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Time as a Trade Barrier

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Abstract:

International trade occurs in physical space and moving goods requires time. This paper examines the importance of time as a trade barrier, estimates the magnitude of time costs, and relates these to patterns of trade and the international organization of production. Estimates indicate that each additional day spent in transport reduces the probability that the US will source from that country by 1 – 1.5 percent. Conditional on exporting country, estimates directly identify a willingness-to-pay for time savings using variation across exporters and commodities in the relative price / speed tradeoff for air and ocean shipping. Each day saved in shipping time is worth 0.8 percent ad-valorem for manufactured goods. Relative declines over time in air shipping prices make time-savings less expensive, providing a compelling explanation for aggregate trade growth, compositional effects in trade growth, as well as growth in time-intensive forms of integration such as vertical specialization. Specifically, the advent of fast transport (air shipping and faster ocean vessels) is equivalent to reducing tariffs on manufactured goods from 32% to 9% between 1950-1998.

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I. Introduction

International trade occurs in physical space and moving goods requires time. Shipping containers from European ports to the US Midwest requires 2-3 weeks; Far Eastern ports as long as 6 weeks. In contrast, air shipping requires only a day or less to most destinations, but it is also much more expensive. For US trade in 1998, air freight commands a typical premium equal to 25 percent of the transported good's value.[1] Despite the expense, a large and growing fraction is air shipped. Thirty percent of US trade in 1998 was air-shipped, up from 7 percent in 1965 (and virtually no trade employed air-shipment in 1950). Excluding Canada and Mexico, over half of US exports are air-shipped. These facts suggest two inferences: lengthy shipping times impose costs that impede trade, and importers exhibit significant willingness-to-pay to avoid those costs.

This paper examines the importance of time as a trade barrier, and addresses three questions. What specific costs does shipping time impose on trade? What is the magnitude of these costs? And, what are the effects of time on patterns of trade and the international organization of production?

Lengthy shipping times impose inventory-holding and depreciation costs on shippers. Inventory-holding costs include both the capital cost of the goods while in transit, as well as the need to hold larger buffer-stock inventories at final destinations to accommodate variation in arrival time. Depreciation captures any reason that a newly produced good might be preferable to an older good. Examples include literal spoilage (fresh produce or cut flowers), items with immediate information content (newspapers),

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[1] See Table 1.

and goods with complex characteristics for which demand cannot be forecast well in advance (holiday toys, high-fashion apparel). These costs will be magnified in the presence of fragmentation. When countries specialize in stages of production and trade intermediate goods the inventory-holding and depreciation costs for early-stage value-added accrue throughout the duration of the production chain.

To estimate the magnitude of time costs, I examine a model of a firm's choice of export location and transport mode that trades off fast but expensive air transport against slow but inexpensive ocean shipping. I employ a novel dataset that includes prices, quantities, and speed for different transportation modes in US trade. Variation across exporters and commodities in the relative price / speed tradeoff identify a willingness-to-pay for time savings in shipment. This is translated into a direct measure of the ad-valorem barrier equivalent of an additional day's travel time. For manufactured goods I find each day in travel is worth an average of 0.8 percent of the value of the good per day, equivalent to a 16% tariff for the average length ocean shipment. An additional benefit of the econometric model is the ability to explain partner selection in trade. Estimates indicate that each additional day in ocean transit reduces the probability that a country will export to the US by 1 percent (all goods) to 1.5 percent (manufactured goods).

These estimates have pronounced implications for trade and the international organization of production. In the post-war era, world trade relative to output has grown at 2.9 percent per year (and manufacturing trade/output has grown at 3.7 percent annually).[2] Typical explanations attribute this growth to declining tariffs and improved

[2] Data from WTO.

technology (information and transportation).[3] Hummels (2000) documents very rapid declines in air relative to ocean shipping rates, as well as extensive substitution toward air-based shipping. To the extent that time is an important impediment to trade for all goods, relative declines in air shipping prices may help explain aggregate trade growth. And, time-sensitive goods (manufactures) should grow especially rapidly as a result of shipping price declines, indicating an important compositional role of the relative price declines.

The post-war era has seen rapid growth in other forms of integration, in particular, foreign direct investment and vertical specialization/fragmentation. FDI increased at 6.8% per year and FDI/output increased 3% per year between 1960 and 1995. Hummels, Ishii and Yi (2000) document that the share of vertical specialization in trade (defined as the use of imported inputs in exported goods) has increased 30%, and been responsible for roughly half of overall trade growth from 1970-1990. As argued above, vertical specialization (aka multi-stage production or fragmentation) may be especially time sensitive. If so, rapid declines in air transport costs, and the corresponding reduction in the cost of time-saving, may be responsible for the growth of time and coordination-intensive forms of integration.

The econometric technique employed here directly identifies the value of time saving from transport modal choice, but the estimates are informative about many policies and sources of technological change that speed goods to market. For example, eliminating or streamlining elaborate customs procedures allow imported goods reach their destinations more quickly. Investing in more efficient port infrastructure may

[3] Baier and Bergstrand (1998) relate aggregate trade growth to changes in aggregate measures of transportation costs and tariffs, but do not emphasize compositional effects.

accomplish similar goals. The estimates that follow indicate that a four-day wait for customs inspection is equivalent to the cost of explicit tariffs for most manufactures. Another example is the economic value of increased cycle times in production. One source of time costs is effective depreciation of a good caused by a mismatch between what the firm produces and what the consumer desires to buy months later. The estimates provided here can be used to calculate the value of changes in production technique that narrow this time gap.

