance, and (b) LSA. We observe that both similarity measures are similarly distributed with means 0.27 (standard deviation of 0.15) and 0.35 (standard deviation of 0.19), respectively. In fact, Spearman's rank correlation coefficient is equal to 0.97, rejecting the null hypothesis that both measures are independent. We further note that both distributions seem bimodal with one peak around zero, and a second peak around 0.27 and 0.35, respectively. This suggests that there are two distinct groups of countries, a larger group with relatively similar food tastes, and a smaller group with relatively dissimilar food tastes compared to most other countries in the world.

Figure 1: Distribution of dyadic food similarity measures



Note: The figure shows the distribution of the dyadic similarity measure based on (a) the Manhattan distance, and (b) latent semantic analysis (LSA).

As an illustration, the food similarity index based on LSA says that the food tastes of Switzerland (Fondue, a melted cheese dish) and Zimbabwe (Sadza, a porridge) are one of the most dissimilar pairs with a value of -0.4, whereas the food tastes of Zimbabwe (Sadza, a porridge) and Zambia (Nshima, a porridge) are one of the most similar pairs with a value of 0.97 (besides the island nations Palau, Micronesia and Seychelles, which all share the same national dish of fruit bat soup). An example of two countries with mean similar tastes of 0.35 are Albania (Fergese Tirane, a meat casserole) and Romania (Sarmale, cabbage rolls stuffed with meat).

3 Effects of food tastes on agro-food trade

To identify the effect of food tastes on international trade, we use variation in the similarity of migrants' and natives' food tastes across countries. In particular, we specify the following gravity model of international trade

$$\ln v_{ijt} = \beta_0 + \beta_1 \ln M_{ijt} + \beta_2 FS_{ij} + \beta_3 \left(\ln M_{ijt} \times FS_{ij}\right) + x'_{ijt}\delta + \alpha_i + \gamma_j + \lambda_t + u_{ijt} \quad (2)$$

where the left-hand side, v_{ijt}, denotes the value of bilateral trade between exporter i and importer j in year t (in millions of USD). M_{ijt} denotes the number of migrants originating from country i residing in host country j in year t (defined as foreign-born, measured stock at mid-year), and FS_{ij} the dyadic measure of similarity in food tastes as measured by the similarity of national dishes between country i and j (based on either the Manhattan distance or LSA).[2] Note that our food taste similarity measures are time invariant.

The main concern for the validity of our estimates are unobserved factors affecting tastes (similarity measure) and migration patterns simultaneously. In particular, other aspects of culture like language or (unobserved) norms and values imposed in (prior) colonial relationships might bias our results. Thus, the vector x contains the following variables: importer and exporter GDP (in current USD) and population (in millions) both in logs, log distance between most populated cities, as well as dummy variables for Preferential Trade Agreement (PTA) in force, contiguity, common official primary language, language spoken by at least 9% of the population in both countries, country pair ever in colonial relationship, common colonizer post-1945, pair currently in colonial relationship, pair in colonial relationship post-1945, countries were or are the same country. The data on those variables comes from Gaulier and Zignago (2010).

Following Egger (2000) on the proper specification of the gravity equation, α_i, γ_j and λ_t denote exporter, importer and year fixed-effects, respectively. Exporter and importer fixed-effects capture unobserved country-specific factors that are constant over time (e.g., very persistent unobserved cultural factors in a country), whereas year fixed-effects are capturing common time trends across all countries (e.g., McDonaldization of the food culture across the world).

We are interested in the effect of migration on food imports depending on how similar migrants' tastes are to the tastes in their host country. In other words, how much does the value of trade between exporter i and importer j, that is, country j's imports, change if more people born in country i with food tastes similar to those of country j reside in country j. This effect is captured by the coefficient β_3 on the interaction of migration M_{ijt} and food tastes similarity FS_{ij}.

