Infrastructure and Export Performance in the Pacific Alliance

Appendices

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APPENDIX A: THEORETICAL SETUP

In foreign destination $-i$, the consumers' preference structure represented by a C.E.S utility function implies a total market demand for products produced locally and abroad:

$$Q^{-i}{}_{\omega,i,m,a} = p_{\omega,i,m,a}{}^{c,-i^{-\sigma_s}} R^{-i} \,. \tag{a.1}$$

where super-index $-i$ identifies the final destination market, while sub-index ω identifies a product's variety. Sub-index i identifies the country where variety ω is produced. Sub-index m identifies the municipality where variety is produced and sub-index α identifies the exit node that is used when exporting cargo ω to foreign destination $-i$. In the context of this study, sub-index may either be a port, an airport, or a customs facility.

Since $p_{\omega,i,m,a}{}^{c,-i}$ accounts for the price paid by consumers in market $-i$, $-\sigma_s$ -in equation (a.1) corresponds to the consumer's price elasticity of demand, with $\sigma_s > 1$. For general purposes, in our empirical setup we allow the estimates of σ_s to vary across the primary and manufactured products economic sectors.

As expressed in equation (a.2), the price paid by consumers in market $-i$ is equal to the sum of the price set by a foreign producer at factory gate $p_{\omega,i,m}$ and the shipping cost of exporting a unit of good ω, which is given by $w_\omega f_{\omega,i,m,a}{}^{-i}$. As such:

$$p_{\omega,i,m,a}{}^{c,-i} = p_{\omega,i,m} + w_\omega f_{\omega,i,m,a}{}^{-i} \tag{a.2}$$

Per-unit shipping cost is determined by multiplying the per-unit cargo weight w_ω and the product-specific cargo shipping price $f_{\omega,i,m,a}{}^{-i}$ that is set in units of cargo weight (US$ per pound or US$ per kilogram). In addition, R^{-i} in equation (1) corresponds to the consumers' real income as

$$R^{-i} = \frac{w^{-i} L^{-i}}{\bar{P}^{-i}} \,,$$

with w^{-i} being the wage, L^{-i} the market size, and $\bar{P}^{-i}$ the price index in foreign market $-i$.

Equations (1) and (2) imply that a producer's product export revenue

$$r^{-i}_{\omega,i,m,a} = p_{\omega,i,m,a}^{c-i} Q^{-i}_{\omega,i,m,a} = p_{\omega,i,m}^{1-\sigma_s} \left[1 + t_{\omega,i,m,a}^{-i}\right]^{-\sigma_s} R^{-i} \quad \text{(a.3)}$$

where $t_{\omega,i,m,a}^{-i}$ is a product-specific *ad valorem* transport cost that is given by the ratio of the total cost of shipping product ω from origin i, m through port a, to foreign destination $-i$ $-f_{\omega,i,m,a}^{-i}-$ to a product's price at factory gate $-p_{\omega,i,m}-$. In other words,

$$t_{\omega,i,m,a}^{-i} = \frac{f_{\omega,i,m,a}^{-i}}{p_{\omega,i,m}} \quad \text{(a.4)},$$

provided that the total shipment cost is equal to the cost of three routes: from the factory gate to local exit node $f_{\omega,i,m,a}$, from local exit node to foreign destination port $f_{\omega,i,a}^{-i}$, and from foreign destination port to foreign-local final destination $f_{\omega,d}^{-i}$. As such, it easy to realize that

$$f_{\omega,i,m,a}^{-i} = f_{\omega,i,m,a} + f_{\omega,i,a}^{-i} + f_{\omega,d}^{-i},$$

which implies that one can re-express an exporter's revenue—equation (a.3)—as:

$$r^{-i}_{\omega,i,m,a} = p_{\omega,i,m}^{1-\sigma_s} \left[1 + t_{\omega,i,m,a} + t_{\omega,i,a}^{-i} + t_{\omega,d}^{-i}\right]^{-\sigma_s} R^{-i} \quad \text{(a.5)}$$

with $t_{\omega,i,m,a} = \frac{w_\omega f_{i,m,a}}{p_{\omega,i,m}}, t_{\omega,i,a}^{-i} = \frac{w_\omega f_{i,a}^{-i}}{p_{\omega,i,m}}$ and $t_{\omega,d}^{-i} = \frac{w_\omega f_{\omega,d}^{-i}}{p_{\omega,i,m}}$.

By adding equation (a.5) across local exit nodes, one arrives at a municipality's total export revenue of product ω as being:

$$X_{\omega,i,m}^{-i} = \Sigma_a r_{\omega,i,m,a}^{-i}. \quad \text{(a.6)}$$

Similarly, by adding equation (a.6) across varieties , one obtains that a municipality's total export revenue is:

$$X_{i,m}^{-i} = \Sigma_\omega \Sigma_a r_{\omega,i,m,a}^{-i}. \quad \text{(a.7)}$$

By adding equation (a.7) across a country's municipalities m, one obtains that a country's total export revenue is:

$$X_i^{-i} = \Sigma_m \Sigma_\omega \Sigma_a r_{\omega,i,m,a}^{-i}. \quad \text{(a.8)}$$

APPENDIX B: ESTIMATION STRATEGY

Appendix B1. Estimation of Price Elasticity of Demand

As the derivation of the partial equilibrium trade model in Appendix A is completely valid for any period *t*, taking logarithm to equation (a.3) implies that at any time *t*, a municipality's logarithm of a product's export revenue is:

$$\tilde{r}^{-i}_{\omega,i,m,a} = (1-\sigma_s)\tilde{p}_{\omega,i,m,t} - \sigma_s \, ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i} + t_{\omega,d,t}{}^{-i}\right] + \tilde{R}^{-i}_t \qquad \text{(b1.1)}$$

with $\tilde{r}^{-i}{}_{\omega,i,m,a,t} = ln\, r^{-i}{}_{\omega,i,m,a,t}$, $\tilde{p}_{\omega,i,m,t} = ln\, p_{\omega,i,m,t}$, and $\tilde{R}^{-i}_t = ln\, R^{-i}_t$.

