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Abstract

This paper documents the importance of consumer taste in the food industry using Belgian firm-product customs data by destination. We identify consumer taste through the use of a control function approach and estimate it jointly with other demand parameters using a very flexible demand specification. The results show that taste decreases in distance but this relationship is not monotonic. The contribution of consumer taste to actual export revenue ranges from 1% to 31% depending on the product category in the food industry. On average, consumer taste explains about as much of the variation in exports as marginal costs.

JEL Classification: F14, F12

Keywords: tastes, Quality, marginal cost, exports, firm-product, consumer heterogeneity

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The Importance of Consumer Taste in Trade*

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1 Introduction

Recent papers in international trade document the importance of the demand side. In particular, Eaton et al. (2015) stress the importance of learning about demand for customer accumulation. Hottman et al. (2016) find that firm-appeal explains more than half of the variation in the product sales of firms. Foster et al. (2016) show that demand fundamentals explain more of the size gap between new and established firms than productivity does. However, missing in this literature is a better understanding of the various components on the demand side. In this paper, we fill this gap and dig deeper into the notion of firm appeal to analyze the empirical importance of consumer taste in the export success of firms.

Over the past decade the importance of consumer taste is reflected in the rapidly rising marketing budgets of firms relative to productivity-enhancing expenditures.[1] A recent survey by Accenture of around 287 US manufacturing firms, indicated that 61% of firms responded that offshoring for efficiency reasons was no longer their priority. Instead, firms prefer to be closer to consumers to respond better to local tastes and taste heterogeneity.[2] An example of this is Nike, which has recently been setting up speed factories in the US to produce tailor-made sneakers to satisfy individual customer taste. Adidas has done the same in Germany.[3]

Studying consumer taste has important implications for a number of other research questions related to traditional international trade, gravity and macro-models. Workhorse models in international trade and the price indices that they generate, typically assume demand to be identical across products and countries and do not include consumer heterogeneity.[4] Our empirical finding that consumer taste is as important to export success as marginal costs suggests that a richer parameterization of demand preferences seems warranted. In the current gravity literature, distance is often used as a proxy for transport costs. In this paper we show that distance also reflects the decay of taste in space. Moreover, our finding that consumer taste decays in space suggests that we may need to think differently about what distance captures in gravity models. Without controlling for taste, the role attributed to distance in gravity models is likely to be over-estimated. Finally, consumer taste, as a determinant of firm-level exporting, is likely to have macroeconomic impact since aggregate exports are an important component of country-level GDP (Gabaix (2016); Giovanni and Levchenko (2012)). While the recent focus in macro models has been to incorporate heterogeneity on the supply side (Ghironi and Melitz (2005)), the inclusion of demand side heterogeneity may prove just as important as the driver of

[1] *The Economist*,https://cdn.static-economist.com/sites/default/files/images/print-edition/20150829$_{W}BC$539*.png*

[2] http://www.areadevelopment.com/BusinessGlobalization/4-20-2011/backshoring-us-manufacturing-labor-costs1266672.shtml

[3] https://www.forbes.com/sites/retailwire/2017/09/27/nike-can-make-you-custom-sneakers-in-under-an-hour/#29d2a8ce72f6

[4] An exception is Di Comit et al. (2014)

aggregate growth.

The importance of consumer taste also has implications for the research in industrial organization relating to the sources of firm growth and productivity measurement. Recent papers by Head et al. (2014) and Mrazova and Neary (2017) incorporate the role of demand in explaining firm size distributions. However, demand heterogeneity in consumer taste has not been explored even though taste is very likely to affect firm size and the firm size distributions. Acknowledging that firms and products can be subject to heterogeneous demand shocks is likely to affect how productivity is measured. Deflating revenues with traditional price indices is likely to underestimate firm-level productivity as shown by Foster et al. (2008) and more recently by Smeets and Warzynski (2013). Accounting for demand heterogeneity leads to more concise price indices, thus reducing the output price bias and generating more accurate productivity measures.

The current literature on quantifying taste in trade is limited to specific products as demonstrated by Atkin (2013) for rice and Cosar et al. (2018) for cars. The aim of our paper is to develop a more general taste measure for a wide spectrum of traded goods, including those where taste indicators do not exist. The approach can be applied to any traded product where taste is likely to matter. The method that we propose is easy to replicate and does not require any functional form assumptions. This should then allow researchers to study demand related aspects in many more markets in the future. Our product definition is more aggregate than in the scanner data of Hottman et al. (2016). However, the advantage of using trade data is that we have destination-specific information on consumer purchases which allows us to account for the heterogeneity of consumers across countries. The use of firm-level customs data allows us to obtain consumer taste and marginal cost measures at firm-product and destination level.

To identify consumer taste we do not use a demand residuals approach since this would potentially be confounding taste with other unobservable demand and cost shifters. Instead we want to tease out the part of the demand residual that best captures different dimensions of consumer heterogeneity related to taste differences across countries. For this purpose, we adopt a control function approach with variables which have been successfully used in the international business and gravity literature, such as common spoken languages, religions, cultural distance and nationalities which are likely to affect taste. In section 2.2, we provide evidence to show that these variables are not just picking up distance or transaction costs.

There is an abundance of anecdotal evidence to support the idea that wherever people share the same language, religion, nationality or cultural history, there is strong taste overlap.[5] For example, sea cucumbers are a delicacy in the Chinese-speaking part of the world but rank low

[5] Abbott Nutrition,"Ten Surprising Things that Affect Your Taste," August, 2017.

in the taste of Westerners. Food habits in Australia are closer to the UK and the US than to Asia, clearly illustrating that in matters of taste, culture can be more important than physical distance since Australia is physically closer to Asia. Immigration and overlap in nationalities also seem associated with food habits. For instance, pizza which originated from Naples in Italy, came to the US in the 19th century with the arrival of Italian immigrants.[6] Similarly, it was an influx of German and Italian immigrants into Australia in the 1950s that helped to expand the wine industry because they were adept to drinking European varieties.[7] The pizza and wine examples illustrate how local tastes for food can be influenced by foreign immigrants.[8] Religion can also affect consumer taste. Exporting pork to Muslim countries, for instance, will not be a success for religious reasons, regardless of the quality of the pork.

The data that we use in this paper are Belgian customs data at firm-product level with destination specific information on quantities and prices. Based on a decomposition of export revenues, our findings indicate that consumer taste is important in explaining export success. Consumer taste accounts for between 1-31% of actual export revenue depending on the product category. On average, consumer taste explains about as much of the variation in exports as marginal costs.[9] We show that taste is a fundamentally different source of heterogeneity in the data than quality even though the two dimensions are often lumped together as firm-appeal. In the data we find the variance in quality to be largest across firms, while the variance in consumer taste to be largest across countries. We find that consumer taste for Belgian food products decays with distance but the relationship is not monotonic, suggesting that distance captures more than transport cost.

The remainder of the paper is structured as follows. Section 2 lays out the empirical identification strategy of consumer taste using a control function approach. In Section 3, we obtain marginal cost by backing it out from the price data. Section 4 describes the data. Section 5 reports the demand and cost parameter estimates. In section 6, we assess the relative importance of consumer taste in explaining firms' export revenues relative to other determinants such as quality and cost, market size and markups. Section 7 contains the summary and conclusion.

[6] https://slice.seriouseats.com/2006/02/a-slice-of-heaven-a-history-of-pizza-in-america.html

[7] http://sedimentality.com/wine-history/the-history-of-wine-in-australia/

[8] Rauch and Trindade (2002) find that ethnic Chinese networks have a positive impact on bilateral trade.

[9] We know that the main contribution of the demand side lies at the intensive margin from the work of Roberts et al. (2018) who assess the role of firm-level demand heterogeneity in export participation. By conditioning on export participation we ignore fixed entry costs as a source of variation in trade decisions which was studied earlier by Aw et al. (2011).

2 General Demand Specification

2.1 Identification

We begin with a demand model in which we empirically identify the demand parameters and discuss the potential endogeneity issues. Consumers in country d have the following general demand function Q_{jidt} for product i exported by firm j in year t:

$$q_{jidt} = Q_{jidt}[p_{jidt}, \lambda(X')_{jidt}, \delta(Y')_{jidt}, \gamma_{idt}, \epsilon_{jidt}] \tag{1}$$

where q_{jidt} is the quantity of product i sold by firm j that is consumed in country d and year t, $\lambda(X')$ represents the control function for consumer taste and $\delta(Y')$ represents the control function for quality where X' and Y' are vectors of variables that proxy for taste and quality respectively. Applying insights from Levinsohn and Petrin (2003), Olley and Pakes (1996) and others, we replace the unobservables $\lambda(.)$ and $\delta(.)$ with observables using polynomial functions to estimate the coefficients which are then used to predict indexes of quality and taste at the $jidt$ level.[10] p_{jidt} is the price (f.o.b.) of product i provided by firm j exclusive of transport cost and distribution cost. Firm-level demand in a destination can thus vary due to the export price, the quality offered and the local taste. γ_{idt} represents a set of product-country-year fixed effects. Given that our data are trade flows originating from Belgium, γ_{idt} captures product-country specific characteristics such as market size, market structure, distance and distribution costs in the destination. Finally ϵ_{jidt} is the residual term which captures additional demand and cost shifters. The residual (ϵ_{jidt}) may still contain important firm-product variation of trade cost (such as transport, distribution costs and exchange rate fluctuations) and markups that could plague the identification of the demand parameters. To address this endogeneity problem, we need to instrument for price. A good instrument for price should be highly correlated with the export price to destination d, but uncorrelated with the residual term. An instrument that satisfies these conditions is an average price of the same firm-product (ji), but exported to distant destinations (Hausman (1996)). These destinations should not be in the proximity of country d because then the firm-product transport cost (τ_{jidt}) will be too similar and correlated between nearby countries. For this reason we define our instrument for price as the average price for the same firm-product that is at least 1000 km apart from destination d. This ensures that the instrumented price does not reflect firm-

