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Extensive and Intensive Trade Margins: A State-by-State View*

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Abstract

This paper examines a topic of increasing interest, the potential determinants of extensive (i.e., number of firms) and intensive (i.e., average exports per firm) trade margins, using state-level trade to 190 countries. In addition to distance and country size, other factors affecting trade costs and export demand are explored. In state-by-state regressions, these other factors exhibit more consistent and statistically significant effects on the extensive than on the intensive trade margin. One noteworthy finding is that U.S. foreign direct investment has a positive effect on both margins. In regressions using all state-level data simultaneously, some factors affect both margins, but not necessarily in the same way. For example, the impact of the communications infrastructure in the importing country affects the extensive margin positively and the intensive margin negatively. Finally, reasons for differences across states, such as state size and trade missions, are identified.

JEL Codes: F10, R10

Keywords: state exports, extensive margin, intensive margin

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1. Introduction

Relatively few firms export and these firms usually export to a small number of markets.[1] Not surprisingly, these exporting firms possess productivity advantages over non-exporting firms. The theoretical foundations for these results can be found in models of firm behavior, most notably in Melitz (2003), based on firm heterogeneity in productivity and on the costs of exporting. One implication is that for firms exporting to a particular country a productivity threshold must be exceeded. Moreover, this productivity threshold affects extensive (i.e., number of firms) and intensive (i.e., average exports per firm) trade margins. Interest in these margins, especially in the context of trade liberalization, is growing rapidly.[2] In this paper, I generate results concerning the determinants of these margins using firm data aggregated to the level of individual states.[3] Such results about the geography of trade are essential for understanding trade flows at the state level and can be useful for assessing related policies, such as the Obama Administration's "National Export Initiative," which has a goal of doubling U.S. exports over a five-year period beginning in 2010.[4]

The extensive margin exists because a firm, if it is to be an exporter, must export at adequate quantities and at prices above variable costs to cover its fixed costs of exporting.[5]

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[1] Bernard, Jensen, Redding, and Schott (2007) stated that only four percent of the 5.5 million firms in the United States in 2000 were exporters. Of this four percent, the top ten percent accounted for 96 percent of U.S. exports. Even restricting the focus to those industries that are more involved in producing tradable goods, such as manufacturing, mining, and agriculture, only 15 percent of U.S. firms were exporters. A similar finding for French producers can be found in Eaton, Kortum, and Kramarz (2004).

[2] Recent papers include Lawless (2010), Persson (2010), Buono and Lalanne (2010), Markusen (2010), Kehoe and Ruhl (2009), and Berthou and Fontagné (2008).

[3] We lack individual firm-level data but rather have firm-level data aggregated to the state level.

[4] See Cassey (2011) for a summary of the state export literature.

[5] These variable costs include all variable costs associated with exporting as well as production costs.

Thus, increases in either fixed or variable trade costs should reduce the number of exporters. Relative to the intensive margin, however, predictions concerning the impact of variable trade costs are ambiguous. For example, an increase in variable trade costs will reduce the quantity sold by firms exporting to a country, a change that can reduce total sales revenue and average sales per firm. At the same time, an increase in variable trade costs will cause some exporters to exit the market, which tends to increase average sales per firm remaining in the market. Thus, an increase in variable trade costs has an ambiguous effect on the intensive margin. Meanwhile, an increase in fixed trade costs should be associated with an increase in average sales per firm. The increase in fixed trade costs increases the sales necessary to make exporting profitable, so sales per firm should be related positively to fixed trade costs.

This paper examines the potential determinants of how many firms in a state export to a specific country and the average sales of those firms to that country. In addition to examining distance and foreign country (economic) size in explaining these trade margins, the impacts of many other factors are explored. Ultimately, this analysis provides insights as to the importance and operation of geographically-based frictions. I also explore whether U.S. foreign direct investment affects either trade margin.

This paper is complementary to recent papers by Hillberry and Hummels (2008) and Lawless (2010). The former paper examines firm-level trade flows within the United States, while I examine U.S. international trade flows at the state level. Hillberry and Hummels (2008) find that the number of unique establishment/destination pairs declines sharply for distances up to 200 miles, with little decline thereafter. They also find that the average value of a shipment declines with distance, but the decline over (ever-longer) short distances is minimal and then the declines becomes only slightly more pronounced over longer distances.

Meanwhile, similar to Lawless (2010), this paper examines the number of firms exporting to a particular country as a function of country size and distance. Lawless (2010) uses data for 2006 on U.S. exports to 156 countries. Following Eaton, Kortum, and Kramarz (2004), she decomposes exports to each country into the number of firms exporting (i.e., the extensive margin) and average export sales per firm (i.e., the intensive margin).[6] With respect to country size, she finds a positive, statistically significant effect on both margins, with the magnitude larger for the extensive margin. For distance, she finds a negative, statistically significant impact on both margins, with the (absolute) magnitude larger for the extensive margin. She also finds that most proxies for trade costs affect only the extensive margin.

Similar to Lawless (2010), I estimate basic and extended gravity models using data from 2006. Rather than estimate the model at the national level, I estimate separate regressions for each state and for each trade margin using foreign destination size and distance from state to destination plus other variables capturing trade costs. These other control variables include language, infrastructure variables, geographic variables, the ease of trading across borders, the destination's legal environment, and the existence of both formal and informal networks. This analysis decomposes the trade margins to the level of individual states and provides additional insights on Lawless' (2010) findings, especially whether trade costs have a systematic impact on the intensive margin for some states. In other words, her finding that trade costs have little effect on average exports per firm at the national level could hide the importance of trade costs for a subset of states.

[6] Lawless (2010) notes that alternative definitions of trade margins exist – see pages 1158-1159.

In addition to using state-by-state data rather than national data, I differ from Lawless (2010) by examining exports to more foreign destinations.[7] The preceding differences lead to estimation issues for analyzing the extensive margin because frequently no firms in a state export to a specific destination. Not surprisingly, smaller states tend to export to fewer destinations than larger states. As a result, the approach used by Lawless (2010) ─ ordinary least squares with the natural log of the number of exporting firms as the dependent variable ─ is inappropriate for state-level data. Thus, estimation techniques suited for handling zeros and non-normal distributions of the dependent variable are used.

The use of state-by-state data allows one to examine the similarity of coefficients for a specific independent variable across states. In addition, the data allow for a single-equation estimation that allows us to focus on potential reasons for differences across states. I show the importance of state size and provide evidence concerning the roles of geography and state export promotion policy.

The remainder of the paper is arranged as follows. Section 2 presents the theoretical model underlying the empirical analysis. Section 3 describes the data used in the empirical analysis is described. Section 4 discusses the estimated models and the results. Section 5 completes the paper with a summary of the key contributions of the analysis.

2. Underlying Theoretical Model: Heterogeneous Firms and Trade Costs

The underlying model can be found in Lawless (2010), the origins of which can be found in Melitz (2003) and Chaney (2008). Only the key points are highlighted. Essential factors driving

[7] The number of observations actually used in the regression varies due to limitations on the country coverage of independent variables. The upper limit is 190; however, the sample size is smaller in most regressions.

the results are that firms differ in their productivity and, in order to export, must incur fixed as well as variable export costs.

Begin by assuming that in each geographic unit (e.g., states in the United States and countries in the rest of the world), firms produce a continuum of separate differentiated products. Moreover, consumers in foreign country j have the following utility function for goods k of the following form:

$$U_j = \left[\int x_j(k)^{\frac{\epsilon-1}{\epsilon}} dk \right]^{\frac{\epsilon}{\epsilon-1}} . \tag{1}$$

where ∈ is the elasticity of demand. The demand for good k in country j is simply:

$$x_j(k) = \frac{p_j(k)^{-\epsilon} Y_j}{P_j^{1-\epsilon}}, \tag{2}$$

where $p_j(k)$ is the price for good k in country j, Y_j is the level of real income in country j, and P_j is the Dixit-Stiglitz price level in country j.

Within each exporting state a continuum of separate differentiated products, each with unit mass, are produced. Each firm, using a Ricardian technology, produces one product at a cost-minimizing unit cost of c/a, where c depends on the exporting state's cost level and a is a firm-specific productivity parameter. This productivity parameter is a random variable drawn from a distribution $G(a)$ with a ranging from zero to infinity. Exporting firms incur fixed, F_j, as well as variable trade costs.[8] These variable trade costs are modeled as iceberg costs. As a result, τ_j units must be shipped for one unit to arrive at the foreign destination.

In light of the preceding assumptions, the profit-maximizing sales price in country j for a good generated by a firm with technology level a is:

$$p_j(a) = \frac{\epsilon}{\epsilon - 1} \frac{\tau_j c}{a}. \quad (3)$$

Profits and, therefore, sales will only occur in country j for firms exceeding the following productivity cutoff:

$$\bar{a}_j = \left(\frac{F_j}{\mu Y_j} \right)^{\frac{1}{\epsilon - 1}} \frac{\tau_j c}{P_j}, \quad (4)$$

where $\mu = (\epsilon - 1)^{\epsilon - 1} \epsilon^{-\epsilon}$. Not surprisingly, this minimum productivity level increases with higher trade and domestic cost levels and decreases with higher real income and price levels in the destination country.

[8] Lawless (2010) views the export-related costs associated with paperwork, marketing, and distribution chains as fixed costs, but also recognizes the some portion of these costs might be variable as they likely increase with the scale of exporting. Additional variable costs include transportation costs and import duties.

Next, equations for the intensive and extensive margins can be derived. Total exports from firm *i* to country *j* can be determined using the profit-maximizing price from equation (3) and demand from equation (2). After some manipulation, total exports, s_{ij}, are as follows:

(5) $$s_{ij} = \left(\frac{\in -1}{\in} \frac{P_j a_i}{\tau_j c} \right)^{\in -1} Y_j .$$

The preceding equation shows that a firm's export sales are affected positively by its productivity and the export country's income and negatively by its variable export costs. To obtain total export sales to country *j* from a specific state, one simply adds the export sales by all firms whose productivity exceeds the productivity threshold:

(6) $$S_j = \int_{\bar{a}_j}^{\infty} s_j(a) G(a).$$

By taking the derivative of equation (6) with respect to trade costs one finds two key ways that a state's total exports to a country are affected.

(7) $$\frac{\partial S_j}{\partial x} = \int_{\bar{a}_j}^{\infty} \frac{\partial s_j(a)}{\partial x} G(a)\, da - s_j(\bar{a}_j) G(\bar{a}_j) \frac{\partial \bar{a}_j}{\partial x}.$$

The first part of the expression on the right-hand-side of equation (7) captures the change in sales for firms already exporting (i.e., those already exceeding the productivity threshold) and the second part captures the change in the threshold. Note that a change in variable trade costs affects both parts of the expression. An increase in variable trade costs causes export sales to decline by reducing the sales of existing exporters and by increasing the productivity threshold. Meanwhile, an increase in fixed trade costs does not affect sales of existing exporters, but it may reduce sales by increasing the productivity threshold that might lead firms to cease exporting.