This work belongs to a literature on the analysis and measurement of trade barriers that has received renewed attention of late. One can imagine a long list of barriers that plausibly affect international integration, but careful measures of trade impediments can be difficult to obtain. Contributions to the literature fall into two categories. The first concerns simply obtaining data (of varying quality) on obvious barriers such as tariffs and transportation costs and examining their impact on trade.[4]

The second seeks to identify more subtle barriers such as information (Rauch, 1999), product standards (Moenius, 1999), foreign exchange rate variability (Wei, 1998), environmental standards (Edgerington and Minier 2000), non-tariff barriers of various sorts and structural impediments. These barriers are less obvious and perhaps more interesting, but also much more difficult to directly measure. As a consequence, researchers rely primarily on indirect methods: positing a model of bilateral trade flows and correlating flows with proxy variables meant to represent trade barriers.

Unfortunately, indirect calculations of trade barriers must necessarily be filtered through a particular model to be meaningful. This raises a host of issues with model selection, appropriate levels of aggregation, and interpretation of parameters.[5] The advantage of the current paper is that it offers the analysis of a novel impediment to trade, provides a direct measure of its cost, and relates this measure specifically to the extent and composition of trade and forms of integration other than trade.

Section II describes a simple location and modal choice problem for a firm in the presence of time costs. Section III details the econometric specification and data employed. Section IV provides and discusses results. Section V links time as a trade barrier to changes in the extent, composition and organization of international integration. Section VI concludes.

II. The Firm's Problem

A firm wishing to export commodity k to the United States chooses an export location i and a transportation mode m so as to minimize the total cost of the delivered goods (expressed in per quantity units).

$$(1) \qquad TC_{im}^{k} = C_{i}^{k} + f_{im}^{k} + \tau^{k} T_{im} + \varepsilon_{im}^{k}$$

C is the production cost, f=F/Q is the total freight charge divided by quantity shipped, τ is the time cost, T is the shipment time in days, and ε defines a location-mode-commodity cost shifter.

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[4] Some examples include Yeats (early transport cost paper), Harrigan (1993), Haveman, Nair and Thursby (1998), Djankov, Evenett, and Yeung (1997), Baier and Bergstrand (1998), Hummels (1999), Trefler and Lai (1999), and Hummels (2000).

[5] The canonical model employed for indirect measurment is the gravity equation, usually derived from a one-sector monopolistic competition model. Several authors have criticized the usefulness of this model as

The firm solves this cost minimization problem by asking: conditional on the choice of exporter i, which transport mode should be chosen? Air shipping is chosen if

(2) $$C_i^k + f_{iA}^k + \tau^k T_{iA} + \varepsilon_{iA}^k < C_i^k + f_{io}^k + \tau^k T_{io} + \varepsilon_{io}^k$$

Conditioning on an exporter drops production costs from this expression. Rearranging, we have

(3) $$\tau^k (T_{io} - T_{iA}) - (f_{iA}^k - f_{io}^k) - (\varepsilon_{iA}^k - \varepsilon_{io}^k) > 0$$

Air shipping is chosen if the greater time costs associated with ocean shipping exceed the premium charged for air freight.

The solution to this problem determines an optimal mode m* for a given production location and commodity. Given the location-specific cost minimizing mode, the firm then chooses the optimal location from which to export. This depends not only on the production costs, but also on the optimal mode's *level* of freight rates and time costs for that location relative to other locations. Returning to the cost function, the firm exports from country i rather than j if

(4) $$(C_i^k - C_j^k) + (f_{im*}^k - f_{jm*}^k) + \tau^k (T_{im*} - T_{jm*}) + (\varepsilon_{im*}^k - \varepsilon_{jm*}^k) < 0$$

The per day time cost of the good, τ, is a function of two factors. The first is the per day interest rate *r* on the good in transit, otherwise known as pipeline inventory. The

well as failures in typical implementation. Recent critiques include Anderson and VanWincoop (2000), Evans (2000), and Hillberry and Hummels (2001).

second factor is a "depreciation rate" δ for the good. The depreciation rate encompasses any reason that a newly produced good might be preferable to an older good.

Obvious examples include spoilage that is literal and predictable such as fresh produce or cut flowers. Depreciation may also be probabilistic -- in any given day of transit there is a positive probability that the good may be damaged so that longer shipment times increase the cumulative probability of damage. Depreciation may reflect the immediate need for the good, and lost profitability/utility from the good if it is not available. For example, the absence of key components can idle an entire assembly plant. In this sense, an emergency shipment that arrives in a timely fashion may be worth many times the nominal price of the component, while late arrivals are of considerably depreciated value.

More generally, with long lags between production ordering and final sales, firms may face a mismatch between what consumers want and what the firm has available to sell.[6] Suppose that consumers will pay a premium to purchase goods containing "ideal" characteristics, but that they have unpredictable preferences over what constitutes the ideal characteristic set. Further, let the firm learn about ideal types slowly over time so that the characteristics of the goods made by the firm better match the consumers ideal type. This leads to a few simple implications. First, there is a distance between ideal type and what the firm has available to sell, with the price premium for the ideal type growing in that distance. Second, the distance and therefore price premium grows larger as the time increases between when a firm begins production and when the good is consumed.

[6] This feature of the story owes much to conversations with Alan Deardorff.

To fix ideas, write the consumer's demand function as $D = \alpha / p$. $\alpha \leq 1$ is the type produced by the firm, with $\alpha = 1$ being the ideal type. The firm can costlessly choose characteristics of the good to match the ideal type, but its information about the ideal type is imperfect. This can be represented as $\alpha = 1/\lambda T$ for $\lambda T \geq 1$. T is the time (in days) between when the firm begins production and when the good is consumed. λ is a learning parameter, describing the rate at which firms learn about the ideal type (immediately customizable goods can always match the ideal type). The price of the ideal type relative to the actual type (holding constant quantity) can then be written as $p^* / p = \lambda T$. In this case, lambda is the "depreciation rate".

Specific examples of goods with this property may be useful here. Toy manufactures generally do not know in advance which toys will emerge from among hundreds of competitors to capture the hearts and minds of children during the holiday gift-giving season. The "ideal" types (Tickle me Elmos, and Cabbage Patch Kids come to mind) command price premia over the non-ideal types. As firms near the holidays, they receive market signals (product reviews, early sales) about the ideal type, and can adjust accordingly. High fashion apparel is another example where ideal characteristics are difficult to discern well in advance, and firms must produce (and ship) much closer to sales dates.

