Review of World Economics
https://doi.org/10.1007/s10290-023-00498-1

ORIGINAL PAPER

Globalization and cultural spillover in trade: evidence from the Japanese food culture

Olivier Bargain[1,2,3]

Accepted: 14 March 2023

Abstract
Trade can be slowed down by cultural diversity as a source of friction but also accelerated by the emergence of a global culture. We attempt to illustrate this point by focusing on one good, Japanese sake, whose exports can benefit from the diffusion of Japanese food culture as represented by sushi consumption. We estimate a gravity model of Japanese sake exports worldwide over the years 2001–2016, showing that this trade responds to standard determinants (GDP, distance, exchange rates, tariffs) but also to the flow of Google searches for the word 'sushi'. We extensively discuss the assumption that sushi, as a proxy for the popularity of Japanese culture, is unaffected by other unobservables that may drive up exports from Japan. Future research should attempt to model and further characterize the spillovers from a global culture on international trade.

Keywords Sake exports · Gravity model · Culture · Spillovers · Globalization

JEL Classification F10 · F14 · L66 · Q17

1 Introduction

Alongside traditional determinants of international trade (exchange rate, tariffs, etc.), hidden frictions have recently been characterized that pertain to deeply rooted differences in preferences (Bargain et al., 2023; Boisso & Ferrantino, 1997). Such "dark trade costs" may be well entrenched and, hence, would represent relatively long-lasting barriers to international trade (Head & Mayer, 2013). Yet, not all of our preferences are fixed. Interesting dynamics of cultural globalization have come

✉ Olivier Bargain
Olivier.bargain@u-bordeaux.fr

[1] Bordeaux School of Economics, Bordeaux University, Rue Leon Duguit, Pessac, France

[2] The Institut Universitaire de France, Paris, France

[3] IZA, Bonn, Germany

Published online: 18 April 2023

along with the world economic integration of the past decades. In particular, the emergence of a world food culture has started with the diffusion of iconic products through international migration, for instance the popularization of pizza, fajitas or sushi with Italian, Mexican and Asian migrants in the US.[1] Importantly, cultural globalization may have pervaded local preferences and facilitated the export of products that are perceived as complementary to global cultural goods.

Surprisingly, this question has received little attention. There are related literatures, notably a small one on cultural convergence and trade spillovers that includes studies on taste convergence during the globalization process (Aizenman & Brooks, 2008) and the impact of cultural proximity on trade (Disdier et al., 2010).[2] While slow-moving factors like language, religion and ethnicity are strongly associated with conventional transaction costs (Guiso et al., 2006), more fluctuating links between nations may reflect changing cultural affinity and shifts in preferences (Felbermayr & Toubal, 2010). The more general question of spillovers in trade has been investigated theoretically.[3] Empirically, evidence is mixed. Several studies since Aitken et al. (1997) find evidence of export spillovers but others do not (e.g. Bernard & Jensen, 2004).[4] Evidence is relatively scarce when it comes to complementary goods.[5]

Against this background, the present paper suggests an empirical investigation of cultural spillovers in trade. We focus on a case-study that aims to provide intuitions for further research. We examine the trade determinants of sake, a good produced almost exclusively in Japan for the period under study (Bouzdine-Chameeva & Ninomiya, 2010). The interesting aspect is that the success of sake exports may partly be driven by the emergence of a global Japanese food culture, which we can proxy by the consumption of complementarity goods such as sushi. Such is an iconic good of the Japanese culture, the consumption of which has rapidly diffused to local cultures worldwide. To study this relationship, we estimate a gravity model of Japanese sake export over the years 2001–2016 and show that sake responds to local interest in sushis.

[1] The multifaceted dynamics of cultural flows has been characterized conceptually by sociologists (Tomlinson, 1999) or quantified by proxies such as the global trade of media products (Kluver & Fu, 2004) or that of cultural goods (Disdier et al., 2010).

[2] Disdier et al. (2010) use the trade of cultural goods to measure cultural proximity and show how it encourages overall trade by impacting on values and perceptions about the importing country. Maystre et al. (2014) study the reverse causality, i.e. how overall bilateral trade tends to reduce cultural distance (Maystre et al., 2014).

[3] Work on trade spillovers starts with models in which fixed export costs, specific to a destination country, decrease with the number of firms exporting to that country (Krautheim, 2010). Regarding complementarity, more recent theory tackles the bundling of goods (Gentzkow, 2007).

[4] Koenig et al. (2010) argue that more detailed information is needed on firms and on the geography of trade to elicit the important questions, including the nature of the spillovers (product-specific, destination-specific, etc.) and the channel through which they benefit to firms (a productivity boost, a reduction in—variable or fixed—trade costs, etc.).

[5] Some studies address within-firm trade spillovers from 'superstar' products towards complementary peripheral products (Arnarson, 2016) or the idea of carry-along-trade, i.e. the export of a product not produced by the firm (Bernard et al., 2018). Cheptea et al. (2015) question whether food exports to a given national market are impacted by a domestic retailer opening in that market.

We first test standard trade determinants and show that sake exports respond to usual factors (such as GDP, distance, exchange rates, prices and tariffs) as well as to specific variables pertaining to local preferences (for instance the cultural proximity to other Asian countries that have had a tradition of rice wine consumption).[6] Next, we use time and space variation in the local popularity of Japanese food culture, as proxied by Google searches for sushi-related keywords. We find that sake exports strongly react to the popularity of sushi in destination countries. Results are robust to alternative sets of controls and estimation methods. Presumably, Japanese products are more or less likely to be affected by the popularity of global goods, depending on their degree of complementarity, hence we suggest additional estimations for an alternative export product that is unrelated to food culture (Japanese cars). Results consistently point to the absence of a 'sushi effect' in this case. Our results illustrate how cultural globalization may reduce trade frictions pertaining to country differences in tastes and generate spillovers between iconic global commodities and export products of a complementary nature.