Total exports can be expressed as the product of the number of export firms and the average exports of these firms. The number of export firms, N_j, follows directly from equation for the productivity cut-off:

$$N_j = \int_{\overline{a}_j}^{\infty} G(a)\,da. \tag{8}$$

The change in the number of firms in response to a change in trade costs follows directly:

$$\frac{\partial N_j}{\partial x} = -G(\overline{a}_j)\frac{\partial \overline{a}_j}{\partial x}\ . \tag{9}$$

Equation (9) illustrates that an increase in trade costs leads to a decline in the number of exporters by increasing the productivity threshold.

The ratio of the equations for total exports (equation (6)) and number of exporters (equation (8)) yields average exports per firm. How average exports per firm are affected by trade costs can be expressed as follows:

$$\frac{\partial\left(\frac{S_j}{N_j}\right)}{\partial x} = \frac{\frac{\partial S_j}{\partial x} N_j - S_j \frac{\partial N_j}{\partial x}}{N_j^2} . \tag{10}$$

Fixed and variable trade costs can have different effects on average exports per firm. The intuition underlying the effect of an increase in fixed trade costs is straightforward. An increase in fixed trade costs increases the productivity threshold. The increase in the productivity threshold eliminates low-sales firms. Thus, the average sales of the remaining firms rise. An increase in variable trade costs has a similar effect on the productivity threshold and causes marginal firms to exit the market; however, an increase in variable trade costs has an additional effect that is not present with an increase in fixed trade costs. An increase in variable trade costs adversely affects the sales of firms remaining in the market. Thus, there are two opposing effects on average export sales per firm; the net effect of an increase in variable trade costs is ambiguous.

The implications of the preceding discussion can be summarized succinctly. The number of firms in a state exporting to a specific country should be related positively to the country's income and negatively to the fixed and variable trade costs associated with the country.

Definitive predictions with respect to average sales per firm are problematic.[9] While a decrease in variable trade costs tends to increase the sales of existing exporters, decreases in fixed as well as variable trade costs induce firms to begin exporting. The result is an ambiguous effect on average exports per firm.

Finally, Lawless (2010) also points out that the impact of an increase in income in the foreign market raises total exports to the country; however, the effect on average exports per firm is ambiguous. By inducing the entry of new firms, it is possible that average exports per firm may increase, decrease, or remain unchanged.

3. Data

The analysis in this paper is focused on two dependent variables ─ one for the extensive margin and one for the intensive margin ─ and their relationships with numerous independent variables. Given 50 states and 190 countries in the sample, the maximum number of unique observations for a variable is 9500. However, frequently the number of observations is less than 9500 because some variables are only available at the state or country level and some values for variables are withheld for confidentiality reasons. The variables, which pertain to 2006 unless otherwise indicated, are listed and defined in Table 1. Summary statistics for these variables are contained in Table 2. All data using dollars are denominated in 2005 U.S. dollars. In addition, to assist in the comparisons of results, the theoretical relationships discussed below as well as Lawless' (2010) results are summarized in Table 3.

[9] Lawless (2010) does point out that more specificity about the heterogeneity of productivity can yield precise predictions about the impact of variable trade costs.

For the dependent variables ─ the number of firms and their average export sales by country ─ the paper relies on the U.S. Census Bureau's *Profile of U.S. Exporting Companies*. Rather than the nation as a whole as the basic geographic unit, I use the number of firms in an individual state s exporting to a specific country c, $Firms_{s,c}$, and the average exports of those firms to a specific country, $Exportsperfirm_{s,c}$. This departure from Lawless (2010) has an implication because a firm with plants in different states could export to a given country from plants in different states. As a result, summing the number of exporters over all states will likely exceed the number of exporters at the national level.[10] The state focus also produces numerous state-country pairs (1646 in total) that have a value of zero. In addition, 2190 observations for total exports, $Exports_{s,c}$, and average exports, $Exportsperfirm_{s,c}$, are withheld for confidentiality reasons when only a small number of a state's firms export to a given country.

Turning to the independent variables, variables to capture market demand and trade costs in export destinations are used. Based on the theoretical model, recall that the impact of these variables on the number of firms is definitive, but the impact of these variables on average exports per firm is ambiguous.

Starting with demand, this paper uses the gross domestic product of the destination country for a state's exports, GDP_c, as a proxy for market size. A second variable possibly affecting the demand for exports of U.S. producers, not used in Lawless (2010), relates to U.S. foreign direct investment in the destination market, FDI_c. Through various demand, as well as cost, mechanisms, trade can be affected by the internal networks of multinational firms.[11]

[10] Also, a firm with plants in multiple states might export to different countries depending on the plant. If one were to sum exporters over all countries, then this sum would exceed the number of exporters at the national level.

[11] See Bernard, Jensen, Redding, and Schott (2010) for additional discussion of intra-firm trade and product contractibility.

Whether this foreign direct investment will affect trade flows measured at the state level and whether foreign direct investment is a complement (i.e., positive) or a substitute (i.e., negative) is uncertain on theoretical grounds. Moreover, this uncertainty also extends to the extensive margin as it is possible that increased foreign direct investment might be associated with a smaller number of exporting firms in a state.

All other independent variables can be thought of as proxies for trade costs. These proxies include measures associated primarily, but not exclusively, with geography (i.e., natural trade frictions) as well as those that result from government policies (i.e., unnatural or man-made trade frictions). Given that a gravity model provides the foundation for the analysis, I include a distance measure that is the distance from the largest city in an exporting state to the largest city in the importing country, $Distance_{s,c}$, based on data from the CEPII Research Center. Transportation costs should increase the farther the distance between a state and a country.

Another variable thought to affect trade costs, expressed as a 0/1 dummy, is whether the export destination uses English as an official language, $English_c$. If the destination country also uses English as an official language, trade costs should tend to be lower because of increased ease of communication with U.S. exporters. In addition to language, I examine the impact of two communication infrastructure variables. $Phones_c$ is the number of mobile cellular subscriptions per 100 people in country *c* and $Internet_c$ is the number of internet users per 100 people in country *c*. Higher values of both of these variables should make it easier to acquire information and transact business.

Two geographic variables thought to affect trade costs ─ population density, $Popdensity_c$, and area, $Landarea_c$ are examined. These variables might capture the internal geography of the export destination that affects the costs of serving the market. Countries with larger population densities or smaller geographic areas should tend to have lower trade costs because of lower distribution network and internal transportation costs.

Trade costs are also affected by government policies and actions. $TradeFreedom_c$ is an index that measures the extent to which trade goods are unaffected by tariffs and non-tariff barriers.[12] Higher values of this index correspond to less burdensome and costly trade impediments.[13]

In addition to tariffs and non-tariff barriers, governments can affect the costs of trading across borders through various administrative and bureaucratic measures. Three specific variables are examined.[14] First, there are documents that must be completed as part of processing imports at the port of entry. The number of required documents per imported shipment, $Tradedocuments_c$, includes the documents required by various entities, such as government ministries, custom authorities, port and container terminal authorities, health and technical control agencies, and banks. Second, time is required to move a shipment from arrival through the port. This time, denoted by $Timeprocess_c$, is in terms of the number of calendar days. Third, there are fees associated with the process of crossing the border. $Tradefees_c$ are the official, administrative fees of importing, excluding tariffs and trade taxes. These fees encompass various costs, such as the costs for documents, administrative fees for customs clearance and technical control, customs brokers' fees, terminal handling charges, and costs for

[12] This index is a product of the Heritage Foundation and the Wall Street Journal. For details on the construction of this index, go to www.heritage.org/index/Trade-Freedom.

[13] A trade restrictiveness index is the preferred index from a theoretical perspective, but the trade freedom index is available for more countries. See Coughlin (2010) for an elementary discussion of trade restrictiveness indices.

[14] Each of these variables is generated by the World Bank's *Doing Business Survey*. See Djankov, Freund, and Pham (2010).

inland transportation. Larger values of each of these measures should be related positively to trade costs.

This paper also considers two measures of governance because stronger legal institutions might facilitate international trade. First, the rule of law, $Legal_c$, measures the confidence of agents in the legal system. Included in this measure is the quality of contract enforcement, property rights, the police, and the courts as well as the likelihood of crime and violence. A second measure, $CorruptionControl_c$, focuses on corruption. This measures the perceptions of agents about the extent to which public power is used for private gain and the effective capture of government by elites and private interests. For both measures, higher values indicate better governance and, thus, should reflect lower trade costs.

The final trade cost variable follows directly from the literature examining the effect of information networks on trade. At the state level, empirical analysis has frequently found a positive connection between a state's exports to a specific country and the state's number of residents born in that country.[15] Trade from a state to a country might be less costly the larger the number of residents in a state that were born in the destination country, $Foreignborn_{s,c}$.

4. Estimation and Results

As discussed previously, I estimated separate models of the extensive and intensive trade margins for each state.[16] Because the underlying distributions of the number of exporting firms

[15] See Bandyopadhyay, Coughlin, and Wall (2008) and Coughlin and Wall (2011). The latter paper finds evidence that ethnic networks are associated with increased trade on the intensive margin but not on the extensive margin.

[16] I also estimated models with total exports as the dependent variable. See the appendix.

per country and the exports per firm are much different, the appropriate estimation technique also differed. This section begins by discussing the extensive margin.

Estimation of the Extensive Margin

For the estimation of the extensive margin, this paper estimates models based on count data. Two standard models used in the estimation of count data are the Poisson model and the negative binomial model. In the present analysis, I do not estimate Poisson models; however, understanding the basics of the Poisson model is useful for the subsequent analysis.

In Figure 1 a representative histogram is shown. Along the horizontal axis, the number of firms in Arkansas exporting to each of 190 countries is shown. Along the vertical axis, the density of the number of firms is shown. In Arkansas, there are no exporting firms for 53 of the 190 countries. The general shape of the density function is consistent with a Poisson distribution as the density generally declining as one moves rightward along the horizontal axis. This general shape is also demonstrated by larger states; however, much less density is associated with the smallest numbers on the horizontal axis.

Assuming a Poisson distribution is appropriate for an outcome *Y* (e.g., the number of a state's firms that export to a specific country), the probability of observing any count, y, is:

$$\Pr(Y = y) = \frac{\lambda^{y} e^{-\lambda}}{y!} \qquad (11)$$

where λ is the population rate parameter. This population rate parameter is both the mean and the variance of the Poisson random variable *Y*.

In the present case, for a given state I am examining the number of the state's firms exporting to numerous countries c ($c=1...n$) and, if a Poisson distribution were appropriate, the explained variables Y_1, Y_2,...Y_n would have independent Poisson distributions with parameters λ_1, λ_2, ...λ_n. In a Poisson regression, the goal is to estimate how the Poisson distribution changes as a function of explanatory variables. The standard assumption is that the λ_c are log-linearly dependent on a set of explanatory variables. Thus,

$$\ln \lambda_c = \beta' x_j \qquad (12)$$

where β is a parameter vector to be estimated and x_j is a vector of observable characteristics (including a constant) that influences the number of firms exporting to a country.