Provided that

$$ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i} + t_{\omega,d,t}{}^{-i}\right] \approx ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i}\right] + ln\left[t_{\omega,d,t}{}^{-i}\right],$$

one can re-express equation (b.1) as:

$$\tilde{r}^{-i}{}_{\omega,i,m,a,t} = (1-\sigma_s)\tilde{p}_{\omega,i,m,t} - \sigma_s \, ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i}\right] - \sigma_s \, ln\left[t_{\omega,d,t}{}^{-i}\right] + \tilde{R}^{-i}_t . \qquad \text{(b1.2)}$$

on the condition that $(1 - \sigma_s)\tilde{p}_{\omega,i,m,t}$ in equation (b1.2) can be proxied by a product C_ω, a municipality D_m, and a year fixed effect C_t, and given that $\sigma_s \, ln\left[t_{\omega,d,t}{}^{-i}\right] + \tilde{R}^{-i}_t$ corresponds to a country of destination-specific parameter that is also proxy, a product V_ω, a country D^{-i}, an exit node D_a, and a year fixed effect V_t. Thus, one obtains:

$$\tilde{r}^{-i}{}_{\omega,i,m,a,t} = -\sigma_s \, ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i}\right] + D_\omega + D_m + D_a + D^{-i} + D_t . \qquad \text{(b1.3)}$$

with $D_\omega = C_\omega + V_\omega$. Thus our estimation equation is:

$$\tilde{r}^{-i}{}_{\omega,i,m,a,t} = \beta_0 + \beta_1 \, ln\left[1 + t_{\omega,i,m,a,t} + t_{\omega,i,a,t}{}^{-i}\right] + \bar{\Lambda}'_\omega \bar{D}_\omega + \bar{\Lambda}'_m \bar{D}_m + \bar{\Lambda}'_a \bar{D}_a + \bar{\Lambda}'_{-i} \bar{D}^{-i} + \bar{\Lambda}'_t \bar{D}_t + \xi_{\omega,i,m,a,t} \qquad \text{(b1.4)}$$

where β_0 is the regression constant, $\hat{\beta}_1 = 1 - \sigma_s$, and $\bar{\Lambda}'_\omega, \bar{\Lambda}'_m, \bar{\Lambda}'_a, \bar{\Lambda}'_{-i}$ and $\bar{\Lambda}'_t$ are the set of coefficients linked to the product, municipality, exit node, country of destination, and year fixed effects. As derived, $\hat{\beta}_1$ constitutes

our key estimated parameter as it lets us infer the price elasticity of demand $-\sigma_s$, which is key to the quantification of the policy scenarios analyzed.

In connection with the constructed data, one should take into account that local transport cost $t_{\omega,i,m,a,t}$ and international transport cost $t_{\omega,i,a,t}{}^{-i}$ are given by

$$t_{\omega,i,m,a,t} = \frac{w_\omega f_{i,m,a,t}}{mc_{\omega,i,m,t}} = \frac{w_\omega Q_{\omega,i,m,a,t}{}^{-i} f_{i,m,a,t}}{p_{\omega,i,m,t} Q_{\omega,i,m,a,t}{}^{-i}}$$

and

$$t_{\omega,i,a,t}{}^{-i} = \frac{w_\omega Q_{\omega,i,m,a,t}{}^{-i} f_{i,a,t}{}^{-i}}{p_{\omega,i,m,t} Q_{\omega,i,m,a,t}{}^{-i}}.$$

Appendix B2. Estimation: Transport cost Elasticity of the Number of Exported Varieties

Transport costs may shape a region's export market participation throughout the export product scope. In this regard, we extended our results on a municipality's export performance by examining whether total transport costs also affect a municipality's export product scope. Provided $\tilde{N}^{-i}{}_{i,m,a,t}$ that corresponds to the logarithm of a municipality's product export scope to country $-i$, we proceeded to relate the number of exported products with the costs of cargo shipping by estimating the following reduced form equation:

$$\tilde{N}^{-i}{}_{i,m,a,t} = \alpha_0 + \alpha_1 ln\left[1 + \bar{t}_{i,m,a,t}{}^{-i}\right] \cdot \\ + \bar{\Lambda}'_m \bar{D}_m + \bar{\Lambda}'_a \bar{D}_a + \bar{\Lambda}'_{-i} \bar{D}^{-i} + \bar{\Lambda}'_t \bar{D}_t + \varepsilon_{i,m,a,t}. \qquad \text{(b2.1)}$$

where a municipality's product scope was counted at the 6- and 8-digit levels of the Harmonized System code. Our baseline specification in equation (b.2.1) included a set of municipality, exit node, destination, and year fixed effects— $\bar{D}_m, \bar{D}_a, \bar{D}_t$ and $\bar{D}^{-}$—that control for non-observable variables that have an effect on a municipality's export product scope. As reported in section D, $\hat{\alpha}_1$ is expected to be negative.

Appendix B3. Estimation: Probability of Entering into Exporting

The effect of regional transport costs on a municipality's probability of exporting was modeled using a linear probability model where

$$P\left(id\,exp^{-i}_{i,m,a,t} = 1 \middle| \bar{t}_{i,m,a,t}{}^{-i}\right) = \gamma_0 + \gamma_1 ln\left[1 + \bar{t}_{i,m,a,t}{}^{-i}\right] \\ + \bar{\Lambda}'_m \bar{D}_m + \bar{\Lambda}'_a \bar{D}_a + \bar{\Lambda}'_{-i} \bar{D}^{-i} + \bar{\Lambda}'_t \bar{D}_t. \qquad \text{(b3.1)}$$

with $\bar{t}_{i,m,a,t}{}^{-i}$ being the average total transport costs of shipping products from origin municipality *m*. For the years when a municipality does not export, we replaced the non-observable *ad valorem* transport cost $\bar{t}_{i,m,a,t}{}^{-i}$ for the maximum value of that of the state where the municipality is geographically located. The reason for making this replacement relies on the concept that when a municipality does not export, it is because transport costs may be too high; which in this case corresponds to when transport costs are highest. In addition, our baseline specification in equation (b.3.1) includes a set of municipality, exit node, destination, and year fixed effects— $\bar{D}_m, \bar{D}_a, \bar{D}_t$ and $\bar{D}^{-i}$ —that control for non-observable variables that have an effect on a municipality's self-selection into exporting. As reported in section D, $\hat{\gamma}_1$ is expected to be negative.

APPENDIX C: TRANSPORT COSTS

As explained in Appendix A, total transport costs are structured using the shipping cost of moving cargo throughout the following transportation segments: i) transport cost from origin to local exit node, ii) local exit node to foreign destination node, and iii) from foreign arrival node to final local foreign destination. Data availability for the PA enabled us to proxy the cost of international cargo shipping in (ii) and (iii) by using the information on international cargo shipping costs extracted from the ALADI database. Transport costs in the form of local transport costs were constructed following a four-step calculation process:

First, from the custom level datasets we identified the potential universe of local exit nodes and we georeferenced them into a country's local transportation network. Chile is the only country where one can identify an exit node as a port or an airport—in the cases of Colombia, Mexico, and Peru, a local exit node refers to the customs facility through which a product exited the country.

Second, we used the universe list of the municipalities in which exporters are located and we mapped these onto the corresponding georeferenced local road network.

For Chile, we were able to map 335 municipalities (*comunas*) onto 93 export nodes—airports, ports, and borders. We were able to map 1080 municipalities to 51 export nodes in Colombia; 2457 municipalities to 94 export nodes in Mexico; and 1838 municipalities to 25 export nodes in Peru; these export nodes were customs facilities in all three cases.