2 Context

2.1 The exported good: sake

We focus on sake as an interesting export product, as it is produced almost exclusively in Japan and has experienced a sharp rise in exports over the last decades. More commonly referred to as 'nihonshu' in Japan, sake is a 12–17 degrees alcoholic beverage made from rice fermentation and produced in around 1200 breweries all over Japan.[7] Sake used to dominate the consumption of alcoholic beverages in Japan but its share in consumption has fell due to the success of beer, to demographic changes (a decline in the working-age population, who is the main consumer of sake) and to changes in consumption patterns (the lack of interest by the young generation, more keen on the consumption of spirits). Thus, some efforts have been

[6] This paper is also positioned in the limited literature exploring the determinants of luxury alcoholic drinks, which includes the work of Crozet et al. (2012) on Champagne and of Bouët et al. (2017) on Cognac brandy. More generally, several studies have looked at wine exports in the world and highlight the role of usual determinants like trade costs and frictions, real exchange rates (Anderson and Wittwer, 2001, 2013, Cardebat and Figuet, 2019), quality (Chen and Juvenal, 2016), specific policies (like China's forced reduction in the demand for luxury wine products, cf. Anderson 2015), border effects (Kashiha et al., 2017) or biological/cultural proximity (Bargain et al., 2023).

[7] What is commonly called 'rice wine' is as old as rice, and all Asian countries produce it under various names (e.g. shaoxingjiu in China or shogokchu in Korea). In most of these countries, it has been marginalized at the benefit of strong spirits when distillation techniques were discovered. In contrast, in Japan, sake became an identity product, one of the reasons being its strong association with Shintoism (the original religion of Japan before Buddhism became the main cult). Sake is made in open tanks according to a complex process of multiple and parallel fermentations started and accompanied by the work of the brewer. Rice starch is converted to sugar, itself converted to alcohol by yeast. This makes the sake production process actually more closely related to beer than wine.

made to boost farming productivity and develop export markets before the country's entry into the Trans-Pacific Partnership (TPP) in 2016.

While exports were confined to a few countries at the beginning of the century (United States and South Korea absorbed half of Japan's cargo shipments), other countries are opening up to the Japanese "gods' drink", including new large importers in Asia (Taiwan, Hong Kong or China) as well as many European and Oceania countries. Traditional supply and demand factors may explain part of the skyrocketing exports of sake: professionals' and governmental initiatives to promote sake abroad,[8] as well as the demand for variety and the authenticity associated with traditional Japanese culture (Beverland, 2005). We also conjecture that the internationalization of sake has been facilitated by cultural globalization and the diffusion of Japanese culture more generally, notably through iconic goods such as sushi.

2.2 Japanese food culture and sushi

Sushi has pervaded Western food habits over the past twenty years and become a global food commodity. The process had started earlier, since the 1960s, in Asia and the Pacific Rim (in particular in the US, Brazil and Australia), with the influence of large Japanese immigrant communities and the diffusion of a sushi culture to diet conscious upper-middle class Western citizens (Issenberg, 2007).[9] This process has greatly accelerated lately through globalization and the emergence of a global food culture. Tastes for sushi have proliferated worldwide, reflecting a multifaceted cultural globalization that defies the traditional west-to-east directional flow. Cultural dissemination of tastes and eating habits has been studied in the case of sushi in ethnographic work and notably by Harvard anthropologist Theodore Bestor. Bestor (2000, 2004) explores the global commodity chains that supply the Tsukiji market in Tokyo (the largest seafood market in the world) and points to sushi as both an icon of Japanese culture and an icon of globalization.

2.3 Channels and interpretations

The popularity of sushi at a point in time and space may indicate the local attraction of Japanese culture and potential spillovers for export products of a complementary nature (like Japanese sake and beer)—or perceived as complementary.[10] In Western countries and Asia, sake is often sold in Japanese or fusion restaurants that serve

[8] Notably actions by the Japan External Trade Organization (JETRO), as part of the 'cool Japan' campaign, which involved sake tasting in Japanese embassies or the multiplication of commercial operations in wine Salons around the world.

[9] The integration and adaptation in American food culture is exemplified by the famous California rolls.

[10] Note that the perception is what matters, not the real gastronomic complementarity between a fish-rice dish (sushi) and a rice wine (sake). Indeed, this association itself is not necessarily desirable ('adding rice on rice'), nor necessarily genuine to the Japanese culture.

sushi, so that world customers implicitly associate these goods, or have done so the first time they have come across sake on a Japanese restaurant menu.[11]

Note that the local popularity of sushi may (i) proxy the local demand for Japanese culture and/or (ii) may have a direct impact on the demand for complementary goods because it reduces fixed costs such as promotion costs (Koenig et al., 2010). Differentiating between these interpretations is beyond our scope. Most importantly, we must assume that the popularity of sushi is unaffected by unobservables that may also drive up Japanese exports. Arnarson (2016) addresses this type of simultaneity bias between a superstar good and its peripheral products, suggesting to instrument the trade of the former using destination-specific demand shocks for that good. Importantly, there is no such problem here since our superstar good (sushi) is not an export good: it is produced locally.[12] Hence, we can rule out interpretations such as spillovers from a common distribution network.[13]

3 Empirical approach

3.1 The gravity model

We rely on the standard gravity model of trade (see for instance Anderson & Van Wincoop, 2003, 2004, and Head & Mayer, 2014). The most frequent approach used in the empirical literature is the log-linearized form of the gravity equation. Given that there is only one exporter (Japan), the basic model is written:

$$\ln(X_{jt}) = \gamma_0 + \gamma_1 ln\left(Y_{jt}\right) + \gamma_2 ln\left(Pop_{jt}\right) + \gamma_3 ln\left(Dist_j\right) + \gamma_4 ln\left(RER_{jt}\right) + \gamma_5 ln\left(AVE_{jt}\right) + \gamma_6 ln\left(UV_{jt}\right) + \gamma_7 \ln\left(Sushi_{jt}\right) + \gamma_8 Z_j + \lambda_t + \varepsilon_{jt}$$