However, as highlighted above, the Poisson model imposes the restriction that the dependent variable's mean and variance equal λ_c. Almost without exception, histograms, such as the one shown in Figure 1, as well as statistical tests indicate that the variance greatly exceeds the mean. Thus, rather than estimate a Poisson model, I estimate the following negative binomial model:

$$\ln \lambda_c = \beta' x_j + \varepsilon_j \qquad (13)$$

where ε_j is gamma distributed with mean 1.0 and variance alpha. This allows the variance to exceed the mean. One final point concerning my estimation is that the independent variables are generally expressed in natural logarithms, so the estimated coefficients are often elasticities.

Extensive Margin: Results

Three sets of results are presented.[17] The first set provides the results associated with a simple or benchmark gravity model that includes as independent variables only the gross domestic product of the importing country, GDP_c, and its distance from the exporting state, $Distance_{s,c}$.[18] The second set of results, based on an extended gravity model, incorporates explanatory variables that provide additional insights.[19] These first two sets of results are based on separate regressions for each state. This approach allows the parameter estimates for the independent variables to vary across states. A third set of results is generated by estimating one regression using all states. Controls are included to account for differences across states.

Simple Gravity Model – Estimates by State. The extensive-margin results for the simple gravity model are presented in Table 4. In summary, the results for the individual state regressions matched expectations. Using 190 observations for each state, the pseudo R^2 values ranged from .10 in Florida to 0.26 in Wyoming. The dispersion parameter, which provides a test of the negative binomial model versus a Poisson model, was statistically significant for 38 of the 50 states. The results for GDP_c and $Distance_{s,c}$ are consistent with expectations and with Lawless (2010). For each state, GDP_c is a positive, statistically significant determinant of the number of exporting firms, while $Distance_{s,c}$ is a negative, statistically significant determinant. The mean estimate for the coefficient on GDP_c is 0.75, with a range from 0.59 for Florida to 0.87 for New Hampshire. This mean estimate is slightly larger than Lawless' (2010) estimate of 0.65. Meanwhile, the mean estimate for the coefficient on $Distance_{s,c}$ is -1.20, with a range from -4.24

[17] All regressions were re-run with robust standard errors. Overall, the results were virtually unchanged.

[18] Because this estimation uses one export state, the effect of the state's gross product is captured in the constant.

[19] I have chosen to be highly selective in discussing results. Because groups of candidate explanatory variables are strongly correlated, the use of alternative variables produces very similar results in most cases.

for Hawaii to -0.54 for New Hampshire. This mean estimate is slightly larger in absolute value than Lawless' (2010) estimate of -1.06. Other relatively large (in absolute value) coefficients are estimated for Alaska (-2.27) and Florida (-1.99).

Extended Gravity Model – Estimates by State. Turning to the extensive-margin results listed in Table 5 for the extended gravity model, one sees a richer set of results. Once again, the results for the individual state regressions matched expectations and were consistent with Lawless' (2010) findings. Here the sample size was 137 because some independent variables were unavailable. The pseudo R^2 values ranged from 0.12 in Florida to 0.35 in Montana. The dispersion parameter was statistically significant in every state but Alaska.

The results for the independent variables are summarized in Table 6. For each state, identical to the results for the simple gravity model, GDP_c is a positive, statistically significant determinant of the number of exporting firms, while $Distance_{s,c}$ is a negative, statistically significant determinant. Relative to the coefficient estimates for the simple gravity model, the coefficient estimates tend to be absolutely smaller. The mean estimate for the coefficient on GDP_c is 0.46, with a range from 0.27 for Florida to 0.60 in New Mexico. Meanwhile, the mean estimate for the coefficient on $Distance_{s,c}$ is -0.81, with a range from -3.48 for Hawaii to -0.29 in New Hampshire.[20]

Turning to the additional independent variables, U.S. foreign direct investment in a destination country, FDI_c, is positively related to the number of state exporters. This variable, whose parameter estimates ranged from 0.08 for North Dakota and Virginia to 0.27 for

[20] For Lawless' (2010) preferred extended gravity model, the coefficient on GDP_c is 0.53 and on $Distance_{s,c}$ is -1.01.

Wyoming, with a mean of 0.17, was statistically significant for every state. This result suggests a complementarity between state exporters and U.S. foreign direct investment.

On the cost side, destinations in which English is an official language, $English_c$, seem to contribute to an increased number of state exporters. This finding is consistent with Lawless (2010). For 49 of 50 states the estimated parameter is positive, with statistical significance in 36 (i.e., 72 percent) of these 50 cases. Coefficient estimates for this variable ranges from -0.05 for Delaware to 0.79 in Montana, with a mean of 0.34.

Similar to Lawless (2010), an increased number of state exporters also tends to be associated with more developed communications infrastructure. The number of mobile cellular subscriptions per 100 people, *Phones*, is generally associated with more exporters. The mean estimate is 0.06. For 37 of 50 states the estimated parameter is positive; however, in only 16 was this relationship statistically significant. Meanwhile, of the 13 states with a negative estimate, only one was statistically significant.[21]

The results for a geographic variable, *Popdensity*, are similar to those in Lawless (2010) and similar to the results for the communications infrastructure. The mean coefficient estimate is 0.05. For 39 of 50 states the estimated parameter is positive, with 18 cases of statistical significance. Of the 11 states with a negative estimate, two were statistically significant.[22]

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[21] When included as a replacement for *Phones*, *Internet* produces similar, but weaker results.

[22] When replacing *Popdensity*, *Landarea* tends to have a negative impact, often statistically significant. Overall, however, *Popdensity* yields better results.

Finally, also similar to Lawless (2010), higher levels of official, administrative fees, *Tradefees*, decrease the number of state exporters.[23] All 50 states exhibit a negative sign, with 49 being statistically significant. The mean coefficient estimate is -0.52, ranging from -0.73 for Oregon and South Dakota to -0.22 for Texas.[24]

Estimates Using all State Data Simultaneously. In addition to estimating a separate regression for each state's extensive margin, I combined all the states and estimated a single regression. Thus, the coefficient estimates for the independent variables are assumed to be equal for all states. Two approaches are use to account for differences across states. One approach includes gross state product, $GSPA_s$, as an independent variable, while a second approach includes state fixed effects to capture differences across states. What explains the variation of the fixed-effects estimates across states is addressed at the end of this section.

The results of estimating the extensive margin using state-level data simultaneously for both the simple and extended gravity models are listed in Table 7. Column (1) lists the results for the simple gravity model using gross state product. Not surprisingly, larger states tend to have more exporting firms. In other words, gross state product is a positive, statistically significant determinant of the number of exporters. The rest of the results are also not surprising. Gross domestic product of the importing country, GDP_c, is a positive, statistically significant determinant of the number of exporters. The coefficient estimate, 0.74, is almost identical to the mean estimate when the states are estimated separately. The distance between the importing country and exporting state, $Distance_{s,c}$, is a negative, statistically significant determinant of the

[23] A similar conclusion pertains to related measures for the costs of trading across borders.

[24] Attempts to control for the legal environment in the destination country failed to produce results that were statistically significant. A similar comment applies to the possible impact of ethnic networks.

number of exporters. The coefficient estimate, -1.05, is somewhat smaller (in absolute terms) than the mean of the 50 states, -1.20.

Turning to the extended model, no surprising results appear in column (2) of Table 7. All variables exhibit their expected sign and are statistically significant. The coefficient estimates tend to be very close to the mean estimates of the 50 states. Relative to the results in column (1), the coefficient estimate for gross state product is virtually unchanged. Meanwhile, the (absolute) coefficient estimates for both gross domestic product and distance decline. The estimate for gross domestic product declines from 0.74 to 0.46, while the estimate for distance declines from -1.05 to -0.83.

The results in columns (3) and (4) show the effects of replacing gross state product with dummy variables for each of the states using Wyoming as the base. Note that the coefficient estimates and statistical significance are virtually identical when one compares the results in column (3) with column (1) and the results in column (4) with column (2).

The estimates for the coefficients for the state dummy variables are not reported, but are available upon request. A comparison of these results for the models in columns (3) and (4) are nearly identical as the simple correlation is virtually one. These estimates naturally lead to the question of what explains the difference across states. To answer this question, I ran regressions to see what state characteristics were driving the results. The independent variables used in these regressions are listed and defined in Table 8.[25]

[25] With one exception, each variable can be found using standard reference sources, such as the U.S. Census Bureau. The exception is *Trademission*, which was provided by Andrew Cassey in private correspondence.

I began by running a bivariate regression using gross state product as the independent variable to explain the fixed-effects estimates generated by the regression reported in column (4) of Table 7. The results are reported in column (1) of Table 9. Obviously, state size, $GSPA_s$, is a key determinant explaining over 60 percent of the variation. Next, I explored the effects of other potential determinants. A set of representative results are reported in column (2) of Table 9.

A number of measures attempting to capture the skill levels in a state were used. Neither of the two measures of educational attainment, $School1_s$ and $School2_s$, was found to be statistically significant. However, per capita gross state product, $GSPAPC_s$, was found to be a negative, statistically significant determinant. Thus, relative to other states, higher per capita levels of gross state product tend to be associated with fewer state exporters. Recall that the examination of exporters in this paper does not include exporters of services.

A number of geographically-based measures of state characteristics were also examined. The results showed that states with a coastline, $Coast_s$, did not have any favorable effect on the number of state exporters; however, states with either a land or water border with either Canada or Mexico were found to have an unfavorable effect on the number of exporters. This latter result is somewhat surprising in light of all the trade activity that flows through certain states, such as Texas. Finally, I found that states with higher levels of population density, $Popdensity_s$, tended to have more exporters.

Our last finding is that state foreign trade missions, $Trademission_s$, tended to have a positive effect on the number of exporters. Thus, state government actions appear to stimulate export involvement. However, this finding does not necessarily imply that such actions pass a cost-benefit test.

Estimation of the Intensive Margin

The estimation of the intensive margin uses an ordinary least squares model, similar to Lawless (2010).[26] For comparability with the results for the extensive margin, the same independent variables are examined using both simple and extended gravity-based models. In addition, a third set of results is generated by estimating the basic and extended models across all states, with either gross state product or state fixed effects to account for non-random variation across states.

Intensive Margin: Results

Similar to the preceding discussion of results for the intensive margin, three sets of results are presented. The first set provides the results associated with a simple gravity model that includes as independent variables only the gross domestic product of the importing country, GDP_c, and its distance from the exporting state, $Distance_{s,c}$. The second set of results, based on an extended gravity model, incorporates additional explanatory variables that provide further insights concerning average exports from a state to specific countries. The third set of results is generated by estimating one regression using all states.

Simple Gravity Model – Estimates by State. The results for the simple gravity model are listed in Table 10. Because the dependent variable is a state's average exports per firm to a country and a given state is unlikely to export to all states, the number of observations for these

[26] Based on Santos Silva and Tenreyro (2006), negative binomial models were also estimated. Relative to the reported results, few differences were found.

regressions varies substantially across states.[27] Even if exports occur, information for a specific state-country pair might not be available for confidentiality reasons. As a result, the sample size ranges from 19 in Wyoming, a small state, to 185 in California, a large state.