Third, as in Combes and Lafourcade (2005), we used each country's transportation survey in combination with the categorization of a shipper's input types to calculate a distance— C_{d,r_t} —and a time—$C_{t,r}$—coefficient for each country and for each sample year. These two coefficients allowed us to use ArcGIS[1] to calculate the transport cost of shipping a ton of cargo along all the potential combinations of origin and local exit nodes—$CPT_{i,m,a,r,t}$. As proposed by the authors,

$$CPT_{i,m,a,r,t} = C_{d,r_t} * D_{i,m,a,r,t} + C_{t,r} * T_{i,m,a,r,t} \quad \text{(c.1)}$$

[1] Geographical information system software.

where C_{d,r_t} and $C_{t,r}$ are the country-year-specific distance and time components. $D_{i,m,a,r,t}$ is the physical distance of the road segment and $T_{i,m,a,r,t}$ corresponds to the effective travel time which we obtained by assuming that a truck covers distance $D_{i,m,a,r,t}$ of a given road segment at the segment's legal speed limit $LS_{i,m,a,r,t}$. Hence

$$T_{i,m,a,r,t} = \frac{D_{i,m,a,r,t}}{LS_{i,m,a,r,t}} .$$

Both $D_{i,m,a,r,t}$ and $LS_{i,m,a,r,t}$ are parameters that are given by the georeferenced road segment data included in the GIS road-map files.

Clearly, calculations of C_{d_t} and C_t vary by country, as market-specific regulations on the number of hours that cargo workers are allowed to work and market regulations around truck types affect the overall estimates of the distance and time coefficients.[2]

In sum, these market-specific characteristics allowed us to obtain distance and time coefficients that are country specific. While the distance parameter C_{d,r_t} seems to be more important in Chile, Colombia, and Mexico, in the case of Peru the time parameter $C_{t,r}$ is more important as wages represent a higher share of a carrier's total cost composition.

Fourth, once we had calculated all $CPT_{i,m,a,r,t}$, we identified the optimal cargo route on the assumption that cargo carriers will only chose to move cargo using the least costly cargo route. Hence,

$$CPT_{i,m,a,t} = \min [CPT_{i,m,a,1,t}, \ldots, CPT_{i,m,a,R,t}] \qquad \text{(c.2).}$$

In the context of our model, $CPT_{i,m,a,t}$ in equation c.2 corresponds to $f_{\omega,i,m,a}$.

[2] In this regard, we assume that each truck is allowed to operate 288 hours per month. Since cargo fleets vary from country to country, we allowed the distance and time coefficients to reflect the effect of truck type as measured by capacity. For example, for Colombia, we weighted truck capacities C2, C3, and C4—9, 16, and 34 tons, respectively—by using cargo fleet composition weights of 82%, 5%, and 13% respectively.

TABLE C1/ Determinants of Distance and Time Components in the PA, 2012

	Chile 2012		Colombia 2012		Mexico 2011		Peru 2012	
	USD per km per ton	Weight	USD per km per ton	Weight	USD per km per ton	Weight	USD per km per ton	Weight
(1) Distance-related costs								
Fuel and lubricants	0.041	57.6%	0.274	73.1%	0.013	45.4%	0.060	37.2%
Maintenance and repairs	0.016	22.6%	0.042	11.3%	0.004	13.9%	0.005	3.0%
Operational factors	0.009	12.9%	0.047	12.6%	0.007	23.9%	0.036	22.2%
(2) Time-related costs								
Wages	0.003	4.8%	0.005	1.3%	0.002	8.6%	0.030	18.9%
Licences and taxes	0.000	0.2%	0.000	0.0%	0.000	0.6%	0.005	3.1%
Depreciation	0.001	1.5%	0.005	1.2%	0.002	6.4%	0.013	8.0%
Fixed operational factors	0.000	0.4%	0.002	0.4%	0.000	1.3%	0.012	7.8%
(1) Cd	0.066	93%	0.363	97%	0.024	83%	0.100	62%
(2) Ct	0.005	7%	0.011	3%	0.005	17%	0.060	38%
Total cost per km per ton	0.071	100%	0.375	100%	0.029	100%	0.160	100%

Source: Authors' own calculations.

Note: For Chile, we used the "Encuesta de Servicio de Transporte de Carga" [Survey of Cargo Transportation Services] provided by the National Statistics Institute (INE) to compute the distance- and time-related coefficients for 2006 to 2012. For the case of Colombia, the data was provided by the Ministry of Transportation (2004–2014). For Mexico, we used the "Encuesta Anual de Transportes" [Annual Transportation Survey] (2006–2012) carried out by the National Institute of Statistics, Geography, and Information Processing (INEGI) plus the aggregated reports that contain information related to the fixed assets and depreciation missing from these surveys. For Peru, we used data provided by the Advanced Logistics Group (2001–2012).

APPENDIX D: ESTIMATION RESULTS

TABLE D1/ Impact of Transport costs on Municipal Exports: Cross-Country Evidence

Dependent variable: Product total value of exports in t (ln)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total volume of exports by origin and destination node: Chile								
Ad-val. tot. trans. cost in t (ln)	–4.303	–4.291	–4.506	–4.185	–4.506	–4.166	–4.515	–4.506
	1.383	1.384	1.471	1.434	1.471	1.434	1.570	1.568
Observations	68,264	68,264	68,264	68,264	68,264	68,264	68,264	68,264
R-Squared	0.865	0.865	0.866	0.868	0.866	0.868	0.869	0.869
Panel B: Total volume of exports by origin and destination node: Colombia								
Ad-val. tot. trans. cost in t (ln)	–2.859	–2.859	–2.618	–2.882	–2.613	–2.883	–2.601	–2.597
	(0.853)***	(0.853)***	(0.944)***	(0.899)***	(0.943)***	(0.899)***	(0.976)***	(0.974)***
Observations	26,698	26,698	26,698	26,698	26,698	26,698	26,698	26,698
R-squared	0.875	0.875	0.878	0.876	0.878	0.876	0.879	0.879
Panel C: Total volume of exports by origin and destination node: Mexico								
Ad-val. tot. trans. cost in t (ln)	–1.462	–1.468	–1.429	–1.354	–1.434	–1.356	–1.319	–1.322
	(0.778)*	(0.776)*	(0.774)*	(0.759)*	(0.769)*	(0.756)*	(0.753)*	(0.749)*
Observations	76,441	76,441	76,441	76,441	76,441	76,441	76,441	76,441
R-squared	0.913	0.913	0.914	0.917	0.914	0.917	0.917	0.918

(continued on next page)

TABLE D1/ Impact of Transport costs on Municipal Exports: Cross-Country Evidence *(continued)*

Dependent variable: Product total value of exports in t (ln)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel D: Total volume of exports by origin and destination node: Peru								
Ad-val. tot. trans. cost in t (ln)	–3.884 (1.025)***	–3.908 (1.024)***	–3.898 (1.017)***	–4.147 (1.087)***	–3.911 (1.015)***	–4.157 (1.087)***	–4.167 (1.076)***	–4.179 (1.073)***
Observations	44,272	44,272	44,272	44,272	44,272	44,272	44,272	44,272
R-squared	0.882	0.882	0.883	0.886	0.883	0.886	0.886	0.887
Country/product/ customs facility/ municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	No	No	No	No	No	No	No
Country/Year Fixed Effect	No	Yes	No	No	Yes	Yes	No	Yes
Customs facility/year fixed effect	No	No	Yes	No	Yes	No	Yes	Yes
Municipality/year fixed effect	No	No	No	Yes	No	Yes	Yes	Yes