Two products that exhibit extreme time sensitivity due to depreciation of this sort are newspapers and personal computers. News must be manufactured (reported) very close to its consumption date to have any value at all, and not coincidentally, newspapers were among the very first goods to be imported via air shipment. The current practice for many personal computer manufacturers is to allow no time between purchase and manufacture, and therefore no depreciation rate. Standardized packages do not appeal to many consumers who are willing to pay more for a customized good that is manufactured to particular specifications (larger screen, more memory). So manufacturers simply do not build the computer until they know the precise ideal characteristics, and thereafter the customized build is over-nighted.

Combining the interest rate with the depreciation rate, we have a per day time cost $\tau^k = (r + \delta^k) p^k$. Using this in the modal choice decision (conditional on exporting from importer i) we have

(5) $$(f_{iA}^k - f_{io}^k) - (r + \delta^k) p^k (T_{io} - T_{iA}) + (\varepsilon_{iA}^k - \varepsilon_{io}^k) < 0$$

Recall that the freight rates are described in terms of the quantity of the good to be sold. Holding quantity units constant, time costs are weighted more heavily for higher priced goods as both the interest and depreciation charges are expressed relative to the value of the good. When comparing time costs across goods with varying units, it is convenient to divide through by prices to express this equation in ad-valorem terms

(6) $$(\frac{f_{iA}^k}{p^k} - \frac{f_{io}^k}{p^k}) - (r + \delta^k)(T_{io} - T_{iA}) + (\frac{\varepsilon_{iA}^k}{p^k} - \frac{\varepsilon_{io}^k}{p^k}) < 0$$

Time costs are magnified in the presence of fragmented production -- multi-stage production arrangements where dispersed plants link sequentially to complete a final good. To understand this, realize that time costs for first stage value-added begin to accumulate immediately and do not stop until the final good is sold. As a result, for *n* stages of production, the first stage value added pays time costs *n* times, second stage value added pays time costs *(n-1)* times…until last stage value added pays the cost only for the last voyage. That is, value added (V) in stage c faces transport time after each stage $j \geq c$, so that time costs over the whole system are

(7) $$\tau^S = \sum_{c=1}^{n} V_c \sum_{j=c}^{n} (r + \delta_c) T_j$$

To simplify, if *r* and δ are the same for each stage this can be rewritten as price of the good at each stage (equal to the sum of value added to that point) multiplied by the time cost at that stage.

(8) $$\tau^S = (r + \delta) \sum_{c=1}^{n} p_c T_c$$

This indicates that the importance of time savings in transport rises with each stage because the time savings accrue to successively larger amounts of value-added. This suggests that higher prices in equation (5) can be interpreted as greater cumulative value-added rather than, say, higher quality. However, if the modal decision is described in ad-valorem terms, as in equation (6), the time savings decision is based entirely on modal optimality at the margin. In other words, the estimates to follow identify marginal time costs, but the time costs over an entire fragmented system may be much larger. A back of the envelope calculation based on this point is contained in section V.

As a final note in this section, the preceding interest rate and depreciation stories emphasize time costs that arise from lengthy shipping times, not costs due to variability in arrival times. This focus is guided by data constraints, not because variability is unimportant. Indeed, arrival time variability is a potentially serious cost, especially in the face of fragmented production. The absence of key components can idle an entire assembly plant, which increases the optimal inventory on-hand necessary to accommodate arrival time variation. The costs of defects in component quality are also magnified, as sizable inventories (at the plant, in transit) may be built up before defects are detected. The defect problem motivates "just-in-time" inventory techniques, which aim to minimize both the inventory on-hand and in the pipeline. Studies of JIT indicate some plants hold only a few hours of component inventory.[7] Clearly, the ability to implement a "just-in-time" strategy is limited when parts suppliers are a month of ocean transit time removed from the assembly plant.

In the econometric work to follow, only data on shipment length are available. However, if arrival variability is correlated with shipment length, the estimates should pick up time costs associated with variability as well.

III. Econometric Specification

Section II suggests two principal ways in which time costs may affect trade. Equation (4) indicates that firms with time sensitive goods (high τ) will, other things equal, not produce for export in countries with high levels of time costs (i.e. where ocean

[7] See Womack, et al (1990).

shipping is especially lengthy and air shipping is very expensive). Equation (6) indicates that, conditional on the exporting country, firms will choose air shipping when the time savings from air shipping exceed the price premium charged for it.

The overall effect of time as a trade barrier shows up both in the country selection effect and in the modal choice decision. In order to capture both effects, I employ a selection corrected probit model in modal choice.[8] The first stage determines the probability that country i will export a positive quantity of good k to the United States as a function of underlying location characteristics. The second stage determines the probability that air is chosen as the transport mode, conditional on country i exporting to the US.

I implement equation (4) by estimating the probability that country i exports commodity k to the US in 1998, as a function of production costs, and the freight and time costs of the optimal mode. Production costs are captured by a vector of endowments including labor, capital, and human capital. The optimal mode for each country x commodity is not observed for countries that do not trade. Accordingly, freight costs are captured by distance shipped, a significant determinant of both air and ocean freight rates. Time costs are captured by ocean shipping times.

$$(9)\ P_{ik}(T_i^k > 0) = \beta_1 DAYS_{ip} + \beta_1 \ln DIST_{ip} + \ln L_i + \ln K_i / Y_i + \ln H_i / L_i + \ln TFP_i$$

[8] In principal, one could alternatively employ a nested logit structure. The first level alternative is the choice of specific exporting country. The second level alternative, conditional on exporter, is modal choice. This structure is not employed for two reasons. First, it would be computationally intractable to include as specific first stage options each of the more than 200 countries that export to the US in 1998. Second, the reasons why Germany rather than Mozambique is chosen as an exporter are less interesting

The trade data contain exporter x US entry port x 10-digit Harmonized System detail. Estimates are conducted separately for each 2-digit SITC commodity group, with all exporter x US entry port x 10-digit HS commodity detail retained. This is equivalent to treating each import record as an observation on a separate firm. Estimates are conducted both with and without 5-digit SITC fixed effects.