Turning to the results, the adjusted R^2 range is from 0.09 in North Dakota to 0.72 in Vermont. Generally speaking, the adjusted R^2 is, at least, 0.40. Only eight states have an adjusted R^2 less than 0.40. Recall that the discussion of the theoretical underpinnings of our estimation did not provide strong expectations concerning the signs of any of the independent variables. The results based on the simple gravity model indicate that GDP_c is positively related to a state's average exports. For each state the estimated sign is positive, with statistical significance in 49 cases. The estimated coefficient ranges from 0.21 in North Dakota to 0.71 in West Virginia. The mean estimate is 0.46, which is somewhat larger than the estimate of 0.29 produced by Lawless (2010) using national data.[28]

Meanwhile, the estimated sign for $Distance_{s,c}$ is generally negative (e.g., 46 of 50), but is statistically significant in only 29 of the 46 states. Generally speaking, these estimates fall between -1.00 and zero; however, Alaska exhibits an estimate of -2.11 and Hawaii shows an estimate of -1.74. Statistical significance was not found in any of the four cases of an estimated positive sign. The mean estimate is -0.41, which is (in absolute value) larger than the estimate of -0.26 produced by Lawless (2010). Part of the difference can be attributed to the estimates for Alaska and Hawaii, which assume a greater weight in the state calculations than they do in

[27] For the extended gravity model, the number of observation also varies because of missing values for some independent variables. Here the sample size ranges from 19 in Wyoming to 135 in California.

[28] See Table 3 in Lawless (2010).

Lawless (2010). Potentially, the use of state data should generate more accurate estimates because of more accurate measures of distance.[29]

Extended Gravity Model – Estimates by State. Turning to the results for the extended model presented in Table 11 and summarized in Table 12, the inclusion of more explanatory variables adds very little to understanding the intensive margin. The number of statistically significant results for GDP_c and $Distance_{s,c}$ declined relative to the simple model. For GDP_c, the number of statistically significant cases declined from 49 to 45, while the decline was from 29 to 26 for $Distance_{s,c}$. The mean estimates for the parameter estimates are close to those generated in Lawless (2010).[30] For example, the mean of the parameter estimates for GDP_c was 0.31, while the estimate in Lawless (2010) was 0.36. For $Distance_{s,c}$, the mean estimate of -0.35 was identical to the one in Lawless (2010). Note also that relative to the coefficient estimates for the simple gravity model, the coefficient estimates tend to be absolutely smaller.

None of the additional variables produces results that are consistently statistically significant. Only FDI_c and $Popdensity_c$ exhibit a consistently positive impact on average exports per firm, but *FDI* is statistically significant in roughly 69 percent (31 of 45) the cases and $Popdensity_c$ is statistically significant in roughly 41 percent (16 of 39) of the cases. Meanwhile, $English_c$, $Phones_c$, and $Tradefees_c$ are frequently negative, but rarely statistically significant.[31] Overall, the empirical results for these additional variables, with the exception of FDI_c, provide little help in understanding the intensive margin.

[29] Lawless (2010) assumes all exports move from Washington, D.C. to the foreign country, while we measure distance from individual states to countries.

[30] See Lawless (2010), Table 7.

[31] Lawless (2010) found statistical significance for *Phones*.

Estimates Using all State Data Simultaneously. The results of estimating the intensive margin using state-level data simultaneously for both the simple and extended gravity models are listed in Table 13. Column (1) lists the results for the simple gravity model that also controls for gross state product. In addition to finding that larger importing countries tend to have, from the perspective of a given state, larger exports per firm and that larger distances between the exporting state and importing country reduce exports per firm, the results show that larger states tend to have larger exports per firm than smaller states.

For the extended gravity model that also controls for gross state product, numerous additional variables were found to be statistically significant. This result is in stark contrast to the estimates generated by estimating each state separately. At the same time, the variables in the simple model – GDP_c, $Distance_{s,c}$, and $GSPA_s$ – remained statistically significant and, with the exception of GDP_c, the magnitudes of the coefficient estimates were relatively unchanged. The size of the coefficient estimate on GDP_c declined from 0.43 to 0.29. Turning to the results for the additional variables in the extended model, foreign direct investment was a positive, statistically significant determinant of exports per firm. A similar comment can be made for population density in the foreign country. Meanwhile, English as an official language, mobile phone subscriptions, and trade fees were each a negative, statistically significant determinant of the intensive margin using state-level data.

The results in columns (3) and (4) show the effects of replacing gross state product with dummy variables for each of the states using Wyoming as the base. Similar to the extensive margin results, the coefficient estimates and statistical significance are virtually identical when one compares the results in column (3) with column (1) and the results in column (4) with column (2).

Once again, the estimates for the coefficients for the state dummy variables are not reported, but are available upon request. A comparison of the estimated state fixed effects for the models in columns (3) and (4) are nearly identical as the simple correlation is virtually one. Next, regressions were run to see what state characteristics were driving the results. Recall that the independent variables used in these regressions are listed and defined in Table 8.

I began by running a bivariate regression using gross state product as the independent variable to explain the fixed-effects estimates generated by the regression reported in column (4) of Table 13. The results are reported in column (1) of Table 14. Obviously, state size, $GSPA_s$, is a key determinant explaining roughly 16 percent of the variation. Next, I explored the effects of other potential determinants. Representative results are reported in column (2) of Table 14.

First, two of the measures attempting to capture the skill levels were found to be statistically significant. Per capita gross state product, $GSPAPC_s$, was found to be a positive, statistically significant determinant. Thus, relative to other states, higher per capita levels of gross state product tend to be associated with increased exports per firm. Meanwhile, the fraction of a state's population 25 and older with a high school degree, $School1_s$ was a negative, statistically significant determinant, while the fraction with an undergraduate degree or more was not statistically significant. A number of geographically-based measures of state characteristics – $Border_s$, $Coast_s$, and $Popdensity_s$ - were also examined; however, none were found to be statistically significant. Finally, similar to the results for the extensive margin, state foreign trade missions, $Trademission_s$, was a positive, statistically significant determinant of exports per firm.

5. Discussion and Concluding Comments

My analysis addresses a topic of much interest in international trade, the potential determinants of extensive and intensive trade margins. Relying on a theoretically-based approach in Lawless (2010), I reinforce the importance of distinguishing between the two margins. Not surprisingly, the standard independent variables for gravity-based models, GDP_c and $Distance_{s,c}$, are key explanatory variables for both trade margins. Moreover, the extensive margin is relatively more responsive than the intensive margin to percentage changes in these variables. In addition, numerous other variables capturing other dimensions of trade costs, such as the importance of a common language, communications infrastructure, geography, and government regulations and documents, affect the extensive trade margin.

Similar to Lawless (2010), I find few consistent results for explaining the intensive trade margin in the state-by-state regressions. However, the single-equation estimation of the intensive trade margin did produce a number of results at odds with Lawless (2010). Specifically, I find three variables to be statistically significant determinants of the intensive margin. Both the official use of English and fees associated with crossing the border were found to have negative effects, while population density was found to have a positive effect.

A noteworthy contribution is that this paper extends understanding of the determinants of the extensive and intensive trade margins by highlighting the empirical importance of U.S. foreign direct investment. The number of exporters to a country and exports per firm at the state level to a country are related positively to U.S. foreign direct investment in that country. Thus, U.S. foreign direct investment is complementary to both trade margins at the state level.

This paper also extends empirical knowledge by using state-level trade data. Both the state-by-state regressions and the single-equation regressions produce new results. First, this research provides information on the diversity across states with respect to the impacts of the various independent variables on both trade margins. For virtually every independent variable, but especially for all variables other than the gross domestic product and distance, one observes large differences in both the parameter estimates and statistical significance across states.

Second, it provides information suggesting explanations for differences across states. Not surprisingly, state size is important for both trade margins. Meanwhile, for the extensive margin, differences across states can be attributed to per capita gross state product and sharing a border with Canada or Mexico, with both having a negative impact, and state population density and foreign trade missions, with both having a positive impact. For the intensive margin, differences across states can be attributed to achieving a high school diploma or more, which has a negative impact, and per capita gross state product and foreign trade mission, with both having a positive impact. Overall, our search for differences across states suggests that more research attention should be focused on trade missions and other forms of promotional activity.

The current paper has highlighted some key advantages of using state-level trade data to individual countries. Future research will illustrate another advantage. The use of state-country data also will allow us to examine individual countries separately. Thus, we can examine the determinants of the extensive and intensive trade margins for a specific country.

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Table 1

Variables for Trade Margin Regressions: Abbreviation and Definition

Name	Definition
$Firms_{s,c}$	number of firms in state *s* exporting to the country *c*
$Exports_{s,c}$	exports from state *s* to country *c*
$Exportsperfirm_{s,c}$	average exports per firm from state *s* to country *c*
$Distance_{s,c}$	distance (kilometers) from largest city in state *s* to largest city in country *c*
GSP_s	gross state product of state *s* ($thousands)
GDP_c	gross domestic product of country *c* ($m)
FDI_c	value ($m) of U.S. foreign direct investment in country *c*
$English_c$	if English is an official language of country *c*, then value is 1; otherwise 0
$Phones_c$	mobile cellular subscriptions per 100 people in country *c*
$Internet_c$	internet users per 100 people in country *c*
$Popdensity_c$	population per square kilometer in country *c*
$Landarea_c$	area in square kilometers in country *c*
$TradeFreedom_c$	index measuring the extent to which traded goods are unaffected by tariff and non-tariff barriers - higher values indicate lower barriers in country *c*
$Tradedocuments_c$	number of documents per a standardized shipment in country *c* required for import clearance by government ministries, customs authorities, terminal authorities, health and technical control agencies, and banks
$Timeprocess_c$	days to move a standardized shipment through country *c*'s port
$Tradefees_c$	official, administrative fees in dollars per imported container in country *c* including the costs for documents, administrative fees for customs clearance and technical control, customs brokers fees, terminal handling charges, and inland transportation - tariffs and trade taxes are excluded
$Legal_c$	measures the perceptions to which agents in country *c* have confidence in and follow rules/laws – higher percentile ranks indicate better governance
$CorruptionControl_c$	measures the perceptions that agents in country *c* have concerning the extent to which public power is exercised for public rather than private interests - higher percentile ranks indicate better governance
$Foreignborn_{s,c}$	number of foreign born by country *c* in a state *s*

