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State Trade Missions

By

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Abstract

From 1997–2006, U.S. state governors led more than five hundred trade missions to foreign countries. Trade missions are potentially a form of public investment in export promotion. I create a theory of public investment by introducing government to a Melitz (2003)-Chaney (2008) trade model. Controlling for state and country characteristics, the model predicts a positive relationship between missions and exports by destination. I create a data set on trade missions and match it with state export data, both with destination information. I estimate this relationship in the data, and reject the hypothesis that missions are to random destinations.

JEL classification: F12, F13, H76, L60, 024, R10

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1 Introduction

During the week of October 16, 2005, Tennessee Governor Phillip Bredesen (D) headed an official trip to Japan. In addition to the governor, the delegation included other public officials and more than 50 representatives of private firms. The stated goal of the mission was to "...[use] this experience to create new opportunities for Tennessee businesses and workers as we make our presentation to the international community" (*Bredesen to Conduct Asian Trade Mission* 2005).[1] This is not the first time a Tennessee governor traveled to Japan with the claim of state export promotion. During the ten year interval from 1997–2006, Gov. Bredesen and his predecessor Gov. Don Sundquist (R) undertook five trade missions to Japan (in 1998, 1999, 2000, 2003, and 2005). During that time, Japan was Tennessee's third largest export destination, behind Canada and Mexico.

Trade missions such as Tennessee's are a potential form of public investment to increase exports and enhance development. Unlike public investment, a large literature exists on private investment. Roberts and Tybout (1997) find evidence of significant fixed costs for firms to enter a foreign market. Rauch (1999) and Andersson (2007) find these fixed costs are market specific, and depend on the familiarity of the source country with the destination. Melitz (2003) uses these fixed costs in a theory of private investment where monopolistic competitors, differing in productivity, choose to pay the fixed cost and export, or not. Arkolakis (2008) constructs a model where firms must invest in advertisements to build market awareness of their products. Firms choose how much to advertise and whether or not to export to each country.

For many firms, the entry fixed cost is enough to prohibit exporting. Bernard and Jensen (1995) report only 10% of U.S. firms export to any destination. Eaton, Kortum, and Kramarz (2004) find, of the firms that do exports, many export to only a few countries. Thus there may be a role for government, interested in promoting exports, to reduce a market specific fixed cost to export, and increase the access of domestic firms to consumers they otherwise are unable to reach. This may be done directly by the government subsidizing individual firms or industries. Trade missions, however, are potentially able to decrease the entry cost for all firms in the state by increasing the

[1] `http://www.tennesseeanytime.org/governor/viewArticleContent.do?id=645` (accessed Nov. 6 2007).

familiarity of the target country.

Governor-led trade missions are one piece of the state export promotion repertoire. Other tools include trade offices, translators and professionals specializing in a specific region, and missions led by other officials such as commerce chairs. Unlike some of these other export promotion expenditures, governor-led trade missions are easily observable and cleanly measurable. I create a data set of every governor-led trade mission from each U.S. state by searching through local media reports during the ten year period from 1997–2006. Further, I know the target country of each trade mission. There is a high level of activity: more than five hundred such missions. Nearly twenty states go on at least one trade mission per year. Furthermore, as the example of Tennessee and Japan shows, many missions are repeat trips.

Besides the trade mission data, I obtain data on state exports to each country in the world. This is the only state export data with destination information available. Together with the trade mission data, I know both how much each state exports to each country and how much public investment there is in the target country in terms of governor-led trade missions.

I develop a model of the cross-sectional relationship between state exports and state trade missions, tying theory to the data. The model is an extension of the Melitz (2003) model of trade as modified by Chaney (2008). The Melitz model features monopolistic competitors, differing by productivity, that export by paying both a variable cost and a market specific entry cost. Because of this export fixed cost, only highly productive firms export. Chaney's extension allows for asymmetry across many countries.

I introduce a new agent, the state government, to Chaney's model. The state government is the only agent with access to a costly technology, trade missions, that decreases the effective fixed cost of exporting to the visited country for all firms in that state. I define and solve for an equilibrium where government chooses the optimal frequency of trade missions to each country. The model accounts for unobserved heterogeneity for individual states and individual countries. This controls for the possibility the governor of Tennessee may want to visit Japan because Japan is a large economy or because Japan is an interesting place to visit. The model predicts a strong relationship between trade missions and state exports for state-country pairs that have a relatively large export relationship. The economics is similar to that of a sales representative visiting existing customers to increase sales further.

From the derived structural equation relating trade missions to state exports, I estimate the export elasticity of missions using the trade mission and export data I collected. I compare the estimated export elasticity from the data to a null hypothesis where trade missions are trips to random destinations. Rejecting this random hypothesis is a necessary, but not sufficient, condition for trade missions to have a positive impact on exports.

As both the trade mission and state export data have source and destination information, I am able to control for individual state and individual country characteristics. I find there is a significant relationship between state exports and state missions. Governors travel to destinations with whom they have a large export relationship relative to other destinations. Thus I reject the random model. This finding holds up under several different regression specifications and estimators.

Previous literature on export promotion as potential public investment focuses on estimating the impact of a trade mission on exports using differences in panel data. Wilkinson, Keillor, and d'Amico (2005) find a positive impact on state expenditures promoting exports whereas Bernard and Jensen (2004) do not. Neither of these papers have destination information for exports or export promotion. They compare the difference in total state expenditure on export promotion against the difference in total state exports. Besides the limitation of not knowing which countries are targeted for export promotion, they do not have a particularly clean measure of state promotion expenditures.

Nitsch (2007) and Head and Ries (forthcoming) study the impact of national trade missions on national exports. They both use national export and trade mission data with destination information. They estimate the impact of trade missions led by country leaders on exports by differencing source-target pairs across time using panel data. Again there are conflicting results.[2] Cassey (2007) estimates the impact of a governor-led trade mission on state exports. Initial estimates indicate a significant increase in state exports from a state trade mission. However, accounting for the potential simultaneity bias in exports and missions, he is unable to reject the hypothesis that state

[2] Rose (2007) uses the location of embassies and national trade data to find if the presence of an embassy increases national exports. He finds an embassy increases exports by 6%–10%. Kehoe and Ruhl (2004) suggest the large relative increase in Wisconsin exports to Mexico after NAFTA compared to Minnesota is due to the presence of a Wisconsin trade office in Mexico.

trade missions do not have an impact on state exports to the visited country on average.

The conflicting results from the literature are due to features of the panel data they use. First, on the state level, the large amount of noise in the export data may overwhelm a reasonably sized effect in state exports from a trade mission; the imprecision of the estimates may hide a significant impact. Second, the timing of the treatment is difficult to pin down because missions occur frequently, as in the case of Tennessee and Japan. The lag time for its effects is unknown. Most importantly, the literature does not have an explicit theory for how missions affect exports. The potential endogeneity of missions and exports does not allow for a suitable exogenous treatment. Thus estimation of the average impact of a trade mission on exports to the visited country using panel data differences has not yielded a convincing estimate.

2 A Model of State Exports with Trade Missions

2.1 The Melitz-Chaney Model of International Trade

Consider the model described in Chaney (2008). This model features asymmetric countries differing in market specific entry costs. Chaney expands the model introduced by Melitz (2003) in which monopolistic competitors, differing in productivity, decide whether to export or not.[3] The model is cross-sectional and there is neither aggregate nor individual uncertainty.

There are J countries differing in endowments of the only resource, labor. The endowment is denoted as N_j for each country j. Labor is immobile across countries.