We estimate equation (2) by ordinary least-squares (OLS). In order to take into account the occurrence of zeros in bilateral food trade flows, we estimate the following, appropriately modified equivalent of equation (2),

$$v_{ijt} = \exp\left[\beta_0 + \beta_1 \ln M_{ijt} + \beta_2 FS_{ij} + \beta_3 \left(\ln M_{ijt} \times FS_{ij}\right) + x'_{ijt}\delta + \alpha_i + \gamma_j + \lambda_t\right] u_{ijt}, \quad (3)$$

by Poisson pseudo-maximum likelihood (PPML) (see e.g., Silva and Tenreyro, 2006).

[2] We add 1 to M whenever M is zero so that we do not loose those observations when we take logs.

4 Results and discussion

4.1 Main results

Table 1 shows the coefficient estimates for migration stock (β_1), food tastes similarity (β_2), and their interaction (β_3). Columns (1) and (3) show the results from estimating equation (2) by OLS, whereas columns (2) and (4) show the results from estimating the modified equivalent of equation (2) by PPML including zeros in bilateral trade flows. Our preferred specification is model (4) based on the LSA similarity measure and estimated by PPML. The coefficient estimates for all (gravity) variables are very similar across all models, and can be found in Table 3 in Appendix A.

Table 1: Bilateral trade, migration and food tastes similarity

Dependent variable:	bilateral trade flows			
	Manhattan distance		LSA similarity	
	OLS	PPML	OLS	PPML
	(1)	(2)	(3)	(4)
Migration	0.35***	0.26***	0.35***	0.27***
	(0.02)	(0.03)	(0.02)	(0.03)
Food Similarity	0.28**	0.20	0.20**	0.15
	(0.12)	(0.21)	(0.09)	(0.16)
Migration × Food Similarity	-0.22***	-0.18***	-0.19***	-0.18***
	(0.06)	(0.07)	(0.05)	(0.05)
Observations	70,926	145,350	70,926	145,350
R-squared	0.67	0.86	0.67	0.86

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Clustered standard errors at the country-pair level in parentheses. Migration is measured as (log) total migrant stock (foreign-born) at mid-year (in thousands) and Food Similarity is a dyadic similarity measure either based on the Manhattan distance or latent semantic analysis (LSA). Controls in all models include importer and exporter GDP (in current USD) and population (in millions) in logs, log distance between most populated cities, as well as dummies for Preferential Trade Agreement (PTA) in force, contiguity, common official primary language, language spoken by at least 9% of the population in both countries, country pair ever in colonial relationship, common colonizer post-1945, pair currently in colonial relationship, pair in colonial relationship post-1945, countries were or are the same country. All models include importer, exporter and year fixed-effects. Models (1) and (3) are estimated by OLS, models (2) and (4) are estimated by Poisson pseudo-maximum likelihood (PPML).

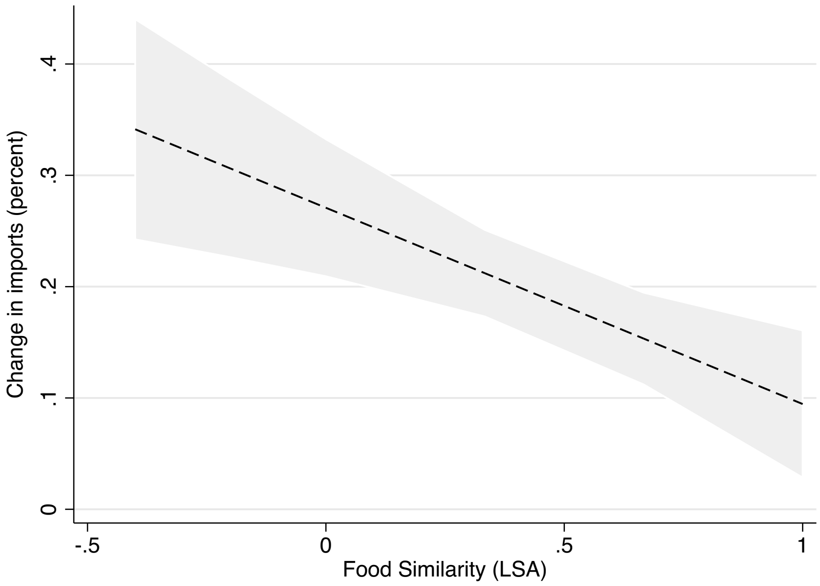
From the results in Table 1, we can compute the effect of migration on food imports depending on how similar migrants' food tastes are relative to the host country's food tastes, *ceteris paribus*. Formally, this effect is given by taking the first order partial derivative of equation (2) with respect to migration:

$$\frac{\partial \ln v_{ijt}}{\partial \ln M_{ijt}} = \beta_1 + \beta_3 FS_{ij}. \tag{4}$$