Table 2

Summary Statistics

Name	Mean	Range* Minimum	Maximum
State-County Variables			
$Firms_{s,c}$	116.0	0 *(1646 pairs)*	16,505 *(California-Canada)*
$Exports_{s,c}$	113,233,436.9	0 *(3836 pairs)*	48,034,934,784 *(Texas-Mexico)*
$Exportsperfirm_{s,c}$	341,570.8	3,198.2 *(Nevada-St. Lucia)*	43,516,696 *(Louisiana-Syria)*
$Distance_{s,c}$	9,480.3	334.0 *(Michigan-Canada)*	19,497.3 *(Hawaii-Botswana)*
$Foreignborn_{s,c}$	8,011.4	0 *(56 pairs)*	3,928,701 *(California-Mexico)*
State Specific Variables			
GSP_s	251,851,864.7	22,925,322 *(Vermont)*	1,673,106,944 *(California)*
Country Specific Variables			
GDP_c	182,489.2	106.5 *(Kiribati)*	4,224,969.5 *(Japan)*
FDI_c	13,880.4	-16.5 *(Madagascar)*	393,540.4 *(United Kingdom)*
$English_c$**	Na	0	1
$Phones_c$	55.8	0 *(Myanmar)*	151 *(Luxembourg)*
$Internet_c$	22.5	0.2 *(Myanmar)*	87.6 *(Iceland)*
$Popdensity_c$	296.8	≈0 *(Greenland)*	17,727 *(Macao)*
$Landarea_c$	629,090.0	28 *(Macao)*	16,377,740 *(Russia)*
$TradeFreedom_c$	68.5	17 *(Bahamas)*	90 *(Hong Kong)*
$Tradedocuments_c$	10.0	2 *(Hong Kong & Kiribati)*	20 *(Rwanda)*
$Timeprocess_c$	34.8	3 *(Singapore)*	139 *(Uzbekistan)*

$Tradefees_c$	1,374.5	322.5 *(Singapore)*	4,421.0 *(Zimbabwe)*
$Legal_c$	48.3	0.5 *(Afghanistan)*	100 *(Iceland)*
$CorruptionControl_c$	49.1	0.5 *(Myanmar)*	100 *(Finland)*

** The geographic unit exhibiting the value is in parentheses*

*** English (dummy) : Of 190 countries, 57 (30 percent) use English as an official language while 133 do not*

Table 3

Comparison of Theoretical Predictions with Lawless' (2010) Results†

Independent Variable	Extensive Margin: *Firms*	Extensive Margin: Lawless	Intensive Margin: *Exportsperfirm*	Intensive Margin: Lawless
GDP_c	+	+ss	?	+ss
FDI_c	?		?	
$Distance_{s,c}$	-	-ss	?	-ss
$English_c$ *(1 for yes)*	+	+ss	?	-insig
$Phones_c$	+	+ss	?	-ss
$Internet_c$	+	+ss	?	-ss
$Popdensity_c$	+	+ss	?	-insig
$Landarea_c$	-	-ss	?	+insig
$TradeFreedom_c$	+		?	
$Tradedocuments_c$	-	-ss	?	+insig
$Timeprocess_c$	-	-ss	?	+insig
$Tradefees_c$	-	-ss	?	+insig
$Legal_c$	+		?	
$CorruptionControl_c$	+		?	
$Foreignborn_{s,c}$	+		?	

† The symbols for the theoretical predictions indicate an expected positive or negative relationship or one indicated by "?" that could be positive, negative, or zero. My interpretation of Lawless' overall results are indicated by the empirical sign and whether the relationship is statistically significant or not (i.e., insig). If the variable was not included in Lawless' study, then the result is left blank.

Table 4
Negative Binomial Coefficient Estimates: Simple Gravity Model for Extensive Margin

Independent Variable	State AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	ID
GDP	0.74***	0.79***	0.74***	0.78***	0.72***	0.76***	0.79***	0.77***	0.59***	0.66***	0.71***	0.68***
Distance	-1.20***	-2.27***	-0.75***	-0.99***	-1.03***	-0.76***	-0.71***	-0.78***	-1.99***	-1.06***	-4.24***	-1.17***
Constant	6.11***	12.77***	2.52**	3.05***	7.86***	2.28*	1.59	0.78	17.31***	7.00***	32.44***	5.47***
Dispersion	-0.28**	0.01	-0.57***	-0.25*	-0.22**	-0.48***	-0.25**	-0.16	0.01	-0.28***	0.09	-0.23
Pseudo R^2	0.17	0.25	0.19	0.18	0.12	0.18	0.16	0.18	0.10	0.13	0.23	0.18
Sample Size	190	190	190	190	190	190	190	190	190	190	190	190

Independent Variable	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS
GDP	0.77***	0.76***	0.72***	0.70***	0.80***	0.67***	0.70***	0.62***	0.80***	0.76***	0.73***	0.75***
Distance	-0.90***	-0.86***	-1.01***	-0.79***	-1.04***	-1.02***	-0.81***	-0.58***	-0.74***	-0.75***	-0.79***	-1.18***
Constant	4.87***	3.50***	4.49***	2.83***	4.16***	5.51***	1.95*	2.36***	2.51**	2.66**	3.37***	5.19***
Dispersion	-0.31***	-0.21*	-0.44***	-0.69***	-0.14	-0.27**	-0.53***	-0.60***	-0.35***	-0.19*	-0.40***	-0.30**
Pseudo R^2	0.14	0.16	0.18	0.19	0.16	0.15	0.22	0.16	0.16	0.16	0.16	0.18
Sample Size	190	190	190	190	190	190	190	190	190	190	190	190

Independent Variable	MO	MT	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR
GDP	0.78***	0.82***	0.74***	0.79***	0.87***	0.72***	0.73***	0.75***	0.76***	0.66***	0.78***	0.77***	0.71***
Distance	-1.03***	-1.45***	-0.81***	-1.16***	-0.54***	-0.91***	-0.94***	-0.80***	-0.93***	-0.97***	-0.90***	-0.78***	-1.11***
Constant	4.61***	5.27***	1.90*	4.67**	-1.52	5.42***	2.58*	4.64***	4.58***	3.14**	4.36***	1.87	6.10***
Dispersion	-0.20*	-0.20	-0.65***	-0.21	-0.23*	-0.28***	-0.44***	-0.31***	-0.27***	-0.68***	-0.25**	-0.38***	-0.19
Pseudo R^2	0.16	0.25	0.22	0.18	0.18	0.13	0.22	0.13	0.15	0.25	0.15	0.18	0.16
Sample Size	190	190	190	190	190	190	190	190	190	190	190	190	190

Independent Variable	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
GDP	0.76***	0.83***	0.75***	0.77***	0.75***	0.72***	0.75***	0.77***	0.66***	0.70***	0.86***	0.77***	0.82***
Distance	-0.89***	-0.74***	-0.96***	-1.09***	-1.03***	-0.78***	-0.83***	-0.58***	-0.66***	-1.13***	-0.57***	-1.10***	-0.81***
Constant	4.53***	0.20	4.34***	2.83*	5.04***	4.86***	2.67*	-1.12	2.92***	6.93***	-2.53**	5.91***	-1.13
Dispersion	-0.33***	0.06	-0.31***	-0.27	-0.21*	-0.54***	0.50***	-0.66***	-0.52***	-0.32***	-0.37**	-0.30***	-0.23
Pseudo R^2	0.15	0.17	0.16	0.23	0.15	0.14	0.19	0.23	0.15	0.16	0.23	0.15	0.26
Sample Size	190	190	190	190	190	190	190	190	190	190	190	190	190

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 5

Negative Binomial Coefficient Estimates: Extended Gravity Model for Extensive Margin

Independent Variable	State AL	AK	AZ	AR	CA	CO	CT	DE
GDP	0.47***	0.54***	0.55***	0.44***	0.50***	0.51***	0.45***	0.42***
Distance	-0.94***	-2.66***	-0.71***	-0.82***	-0.79***	-0.50***	-0.47***	-0.62***
FDI	0.13***	0.14*	0.10***	0.20***	0.13***	0.13***	0.19***	0.19***
English	0.49***	0.12	0.47***	0.30**	0.35***	0.45***	0.24*	-0.05
Phones	0.05	-0.06	0.10	0.05	0.13**	0.17**	0.19***	-0.03
Popdensity	0.09**	0.02	0.06	0.03	0.11***	0.04	0.13***	0.11**
Tradefees	-0.58***	-0.36	-0.31***	-0.65***	-0.48***	-0.44***	-0.46***	-0.66***
Constant	9.06***	20.86***	4.76***	7.79***	9.33***	3.81**	3.76**	5.99***
Dispersion	-1.09***	-0.24	-1.21***	-1.22***	-0.95***	-1.38***	-1.18***	-0.81***
Pseudo R^2	0.21	0.25	0.22	0.25	0.16	0.23	0.21	0.22
Sample Size	137	137	137	137	137	137	137	137

FL	GA	HI	ID	IL	IN	IA	KS	KY
0.27***	0.38***	0.47***	0.41***	0.46***	0.48***	0.43***	0.43***	0.41***
-1.70***	-0.75***	-3.48***	-1.05***	-0.56***	-0.62***	-0.70***	-0.61***	-0.67***
0.16***	0.15***	0.19***	0.16***	0.16***	0.16***	0.16***	0.16***	0.23***
0.39**	0.35***	0.50**	0.71***	0.21	0.37**	0.26**	0.36***	0.22
0.18**	0.10	0.04	0.01	0.16**	0.18**	0.05	0.01	0.08
-0.05	0.05	0.20***	0.02	0.07*	0.09**	0.02	0.01	0.02
-0.60***	-0.44***	-0.52**	-0.51***	-0.38***	-0.43***	-0.53***	-0.39***	-0.60***
20.54***	8.60***	28.95***	9.56***	5.68***	5.09***	7.07***	5.52***	7.19***
-0.45***	-1.10***	-0.75***	-1.40***	-0.98***	-0.89***	-1.29***	-1.52***	-0.92***
0.12	0.18	0.28	0.25	0.17	0.20	0.23	0.24	0.21
137	137	137	137	137	137	137	137	137

Table 5 Cont.

LA	ME	MD	MA	MI	MN	MS	MO	MT
0.31***	0.39***	0.48***	0.54***	0.50***	0.45***	0.45***	0.45***	0.42***
-0.75***	-0.61***	-0.42***	-0.43***	-0.58***	-0.50***	-1.00***	-0.78***	-1.25***
0.23***	0.20***	0.11***	0.13***	0.18***	0.16***	0.14***	0.19***	0.26***
0.23	0.58***	0.22*	0.24**	0.12	0.27**	0.30*	0.37**	0.79***
-0.07	-0.02	-0.10	0.22***	0.00	0.11*	0.06	0.04	0.13
-0.04	0.03	0.05	0.13***	0.07*	0.07*	0.03	0.04	-0.09**
-0.46***	-0.41***	-0.40***	-0.48***	-0.49***	-0.42***	-0.69***	-0.60***	-0.72***
9.01***	4.64***	4.54***	3.48**	5.80***	4.78***	10.14***	8.36***	10.69***
-0.82***	-1.72***	-1.29***	-1.26***	-0.82***	-1.25***	-0.98***	-0.96***	-1.71***
0.17	0.28	0.20	0.21	0.19	0.21	0.22	0.20	0.35
137	137	137	137	137	137	137	137	137

NE	NV	NH	NJ	NM	NY	NC	ND	OH
0.42***	0.44***	0.50***	0.46***	0.60***	0.55***	0.49***	0.55***	0.48***
-0.65***	-0.84***	-0.29***	-0.66***	-1.06	-0.55***	-0.72***	-1.00***	-0.61***
0.19***	0.20***	0.19***	0.15***	0.13***	0.09**	0.14***	0.08*	0.17***
0.39***	0.57***	0.34***	0.14	0.65***	0.31**	0.11	0.57***	0.18
-0.06	0.21**	0.23***	0.11	-0.15	0.17**	-0.02	-0.21**	0.13*
0.02	-0.02	0.06	0.10**	0.07	0.12**	0.10**	-0.02	0.06
-0.44***	-0.72***	-0.60***	-0.47***	-0.55***	-0.47***	-0.53***	-0.40***	-0.56***
9.01***	4.64***	4.54***	3.48**	5.80***	4.78***	10.14***	8.36***	7.01***
-0.82***	-1.72***	-1.29***	-1.26***	-0.82***	-1.25***	-0.98***	-0.96***	-1.03***
0.17	0.28	0.20	0.21	0.19	0.21	0.22	0.20	0.19
137	137	137	137	137	137	137	137	137

Table 5 Cont.