Consumers in all countries have identical preferences and may be aggregated into a single representative with a taste for variety:

$$U_j = x_j(0)^{1-\mu} \times \left(\int_{\Omega_j} x_j(\omega)^{\frac{\sigma-1}{\sigma}} \, d\omega \right)^{\frac{\sigma}{\sigma-1}\mu} \tag{1}$$

where x indicates the quantity consumed, ω is the particular variety, Ω_j is the set of available varieties in country j, $\mu \in (0,1)$ is the income share spent on the set of varieties, and $\sigma > 1$ is the elasticity of substitution between varieties. Varieties are assumed to be imperfect substitutes

[3]Helpman, Melitz, and Rubinstein (2008) describe a similar model.

for one another. Labor does not reduce utility. The representative consumer in different countries faces a different set of available goods, Ω_j.

Good 0 is produced by a constant returns to scale production function where one unit of labor makes w_j units of good 0, $q_j(0) = w_j(0)l_j(0)$. This good is traded competitively and freely throughout the world.

Besides production of good 0, in each country there are monopolistic competitors, each producing one particular variety ω. The measure of monopolistic competitors active in each country is L_j. This measure of active firms is exogenously given, but is proportional to the aggregate labor endowment N_j. No two potential competitors anywhere in the world produce the same good ω. Therefore knowing the variety ω pins down the country of production of ω. Labor is perfectly mobile across varieties and good 0 within each country.

Monopolistic competitors differ in the goods they produce as well as their productivity, ϕ. Across and within countries, active firms know their permanent productivity $\phi(\omega)$, which is the realization of a random variable Φ drawn from a Pareto distribution with support $[1, \infty)$ and parameter γ:

$$\Pr(\Phi \leq u) = H(u) = 1 - u^{-\gamma}. \tag{2}$$

Let $\gamma > 0$. The parameter γ indicates the heterogeneity of productivity: larger γ indicates firms are more similar since the mass of firms is more tightly packed. The Pareto distribution is a standard modeling choice because of its analytic simplicity.

Production by firm ω for sale in country j depends on the productivity of firm ω and the labor it uses to sell to j: $q_j(\phi(\omega)) = \phi(\omega)l_j(\phi(\omega))$.

Any of the varieties may be traded. There is a variable cost to trade given by τ_{ij}. If τ_{ij} units of a variety are shipped from i to j then one unit arrives (Samuelson 1954). Assume $\tau_{jj} = 1$ for all j, $\tau_{ij} > 1$ for all $i \neq j$, and the triangle inequality holds. The transportation cost need not be symmetric so it is possible $\tau_{ij} \neq \tau_{ji}$. There is also a fixed cost for firms in i who export to j given by $f_{ij} > 0$ for $i \neq j$ and $f_{jj} = 0$. Similar to τ_{ij}, assume the triangle inequality holds for f_{ij} and symmetry need not hold. The fixed cost is paid in units of labor by the exporting firm. These trade costs are identical for all firms in the same country; they do not depend on the productivity of firms.

The cost of delivering q units from i to j by a firm with productivity ϕ:

$$c_{ij}(\phi) = \begin{cases} \frac{w_i \tau_{ij}}{\phi} q_{ij}(\phi) + w_i f_{ij} & : \quad q_{ij}(\phi) > 0 \\ 0 & : \quad q_{ij}(\phi) = 0 \end{cases} \tag{3}$$

and profits:

$$\pi_{ij}(\phi) = p_{ij}(\phi) q_{ij}(\phi) - c_{ij}(\phi).$$

Because costs, production, and profits depend on productivity and not the particular good, one may switch between describing goods with ω, $\phi(\omega)$, or ϕ as convenience dictates. Therefore, $q_j(\omega) = q_j(\phi(\omega)) = q_{ij}(\phi)$, $l_j(\omega) = l_j(\phi(\omega)) = l_{ij}(\phi)$, $p_j(\omega) = p_j(\phi(\omega)) = p_{ij}(\phi)$, and $\pi_j(\omega) = \pi_j(\phi(\omega)) = \pi_{ij}(\phi)$. There is no need for a source subscript when the variety ω is known because each variety is uniquely produced in the world.

As in Chaney (2008), I only consider equilibria in which every country produces good 0 and the measure of monopolistic competitors is proportionally fixed based on the labor force of the country. Good 0 is set to be the world wide numeraire. Its price is fixed to one in every country. Given $p(0) = 1$ in every country, the labor productivity of producing good 0 in country j, w_j, is the wage in country j, justifying (3).

Because there is no free entry, monopolistic competitors may receive positive profits. The profits from all firms in country j, Π_j are redistributed to the consumer in country j. Thus the aggregate income of country j is $Y_j = w_j N_j + \Pi_j$. The only substantive difference with this model and the Chaney model is each country retains its own profits. I require each country to retain its own profits so state government has something to maximize with trade missions.

An equilibrium is the set of available goods in each country, $\{\Omega_j^*\}_{j=1}^J$ and the associated productivity thresholds for operating there, $\{\hat{\phi}_{ij}^*\}_{i=1}^J$; consumption in each country for all goods available there, $\{x_j^*(0)\}_{j=1}^J$ and $\{x_j^*(\omega) | \omega \in \Omega_j^*\}_{j=1}^J$; prices for each variety in each country that are produced at a positive level, $\{p_j^*(0)\}_{j=1}^J$ and $\{p_j^*(\omega) | \omega \in \Omega_j^*\}_{j=1}^J$; the wage in each country, $\{w_j^*\}_{j=1}^J$; aggregate profits in each country $\{\Pi_j^*\}_{j=1}^J$; and the production plans for each firm selling a positive amount in each country, $\{\left(q_j^*(0), l_j^*(0)\right)\}_{j=1}^J$ and $\{\left(q_j^*(\omega), l_j^*(\omega)\right) | \omega \in \Omega_j^*\}_{j=1}^J$; such that the following conditions hold.

- Good 0: $q_j^*(0) > 0$, $p^*(0)w_j(0) = w_j^*$, and $q_j^*(0) = w_j(0)l_j^*(0), \forall j$ and $\sum_{j=1}^J q_j^*(0) = \sum_{j=1}^J x_j^*(0)$.

- Given prices, labor endowment, wages, profits, and the set of available goods, the representative consumer in each country maximizes (1) by choosing $x^*(0)$ and $x^*(\omega)$ such that $p_j^*(0)x_j(0) + \int_{\Omega_j^*} p_j^*(\omega)x_j(\omega)d\omega \leq w_j^* N_j + \Pi_j^*$ and $x_j(0), x_j(\omega) \geq 0\ \forall \omega \in \Omega_j^*$.

- Given wages, transportation and fixed costs, and the demand function for its good in each country, each monopolistic competitor chooses $p_j^*(\omega)$ to maximize $\sum_{j=1}^J p_j(\omega)q_j^*(\omega) - c_j^*(\omega)$.

- Individual goods and labor clearing condition: $q_j^*(\omega) = x_j^*(\omega)$ and $q_j^*(\omega) = \phi(\omega)l_j^*(\omega), \forall j \forall \omega$.

- Country labor clearing condition: $\sum_{k=1}^J \big(l_k^*(0) + \int_{L_{jk}} (l_k^*(\omega) + f_{jk})\, d\omega\big) = N_j, \forall j$ where L_{jk} is the measure of country j firms exporting to k.

- Country profits condition: $\int_{L_j} \big(\sum_{k=1}^J \pi_k^*(\omega)\big) d\omega = \Pi_j^*, \forall j$.

- Ω_j^* determined by L_j and $\{\hat{\phi}_{ij}^*\}_{i=1}^J$ where $\hat{\phi}_{ij}^* = \sup_{\phi \geq 1}\{\pi_{ij}^*(\phi) = 0\}$.

With a continuum of varieties, the equilibrium is identical under either Bertrand competition or Cournot competition. Chaney (2008) proves the existence of this equilibrium for $\gamma > \sigma - 1 > 0$. Henceforth, all variables are assumed to be at their equilibrium values and thus the stars are dropped. Equilibrium properties include the following.