[11] As explained by a major online retailer of sake: "9 out to 10 people take their first sip of sake at a sushi restaurant, and the popularity of sushi has exploded over the past 10 years. As Americans have embraced Japanese foods they have also embraced sake." (see https://www.sakesocial.com/pages/the-present-part-3-how-much-sake-is-being-sold). Note however that sake is not only retailed in sushi, Asian or fusion restaurants: it is increasingly sold in bars (as a luxury beverage) and off-premise (wine and spirit shops, supermarkets and grocery shops). In the US, the main importer of sake outside Asia, off-premise sales represent two-thirds of total sake sales in 2017.

[12] As stated in the anthropological literature, sushi is not an exported product but an exported culture (Issenberg, 2007). Sushis are made locally in Japanese or fusion restaurants, using goods that are produced and traded in a complex and global commodity network. In Europe, for instance, the rice comes from all over the world, the Kikkoman soy sauce accompanying sushis is produced in the Netherlands and the fish is purchased daily by European merchants at large markets (like the Rungis wholesale market outside of Paris) and may come from the Mediterranean Sea, Canada, Alaska, Norway or even South Korea and China. Note that there is also an emergence of industrial sushis – ready-made sushi imported from China and Vietnam—sold in supermarkets or take-away chains.

[13] Cheptea et al. (2015) find a strong positive effect of the presence of country A's retailers in country B on exports from A to B. Most products sold in B by these retailers are produced locally; the presence of country A's retail companies in B hence concerns primarily a reduction in export costs for other firms from A. There is no such mechanism in our case. In Europe, Japanese restaurants are not even held by Japanese investors (they are often Chinese) while sushi take-away chains are held by Europeans. Hence, this is really the diffusion of a certain Japanese culture that should matter.

where X_{jkt} represents Japanese exports to partner j at time t, Y_{jt} the GDP of this partner at time t, Pop_{jt} its population size (it is equivalent, in logs, to use GDP and GDP per capita), $Dist_j$ the distance to partner j, RER_{jt} the bilateral real exchange rate between the Japanese yen and country j's local currency at time t, AVE_{jt} the average tariff level with partner j (in ad valorem equivalent), and UV_{jt} the unit value taken as a proxy for the unitary price of sake sold in country j. Our empirical model includes an original determinant, namely the Google search score for 'sushi', as extensively described hereafter. We also control for year dummies denoted by λ_t.[14]

A set Z_j of time-invariant characteristics of partner j is also added. In the baseline model, it includes a hub dummy to denote the particular role of re-exporter countries (e.g. Honk-Kong and Singapore). In additional estimations, it also accounts for regional dummies, for instance for the US and Asia, to denote a specific cultural proximity regarding the consumption of rice wine. It also includes a prohibition dummy equal to 1 for countries where alcohol beverage is in principle forbidden (i.e. country with a Muslim population above 50%—see Boüet et al., 2017). The latter can possibly be replaced by a more general proxy of local preferences for alcoholic drinks using local per capital consumption of these goods.

Finally, our favorite specification replaces time-invariant variables $Dist_j$ and Z_j by importing country fixed effects (FE), denoted θ_j, so the model becomes:

$$X_{jt} = \gamma_0 + \gamma_1 ln\left(Y_{jt}\right) + \gamma_2 ln\left(Pop_{jt}\right) + \gamma_3 ln\left(Dist_j\right) + \gamma_4 ln\left(RER_{jt}\right) + \gamma_5 ln\left(AVE_{jt}\right) + \gamma_6 ln\left(UV_{jt}\right) + \gamma_7 \ln\left(Sushi_{jt}\right) + \theta_j + \lambda_t + \varepsilon_{jt.}$$

To estimate such a model, a common approach is the Poisson Pseudo Maximum Likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006). This method has the advantage to deal with two central issues, namely potential heteroscedasticity and the selection bias due to the omission of zero-value observations in a log-linearized model.[15]

3.2 Data and selection

We rely on data from the International Trade Center (ITC) on volumes exported by Japan to the rest of the world. In our baseline estimations, we focus on the 32 largest sake importers worldwide over the years 2001–2016, which represent 98% of total sake consumption outside Japan. The ITC records 6-digit exports yearly and 4-digit monthly. Sake is registered under "fermented beverage: sake".[16] For the same subset

[14] Given the geographical and linguistic characteristics of Japan, we do not need to introduce standard variables like common border and common language.

[15] PPML outperforms OLS and Tobit in the presence of heteroskedasticity. Moreover, to deal with zeros, relying on a Heckman two-step procedure is only possible under the assumption that all random components of the model are homoscedastic. Finally, the PPML remains consistent in case of over-dispersion in the data (Head and Mayer, 2014).

[16] Google Trend data is provided by Google. It allows investigations in multiple combinations of space and time, and hence is increasingly used to measure trends as diverse as unemployment rates, inflation rates or flu epidemics (e.g. Choi and Varian, 2012, Askitas and Zimmermann, 2015, or Ginsberg et al., 2009). See: http://www.intracen.org/itc/market-info-tools/trade-statistics/.

of countries, we also use the export volumes for cars in additional analyses. Trade data is combined with information on standard trade determinants including GDP, GDP/capita (or market size), real exchange rates, geographic distance, tariffs, and potential prohibition on alcohol due to religious factors. All these variables, as well as their data source, are explained in Appendix Table 3.