Source: Authors' own estimates. Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimates correspond to the reduced form of the equation proposed in (b1.4).
Clustered standard errors by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE D2/ Impact of Transport costs on Municipal Exports: Sector Clustering Analysis

Dependent variable: Product total value of exports in t (ln)	Coeff.	Clustered standard errors				Observations
		Municipality	SITC 4	SITC 5	SITC5 and Munic.	
Ad-val. tot. trans. Cost in t (ln): Chile	–4.506	(1.568)***	(1.779)**	(1.793)**	(1.744)***	68,264
R-squared		0.869	0.869	0.869	0.869	
Ad-val. tot. trans. Cost in t (ln): Colombia	–2.597	(0.974)***	(1.002)***	(0.979)***	(0.977)***	26,698
R-squared		0.879	0.879	0.879	0.879	
Ad-val. tot. trans. cost in t (ln): Mexico	–1.322	(0.749)*	(0.813)	(0.804)	(0.749)*	76,441
R-squared		0.918	0.918	0.918	0.918	
Ad-val. tot. trans. cost in t (ln): Peru	–4.179	(1.073)***	(0.936)***	(0.883)***	(0.960)***	44,272
R-squared		0.887	0.887	0.887	0.887	

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimated coefficients correspond to specification (8) as reported in Table D1. Estimates correspond to the reduced form of the equation proposed in (b1.4).
Clustered Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE D3/ Impact of Transport costs on Municipal Exports by Sector: Primary and Manufacturing

Dependent variable: Product total value of exports in t (ln)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total volume of exports by origin and destination node: Chile								
Ad-val. tot. trans. cost in t (ln)	–2.462	–2.458	–2.625	–1.732	–2.641	–1.711	–1.944	–1.936
Primary	2.355.	2.358.	2.482.	2.508.	2.483.	2.505.	2.761.	2.756.
Ad-val. tot. trans. cost in t (ln)	–6.187	–6.176	–6.395	–6.336	–6.391	–6.323	–6.628	–6.623
Manufacturing	(1.904)***	(1.904)***	(2.095)***	(1.949)***	(2.094)***	(1.948)***	(2.179)***	(2.177)***
Observations	68,264	68,264	68,264	68,264	68,264	68,264	68,264	68,264
R-squared	0.867	0.867	0.867	0.870	0.868	0.870	0.870	0.871
Panel B: Total volume of exports by origin and destination node: Colombia								
Ad-val. tot. trans. cost in t (ln)	–0.154	–0.148	0.229	–0.136	0.235	–0.131	0.223	0.229
Primary	0.795.	0.798.	1.010.	0.814.	1.013.	0.818.	1.022.	1.026.
Ad-val. tot. trans. cost in t (ln)	–3.613	–3.614	–3.376	–3.666	–3.374	–3.669	–3.391	–3.389
Manufacturing	(1.167)***	(1.168)***	(1.241)***	(1.241)***	(1.240)***	(1.242)***	(1.301)***	(1.301)***
Observations	26,698	26,698	26,698	26,698	26,698	26,698	26,698	26,698
R-squared	0.874	0.874	0.877	0.875	0.877	0.875	0.877	0.877

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TABLE D3/ Impact of Transport costs on Municipal Exports by Sector: Primary and Manufacturing *(continued)*

Dependent variable: Product total value of exports in t (ln)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel C: Total volume of exports by origin and destination node: Mexico								
Ad-val. tot. trans. cost in t (ln)	–10.352	–10.366	–10.781	–9.278	–10.788	–9.290	–9.420	–9.462
Primary	(4.977)**	(4.992)**	(5.053)**	(5.372)*	(5.061)**	(5.386)*	(5.313)*	(5.318)*
Ad-val. tot. trans. cost in t (ln)	–1.410	–1.417	–1.377	–1.341	–1.384	–1.346	–1.308	–1.313
Manufacturing	(0.690)**	(0.688)**	(0.686)**	(0.680)**	(0.682)**	(0.678)**	(0.675)*	(0.672)*
Observations	76,441	76,441	76,441	76,441	76,441	76,441	76,441	76,441
R-squared	0.915	0.915	0.916	0.918	0.916	0.918	0.919	0.919
Panel D: Total Volume of Exports by Origin and Destination Node: Peru								
Ad-val. tot. trans. cost in t (ln)	–2.196	–2.218	–2.188	–2.297	–2.196	–2.295	–2.454	–2.45
Primary	(1.134)*	(1.121)**	(1.119)*	(1.338)*	(1.121)*	(1.330)*	1.330–2019.	(1.391)*
Ad-val. tot. trans. cost in t (ln)	–4.448	–4.472	–4.462	–4.672	–4.477	–4.686	–4.634	–4.651
Manufacturing	(1.428)***	(1.431)***	(1.431)***	(1.525)***	(1.426)***	(1.531)***	1.531–2019.	(1.494)***
Observations	44,272	44,272	44,272	44,272	44,272	44,272	44,272	44,272
R-squared	0.882	0.882	0.883	0.886	0.883	0.886	0.887	0.887
Country/product/customs facility/municipality fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	No	No	No	No	No	No	No
Country/year fixed effect	No	Yes	No	No	Yes	Yes	No	Yes
Customs facility/year fixed effect	No	No	Yes	No	Yes	No	Yes	Yes
Municipality/year fixed effect	No	No	No	Yes	No	Yes	Yes	Yes

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimates correspond to the reduced form of the equation proposed in (b1.4), but allowing for differences across product-sector classification. Clustered standard errors by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
a Standard errors proxied by previous specification.

TABLE D4/ Impact of Transport costs on Municipal Exports by Sector: Sector Cluster Analysis

Total Volume of Exports by Origin and Destination Node: Clusters							
			Clustered Standard Errors				
Country	Dependent variable: Product total value of exports in t (ln)	Coef.	Municipality	1992 to 4	1992 to 5	"Facts and Forecasts:	Observations
Chile	Ad-val. tot. trans. cost in t (ln): Primary	–1.936	(2.756)	(3.276)	(3.240)	(3.066)	68,264
	Ad-val. tot. trans. cost in t (ln): Manufacturing	–6.623	(2.177)***	(2.185)***	(2.195)***	(2.193)***	
	R-squared		0.871	0.871	0.871	0.871	
Colombia	Ad-val. tot. trans. cost in t (ln): Primary	0.229	(1.026)	(1.093)	(0.990)	(0.993)	26,698
	Ad-val. tot. trans. cost in t (ln): Manufacturing	–3.389	(1.301)***	(1.344)**	(1.304)***	(1.304)***	
	R-squared		0.877	0.877	0.877	0.877	
Mexico	Ad-val. tot. trans. cost in t (ln): Primary	–9.462	(5.318)*	(5.120)*	(5.509)*	(5.353)*	76,441
	Ad-val. tot. trans. cost in t (ln): Manufacturing	–1.313	(0.672)*	(0.770)*	(0.770)*	(0.719)*	
	R-squared		0.919	0.919	0.919	0.919	
Peru	Ad-val. tot. trans. cost in t (ln): Primary	–2.45	(1.391)*	(1.316)*	(1.312)*	(1.301)*	44,272
	Ad-val. tot. trans. cost in t (ln): Manufacturing	–4.651	(1.494)***	(1.341)***	(1.294)***	(1.382)***	
	R-squared		0.887	0.887	0.887	0.887	