[10] By using a control function approach for consumer taste and product quality we avoid the endogeneity bias arising from correlation of these variables with the residual in the demand function. For instance, if not properly controlled for, taste will enter the residual of the demand function, rendering $E(p_{jidt}\epsilon_{jidt}) \neq 0$, affecting price as firms may set a higher price for products with a stronger taste. This would result in a misspecification of demand and biased coefficients.

product transport costs to destination d. Put differently we ensure that our instrument is such that $E(p_{jikt}\tau_{jidt}) = 0$. For robustness, we also verify results when simply using all prices for the same firm-product to all alternative destinations as an instrument and results remain the same. This suggests that when using only the prices of remote destinations, we are not introducing a selection effect into the instrumental variable strategy.[11][12]

While our instrumentation strategy is one that has successfully been used in other papers, endogeneity could still be a problem if the pass-through rates of costs (exchange rates, markups or other) into prices systematically vary with the size of a firm in a destination (Amiti et al. (2014), Atkinson and Burstein (2008)). This could potentially undermine our Hausman (1996) price instrumentation strategy because the price in another market would not be independent of the size effect. Whether a firm-product market share is positively correlated across markets is ultimately an empirical question. If being large means that pass-through rates are significantly lower than for products with small market shares, our instrumented price could still be correlated with the residual of equation (1).

For this purpose, we verify the bilateral correlations between firm-product ji's market size across destination markets. We find it to be very low and no higher than 0.2. Thus while a firm-product ji can have a large market share in one market, it may end up having a small market share in another market. This suggests that our instrument is still a good one, because the instrumented price is unlikely to be correlated with the residual, ϵ_{jidt}. Our instrument for price is the following:

$$lnPIV_{jidt} = \frac{1}{N_{jit}} \sum_{k \in S_{jit}, k \neq d} lnp_{jikt}, \tag{2}$$

where S_{jit} is the set of the remote countries that firm-product ji is exported to in year t and N_{jit} is the number of export destinations far from country d for the firm-product ji.

The demand equation (1) results in the following empirical specification:

$$\ln q_{jidt} = \gamma_{idt} - \sigma_{id} \ln p_{jidt} + \ln\hat{\lambda}_{jidt} + \ln\hat{\delta}_{jidt} + \epsilon_{jidt} \tag{3}$$

where q_{jidt} is the quantity of exports sold of product i that firm j sold to country d in year t. p_{jidt} is the f.o.b. price, $\ln\lambda(.)$ is consumer taste, $\ln\delta(.)$ is quality which all enter the demand function

[11] In an earlier paper Aw and Lee (2017) used the productivity of other firms selling the same product as an alternative instrument in the estimation of their demand equation. In the current paper we want to be more general and avoid the use of functional forms, which is why we turn to the Hausman (1996) price instrument.

[12] Fontagné, Martin and Orefice (2018) instrument export prices by firm-level electricity cost shocks, which is an alternative if you have access to that type of data

at the same level of disaggregation. The price elasticities of demand σ_{id}, vary across destination countries and product markets and γ_{idt} represents a set of product-country-year fixed effects. Both consumer taste and product quality are unobservables in the data. To obtain consistent estimates of $\ln\hat{\lambda}_{jidt}$ and $\ln\hat{\delta}_{jidt}$, a control function approach is used and described in the sections below. ϵ_{jidt} accounts for any remaining unobserved demand shock correlated with price as well as white noise.

2.2 Control Function for Consumer Taste

We apply a control function approach to the estimation of demand to tease out the unobserved taste heterogeneity from the demand residual. We do this in a non-parametric way by specifying a polynomial on exogenous variables correlated with taste.[13] To control for the unobservable consumer taste in equation (3), we define $ln\hat{\lambda} = \lambda(X')$ where X' is a set of proxy variables that capture the taste of consumers in country d for variety ji. This control function for consumer taste is then embedded in the demand function and estimated jointly with other demand parameters. The variables, included in the control function for taste, capture several aspects of consumer heterogeneity across countries and represented as follows.

$$ln\lambda(X')_{jidt} = ln\lambda[s_{jid(t_0)} * (CL, CR, CN, CD), z_{idt}] \tag{4}$$

We include a set of exogenous indicators that capture different aspects of consumer heterogeneity at the country-level. One of the most frequently used indicators for this purpose comes from the international business literature e.g. cultural distance between countries which has been used extensively.[14] Separately, the gravity literature[15] has also pointed out a number of variables that capture important aspects of consumer heterogeneity across countries. These variables include common spoken languages (CL), common religion (CR)[16] and the extent of overlap

[13]Our approach differs from the productivity literature (Olley & Pakes, 1996) where they model the unobservable productivity as a dynamic process, resulting in an a priori relationship between observable and the unobservable. Instead we use a set of exogenous variables that proxy for taste. Therefore we have no inversion and monotonicity requirement in our control function approach. Empirically, we allow taste to vary by year but do not model taste dynamics in this paper.

[14]Shenkar (2001), Beugelsdijk et al. (2017), Kogut and Singh (1988), Guiso et al. (2009) and Gollnhofer and Turkina (2015) introduced the applications of Hofstede' s (1980) culture difference indicators in several topics such as the entry modes of foreign direct investment(FDI).

[15]Melitz (2008), Egger and Lassman (2012), Melitz and Toubal (2014), and Egger and Toubal (2016).

[16]Melitz and Toubal (2014) and Egger and Toubal (2016) indicate that common religions play an important role in explaining the bilateral trade flows.

between countries in nationalities (CN).[17]

Common spoken language has been used in the literature as a proxy for transaction/trade costs between countries. However, we find the correlation between common spoken language (CL) and distance in the raw data (Melitz and Toubal (2014)) to be (-0.2). In addition, we also find the correlation between common language and aggregate exports (0.2) to a destination to be low. If the common language indicator was merely a reflection of transactions costs, these correlations would have been high. The low correlations suggest that common spoken language is different from transaction or trade costs.

In equation (4), we transform values for the country-level indicators for CL, CR, CN and CD into indicators that capture variations in consumer taste at the firm and product levels. This can be done by introducing two additional variables, $s_{jid(t_0)}$ and z_{idt}. The share $s_{jid(t_0)}$ is the ratio of firm j's sales revenue in product (CN8) i exported to country d to firm j's global exports of product i in the initial year t_0 of the data. This ensures that two Belgian firms with identical country-level indicators to China and Japan can have different consumer taste for their exports if the firms have different $s_{jid(t_0)}$.[18] The Belgian firm that exports 15% of its global sales of say, chocolates will be assigned a stronger consumer taste for chocolates than a competitor that exports only 5% of its global chocolate sales to the same country. We define the share in the initial year of our data $s_{jid(t_0)}$ to address concerns of its potential endogeneity. This share is kept constant over the years.[19]

The country-level indicators (CL,CR,CN,CD) are collected from different sources. Following Melitz and Toubal (2014) and Egger and Toubal's (2016) methodology, we construct the indicator of common nationalities(CN) based on the data of the share of residents versus citizens in each country. This transforms the raw data per country into bilateral indices[20] that reflect the closeness in each dimension between any country pair cd. For example, to construct the closeness index between countries c and d in terms of common nationalities (CN), we take the share of people from country l in country c (s_{lc}) and multiply it by the share of people from country l in country

[17]Gould (1994), Felbermayer, Jung and Toubal (2010), Head and Ries (1998) and Rauch and Trinidade (2002) study the link between immigration and trade flows.

[18]We normalize $s_{jid(t_0)}$ by weighting the firm-product sales share with the GDP of the destination relative to the GDP of a reference country. For example, if country A's GDP is half of country B's GDP then we multiply a firm's trade flow going to country A by one half. This accounts for the difference in market size between countries A and B.

[19]The correlation between the taste index with initial weights $s_{jid(t_0)}$ versus contemporaneous weights is 0.98. Given this very high correlation and the loss of many observations (29%) with initial weights, we report results with contemporaneous weights.

[20]In our bilateral index, we only focus on Belgium as the exporting country.

d (s_{ld}). Doing this for every country and summing over these countries results in:

$$CN_{cd} = \sum_l s_{lc} s_{ld} \tag{5}$$

A high value for the indicator CN_{cd} indicates that countries c and d have similar distributions of nationality components. For the bilateral indices of common spoken language (CL) and common religion (CR) we use the indices constructed by Melitz and Toubal (2014). Appendix A provides more details including an example of how these indicators are constructed, based on raw data as in Table A-1.

