Spatial Concentration of Sourcing in International Trade: The Role of Institutions[1]

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Abstract

We use location and transaction data on imports by U.S. firms to test the importance of country-level institutions in shaping the patterns of spatial concentration in sourcing. To this end, we adapt the Ellison and Glaeser (1997) index to construct a product-country-specific measure of supplier concentration for U.S. importers. We find that U.S. importers source in a more spatially concentrated manner from countries with weaker contract enforcement. Our result is consistent with the idea that, where contract enforcement is weak, local supplier networks compensate by sharing information to facilitate matching and transactions.

JEL Classification: F1, F6, F14, R12
Keywords: exporter-importer match, sourcing, contract enforcement, institutions, spillovers, trade

[1] Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed.
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1. Introduction

A long line of research has established that the quality of institutions in a country can determine a range of economic outcomes including economic development (Acemoglu, Johnson and Robinson, 2001), comparative advantage, trade patterns (Antràs and Helpman, 2008; Nunn, 2007; Levchenko, 2007), and sales and employment concentration (Mitton, 2008). Weak contract enforcement and tenuous property rights can hamper investments in physical and human capital, thereby undermining economic growth. A poor contracting environment can also result in high transaction costs and frequent losses for firms from hold-ups or reneging by either party in a business transaction.

Often, where the legal system cannot effectively uphold contracts, informal institutions can substitute for them, thereby mitigating some of the costs weak institutions impose. Greif (1993) demonstrated that 11th century Maghribi traders relied on cooperative coalitions to circumvent commitment problems with employing overseas agents, giving rise to a type of informal institution that disciplined agents' incentives to behave opportunistically. McMillan and Woodruff (1999) show that Vietnamese suppliers offered more credit to customers identified through a business network, proposing that business networks can provide information on the reputation and reliability of the supplier and act as a sanction on defaulting customers.

In this paper, we test how the quality of a country's institutional environment shapes the tendency for U.S. importers to source in a spatially concentrated manner from within that country. Specifically, we ask whether U.S. importers source in a more spatially concentrated manner from institutionally weaker countries. We propose a conceptual framework where importing firms sourcing from a country with weaker contract enforcement institutions are more likely to rely on their network of suppliers when establishing new supplier links in a city. Within our framework, conditional on importing from a country, firms trade off incurring city-

specific fixed costs and the gain in accessing low-cost suppliers in a new city. Finding a new supplier in a new city exposes the firm to risks of hold-up or expropriation when the rule of law is weak. However, sourcing from a new supplier in the same city may mitigate some of the costs associated with weak institutions through reliance on local supplier networks. Supplier networks can readily provide information on potential suppliers or sanction default, resulting in spatially concentrated sourcing patterns.

The research question is important for two reasons. First, importers benefit from access to suppliers who are productive, and can hence supply at lower cost. Weak institutions that restrict access to suppliers in particular regions by increasing the cost of matching and maintaining a trade relationship with them can erode these benefits and lead to inefficient importer-exporter matches. Second, weak institutions may differentially dampen the competitiveness of suppliers in more remote regions, making them less attractive to potential foreign buyers, thereby depriving them of export opportunities. This may exacerbate regional inequality, and is of particular concern to developing countries, where national and regional governments view exporting as a means to generate jobs and spur growth. Seeking evidence of weaker institutions leading to spatially concentrated sourcing patterns sheds light on the potential gains from strengthening local institutions.

Our empirical analyses uses confidential U.S. customs data maintained by the U.S. Census Bureau. We observe import transactions of a product by a firm from distinct suppliers located across cities within a country. We construct an index of supplier concentration for each U.S. importer specific to a product and country. We adapt the index of spatial concentration in Ellison and Glaeser (1997) to measure supplier concentration, henceforth EG index, which varies at the importer-product-country level. In the context of our study, the EG index measures the concentration of suppliers to a U.S. importer above the overall concentration of exporters to the U.S., the latter capturing exporters' tendencies to agglomerate in space. Thus, our

measure of supplier spatial concentration isolates importer-level deviations from overall exporter concentration within a product-country pair.

Results suggest that in countries with weaker institutions, U.S. importers source in a more concentrated manner, consistent with our conceptual framework. We find that a decrease of ten in the number of procedures required to legally enforce a contract is associated with a decrease in the EG supplier concentration index of 0.5. We also find that a decrease of 100 in the number of days required to legally enforce a contract is associated with a decrease in the EG supplier concentration index of 0.1. Our results are robust to including a battery of control variables, an instrumental variables estimation strategy to account for the endogeneity of institutions, alternate measures of both spatial concentration of sourcing and institutions and holds across several years.

This research contributes to the urban agglomeration literature. We establish patterns in the geographic concentration of sourcing by U.S. importers consistent with the idea that local business networks facilitate spillovers in information.[3] Kamal and Sundaram (2016) complements our study most closely. The authors establish the role of buyer-specific geographic neighbors in facilitating matches between buyers and sellers in an international trade transaction. They find that a 1% increase in the number of Bangladeshi exporters that matched with a U.S. importer in the neighborhood of a firm is associated with a 0.15% increase in the likelihood of the firm matching with the same importer for the first time. Our focus on importers' sourcing patterns across all countries (as opposed to a single bilateral relationship) permits an examination of the importance of buyer-specific supplier networks facilitating importer-exporter matches in countries with varying levels of institutional quality.

[3] The information flow within an importer's supplier network are "spillovers" since firms in our conceptual framework do not internalize these externalities.

Related studies have demonstrated that spatial proximity to other exporters can benefit local firms by spurring new export relationships in a given market. Using French Customs data between 1986 and 1992, Koenig (2009) finds that a 1% increase in the share of firms exporting to a given destination increases the probability of starting to export to that same destination by 0.26%. Koenig, Mayneris, and Poncet (2010) extend this work to show that export spillovers on the decision to start exporting are stronger when specific by both destination and product. Lovely, Rosenthal, and Sharma (2005) provide evidence that U.S. exporters selling to more "difficult" countries (specifically, countries with poor records on political rights and civil liberties) tend to concentrate in space in order to gain specialized knowledge of foreign markets. Our focus on importers and concentration in their sourcing patterns highlights a heretofore understudied source of information spillovers – supplier networks.