A key variable is the popularity measure of sushi, a symbol of Japanese food culture. An obvious proxy would be the local number of sushi restaurants or takeaway selling points. This information is difficult to obtain for so many countries and so many years. We opt for Google search scores of the keyword 'sushi': it is easily obtained and it directly measures the local popularity of Japanese cuisine. We opt for the search of the word 'sushi'. Several other keywords could be chosen but in fact, this word is the most common used for our purpose, as shown by Google audits realized using the Google Keyword Planner.[17] Overall, it seems a good marker of local preferences and awareness about Japanese cuisine.

Local search scores for a specific keyword and a given time period are expressed relatively to total searches for that locality and period. This score is normalized on a 0–100 scale but entered in log terms in our model. Given the implicit time-demeaning approach of an estimation with country fixed effect, what matters is the time change in key variables and in the case of Google trends, the score expressed in logs reflects a relative change in sushi popularity for each country, so that there is no problem of comparability of the score across countries. Note also that we use broad geographical zone (country) and time bandwidth (the year) so that there is a limited impact of local search behavior or seasonality on total searches in each cell.[18]

3.3 Descriptive statistics

We now provide statistics about the two main variables of our empirical investigation, namely sake exports and the popularity of sushi. Figure 1 (top-left) first focuses on sake export volumes by main world regions. Asia (outside Japan) and the US show both the largest export levels and the most dynamic trends. With export volumes expressed in logs, we can directly read a progression of almost 100% in the US and 150% in Asia over the 16 years under study. The rise in sake export is also visible in Europe and the rest of the world even if at a slower pace (around + 40%).

[17] For instance, a Google audit for the sushi sector in France was based on 662 key words with a strong local dimension (for instance 'sushi Paris', 'Japanese restaurant Paris', etc.). This long list has allowed extracting the "blockbuster" terms: the sole term 'sushi' comes as number one, with 40,500 monthly searches among a total of 93,317 searches (1%); the following terms are more geo-localized (the number two and three are 'Japanese restaurant Paris' and 'Japanese restaurant' with around 5,400 monthly searches each). See: https://docplayer.fr/16389180-Audit-de-positionnement-du-secteur-du-sushi-sur-google.html.

[18] See Askitas (2015) for a survey and a review of good practice using Google trends.

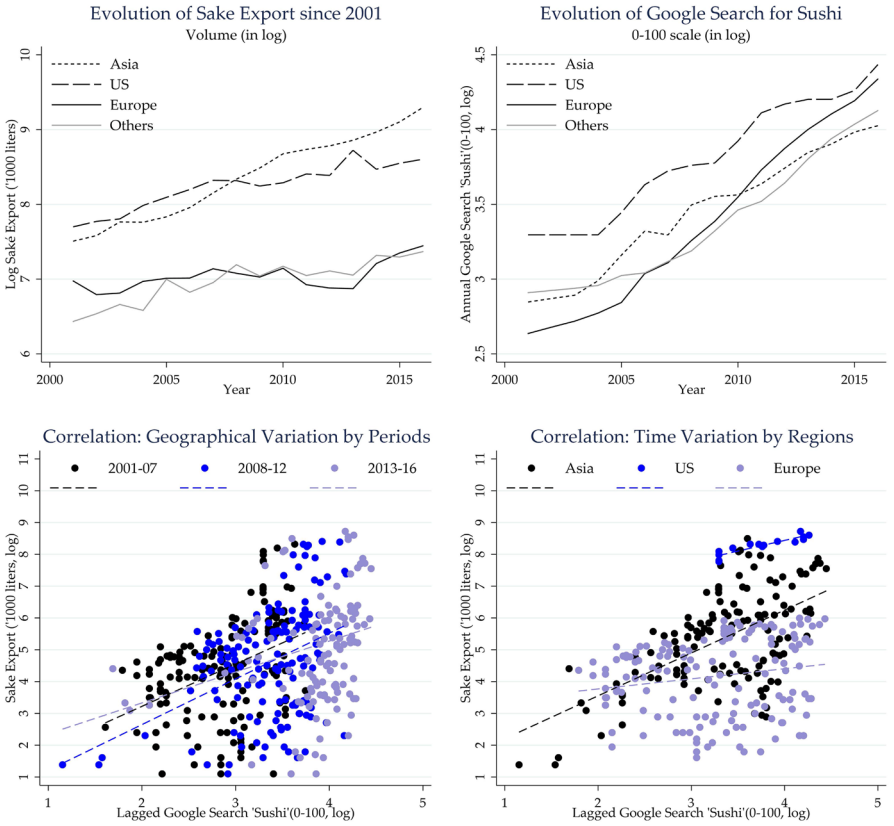

Fig. 1 Evolution of sake exports and sushi Google trends

The rise of a global sushi culture is illustrated by the rapid increase of Japanese restaurants worldwide.[19] We argue that this success has possibly had spillover effects, boosting the awareness towards Japanese culture and the demand towards other Japanese products like sake. We document it with the Google Trends results for the keyword 'sushi' in the top-right graph of Fig. 1. It shows an increase of around 100% in Asia, 140% in the US and 160% in Europe.

The lower graphs represent all the observations (country x year variation), plotting log export volumes against the lagged log Google searches for sushi. The correlation is 0.46 in log (0.31 in levels). This dispersion can be decomposed in two ways. In the bottom-left graph, we represent country variation by sub-periods. It shows a

[19] Broad estimations by the Japan External Trade Organization (JETRO) indicate an increase from around 25,000 restaurants in 2007 – including 43% in North America, 33% in Asia (outside Japan), 10% in Europe, 8% in Latin America, 5% in Australia and Oceania – to 50,000 restaurant in 2013 and around 100,000 in 2018.
See https://www.nippon.com/en/japan-data/.

strong correlation at the different points in time: 0.58 before the crisis, 0.43 during 2008–12 and 0.30 since 2012. In the bottom-right graph, time variation by large regions indicates that not only differences in geographical diffusion of the sushi culture matter but also the timing of diffusion: for Asia and the US especially, the fast rise in sake export is associated with a rapid spread of popularity for sushi. The correlation across sake export and sushi Google scores is 0.72, 0.91 and 0.16 for Asia, the US and Europe respectively.