The raw data from Hofstede (1980) are somewhat different from the previous country-level indicators of consumer heterogeneity. They present six different dimensions of culture (i.e. individualism, power distance, masculinity, uncertainty avoidance, long-term orientation and indulgence) for every country. To turn them into one bilateral index on cultural distance, we follow Kogut and Singh (1988) which is widely used for this purpose. This consists in calculating the sum of the deviations along each of the six cultural dimensions between countries c and d (CD_{cd}) as follows:

$$CD_{cd} = \frac{1}{6} \sum_{k=1}^{6} \frac{(I_{kc} - I_{kd})^2}{V_k} \tag{6}$$

where I_{kc} represents the index for the k^{th} cultural dimension for country c, V_k is the variance of the index of the k^{th} cultural dimension. $(I_{kc} - I_{kd})^2$ reflects the distance in the k^{th} cultural dimension between countries c and d and a large $(I_{kc} - I_{kd})^2$ indicates that countries c and d are dissimilar in the k^{th} cultural dimension. Since the range of each cultural dimension is different, we divide $(I_{kc} - I_{kd})^2$ by the variation of the k^{th} cultural dimension. CD_{cd} stands for the cultural difference between countries c and d and a high CD_{cd} indicates that countries c and d are less similar in culture. As such the CD index provides an average difference across the six dimensions of the Hofstede indicator.

Similarly, in the control function for taste, we also include a product-level share by destination, z_{idt} which captures how much of a Belgian product i (all firms) is shipped to a particular destination d compared to the rest of the world. The reason for introducing this second share is that $s_{jid(t_0)}$ for a particular firm A could be identical for both China and Japan i.e. if they each get a similar share of firm A chocolates. Without introducing z_{idt}, the control function for taste would assign similar taste levels to firm A' chocolates shipped to China and Japan. But now suppose that the global sales share of (all) Belgian chocolates shipped to Japan is higher than to China. This would suggest that there is a stronger taste for chocolates in general in Japan than in China. This information is taken into account by introducing z_{idt}, which will assign a higher taste for all Belgian chocolates shipped to Japan relative to China.[21] The share z_{idt} is an across-destinations share at product level and therefore unlikely to be correlated with demand residuals in equation (1) ensuring that $E(z_{idt}\epsilon_{jidt}) = 0$.[22] The control function for consumer taste $\lambda(X')_{jidt}$ will then be proxied by a polynomial in all these variables.[23]

The resulting taste index at trade flow level then consists of (i) a country-level dimension that captures the bilateral consumer heterogeneity between Belgium and the destination and that affects the taste index for all products shipped there; (ii) a product-level dimension that indicates how important a destination d is for a particular exported product; (iii) a firm-product-level dimension, that reflects how much a destination d likes an individual firm's product relative to other destinations. This ultimately results in a firm-product-destination measure of consumer taste for every trade flow. Taste indices can be compared for the same firm-product across destinations or for different firm-products within destinations. Taste indices can be aggregated at the level of the product group or the level of the country and are comparable across products and countries.

Table 4 shows that the bilateral correlations of CL, CR, CN and CD are very low. Nevertheless we experimented with applying a principal component analysis on the four indicators in order to capture the extent of overlap in information between them. The taste measure that we obtain by using a control function for taste using the principal-component measure is highly correlated with the control function for taste where we just include the four bilateral indicators (0.83). In the estimation of the demand function, each of the (CL, CR, CN, CD) indicators is significant either by itself or in its interaction terms.[24] Thus, we do not reduce the number of consumer heterogeneity dimensions, since this would end up in the residual of the demand estimation.

In the data, the structural parameter for consumer taste is measured at the most disaggregate level of trade flows in the data e.g. firm-product (CN8)-destination level. But in some product categories this is asking a lot from the data as it requires a sufficient number of destinations that each firm-product is shipped to. As a robustness check, we also verify our results for consumer taste defined at the product-destination level of aggregation but results remain qualitatively the

[21] Demand estimation includes product-country-year FE γ_{idt} which, amongst other things, controls for market size and is defined at a higher level of product aggregation than z_{idt}.

[22] In our data, we require at least 20 firms selling the same product to the same destination to allow for sufficient variation required to identify demand coefficients. This also ensures that the firm-product trade flow to a country does not coincide with the entire product-level flow going to that destination.

[23] We use a polynomial of order two. The use of a higher order polynomial of degree three does not affect our results qualitatively.

[24] Regression results on the demand estimation are available upon request but will not be shown for brevity.

same.

2.3 Control Function for Quality

We follow the literature to account for product quality in the demand specification and also use a control function approach. Earlier papers indicated that higher quality outputs are positively correlated with input prices, income levels and market shares in a given destination country (Bastos, Silva and Verhoogen (2018); Khandelwal (2010), De Loecker et al. (2016)). The control function for quality $\delta(Y')_{jidt}$ is thus defined as a function of import prices ($PIMP_{jt}$), the weighted GDP per capita across destinations ($WGDP_{jit}$), the weighted local GDP per capita of the destination ($LGDP_{jidt}$) and the firm-product market share within the destination (f_{jidt}):

$$ln\delta(Y')_{jidt} = ln\delta[PIMP_{jt}, WGDP_{jit}, LGDP_{jidt}, f_{jidt}] \tag{7}$$

Firms are likely to export high-quality products to high-income countries. Therefore in the control function for quality, $\delta(Y')$, we include GDP per capita of the destination country (Schott (2004); Bils and Klenow (2001) and Hallak (2006)). Firms may export a product i to several countries other than country d. Thus we use the weighted sum of GDP per capita across all countries($WGDP_{jit}$) that a firm-product pair is exported to.[25] Including $WGDP_{jit}$ in $\delta(Y')$ accounts for the idea that the higher the average GDP of all the countries that a firm export its product to, the higher the quality of the product. In addition, we also include the local GDP per capita of the destination, weighted by the firm-product market share ($LGDP_{jidt}$) in the control function for quality.[26] This accounts for the idea that firms can vary their quality by destination and may offer higher quality to countries with higher local GDP per capita.

In the control function for quality, we also include firm-level input prices since producing high-quality products generally requires high-quality inputs (Kugler and Verhoogen (2011), Bastos, Silva and Verhoogen (2018) and Fan et al. (2018)). For this purpose we construct a firm-level import price index ($PIMP_{jt}$) by calculating the weighted sum of import prices (unit values) of each imported product within a firm.[27] We normalize import prices of inputs by their (CN8)product mean to control for absolute price differences across products.

Finally, we include firm-product market share within destination d (f_{jidt}). This captures the idea that within a destination, higher quality products have a higher market share (Khandelwal

[25] As weights we use the sales share of a firm-product ji to country d in the total exports of firm-product ji.

[26] The weight that we use is the share of firm-product ij in country d over the total sales of product i in country d.

[27] Here $PIMP_{jt} = \sum_z \sum_o s_{jzot} \times IMP_{jzot}$ where s_{jzot} is the import share of firm j's total imports that come from good z imported from country o and IMP_{jzot} is the import price of good z coming from country o.

(2010); De Loecker et al. (2016)).

This control function is introduced in the demand function as a polynomial in these variables, whose coefficients are simultaneously estimated with other demand parameters.[28]

3 Estimation of Demand and Cost

3.1 Demand Estimation

We estimate the demand function:

$$\ln q_{jidt} = \gamma_{idt} - \sigma_{id}\ln p_{jidt} + \ln\lambda(X^{'})_{jidt} + \ln\delta(Y^{'})_{jidt} + \epsilon_{jidt} \tag{8}$$

To ensure that the Corr(lnp_{jidt}, ϵ_{jidt}) = 0, we use the average export prices in other remote destinations k (ln p_{ji-dt}) as the instrument for price as shown in equation (8). We define remote countries based on the following criteria: (1) country k and country d do not share the same border; (2) country k and country d do not have a colony history; (3) the distance between countries k and d is at least 1,000 km.

By using 2SLS, the estimation of the demand function in equation (8) allows us to empirically identify three important parameters e.g. the elasticity of demand $\hat{\sigma}_{id}$, the consumers' taste $ln\hat{\lambda}_{jidt}$ and the quality index $ln\hat{\delta}_{jidt}$.

The empirical counterparts to the control functions for taste and quality represented in equations (4) and (7) are constructed at the firm-product-country level quality index ($ln\delta_{jidt}$) and taste index ($ln\lambda_{jidt}$) as follows:

$$ln\hat{\lambda}_{jidt} = \sum_{l} \hat{\beta}_l X^l_{jidt} + \sum_{l}\sum_{m} \hat{\beta}_{lm}(X^l_{jidt}X^m_{jidt}) \tag{9}$$

where l and m include all variables in the control function of taste in Eq. (4)

$$ln\hat{\delta}_{jidt} = \sum_{v} \hat{\beta}_v X^v_{jidt} + \sum_{v}\sum_{n} \hat{\beta}_{vn}(X^v_{jidt}X^n_{jidt})$$

where v and n include all variables in the control function of quality in Eq. (7).

[28] We used a polynomial of order two. Experimenting with higher order polynomials did not alter results much.