Within the urban agglomeration literature, our study also extends the application of the EG index of geographic concentration that has traditionally been used to measure industrial economic activity in purely domestic contexts (Ellison and Glaeser, 1997; Henderson, 2003; Rosenthal and Strange, 2004). We apply the EG index to a novel setting – measurement of spatial concentration in sourcing in international trade. This novel application allows us to summarize complex spatial sourcing patterns in a succinct manner while enabling us to control for agglomeration by exporters within an industry and city.

This paper also contributes to the empirical international trade literature that demonstrates the importance of institutional quality in determining a host of economic outcomes. Institutions influence the type of goods that firms import from source countries and the organizational structure that the firm chooses to engage with in trade. Bernard, Jensen, Redding, and Schott (2010a) show that firms import differentiated intermediate inputs from countries where contract enforcement is stronger, and prefer to vertically integrate, rather than outsource intermediate input production in countries where contract enforcement is weaker.

Firm export dynamics may also be shaped by institutions. Araujo, Mion, and Ornelas (2016) find that exporters start with higher export volumes and sell for longer periods in countries with better contracting institutions, although, conditional on survival, export growth declines with institutional quality. Finally, institutions influence the comparative advantage of countries (Levchenko, 2007; Nunn, 2007). Countries with good institutional quality tend to specialize in the production of goods that rely more heavily on relationship-specific investments. Nunn and Trefler (2014) offer a comprehensive discussion of the various institutional determinants of comparative advantage. Complementing this rich body of work, we highlight an additional role for institutions in influencing international trade: spatial patterns in international sourcing.

The next section outlines our conceptual framework followed by Section 3 where we develop our empirical specifications. Section 4 provides a description of the data sources and summary statistics followed by our results in Section 5. The final section concludes.

2. Conceptual Framework

In this section, we sketch the intuition guiding our hypothesis on the relationship between institutional quality and spatial concentration of sourcing. We assume that firms seeking to source from abroad (import) face efficiency losses associated with weak institutions that reduce profitability (Antràs, 2015). When contracting institutions are not well developed in the source country, or the rule of law is weak, firms have to incur costs to mitigate risks against hold-up problems or expropriation.

Consider a firm that already sources from a supplier located in a city in a given source country and is looking to source from an additional supplier.[4] Sourcing from a new city involves additional city-specific fixed costs, like searching for a reliable input supplier and

[4] Our empirical analysis is conditional on an importer sourcing from a particular country and we only consider U.S. firms sourcing from multiple suppliers in a given source country.

establishing transport links to the new city. Firms trade off incurring these city-specific fixed costs by the expected gain from accessing a lower-cost supplier in a new city. We allow city-specific fixed costs to differ across firms to capture the idea that firms face varying costs of entering a city due to certain city-specific advantages (such as supplier networks) they may possess.

Finding a new supplier in a new city exposes the firm to risks associated with hold-up or expropriation. Sourcing from a new supplier in the same city, on the other hand, may mitigate some of the costs associated with weak institutions. Firms may have access to better information within the same city through local business networks, either about individual input suppliers, their reputation and reliability, or about doing business in the local city environment. The city-specific mitigating factors may be more important in countries with weak institutional environments than in countries with strong institutions. In an environment where institutions are weak, the gains from finding a lower-cost supplier in a new city would be more substantially eroded by costs involved in sourcing from a new city. Thus, within this framework, firms are more likely to source in a spatially concentrated manner from partner countries with weak institutional environments.

3. Empirical Specification

To measure a U.S. importer's supplier concentration in a source country, we adopt the EG index following Ellison and Glaeser (1997). A key contribution of our study is the application of this index to capturing the spatial concentration of sourcing. The EG index is widely used to measure geographic concentration of economic activity. It measures agglomeration of economic activity relative to what one would observe if firm location choice were random. In our application, the index measures a U.S. importer's geographic concentration of sourcing relative to the concentration of all suppliers to the U.S. from the same

country. This adaptation of the EG index isolates the concentration of suppliers to a U.S. importer over and above the concentration implied by the agglomeration of exporting firms located within an industry and city in the source country.

As emphasized in the agglomeration literature that studies location choices of firms, domestic firms, and exporters in particular, have a tendency to agglomerate (Rosenthal and Strange, 2004; Koenig, 2009; Puga, 2010). Our application of the EG index captures this tendency of suppliers to locate in a concentrated manner by accounting for the overall concentration of all suppliers to the U.S. within an industry and city. We attribute the importer-specific deviations in supplier concentration to reliance on supplier networks for information.[5]

We construct EG_{mcp}, an index of supplier concentration, for a U.S. importer, m, sourcing product p from country c, as follows:

$$EG_{mcp} = {G - \left(1 - \sum_j x_p^2\right) H} \Big/ {\left(1 - \sum_j x_p^2\right)(1 - H)} \tag{3.1}$$

where p is a four-digit HS product code that is roughly comparable to a four-digit NAICS industry.[6] The spatial Gini coefficient (also used independently to measure geographic concentration as in Audretsch and Feldman, 1996) is given by $G \equiv \sum_{j=1}^{N_{cp}} (s_{mjcp} - x_{jcp})^2$. Here, $s_{mjcp} \equiv \frac{value_{mjcp}}{value_{mcp}}$ represents the share of imports of product p that importer m buys from city j in the total value of imports of product p bought by importer m from country c. $x_{jcp} \equiv \frac{value_{jcp}}{value_{cp}}$ represents the total value of U.S. imports of product p from city j as a share in

[5] We note here that although we cannot separately measure total domestic activity within an industry-city in a source country due to data constraints, we believe that our measure of concentration by exporters in a source country selling to the U.S. correlates very highly with overall domestic activity within that industry-city. It thus controls for the concentration of economic activity in the source country that may arise from local agglomeration economies. In addition, our empirical specification controls for the concentration of economic activity in a country using night-lights data (Henderson, Storeygard, and Weil, 2012). Finally, we exclude transactions in resource-intensive products, since these may be driven by natural advantage – an alternate source of agglomeration economies.

[6] U.S. import transactions are collected at the ten-digit HS level. The choice of four-digit HS product is motivated by the desire to measure concentration at a fairly disaggregated level while still allowing for enough observations within a country-product space to meet Census Bureau disclosure requirements.

total U.S. imports of product p from country c. N_{cp} refers to the total number of cities supplying product p. Thus, the spatial Gini coefficient, at the product level, measures the concentration of sourcing by a U.S. importer above the concentration of exporters to the U.S.