OK	OR	PA	RI	SC	SD	TN	TX
0.39***	0.48***	0.45***	0.40***	0.42***	0.48***	0.44***	0.38***
-0.45***	-0.85***	-0.56***	-0.62***	-0.72***	-1.00***	-0.75***	-0.50***
0.25***	0.18***	0.19***	0.25***	0.19***	0.15***	0.17***	0.22***
0.14	0.44***	0.22*	0.34**	0.08	0.46***	0.35**	0.05
-0.08	-0.04	0.11*	0.17*	0.03	0.11	0.08	0.01
-0.07*	-0.00	0.08**	0.13**	0.08*	-0.01	0.08*	-0.03
-0.55***	-0.73***	-0.47***	-0.72***	-0.53***	-0.73***	-0.52***	-0.22**
5.71***	9.95***	5.99***	5.58***	7.60***	8.75***	7.62***	5.98***
-1.32***	-1.18***	-1.15***	-0.92***	-1.04***	-1.31***	-0.94***	-1.08***
0.23	0.22	0.19	0.24	0.19	0.28	0.19	0.16
137	137	137	137	137	137	137	137

UT	VT	VA	WA	WV	WI	WY
0.52***	0.43***	0.49***	0.53***	0.54***	0.49***	0.39***
-0.68***	-0.49***	-0.49***	-0.86***	-0.40***	-0.72***	-0.95***
0.12***	0.17***	0.08**	0.11***	0.19***	0.14***	0.27***
0.55***	0.36***	0.08	0.68***	0.25	0.33***	0.65***
0.10	0.17**	0.03	0.07	-0.02	0.14**	-0.01
-0.00	0.04	0.07*	0.03	0.05	0.06	-0.02
-0.61***	-0.57***	-0.36***	-0.63***	-0.52***	-0.52***	-0.49**
6.58***	3.63***	4.68***	9.30***	1.54***	7.18***	6.22***
-1.50***	-2.09***	-1.06***	-1.19***	0.99***	-1.15***	-1.15***
0.24	0.31	0.18	0.21	0.26	0.20	0.31
137	137	137	137	137	137	137

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 6

Summary of Results: Extended Gravity Model for Extensive Margin

Independent	Sign		Statistical Significance	
Variables	Positive	Negative	Positive	Negative
GDP	50	0	50	0
FDI	50	0	50	0
Distance	0	50	0	50
English	49	1	36	0
Phones	37	13	16	1
Popdensity	39	11	18	2
Tradefees	0	50	0	49

Table 7

Single Equation Results for Extensive Margin

Independent Variable	Negative Binomial Coefficient Estimates (1)	(2)	(3)	(4)
GDP	0.74***	0.46***	0.74***	0.46***
Distance	-1.05***	-0.83***	-0.96***	-0.75***
FDI		0.16***		0.16***
English		0.36***		0.35***
Phones		0.08***		0.06***
Popdensity		0.05***		0.05***
Tradefees		-0.51***		-0.50***
GSPA	1.22***	1.21***		
Constant	-17.99***	-14.89***	1.17***	4.13***
Dispersion	-0.10***	-0.64***	-0.25***	-0.89***
Pseudo R^2	0.18	0.21	0.20	0.23
Sample Size	9500	6850	9500	6850
Fixed Effects	no	no	yes	yes

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 8

Variables for Fixed-Effect Regressions: Abbreviation and Definition

Name	Definition
$GSPA_s$	gross state product of state *s* ($)
$GSPAPC_s$	per capita gross state product of state *s* ($)
$School1_s$	percentage of state population 25 and older with a high school degree or more
$School2_s$	percentage of state population 25 and older with a bachelor's degree or more
$Coast_s$	states with a coastline equal 1, otherwise 0; coastal states border water or territorial seas, but not the Great Lakes
$Border_s$	states with a land or water border with Canada or Mexico equal 1, otherwise 0
$Popdensitys_s$	population per square kilometer in state *s*
$Trademission_s$	number of individual foreign trade missions from a state between 2000 and 2005

Table 9

Explaining Extensive Margin Fixed-Effects Estimates

Independent Variable	OLS Coefficient Estimates (1)	(2)
GSPA	0.004***	0.004***
GSPAPC		-0.026*
Border		-0.477***
Popdensitys		0.003**
Trademission		0.059**
Constant	1.971***	2.611***
Adjusted R^2	0.62	0.70
Sample Size	50	50

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 10
OLS Coefficient Estimates: Simple Gravity Model for Intensive Margin

Independent Variable	AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	ID
GDP	0.42***	0.49***	0.55***	0.50***	0.32***	0.52***	0.51***	0.53***	0.29***	0.33***	0.33***	0.53***
Distance	-0.73***	-2.11**	0.04	-0.18	-0.06	-0.37**	-0.19	0.02	-0.34***	-0.45***	-1.74**	-0.29
Constant	14.31***	26.05**	5.48***	8.07***	9.19***	8.89***	7.85***	5.71***	11.74***	12.75***	22.89***	8.19***
Adjusted R^2	0.39	0.44	0.54	0.60	0.50	0.64	0.65	0.40	0.50	0.52	0.23	0.47
Sample Size	110	32	137	82	185	137	123	71	172	153	34	84

Independent Variable	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS
GDP	0.41***	0.51***	0.50***	0.58***	0.62***	0.42***	0.51***	0.37***	0.44***	0.45***	0.42***	0.49***
Distance	-0.13	-0.53***	-0.38***	-0.46**	-0.59***	-0.97***	-0.09	-0.06	-0.17	-0.52***	-0.34**	-0.62***
Constant	8.88***	11.09***	10.14***	9.95***	10.34***	17.45***	6.32***	8.19***	8.54***	11.72***	10.32***	12.30***
Adjusted R^2	0.57	0.67	0.69	0.59	0.64	0.31	0.53	0.47	0.51	0.56	0.50	0.41
Sample Size	162	136	107	111	117	117	82	143	151	141	142	92

Independent Variable	MO	MT	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR
GDP	0.47***	0.58***	0.52***	0.54***	0.48***	0.32***	0.39***	0.35***	0.38***	0.21**	0.50***	0.39***	0.43***
Distance	-0.47***	0.33	-0.40**	-0.09	-0.21	-0.21*	-0.31	-0.45***	-0.62***	0.05	-0.50***	-0.03	-0.19
Constant	10.70***	1.43	9.71***	6.12***	7.75***	10.32***	9.54***	12.26***	13.55***	9.32***	11.00***	7.61***	8.93**
Adjusted R^2	0.57	0.44	0.52	0.56	0.56	0.42	0.35	0.47	0.45	0.09	0.66	0.37	0.36
Sample Size	119	48	96	88	98	163	62	172	146	54	149	113	118

Independent Variable	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
GDP	0.39***	0.41***	0.40***	0.53***	0.48***	0.32***	0.39***	0.62***	0.42***	0.51***	0.71***	0.45***	0.60
Distance	-0.61***	-0.49***	-0.29**	-0.09	-0.63***	-0.49***	-0.68***	-0.63***	-0.42***	-0.39	-0.11	-0.33***	-0.73
Constant	13.00***	10.91***	10.53***	6.07***	12.83***	13.98***	13.27***	9.46***	11.54***	10.16***	4.89***	10.09***	10.30
Adjusted R^2	0.57	0.40	0.54	0.54	0.51	0.41	0.42	0.72	0.56	0.57	0.62	0.65	0.10
Sample Size	161	88	126	60	121	172	111	77	142	136	60	144	19

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 11

OLS Coefficient Estimates: Extended Gravity Model for Intensive Margin

Independent Variable	AL	AK	AZ	AR	CA	CO	CT	DE
GDP	0.21	0.53*	0.29***	0.57***	0.18***	0.34***	0.28***	0.35**
Distance	-0.66***	-2.51**	0.21	-0.18	0.01	-0.12	-0.15	-0.05
FDI	0.15*	-0.08	0.18***	-0.04	0.12***	0.15***	0.18***	0.22*
English	0.34	-0.32	-0.17	-0.08	-0.14	-0.01	-0.14	-0.24
Phones	0.06	0.28	-0.01	0.20	-0.13*	-0.06	-0.05	-0.12
Popdensity	0.15*	0.28*	0.12*	0.08	0.04	0.05	0.16***	0.16
Tradefees	-0.07	-0.02	0.02	0.22	-0.10	-0.02	-0.26	-0.08
Constant	14.62***	27.52**	5.00	4.87**	10.20***	7.66***	9.98***	6.96*
Adjusted R^2	0.45	0.44	0.57	0.65	0.60	0.69	0.71	0.44
Sample Size	90	31	108	70	135	107	100	62

FL	GA	HI	ID	IL	IN	IA	KS	KY
0.16***	0.12**	0.14	0.38***	0.37***	0.31***	0.42***	0.53***	0.36***
-0.33***	-0.36***	-1.77*	-0.24	-0.05	-0.45***	-0.28*	-0.43**	-0.45**
0.09***	0.12***	0.16	0.15	0.04	0.14***	0.04	0.04	0.20***
0.01	-0.13	-0.66	0.22	0.26*	-0.10	-0.05	0.32	-0.05
-0.10	-0.03	-0.09	-0.45**	-0.05	0.01	0.19*	-0.01	-0.05
-0.01	0.06	0.26*	0.23**	-0.08*	0.04	-0.01	-0.01	0.11
-0.06	-0.29**	-0.16	-0.62**	0.16	-0.12	-0.01	-0.22	-0.17
13.32***	15.24***	24.64***	13.38***	7.66***	12.21***	9.12***	11.57***	11.51***
0.49	0.62	0.24	0.58	0.64	0.70	0.67	0.60	0.70
127	121	31	71	122	107	89	93	96

Table 11 Cont.