3.2 Cost Estimation

We now retrieve the structural demand parameters from estimating equation (8). In particular, we obtain the elasticity of demand (σ) as the regression coefficient on price ($\partial lnq_{ijdt}/\partial lnp_{ijdt}$) and use the optimal equilibrium pricing condition for profit maximization in every destination to back out the marginal cost from the prices without using any additional functional forms on the supply side.

$$p_{jidt}[1 - (1/\sigma_{id})] = MC_{jidt} \tag{10}$$

Since prices are f.o.b. export prices, our estimates of marginal cost are exclusive of transport and distribution cost but inclusive of the marginal cost of production which also includes costs related to vertical (quality) and horizontal (taste) product differentiation.[29] Our estimates for marginal cost thus vary at the firm-product-destination level since we back out cost from destination level prices.

4 Data Description and Documentation

Our trade data consist of Belgian customs data of manufacturing firms for the period 1998-2005 with information on firms exports in quantities and values by product and by destination and firm imports by product and country of origin. The Belgian trade data has been handled at the National Bank of Belgiums (NBB) Trade Database, which covers the entire population of recorded trade flows.[30] The trade data are recorded at the firm-product-country-year level, i.e. they provide annual information on firm-level trade flows by 8-digit Combined Nomenclature (CN8) product and by country. Export prices and import prices are unit values which we obtain at the level of the trade flow, by dividing export values by quantities.[31]

The period 1998-2005 has a congruent reporting threshold for firms to be considered as exporters over time. This threshold at firm-product level was raised in 1998 from 104,115€ to 250,000€ but did not change afterwards until 2006. However, during the period of our analysis,

[29] Firm-product-destination-year ($jidt$) specific transport and distribution costs are unobservables in the demand function. Our instrumentation strategy, ensures that their presence in the residual does not contaminate the elasticity of demand, estimated as the coefficient on price. Thus, while we cannot separate them, they do not affect our estimates. See section 2.1.

[30] We exclude transactions that do not involve a "transfer of ownership with compensation". This means that we omit transaction flows such as re-exports, the return, replacement and repair of goods and transactions without compensation, e.g. government support, processing or repair transactions, etc.

[31] The CN8-product classification is similar to the HS6 classification for the first 6 digits but offers more product detail in the last two digits.

the HS6 product classification altered three times. To address the changes in product classifications over time, we concord the product codes along the lines of Bernard et al. (2019).[32] In doing so we lose about 20% of export value in our data, but this ensures that our data are cleaned of product code changes.

In our analysis we focus on the food industry. Belgium exports a wide range of food products. The food industry accounts for 5-6% of total export revenue during 1998-2005. This results in a sample of 1,802 firm-products in seven different food categories (from HS2, 15-22) for which we can identify taste in every destination they are exported to.

The data on common languages and common religion come from Melitz and Toubal (2014),[33] while data on nationalities as a share of the population come from the World Bank in the year 2000.[34] and finally, the cross-sectional cultural distance indicators are obtained from Hofstede (1980).[35] Table A-2 in the Appendix in the top part lists the top ten countries that are closest to Belgium for each of the country-level indicators, while in the bottom part we list the ten countries that are most different from Belgium.

In Table 1 we start by listing the four parameters and the level of aggregation at which they are measured empirically. This comprises the taste index (λ_{jidt}), the quality index (δ_{jidt}) and the marginal cost index (c_{jidt}) which are all estimated at the same level of aggregation e.g. the firm-(CN8) product-country-year level.

Table 2 documents the number of trade flow observations, where each observation is a firm-product (CN8)-destination export flow. We have over 100,000 trade flows. Observations are spread relatively evenly over the broad product (HS2)classifications ranging from 15 to 22.[36]

Table 3 documents the variation in the raw data on the bilateral indices between Belgium and country of destination of common spoken language (CL), common religion (CR), common nationality (CN) and cultural distance (CD), where for exposition purposes we again aggregate destinations into regional blocs. The details of the construction of the common nationality (CN) index is reported in Appendix A. The other variables are from the literature and reflect the raw data. There are 194 countries for which we have bilateral indices on common language (CL) and common religion (CR), and 208 countries with information on common nationality (CN).

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[32] Instructions for concordance of trade classifications over time can be found here: https://www.sites.google.com/site/ilkevanbeveren/Concordances and is described in Van Beveren et al. (2012)

[33] http://faridtoubal.com/research.htm. This data set contains cross-sectional bilateral indicators for every pair of countries. Here we only use the data between Belgium and its trading partners.

[34] http://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

[35] Hofstede indicator can be found from https://geerthofstede.com/research-and-vsm/dimension-data-matrix/

[36] HS2 range from HS2=15 which is Animal or Vegetable Fats and Oils to HS=22 which is Beverages, Spirits and Vinegar.

However, there is much less information for the bilateral cultural index (CD) for which we have 62 countries. In the demand function estimation, we only keep countries with information on these four indices, which implies a loss of 24% of observations.

Table 4 shows that the correlation between each pair of the four bilateral indices is low. This pattern justifies the inclusion of all of them as they seem to capture different aspects of consumer heterogeneity across space.

5 Parameter Estimates

5.1 Elasticity of Demand

From the estimation of the demand specification in equation (8), we obtain the elasticities of demand (σ_{id}). Table 5 documents the estimated average elasticities of demand (σ_{id}) which for expositional purposes we aggregate up to the broad (HS2)product categories. Average values range between 1.77 and 3.15 with standard deviations between 0.54 and 1.48. The inclusion of consumer taste and product quality demand shifters absorbs some of the variation that otherwise would be attributed to the demand elasticity. Without the inclusion of control functions for these additional demand shifters, an endogeneity bias would occur and result in an upward bias on the demand elasticity estimates.

5.2 Taste versus Quality and Cost Indices

Averages of the estimated taste, quality and marginal cost indices by regional bloc (Table 6) indicate that consumer taste for exported Belgian products display substantial geographical variation while quality and cost appear to vary less by destination.[37]

Table 7 lists the correlation matrix between consumer taste, quality and marginal cost. The low correlation between marginal cost and taste suggests that our taste measure captures an inherently different source of variation in the data than say the presence of distribution networks (Arkolakis (2010)). The correlation between quality and taste is similarly very small indicating that both demand shifters are clearly separated and pick up different sources of variation in the data.

The negative correlation between quality and marginal cost appears to be a counter-intuitive result in view of earlier work (Baldwin and Harrigan (2011)). However, our measure of marginal cost reflects both the inverse of productivity as well as the cost of producing quality. We cannot

[37]The taste index takes on a negative value in some regions because the mean indices are expressed in logs.

disentangle the two without assuming specific functional forms which we want to avoid here. To establish a clean correlation between quality and marginal cost, we first need to control for the level of output since high output in the data can come from high productivity (low MC) as well as high quality (high MC). A simple OLS regression of marginal cost (lnc_{jidt}) on the quantity shipped (lnq_{jidt}) and the quality embedded ($ln\delta_{jidt}$), results in a positive and very significant coefficient on quality. This suggests that at any given level of output, higher quality goods in our data have a higher marginal cost.

In Table 8 we decompose the variance of each index. The first column shows that about 70% of the variation in the consumer taste index is explained by the country dimension, about 23% by the product dimension and only 7% by the firm dimension in the data. This suggests that consumer taste is a source of variation that is primarily driven by consumer heterogeneity across destination countries and that estimating consumer taste at product-country level, as in Aw, Lee and Vandenbussche (2018), would capture the bulk of the variance observed in consumer taste.

The second column of Table 8 decomposes the variance of the quality index. In this paper we empirically identify quality at the most disaggregate level possible in the trade data. This variance decomposition shows that the main source of quality variation comes from the firm and product-level dimensions explaining respectively 65% and 32% of the variance of the quality index. The country-dimension explains only 3% of the quality index variance in our data. Thus, while we cannot exclude quality differentiation by destination, we find it to be extremely small.

And finally in the last column, we show the decomposition of the variance of the marginal cost index. Most of the variation in costs come from the product-level which explains around 60%, while the firm-level dimension explains about 27% and the country-dimension about 13% of the overall cost variance. This suggests that the bulk of marginal cost differences in trade flows are due to different product-level technology.

6 The Importance of Consumer Taste

6.1 Consumer Taste and Distance

In Figure 1 we aggregate our measure of consumer taste up to the country-level and then plot the average taste for Belgian food products for each destination in the world. The taste index is normalized between zero and one as indicated in the legend to the figure. Darker colors reflect a higher level of the destination-specific taste index. The world map clearly indicates how consumer taste evolves in space. Not surprisingly, taste for Belgian exported products is typically strong in nearby Western European countries. The map also shows that distance is not the only driving force underlying consumer taste. Taste for Belgian products is also strong in countries very far away from Belgium such as the U.S., Canada and Australia. The correlation between consumer taste and distance from Belgium in our data, is negative and around -0.6. This suggests that with a doubling of distance, taste falls by about half. The scatter plot in Figure 2 between λ_{jidt} and distance (both in logs), shows the negative relationship. But Figure 1 clearly shows that consumer taste for Belgian products does not vary monotonically with distance. Thus, in addition to distance the taste index is really picking up another source of variation. This is expected since in the demand estimation of Equation (8), we included product-country fixed effects to control for bilateral distance at the product market-level. This non-monotonicity of consumer taste with distance suggests that, in addition to geography, consumer tastes also matters in explaining trade flows among countries.[38] Figure 1 however also suggests that excluding consumer tastes in demand estimation, then the coefficient obtained on distance reflects both transport cost and the decay of consumer taste in space.