Firms from i selling in country j set the price $p_j\big(\phi(\omega)\big) = p_{ij}(\phi) = \frac{\sigma}{\sigma-1}\frac{w_i \tau_{ij}}{\phi}$. For some firms, their productivity is low enough that there does not exist a price such that $\pi_{ij}(\phi) \geq 0$. Therefore for each (i, j) there exists a threshold productivity, $\hat{\phi}_{ij}$ such that firms in i with $\phi < \hat{\phi}_{ij}$ choose not to export to j. Among other fundamentals and parameters, this threshold productivity depends on the fixed cost to export f_{ij}:

$$\hat{\phi}_{ij} = \left(\frac{\sigma}{\mu}\frac{\gamma}{\gamma - (\sigma - 1)}\right)^{\frac{1}{\gamma}} \times Y_j^{-\frac{1}{\gamma}} \left(\frac{w_i \tau_{ij}}{\theta_j}\right) \times (w_i f_{ij})^{\frac{1}{\sigma-1}}\,. \tag{4}$$

As f_{ij} increases, the threshold productivity is larger. Notice because $f_{ii} = 0$, all L_i firms produce domestically. Using (2), the measure of firms in i exporting to j is $L_{ij} = L_i\big(1 - H(\hat{\phi}_{ij})\big)$.

In (4), θ_j is the multilateral resistance term representing country j's remoteness from the rest of the world. The multilateral resistance term is defined in variable costs, fixed costs, and goods availability:

$$\theta_j = \sum_{i=1}^{J} L_i^{-\frac{1}{\gamma}} w_i \tau_{ij} \times (w_i f_{ij})^{\frac{a}{\gamma}}$$

where $a = \frac{\gamma}{\sigma - 1} - 1 > 0$. The multilateral resistance term takes into account how the firm heterogeneity parameter γ and the variable and fixed cost terms affect the measure of firms selling in country j, and thus the aggregate price level facing consumers in country j.

Interating the exports from those firms whose productivity is greater than $\hat{\phi_{ij}}$ obtains the equilibrium aggregate exports from i to j. This involves solving for $q_j(\omega(\phi)) = q_{ij}(\phi)$ using the fundamentals of L_i, w_i, f_{ij}, τ_{ij}, and $H(\phi)$:

$$\begin{aligned} \tilde{X}_{ij} &= L_i \int_{\hat{\phi}_{ij}}^{\infty} p_{ij}(\phi) q_{ij}(\phi) dH(\phi) \\ &= \mu L_i Y_j \left(\frac{\theta_j}{w_i \tau_{ij}} \right)^{\gamma} \times (w_i f_{ij})^{-a}. \end{aligned} \tag{5}$$

Aggregate exports from i to j increase in the measure of firms in i, the income in j, and the difficulty in j of receiving exports from all other countries, θ_j. Aggregate exports decrease in the transportation and fixed costs to export.

2.2 Adding Government

Departing from the Melitz-Chaney model, I introduce a new agent in each country called government, or alternatively the governor. The government is the sole agent with access to a technology that, for a cost, decreases the effective fixed cost to export for all firms located in that country. This technology is the trade missions the governor of i takes to j.

The effective fixed cost facing all potential exporters in i to j is η_{ij} and depends on the untreated fixed cost to export, f_{ij}, and the trade mission intensity, m_{ij}. For modeling purposes, m_{ij} is a real number indicating trade mission durations and quality otherwise missing from the model. The effective fixed cost:

$$\eta_{ij}(m_{ij}) = \frac{z^b f_{ij}}{(z + m_{ij})^b}.$$

If there are zero trade missions then $\eta_{ij} = f_{ij}$. The reduction in the effective fixed cost diminishes in trade mission intensity and has an elasticity of $-bm_{ij}/(z + m_{ij})$. Let $M_{ij} = z + m_{ij}$. Therefore b is the elasticity with respect to M_{ij}. The z parameter is a curvature parameter that may be thought of as the common mission intensity that has already occurred.

The cost associated with trade missions depends on the source i and the target j. The government in i has total trade mission expenditure of

$$G_i = d_i \sum_{j=1}^{J} g_j (M_{ij} - z).$$

The interpretation of d_i is the opportunity cost of the governor's time. The opportunity cost of time does not depend on the visited country. The g_j represents the cost of organizing each instant of a mission to j, which is common to all governments visiting j. There is no cost from traveling on zero missions.[4]

The government pays for the trade mission expenditure, G_i, with a proportional labor tax t_i.

Before proceeding, let me reinterpret the Melitz-Chaney model for U.S. states. Consider U.S. states as a subset of the countries in the model. Henceforth they are indexed by i as the source for both exports and missions. Destinations are countries, not other states. The country index is j.

The equilibrium with government is similar to the Melitz-Chaney equilibrium in section 2.1. The representative's budget changes to $(1 - t_i)w_i N_i + \Pi_i$ for states, but remains $Y_j = w_j N_j + \Pi_j$ for countries. The government in each state maximizes the income of the representative consumer by choosing a labor tax rate and trade mission intensity to all countries in the world.

Assumption 1. *The measure of potential exporters in state i, L_i, is exogenously fixed proportional to state size N_i.*

Assumption 1 simplifies the analysis by preventing a general equilibrium effect of trade missions on firm entry. In the Melitz (2003) model, the measure of domestic producers is endogenously determined as the result of a continuum of potential firms paying a fixed cost to learn their productivity

[4] Again, trade missions are investment in a costly technology for decreasing the fixed cost to all potential exporters. It is neither the case that trade missions pay the difference between f_{ij} and η_{ij}, or a fraction thereof, for each actual exporter, nor is it the case the target country receives income from expenditures on f_{ij}, η_{ij}, or M_{ij}.

and then deciding to domestically produce or not. Subsequently, domestic firms choose whether to export or not. With free entry, the expected firm profits, net of the cost to learn their productivity, is zero. Conditional on producing domestically, firm profits are nonnegative with some strictly positive. Melitz shows the measure of actual firms is proportional to domestic country size, N_j, thus justifying the assumption of a fixed measure of firms in section 2.1. With the introduction of government, the expected profits before knowing one's productivity are a function of trade missions. Thus more firms may choose to enter domestically than without government since they know government will lower the effective export fixed cost to some countries. Assumption 1 prevents this.

Assumption 2. *The multilateral resistance term θ_j does not depend on mission intensity.*

Assumption 2 keeps the definition of θ_j using f_{ij} rather than replacing it with η_{ij}. The implication is missions from state i do not open up country j to potential exporters from another state k. Together assumptions 1 and 2 appear strong. However they are approximately true in the limit as the benefit and cost of a trade mission go to zero. See appendix A for details.

The following lemma shows the equilibrium relationship between trade missions and state exports.

Lemma 1. *Equilibrium aggregate exports from i to j as a function of trade missions,*

$$\begin{aligned} X_{ij}(M_{ij}) &= \mu L_i Y_j \left(\frac{\theta_j}{w_i \tau_{ij}}\right)^{\gamma} (w_i f_{ij})^{-a} \times \left(\frac{1}{z} M_{ij}\right)^{ab} \\ &= \tilde{X}_{ij} \times \left(\frac{1}{z} M_{ij}\right)^{ab}, \end{aligned}$$

where $a = \frac{\gamma}{\sigma-1} - 1 > 0$ and $b, z > 0$, is increasing in M_{ij}.

This proof, as well as all others, is in appendix A.