If the U.S. importer sources from a small number of suppliers from the country, we would observe a high value of the spatial Gini (indicating concentration) simply because a small number of suppliers are less likely to be spread across many cities. To account for this, Ellison and Glaeser (1997) propose adjusting the spatial Gini with a Herfindahl index, which we adapt to our setting as $H \equiv \sum_{k=1}^{S_{mcp}} (z_{kmcp})^2$ where $z_{kmcp} \equiv \frac{value_{kmcp}}{value_{mcp}}$ measures importer m's imports of product p from each supplier, k, as a share of importer m's total imports of product p from country c. S_{mcp} is the total number of suppliers in country c supplying product p to importer m.[7]

Two important properties of the EG index, as defined in (3.1), make it suitable for testing our research question. First, the index allows us to succinctly capture patterns of sourcing by U.S. importers and is comparable across countries. Second, the index controls for concentration that may arise if U.S. importers source a larger share of imports from only a few suppliers and hence appear to source in a concentrated manner across cities.[8] In a robustness exercise, we construct an alternate EG index using the count of suppliers instead of trade value and verify that our results remain qualitatively similar using this alternate index.

To explore the relationship between institutions and spatial concentration of sourcing, we estimate the following equation.

$$EG_{mcp} = \alpha + \beta Institutions_c + \gamma X_c + \theta X_{cp} + \delta_m + \vartheta_p + \epsilon_{mcp} \quad (3.2)$$

[7] Note that the Herfindahl index has no city component to it. The term $\left(1 - \sum_j x_p^2\right)$, appears in the EG index following Ellison and Glaeser (1997), who demonstrate that the expected value for G is $\left[EG\left(1 - \sum_j x_p^2\right)(1 - H)\right] + \left(1 - \sum_j x_p^2\right)H$.

[8] Note that given the nature of the EG index, we cannot calculate it for importers that source from a single supplier in a given product-country pair. Hence, single supplier importer-product pairs are excluded from our analysis sample.

$Institutions_c$ is a measure of institutional quality in country c, X_c a set of country-specific control variables, and X_{cp}, a set of country-product specific control variables. Country-specific variables include information- and transport-infrastructure, GDP per capita, population, land area, common language with the U.S., and concentration of economic activity (measured with night-lights data). Country-product controls include the total number of suppliers and total number of cities selling product p from country c. δ_m and ϑ_p refer to a set of importer and product fixed-effects, respectively. ϵ_{mcp} is an idiosyncratic error term. In all our tables, we report robust standard errors clustered at the country-level. Our conceptual framework implies that $\beta < 0$ or that weaker institutional quality is associated with higher supplier concentration.

The empirical specification exploits cross-country variation in a U.S. importer's supplier concentration to identify the relationship of interest after accounting for importer- and product-specific characteristics. Equation (3.2) accounts for unobserved importer- and product-specific factors. A remaining concern is unobserved country-specific factors that may drive both institutional quality and sourcing concentration simultaneously.

We adopt an instrumental variables strategy to address potential simultaneity bias. We instrument for institutions with legal origins at the country-level following Nunn (2007). The idea exploited here is that the legal origin of a country affects institutional quality (given persistence in institutions), but drives contemporaneous economic outcomes only through the channel of institutions. Our result is robust to the instrumental variables strategy as well as to employing alternate measures of both concentration and institutional quality and holds across multiple years.

4. Data

We test our hypotheses using confidential U.S. firm-trade transaction linked data in conjunction with measures of institutional quality and additional country-level controls. Availability of firm-level trade transactions data identifying both trading parties in the transaction permits construction of spatial sourcing concentration measures for an importer-product-country triad. Given our interest in understanding the role of institutions in shaping the patterns of spatial concentration of sourcing by U.S. importers from a country, we utilize measures of contract enforcement or the ease with which contracts can be legally enforced. Since institutions change slowly over time, measures of institutional quality remain stable in the time-series and derive most of its variation within a cross-section. Thus, we perform cross-sectional empirical analyses utilizing data from 2011.[9]

4.1 Firm-Trade Transactions Data

We use U.S. merchandise import transactions in the Linked Firm Trade Transactions Database (LFTTD). The import transactions data contain an identifier for the U.S. importer and the foreign exporter. The foreign exporter or supplier is uniquely identified by the "Manufacturer ID" (MID) that is a required field on the form (Form 7501) U.S. importers must file with the U.S. Customs and Border Protection.[10] The MID is an alphanumeric code constructed using a pre-specified algorithm with a maximum length of 15 characters.[11] The last three characters in the MID designate the city where the manufacturer is located. We treat a distinct three-letter code as a unique city. We carry out robustness checks to address concerns that there may exist multiple cities within a country beginning with the same first three letters.[12]

[9] 2011 was the latest available year at the time we began our study. Also, motivating our choice is the extensive cleaning of the foreign supplier identifier variable performed by Kamal and Monarch (2016) in 2011.
[10] See form http://forms.cbp.gov/pdf/cbp_form_7501.pdf.
[11] See Block 13 (pg. 7) for description of MID and Appendix2 (pg. 30) for instructions on constructing MID at http://forms.cbp.gov/pdf/7501_instructions.pdf.
[12] Since we identify cities within a country using the three letter codes extracted from the MID, it is possible that for cities that begin with the same three letters, a single code many actually represent multiple cities and introduce measurement bias in our spatial concentration index. However, as long as the incidence of such cases is not systematically correlated with our measures of country institutions, our coefficient estimates of these measures of

We restrict the data in three main ways. First, we only employ arm's length transactions thereby excluding related-party transactions. Sourcing strategies from subsidiary or parent companies as compared to unaffiliated parties are governed by very different economic forces (Ramondo, Rappoport, and Ruhl, 2016). Second, we exclude natural resource-intensive products whose production location is more likely to be governed by natural advantages.[13] Finally, we exclude observations for countries in the sample that are associated with a single city, representing an insignificant share (less than 0.01%) of the overall sample.

In our descriptive analyses, we construct indicators for importer size and in regression analyses we test for the role of firm heterogeneity using an importer's total employment, total number of establishments, age, and primary industry of operation. We obtain information on basic firm characteristics from the Longitudinal Business Database (LBD) that consists of data on all private, non-farm U.S. establishments in existence that have at least one paid employee (Jarmin and Miranda, 2002). For multi-plant firms, age is calculated as the difference between the year of interest and the year of establishment of its oldest plant and the firm is considered to be operating in the sector where the largest share of its employment is housed.