6.2 Taste for Chocolates

Both our measures of quality and consumer taste generate results that are intuitive and that correspond with case-based evidence of quality and taste in some product categories. A good example is chocolates, a well-known Belgian export. This is a product category for which the CN8-product classification makes a distinction between high-end dark chocolates with high cocao content (18062010) and low-end milk chocolates with low cocao content (18062030). Since cocao is the main and most expensive ingredient in chocolates, dark chocolate is generally regarded as higher quality than milk chocolate. When we compare this independent product quality ranking embedded in the product classification with the quality and taste indices obtained from our empirical strategy above, our priors are confirmed. In every destination where chocolates are sold, we find that high-end dark chocolates with a cocao content exceeding 30%, has a higher quality index than the low-end milk chocolate with a much lower cocao content. Marginal cost for dark chocolates is significantly higher than for milk chocolates. In terms of taste, we consistently find stronger taste for the sweeter low-end milk chocolate than for more bitter high-end dark chocolate. These quality and taste rankings of chocolates are independent of the specification that we run or the level of aggregation of our consumer taste variable. The values generated by our taste and quality indices correspond quite well with industry reports on the chocolate market and chocolate consumption where milk chocolate typically holds the largest market share but

[38] Eaton and Kortum (2002) find that geography plays an important role in determining trade flows among countries.

dark chocolate is known to be more expensive and to have health benefits.[39]

6.3 The Decomposition of Export Revenues

Finally, based on the joint demand and supply parameters we perform a decomposition of export revenues to assess the relative importance of taste in explaining firms' export revenues relative to other determinants like quality and cost, market size and markups. Our decomposition is in the spirit of Hottman et al. (2016), but whereas they pursued it at firm-level, our decomposition is at firm-product-country level. The coefficients arising from the decomposition can be interpreted as the percentage variation in export revenues that is explained by each particular indicator including consumer taste.

Based on the estimated demand function (Eq. (3)) and the firm's optimal price (Eq. (10)), firm j's export revenue of product i in country d can be expressed as:

$$\begin{aligned} lnr_{jidt} &= lnp_{jidt} + lnq_{jidt} \\ &= \gamma_{idt} + (1-\sigma_{id})lnp_{jidt} + ln\widehat{\lambda}_{jidt} + ln\widehat{\delta}_{jidt} + \epsilon_{jidt} \\ &= \underbrace{\gamma_{idt} + (1-\sigma_{id})ln\Big(\frac{\sigma_{id}}{\sigma_{id}-1}\Big)}_{M_{idt}} + (1-\sigma_{id})lnc_{jidt} + ln\widehat{\lambda}_{jidt} + ln\widehat{\delta}_{jidt} + \epsilon_{jidt} \end{aligned} \tag{11}$$

Equation (11) shows how export sales revenue at firm-product-country level can be decomposed into its separate components: the variation of market size and market competition, including markup variations (M_{idt}), firm-product-destination costs (lnc_{jidt}), firm-product-destination quality ($ln\hat{\delta}_{jidt}$), firm-product-destination consumer taste ($ln\hat{\lambda}_{jidt}$) and a residual (ϵ_{jidt}.

Following Hottman et al. (2016), we regress each component of the right-hand side of equation (11) on lnr_{jidt} to get the contribution of each component of firm-product-destination export revenue on total export revenues. This is given in equation (12).

$$\begin{aligned} M_{idt} &= \beta_M lnr_{jidt} + \varepsilon^M_{jidt} \\ ln\hat{\lambda}_{jidt} &= \beta_\lambda lnr_{jidt} + \varepsilon^\lambda_{jidt} \\ ln\hat{\delta}_{jidt} &= \beta_\delta lnr_{jidt} + \varepsilon^\delta_{jidt} \\ (1-\sigma_{id})lnc_{jidt} &= \beta_c lnr_{jidt} + \varepsilon^c_{jidt} \\ \epsilon_{jidt} &= \beta_R lnr_{jidt} + \varepsilon^R_{jidt} \end{aligned} \tag{12}$$

[39] https://www.grandviewresearch.com/industry-analysis/chocolate-market

Each of the β coefficients in equation (12) can now be interpreted as the "percentage variation of the revenue explained by the indicator". As such the β coefficients can directly be compared with each other.

Empirical findings of the decomposition are reported in Table 9. The decomposition results on consumer taste, given by β_λ, vary between 11-17%, depending on whether we define consumer taste at its most disaggregate level e.g. the firm-product-country level (columns (1)-(2)) or at the product-country level (columns (3)-(4)) and depending on whether we normalize the weight $s_{jid(t_0)}$ in the consumer taste control function by the market size of the destinations (columns (2) & (4)). In general, defining consumer taste at its most disaggregated level in the data as in column (1), results in higher β_λ, while normalizing for market size lowers β_λ as in column (4). Decomposition results however appear stable and the importance of consumer taste in explaining export revenue is not generally affected by the level of aggregation and of the weighting scheme that we used in the control function for consumer taste.[40]

The corresponding estimated coefficients for the quality index ranges between 20-23% and for the marginal cost index between 13-15%. Market size and other effects account for about 7-8% of the variation in firm-product-country export revenues. The coefficient on the residual component ranges between 42-45%, depending on the specification.[41] Despite the fact that the residual component is substantial, the relative importance of consumer taste is important. Relative to the other structural parameters, we find consumer taste in food products to be about equally important to marginal cost. Table 9 shows that on average across industries, consumer taste is about as important as marginal costs in explaining the variation in actual export revenues.

In Appendix Table A-3 we show decomposition results for every HS4 product category based on specification (2) in Table 9. Table A-3 shows that the importance of consumer taste index varies significantly depending on the product category and ranges between 1-31%. For example in product group Belgian Ice cream (2105), consumer taste explains 27% of the export revenues, compared to 24% and 7% attributed to quality and marginal costs, respectively. In the majority of industries, consumer taste together with quality explain more of the variation in export revenue than marginal cost. These results confirm the result of Hottman, Redding and Weinstein (2016) who found that firm-appeal which combines quality and taste, explains more than half of the variation in the sales of barcoded products. These results are also in line with Aw et al. (2018) that use a more functional form approach to derive structural parameters on consumer taste,

[40]In Aw et al. (2018), consumer taste was proxied by product-country dummies and picked up more of the variation in the decomposition. Here we tease out the part of the residual that is related to taste and find quantitatively smaller results.

[41]Goodness-of-fit measures in firm-level panel data are typically very low, especially at the level of disaggregation that we consider in the data.

quality and cost. Their conclusion, based on a wider range of industries, also pointed to the demand side being more important than the cost side in the decomposition of export revenues. Another way of looking at the results in Table 9 is to consider the share of variation that the demand side can explain of the predicted export revenue. When we exclude the residual, taste and quality together account for the bulk of the variation in the data that the model can explain i.e. 63% ((17%+20%)/58%) .

6.4 Robustness Checks

6.4.1 Balanced Panel Results

Thus far in the analysis, we have used all observations in our data set. But the question can be raised whether there are selection effects at work when not every product is exported to every destination. If there are selection effects at work then we should find that the composition of Belgian export products differs across destination countries. For this purpose we take a look at the minimum cutoff level of the indices and how they vary with distance from Belgium.

Table 10 shows a positive correlation between distance to destination and the minimum product quality present in a destination indicating that the minimum quality offered rises with distance to the destination country.[42] We also find a positive correlation between distance and the minimum cost at firm-product level. To understand this result, we have to keep in mind that the cost index used here also include the cost of producing higher quality. Therefore our cost measure is not simply the inverse of productivity as it is in other models. Similar to the minimum quality, the results in Table 10 suggest that the minimum cost of products present in a destination goes up in distance.[43] Finally, in column (2) of Table 10, we find a negative correlation between the distance to destination and the minimum tastes index present in the market. This result is consistent with the way taste is shown to decay in space in Figure 1. For every product shipped to a farther destination, taste will be lower. Hence the minimum cutoff in taste will also be lower in more distant destinations. The results in Table 10 suggest that a decomposition of export revenues into taste, quality and cost determinants, may be affected by a different product composition being present in each destination.

To verify whether results change in a balanced panel we present Table 11 where we now only include products that are present in every destination. Results for the balanced panel

[42] Baldwin and Harrigan (2011) find similar results.

[43] The positive correlations between distance to destination and the quality (cost) threshold also hold if the 1 percentile of quality (cost) index is used instead of the minimum level of quality (cost) indices across firms within one destination.

are similar to the ones in Table 9 even though the number of observations drops substantially. Taste continues to feature as an important determinant (10-16%) in the decomposition of export revenues. Compared to marginal cost, consumer taste together with quality still explain the large fraction of data variation in export revenue.

Based on the predicted revenues, firm-appeal (taste and quality) explains 76% ((16% + 20%)/47%) of the overall variation that can be explained by the model which is by far the main determinant of export revenues for food products.

For chocolates, the number of observations in our data are large (Table A-3) stemming from the fact that chocolates is one of the few products that is shipped to every destination and more likely to appear in the balanced panel. The low values on the marginal cost coefficients in the balanced panel can be ascribed to the fact that chocolates (1806) which are shipped almost everywhere are typically products for which cost differences between firm-products appear to be very low.