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimated coefficients correspond to specification (8) as reported in Table D3. Estimates correspond to reduced form equation as proposed in equation (b1.4), but allowing for differences across product-sector classification.
Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE D5/ Transport costs and Municipal Product Export Scope

Dependent variable: Number of products in t (ln)	Panel A: HS 8-digit level		Panel B: HS 6-digit level	
	(1)	(2)	(3)	(4)
Ad-valorem total transport cost in t (ln)	–1.897	–3.070	–2.172	–3.553
Chile	(0.504)***	(1.515)**	(0.481)***	(1.143)***
R-squared	0.867	0.920	0.883	0.931
Observations	1,468	1,468	1,468	1,468
Ad-valorem total transport cost in t (ln)	–0.215	–0.492	–0.214	–0.487
Colombia	(0.168)	(0.223)**	(0.167)	(0.227)**
R-squared	0.951	0.984	0.958	0.950
Observations	298	298	298	298
Ad-valorem total transport cost in t (ln)	–1.401	–1.561	–1.329	–1.495
Mexico	(0.325)***	(0.393)***	(0.309)***	(0.371)***
R-squared	0.878	0.929	0.877	0.928
Observations	2,450	2,450	2,450	2,450
Ad-valorem total transport cost in t (ln)	–0.738	–0.819	–0.746	–0.884
Peru	(0.164)***	(0.319)**	(0.164)***	(0.321)***
R-squared	0.865	0.929	0.867	0.931
Observations	1,583	1,583	1.583	1,583
Municipality fixed effect	Yes	No	Yes	No
Country fixed effect	Yes	No	Yes	No
Year fixed effect	Yes	No	Yes	No
Municipality/year fixed effect	No	Yes	No	Yes
Country/year fixed effect	No	Yes	No	Yes

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimates correspond to reduced form equation as proposed in equation (b2.1). Columns (1), (2), (5), and (6) were estimated by specifying the product scope to be calculated at the 8-digit level of the Harmonized System code.
Clustered standard errors by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE D6/ Transport costs and Municipal Product Export Scope in Primary and Manufacturing Sectors

Dependent variable: Number of products in t (ln)	Primary				Manufacturing			
	HS8		HS6		HS8		HS6	
Panel A: Number of products by sector: Chile								
***Ad-val.* tot. trans. cost in t (ln)**	–0.641	–0.378	–0.844	–0.795	–1.476	–7.078	–1.651	–6.812
	(0.541)	(1.867)	(0.393)**	(1.296)	(1.300)	(2.571)***	(1.310)	(2.456)***
Observations	1,202	1,202	1,202	1,202	992	992	992	992
R-squared	0.797	0.885	0.817	0.896	0.884	0.944	0.885	0.945
Panel B: Number of products by sector: Colombia								
***Ad-val.* tot. trans. cost in t (ln)**	–0.311	–0.142	–0.286	–0.152	–0.119	–0.481	–0.119	–0.477
	(0.070)***	(0.082)*	(0.059)***	(0.100)	(0.181)	(0.228)**	(0.179)	(0.253)*
Observations	169	169	169	169	258	258	258	258
R-squared	0.926	0.977	0.925	0.970	0.948	0.985	0.947	0.985
Panel C: Number of products by sector: Mexico								
***Ad-val.* tot. trans. cost in t (ln)**	–0.396	–0.736	–0.402	–0.727	–1.628	–1.620	–1.543	–1.553
	(0.212)*	(1.431)	(0.219)*	(1.441)	(0.392)***	(0.432)***	(0.371)***	(0.411)***
Observations	1,133	1,133	1,133	1,133	2,242	2,242	2,242	2,242
R-squared	0.780	0.866	0.771	0.862	0.869	0.924	0.869	0.923

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TABLE D6/ Transport costs and Municipal Product Export Scope in Primary and Manufacturing Sectors *(continued)*

Dependent variable: Number of products in t (ln)	Primary				Manufacturing			
	HS8		HS6		HS8		HS6	
Panel D: Number of products by sector: Peru								
Ad-val. tot. trans. cost in t (ln)	–0.279	–0.459	–0.329	–0.612	–0.635	–0.647	–0.629	–0.655
	–0.276	–0.557	–0.257	–0.5	(00891)***	(0.121)***	(00867)***	(0.116)***
Observations	0.757	0.87	0.762	0.874	0.85	0.919	0.851	0.921
R-squared	1,260	1,260	1,260	1,260	950	950	950	950
Municipality fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Country fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Year fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Municipality/year fixed effect	No	Yes	No	Yes	No	Yes	No	Yes
Country/year fixed effect	No	Yes	No	Yes	No	Yes	No	Yes

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012. Estimates correspond to reduced form equation as proposed in equation (b2.1). Columns (1), (2), (5), and (6) were estimated by specifying the product scope to be calculated at the 8-digit level of the Harmonized System code.
Clustered standard errors by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

TABLE D7/ Transport costs and Entry of Municipalities into Exporting

Dependent variable: Entry into exporting in t	Chile		Colombia		Mexico		Peru	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ad-valorem total transport cost in t (ln)	–0.860 (0.014)***	–0.971 (0.018)***	–0.227 (0.030)***	–0.388 (0.030)***	–0.090 (0.007)***	–1.336 (0.080)***	–0.007 (0.002)***	–0.162 (0.024)***
Observations	4,200	4,200	13,464	13,464	36,855	36,855	21,958	21,958
R-squared	0.935	0.983	0.816	0.935	0.774	0.921	0.710	0.831
Sample	2007–2012.		2007–2012.		2007–2011.		2007–2012.	
Municipality fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Country fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Year fixed effect	Yes	No	Yes	No	Yes	No	Yes	No
Municipality/year fixed effect	No	Yes	No	Yes	No	Yes	No	Yes
Country/year fixed effect	No	Yes	No	Yes	No	Yes	No	Yes

Source: Authors' own estimates.
Note: Mexico is the only case where sample data is only for the period of 2007–2011. In the case of Chile, Colombia, and Peru, data is for 2007–2012.
Estimates correspond to the reduced form of the equation proposed in (b3.1).
Clustered standard errors by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX E: SELECTED PROJECTS

The status of projects is classified according to the following categories: *i. under study:* this refers to projects for which pre-feasibility and feasibility analyses are being performed prior to the bidding process; *ii. pre-bidding:* refers to projects for which no further studies are being undertaken but that have not yet published a bid call; *iii. bidding process:* there is an open bid for at least part of the project; *iv. bid concluded:* the project has been allotted but construction has not started yet; *v. implementation:* construction is already underway; *vi. concluded:* construction has finished.