LA	ME	MD	MA	MI	MN	MS	MO	MT
0.43***	0.46***	0.20***	0.19**	0.10	0.27***	0.30**	0.33**	0.32*
-1.02***	-0.16	-0.07	0.05	-0.32**	-0.16	-0.64***	-0.51***	0.37
0.04	0.06	0.19***	0.19***	0.24***	0.15***	0.19*	0.11*	0.34*
-0.23	0.13	0.09	-0.43**	-0.51***	0.08	-0.23	-0.25	-0.41
-0.70***	-0.16	-0.27***	-0.04	-0.06	-0.05	-0.39**	-0.20	-0.55*
0.07	0.21***	-0.01	0.14**	-0.06	0.07	0.12	0.06	0.13
-0.11	-0.03	0.13	0.15	-0.11	-0.00	-0.12	0.17	-0.60*
20.73***	6.90**	9.06***	6.59***	13.45***	9.35***	15.16***	11.33***	6.99
0.30	0.55	0.57	0.60	0.64	0.57	0.48	0.52	0.49
95	72	110	113	111	112	78	97	45

NE	NV	NH	NJ	NM	NY	NC	ND	OH
0.30***	0.34***	0.42***	0.23***	0.30*	0.25***	0.09	0.59***	0.42***
-0.29	0.22	-0.33*	-0.16	-0.14	-0.42**	-0.59***	-0.07	-0.45***
0.14*	0.24***	-0.00	0.09*	0.14	0.08*	0.17***	-0.33***	0.03
0.02	0.02	-0.09	-0.03	0.66**	0.07	-0.42**	0.46	-0.28*
-0.20	-0.01	0.26*	-0.11	-0.01	-0.13	-0.08	0.17	0.13
0.03	-0.04	0.11*	0.09*	0.09	0.11*	0.14***	-0.14	0.02
0.11	0.29	-0.28	0.37***	0.21	-0.09	-0.14	0.08	-0.15
10.26***	1.97	9.95***	7.75***	5.93	13.14***	16.21***	7.98**	11.57***
0.44	0.70	0.59	0.51	0.44	0.49	0.55	0.26	0.73
84	73	85	120	54	126	116	50	114

Table 11 Cont.

OK	OR	PA	RI	SC	SD	TN	TX	UT
0.18**	0.32***	0.27***	0.21*	0.24***	0.54***	0.46***	0.14**	0.25**
0.11	-0.08	-0.42***	-0.44**	-0.25*	-0.25	-0.59***	-0.44***	-0.93***
0.20***	0.17**	0.10***	0.15*	0.10*	0.03	0.02	0.16***	0.10
-0.14	-0.37	0.00	-0.14	-0.25	0.17	-0.28	-0.27	0.54**
-0.12	-0.53***	-0.02	-0.09	-0.11	0.28	-0.12	-0.33***	-0.24*
-0.12*	0.11	0.07	0.18**	0.06	0.14*	0.16***	-0.09*	0.09
0.33	-0.40*	-0.10	-0.05	-0.44***	-0.44*	-0.34*	-0.08	-0.32
5.91**	12.58***	12.44***	11.62***	14.67***	8.29***	14.88***	16.83***	19.15***
0.44	0.47	0.71	0.37	0.56	0.57	0.64	0.52	0.49
94	96	119	75	102	55	98	124	88

VT	VA	WA	WV	WI	WY
0.47***	0.42***	0.38***	0.37**	0.44***	-0.09
-0.54***	-0.62***	-0.36	-0.06	-0.34**	0.15
0.16**	-0.01	0.13**	0.31**	0.00	0.72
-0.29	-0.38**	-0.00	-0.24	-0.04	-1.04
-0.09	-0.11	-0.36***	-0.48**	-0.14	-0.97
0.06	0.14***	0.06	0.12	0.06	-0.26
-0.39*	-0.03	-0.47**	-0.26	0.01	-0.76
12.08***	13.52***	14.92***	9.15***	10.51***	15.00
0.73	0.63	0.59	0.62	0.63	-0.02
65	113	102	52	115	19

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 12

Summary of Results: Extended Gravity Model for Intensive Margin

Independent Variables	Sign: Positive	Sign: Negative	Statistical Significance: Positive	Statistical Significance: Negative
GDP	49	1	45	0
FDI	45	5	31	1
Distance	7	43	0	26
English	16	34	3	5
Phones	9	41	2	11
Popdensity	39	11	16	3
Tradefees	13	37	1	9

Table 13

Single Equation Results for Intensive Margin

Independent Variable	OLS Coefficient Estimates (1)	(2)	(3)	(4)
GDP	0.43***	0.29***	0.43***	0.30***
Distance	-0.37***	-0.34***	-0.37***	-0.34***
FDI		0.12***		0.11***
English		-0.08**		-0.06*
Phones		-0.14***		-0.14***
Popdensity		0.07***		0.07***
Tradefees		-0.08**		-0.08***
GSP	0.30***	0.30***		
Constant	4.79***	6.17***	9.18***	10.43***
Adjusted R^2	0.45	0.47	0.54	0.57
Sample Size	5664	4532	5664	4532
Fixed Effects	no	no	yes	yes

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table 14

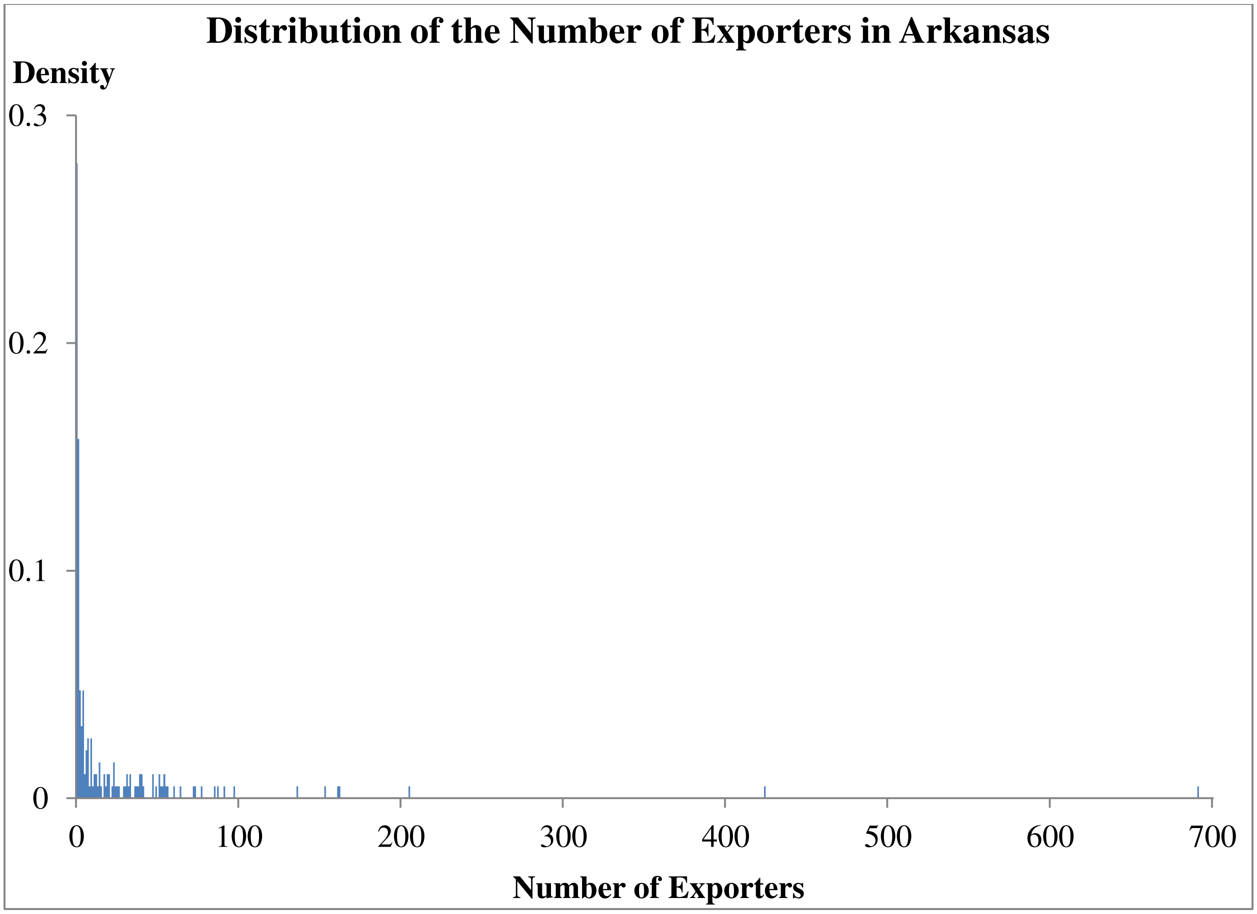
Explaining Intensive Margin Fixed-Effects Estimates

Independent Variable	OLS Coefficient Estimates (1)	(2)
GSPA	0.0008***	0.0005*
GSPAPC		0.0160*
School1		-0.0850***
Trademission		0.0525***
Constant	1.1050***	7.4952***
Adjusted R^2	0.16	0.39
Sample Size	50	50

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Figure 1

Representative Histogram



Appendix – Results for an Extended Gravity Model for Total Exports

The results of estimating the simple and extended gravity models for total exports are presented and discussed in this appendix. Prior results indicate that the determinants of the extensive and intensive margins differ. Frequently, however, researchers are unable to separate total exports into extensive and intensive margins, so the results in this appendix allow one to see the overall impacts of selected variables on total exports.

The results of estimating the simple gravity model are presented in Table A-1. The range of explanatory power ranges from a low of 0.22 for Wyoming to a high of 0.82 for Ohio. For 48 of the 50 states, the value of the adjusted R^2 exceeds 0.5. Similar to the results for both the extensive and intensive margins, the export destination's gross domestic product is a positive, statistically significant determinant of total exports.[32] The mean of these coefficient estimates is 1.06, close to Lawless' (2010) estimate of 0.94. Similar to the results for the extensive margin, but not as strong, distance is a negative, statistically significant determinant of total exports. The mean of these estimates for distance is -1.28, virtually identical to Lawless' (2010) estimate of -1.32. The key to the fact that the results are not quite as strong is due to the results for relationship between distance and the intensive margin. Recall that this relationship was generally negative (i.e., 46 of 50 states), but not always statistically significant (i.e., 29 of 46 states).

The results of estimating the extended gravity model are presented in Table A-2 and summarized in Table A-3. The range of explanatory power ranges from 0.27 in Wyoming to 0.89 in Ohio. The results for export destination's gross domestic product and distance change

[32] Note that, for comparable models, the sum of the elasticities for the intensive and extensive margins for a specific variable, such as gross domestic product, is not equal to the elasticity for the total exports regression. The reason is that the sample sizes differ for the intensive and extensive margins because of zeros and confidentiality reasons.

very little from the results for the simple model. The mean coefficients for these variables are 0.72 and -1.07, respectively. Similar to the results for the extensive margin, but not as strong, U.S. foreign direct investment is generally a positive, statistically significant determinant of total exports.