Trade missions increase aggregate state i exports to j. The increase in state exports is due entirely to exports from firms whose productivity is not great enough to cover f_{ij}, but is great enough to pay η_{ij}. The exports from firms willing to pay f_{ij} do not change if instead these firms actually pay η_{ij}, though their profit increases. Therefore trade missions increase total state exports entirely through the extensive margin. Furthermore, M_{ij} does not impact X_{ik}; there is no diversionary impact of missions. Lemma 1 also says missions are more effective if firms are more homegenous (γ is large), but less effective if goods are more substitutable (σ is large).

Trade missions increase state exports. Lemma 2 says they increase state profit also.

Lemma 2. *State profit as a function of trade missions,*

$$\begin{aligned}\Pi_s\left(M_{i,1}, M_{i,2}, ..., M_{i,J}\right) &= \frac{\sigma-1}{\sigma\gamma}\sum_{j=1}^{J}\mu L_i Y_j\left(\frac{\theta_j}{w_i\tau_{ij}}\right)^{\gamma}(w_i f_{ij})^{-a}\times\left(\frac{1}{z}M_{ij}\right)^{ab} \\ &= \frac{\sigma-1}{\sigma\gamma}z^{-ab}\sum_{j=1}^{J}\tilde{X}_{ij}\times M_{ij}^{ab},\end{aligned}$$

is increasing in M_{ij}.

Trade missions increase state profits through their effect on exports, though the increase in profits is less than the increase in exports. The government faces a tradeoff: trade missions and increased state profit versus the expense of higher labor taxes reducing state disposable income. Given the strategies of consumers, firms, and other governments, a governor chooses t_i^* and $\{M_{ij}^*\}_{j=1}^{J}$ to solve

$$\max(1-t_i)w_i N_i + \Pi_i(M_{i1}, ..., M_{iJ}) \quad \text{such that} \quad t_i w_i N_i \geq G_i \quad \text{and} \quad t_i \geq 0, M_{ij} \geq z. \tag{6}$$

Theorem. *An equilibrium exists in which trade mission intensity from i to j is given by*

$$\begin{aligned}M_{ij} &= \max\left\{\frac{\gamma-(\sigma-1)}{\gamma}\frac{\mu}{\sigma d_i g_j}L_i Y_j\left(\frac{\theta_j}{w_i\tau_{ij}}\right)^{\gamma}(w_i f_{ij})^{-a}, z\right\} \\ &= \max\left\{\frac{\gamma-(\sigma-1)}{\gamma}\frac{1}{\sigma d_i g_j}\tilde{X}_{ij}, z\right\}\end{aligned}$$

In order for an equilibrium to exist, parameters must satisfy $0 < \frac{\gamma}{\sigma-1} - 1$ otherwise equilibrium prices are not well defined. The parameters must satsify $(\frac{\gamma}{\sigma-1} - 1)b < 1$ otherwise the marginal benefit of trade missions is greater than the marginal cost as missions tend to infinity; no optimal mission intensity exists. Using data from French firms, Eaton, Kortum, and Kramarz (2010) estimate $\frac{\gamma}{\sigma-1}$ to be 1.5.

The theorem says optimal mission intensity inversely depends on the state and country-specific mission costs, d_i and g_j, and the default difficulty in penetrating the foreign country, f_{ij}. Optimal mission intensity is increasing in the size of the foreign country, and the size of the state. These fundamentals are summarized by $\tilde{X}_{ij}$, the state exports in the absence of government action. Therefore the model predicts a positive relationship between untreated exports and missions.

This result is not obvious. One may have thought trade missions would be most effective if the target country was not a large export destination without government. Then government investment would open the country up for exports. On the contrary, optimal mission intensity is greater for targets where there is a large export relationship in the absence of government. The economics underlying this result are displayed in figure 1.

Figure 1 displays the pdf for the Pareto distribution (2). Consider the case of a target country with large threshold productivity, $\hat{\phi}_1$. It does not matter if this high threshold is due to small country size, which affects all states equally, or high transportation costs or high f, which affects the match between a state-country pair. Since $\hat{\phi}_1$ is large, there is a small mass of firms with productivity greater than $\hat{\phi}_1$. A trade mission reduces the effective fixed cost and the threshold productivity to $\hat{\phi}_2$. The additional aggregate exports accrue exclusively from the extensive margin: the exports of new exporters induced by the lower effective fixed cost. The extensive margin is the mass of firms between $\hat{\phi}_1$ and $\hat{\phi}_2$. There is no change in exports from those with productivity greater than $\hat{\phi}_1$ because in this model, the general equilibrium effects of θ are suppressed, and thus a decrease in the fixed cost does not affect exports for a firm with productivity above $\hat{\phi}_1$.

Now consider the impact of a mission to another country identical to the first except for a lower threshold productivity, $\hat{\phi}_3$. There is a much larger export relationship with this second country without government because there is a larger mass of firms to the right of $\hat{\phi}_3$ than $\hat{\phi}_1$. A mission to this country reduces the fixed cost and the threshold productivity to $\hat{\phi}_4$. Again the additional state exports are from the extensive margin, the mass of firms between $\hat{\phi}_3$ and $\hat{\phi}_4$. It is clear from figure 1 there is a far greater mass of new exports from a mission to the second country compared to the first. This effect is greater the larger is γ because this puts more mass in the left tail at the expense of the right tail. Though firms with productivity between $\hat{\phi}_1$ and $\hat{\phi}_2$ each export more than any firm with productivity between $\hat{\phi}_3$ and $\hat{\phi}_4$, the difference in aggregate is more than made

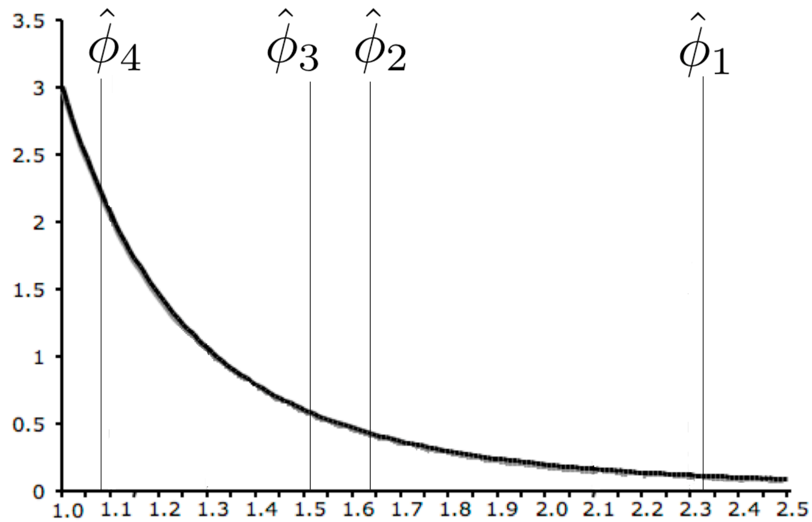

Figure 1. Economics of the theorem. The graph is the pdf for the Pareto distribution with $\gamma = 3$. The additional mass of new exporters from a mission decreasing the threshold productivity from $\hat{\phi}_1$ to $\hat{\phi}_2$ is less than the additional mass of new exporters from a mission decreasing the threshold productivity from $\hat{\phi}_3$ to $\hat{\phi}_4$.

up for by the mass of new exporters. Thus optimal missions target countries with a large export relationship without government.