Distances and travel days are calculated using exporter x US entry port information. Zero trade value observations are created corresponding to cases where the value of trade is zero for any exporter x 10-digit HS code. Distances and travel days for the zero trade values are calculated relative to the nearest US port.

Conditional on trade being observed from an exporter, the probability that air transport is chosen as

$$(10) \qquad P_{ik}(m_i^k = air \mid T_i^k > 0) = \alpha_k \left(\frac{f_{iA}^k}{p} - \frac{f_{io}^k}{p}\right) + \alpha_k \tau_k \cdot T_{io} + X_k + \varepsilon_{ik}$$

The data on freight rates are discussed in detail in the next sub-section. Data on shipping times are only available for ocean freight. On the assumption that air freight can reach any worldwide destination within one day, the included variable is simply ocean shipping less one day.

This model differs from equation (3) in the inclusion of a modal substitutability parameter, α. This parameter describes the rate at which a higher air freight premia lowers the probability that air shipping is selected. The coefficient on shipping times

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than the characteristics of Germany relative to Mozambique. This is the flavor of the selection corrected probit.

includes both the per day time cost, τ, and the modal substitutability parameter. Multiplying shipment times by the per day time cost yields the time cost of (longer) ocean shipping in ad-valorem terms, equivalent to the included freight rates. Multiplying by the modal substitution parameter converts this value into the probability that air shipping is selected. This specification is very handy in that combining the estimated coefficients on air freight premia and ocean time costs yields the per day time cost. The usual problem with interpreting probits is that the marginal probabilities are non-constant over the probability distribution. However, the relationship between time and freight rates is constant. As an example, suppose that 5 extra days corresponds to a 2% freight premium. While the effect of 5 additional days (or 2% higher rates) on the probability of choosing the air transport mode varies over the distribution, the effect of 5 days relative to a 2% freight premium is constant throughout.

Note that this estimation uses variation across all 3 dimensions (exporter x US entry port x 10 digit HS cateogry within a 2-digit category) to identify the price/speed trade-off. This modeling choice is employed because there are typically very few exporters in any narrowly defined good, and this precludes identification. Moreover, variation in characteristics (weight, bulk) across goods provides needed variability in freight rates.

To assuage concerns about pooling over a too-large grouping of goods, estimates are performed both with and without 5-digit SITC fixed effects. The argument for employing the fixed effects is that goods within a 2-digit classification may exhibit significant heterogeneity in the probability of employing air transport for reasons outside the model. Of course, heterogeneity within 2-digit classifications also creates variation in the air freight premium. For example, within office machinery, laptop computers are always air shipped while large copying machines are generally ocean shipped. This choice is driven by the relative air/ocean freight rates of the two goods and provides precisely the sort of variation the model calls for to identify time costs. Including lower level fixed effects in this case completely eliminates the useful variation in the data.

It is certainly the case that pooling over a larger set of goods will lead to a lower modal substitution value, alpha. However, since alpha appears in both the air freight premium and shipping time coefficients, examining the ratio of these coefficients eliminates this problem. Accordingly, results are presented both ways to allow the reader their preferred specification.

Data

Three essential pieces of information are necessary for this exercise -- modal choice, prices, and shipping times. Data on ocean shipping times are derived from a master schedule of shipping for 1999 taken from www.shipguide.com. This shipping schedule describes all departures and arrivals of all commercial vessels operating worldwide in this period. From this, I construct a matrix of shipping times between all ports everywhere in the world and all US entry ports. Several modifications are necessary. First, direct shipments are not available for every port-port combination (Tunis does not ship directly to Houston). In these cases, I calculate all possible combinations of indirect routings (Tunis to Rotterdam to Houston; Tunis to Rio to Houston and so on) and take the minimum shipment time available through these routings. Second, there are generally multiple ports within each origin country. In this section, a within-country average of shipment time from these ports is employed. Because US data include entry port detail, these are combined with destination-port specific arrival times.

Some other complications are not currently pursued. Shipping times for developing countries exhibit three interesting characteristics. First, these countries are, on average, further away from destination markets and have longer distance related shipping times. Second, shipping volumes for these countries are smaller and so a larger number of stops is required to fill a vessel. These characteristics are accounted for in the shipping schedule. Third, the frequency of visits is much lower. Ships arrive from Japan daily while ships arrive from Africa every 15 days. Put another way, if a shipment is ready to leave on March 1 but the next available vessel does not arrive for two weeks, the effective shipping time is the time-on-vessel plus the arrival lag. Of course, production timing for certain goods may then be adjusted endogenously to accommodate the shipping lag. This problem becomes quite complicated and has been ignored in this draft.

Data on modal choice and prices are taken from US Census, "Imports of Merchandise" CD-ROMs. These data include, for the 1974-1998 period, the value (V), weight (W), freight and insurance charges (F) by transport mode (m=sea,air) for US imports with detail by commodity groups (k), exporter (j) , and district of entry (i). Commodities are defined according the 10-digit Harmonized System, or roughly 15,000 categories.[9] That is, I observe $V_{ijk}^{m}, W_{ijk}^{m}, F_{ijk}^{m}$ for approximately one million records per year. This is not quite shipment level data, meaning that I observe some aggregation over several unique shipments within a (ijk) commodity x exporter x entry district record.

[9] Prior to 1989 the commodity classification is TSUSA which maps reasonably well into HS.

While shipment-level data will always have a unique transport mode, these somewhat more aggregated data may include both modes.