6.4.2 Age of the Firm

We next examine whether our results on consumer taste are picking up the age of the firm e.g. how long a firm-product has been present in a destination market. In order to define a firm-product age, we first drop the firm-(CN8)-product-destination combinations that appear in the first year of our panel since we have no information on how long they have been in the destination market.

Next, we run an OLS regression of our taste measure on ln(age). This results in a very low correlation of 0.03. When we then insert ln(age) as a separate regressor in the demand equation (8), the age variable is not significantly different than zero. The correlation of our taste variable in the models with and without the age variable is around 0.98 implying that the ranking of our earlier taste index does not change much when controlling for the firm-product age in the demand function estimation. This is illustrated in Figure 3 which clearly shows the strong correlation between the two measures.

7 Summary and Conclusion

In this paper, we develop and use an empirical strategy to identify consumer taste that is very general and independent of functional forms. We tease out the part of the demand residual that captures cross-country consumer taste heterogeneity based on a control function approach. This approach is easy to replicate and provides measures of taste for every trade flow in the data at any level of aggregation. The approach also allows for an identification of quality and marginal cost at the same level of aggregation.

Based on a decomposition of export revenues, we find consumer taste to be important in explaining export success. The contribution of consumer taste to actual export revenue is between 1% and 31% and depends on the product category in the food industry. On average, consumer taste explains about as much of the variation in exports as marginal costs. Our findings indicate that taste is a fundamentally different source of heterogeneity in the data than quality even though the two dimensions are often lumped together as firm-appeal. Together, quality and taste explain the majority of the variation in the data, independent of the product category.

The results on consumer taste documented in this paper can potentially provide insights to several strands of literature such as firm dynamics, export entry, productivity measurement and gravity models. Exploring the impact of consumer tastes in these various settings will prove to be fruitful avenues for future research.

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Table 1: Level of Estimated Parameters

Parameters	Variables	Level of Analysis
σ_{idt}	Demand Elasticities	(HS4)Product-Country
λ_{jidt}	Taste Index	Firm-(CN8)Product-Country-Year
δ_{jidt}	Quality Index	Firm-(CN8)Product-Country-Year
c_{jidt}	Marginal costs Index	Firm-(CN8)Product-Country-Year

Note: We also identified demand elasticities (σ) at the (HS6)product-country level and the decomposition results did not have a significant change. Estimating σ at the (HS6)product-country level provides a large number of the (HS6)product-country markets with inelastic demand ($\sigma < 1$). Therefore, we estimate the demand elasticity at the (HS4)product-country level.

Table 2: Number of Observations by (HS2)Industries and Regions

	15	16	17	18	19	20	21	22	Total
AU	65	1	174	507	75	84	85	108	1,099
EA	360	78	706	1,945	337	605	558	675	5,264
EE	1,283	662	1,137	2,482	1,193	1,367	1,562	1,203	10,889
ME	522	139	787	1,816	579	1,156	664	524	6,187
NA	41	36	406	1,018	208	443	205	377	2,734
SA	49	8	81	181	57	52	89	120	637
SAM	311	74	327	1,002	282	506	319	395	3,216
SSA	321	64	443	376	337	395	471	448	2,855
WE	4,990	11,273	7,294	11,046	7,719	10,073	8,972	6,234	67,601
Total	7,942	12,335	11,355	20,373	10,787	14,681	12,925	10,084	100,482

Notes: Regions: AU: Australia and New Zealand, EA: East Asia, EE: East Europe, ME: Middle East, NA: North America, SA: South Asia, SAM: South America, SSA: Sub-Saharan Africa , WE: West Europe.
(HS2)Industries: 15: Animal or Vegetable Fats and Oils, 16: Meat, Fish or Crustaceans, 17: Sugars and Sugar Confectionery, 18: Cocoa and Cocoa Preparations, 19: Preparations of Cereals, Flour, Starch or Milk, 20: Preparations of Vegetables, Fruit, Nuts, 21: Miscellaneous Edible Preparations, 22: Beverages, Spirits and Vinegar.

Table 3: Average Bilateral Indices on Consumer Heterogeneity between Belgium and Destinations

	CL	CR	CN	CD
AU	0.5781	0.1480	0.0006	2.2243
EA	0.1698	0.0889	0.0001	2.2696
EE	0.1954	0.2006	0.0003	1.4109
ME	0.1232	0.0376	0.0009	1.8414
NA	0.6188	0.2532	0.0012	1.8832
SA	0.0589	0.0865	0.0001	2.2769
SAM	0.2946	0.3705	0.0001	2.3689
SSA	0.2349	0.1890	0.0002	0.9718
WE	0.5866	0.2987	0.0055	1.7329

Notes: CL: Common Spoken Language Index, CR: Common Religion Index; CN: Common Nationality index; CD: Culture Difference Index. Regions: AU: Australia and New Zealand, EA: East Asia, EE: East Europe, ME: Middle East, NA: North America, SA: South Asia, SAM: South America, SSA: Sub-Saharan Africa ,WE: West Europe.

Common spoken language(CL) and common religions(CR) are collected from Melita and Toubal (2014). Common nationality (CN) is constructed based on the migrant data of World Bank where the details of the construction is reported in Appendix A. Cultural difference(CD) is constructed from Hofstede (1980).

There are 194 countries with bilateral indices on CL and CR, and 208 countries with information on CN. However, there is less information for the bilateral cultural index CD for which we have 62 countries. In the demand function estimation, we only keep countries with information on these four indices and thus lose 24% of observations.

Table 4: Correlation Matrix of Consumer Heterogeneity Indices

	CL	CR	CN	CD
CL	1			
CR	0.0909	1		
CN	0.351	0.1689	1	
CD	-0.0599	-0.2031	-0.3495	1

Note: CL: Common Spoken Language Index, CR: Common Religion Index; CN: Common Nationality index; CD: Cultural Difference Index.

Table 5: Average Demand Elasticities by (HS2)Sectors

HS2 Industries	Mean(σ)	S.D.(σ)	Number of (HS4)Product-Country Pairs
15	3.1545	1.2242	41
16	2.2549	1.0154	33
17	2.4690	1.0547	69
18	1.7656	0.5413	39
19	2.2111	0.9907	46
20	3.0631	1.4856	81
21	2.1231	0.8161	60
22	1.9123	0.6634	34

Notes: The demand elasticities are estimated at (HS4)Product-Destination level. The figures here show the average over product categories and regional blocs. Similar elasticities are obtained at the HS6-destination levels.
There are around 27% of HS4-Destination markets with estimated demand elasticities of less than one. Only HS4-Destination markets with demand elasticities greater than one are reported in the table.
(HS2)Industries: 15: Animal or Vegetable Fats and Oils, 16: Meat, Fish or Crustaceans, 17: Sugars and Sugar Confectionery, 18: Cocoa and Cocoa Preparations, 19: Preparations of Cereals, Flour, Starch or Milk, 20: Preparations of Vegetables, Fruit, Nuts, 21: Miscellaneous Edible Preparations, 22: Beverages, Spirits and Vinegar.

Table 6: Summary Statistics of Demand and Cost Indices

Region	Quality Index ($ln\hat{\delta}$)	Taste Index ($ln\hat{\lambda}$)	MC Index ($ln\hat{c}$)
AU	4.1617	0.0721	-0.4427
EA	4.0137	0.1404	-0.1306
EE	4.0389	0.1274	-0.0163
ME	4.0105	0.3090	0.9242
NA	3.6662	0.3754	-0.2548
SA	4.4479	0.0203	-0.1862
SAM	4.1510	0.0639	0.1941
SSA	3.9864	0.2802	0.0522
WE	3.7186	1.1351	0.3508
S.D.	1.3660	1.0310	0.9501

Note: Regions: AU: Australia and New Zealand, EA: East Asia, EE: East Europe, ME: Middle East, NA: North America, SA: South Asia, SAM: South America , SSA: Sub-Saharan Africa, WE: West Europe.

Table 7: Correlation Matrix of Quality, Tastes and MC indices

	Quality Index ($ln\hat{\delta}$)	Taste Index ($ln\hat{\lambda}$)	MC Index ($ln\hat{c}$)
Quality Index ($ln\hat{\delta}$)	1		
Taste Index ($ln\hat{\lambda}$)	-0.0623	1	
MC Index ($ln\hat{c}$)	-0.1842	-0.0600	1

Table 8: Variance Decomposition of Indices

Variation in:	Taste Index	Quality Index	MC Index
Firm	7%	65%	27%
Product	23%	32%	60%
Country	70%	3%	13%
	100%	100%	100%

Notes: We decompose the variations of the taste (quality and cost) index into three components: (1) Variations across firms within the same (HS6) Product-Country market; (2) Variations across (HS6) Products within the same country; (3) Variations across countries.
The decomposition of the variations of taste index is shown as $\sum_{jid}(ln\lambda_{jidt} - ln\lambda_t)^2 = \sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})^2 + \sum_{jid}(ln\lambda_{idt} - ln\lambda_{dt})^2 + \sum_{jid}(ln\lambda_{dt} - ln\lambda_t)^2 + 2\sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})(ln\lambda_{idt} - ln\lambda_{dt}) + 2\sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})(ln\lambda_{dt} - ln\lambda_t) + 2\sum_{jid}(ln\lambda_{idt} - ln\lambda_{dt})(ln\lambda_{dt} - ln\lambda_t)$. Here the first term represents the variations across firms, the second term represents the variations across products, and the third term represents the variations across countries. The last three terms are the covariances.
The covariance terms are empirically negligible so we do not report them here.