4.2 Country-level and Country-product-level Data

The country-level measures are sourced from five public-use databases. First, our primary measure of institutions utilizes data from the World Bank's Doing Business project. We use measures of contract enforcement capturing the cost, days and procedures involved in the legal enforcement of contracts. We then calculate the principal component of these measures and employ this as our baseline measure of the legal enforcement of contracts. We normalize the measure so that higher values correspond to stronger institutions. The World

interest will remain unbiased. Nonetheless, a test excluding the largest five countries by population with the premise that larger countries are likely to have larger number of cities that may share the same first three letters shows that our results are qualitatively robust.

[13] Resource-intensive products are defined as two-digit HS categories 2-14 (agricultural products) and 25-27 (mineral products).

Bank contract enforcement measures have been used extensively in prior research (for examples, see Feenstra, Hong, Ma, and Spencer, 2013; Araujo, Mion, and Ornelas, 2016).

Second, we utilize data from the Fraser Institute's Economic Freedom of the World index that provides a wide coverage of countries. We focus on the indices of legal structure and security of property rights and freedom to trade internationally.[14] The index of legal structure and security of property rights is used as an alternative index measuring institutional quality, which measures institutions more broadly. Regulatory trade barriers may be moderated by geographic networks and enters as a control variable in all our regressions. The regulatory trade barriers measure non-tariff trade barriers as well as the compliance costs of importing and exporting. The indices range from 0 to 10 where higher numbers correspond to better institutional quality.

Third, we use data on freedom from corruption from the Heritage Foundation as an alternate measure of institutions.[15] The score varies from 0 to 100 and higher numbers correspond to better measures of freedom. The freedom from corruption score is derived from equally weighting indices for public trust in politicians, irregular payments and bribes, transparency of government policymaking, absence of corruption, perceptions of corruption, and governmental and civil service transparency.

Fourth, we use the World Bank's World Development Indicators (WDI) database to control for country-level characteristics.[16] We measure information infrastructure as internet technology presence that counts the number of internet users per 100 people. Internet users are defined as "individuals who have used the internet (from any location) in the last 12 months. Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc". This measure captures the ease of information transmission between buyers

[14] See http://www.freetheworld.com/2015/economic-freedom-of-the-world-2015.pdf for detailed description of the index.
[15] Accessed at http://www.heritage.org/index/download.
[16] See http://data.worldbank.org/data-catalog/world-development-indicators for details on data coverage.

and sellers for instance, via company websites, portals and electronic communication in general. Our hypothesis is that superior information infrastructure can mitigate the need for exploiting spatially proximate networks in sourcing decisions. We measure physical infrastructure by the percentage of paved roads as a share of all the country's roads, measured in length, to capture physical infrastructure barriers to dispersed sourcing. Controlling for transportation infrastructure is also important since it has been shown to determine patterns of specialization in cities (Duranton, 2015; Duranton, Morrow, and Turner, 2014). The WDI also provides the GDP per capita (in 2010 U.S.D), total population, and land area, all of which enter our specification in logs as control variables for the level of development and country size, factors which have previously been demonstrated to be correlated with economic concentration (Mitton, 2008).

Finally, to capture the idea that language barriers might deter information flows and reinforce the need for networks in obtaining suppliers, we include an indicator variable if the source country and the U.S. share a common language sourced from CEPII (Melitz and Toubal, 2014).[17]

Even though our EG index accounts for the concentration of exports in each product at the country level, we additionally control for differences in industrial concentration across countries. We exploit data on night-lights from Henderson, Storeygard, and Weil (2012).[18] Night-lights data measures lights from human settlements and is therefore a reflection of human activity. Moreover, lights as the measure of economic activity is measured consistently across the world at the same spatial scale. We use the within-country Gini measure of night-lights as a control variable in our analysis.

[17] Accessed at http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=19.
[18] Note that the latest available year is 2008. Therefore, we utilize the 2008 log Gini night-lights measure in our baseline regressions.

In addition to the country level variables, we construct and include two additional product-country variables as controls - the log number of suppliers to the U.S. per product-country and the log number of cities from which exports to the U.S. originate per product-country, both constructed using the LFTTD.

4.3 Analysis Sample

The analysis sample is constructed using firm-import transactions in the 2011 LFTTD.[19] We aggregate the transaction level data at the importer, foreign supplier, and four-digit product level. About 40 percent of importers source a four-digit HS product from a single supplier accounting for only about 20 percent of total trade value. By definition of the EG index, single-supplier importers of a particular product will be excluded from our analysis. Therefore, our analysis sample necessarily focuses on importers that source from more than a single supplier within a product-country cell. Once we create an EG index for an importer-product-country triad we obtain a dataset with approximately half a million observations. We trim our analysis dataset for the top and bottom 1 percent of the EG index, dropping about 2 percent of the observations. We then link in country-level measures of institutional quality and control variables described in the previous section. The number of observations differ in each of our specifications due to differential availability and coverage of the country-level variables.

4.4 Summary Statistics

In this section we provide descriptive evidence in support of our hypothesis that in partner countries with weaker contract enforcement regimes, U.S. importers tend to source in a spatially concentrated manner. Table 1 shows average values in the sample for our main institutional variables and the EG index. In our analysis sample, the average Ellison-Glaeser index, EG_{mcp}, is 0.67 while the median is 0.23. The average costs, days and procedures

[19] In robustness exercises where we show results different cross-sections, the analysis datasets are constructed in a similar manner.

required to enforce a contract legally are given by 20 percent of claims, 485 days and 36 procedures, respectively. Table 2 shows the average concentration index by broad product categories.[20] Overall, we find that broad product categories that display the highest average spatial concentration of sourcing tend to be in more hi-tech, capital-intensive industries with the opposite holding true for categories displaying the lowest average concentration. The exceptions are vegetable products, leather and footwear.

Figure 1 displays a world map showing values of the average EG index across countries. Darker colors correspond to greater concentration while lighter colors indicate lower concentration. We note that there is substantial variation in the concentration index even within country groups defined across various dimensions like land area (medium levels of concentration in China and Canada versus high concentration in Russia), population (India versus China) and level of development (variation in concentration within Africa and Europe and across middle-income countries like Brazil, Russia and South Africa).