Figure 2 shows that the effect of migration on food imports from the migrants' home countries is decreasing in the similarity of food tastes between the migrants' home and host countries.[3] In other words, while an increase of 10 percent in the migration stock increases food imports from the migrants' home country by approximately 3.5 percent if food tastes are very dissimilar (FS value of around -0.4), they increase by less than 1 percent if food tastes are very similar (FS value of around 1). Thus, we can show that tastes matter for international trade flows, and quantify their effect.

[3]Based on model (4) in Table 1, we also estimate the effects from the cross-section for every year separately. The results are similar to the panel estimates. In fact, the effects of migration on food imports at the mean similarity of 0.35 are all around 0.21 for every year in our sample (all effects are statistically significant at the 1 percent significance level).

Figure 2: Effect of migration on food imports depending on similarity of food tastes



Note: The figure shows the effect (in percent) of migration on food imports depending on how similar migrants' food tastes are relative to their host country's food tastes based on the estimation results of model (4) in Table 1 (based on LSA similarity measure, estimated by PPML). The y-axis displays equation (4), i.e. $\beta_1 + \beta_3 FS$, and how its value changes with the degree of similarity FS on the x-axis. The grey shaded area displays a 95 percent confidence interval. The more similar migrants' food tastes are to their host country's food tastes (higher values of FS), the lower is the effect of migration (M) on food imports from the migrants' home country (v).

4.2 HS Sections

In this section, we take a closer look at the effect of migration on different types of food imports depending on the similarity of food tastes between migrants and their host country. This recognizes that the effect of food tastes might differ for different types of food like raw animal or vegetable products and processed food products.

In Subsection 4.1, we analyze agro-food trade, aggregating HS2 categories 1-24. In this subsection, we look at HS sections I to IV. According to UN Trade Statistics (2021), HS Section I includes HS2 categories 1-5 (live animals and animal products), HS Section II includes HS2 categories 6-14 (vegetable products), HS Section III includes HS2 category 15 (animal or vegetable fats and oils), and HS Section IV includes HS2 categories 16-24 (prepared foodstuffs, beverages and tobacco).

Table 2 shows the coefficient estimates for migration stock (β_1), food tastes similarity (β_2) based on the LSA similarity measure, and their interaction (β_3) from estimating equation (3) by PPML, including zeros in bilateral trade flows (our preferred specification). The coefficient estimates for all variables can be found in Table 4 in Appendix A.

We see that for animal products (column HS Sect. I) as well as vegetable products (column HS Sect. II), the results are very similar to the results for aggregated foodstuffs in Table 1. Tastes matter for trade. For prepared foodstuffs (column HS Sect. IV) tastes matter slightly less. Finally, for fats and oils (column HS Sect. III) tastes do not matter.

Anecdotal evidence suggests that migrants often freshly prepare food, cooking dishes from their home country, requiring raw ingredients like meats and vegetables. If their host country has very dissimilar tastes, those ingredients may not be locally produced and close substitutes may not be available. Consequently, such ingredients must be imported. As prepared foodstuffs are usually less important in home-cooked meals tastes matter less. Fats and oils are used in almost all kitchens around the world, and can easily be substituted. Intuitively, differences in food tastes play no role in the trade of fats and oils. One can interpret the case of fats and oils as sort of a placebo test for our food similarity measure. Passing this placebo test increases our confidence in the results.

4.3 Discussion

Standard international trade theory has focused on the supply side, and long neglected the role of preferences in determining international trade patterns. Only recently has theoretical and empirical work started to recognize that tastes matter for international trade flows (e.g., Atkin 2013, Aw et al. 2019, Chang and Lee 2019), with, for example, important consequences for evaluating the gains from trade. We expand and complement this nascent literature by proposing a new explicit measure of food tastes, which we use to quantify the effect of tastes on international food trade flows.