Table 9: Decomposition of Firm-Product Export Revenues

	ln(TR)			
	(1)	(2)	(3)	(4)
β_λ (Tastes)	0.17	0.13	0.13	0.11
	(.002)***	(.002)***	(.002)***	(.002)***
β_δ (Quality)	0.20	0.22	0.23	0.22
	(.002)***	(.002)***	(.002)***	(.002)***
β_c (MC)	0.15	0.14	0.13	0.14
	(.003)***	(.003)***	(.003)***	(.003)***
β_M (Market Competition)	0.07	0.08	0.07	0.08
	(.003)***	(.003)***	(.003)***	(.003)***
β_R (Demand Residuals)	0.42	0.43	0.44	0.45
	(.003)***	(.003)***	(.003)***	(.003)***
Observations	38,949	37,928	37,480	37,617

Notes: Specification: (1) Firm-(CN8)Product-Country level Taste Index, (2) Firm-(CN8)Product-Country level Tastes Index, normalized by local GDP, (3) (CN8)Product-Country level Tastes Index, (4) (CN8)Product-Country level Tastes Index, normalized by local GDP.
Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
When estimating the demand function, we lose 52% of total number of observations due to the following criteria: (1) dropping outliers in lnp (lose 6% of total number of observations); (2) dropping observations without information on the proxy variables of tastes index and IV for prices (lose 38% of total number of observations); (3) dropping (HS4)Product-country markets with the number of Belgium firms less than twenty. (lose 7% of total number of observations) Even with the loss of 51% number of observations, the sample in the demand function estimation captures 70% of total export value in the Belgium Food Industry.
See Equations (12) for the regression equations.

Table 10: Relationship between Minimum Indices and Distance from Belgium

	Minimum Quality index	Minimum Tastes index	Minimum Cost index
ln(Distance)	0.1690	-0.0509	0.1396
	(0.014)***	(0.007)***	(0.015)***
Constant	1.9553	0.4891	-1.9616
	(0.124)***	(0.050)***	(0.148)***
Year dummy	yes	yes	yes
(HS2)Industry Dummy	yes	yes	yes
Observations	1,935	1,935	1,935
R-squared	0.113	0.060	0.197

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Similar results are obtained when we use the quality (tastes, cost) index at 1% as the minimum cutoff value.
The relationship between distance and the minimum cutoff value did not change after controlling the market size (ln(GDP)) of the destination country.

Table 11: Decomposition of Firm-Product Revenues (Balanced Panel)

	ln(TR)			
	(1)	(2)	(3)	(4)
β_λ (Tastes)	0.16	0.11	0.11	0.10
	(.004)***	(.004)***	(.004)***	(.004)***
β_δ (Quality)	0.20	0.22	0.22	0.23
	(.005)***	(.006)***	(.006)***	(.006)***
β_c (MC)	0.03	0.03	0.03	0.03
	(.004)***	(.004)***	(.004)***	(.005)***
β_M (Market Competition)	0.07	0.09	0.07	0.08
	(.004)***	(.004)***	(.004)***	(.004)***
β_R (Demand Residuals)	0.53	0.55	0.57	0.57
	(.007)***	(.007)***	(.007)***	(.007)***
Observations	5,358	5,170	5,153	5,107

Notes: With the balanced panel (includes products that are sold to all countries) there are only four products: 18062010, 18063290, 18069019, 18069031.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Specification: (1) Firm-(CN8)Product-Country level Taste Index, (2) Firm-(CN8)Product-Country level Tastes Index, normalized by local GDP, (3) (CN8)Product-Country level Tastes Index, (4) (CN8)Product-Country level Tastes Index, normalized by local GDP

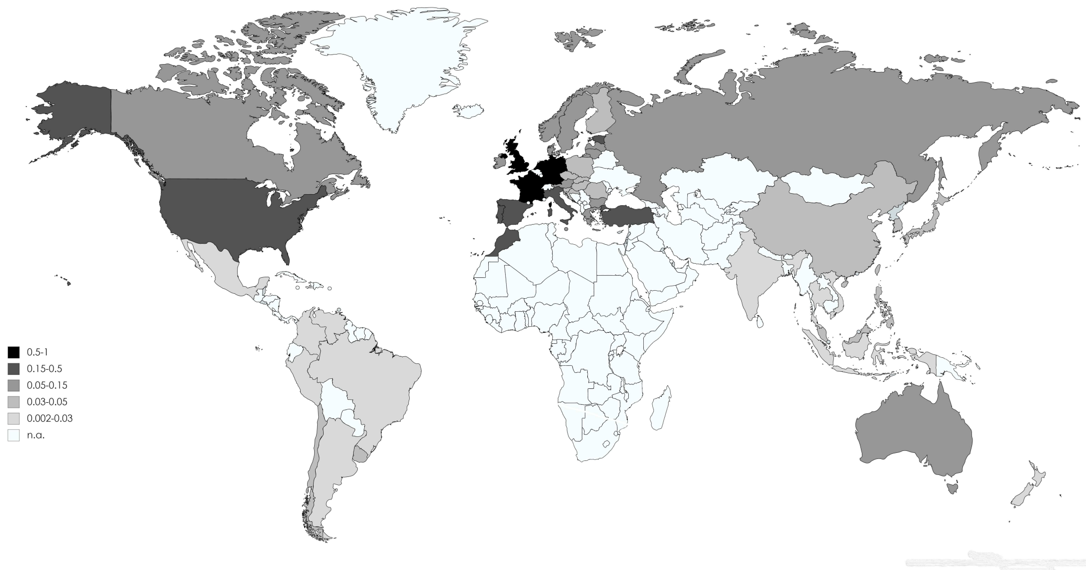

Figure 1: Taste for Belgian Food Exports

Note: Darker color indicates stronger taste for Belgian export products.

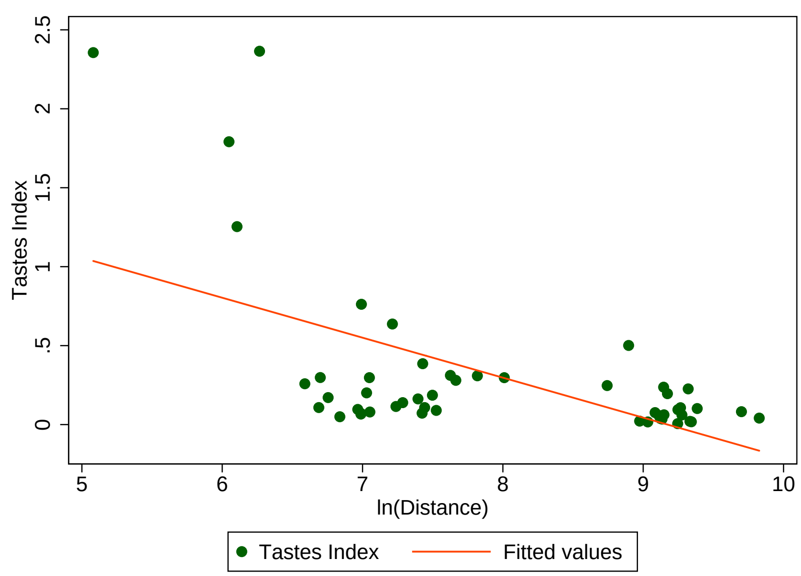

Figure 2: Relationship between Average Taste and Distance to Belgium, by Destination

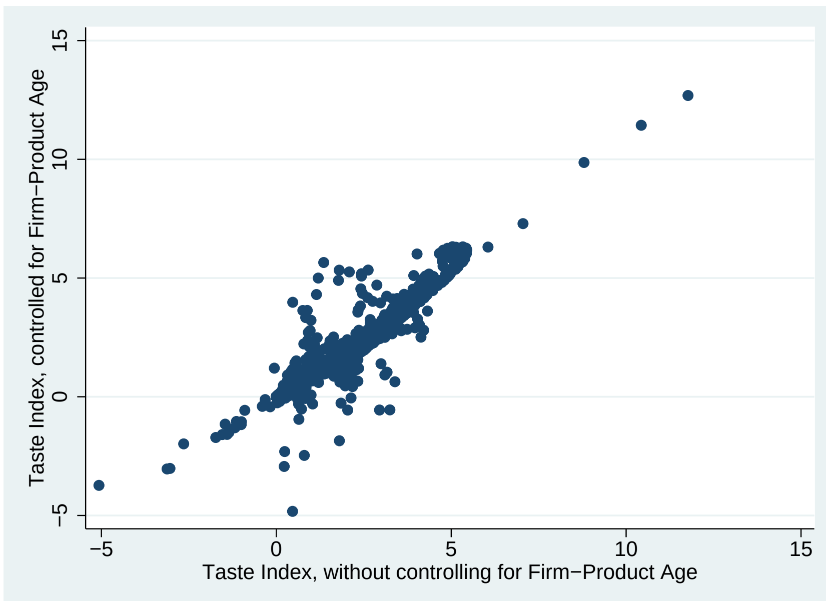

Figure 3: Taste with and without Controlling Firm-Product Age

Appendix A

Here we illustrate how we construct a bilateral indicator of closeness between any two countries. Consider the following hypothetical example where we have information on the share of migrants by country of origin as given in Table A-1.