2.3 A Reduced Form Equation

The theorem relates trade missions to $\tilde{X}_{ij}$, the aggregate exports in the absence of government. However there can be no data on $\tilde{X}_{ij}$ because most states do in fact travel on trade missions. Therefore $\tilde{X}_{ij}$ needs to be replaced with actual exports X_{ij} using lemma 1:

$$X_{ij} = \tilde{X}_{ij} \times \left(\frac{1}{z} M_{ij}\right)^{ab}. \tag{7}$$

To make this switch, revisit the government's problem, (6). By lemma 2, the government's problem becomes

$$\max_{M_{i,1},\ldots,M_{i,J}} \frac{\sigma - 1}{\sigma\gamma} z^{-ab} \sum_{j=1}^{J} \tilde{X}_{ij} M_{ij}^{ab} - d_i \sum_{j=1}^{J} g_j \left(M_{ij} - z\right).$$

Taking derivatives, taking logs, using the substitution (7), and solving yields

$$\log M_{ij} = \log \frac{\sigma - 1}{\sigma\gamma} ab + \log X_{ij} - \log d_i - \log g_j. \tag{8}$$

It is feasible to take the log of $\tilde{X}_{ij}$ because each country has a continuum of varieties and there is no real valued upper support on the productivity distribution. There is always a mass of exporting firms $L_{ij} = L_i\big(1 - H(\hat{\phi}_{ij})\big) > 0$ regardless of the size of $\hat{\phi}_{ij}$.

Equation (8) shows the relationship between bilateral state exports and bilateral state trade missions controlling for state and country characteristics, d_i and g_j. The reduced form equation (8) predicts the export elasticity of trade missions is one relative to each state-country pair. However this is with respect to M_{ij}.

The variation in the model comes from the bilateral trade costs τ_{ij} and f_{ij}. Since state and country characteristics are accounted for by d_i and g_j, the variation in X_{ij} is driven by the quality of state-country matches in τ_{ij} and f_{ij}. For reasons outside of the model, some state-country pairs have a good match, and thus there is a large export relationship and a strong motive for sending trade missions. Other state-country pairs are not a good match. The quality of the match may be thought of as the relative geography or the relative immigrant history of state-country pairs.

3 A Description of the Data

Equation (8) relates actual state exports to actual state trade missions (plus z) controlling for state and country characteristics. To see if the estimate for the export elasticity of missions is positive as it is in (8) requires state level data on trade missions and exports *by destination*. I compile the trade missions data by searching through local media sources from all states for 1997–2006. Appendix B contains the details of the trade mission collecting process. State export data comes from a data set compiled by the U.S. Bureau of the Census that is rarely used in the international trade literature. It is the Origin of Movement (OM) state export data available for purchase from the World Institute of Strategic Economic Research. Cassey (2009) provides the details for the collection of the OM data. The OM data are the only state export data with the destination information available.

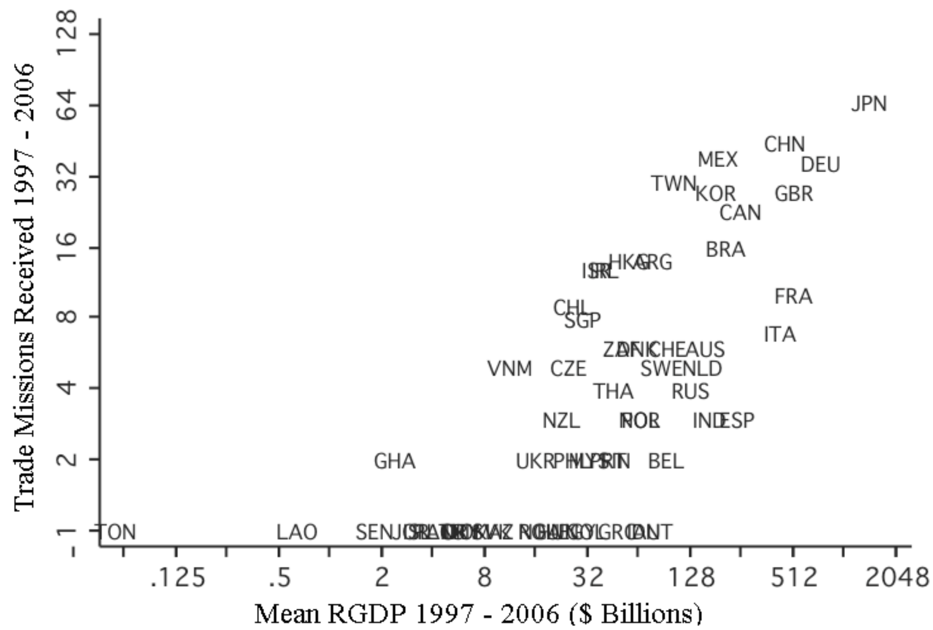

Figure 2. Country RGDP and state trade missions. Mean is the average of real GDP from 1997–2006. Point labels are the 3-letter ISO country code. Axes are log base 2 scale. Countries receiving zero missions are not included.

3.1 The State Trade Mission Data

During the ten years from 1997 through 2006, there are 512 governor-led U.S. state trade missions. This is roughly fifty-five trade missions per year. The most missions occurred in 1997 (81) followed by 1999 (70). The fewest missions occurred in 2001 (29). Each year around 20 states travel on at least one trade mission. I only consider trade missions to countries with 1997 GDP data available from the IMF. This reduces the number of missions to 503.

Out of 176 destinations with GDP data, 117 (66.48%) of these never host a trade mission during the ten year period. The average 1997 GDP of destinations that never host a trade mission is $12.52 billion whereas it is $713 billion for those that do host a trade mission. Thus there is a strong relationship between the size of a country and the number of missions it hosts. Figure 2 shows this relationship, where the size of a country is given by the mean of its real GDP over the 1997–2006 period.

The largest destinations not visited are Turkey ($186 billion GDP in 1997), Saudi Arabia ($165 billion), and Iran ($106 billion). The smallest destinations visited are Tonga ($0.18 billion), Laos ($1.76 billion), Senegal ($4.41 billion), and Ghana ($6.88 billion). There are 37 destinations to host a trade mission with GDP smaller than Turkey's.

Japan is the most frequent destination for governor-led trade missions. It is visited 67 times from 1997–2006. Other frequent destinations are China (45), Mexico (39), Germany (37), and Taiwan (31). Though Japan is the most frequent destination, China holds the record for most trips in a single year: 11 in 2005. Japan is next with ten in 2005. The most frequent state-country trip is Virginia to Germany which occurs five times over the ten years. Also, Tennessee to Japan and Oregon to Japan occurs five times.

Visited countries tend to be larger than non-visited countries, however visited countries grow less quickly. The correlation between 1997 GDP of the destination and the total number of trips there between 1997 and 2006 is 0.82. Compare this to 0.46 which is the correlation of 1997 GDP with total exports to the country, or 0.44 which is the correlation between 1997 GDP and the total number of states exporting to the country pooled across panels. The correlation between the total number of trips and the average GDP growth rate is -0.10. This is similar to the correlation of the number of exporting states with the average GDP growth rate.

Virginia took the most trips, visiting foreign destinations 31 times in ten years. Other states with a large number of trips are Wisconsin (30), Nebraska (23), and Ohio (21). The governors of Connecticut, Nevada, South Dakota, and Wyoming did not travel to any country on a trade mission. The average state has 10.08 trade missions from 1997–2006. The most missions per year is by Wisconsin. In 1997 the governor of Wisconsin, Tommy Thompson, went on 12 trade missions. The average number of trips per year is 2.4 for states with at least one trade mission during 1997 to 2006.

States with the most missions tend to be slightly larger in terms of their total value of manufacturing shipments (TVS), although, as seen in figure 3, the relationship between size and the number of missions is not strong. The correlation between the total number of trade missions taken by states during 1997–2006 and their 1997 TVS is 0.22. It is -0.26 between trips and TVS growth. The correlation between TVS and missions is much less than the correlation of TVS with either state exports (0.89) or the number of states exporting (0.78).