4 Results

4.1 Standard gravity factors

We now move to the main results. Table 1 reports PPML estimates first for a model without sushi scores (column 1) or country FE, in order to interpret the standard trade determinants of trade. We see a positive and significant effect of importers' income and market size using GDP per capita and total population (in logs). Geographical distance plays an expected negative effect on volumes of export. A few countries have a role of re-exporter, which is explicitly accounted with the 'hubs' dummy. The exchange rate has a negative impact on the volume of trade as expected (when the yen appreciates against local currency, the volume of trade decreases). There is also an expected negative effect of customs duties on traded volumes. Finally, the log of unit values (export values divided by volumes) is used as a proxy for price and affects exports negatively.

4.2 The effect of sushi as a global good: model without country fixed effect

We then focus on our main addition to the literature, namely the inclusion of a Google Trends search score for the keyword 'sushi'. As explained, it aims to proxy the diffusion of Japanese food culture and its potentially pervasive effect on local preferences. In a model without country FE (Table 1, column 2), the coefficient of the sushi score is significant and large: a 1% increase in sushi popularity is associated with a 0.66% increase in sake exports. We have discussed the fact that there is no real suspicion of reverse causality (because sushi is the iconic/superstar good) or of a bias due to a simultaneity in diffusion (sushi is produced locally). We also implicitly detrend series by accounting for a flexible time pattern in the regression (this point is further discuss below). In the favorite specification with a lagged effect of sushi popularity (column 3), the effect is slightly larger and highly significant.

Next, we check whether these results are sensitive to the specification and the potential absence of unobservable factors linked for instance to specific world regions. In Appendix Table 4, we compare the baseline (reproduced in column i) to models that may capture the specific role of historical importers, namely Asia (column ii) or the US (column iii).[20] As expected, the coefficients associated with an

[20] As described above, other Asian countries share a taste for rice wine and the historical development of a Japanese culture worldwide also involves the early diffusion to the US via California.

Table 1 Estimation of sake export (Log volume in 1000 L)

	(1)	(2)	(3)
Ln GDP/capita	0.860***	0.878***	0.886***
	(0.165)	(0.169)	(0.172)
Ln pop size	0.972***	0.908***	0.902***
	(0.071)	(0.077)	(0.077)
Ln distance	−0.783***	−0.740***	−0.740***
	(0.165)	(0.184)	(0.187)
Hubs (0/1)	0.969***	0.778**	0.764**
	(0.316)	(0.316)	(0.319)
Ln exch. rate (Yen/LCU)	−0.250***	−0.258***	−0.256***
	(0.058)	(0.066)	(0.067)
Ln average AVE	−0.796***	−0.702***	−0.688***
	(0.127)	(0.134)	(0.137)
Ln unit value	−0.127	−0.161	−0.164
	(0.129)	(0.119)	(0.120)
Ln Google search 'Sushi'		0.665***	
		(0.210)	
Ln Google search 'Sushi' (lag)			0.695***
			(0.205)
Year FE	Yes	Yes	Yes
Country FE	No	No	No
Observations	512	512	480
R-squared	0.941	0.940	0.941

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

Asian dummy and a US dummy are strongly positive. The effect on sushi popularity diminishes only slightly. To control for religious preferences and their impact on the consumption of alcoholic beverages, we additionally control for a prohibition dummy that just characterizes importing countries with a majority of Muslim citizens (column iv). While the prohibition coefficient has the expected negative sign (see also Boüet et al., 2017), the sushi effect remains similar to the baseline. To proxy local preferences more generally, we alternatively use a direct measure of per capita consumption of alcoholic beverages (column v). As expected, its effect is positive while the usual sushi effect is barely affected. Finally, sake might be exported especially to places with a relatively large migrant population. To check this mechanism, we retrieve the number of Japanese migrants for each country-year observation using the OECD International Migration Database and add this variable in the model (column vi). Results point to a positive effect of migrant density on sake consumption but the sushi effect is unchanged.

Table 2 Estimation of sake export (Log volume in 1000 L), with country FE

	(1)	(2)
Ln GDP/capita	1.625**	1.825***
	(0.633)	(0.627)
Ln pop size	0.406	0.668
	(0.911)	(0.827)
Ln exch. rate (Yen/LCU)	−0.962**	−0.992**
	(0.466)	(0.483)
Ln unit value	−0.635***	−0.640***
	(0.202)	(0.188)
Ln Google search 'Sushi'	0.160**	
	(0.070)	
Ln Google search 'Sushi' (lag)		0.299***
		(0.069)
Year FE	Yes	Yes
Country FE	Yes	Yes
Observations	512	480
R-squared	0.982	0.985

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

4.3 The effect of sushi as a global good: model with country fixed effect

Our favorite approach is a PPML with country FE. In panel estimations, country FE capture all of the previous time-invariant characteristics, i.e. distance, re-exporting countries ('hubs'), specific locations (Asia, the US) or specific preferences (Muslim countries), as well as possible time-invariant confounders. Results are reported in Table 2. 'Within' estimations are qualitatively similar to previous results but with some differences in the size of some coefficients. The effect of sushi scores is now identified only by time changes within countries. Despite this more demanding specification, the effect of the sushi score is still positive and significant at the 5% level (although the coefficient is now only about a quarter of that in the model without country FE). Using the lag sushi score was more relevant previously and it is so here: the coefficient is half of what it was without FE—a 1% increase in sushi popularity is associated with a 0.3% increase in sake exports—but still significant at 1%.