Table 2: Bilateral trade, migration and food tastes similarity (HS Sections I-IV)

Dependent variable:	bilateral trade flows			
	HS Sect. I	HS Sect. II	HS Sect. III	HS Sect. IV
Migration	0.24***	0.33***	0.08	0.26***
	(0.05)	(0.04)	(0.06)	(0.03)
Food Similarity	0.00	-0.23	0.02	0.34*
	(0.26)	(0.24)	(0.39)	(0.20)
Migration × Food Similarity	-0.21***	-0.20***	-0.05	-0.11*
	(0.08)	(0.07)	(0.13)	(0.06)
Observations	145,350	145,350	142,800	145,350
R-squared	0.81	0.77	0.70	0.86

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Clustered standard errors at the country-pair level in parentheses. Migration is measured as (log) total migrant stock (foreign-born) at mid-year (in thousands) and Food Similarity is the dyadic similarity measure based on latent semantic analysis (LSA). Controls in all models include importer and exporter GDP (in current USD) and population (in millions) in logs, log distance between most populated cities, as well as dummies for Preferential Trade Agreement (PTA) in force, contiguity, common official primary language, language spoken by at least 9% of the population in both countries, country pair ever in colonial relationship, common colonizer post-1945, pair currently in colonial relationship, pair in colonial relationship post-1945, countries were or are the same country. All models include importer, exporter and year fixed-effects. All models are estimated by Poisson pseudo-maximum likelihood (PPML). HS Sect. I includes HS2 categories 1-5 (animals), HS Sect. II includes HS2 categories 6-14 (vegetables), HS Sect. III includes HS2 category 15 (fats and oils), and HS Sect. IV includes HS2 categories 16-24 (prepared foodstuffs).

5 Conclusion

The case of food offers a unique opportunity to identify the effect of tastes on international trade at the country level based on a novel data set of national dishes. We provide evidence that tastes matter for international (food) trade flows. Thus, strengthening the argument that future research should further analyze the role of differences in tastes in determining international trade flows rather than assuming identical tastes across countries.

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A Appendix: Results

Tables 3 and 4 show the coefficient estimates for all gravity variables.

Table 3: Bilateral trade, migration and food tastes similarity

Dependent variable:	bilateral trade flows			
	Manhattan distance		LSA similarity	
	OLS	PPML	OLS	PPML
	(1)	(2)	(3)	(4)
Migration	0.35***	0.26***	0.35***	0.27***
	(0.02)	(0.03)	(0.02)	(0.03)
Food Similarity	0.28**	0.20	0.20**	0.15
	(0.12)	(0.21)	(0.09)	(0.16)
Migration × Food Similarity	-0.22***	-0.18***	-0.19***	-0.18***
	(0.06)	(0.07)	(0.05)	(0.05)
Log Distance	-1.11***	-0.58***	-1.11***	-0.59***
	(0.02)	(0.03)	(0.02)	(0.03)
Log GDP exporter	0.40***	0.17***	0.40***	0.17***
	(0.03)	(0.4)	(0.03)	(0.04)
Log GDP importer	0.54***	0.73***	0.54***	0.73***
	(0.03)	(0.05)	(0.03)	(0.05)
Log Population exporter	-0.55***	-0.31*	-0.55***	-0.31*
	(0.09)	(0.17)	(0.09)	(0.17)
Log Population importer	0.58***	0.25**	0.58***	0.25**
	(0.08)	(0.10)	(0.08)	(0.10)
Preferential Trade Agreement	0.50***	0.47***	0.50***	0.47***
	(0.03)	(0.04)	(0.03)	(0.04)
Contiguity	0.31***	0.30***	0.31***	0.28***
	(0.09)	(0.07)	(0.09)	(0.07)
Common Official Language	0.29***	-0.16	0.29***	-0.15
	(0.07)	(0.10)	(0.07)	(0.10)
Language Spoken By At Least 9%	0.14**	0.32***	0.14**	0.32***
	(0.06)	(0.11)	(0.06)	(0.11)
Past Colonial Relationship	0.26**	0.06	0.26**	0.06
	(0.11)	(0.12)	(0.11)	(0.12)
Common Colonizer Post 1945	0.81**	0.33***	0.81***	0.32***
	(0.05)	(0.12)	(0.05)	(0.12)
Current Colonial Relationship	0.49	1.69***	0.48	1.68***
	(1.09)	(0.47)	(1.08)	(0.48)
Colonial Relationship Post 1945	1.06***	0.53***	1.06***	0.53***
	(0.15)	(0.15)	(0.15)	(0.15)
Were Or Are Same Country	0.59***	-0.05	0.59***	-0.02
	(0.13)	(0.10)	(0.13)	(0.10)
Observations	70,926	145,350	70,926	145,350
R-squared	0.67	0.86	0.67	0.86