TABLE E1/ Projects in Chile

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Antofagasta region freeway	29%	317	Implementation
Alternative routes into Iquique	29%	216	Implementation
Highway R5 Caldera Chañaral	29%	250	Under study
Highway R5 North Concession, La Serena–Vallenar section	29%	312	Implementation
La Serena–Coquimbo highway	29%	33	Under study
Expansion of El Melón tunnel	New	120	Bidding process
Northern route into Valparaíso via Cabriteria	New	10	Under study
Nogales–Puchuncaví road	25%	148	Implementation
Roads into Arturo Merino Benitez Airport	26%	30	Implementation
Northern and southern roads out of Santiago via R5	26%	55	Implementation
Road link between highways R68 and R78	29%	108	Under study
Improvement to highway R68	29%	200	Under study
Melipilla Ruta de la Fruta highway	25%	38	Bidding process
Improvements to Ruta de la Fruta highway	29%	420	Bidding process
Highway R160, Coronel–Tres Pinos section	29%	330	Implementation
Concepción–Cabrero freeway	29%	360	Implementation
Industrial bridge over the Bío Bío River	New	190	Bidding process
Road into port of Panul, port of San Antonio	New	29	Under study

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TABLE E1/
Projects in Chile
(continued)

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Continuation of the San Rafael–Villa Prat–Lolol highway, Hualañe Lolol section	25%	35	Implementation
San Fernando–Santa Cruz highway	29%	298	Under study
Improvements to the Nahuelbuta highway	20%	243	Under study
Ruta de la Madera highway	25%	142	Bidding process
Cuesta las Chilcas highway	26%	75	Implementation
Rutas del Loa highway	25%	281	Bid concluded
Exclusive road into the port of Arica	26%	4	N.A.
Improvements to northern highway R5 in Antofagasta, Iquique, and Arica	20%	850	N.A.
Highway R160 between port of San Vicente and the port-to-port highway	26%	6	Under study
Truck bypass through Puerto Coronel, El Patagual, Hualqui, Copiulemu, Roa, and Lirquén	26%	300	N.A.
Alternate route to highway R68	26%	200	Under study
Freeway through Puchuncaví, Ventanas, Con Cón, Viña del Mar via highways R68 and RF30E.	20%	350	N.A.
Improvements to roads into the port of Ventanas	26%	10	N.A.
New bridge over the River Maipo, highway R5	New	70	Under study
Port Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
New terminal 2 and EPV breakwater at the port of Valparaíso	40%	330	Bid concluded
Expansion of site no. 3	40%	60	Bid concluded
New wharf, coastal terminal, and breakwater	22%	325	Implementation
Large-scale port in the central region	40%	2	N.A.
Invitation for bids for Terminal 1	40%	300 to 450	Bidding process
Invitation for bids for Terminal 1	40%	60	Bidding process
Outer harbor of Arica	56%	8	N.A.
Antofagasta international land port	56%	45	Under study
Logistics Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
New truck park in the Placilla sector	40%	12	N.A.
New container transfer station and container parking lot in the Bío Bío region	29%	27	N.A.

TABLE E2/ Projects in Colombia

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Road infrastructure for two-lane highways (Ruta del Sol I, II, and III)	38%	2.5	Implementation
Road infrastructure for two-lane highway, Conexión Norte project	26%	518	Bidding process
Conexión Pacífico 1 freeway road concessions for Conexión Pacífico 1, 2, and 3 freeways	26%	1,025.6	Bidding process
Conexión Pacífico 2 freeway (Autopistas para la Prosperidad)	23%	507.5	Bidding process
Conexión Pacífico 3 freeway (Autopistas para la Prosperidad)	23%	640	Bidding process
Río Magdalena 1 freeway	23%	1,149.3	Bidding process
Río Magdalena 2 freeway	23%	712.25	Bidding process
Autopista al Mar 1 freeway	23%	809.4	Bidding process
Autopista al Mar 2 freeway	23%	841.75	Bidding process
Santander de Quilichao–Popayán highway	23%	647.5	Under study
Rumichaca–Pasto, group 2, center-west	33%	798.6	Implementation
Caracas–Bogota–Buenaventura / Quito IIRSA AND07	26%	653.19	Implementation
Cajamarca La Paila	26%	704.5	Implementation
Second lane Ibagué–Cajamarca	26%	701.5	Implementation
Improvements to Buga–Loboguerrero road	26%	32.4	Implementation
Mulaló–Loboguerrero and Cali–Dagua–Loboguerrero	26%	793.2	Pre-bidding
Second lane Buga–Buenaventura	26%	1.2	Implementation
Section of road between Facatativá and Villeta .	38%	756	Bidding process
Section of road between Villeta and Honda.	38%	609.7	Bidding process
Section of road between Manizales and Mariquita	26%	787.8	Bidding process
Bogotá–Cúcuta highway (IIRSA AND05)	26%	1,559	Implementation
Section of road between Puerto Triunfo and Santuario (second lane)	26%	751.5	Bidding process
Section of road between Medellín and Santuario (third lane)	26%	340.5	Bidding process

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TABLE E2/ Projects in Colombia *(continued)*

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Section of road between Santafé de Antioquia and Cañasgordas (second lane)	23%	137.2	Bidding process
Section of road between Barrancabermeja and Bucaramanga (second lane)	26%	863.3	Bidding process
Section of road between Villanueva and Cuestecitas (second lane)	26%	218.5	Bidding process
Cartagena–Barranquilla highway and Prosperidad del Atlántico beltway	26%	647.5	Bidding process
Girardot–Honda–Puerto Salgar	26%	540.5	Bid concluded
Western Cundinamarca beltway, Group 3: Center-west	26%	430.5	Bid concluded
Port Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
Port of Buenaventura	29%	28	Implementation
Port of Tumaco IIRSA AMA 59	23%	12.7	Implementation
Port of Barranquilla 2014 investments	27%	19.5	Implementation
Port of Turbo 2014 investments	20%	140	Implementation
Ports of Ciénaga (Carboneros, Nuevo, and Drummond), Cerrejón, Dibulla.	20%	560	Implementation
Port of Santa Marta 2014 investments	20%	7.2	Implementation
Logistics Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
Logistic activity zone for the port of Buenaventura	23%	150	Under study

TABLE E3/ Projects in Mexico

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Atasta beltway	33%	45.1	Implementation
San Cristóbal de las Casas–Rancho Nuevo	33%	19.6	Concluded
Expansion of Guadalajara–Manzanillo freeway to 6 lanes	33%	40.2	Implementation
Pachuca–Huejutla	33%	20.4	Implementation
Ixmiquilpan beltway	33%	85.1	Under study
Jala–Puerto Vallarta and Puerto Vallarta beltway	New	61.9	Implementation
Jiquilpan–Guadalajara, Tizapán El Alto–Jocotepec section	33%	51.0	Bidding process
Zitácuaro–Valle de Bravo	35%		Under study
Ixtlahuaca beltway	35%		Pre-bidding
México–Toluca federal highway, La Marquesa–Paseo Tollocan section	33%	270.8	Implementation
Overpass over the México–Toluca freeway	New	27.1	Implementation
E.C.F. (Cuernavaca–Acapulco–Autopista Siglo XXI freeway), Colonia la Unión–La Lagunilla section, Delegación Mariano	33%	1.3	Implementation
Jala–Compostela–Bahía de Banderas freeway	35%	1,005.8	Implementation
Tampico–Ciudad Victoria–Border with the state of Nuevo León	35%		Implementation
Oaxaca–Itsmo highway	33%	696.3	Implementation
Oaxaca–Puerto Escondido–Huatulco, La Y–Barranca Larga–Ventanilla and Puerto Escondido–Pochutla–Huatulco sections	33%	217.6	Implementation
Construction of an overpass over the México–Veracruz freeway, Planta VW–Estadio Cuauhtémoc section	New		N.A.
La Galarza–Amatitlanes beltway, which connects with the highway to Cuautla, Morelos	33%	5.3	N.A.
Tulum and Solidaridad infrastructure Tulum beltway section	35%		N.A.
Ciudad Obregón beltway	33%	12.4	Implementation
Ciudad de Apizaco northwestern beltway	33%	139.8	N.A.