4.4 Additional checks

We provide a few additional checks. First, note that these results are obtained with a very flexible specification of time, i.e. using year dummies. We replicate estimations with a simple linear time trend. Results in Appendix Table 5 (columns a–c) for the basic model exploiting between and within-country variation (columns 1–3) are very similar to the baseline estimates of Table 1. Results in Table 5 (columns d–e) for the model including country FE are very much in line with those of Table 2.

In Appendix III, we also discuss potential time series issues and cannot reject unit roots for volume and sushi variables. However, standard solutions, namely first differences and detrending, make these variables stationary at standard significance levels. Detrending is implicitly applied in the model with linear trend (in Table 5) and a fortiori with a flexible time specification in our baseline results.

Previous results were obtained using a selection of the non-marginal sake importers worldwide. To check if this may create some selection bias, we replicate our estimations on the comprehensive set of countries provided by the ITC, i.e. countries with at least one year of nonzero import level of sake over the period 2001–2016. This corresponds to the addition of 16 countries and, hence, $16 \times 16 = 256$ observations. These additional countries have 46% of zero import values on average (compared to 6% of zero import values for the core group of 32 countries). This is not an issue since the PPML handles zeros, as recalled before. Results reported in Table 6, columns 1–3 (columns 4–5), are very similar to the estimates of Table 1 (Table 2).

We have interpreted our main result as a causal spillover effect of global culture (proxied by an iconic Japanese good, sushi) on the export of related goods (sake). We have extensively discussed the underlying identification assumption, namely that there is no simultaneity in export strategies or, more generally, no unobservable factors that could drive up the local consumption of both types of goods. The main justification was that sushi is produced locally, i.e. it is not a good exported from Japan. As a placebo check, we replicate our assumption for a good that is unrelated to Japanese food culture products. We use PPML estimations with country FE. Table 7 reports the estimation for sake (column 1) and cars (column 2), consistently pointing to the role of alcohol consumption at destination only for the former good. It also confirms that Japanese cars are unrelated to the type of preferences that may generate spillovers in food/beverage consumption, with an insignificant effect of the lagged sushi score.

5 Conclusion

This paper explores the determinants of an export good, Japanese sake, to illustrate the potential spillovers of cultural globalization. We rely on state-of-the-art gravity estimations to elicit the role of the local popularity of a global good (sushi) on Japanese sake exports. We find a significant elasticity of sake exports to sushi Google searches. There is no such effect for goods that are unrelated to food culture (such as Japanese cars). We interpret these results as the evidence of cultural spillovers in trade: a shift in preferences due to cultural globalization may improve export performances of complementary goods.

These results are based on the past (2001–2016) but may be relevant for the future development of Japanese exports. As stated some years ago in management reviews, "food pairing is the next marketing frontier for sake"[21]. More generally, this study emphasizes the potential benefits from cultural globalization and aims to

[21] See: https://www.marketwatchmag.com/sake-soars/.

promote further case studies, theoretical work and empirical research in this direction. With the sake example, we illustrate how trade frictions pertaining to country differences in tastes may partly be overcome by cultural diffusion and the cultural spillovers in trade from global cultural goods. In particular, further work could aim to replicate this approach on a broad range of export goods and to identify the subset of goods that benefit from cultural spillovers—possibly from a broader set of iconic goods—as those exemplified in the present paper.

Appendix

Variable definition and data sources

Table 3 describes the variables used in the empirical analysis and reports detailed data sources.

Table 3 Definition and sources for the main variables

Dep. variable	Unit/variable type	Source
Sake export (volume)	1000 L	International trade center: www.trademap.org/tradestat
Car export (volume)	Tons	International trade center: www.trademap.org/tradestat
Explanatory variables	Unit/variable type	Source
GDP	2010 PPP$	databank.worldbank.org/data
GDP/capita	2010 PPP$	databank.worldbank.org/data
Distance	Km	GeoDist from CEPII
Exchange rate	Yen/LCU	fxtop.com
Ad valorem equivalent	Average rate of tariff/tax, in %	WTO*, http://tariffdata.wto.org
Average income tax	In % of GDP	https://data.worldbank.org/indicator
Unit Value	$/liter	Calculated as export value/volume (or zero of volume = 0)
Hubs	Dummy	Dummy for re-exporters
Alcohol consumption	Liter per year & capita	WHO, www.who.int/gho/alcohol/consumption_levels
Migrants number	In 1000	OECD international migration database
Google trend for 'Sushi'	0–100 search score	Google search in "food and beverage", https://trends.google.com

Sensitivity checks

See Table 4.

Table 4 Estimation of sake export (volume in 1000 L) with additional controls

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Ln GDP/capita	0.882***	1.122***	0.876***	1.122***	0.901***	0.534**
	(0.173)	(0.235)	(0.260)	(0.283)	(0.259)	(0.229)
Ln pop size	0.902***	0.908***	0.598***	0.722***	0.606***	0.469***
	(0.078)	(0.076)	(0.153)	(0.161)	(0.152)	(0.147)
Ln distance	−0.746***	−0.345	−0.676*	0.054	−0.392	−1.054***
	(0.187)	(0.389)	(0.360)	(0.424)	(0.428)	(0.189)
Hubs (0/1)	0.747**	0.291	0.405	0.530	0.544	0.767**
	(0.323)	(0.436)	(0.360)	(0.347)	(0.394)	(0.351)
Ln exch. rate (Yen/LCU)	−0.256***	−0.241***	−0.134*	−0.280***	−0.141*	−0.094
	(0.067)	(0.073)	(0.081)	(0.064)	(0.078)	(0.073)
Ln average AVE	−0.696***	−0.659***	−0.351**	−0.297*	−0.301	−0.300*
	(0.137)	(0.142)	(0.175)	(0.180)	(0.213)	(0.172)
Ln unit value	−0.163	−0.115	−0.106	−0.048	−0.101	−0.123
	(0.120)	(0.106)	(0.104)	(0.088)	(0.101)	(0.096)
Ln Google search 'Sushi' (lag)	0.682***	0.549***	0.583***	0.631***	0.676***	0.638***
	(0.201)	(0.170)	(0.182)	(0.165)	(0.192)	(0.183)
Asia (0/1)		1.120	0.827	1.613**	1.441	
		(0.773)	(0.614)	(0.752)	(0.908)	
USA (0/1)			1.275**	0.975	1.321**	
			(0.606)	(0.607)	(0.633)	
Prohibition (0/1)				−2.857***		
				(0.598)		
Ln alcohol consumption/capita					0.347	
					(0.329)	
Japanese migrants						0.008***
						(0.003)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No
Observations	480	480	480	480	480	480
R-squared	0.941	0.938	0.937	0.936	0.937	0.946