This creates a potential problem in that modal detail in the data is not purely binary (0,1 – air,sea). An alternative approach to the probit model is to use a share equation, in which the value share of goods moved via each mode is explained by relative rates, time, and country and commodity characteristics. I have chosen not to employ the share approach for several reasons. When employing maximum available detail, roughly 95% of all records are binary, either all sea or all air shipping. For the remaining 5% of the observations, the weight/value ratio for the sea-shipped goods is many times higher than that ratio for air-shipped goods. This suggests either data entry errors (perhaps mis-coding the commodity) for the 5%, or meaningful but unobservable within-commodity heterogeneity. As the cost of discarding these data consists of losing a small portion of a very large dataset (one million plus observations in each year), I restrict my attention to records with a single transportation mode.

Another problem posed by these data is that freight rates are only available for the mode actually chosen by the exporter. This means that I must first use available data to predict what the air or sea freight rate *would have been* had that transport mode been chosen. Then I use the predicted rates to estimate the effect of air v. sea shipping costs on the modal choice.

The base model for freight rates, estimated separately for air and ocean shipping in each 2-digit SITC category, relates the total freight bill to importer and commodity intercepts, the weight and value of the shipment, and the distance it travels.

$$\ln F_{ijk} = a + a_j + a_k + \beta_1 \ln WGT_{ijk} + \beta_2 \ln V_{ijk} + \beta_3 \ln DIST_{ij} + e_{ijk} \quad (11)$$

Dividing the predicted total freight bill for the shipment by the shipment's (observed) value yields the ad-valorem freight rates firms would have faced had the chosen the alternative mode.

Because the construction of these data are critical to the empirical exercise, I applied several robustness checks to these estimates and experimented with different functional forms. First, the transportation technology for a particular vessel is almost certainly affine in distance. The vessel incurs some fixed costs of loading and unloading and marginal costs (fuel, manning) that are very nearly linear in distance. However, this shape is difficult to identify because the shipping fleet is very heterogeneous, with small vessels (low fixed costs, high marginal costs) used for short hauls, and larger vessels (larger fixed costs, lower marginal costs) used for longer hauls. The data do not distinguish vessel type and so I observe a lower envelope of vessel costs. Attempts to identify this shape with functional forms that allow non-zero fixed costs or splines result in poor fit and nonsensical results.[10]

Second, data censoring may result in inconsistent estimates of parameters in equation (3). Suppose that at any range of distance there is a set of available goods from which an importer may select, and these goods exhibit some unobserved heterogeneity in their ad-valorem freight rates. At short distances, freight rates are sufficiently low that importers buy all available goods. However, at longer distances freight rates may rise so as to prohibit trade entirely, and I will not observe these rates in the trade data. The censoring may bias OLS estimates of the freight-distance relationship downward and so a Heckman selection model is employed. The first step estimates a probit where the

[10] Spline estimates, for example, yield line segments that are sharply decreasing in distance, or non-concave in distance.

dependent variable is an indicator for bilateral trade (0 if no trade takes places using mode m, between importer i and exporter j in commodity k, and 1 otherwise). Independent variables include importer and exporter intercepts, distance shipped, and as an exogenous variable, the tariff rate that would be applied to that flow.

Third, a more pernicious sort of selection cannot be corrected through the Heckman estimation. Suppose that the true freight rate for an ijkm observation is idiosyncratically high in a way that is not predicted by the freight rate regressors. However, the modal choice is unobserved precisely because it is idiosyncratically high (and the other transport mode is chosen). This problem cannot be solved, but I can sign the bias it imparts. If the unchosen mode has idiosyncratically high costs then, c.p., our predicted rates will understate the true cost gap between the modes. The true value of alpha will be biased downward, and by construction the value of tau will be biased upward.

The only response to this problem is to fit the freight rates as precisely as possible. Results of these regressions are collected in appendix Table A-1. The ocean regressions typically explain 70-90 percent of the observed variation. Air freight rates are noisier, especially for commodity categories where air is infrequently chosen. For manufactures, air freight regressions typically explain 60-80 percent of the variation.

IV. Results

Table 1 reports summary statistics for the included variables for each 2-digit SITC code. For SITC categories 0-4 (commodities) trade is observed for an average of 20 percent of observations; for SITC 5-8 (manufactures) trade is observed for nearly half. Air shipping is more commonly chosen for manufactures, comprising half of observed shipments, compared to one-quarter of commodity shipments. The median values of air freight relative to ocean freight rates for each commodity group are also reported in Table 1.[11] Air rates are typically 2.5 times higher than ocean rates, a premium equal to around 25 percent of the value of the good being shipped.

Table 2 reports estimation of equation (9), the probability that trade is observed conditional on costs, distance shipped, and shipment days. Included cost variables are strongly correlated with the probability of shipping. The probability of observing trade is significantly decreasing in shipment days for all but 6 bulk materials categories (cork and wood, pulp and waste, natural gas, coal, animal oils, and fertilizers). The reported magnitudes indicate the effect of marginal changes of the included variables on the probability of trade at the variable means. The effects are sizable. Increasing shipment length by one day reduces the probability of trade by an average of one percent. Restricting our attention to goods in SITC 7 and 8, shipment length decreases the probability of observing trade by 1.5 percent.

These effects are conditional on shipment distance, which also enters significantly in most of the regressions. However, the expected sign is reversed (greater distance increases the probability of trade) for most commodities, and the magnitudes are very small. Increasing distance by 1000 kilometers increases the probability of shipping manufactures by 0.02 percent.

[11] Medians are used rather than means because some predicted values (e.g. air freight rates for shipping iron ore) are enormous outliers.

There are two margins that shipping time may operate on. The first is a pure partner selection effect. If a country experiences long shipping lags to the United States it is much less likely to ship to the US. This may lead to general equilibrium effects in which countries that are long shipping lags away from large markets simply do not produce time sensitive goods. Disentangling these margins requires data for multiple importers and is left for future research.