Figures 2 and 3 provide a nice overview of the state trade mission data and of which countries host missions and which states travel frequently. They are incapable of showing any relationship

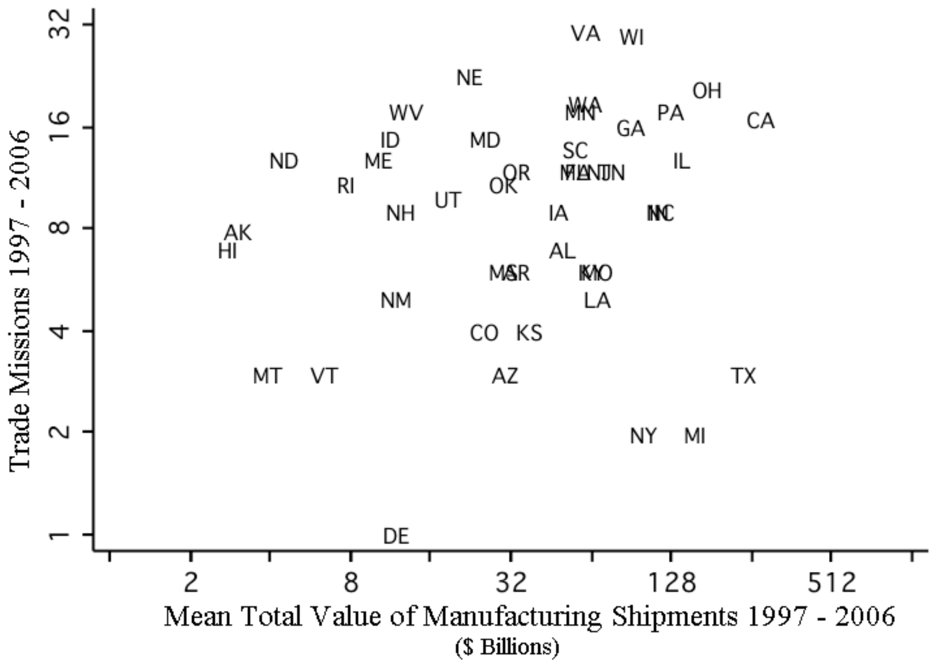

Figure 3. State total value of manufacturing shipments and state trade missions. Mean is the average of real TVS from 1997–2006. Axes are log base 2 scale. Connecticut, Nevada, South Dakota, and Wyoming are not included since they do not have any missions from 1997–2006.

between exports and missions as predicted by the theorem. Thus I introduce data on state exports by destination.

3.2 The State Export Data

U.S. state export data (OM) to 242 foreign destinations are available, though not well known to academic audiences. I use export data from all 50 U.S. states to the 176 countries with 1997 IMF GDP data, in correspondence with the trade mission data. The data are measured at the port of exit by compiling forms required of those exporting more than $2500 in a shipment. Cassey (2009) provides complete details of the OM data, including its collection.

The OM data are the only state export data with destination information. Because the data are collected before any shipments leave the U.S., the quality of the data does not depend on the destination country.

Another attractive feature of the OM data is, unlike other Census data sets, there is no Census suppression to protect individual exporter's identities. There is, however, a low-value threshold of

$2500. That is, there must be at least one shipment from state i to country j of at least $2500 to be included in the data. On a state scale, this low-value threshold is easily satisfied. However, nearly 20% of state-country observations are zero. Given no Census edits and the small low-value threshold, these zeros reflect “true” zeros.

I only use state export data from odd-numbered years during 1997–2006. Exports are deflated using the annualized Producer Price Index for *All industrial commodities less fuel.*[5]

Since the export data are collected at the port of exit rather than in the state of production, it is possible the OM data do not reflect state exports for two reasons. First, the OM data include inland freight costs which may overestimate exports from interior states. Second, the OM data may underestimate exports from interior states because exports consolidated at a port state are attributed to the port state. Ignoring the destination information, Cassey (2009) compares the OM data to a destination-less state export data set based on the Annual Survey of Manufactures. He finds on average the OM data measure state exports for manufacturing exports relatively accurately, albeit noisily. There is evidence of consolidation, however, for Florida and Texas. For this reason, I only use manufacturing state export data in the sections that follow. Agricultural and mining exports are removed from consideration because the OM state exports are not reliable for state of origin of production.

Combining the state trade mission and state export data yields one observation where there is a trade mission to a country with whom the traveling state does not export: in 2000 Vermont visited Laos. Laos is the only country included that does not have normal trade relations with the United States for much of the study period. Though arranged in 1997, Congress did not approve normal trade relations with Laos until 2004.

4 Comparing Model Predictions to Regression Estimates

The theory in section 2 yields a prediction of the export elasticity of missions as given in (8). The model's elasticity is one. I use the data described in section 3 to estimate the same elasticity in the

[5] *Source*: U.S. Bureau of Labor Statistics, `http://data.bls.gov/cgi-bin/surveymost?wp`. Accessed June 11, 2007.

data. The regression equation corresponding to (8):

$$\log M_{ij} = \beta_0 + \beta_1 \log X_{ij} + \delta_i + \zeta_j + \varepsilon_{ij}, \tag{9}$$

where δ_i is the coefficient on a state dummy and ζ_j is the coefficient on a country dummy. I assume ε_{ij} includes measurement error. The state and country dummies attempt to deal with any unobserved heterogeneity. Heteroskedasticty is present in the data.

The null hypothesis of trade mission travel to random countries is rejected if estimates for β_1 are significantly different from zero. The data must reject the random hypothesis in order for trade missions to have any hope as effective public investment in export promotion. A rejection of the null hypothesis indicates trade missions are traveling to countries that make economic sense based on the model. It does not mean there is a statistically significant impact of state trade missions on state exports.

Notice the image in figure 2 can be reproduced by the model. But figure 2 could also be produced with an alternative model in which governor's choose to visit destinations by throwing darts at a weighted map of the world. If these visits are just about politics, then governors would tend to visit locations with large economies (which will also be where the states tend to have large exports). Therefore it is crucial to difference out the unobservable individual characteristics that would attract a politically motivated governor to get at the underlying match between states and countries.

4.1 Estimation and Results

The model and corresponding regression equation may be thought of as in the long run and requiring cross-sectional estimation. However the data are longitudinal. To transform the panel data into a cross section, I treat every year as exactly the same. Thus I sum the number of missions from state i to country j over the ten year period from 1997 – 2006. I average real state manufacturing exports from i to j in odd-numbered years over the same period to use for actual exports, X_{ij}. The averaging over years eliminates most zeros in the export data. There are $176 \times 50 = 8800$ observations for trade mission intensity and state exports. Of these, 719 (8.2%) state-country pairs are never export partners during 1997–2006. Thus log-linearizing as in (9) loses nonrandom observations. This potentially introduces selection bias in estimates using the ordinary least squares estimator (OLS), though the the fact that only 8% are zero suggests this bias will be small if it exists.

The sets of state and country binary variables in (9) control for unobserved heterogeneity in individual state and individual country characteristics. Because the model and regression equation are a long run cross-section, the data is not differenced over time for each state-country pair. I deal with issues of causality and simultaneity bias using the state and country binary variables. Minimizing the simultaneity bias is crucial because finding an instrument is difficult as one may suspect from the scattered points in figure 3.

Since $M_{ij} = z + m_{ij}$, equation (9) is a nonlinear equation with numerous dummies. I estimate this in a two step procedure. First I estimate z holding the other coefficients fixed at one. Then I plug in the estimated value of z and use the OLS estimator to find an estimate of β_1 and the coefficient for each dummy variables.

Table 1 shows the OLS estimates for β_1. The first column is the estimate for β_1 when all 50 states and 176 countries are included. I weight observations by the mean RGDP of the destination country. This weight diminishes the noise from the many small countries making up a tiny portion of U.S. manufacturing exports. The standard errors are state-country adjusted. Notice the estimate on β_1 is significantly different from zero.

Because of the potential for bias by dropping only those observations with zero exports, I repeat the estimation by restricting the number of countries to the 50, 10, and 5 largest in terms of mean RGDP. All 50 states export to the top 10 countries.[6] The top 10 countries account for 63% of U.S. manufacturing exports.