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

Table 5 Estimation of sake export (volume in 1000 L) with linear time trend

	(a)	(b)	(c)	(d)	(e)
Ln GDP/capita	0.860***	0.878***	0.887***	1.592**	1.760***
	(0.166)	(0.169)	(0.173)	(0.691)	(0.677)
Ln pop size	0.972***	0.909***	0.903***	0.204	0.398
	(0.071)	(0.077)	(0.078)	(0.897)	(0.853)
Ln distance	−0.786***	−0.745***	−0.746***		
	(0.165)	(0.183)	(0.187)		
Hubs (0/1)	0.967***	0.779**	0.764**		
	(0.315)	(0.316)	(0.319)		
Ln exch. rate (Yen/LCU)	−0.248***	−0.255***	−0.253***	−0.629**	−0.607**
	(0.057)	(0.064)	(0.066)	(0.311)	(0.272)
Ln average AVE	−0.795***	−0.701***	−0.687***		
	(0.127)	(0.134)	(0.137)		
Ln unit value	−0.129	−0.165	−0.169	−0.621***	−0.637***
	(0.125)	(0.117)	(0.118)	(0.182)	(0.179)
Ln Google search 'Sushi'		0.647***		0.170***	
		(0.202)		(0.056)	
Ln Google search 'Sushi' (lag)			0.678***		0.300***
			(0.204)		(0.063)
Year linear trend	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Observations	512	512	480	512	480
R-squared	0.938	0.936	0.938	0.978	0.981

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

Stationarity and cointegration tests

We report a few tests to examine the integration order of the main variables in the model using the global means over time: volume, log GDP per capita, log unit values, log exchange rate and log sushi score. For each of them, we run the Augmented Dickey-Fuller (ADF) test with two lags. The null hypothesis that the variable contains unit roots is rejected for log GDP per capita (p-value of 0.03), log unit values (p-value of 0.07) and log exchange rate (p-value of 0.4), but not for the other variables. For log volume and log sushi, the time series is not stationary. Standard solutions are first differences (in case of stochastic trends) and detrending (in case of deterministic trends).[22] Both approaches show that log volume and log sushi are I (1), i.e., become stationary at standard significance levels. The fact that both approaches give similar results, and could alternatively be used, is reassuring. With

[22] With detrending (i.e. linear trend), I reject the null of non-stationarity with p-values of .05 for log volume ad .01 for log sushi. With first difference, I reject the null with p-values of .02 for log volume and .00 for log sushi.

time trends in Table 5 below, or with detailed time effects in our main empirical specification of Table 1, we implicitly account for the detrending of all relevant time series contained in the model.

All countries

See Table 6.

Table 6 Estimation of export (Log) volume for alternative goods, all countries

	(1)	(2)	(3)	(4)	(5)
Ln GDP/capita	0.720***	0.718***	0.722***	1.628***	1.812***
	(0.178)	(0.186)	(0.189)	(0.627)	(0.626)
Ln pop size	0.996***	0.926***	0.922***	0.052	0.100
	(0.074)	(0.083)	(0.084)	(0.269)	(0.241)
Ln distance	−0.804***	−0.775***	−0.780***		
	(0.148)	(0.171)	(0.174)		
Hubs (0/1)	0.884***	0.632*	0.612*		
	(0.311)	(0.354)	(0.359)		
Ln exch. rate (Yen/LCU)	−0.304***	−0.309***	−0.308***	−0.911*	−0.926*
	(0.049)	(0.057)	(0.058)	(0.489)	(0.493)
Ln average AVE	−1.021***	−0.947***	−0.942***		
	(0.089)	(0.102)	(0.103)		
Ln unit value	−0.011	−0.041	−0.041	−0.581***	−0.592***
	(0.106)	(0.097)	(0.097)	(0.190)	(0.180)
Ln Google search 'Sushi'		0.598***		0.163**	
		(0.188)		(0.070)	
Ln Google search 'Sushi' (lag)			0.604***		0.283***
			(0.182)		(0.070)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Observations	768	768	721	768	721
R-squared	0.942	0.943	0.944	0.982	0.985

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

Other goods

See Table 7.

Table 7 Estimation of export (Log) volume for alternative goods

	Sake	Cars
Ln GDP/capita	2.225***	1.876***
	(0.562)	(0.503)
Ln pop size	0.971	1.644***
	(0.872)	(0.394)
Ln exch. rate (Yen/LCU)	−0.977**	0.845***
	(0.417)	(0.251)
Ln unit value	−0.670***	−0.099
	(0.158)	(0.070)
Ln alcohol consumption/capita	0.882**	0.401
	(0.390)	(0.536)
Ln Google search 'Sushi' (lag)	0.338***	−0.128
	(0.092)	(0.091)
Year FE	Yes	Yes
Country FE	Yes	Yes
Observations	480	480
R-squared	0.66	0.61

Standard errors, clustered at country level, in parentheses. Significativity levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10290-023-00498-1.

Acknowledgements The author is grateful to the editor Gerald Willmann and to two anonymous referees for very useful suggestions and corrections.