Table 3 further displays the average spatial concentration by importer size and institutional quality. In panel A, importers are classified as large (employs 500+ workers), medium (employs 250-499 workers), and small (employs <250 workers). We find that large importers exhibit higher values of the EG index compared to small and medium importers. In panel B, countries are classified into three quantiles by the principal component measure of enforcement of contracts using the World Bank's three separate measures of contract enforcement. We find that countries in the top quantile with the strongest institutions display much lower spatial concentration of sourcing relative to countries in the middle and lower quantiles, consistent with our hypothesis in this paper.

[20] The broad product classifications are based on groupings of various two-digit HS product categories. See http://www.foreign-trade.com/reference/hscode.htm.

From Table 4, column 1, we find that an importer sources from 1.79 countries on average. However, this masks variation by importer size. We find that large and medium importers source from 2.4 to almost 3 countries respectively, while small importers source from 1.57 countries on average. In column 2, we present corresponding figures by importer-product pair. We find that an importer sources a particular product from about 1.4 countries on average. Larger importers tend to source from more countries than smaller importers. On average, large importers source from 1.79 countries, while medium and small importers source from 1.46 and 1.24 countries, respectively.

Next, in Table 5, we document the number of suppliers per importer-product-country. In panel A, as expected, we find that larger importers tend to source from more suppliers on average within a particular product and country compared to medium and small importers. Panel B reveals that importers, on average, tend to source more from countries with better institutional quality. Overall, the descriptive analyses support our hypothesis that higher institutional quality is associated with lower spatial concentration of sourcing by U.S. importers. In the next section, we test this hypothesis more rigorously by estimating versions of equation (3.2).

5. Results

5.1 Institutions and spatial concentration of sourcing

Table 6 presents regression results following equation (3.2) estimated using confidential U.S. firm-import transactions linked data in 2011. Columns (1) through (3) present results for the various measures of contract enforcement at the country-level - the cost, number of procedures and number of days required to legally enforce contracts. The World Bank measures contract enforcement by collecting data on the number of procedures required to enforce a contract through the courts, the number of days required to complete procedures, and

the cost required to complete procedures, measured as a percentage of claim. In column (4), we use the principal component of these measures as the key institutional variable, which we use in all subsequent regressions as our baseline measure of institutions. We normalize the measures of institutions so that higher values correspond to stronger contract enforcement. Column (5) presents results from the instrumental variables regression.

Specifications across all columns include controls for infrastructure (information and transportation) quality and for regulatory trade barriers. We also control for the source country's level of development (GDP per capita), population, land area, common language with the U.S., concentration of economic activity (Gini of night-lights) and the total number of suppliers and cities per country-product. Finally, all columns include importer and product fixed effects to account for importer and product heterogeneity.

From Columns (1) through (4), we find that with the full battery of control variables, except for Column (1), our measures of contract enforcement are negatively related to the spatial concentration of sourcing. Coefficients are statistically significant at the five percent level. Results from Column (2) indicate that a decrease of ten in the number of procedures required to legally enforce a contract is associated with a decrease in the EG spatial concentration index of 0.5. Results from Column (3) indicate that a decrease of a hundred in the number of days required to legally enforce a contract is associated with a decrease in the EG spatial concentration index of 0.1.

A potential explanation, from Column (1), for being unable to reject the null hypothesis that the cost of contract enforcement is related to the spatial concentration of sourcing is that the cost of contract enforcement is a noisy measure of the actual ease with which contracts can be legally enforced. We note that the cost measure only captures the formal costs associated with contract enforcement and does not include informal costs like bribes. Countries with high levels of corruption are characterized by more onerous regulations (Ahsan, *forthcoming*) that

are more easily exploited by dishonest officials to extract bribes (for example corruption can drive up trade costs, De Jong and Bogmans, 2011) such that in institutionally weak environments, bribes are likely to be a significant proportion of enforcement costs. The time and number of procedures involved in enforcing contracts are less likely to suffer from measurement error leading to attenuation bias.

Overall, we do not find a statistically significant relationship between infrastructure and regulatory trade barriers and the spatial concentration of sourcing, lending support to our idea that it is the potential costs related to hold-up and other contractual frictions that encourages U.S. importers to concentrate sourcing. A country's level of development, population, number of cities exporting to the U.S. from a country-product and concentration of economic activity in the country are positively related, while land area, common language and the number of suppliers to the U.S. in a country-product are negatively related to the spatial concentration of sourcing.

In column (5), we present results from the instrumental variables estimation. We instrument for contract enforcement with legal origins following Nunn (2007). Legal origins are highly correlated with contemporary institutions due to path-dependence in institutions. The exclusion restriction is derived from the idea that while a country's legal origins are correlated with current institutional quality, they are not correlated with unobserved factors affecting the current spatial concentration of sourcing. We expect that countries with legal origins rooted in British common law to have stronger institutions than countries with legal origins rooted in German, Scandinavian or French (civil) law. We separately include an indicator for countries with a Socialist legal origin. These countries, comprising primarily of former Soviet Union and Eastern European countries, may have transitioned over time to their pre-Russian revolution or pre-World War II legal systems which were French or German civil law (La Porta, Lopez-de-Silanes and Shleifer, 2008).

In our first stage regression, we regress dummies for civil (French, German or Scandinavian), Socialist, and British (the left-out category) legal origins on the principal component measure of contract enforcement. The first stage is significant (F-statistic =13.99) and we find a negative relationship between the civil legal origin dummy and contract enforcement. This is consistent with the idea that relative to common law, a legal origin rooted in civil law is associated with weaker institutions. We find a positive relationship between contract enforcement and the Socialist legal origin dummy. We test for weak instruments using the Hansen J-statistic. The statistic of 1.93 with a p-value of 0.17, does not allow us to reject the null hypothesis that the over-identifying restrictions are valid. We conclude that the instruments are not correlated with the second stage residuals.

Second stage results are presented in column (5). Our results reinforce our baseline finding from column (4) showing a negative and significant relationship between institutional quality and the spatial concentration of sourcing. The instrumental variables result shows a stronger negative relationship between institutions and the spatial concentration of sourcing, hinting at attenuation bias in the OLS estimates due to measurement error. Alternatively, unobserved factors that lead to weaker contract enforcement regimes but decrease supplier concentration could also lead to a downward bias in the OLS coefficients.