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Clustered standard errors at the country-pair level in parentheses. Migration is measured as (log) total migrant stock (foreign-born) at mid-year (in thousands) and Food Similarity is a dyadic similarity measure either based on the Manhattan distance or latent semantic analysis (LSA). All models include importer, exporter and year fixed-effects. Models (1) and (3) are estimated by OLS, models (2) and (4) are estimated by Poisson pseudo-maximum likelihood (PPML).

Table 4: Bilateral trade, migration and food tastes similarity (HS Sections I-IV)

Dependent variable:	bilateral trade flows			
	HS Sect. I	HS Sect. II	HS Sect. III	HS Sect. IV
Migration	0.24***	0.33***	0.08	0.26***
	(0.05)	(0.04)	(0.06)	(0.03)
Food Similarity	0.00	-0.23	0.02	0.34*
	(0.26)	(0.24)	(0.39)	(0.20)
Migration × Food Similarity	-0.21***	-0.20***	-0.05	-0.11*
	(0.08)	(0.07)	(0.05)	(0.05)
Log Distance	-0.68***	-0.60***	-0.79***	-0.57***
	(0.05)	(0.04)	(0.07)	(0.04)
Log GDP exporter	0.04	0.10	0.52***	0.27***
	(0.06)	(0.06)	(0.09)	(0.05)
Log GDP importer	0.90***	0.81***	0.18*	0.59***
	(0.06)	(0.08)	(0.09)	(0.05)
Log Population exporter	-0.07	-0.57*	-0.72*	-0.26
	(0.25)	(0.22)	(0.37)	(0.19)
Log Population importer	0.10	0.15	0.08	0.46***
	(0.16)	(0.15)	(0.25)	(0.12)
Preferential Trade Agreement	0.54***	0.44***	0.38***	0.47***
	(0.07)	(0.06)	(0.11)	(0.05)
Contiguity	0.52***	0.00	0.53***	0.32***
	(0.10)	(0.10)	(0.15)	(0.08)
Common Official Language	-0.10	-0.60***	0.02	0.16
	(0.14)	(0.14)	(0.22)	(0.10)
Language Spoken By At Least 9%	0.30**	0.67***	0.00	0.17
	(0.14)	(0.14)	(0.21)	(0.12)
Past Colonial Relationship	0.02	-0.30*	0.27	0.17
	(0.14)	(0.16)	(0.23)	(0.13)
Common Colonizer Post 1945	0.38**	0.54***	-0.26	0.19
	(0.16)	(0.14)	(0.28)	(0.15)
Current Colonial Relationship	2.55***	1.07**	0.91	1.11**
	(0.41)	(0.49)	(0.60)	(0.46)
Colonial Relationship Post 1945	0.56***	0.79***	0.54	0.51***
	(0.17)	(0.23)	(0.43)	(0.15)
Were Or Are Same Country	0.02	-0.14	0.26***	0.00
	(0.15)	(0.15)	(0.26)	(0.12)
Observations	145,350	145,350	142,800	145,350
R-squared	0.81	0.77	0.70	0.86

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Clustered standard errors at the country-pair level in parentheses. Migration is measured as (log) total migrant stock (foreign-born) at mid-year (in thousands) and Food Similarity is the dyadic similarity measure based on latent semantic analysis (LSA). All models include importer, exporter and year fixed-effects, and estimated by Poisson pseudo-maximum likelihood (PPML).