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TABLE E3/
Projects in Mexico
(continued)

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Construction of the Cardel–Poza Rica highway, first stage	33%	55.7	Implementation
Tuxpan–Tampico highway: Tuxpan–Ozuluama section	33%	53.9	Implementation
Construction of the Orizaba beltway, first stage	35%	425.5	N.A.
Mexicali–San Felipe, El Faro–San Felipe section	35%	117.6	Concluded
El Chaparral border crossing	35%	30.3	N.A.
Ensenada beltway	New	70.5	Implementation
San Pedro–Cabo San Lucas and Todos los Santos beltway	35%	304.1	Concluded
Chihuahua western beltway	New	115.5	Concluded
Toluca–Palmillas federal highway MEX 055	35%	189.0	N.A.
Tepic–San Blas	35%	100.8	N.A.
Valles–Tampico highway road into Tamuín– road into Pánuco	38%	158.3	N.A.
Zacatecas–Saltillo, road into Villa de Cos–border Zac. –Coah	38%	160.0	N.A.
Acapulco western beltway	New	282.6	Bidding process
Expansion of Mérida–Chetumal freeway to 4 lanes	38%	128.8	Implementation
Renovation of Tuxtla Gutiérrez–Villaflores highway	38%		Implementation
Villahermosa northwestern beltway	35%	249.5	Implementation
Road into the port of Veracruz	35%	58.7	N.A.
Atizapán–Atlacomulco highway	38%	583.3	Implementation
Tenango–Malinalco–Alpuyeca highway	38%	251.0	Implementation
Nuevo Necaxa–Tihuatlán highway	38%	688.9	Implementation
Acayucan–La Ventosa highway	38%	121.3	Implementation
Santiago Tuxtla–Catemaco and Cosoleacaque–Jaltipan–Acayucan	33%	41.6	Implementation
Completion and opening of México–Tuxpan freeway	38%	250.0	Implementation
Manzanillo–Minatitlan, Pez Vela–Jalipa	38%	83.3	N.A.

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TABLE E3/
Projects in Mexico
(continued)

Port Projects	Expected % increase in speed	Investment (millions of US$)	Status
Natural expansion of the northern sector of the Port of Veracruz	39%	382.8	Implementation
Development of port infrastructure at Laguna de Pajaritos	21%	77.9	Implementation
Port of Lázaro Cárdenas, dredging and other works	13%		Implementation
Port of Lázaro Cárdenas, strategic bonded warehouse	13%	11.0	Implementation
Port of Lázaro Cárdenas, specialized car terminal	13%	43.7	Implementation
Port of Lázaro Cárdenas, shipyard	21%	10.4	Implementation
Port of Lázaro Cárdenas, liquefied natural gas terminal	13%	50.5	Implementation
Port of Lázaro Cárdenas, coal terminal II	13%	158.3	Implementation
Port of Manzanillo, specialized container terminal II (TEC II)	17%		Implementation
Port of Manzanillo (connectivity, dredging, and formation of islets)	17%	67.3	Implementation
Port of Manzanillo, multiple use terminal (TUM)	17%	83.3	Concluded
Port of Manzanillo, logistic activity zone (ZAL)	17%	23.6	Concluded
Port of Manzanillo, Port of Laguna de Puyutlán	17%	1,345.0	Under study
Port of Veracruz, ZAL	39%	54.7	Concluded
Port of Veracruz, expansion of port, Santa Fe rail bypass, and new customs facility	39%	5,000.0	Implementation
Port of Tuxpan, container terminal II	32%	25.0	Implementation
Port of Ensenada (improvements to and modernization of roads into the port, expansion of coastal shopping wharf, dredging)	21%		Implementation
Port of de Altamira, works	22%	83.2	Implementation

TABLE E4/
Projects in Peru

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Huaura–Sayán–Chirin–Oyón–Yanahuanca–Ambo highway	36%	560.54	Implementation
Lima–Canta Unish highway, IIRSA AMA 72	36%	348.3	Implementation
Nestor Gambetta Ave.	New	183.81	Implementation
Construction and improvements to Santa Rosa Ave.	New	8.45	Under study
Construction and improvements to southern road into El Callao	New	323.74	Implementation
Autopista del Sol Highway	38%	299.6	Implementation
Road Network No.4	38%	286.16	Implementation
Road Network No.5	38%	75.05	Implementation
Road Network No.6	38%	231.86	Implementation
Southern Panamerican highway (Quilca–La Concordia bypass)	38%	160	Implementation
IIRSA North	50%	493.36	Implementation
IIRSA Center, Section 2	36%	100	Implementation
IIRSA South, Section 1	50%	135.95	Implementation
IIRSA South, Section 2	50%	653.66	Implementation
IIRSA South, Section 3	50%	616.15	Implementation
IIRSA South, Section 4	50%	644.54	Implementation
IIRSA South, Section 5	50%	195.14	Implementation
Longitudinal de la Sierra highway, section 4, Junín–Ica–Apurímac	50%		Bidding process
Longitudinal de la Sierra highway, section 5, Urcos–Sicuani–Calapuja–Puno–Ilave–Desaguadero	50%		Pre-bidding
Autopista del Sol: Ancón–Pativilca section, IIRSA AND27	38%	75.05	Implementation
Autopista Del Sol: Sullana–Aguas Verdes section, IIRSA AND28	38%	394.21	Implementation
Autopista Del Sol: Pativilca–Trujillo section, IIRSA AND29	38%	401.6	Implementation
Autopista Del Sol: Trujillo–Sullana section, IIRSA AND30	38%	401.3	Implementation
Construction of a second lane for the Cerro Azul–Ica section, IIRSA AND75	38%	394.2	Implementation
Southern Panamerican highway, Ica–Chilean border, IIRSA AND87	38%	360	Under study
El Reposo–Saramiriza highway (Ruta Nacional No. 4c), IIRSA AMA19	50%	269.4	Implementation
Improvements to the Tingo María–Pucallpa highway, IIRSA AMA26	50%	102.5	Implementation

(continued on next page)

TABLE E4/
Projects in Peru
(continued)