References

Aitken, B., Hanson, G., & Harrison, A. (1997). Spillovers, foreign investment, and export behavior. *Journal of International Economics, 43*, 103–132.

Aizenman, J., & Brooks, E. (2008). Globalization and taste convergence: The cases of wine and beer. *Review of International Economics, 16*(2), 217–233.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review, 93*, 17092.

Anderson, J. E., & Van Wincoop, E. (2004). Trade costs. *Journal of Economic Literature, 42*(3), 691–751.

Anderson, K. (2015). *Growth and cycles in Australia's wine industry: A statistical compendium (1843–2013)*. University of Adelaide Press.

Anderson, K., & Wittwer, G. (2001). U.S. dollar appreciation and the spread of Pierce's disease: Effects on the world's wine markets. *Australian and New Zealand Wine Industry Journal, 16*(2), 70–75.

Anderson, K., & Wittwer, G. (2013). Modeling global wine markets to 2018: Exchange rates, taste changes, and China's import growth. *Journal of Wine Economics, 8*(02), 131–158.
Arnarson, B. T. (2016). The superstar and the followers: Intra-firm product complementarity in international trade. mimeo.
Askitas, N. (2015). Google search activity data and breaking trends. *IZA World of Labor*, 206.
Askitas, N., & Zimmermann, K. F. (2015). The internet as a data source for advancement in social sciences. *International Journal of Manpower, 36*, 2–12.
Bargain, O., Cardebat, J. M., & Chiappini, R. (2023). Trade uncorked: Genetic distance and taste-related barriers in wine trade. *American Journal of Agricultural Economics*, *105*(2) 674–708.
Bernard, A., Blanchard, E., Van Beveren, I. Vandenbussche, H. (2018). Carry-along trade. *Review of Economic Studies*, *2018*(2), 1–38.
Bernard, A., & Jensen, J. B. (2004). Why do firms export. *Review of Economics and Statistics,*, *86*(2), 561–656.
Bestor, T. C. (2000). How Sushi Went Global. *Foreign Policy*. November/December (pp. 54–63).
Bestor, T. C. (2004). *Tsukiji: The fish market at the center of the world*. University of California Press.
Beverland, M. B. (2005). Crafting brand authenticity: The case of luxury wines. *Journal of Management Studies, 42*(5), 1003–1029.
Boisso, D., & Ferrantino, M. (1997). Economic distance, cultural distance, and openness in international trade: Empirical puzzles. *Journal of Economic Integration, 12*(4), 456–484.
Bouët, A., Emlinger, C., & Lamani, V. (2017). What determines exports of luxury products? The case of cognac. *Journal of Wine Economics, 12*(1), 37–58.
Bouzdine-Chameeva, T., & Ninomiya, M. (2010). The Japanese "drink of the Gods": economic and managerial challenges of sake production in the recent decades. In *5th international academy of wine business research conference.*
Cardebat, J. M., & Figuet, J. M. (2019). The impact of exchange rates on French wine exports. *Journal of Wine Economics.14*(1), 71–89.
Chen, N., & Juvenal, L. (2016). "Quality, trade, and exchange rate pass-through", *Journal of International Economics*, *100*, 61–80.
Cheptea, A., Emlinger, C., & Latouche, K. (2015). Multinational retailers and home country food exports. *American Journal of Agricultural Economics, 97*(1), 159–179.
Choi, H., & Varian, H. (2012). Predicting the present with Google trends. *Economic Record, 88*(1), 2–9.
Crozet, M., Head, K., & Mayer, T. (2012). Quality sorting and trade: Firm-level evidence for French wine. *Review of Economic Studies, 79*, 60944.
Disdier, A.-C., Fontagné, L., Mayer, T., & Tai, H. T. S. (2010). Bilateral trade of cultural goods. *Review of World Economics, 145*, 575–595.
Felbermayr, G., & Toubal, F. (2010). Cultural proximity and trade. *European Economic Review, 54*(2), 279–293.
Gentzkow, M. (2007). Valuing new goods in a model with complementarity: Online newspapers. *American Economic Review, 97*(3), 713–744.
Ginsberg, J., Mohebbi, M. H., Patel, R. S., Brammer, L., Smolinski, M. S., & Brilliant, L. (2009). Detecting influenza epidemics using search engine query data. *Nature, 457*, 1012–1014.
Guiso, L., Sapienza, P., & Zingales, L. (2006). Does culture affect economic outcomes? *Journal of Economic Perspectives, 20*(2), 23–48.
Head, K., & Mayer, T. (2013). "What separates us? Sources of resistance to globalization", *Canadian Journal of Economics 46*(4), 1196–1231.
Head, K., & Mayer, T. (2014). Gravity equations: Workhorse, toolkit and cookbook. Chapter 3 In *Handbook of international economics*, (vol. 4, pp. 131–195). Elsevier.
Issenberg, S. (2007). *The sushi economy: Globalization and the making of a modern delicacy*. Penguin Gotham Books.
Kashiha, M., C. Depken, J.C. Thill. (2017). Border effects in a free-trade zone: Evidence from European wine shipments, *Journal of Economic Geography*, *17*(2), 411–433.
Kluver, R., & Fu, W. (2004). The cultural globalization index. In *Foreign policy magazine*
Koenig, P., Mayneris., F. & Poncet., S. (2010). Local export spillovers in France, *European Economic Review*, *54*(4), 622–641.
Krautheim S. (2010). Gravity and information: Heterogenous firms, exporter networks and the 'Distance Puzzle'. Mimeo.
Maystre, N., Olivier, J., Thoenig, M., & Verdier, T. (2014). Product-based cultural change: Is the village global? *Journal of International Economics, 92*(2), 212–230.

Santos Silva, J. M. C., & Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics, 88*(4), 641–658.
Tomlinson, J. (1999). *Globalization and culture*. Polity Press.