Tables 3 and 4 report estimates of equation . Table 3 reports probit estimates with 5-digit commodity specific effects. The left half of the table reports regressions that ignore partner selection; the right half reports results that include a selection correction. Coefficients on rates (air freight premium) and shipment days are included, as well as the ratio of these two, which indicates estimates of the per day time cost. Recall that the model predicts that air shipping is more likely to be chosen when air shipping is relatively inexpensive and when ocean shipping is relatively lengthy. There are a great many numbers in these tables, but several important patterns are evident.

First, this model poorly describes mode selection for commodity categories (SITC 0 – 4). Higher air freight rates lead to a lower probability that air is chosen for fewer than a third of the regressions. In the regressions with no selection correction, increased ocean shipment days decrease the probability of air shipment in most cases. This puzzling result is reversed by the selection correction, but the positive magnitudes in these regressions are not significant.

Second, considering categories SITC 5 and 6 (chemicals and simple manufactures classified by materials) a higher air premium does lead to strong substitution away from air shipping. However, shipment days are not strong predictors of air shipping. Focusing on selection corrected estimates, ocean shipment days insignificantly affect air shipping in half the cases, with the remaining half split evenly between positive and negative significant effects.

Third, the model appears to work very well for SITC categories 7 (machinery) and 8 (miscellaneous manufactures). Higher air premium strongly predict lower air shipping in all categories, and longer ocean shipment days predict higher air shipping in all but a few cases. Turning to the estimated time cost for those categories where rates and days are significant and of the right sign, we find time costs around 0.4 percent per day. That is, the average ocean travel time of 20 days corresponds to an 8 percent tariff.

Table 4 reports selection corrected probits omitting commodity fixed effects. This has the effect of allowing commodity heterogeneity in freight rates within each 2-digit classification to better explain the air/ocean choice. The Table 3 fixed effects regressions entirely eliminate this variation from the data, whereas Table 4 exploits it.

Results for commodities 0-6 are qualitatively similar to Table 3, and so are not reported here. In SITC 7 and 8, not controlling for within category heterogeneity affects the estimates in two ways. First, the coefficients on the air freight premium are generally lower than the Table 3 estimates, while the coefficients on ocean shipment days are generally higher. The combined effect doubles the estimated time cost, to an average of 0.8 percent ad-valorem per day. That is, a 20 day ocean voyage imposes costs equal to a 16 percent tariff on these goods.

Precisely identifying the source of time costs is an exercise left to future work. However, it is instructive to note that the largest measured effect comes in office machinery, a category where the depreciation argument for time savings seems especially strong. Each day in transit is worth 2.2 percent of the value of the good being shipped. Suppose the only costs associated with shipping were the capital costs for the goods during the time they are on the ocean vessel. The per-day cost should then be the prevailing interest rate divided by 365. Using a 6.26 percent interest rate (the average US T-bill rate in this year), we have a daily cost of .017 percent ad-valorem, roughly 130 times smaller than the measured cost.

V. Effects on Trade and Integration: back of the envelope

How does time affect trade and integration? The effects of time as a bilateral trade barrier were demonstrated in section IV: shipping time strongly affects both the selection of trading partners and raises the ad-valorem costs of trade conditional on selection. Time may also play a role in explaining the extent and composition of trade growth. Hummels (2000) shows that ocean shipping prices have been constant or increasing in the post-war era while air shipping prices have dropped precipitously, nearly 6 percent per annum in real terms.

What is the benefit of declining air transport rates, measured in terms of the ad-valorem tariff equivalent reduction? It is clearly less than the 6 percent per annum reduction in rates; there is imperfect substitutability between air and ocean transport and declining air freight rates are not relevant to goods that are never air-shipped. The estimates in the preceding section provide a simple way to calculate the benefit.

From 1950-1998 the share of US trade (excluding Canada and Mexico) that is air-shipped rises from (approximately) 0 % to 50%. In addition, the introduction of containerization in the late 1960s and 1970s results in a doubling of the average ocean fleet speed. Finally, in 1998 the average shipment time for ocean shipped goods was 20 days. These facts allow a calculation of the decrease in the number of shipping days over the past 50 years (holding constant the commodity and partner composition of trade).

1998: shipping days = ocean share * ocean days + air share * air days (1)

= .5 * 20 days + .5 * 1 day = 10.5 days

1950: shipping days = 40 days (100% ocean share and double shipping time)

This results in an average saving of 29.5 days. Evaluated at an average cost per day of 0.5% ad-valorem, the advent of relatively cheap fast shipping is equivalent to reducing tariffs from 20% to 5.2%. However, these effects are far from uniform. Time savings appear to be valued only for SITC categories 7 and 8, where the average effect is 0.8 percent ad-valorem per day. For these categories falling air shipping costs are equivalent to reducing tariffs from 32% to 9%.

If air shipping prices play an important role in trade growth, we would expect it to occur primarily through compositional effects. Table 5 shows the shares of SITC categories for the US and the world, and the change in those category shares over the last 30 years. The share of SITC categories 0-4 and 6, which exhibit no value for time savings, have shrunk considerably. SITC 7 and 8, with a large value for time savings, have grown dramatically.

Finally, recall that equation (5) and the estimates based on it describe the optimal modal choice for the good at the margin. However, the cumulative time costs over the entire finished product are much larger for fragmented production. Consider a simple example. Let production be divided into n stages, each of which adds 1/n of the final good's total value added, p. Assume the ocean travel time is 21 days, air shipping time is one day, and time costs (r+d) are equal to 0.8 percent of each stage's value added per day. We can write the time costs for ocean transport relative to air travel over the entire system as

$$\tau_o^S - \tau_a^S = (r+\delta)\cdot(T_o - T_a)\sum_{c=1}^{n} p_n = 0.8(20)\sum_{c=1}^{n} p_n$$

For n=1 this amounts to 16% of the price of the final good. For n=2, 24%; for n=3, 32%, for n=4, 40%.