Table A-1: Percent of Population, by Nationality

Country	**Share over the population (%)**					
	Turkish	Portuguese	Chinese	Belgium	Sweden	Japan
Belgium	2	1	0.5	96.5	0	0
Sweden	1	0.5	0.2	0	98.3	0
Japan	0.1	0	1	0	0	98.9

Table A-1 indicates that the distribution of nationality components is similar between the U.S. and France compared to the nationality components between Japan and the other two countries. We construct and indicator of bilateral closeness in nationality between any country-pair based on the Toubal and Egger (2016) index as follow:[44]

$$
\begin{aligned}
CN_{Belgium,Sweden} &= (0.02 \times 0.01 + 0.001 \times 0.005 + 0.005 \times 0.002 + 0) \times 100 = 0.026 \\
CN_{Belgium,Japan} &= (0.02 \times 0.001 + 0.01 \times 0 + 0.005 \times 0.01 + 0) \times 100 = 0.007 \\
CN_{Sweden,Japan} &= (0.01 \times 0.001 + 0.005 \times 0 + 0.002 \times 0.01 + 0) \times 100 = 0.003
\end{aligned}
$$

It's clear that the CN index between the Belgium and Sweden (0.026) is higher than the CN index between the Belgium and Japan (0.007). This reflects the fact that the Belgium and Sweden have similar nationality distribution comparing with the nationality distribution between the Belgium and Japan. Based on the same logics, we construct the closeness indices for common language (CL) and common religion distribution (CR) for any country-pair.

The top part of Table A-2 presents the top ten countries with the highest closeness indices between the destination countries and Belgium for common language (CL), common nationality (CN), common religious (CR), and culture distance (CD). The bottom part of Table A-2 reports the ten countries that are most dissimilar to Belgium in terms of these four indices. For example, Netherlands and France have the highest similarity in the distribution of spoken language with Belgium. Indonesia, Korea and Taiwan are less closer to Belgium in terms of

[44]Here we re-scale the CN index where we multiply each indicator by 1oo.

spoken language. European countries have similar nationality distributions and the nationality components in Asian countries are dissimilar to Belgium.

Table A-2: Indices of Consumer Heterogeneity by Countries

1. Top ten countries relative to Belgium							
Country	CL	Country	CN	Country	CR	Country	CD
Netherlands	0.9998	Italy	1.8700	Malta	0.7456	France	0.2193
France	0.8952	France	1.0630	Venezuela	0.7305	Malta	0.5382
U.K.	0.6825	Netherlands	1.0600	Spain	0.7155	Czech	0.5544
Ireland	0.6628	Morocco	1.0500	Argentina	0.6999	Spain	0.6961
Canada	0.6584	Turkey	0.5570	Italy	0.6847	Italy	0.6968
Denmark	0.6548	Spain	0.4890	Colombia	0.6847	Germany	0.8082
Germany	0.6386	Germany	0.3540	Poland	0.6832	Turkey	0.9205
Sweden	0.6201	Portugal	0.2800	Croatia	0.6684	Poland	0.9774
Austria	0.6200	U.K.	0.2670	Ireland	0.6649	Brazil	0.9842
Malta	0.6124	Greece	0.1810	France	0.6489	Greece	1.0428

2. Bottom ten countries relative to Belgium							
Country	CL	Country	CN	Country	CR	Country	CD
Peru	0.0491	Bangladesh	0.0059	Thailand	0.0014	Hong Kong	2.8035
Russian	0.0327	Korea	0.0041	Sweden	0.0012	Ireland	2.8229
Brazil	0.0157	Latvia	0.0039	U.K.	0.0007	Malaysia	2.9461
Bangladesh	0.0118	Estonia	0.0037	Greece	0.0004	Colombia	2.9717
Vietnam	0.0087	Lithuania	0.0035	Latvia	0	Slovakia	2.9822
China	0.0059	Mexico	0.0029	Finland	0	Sweden	3.2554
Iran	0.0026	Trinidad	0.0023	Taiwan	0	Trinidad	3.3321
Indonesia	0	Malaysia	0.0016	Estonia	0	Singapore	3.4231
Korea	0	El Salvador	0.0012	Hong Kong	0	Venezuela	3.5313
Taiwan	0	Taiwan	0.0008	Japan	0	Denmark	3.8605

Notes: CL: Common Spoken Language Index, CR: Common Religious Index; CN: Common Nationality index(original index times 100); DC: Difference in Culture Index.
Countries with higher value of CL, CR and CN are closer to Belgium. In contrast, countries are closer to Belgium in term of culture if the countries have lower values of CD.
There are 62 countries with information on all indices. Trinidad: Trinidad and Tobago.

Table A-3: Decomposition of Export Revenue, by (HS4)Products

(HS4)Sector	β_λ	β_δ	β_c	β_M	β_R	no.(observations)
1501	0.22	0.48	0.12	0.03*	0.15*	17
1507	0.13	0.31	0.33	0.02*	0.21	64
1511	0.04*	0.57	-0.07*	0.03*	0.42	22
1513	0.02*	0.52	-0.001*	0.39	0.07*	13
1515	0.13	0.35	0.20	0.17	0.15	333
1516	0.20	0.34	0.06	-0.01*	0.41	183
1517	0.20	0.30	0.08	0.16	0.27	1,361
1518	0.08*	0.37	0.20	0.24	0.11*	18
1601	0.11	0.26	0.06	0.26	0.31	442
1602	0.13	0.25	0.06	0.08	0.47	3,472
1604	0.31	0.28	0.08	0.06	0.27	145
1605	0.19	0.11	-0.06*	0.10	0.65	59
1701	0.14	0.23	0.08	0.09	0.46	584
1702	0.12	0.28	0.07	0.04	0.49	752
1704	0.11	0.20	0.22	0.06	0.41	3,999
1799	0.06	0.30	0.21	0.10	0.33	210
1806	0.11	0.18	0.03	0.07	0.61	11,198
1901	0.20	0.23	0.01*	0.15	0.40	421
1902	0.13	0.27	0.09	0.09	0.41	627
1904	0.11	0.42	-0.01*	0.09	0.40	131
1905	0.12	0.21	0.07	0.05	0.55	1,970
2004	0.16	0.23	0.30	-0.05	0.36	2,027
2005	0.18	0.30	0.15	0.08	0.29	763
2007	0.20	0.18	0.18	0.11	0.34	1,549
2008	0.17	0.28	0.03	0.10	0.41	1,196
2009	0.20	0.37	-0.01*	0.09	0.35	246
2102	0.29	0.27	0.004*	0.23	0.21	190
2103	0.17	0.27	0.05	0.003*	0.51	489
2104	0.20	0.22	0.10	0.19	0.30	66
2105	0.27	0.24	0.07	0.11	0.30	990
2106	0.11	0.25	0.05	0.07	0.52	3,091
2201	0.19	0.36	-0.05*	0.15	0.35	48
2202	0.01	0.35	0.03	0.46	0.14	18
2203	0.07	0.38	0.04	0.19	0.31	746
2208	0.16	0.16	0.05	0.10	0.53	488

Note:* Insignificant at 10%.

Table A-4: (HS4)Product Definition

HS4	Definition
1501	Pig fat (including lard) and poultry fat
1507	Soya-bean oil and its fractions
1511	Palm oil and its fractions
1513	Coconut (copra), palm kernel or babassu oil and their fractions
1515	Fixed vegetable fats and oils (including jojoba oil) and their fractions
1516	Animal or vegetable fats and oils and their fractions
1517	Margarine; edible mixtures or preparations of animal or vegetable fats or oils
1518	Animal or vegetable fats, oils, fractions, modified in any way
1601	Sausages and similar products of meat, meat offal or blood
1602	Prepared or preserved meat, meat offal or blood
1604	Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs
1605	Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved
1701	Cane or beet sugar and chemically pure sucrose, in solid form
1702	Sugars, sugar syrups, artificial honey, caramel
1704	Sugar confectionery (including white chocolate), not containing cocoa
1806	Chocolate and other food preparations containing cocoa
1901	Malt extract; flour/starch/malt extract products, no cocoa (or less than 40% by weight)
1902	Pasta
1904	Prepared foods obtained by swelling or roasting cereals or cereal product
1905	Bread, pastry, cakes, biscuits, other bakers' wares
2004	Vegetables preparations (frozen)
2005	Vegetables preparations(not frozen)
2007	Jams, fruit jellies, marmalade
2008	Fruit, nuts and other edible parts of plants
2009	Fruit juices (including grape must) and vegetable juices
2102	Yeasts (active or inactive); prepared baking powders
2103	Sauces and preparations therefor
2104	Soups and broths and preparations therefor; homogenised composite food preparations
2105	Ice cream and other edible ice; whether or not containing cocoa
2106	Food preparations not elsewhere specified or included
2201	Waters, including natural or artificial mineral waters and aerated waters, not containing added sugar
2202	Waters, including mineral and aerated waters, containing added sugar or sweetening matter, flavoured
2203	Beer made from malt
2208	Ethyl alcohol, undenatured; of an alcoholic strength by volume of less than 80% volume; spirits, liqueurs and other spirituous beverages