In all cases, the estimated elasticity, β_1, is significantly different from zero. Given the state and country dummies, the significance of β_1 indicates governors travel to countries for which they have a relatively large export relationship compared to all other potential export partners. Because the sets of binary variables control for size, it is not the case that big states travel or big countries are

[6]The top countries ranked by mean RGDP are Japan, Germany, United Kingdom, France, China, Italy, Canada, Spain, Brazil, and Mexico.

Table 1. OLS Estimates of Export Elasticity of Missions using 50 States

	$\log(z + m_{ij}) = \beta_0 + \beta_1 \log X_{ij} + \delta_i + \delta_j + \varepsilon_{ij}$			
	10 countries	20 countries	50 countries	176 countries
z	0.0243	0.041	0.144	*0.144*
	(0.477)	(0.255)	(0.201)	–
β_1	0.411***	0.275***	0.102***	0.075***
	(0.1346)	(0.0788)	(0.0237)	(0.0147)
N	500	1000	2484	8081
$\hat{R}^2$	0.439	0.427	0.428	0.430

Notes: Observations are mean RGDP weighted. Standard errors are robust to state-country pairs. State and country dummy coefficients are estimated but not reported.

**** indicate significance at the 99% level.

targeted. Also, the binary variables control for behavior such as the opening up of a destination to all states uniformly.

Since $\beta_1 > 0$, I reject the random destinations hypothesis. However, the estimates are significantly different from one also. There are several reasons why the estimates may not be one even if trade missions are motivated by increasing state income.

First, a drawback of restricting data to manufactures is trade missions from primarily agrarian states presumably increase agricultural exports not manufacturing exports. Therefore in addition to the regressions with all 50 states, I estimate (9) without the 16 states with an agriculture and mining share of GDP above 10%.[7] Table 2 shows these estimates. The β_1 estimates increase somewhat, but so do the standard errors.

Similarly, I estimate β_1 without Florida and Texas, the two states Cassey (2009) finds evidence of manufacturing export consolidation. Removing Florida and Texas does not increase the estimates.

Another reason the OLS estimates on β_1 may not be one is, in the model, M_{ij} takes real values. In the data, M_{ij} is a count. Though I have data on the duration of each mission in days for 85% of trade missions, the trip duration includes travel time which depends on the location of the target country. Thus using days instead of the count of missions may bias estimates since mission to Asian countries are necessarily longer.

[7] The states in order of most agriculture and mining as a share of GDP are Alaska, Wyoming, North Dakota, New Mexico, Louisiana, Nevada, Texas, Oklahoma, West Virginia, South Dakota, Hawaii, Nebraska, Idaho, Colorado, and Kansas.

Table 2. OLS Estimates of Export Elasticity of Missions using top 34 Manufacturing States

	$\log(z + m_{ij}) = \beta_0 + \beta_1 \log X_{ij} + \delta_i + \delta_j + \varepsilon_{ij}$			
	10 countries	20 countries	50 countries	176 countries
z	0.077	0.331	0.366	*0.366*
	(0.251)	(0.230)	(0.192)	–
β_1	0.403^{**}	0.164^{**}	0.094^{**}	0.070^{*}
	(0.166)	(0.0683)	(0.044)	(0.0361)
N	250	1000	2484	8081
$\hat{R}^2$	0.425	0.424	0.422	0.425

Notes: Observations are mean RGDP weighted. Standard errors are robust to state-country pairs. State and country dummy coefficients are estimated but not reported.

***, **, * indicate significance at the 99%, 95%, and 90% levels respectively.

Table 3. PPML Estimates of Elasticity of Exports on Missions using all 50 states

	$z + m_{ij} = \exp(\beta_0 + \beta_1 \log X_{ij} + \delta_i + \delta_j)\ \hat{\varepsilon}_{ij}$			
	10 countries	20 countries	50 countries	176 countries
z	0.0243	0.041	0.144	*0.144*
	(0.477)	(0.255)	(0.201)	–
β_1	$.281^{***}$	0.265^{***}	0.193^{***}	0.182^{***}
	(.0996)	(0.0802)	(0.0557)	(0.0523)
N	500	1000	2484	8081

Notes: Observations are mean RGDP weighted. Standard errors are state-country adjusted. State and country dummy coefficients are estimates but not reported.

*, ** indicate significance at the 99% and 95% levels respectively.

Count data, such as the cumulative number of missions, commonly follows a Poisson distribution. Because of this, I estimate β_1 using a Poisson pseudo-maximum liklihood estimator (PPML). Besides handling the count data of the trade missions, Santos Silva and Tenreyro (2006) point out the PPML handles the extreme heteroskedasticity common in international trade data biasing OLS estimates on log-linearized data (as well as affect the standard errors). Table 3 contains the results from the PPML.

Similar to table 1, the PPML estimates of β_1 are significantly different from zero. The fact the estimate for β_1 obtained through the data is significant with the binary variables indicates there is some bilateral relationship between exports and missions beyond individual state and individual country characteristics. There is evidence states travel on trade missions to those countries with whom they have a relatively large export relationship. I reject the random hypothesis.

5 Conclusion

U.S. state governors frequently travel abroad on trade missions. The motive for these trade missions, however, is debatable. Proponents argue they increase state exports to the visited country and state income, and thus are a form of public investment in development. Detractors argue trade missions are a vacation for the governor at taxpayer expense. The panel data approach of resolving this debate by testing for a significant change in state exports before and after a governor-led trade mission yields conflicting results. In contrast I take a cross sectional approach testing for a weaker but necessary condition: whether governors travel to random destinations or whether they travel to destinations consistent with a model where trade missions matter for state exports.

I find evidence that trade missions are to destinations for which the state is exporting a relatively large amount compared to that state's other export relationships. My data allow me to control for the unobserved heterogeneity in individual state and country characteristics. Therefore my estimate is of the export elasticity of missions relative to the state-country pair. I reject the random destination hypothesis.

The model's predicted elasticity is part of the solution of a reduced form equation derived by adding a benevolent government to the heterogeneous firm monopolistic competition trade model of Melitz (2003) and Chaney (2008). I solve this extended model for the equilibrium frequency of trade missions to each country. I derive a relationship between trade missions and actual state exports. I create a new data set on governor-led trade missions from 1997–2006 containing the destination information and combine it with a little used data set of state exports, also with the destination information. Since I know the source state and target countries for both trade missions and exports, I control for individual state and individual country characteristics in a regression of the data.

This paper takes a step toward resolving the debate on whether public investment in targeted export promotion and customer acquisition leads to increased exports and development. It adds to the literature by focusing on one particular targeted export promotion policy—governor-led trade missions—that unlike previous work in which investment is private and inferred, is a measurable form of investment. I develop a theory of public investment commensurate with this public investment data.

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Appendices

A Proofs

Assumptions $\quad L_i(M_{ij}) = L_i \qquad Y_j(M_{ij}) = Y_j \qquad \theta_j(M_{ij}) = \theta_j.$

Justification. Suppose governor i may take at most one trade mission to country j. Further suppose the parameters and fundamentals, Y_j, w_i, and τ_{ij}, are such that this governor chooses to go on the mission. I show this decision will not change to zero missions when both the benefit and the cost of the mission go to zero,

$$\lim_{b \to 0} \tilde{X}_{ij} M_{ij}^b - \tilde{X}_{ij} = 0 \qquad \text{and} \qquad \lim_{d_i \to 0} d_i g_j (M_{ij} - 1) = 0.$$

The notation above matches that in the paper, yet should be viewed generally enough to hold in form when the assumptions do not hold. Let d_i and b converge to zero along the same sequence. Compare the rates of convergence. Use l'Hôpital's rule:

$$\lim_{z \to 0} \frac{\tilde{X}_{ij} M_{ij}^z - \tilde{X}_{ij}}{z g_j} = \lim_{z \to 0} \frac{\tilde{X}_{ij} M_{ij}^z \log M_{ij}}{g_j (M_{ij} - 1)} = \frac{\tilde{X}_{ij} \log M_{ij}}{g_j (M_{ij} - 1)} > 0.$$

Therefore near the limit, the convergence rate is equal. Since the governor chooses to go on a trade mission initially and the rate of convergence is constant in the limit, the governor does not want to change her mind at any point in the sequence.