Not surprisingly, the results for the other variables tend to be somewhat mixed because of the differing results that these variables had on the extensive and intensive margins. The results for foreign direct investment illustrate this point. For 48 of 50 states, foreign direct investment was related positively to total exports. For the states with positive values, 40 states exhibited a statistically significant relationship, while for the states with negative values, one of the two states exhibited a statistically significant relationship. Recall that the impact of foreign direct investment on the extensive margin was always positive and statistically significant and was nearly always positive for the intensive margin, but statistically significant for 31 of 45 states.

Turning to the results for the remaining variables, the use of English as an official language was also related positively to total exports in most cases (i.e., 40 of 50 states), but this relationship was not generally statistically significant (i.e., 11 of 40 states). Meanwhile, the communications infrastructure as reflected by mobile phone subscriptions exhibited a negative impact on total exports more often than a positive impact (34 versus 16). This relationship was not generally statistically significant as only 1 of the 16 positive estimates and only 9 of the 34 negative estimates was statistically significant. Population density tended to show a positive relationship with total exports, but was statistically significant for only 18 of the 42 positive cases. Finally, for every state the costs to import variable was related negatively to total exports and was statistically significant for 30 cases.

Table A-1
OLS Coefficient Estimates: Simple Gravity Model for Total Exports

Independent Variable	AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	ID
GDP	1.00***	1.01***	1.23***	1.04***	1.04***	1.20***	1.18***	0.99***	0.84***	0.91***	0.80***	1.02***
Distance	-1.66***	-3.95**	-0.67**	-0.86***	-1.47***	-1.17***	-0.78***	-0.30	-2.28***	-1.52***	-4.61**	-1.30***
Constant	19.82***	38.74***	8.03***	11.19***	20.09***	12.29***	9.63***	6.18**	28.50***	20.55***	46.04***	14.52***
Adjusted R^2	0.63	0.65	0.76	0.77	0.76	0.78	0.79	0.55	0.69	0.74	0.51	0.62
Sample Size	110	32	137	82	185	137	123	71	172	153	34	84

Independent Variable	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS
GDP	1.12***	1.17***	1.07***	1.16***	1.27***	0.94***	1.03***	0.95***	1.17***	1.15***	1.05***	0.98***
Distance	-1.19***	-1.43***	-1.14***	-1.17***	-1.47***	-1.84***	-0.74***	-0.64***	-1.01***	-1.35***	-1.26**	-1.43***
Constant	15.47***	15.75***	14.07***	13.42***	14.59***	23.22***	8.89***	10.94***	12.42***	15.54***	15.83***	17.06***
Adjusted R^2	0.77	0.79	0.81	0.74	0.75	0.57	0.68	0.72	0.77	0.77	0.70	0.57
Sample Size	162	136	107	111	117	117	82	143	151	141	142	92

Independent Variable	MO	MT	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR
GDP	1.12***	1.07***	1.08***	1.13***	1.19***	1.02***	0.89***	1.05***	1.05***	0.65***	1.23***	1.00***	1.05***
Distance	-1.47***	-0.39	-1.04***	-0.89**	-0.64**	-1.20***	-1.00**	-1.35***	-1.55***	-0.63	-1.51***	-0.60**	-1.14**
Constant	16.48***	4.33	12.10***	9.82***	6.96***	16.27***	12.70***	17.87***	18.83***	12.78***	16.65***	9.32***	14.53**
Adjusted R^2	0.76	0.52	0.69	0.73	0.72	0.74	0.57	0.74	0.72	0.39	0.82	0.64	0.62
Sample Size	119	48	96	88	98	163	62	172	146	54	149	113	118

Independent Variable	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
GDP	1.11***	0.99***	1.01***	0.96***	1.12***	1.00***	1.01***	1.20***	1.02***	1.17***	1.25***	1.10***	1.00*
Distance	-1.54***	-0.91***	-1.06***	-0.68**	-1.56***	-1.33***	-1.36***	-1.26***	-1.08***	-1.38***	-0.29	-1.37***	-1.49
Constant	18.03***	11.17***	14.60***	8.81***	18.17***	19.63***	15.83***	10.92***	14.91***	16.13***	2.96	16.62***	14.19
Adjusted R^2	0.75	0.62	0.72	0.60	0.72	0.74	0.67	0.81	0.78	0.75	0.69	0.81	0.22
Sample Size	161	88	126	60	121	172	111	77	142	136	60	144	19

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table A-2
OLS Coefficient Estimates: Extended Gravity Model for Total Exports

Independent Variable	AL	AK	AZ	AR	CA	CO	CT	DE
GDP	0.56***	1.00**	0.82***	1.01***	0.69***	0.84***	0.78***	0.70***
Distance	-1.45***	-4.64**	-0.36	-0.91***	-0.91***	-0.59*	-0.62***	-0.51
FDI	0.31***	-0.03	0.26***	0.06	0.25***	0.26***	0.29***	0.31*
English	0.90**	-0.07	0.36	0.32	0.24	0.38	0.19	0.09
Phones	-0.01	-0.20	0.14	0.17	0.00	0.03	0.08	-0.23
Popdensity	0.22**	0.32	0.18*	0.08	0.17**	0.11	0.26***	0.24*
Tradefees	-0.66*	-0.42	-0.27	-0.38	-0.62***	-0.41	-0.78***	-0.48
Constant	24.03***	47.53**	8.40*	13.02***	20.70***	11.35***	14.46***	11.93**
Adjusted R^2	0.73	0.65	0.78	0.83	0.87	0.83	0.86	0.58
Sample Size	90	31	108	70	135	107	100	62

Independent Variable	FL	GA	HI	ID	IL	IN	IA	KS	KY
GDP	0.45***	0.48***	0.52*	0.74***	0.85***	0.74***	0.82****	0.96***	0.76***
Distance	-2.01***	-1.12***	-4.90***	-1.30**	-0.69***	-1.06***	-0.90***	-1.06***	-1.10***
FDI	0.23***	0.27***	0.23	0.26*	0.19***	0.30***	0.17**	0.16	0.39***
English	0.44	0.31	-0.61	0.93**	0.61***	0.24	0.31	0.79**	0.25
Phones	0.05	-0.05	0.03	-0.57**	0.04	0.10	0.19	-0.06	-0.06
Popdensity	-0.02	0.14**	0.42**	0.18	0.01	0.10	0.00	-0.00	0.11
Tradefees	-0.70***	-0.76***	-0.58	-1.07***	-0.31	-0.59**	-0.57**	-0.61**	-0.76**
Constant	33.71***	24.65***	52.11***	24.30***	14.67***	18.43***	16.49***	17.80***	19.21***
Adjusted R^2	0.73	0.86	0.51	0.72	0.85	0.85	0.84	0.79	0.83
Sample Size	127	121	31	71	122	107	89	93	96

Table A-2 Cont.

LA	ME	MD	MA	MI	MN	MS	MO	MT
0.65***	0.78***	0.61***	0.68***	0.59***	0.66***	0.65***	0.74***	0.61**
-1.68***	-0.66**	-0.47**	-0.36	-0.92***	-0.61**	-1.46***	-1.35***	-0.31
0.26*	0.23*	0.32***	0.32***	0.41***	0.31***	0.30**	0.28***	0.63***
0.09	0.64*	0.48*	-0.18	-0.17	0.29	0.22	0.17	0.09
-0.84***	-0.27	-0.45***	0.15	-0.10	0.06	-0.53**	-0.21	-0.70
0.04	0.23**	0.01	0.27***	-0.00	0.12	0.13	0.11	0.01
-0.60	-0.45	-0.34	-0.38*	-0.71***	-0.40	-0.63*	-0.51*	-1.16**
30.44***	12.23***	14.83***	10.81***	20.49***	14.21***	24.74***	21.44***	14.29**
0.55	0.74	0.81	0.85	0.83	0.81	0.65	0.78	0.64
95	72	110	113	111	112	78	97	45

NE	NV	NH	NJ	NM	NY	NC	ND	OH
066***	0.69***	0.89***	0.66***	0.76***	0.68***	0.51***	1.01***	0.87***
-0.92***	-0.34	-0.68***	-0.80***	-0.98**	-0.92***	-1.26***	-0.82**	-1.09***
0.31***	0.43***	0.15	0.25***	0.32**	0.25***	0.33***	-0.29*	0.21***
0.52	0.69**	0.34	0.14	1.13***	0.40	-0.26	0.99**	-0.11
-0.35*	-0.01	0.57***	-0.05	-0.28	-0.01	-0.17	-0.08	0.16
0.03	-0.09	0.17*	0.20**	0.15	0.24***	0.28***	-0.23*	0.11
-0.35	-0.06	-0.88***	-0.05	-0.33	-0.54**	-0.70***	-0.26	-0.78***
17.18***	7.20*	12.52***	14.97***	13.77***	19.30***	24.47***	15.51***	19.79***
0.72	0.86	0.81	0.81	0.73	0.82	0.81	0.49	0.89
84	73	85	120	54	126	116	50	114

Table A-2 Cont.

OK	OR	PA	RI	SC	SD	TN	TX	UT
0.58***	0.67***	0.73***	0.50***	0.59***	0.86***	0.92***	0.56**	0.71***
-0.37	-0.65	-0.98***	-0.81***	-0.86***	-1.02***	-1.36***	-0.99***	-1.55***
0.40***	0.38***	0.27***	0.37***	0.29***	0.15	0.13	0.34***	0.20**
0.25	0.05	0.31	0.36	-0.06	0.68	0.03	-0.16	1.22***
-0.27	-0.47**	0.02	-0.10	-0.23	0.12	-0.12	-0.40***	-0.22
-0.20**	0.08	0.14**	0.25**	0.12	0.13	0.24***	-0.14*	0.07
-0.15	-1.06***	-0.64***	-0.58*	-1.02***	-0.95***	-0.92***	-0.36	-0.88***
11.84***	20.41***	19.19***	16.19***	22.90***	16.90***	23.53***	23.92***	26.10***
0.72	0.76	0.88	0.69	0.79	0.66	0.80	0.81	0.76
94	96	119	75	102	55	98	124	88

VT	VA	WA	WV	WI	WY
0.79***	0.97***	0.89***	0.74***	0.85***	0.18
-0.98***	-1.18***	-1.21**	-0.24	-1.01***	-0.51
0.34***	0.02	0.24***	0.47***	0.18***	0.93
0.01	-0.12	-0.61*	0.16	0.33	-0.46
-0.00	-0.17	-0.32*	-0.79**	-0.14	-1.09
0.03	0.21***	0.08	0.14	0.13*	-0.34
-0.84***	-0.57**	-1.02***	-0.55	-0.56**	-1.49
16.19***	20.02***	23.79***	11.01***	18.87***	23.20
0.83	0.83	0.81	0.71	0.86	0.27
65	113	102	52	115	19

Note: Statistical significance: 1% level -- ***; 5% level -- **; 10% level -- *.

Table A-3

Summary of Results: Extended Gravity Model for Total Exports

Independent Variables	Sign: Positive	Sign: Negative	Statistical Significance: Positive	Statistical Significance: Negative
GDP	50	0	49	0
FDI	48	2	40	1
Distance	0	50	0	41
English	40	10	11	0
Phones	16	34	1	9
Popdensity	42	8	18	3
Tradefees	0	50	0	30