5.2 Robustness Checks

Tables 7 and 8 provide results from further robustness checks of our baseline result in Column 4, Table 6. In columns (1) through (3) of Table 7, we estimate equation (3.2) with all our control variables for years, separately, between 2008 and 2010. The coefficient on contract enforcement is remarkably robust and varies between -0.13 and -0.15. In columns (1) and (2) of Table 8, we present results using two alternate measures of institutional quality. We use the Fraser Institute's comprehensive index of legal system and property rights, and the Heritage Foundation's freedom from corruption measure. The former is a broader measure of

institutional quality, while the latter captures an alternate dimension of institutions that impacts contract enforcement. Corruption introduces uncertainty in economic relationships that may exacerbate the ability of importers to seek legal redress in the event of default. The results support our hypothesis – institutional quality is negatively associated with the spatial concentration of sourcing. In column (3), we use a count-based EG index instead of a value-based EG index to measure concentration. This alternate index uses the number of suppliers, instead of value of imports sourced from these suppliers to calculate the EG measure of concentration. Again, we find that our result holds qualitatively.

Overall, results in Tables 7 and 8 provide support for our hypothesis that weaker institutions are associated with greater concentration of sourcing by U.S. importers, consistent with the idea that supplier networks facilitate information flows in settings where formal institutions are inadequate in their ability to uphold contracts.

5.3 Extensions

Our goal thus far has been to establish a robust negative relationship between source country institutional quality and the propensity for importers to source in a spatially concentrated manner. In this section, we explore the nature of this relationship further by analyzing the role of firm heterogeneity in mediating the impact of institutional quality on spatial concentration of sourcing. Firm size and productivity and consequently, profitability are highly correlated. Therefore, we may expect larger importers to be able to source from suppliers spread out across various cities within a country as they may command additional resources that allow them to gain information and guard or insure against opportunistic behavior.

In order to explore this possibility, we interact our measure of institutional quality with two measures of firm size. One is the total employment at the firm (in logs) and the second is the firm's total number of establishments (in logs). We expect the coefficient on the interaction

between size and institutions to be positive implying that the negative relationship between institutions and concentration would be mitigated for larger firms.

Columns (1) and (2) in Table 9 presents results using these two measures of size respectively. In both columns, the contract enforcement measure is negative and statistically significant and although the interaction terms fail to gain statistical significance, they are positive as hypothesized. In column (3), we include an interaction term between firm age and institutions to test if older importers may be able to utilize experience to better navigate in markets characterized by weaker institutions. As in the previous two columns, the contract enforcement measure is negative and statistically significant and again the interaction term is statistically insignificant but positive.

Next, we explore if intermediaries behave differently from importers that only produce or engage in a combination of production and consumption. We follow Bernard, Jensen, Redding, and Schott's (2010b) measure of an intermediary – firms with 100 percent of their U.S. employment in the wholesale or retail sectors. Intermediaries are less sensitive to market size and can subsequently enter more difficult markets (Ahn, Khandelwal, Wei, 2011). We thus expect the interaction of the intermediary status indicator with the institutional quality measure to be positive. Similar to our results on importer size, we find in column (4) of Table 9 that while the contract enforcement measure is negative and statistically significant, the interaction term fails to gain statistical significance but is positive as hypothesized.

Overall, from Table 9, we are unable to reject the null hypothesis that importer heterogeneity, at least along the dimensions of firm size, age, and sector, does not matter for mediating the relationship between supplier concentration within a country and institutional quality in that country.

6. Conclusion

This paper tests the role of a source country's institutional environment in shaping the patterns of spatial concentration of sourcing by U.S. importers. We find that weaker institutions are associated with greater concentration of sourcing by U.S. importers. On average, U.S. importers tend to source in a more spatially concentrated manner from countries with weaker contract enforcement regimes. This result is robust to an instrumental variables strategy and a host of robustness checks including use of alternative measures of institutions and supplier concentration as well as samples in different cross-sections.

The empirical evidence we present is consistent with the idea that in weaker institutional environments, local business networks enable importers to lower the costs of matching and transacting with suppliers. Our study highlights the role for institutions in driving spatial patterns in U.S. importers' sourcing strategies. We offer initial evidence in support of information spillovers that may arise in supplier networks above and beyond local export spillovers in the presence of weak institutions. In addition to contributing to the literatures on urban agglomeration and international trade, we augment the literature studying how informal institutions may foster economic activity, particularly, the role of informal cooperative coalitions in promoting efficiency by reducing agency and other transactions costs in the absence of strong formal enforcement institutions.

Ackowledgments

We thank Emek Basker, Gilles Duranton, Mark Kutzbach, Ben Zissimos, and participants of the lunch seminar at the 2014 Center for Economic Studies, U.S. Census Bureau, 2015 Georgetown Center for Economic Research Conference, Midwest International Trade Meetings, European Trade Study Group (Paris), Syracuse University Trade, Development, and Political Economy seminar series, 62nd Annual North American Regional Science Meetings, 2016 Workshop on Institutions, Trade, and Economic Development, and 2017 University of Auckland Economics Department seminar series for their invaluable comments. All errors and omissions remain our own.

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Table 1. Summary Statistics, 2011

Variable	Mean	Standard Deviation
Contract Enforcement - Cost	20.291	19.044
Contract Enforcement - Days	484.629	277.034
Contract Enforcement - Procedures	36.155	4.681
Contract Enforcement – Principal Component	0.009	1.252
EG Index (value)	0.669	2.842

Notes: This table displays average institutional quality and spatial concentration of sourcing per importer-country. The World Bank measures contract enforcement by the cost required to complete procedures and measured as a percentage of claim (Contract Enforcement - Cost), the number of days required to complete procedures (Contract Enforcement - Days), and the number of procedures required to enforce a contract through the courts (Contract Enforcement - Procedures).

Table 2. Spatial concentration of sourcing using EG Index, by Product Classification, 2011

Broad Product Categories	Mean	Standard Deviation
Animal & Animal Products	0.555	2.837
Vegetable Products	0.737	3.185
Prepared Foodstuffs	0.514	2.612
Chemical & Allied Industries	0.993	3.579
Plastics & Rubber	0.718	2.932
Raw Hides, Skins, Leather, & Furs	0.799	3.133
Wood & Wood Products	0.497	2.320
Textiles	0.584	2.789
Footwear & Headgear	0.694	3.182
Stone & Glass	0.539	3.033
Metals	0.705	2.948
Machinery & Electrical	0.749	2.838
Transportation	0.781	2.938
Miscellaneous	0.654	2.762
All	0.678	2.873

Notes: This table displays the average supplier concentration measured as the Ellison-Glaeser index as defined in (3.1) by two-digit HS product categories following http://www.foreign-trade.com/reference/hscode.htm.