Road Projects	Expected % increase in speed	Investment (millions of US$)	Status
Lima–Ricardo Palma freeway, IIRSA AMA32	38%	499	Under study
IIRSA Center, Section 3: Cerro de Pasco–Tingo María bypass, AMA64	50%	115.6	Under study
Camaná–Matarani–Ilo highway, IIRSA LOC42	38%	271	Implementation
Blanco Arapa River tunnel	New	140	N.A.
Alternate routes to the Central highway (north), Huaral to intersection with highway RPE–3N	50%	370	N.A.
Alternate routes to the Central highway (south), San Vicente Huancayo	50%	420	N.A.
Truck express lane, Ancón El Callao	38%	45	N.A.
Beltway	New	160	Under study
IIRSA Center, Section 2: Ricardo Palma–La Oroya / La Oroya–Huancayo, AMA63	38%	100	Under study
Logistics Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
Mineral shipping terminal, Callao port terminal, IIRSA AMA67	21%	120.33	Concluded
Multipurpose northern terminal, Callao port terminal, IIRSA AMA66	25%	883.48	Implementation
New container terminal–southern region–Callao port terminal, IIRSA AMA31	31%	704.84	Implementation
Port Projects	**Expected % increase in speed**	**Investment (millions of US$)**	**Status**
Modernization of the port of Iquitos, IIRSA AMA56	31%	39.55	Under study
Matarani port terminal	14%	15.7	Implementation
Modernization of the port of Ilo IIRSA LOC61	14%	100	Under study

APPENDIX F: SIMULATIONS

For notational purposes, let $\%\Delta x$ represent the percentage change in any of the transport cost components: from a municipality to an exit node and from the exit node to foreign country of destination or from foreign port of arrival to foreign local arrival node. From equation (a.3) it can be seen that a percentage change in a Municipality's Product Export Revenue is determined by the product of three terms: the estimated price elasticity of demand $-\hat{\sigma}_s$ obtained when estimating equation b1.4, the relative importance of the transport cost component $S_{x,t}$, and the percentage adjustment of the respective transport cost price. In other words:

$$\%\Delta r^{-i}{}_{\omega,i,m,a,t} = -\hat{\sigma}_s * S_{x,t} * \%\Delta x \qquad \text{(f.1)}$$

where $S_{x,t}$ may be either equal to

$$S_{\omega,i,m,a,t} = \frac{w_\omega f_{\omega,i,m,a,t}}{p_{\omega,i,m,t} + w_\omega\left[f_{\omega,i,m,a,t} + f_{\omega,i,a,t}{}^{-i} + f_{\omega,d,t}{}^{-i}\right]},$$

$$S^{-i}_{\omega,i,a,t} = \frac{w_\omega f_{\omega,i,a,t}{}^{-i}}{p_{\omega,i,m,t} + w_\omega\left[f_{\omega,i,m,a,t} + f_{\omega,i,a,t}{}^{-i} + f_{\omega,d,t}{}^{-i}\right]},$$

or

$$S^{-i}_{\omega,d,t} = \frac{w_\omega f_{\omega,d,t}}{p_{\omega,i,m,t} + w_\omega\left[f_{\omega,i,m,a,t} + f_{\omega,i,a,t}{}^{-i} + f_{\omega,d,t}{}^{-i}\right]},$$

and $\%\Delta x = \frac{\partial f}{\partial x}\frac{x}{f}$; with being any of the three transport costs: $f_{\omega,i,m,a,t}$, $f_{\omega,i,a,t}$ or $f_{\omega,d,t}$.

By using (d.1.), it becomes clear that the effect of an exogenous percentage change in x on a region's exports of product ω is:

$$\%\Delta X_{\omega,i,m,t}{}^{-i} = \sum_a S_{\omega,i,m,a,t}{}^{-i}\%\Delta r^{-i}{}_{\omega,i,m,a,t}$$

$$= -\sigma \sum_a S_{\omega,i,m,a,t}{}^{-i} * S_{x,t} * \%\Delta x \qquad \text{(f.2),}$$

where $S_{\omega,i,m,a,t}{}^{-i}$ corresponds to the relative importance of an exit node within a region's exports of ω.

Similarly, the effect of an exogenous percentage change in x on a region's total exports is:

$$\%\Delta X_{i,m,t}{}^{-i} = \sum_\omega S_{\omega,i,m,t}{}^{-i}\%\Delta X_{\omega,i,m,t}{}^{-i}$$

$$= \sum_\omega \sum_a -\sigma_s S_{\omega,i,m,t}{}^{-i} * S_{\omega,i,m,a,t}{}^{-i} * S_{x,t} * \%\Delta X \qquad \text{(f.3)}$$

where $S_{\omega,i,m,t}{}^{-i}$ corresponds to the relative importance of a product's exports within a municipality's total export volume.

The effect of an exogenous percentage change in x on a country's bilateral exports is:

$$\%\Delta X_{i,t}{}^{-i} = \Sigma_m S_{m,i,t}{}^{-i} \%\Delta X_{i,m,t}{}^{-i}$$
$$= \Sigma_m \Sigma_\omega \Sigma_a -\sigma_s S_{m,i,t}{}^{-i} * S_{\omega,i,m,t}{}^{-i} S_{\omega,i,m,a,t}{}^{-i} * S_{x,t} * \%\Delta x \qquad \text{(f.4)}$$

where $S_{\omega,i,m,t}{}^{-i}$ represents the export share of municipality m within a country's total export volume.

Finally, the effect of an exogenous percentage change in x on a country's total exports is

$$\%\Delta X_{i,t} = \Sigma_{-i} \Sigma_m \Sigma_\omega \Sigma_a -\sigma_s S_{-i,i,t} S_{m,i,t}{}^{-i}$$
$$* S_{\omega,i,m,t}{}^{-i} S_{\omega,i,m,a,t}{}^{-i} * S_{x,t} * \%\Delta x \,. \qquad \text{(f.5)}$$

where $S_{-i,i,t}$ represents country's $-i$ export share within country's i total export volume.

APPENDIX G: REGIONAL GROUPINGS

The regional groupings used in this study are taken from the WDI. **East Asia & Pacific** is comprised of American Samoa, Australia, Brunei, Cambodia, China, Fiji, French Polynesia, Guam, Hong Kong, Indonesia, Japan, Kiribati, Republic of Korea, Lao, Macao, Malaysia, Marshall Islands, Micronesia, Mongolia, Myanmar, New Caledonia, New Zealand, Northern Mariana Islands, Palau, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, and Vietnam. The **European Union** is comprised of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Germany, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden, and the United Kingdom. **Latin America and the Caribbean** is comprised of Antigua & Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Barthélemy, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Suriname, Trinidad & Tobago, Turks & Caicos Islands, Uruguay, Virgin Islands, and Venezuela. The **Mercosur** is comprised of Argentina, Brazil, Paraguay, Uruguay, and Venezuela. The **Pacific Alliance** is comprised of Chile, Colombia, Mexico, and Peru. **North America** includes Canada and the United States. **Sub-Saharan Africa** is comprised of Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé & Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. **South Asia** is comprised of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The **Middle East and North Africa** is comprised of Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates, West Bank & Gaza, and Yemen.