V. Conclusions and Future Directions

Each day of increased ocean transit time between two countries reduces the probability of trade by 1 percent (all goods) to 1.5 percent (manufactures). Conditional on the exporter, I find that modal selection reveals no time sensitivity for commodity type goods. However, exporters in the largest manufacturing categories exhibit a willingness to pay for time savings equal to 0.8% ad-valorem per day. This means that a average length ocean voyage of 20 days is equivalent to a 16% tariff. This time sensitivity, plus large reductions in the cost of air shipping over time, may play a significant role in the extent and composition of trade growth. Back of the envelope calculations suggest that air shipping cost declines are equivalent to reducing tariffs on manufactured goods from 32% to 9% ad-valorem. Moreover, these costs are significantly magnified in the presence of fragmented production.

This work leaves open several interesting future avenues for research. The first is to go beyond back of the envelope calculations and directly assess the role of time costs and air shipping in trade growth. In addition to the growth of manufactured goods trade, there are several additional margins that may matter. Extremely time sensitive goods may not be traded at all in periods in which air transport is more expensive, and countries may be entirely precluded from certain distant export markets. This suggests that the availability of cheap air-freight may be responsible for the introduction of "new" goods to international trade. This is noteworthy because the welfare gains from introduction of "new" goods can be much greater than the welfare gains associated with marginal increases in trade volumes for existing goods.[12] Future research focused on why new goods are introduced may point to even greater welfare gains from cheap air transport – both in the time series, and in the cross-section.

[12] See Romer (1994).

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Table 1 -- Summary Statistics

SITC Categories		Observations			Air / Ocean Freight Premium		Mean Days in Transit		
Code	Name	Total	Trade > 0 (% of obs)	Mode= Air (% of trade obs)	Median Fa - Fo	Median Fa / Fo	Trade Ocean	Trade Air	No Trade
0	Live Animals	4677	8.32	99.74	-0.302	0.273	14.396	18.911	22.654
1	Meat And Meat Products	14917	8.74	19.8	0.215	3.194	24.556	21.509	22.492
2	Dairy Products	15692	6.67	18.62	0.278	3.765	21.180	16.361	22.540
3	Fish	44365	18	26.21	0.288	4.165	20.474	16.335	22.514
4	Cereals	12688	26	10.61	0.288	3.550	20.344	17.718	22.710
5	Vegetables And Fruits	63193	19.56	11.34	0.388	5.616	19.985	16.460	22.704
6	Sugars, Sugar Prep	7447	26.2	11.84	0.304	4.058	20.069	17.377	22.786
7	Coffee, Tea	16218	31.47	18.48	0.253	3.530	20.194	18.017	22.833
8	Feeding Stuff	5595	7.36	21.84	-0.005	0.980	19.877	17.506	22.633
9	Misc food products	13146	24.74	16.21	0.342	4.417	19.013	17.840	22.776
11	Beverages	15276	49.41	6.76	0.188	2.526	18.956	17.466	22.995
12	Tobacco	8496	15.65	45.49	0.177	2.505	18.198	13.382	22.637
21	Hides, Skins	3692	11.4	73.87	0.082	1.445	22.038	19.348	22.741
22	Oil Seeds	3485	11.16	16.45	0.190	2.403	20.284	18.402	22.569
23	Crude Rubber	4090	36.21	20.39	0.272	3.394	20.614	17.526	22.620
24	Cork And Wood	16285	17.98	7	0.014	1.071	21.946	18.214	22.665
25	Pulp And Waste	2382	6.21	4.73	-0.275	0.223	19.422	26.587	22.648
26	Textile Fibers	12164	16.93	32.35	0.246	2.947	21.396	16.938	22.624
27	Crude Fertilize	11885	17.99	29.14	0.051	1.278	19.147	19.756	22.769
28	Metalliferous Ores	10268	15.31	13.8	0.142	2.100	18.017	16.206	22.825
29	Crude Animal n.e.s	21705	26.24	50.33	0.196	2.494	21.245	18.620	22.687
32	Coal, Coke	1051	5.99	4.76	-1.233	0.000	17.925	18.875	22.550
33	Petroleum,	7447	27.45	16.83	0.128	2.034	17.703	17.088	22.870
34	Gas, Natural	1495	6.49	14.43	-0.360	0.131	21.643	15.311	22.474
41	Animal Oils	1776	9.74	32.37	0.209	2.767	19.134	17.884	22.639
42	Vegetable Fats	4694	20.37	11.72	0.291	4.080	22.059	17.932	22.647
43	Animal Or Veget fats	1756	17.2	15.23	0.214	2.842	20.708	16.978	22.806
51	Organic Chemical	99109	17.8	44.39	0.175	2.540	18.118	17.444	22.719
52	Inorganic Chemicals	31217	20.49	31.64	0.189	2.570	17.997	16.914	22.817