Lemma 1. *Equilibrium aggregate exports from i to j as a function of trade missions,*

$$X_{ij}(M_{ij}) = \tilde{X}_{ij} \times M_{ij}^{ab},$$

where $a = \frac{\gamma}{\sigma - 1} - 1 > 0$ and $b > 0$, is increasing in M_{ij}.

Proof. From Chaney, aggregate state i exports to country j are given by (5),

$$\tilde{X_{ij}} = \mu L_i Y_j \left(\frac{\theta_j}{w_i \tau_{ij}}\right)^{\gamma} \times (w_i f_{ij})^{-a}.$$

Replace the untreated fixed cost to export f_{ij} with the effective fixed export cost η_{ij},

$$X_{ij} = \mu L_i Y_j \left(\frac{\theta_j}{w_i \tau_{ij}}\right)^{\gamma} \times (w_i \eta_{ij})^{-a}$$

which is legitimate due to the assumptions. Substitute in for η_{ij} using (2.2), $\eta_{ij} = \frac{f_{ij}}{M_{ij}^b}$. Positive first derivative shows state exports are increasing in missions:

$$\frac{dX_{ij}}{dM_{ij}} = ab\tilde{X}_{ij} M_{ij}^{ab-1} > 0$$

for $a, b > 0$ and $M_{ij} \geq 1$. Since there is no upper bound on the Pareto distribution, $\tilde{X}_{ij} > 0$; there is always a mass of firms with productivity greater than the threshold $\hat{\phi}_{ij}$. □

Lemma 2. *State profit as a function of trade missions,*

$$\Pi_s \left(M_{i,1}, M_{i,2}, ..., M_{i,J}\right) = \frac{\sigma - 1}{\sigma\gamma} \sum_{j=1}^{J} \tilde{X}_{ij} \times M_{ij}^{ab},$$

is increasing in M_{ij}.

Proof. By definition,

$$\Pi_i = \sum_{j=1}^{J} L_i \int_{\hat{\phi}_{ij}}^{\infty} \pi_{ij}(\phi) dH(\phi).$$

Plug in for $\hat{\phi}_{ij}$ and $\pi_{ij} = p_{ij}(\phi)q_{ij}(\phi) - c_{ij}(\phi)$ using the equilibrium values of $p_{ij}(\phi) = \frac{\sigma}{\sigma-1}\frac{w_i\tau_{ij}}{\phi}$ and, conditional on exporting at all, $q_{ij}(\phi) = \sigma \left(\frac{\sigma}{\mu}\frac{\gamma}{\gamma-(\sigma-1)}\right)^{-\frac{\sigma-1}{\gamma}} \left(\frac{w_i\tau_{ij}}{\theta_j}\right)^{1-\sigma} \phi^{\sigma-1} Y_j^{\frac{\sigma-1}{\gamma}}$. Given the distribution is Pareto, there is an analytic solution,

$$\Pi_i = \sum_{j=1}^{J} \frac{\sigma - 1}{\sigma\gamma} \mu L_i Y_j \left(\frac{\theta_j}{w_i \tau_{ij}}\right)^{\gamma} (w_i \eta_{ij})^{-\left(\frac{\gamma}{\sigma-1}-1\right)}.$$

Substitute in $\eta_{ij} = \frac{f_{ij}}{M_{ij}^b}$. □

Theorem. *An equilibrium exists in which trade mission intensity from* i *to* j *is given by*

$$M_{ij} = \left(\frac{\sigma-1}{\sigma\gamma}\frac{ab}{g_i g_j}\tilde{X}_{ij}\right)^{\frac{1}{1-ab}}$$

provided f_{ij} *or* d_i *and* g_j *are small enough so that* $M_{ij} \geq 1\ \forall i, j$ *and* $0 < ab < 1$.

Proof. The consumer and firms problems solved in Melitz (2003) and Chaney (2008). I show the government's problem and solution. Set up the Lagrangian from (6). Then the first order necessary condition:

$$ab\frac{\sigma-1}{\sigma\gamma}\tilde{X_i}jM_{ij}^{ab-1} - d_i g_j = 0.$$

The second order sufficient condition:

$$ab(ab-1)\frac{\sigma-1}{\sigma\gamma}\tilde{X}_{ij}M_{ij}^{ab-2} < 0.$$

In order for this to hold with $\gamma > \sigma - 1 > 0$ it must be that $ab - 1 < 0$. The problem is greatly simplified with the assumptions because then $\tilde{X_{ij}}$ is treated as a constant by the government. □

B Trade Mission Data Collection and Sources

Data on trade missions are obtained by the author through a Lexis-Nexis Academic search through local news sources. The search is state-by-state, covering the years 1997–2006. Keywords in the search are "governor," "trade," and "mission." For some states, the returns to this search were large and mainly irrelevant. Thus "governor," "export," and "mission" are used for some large states.

It is common for each trip to include multiple foreign destinations. Each country is counted as a separate trade mission. Furthermore both Hong Kong and Taiwan are counted as destinations separate from China. Also if the same destination is visited twice in the same calendar year then it is counted as two separate trips. The data do not include any visits of foreign delegates in the United States, any governor trips for reasons not explicitly stated as "trade missions," any trips in which the governor of the state is not present, or any trips that are organized by the Federal

Government. Finally there must be a local newspaper reference close to the data of departure for the trip count. Any reference such as "Unlike the governor of X, the governor of Y traveled to Japan in 1984" is not counted.

Additional information is the duration of each trade mission in days. These days include travel time, thus more remote destinations have longer durations than closer destinations even if the time in each host is the same. Travel time is included because news sources near unanimously report the time the governor is away from the state rather than the time in each host. Both the taxpayer cost of the trip and the number of delegates is reported infrequently and inconsistently and thus are not used.

The reason for using only governor-led trade missions is twofold. The governor is an important enough figure in local, if not national media, that the press makes a record of the trade mission. This allows me to compile a list of all trade missions using a standardized source, LexisNexis academic. Also, trade missions vary in importance. The governor provides a signal of the importance of the mission. As one trade mission participant said, "We will be viewed as serious people because our governor is supporting us..." (*Doyle Goes to China on Businesses' Dime*, Madison Capital Times, March 22, 2004). This is not necessarily the case with other public officials, such as Lt. Governors, commerce chairs, and others, who sometimes lead missions.

Trade missions do not directly cost the taxpayer much. Some of the trade mission observations include data on direct public expenditure on the trade mission. Typically the state pays for the governor and a few other officials, but private delegates pay for themselves. It is not rare for a growth promotion organization to sponsor public officials, thus no taxes are used. Out of 183 missions for which the public expense is reported in the media, 38 (20.76%) were fully paid for privately. The average total public outlay for trips using public money is $47,500. The most expensive trip recorded cost is $250,000 (North Carolina to China in 1998), a tiny fraction of any state's budget. The most significant cost is the time the governor is not in the state, an aspect I model. It is this opportunity cost that is most important in the trade mission debate. I model this explicitly. Though the costs of a trade mission are relatively small, the question of its effect is still important for guiding state policy and for settling a matter of public debate. If in fact trade missions do increase state exports, then their low cost is one of their most attractive characteristics.