Table 3. Spatial concentration of sourcing using EG Index, 2011

Panel A: By Importer Size	
Firm Size	**Average (s.d)**
Large (500+)	0.698 (2.973)
Medium (250-499)	0.643 (2.907)
Small (< 250)	0.651 (2.740)
Panel B: By Institutional Quality	
Country Group	**Average (s.d)**
High	0.469 (1.851)
Middle	0.865 (3.380)
Low	0.752 (2.774)

Notes: This table displays the average supplier concentration measured as the Ellison-Glaeser index as defined in (3.1) with standard deviation in parentheses. Importers are classified into three size bins: "large" employs more than 500 workers, "medium" employs between 250 and 500 workers, and "small" employs less than 250 workers. Countries are divided into three quantiles of institutional quality captured by ease of contract enforcement.

Table 4. Number of source countries, 2011

Firm Size	**Average**	
	Importer	**Importer-Product**
Large (500+)	2.42	1.79
Medium (250-499)	2.92	1.46
Small (< 250)	1.57	1.24
All	1.79	1.40

Notes: This table displays the average number of countries that an importer (Column 1) and importer-product pair (Column 2) sources from. Importers are classified into three size bins: "large" employs more than 500 workers, "medium" employs between 250 and 500 workers, and "small" employs less than 250 workers.

Table 5. Number of suppliers per importer-product-country, 2011

Panel A: By Importer Size	
Firm Size	**Average (s.d)**
Large (500+)	5.24 (11.98)
Medium (250-499)	4.15 (9.40)
Small (< 250)	3.51 (4.29)
Panel B: By Institutional Quality	
Country Group	**Average (s.d)**
High	5.04 (10.34)
Middle	3.77 (5.60)
Low	3.97 (8.95)

Notes: This table displays the average number of suppliers per importer-product-country triad with standard deviation in parentheses. Importers are classified into three size bins: "large" employs more than 500 workers, "medium" employs between 250 and 500 workers, and "small" employs less than 250 workers. Countries are divided into three quantiles of institutional quality captured by ease of contract enforcement.

Table 6. Spatial Concentration of Foreign Suppliers and the Role of Institutions, 2011

Dependent Variable:	(1)	(2)	(3)	(4)	(5)
EG Index Value	**Cost**	**Procedures**	**Days**	**P.C.**	**IV**
Contract Enforcement	0.001	-0.049**	-0.001**	-0.169**	-0.228*
	(0.002)	(0.019)	(0.000)	(0.085)	(0.121)
Regulatory Trade Barrier	-0.146	-0.070	-0.027	-0.135	-0.124
	(0.139)	(0.120)	(0.127)	(0.142)	(0.149)
Internet per 100 people	-0.014	-0.015*	-0.010	-0.009	-0.008
	(0.011)	(0.008)	(0.010)	(0.011)	(0.011)
% Paved Roads	-0.002	0.002	-0.002	-0.001	-0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Log GDP Per Capita (constant 2010 USD)	0.485*	0.673***	0.708**	0.621**	0.672**
	(0.257)	(0.235)	(0.269)	(0.269)	(0.291)
Log Population	0.170+	0.152*	0.330***	0.180*	0.189*
	(0.110)	(0.087)	(0.122)	(0.106)	(0.111)
Log Land Area	-0.126	-0.083	-0.244**	-0.085	-0.078
	(0.109)	(0.085)	(0.113)	(0.098)	(0.100)
Common Language	-0.219+	-0.230**	-0.581***	-0.355**	-0.404**
	(0.147)	(0.111)	(0.165)	(0.164)	(0.196)
Log Gini Lights (2008)	1.577*	1.662**	2.925***	1.591**	1.657**
	(0.899)	(0.659)	(0.950)	(0.791)	(0.819)
Log # Suppliers per Product-Country	-0.584***	-0.453***	-0.419***	-0.416***	-0.363***
	(0.095)	(0.073)	(0.082)	(0.090)	(0.114)
Log # Cities per Product-Country	0.582***	0.405***	0.332**	0.358**	0.286
	(0.149)	(0.128)	(0.138)	(0.153)	(0.187)

Notes: Number of observations equals 245,000 and rounded for disclosure avoidance. Column headings for columns 1 through 4 list the various measures of contract enforcement used as the key independent variable. Column 5 uses legal origins as an instrument for the principal component of contract enforcement. First stage results are reported in the text. The dependent variable is as defined in (3.1). All columns include Importer and HS4 fixed effects. Standard errors clustered by country in parentheses. * < 0.10, ** < 0.05; *** < 0.01.

Table 7. Spatial Concentration of Foreign Suppliers and the Role of Institutions, Alternate Years

Dependent Variable: EG Index Value	(1)	(2)	(3)
	2008	**2009**	**2010**
Contract Enforcement	-0.149**	-0.142**	-0.132*
	(0.066)	(0.070)	(0.074)
Regulatory Trade Barrier	-0.238	-0.171	-0.216
	(0.142)	(0.123)	(0.141)
Internet per 100 people	-0.001	-0.007	-0.008
	(0.008)	(0.008)	(0.009)
% Paved Roads	-0.002	-0.001	0.001
	(0.004)	(0.004)	(0.003)
Observations	222,000	214,000	242,000
Fixed Effect		Importer, HS4	

Notes: Number of observations rounded for disclosure avoidance. Column headings for columns 1 through 3 list years corresponding to the sample used. The dependent variable is as defined in (3.1). The following control variables are included in all specifications: log GDP per capita (constant 2010 USD), log population, log land area, common language indicator, log gini lights, log number of suppliers per product-country, log number of cities per product-country. Standard errors clustered by country in parentheses. * < 0.10, ** < 0.05; *** < 0.01.

Table 8. Spatial Concentration of Foreign Suppliers and the Role of Institutions, Alternate Enforcement and EG Index Measures

Dependent Variable: EG Index	(1) **EG Index Value**	(2) **EG Index Value**	(3) **EG Index Count**
Contract Enforcement			-0.120***
			(0.024)
Legal System & Property Rights	-0.232***		
	(0.080)		
Freedom from Corruption		-0.017**	
		(0.006)	
Regulatory Trade Barrier	-0.075	-0.059	-0.017
	(0.129)	(0.123)	(0.049)
Internet per 100 people	-0.003	-0.008	0.022***
	(0.008)	(0.007)	(0.005)
% Paved Roads	0.000	0.000	0.005**
	(0.003)	(0.004)	(0.002)
Observations	245,000	245,000	245,000
Fixed Effect	Importer, HS4		

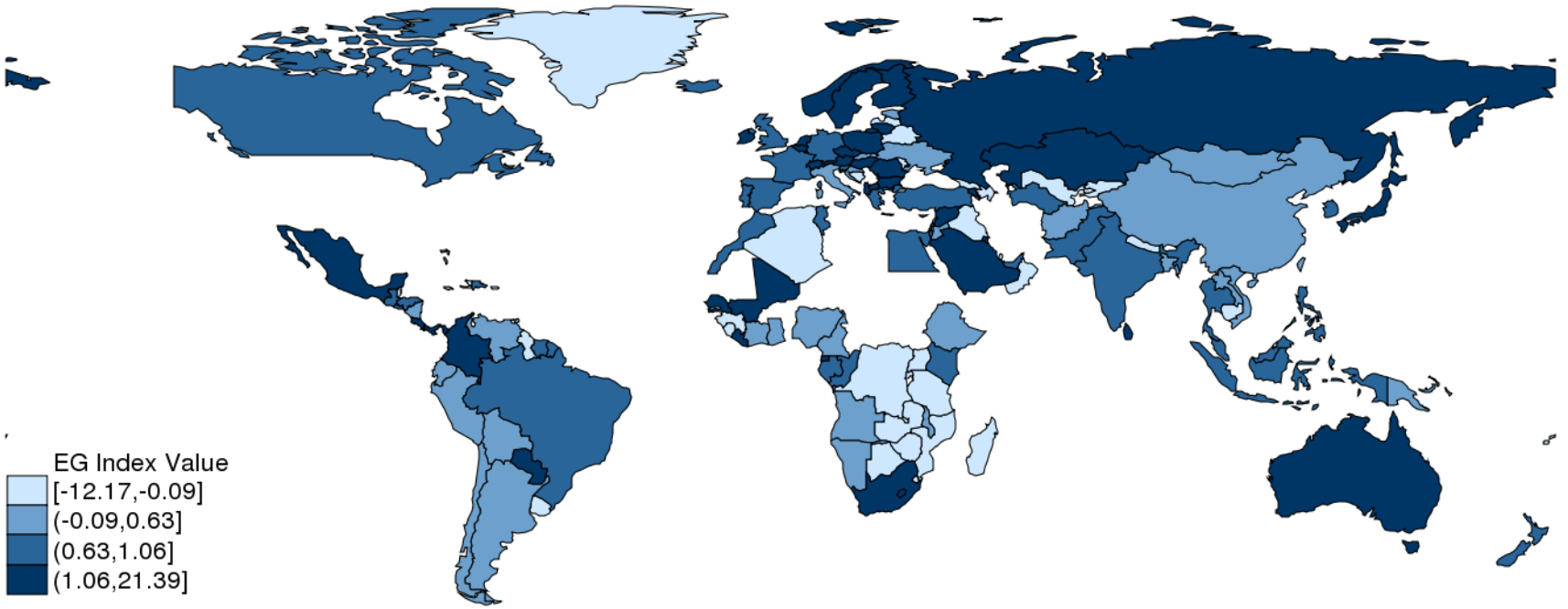
Notes: Number of observations rounded for disclosure avoidance. The dependent variable in columns 1 and 2 is as defined in (3.1) and in column 3 is similarly defined, except it uses the count of suppliers. In column 1, we use an alternate measures of institutional quality from the Fraser Institute. In column 2, we use the freedom from corruption measure from the Heritage Foundation. The following control variables are included in all specifications: log GDP per capita (constant 2010 USD), log population, log land area, common language indicator, log gini lights, log number of suppliers per product-country, log number of cities per product-country. Standard errors clustered by country in parentheses. * < 0.10, ** < 0.05; *** < 0.01.

Table 9. Spatial Concentration of Foreign Suppliers and the Role of Institutions, Firm Heterogeneity

Dependent Variable: EG Index	(1)	(2)	(3)	(4)
	Size		**Age**	**Intermediary**
	Employment	**Establishments**		
Contract Enforcement	-0.164*	-0.163*	-0.174*	-0.160**
	(0.087)	(0.091)	(0.103)	(0.083)
Contract Enforcement x Log Employment	0.002			
	(0.002)			
Contract Enforcement x Log Establishments		0.001		
		(0.002)		
Contract Enforcement x Log Age			0.005	
			(0.009)	
Contract Enforcement x Intermediary				0.008
				(0.016)
Regulatory Trade Barrier	-0.129	-0.129	-0.129	-0.128
	(0.141)	(0.141)	(0.141)	(0.140)
Internet per 100	-0.009	-0.009	-0.009	-0.009
	(0.011)	(0.011)	(0.011)	(0.011)
% Paved Roads	-0.001	-0.001	-0.001	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Observations	225,000			
Fixed Effect	Importer, HS4			

Notes: Number of observations rounded for disclosure avoidance. The following control variables are included in all specifications: log GDP per capita (constant 2010 USD), log population, log land area common language indicator, log gini lights, log number of suppliers per product-country, log number of cities per product-country. Column 1 presents interactions with importer's log total employment; column 2 presents interactions with importer's log total establishments; column 3 presents interaction with importer's log total age; and column 4 presents an interaction with an intermediary dummy which is 1 if the importer has 100% of its employment in NAICS two-digit industries 42, 44, or 45. Standard errors clustered by country in parentheses. * < 0.10, ** < 0.05; *** < 0.01.

Figure 1. Spatial Concentration of Sourcing using EG Index, 2011



Notes: This figure displays the average EG index by country. Darker (lighter) shades of blue correspond to higher (lower) values of the index indicating greater (smaller) supplier concentration. Countries shaded in white fail to pass Census Bureau disclosure requirements. The U.S. is shaded white because it is the importing country.