Table 1 -- Summary Statistics

SITC Categories		Observations			Air / Ocean Freight Premium		Mean Days in Transit		
Code	Name	Total	Trade > 0	Mode= Air	Median	Median	Trade		No Trade
			(% of obs)	(% of trade obs)	Fa - Fo	Fa / Fo	Ocean	Air	
53	Dyeing, Tanning	20526	35.64	40.43	0.253	3.466	18.228	17.382	22.941
54	Pharmaceuticals	17584	26.13	76.47	0.085	1.632	17.827	17.658	22.978
55	Essential Oils	16067	50.61	51.02	0.164	2.174	18.580	17.902	23.281
56	Fertilizers	2527	11.71	12.84	0.278	3.638	18.364	18.867	22.932
57	Plastics In Primary	15487	51.63	45.94	0.282	3.466	16.933	16.717	23.363
58	Plastics In Nonprimary	18575	62.15	55.05	0.254	3.057	17.829	16.904	23.371
59	Chemical Materials nes	22733	32.37	42.72	0.216	2.881	17.738	17.439	23.031
61	Leather manufactures	12077	45.58	75.06	0.183	2.369	20.565	19.971	22.988
62	Rubber Manufactures	32620	71.33	52.23	0.237	2.841	18.955	17.660	23.299
63	Cork And Wood Manufactures	27423	36.86	25.18	0.192	2.330	21.295	18.862	22.718
64	Paper, Paperboard	28552	39.07	37.58	0.241	3.011	18.108	17.676	23.048
65	Textile Yarn	222027	33.02	63.49	0.210	2.516	20.783	19.044	22.839
66	Nonmetallic Manufactures	62190	55.36	34.06	0.199	2.483	19.796	18.580	23.178
67	Iron And Steel	79414	25.16	18.1	0.301	4.315	19.234	16.625	22.930
68	Nonferrous Metals	31954	27.29	40.28	0.236	3.285	18.281	16.696	22.944
69	Manufactures Of metals nes	120989	63.38	42.11	0.236	3.062	19.181	17.963	23.225
71	Power Generating Machinery	42480	54.57	67.61	0.175	2.465	17.227	17.274	23.218
72	Machinery Specialized	83968	49.48	56.85	0.152	2.193	17.737	17.499	23.144
73	Metalworking Machinery	37475	39.57	54.61	0.135	2.041	17.511	17.365	23.047
74	General Industrial Machinery	129132	66.75	61.06	0.166	2.309	17.481	17.344	23.379
75	Office Machines	35895	72.81	85	0.074	1.516	17.869	18.905	23.319
76	Telecommunications	52604	52.63	70.53	0.109	1.829	18.644	17.895	22.874
77	Electrical Machinery	135297	65.53	73.1	0.128	1.983	17.400	18.198	23.300
78	Road Vehicles	42440	49.55	43.27	0.213	2.881	18.328	17.770	23.025
79	Transport Equip	15353	35.7	75.81	0.041	1.266	18.555	16.975	22.879
81	Prefabricated Buildings	12597	70.57	36.67	0.187	2.373	19.774	18.586	23.533
82	Furniture	39344	81.72	20.48	0.188	2.334	20.523	17.631	23.540
83	Travel Goods	21791	71.66	60.05	0.182	2.274	20.037	19.852	23.189
84	Apparel	256493	51.35	63.86	0.169	2.262	20.669	20.143	22.840
85	Footwear	47572	45.15	54.43	0.194	2.464	20.022	18.714	22.774
87	Scientific Instruments	60739	65.13	80.83	0.078	1.525	17.464	17.469	23.359
88	Photographic Equipment	73193	39.3	72.51	0.155	2.261	17.863	18.901	22.788
89	Miscellaneous Manufactures	151475	66.01	55.79	0.168	2.179	19.146	18.808	23.105

Table 2 -- Location Selection
(Probits on Trade, No Trade)

code	Name	days	dist	lnl	lnky	lnhl	lntfp	obs	adj R2
0	Live Animals	-0.0001	-1.32E-06 [b]	0.008 [a]	-0.030 [a]	0.066 [a]	0.01069 [a]	3387	0.42
1	Meat And Meat Products	0.0040 [a]	-3.69E-06 [a]	0.012 [a]	0.038 [a]	0.203 [a]	0.051598 [a]	10683	0.32
2	Dairy Products	0.0020 [a]	-2.96E-06 [a]	0.012 [a]	0.069 [a]	0.106 [a]	0.053356 [a]	11421	0.25
3	Fish	-0.0136 [a]	1.80E-05 [a]	0.060 [a]	-0.032 [c]	0.321 [a]	-0.032838 [a]	33643	0.25
4	Cereals	-0.0082 [a]	1.21E-05 [a]	0.128 [a]	0.156 [a]	0.167 [a]	0.15013 [a]	9640	0.42
5	Vegetables And Fruits	-0.0122 [a]	1.01E-05 [a]	0.088 [a]	0.094 [a]	-0.081 [a]	0.078513 [a]	48003	0.21
6	Sugars, Sugar Prep	-0.0067 [a]	3.43E-06	0.109 [a]	-0.106 [b]	0.304 [a]	0.132594 [a]	5638	0.34
7	Coffee, Tea	-0.0104 [a]	7.01E-06 [a]	0.130 [a]	0.163 [a]	-0.022	0.177081 [a]	12467	0.34
8	Feeding Stuff	-0.0011 [a]	1.70E-06 [a]	0.020 [a]	0.002	0.092 [a]	0.030717 [a]	3645	0.37
9	Misc food products	-0.0180 [a]	2.20E-05 [a]	0.099 [a]	0.093 [a]	0.182 [a]	0.097264 [a]	10067	0.36
11	Beverages	0.0077 [a]	-2.89E-05 [a]	0.165 [a]	0.671 [a]	0.423 [a]	0.500794 [a]	12423	0.41
12	Tobacco	-0.0109 [a]	1.67E-06	0.059 [a]	0.074 [b]	-0.177 [a]	0.03049 [a]	6422	0.29
21	Hides, Skins	0.0034 [a]	-6.76E-06 [a]	0.059 [a]	0.026	0.195 [a]	0.133979 [a]	2666	0.25
22	Oil Seeds	-0.0040 [a]	3.21E-06	0.052 [a]	-0.120 [a]	0.196 [a]	0.062491 [a]	2399	0.32
23	Crude Rubber	-0.0200 [a]	5.11E-05 [a]	0.190 [a]	0.448 [a]	-0.072	0.31709 [a]	3107	0.46
24	Cork And Wood	-0.0004	3.60E-06 [a]	0.064 [a]	0.119 [a]	-0.062 [a]	0.098869 [a]	12307	0.23
25	Pulp And Waste	0.0014	-1.87E-06	0.024 [a]	0.050 [c]	0.073 [a]	0.05933 [a]	1612	0.22
26	Textile Fibers	0.0022 [a]	-6.91E-07	0.079 [a]	-0.063 [a]	0.413 [a]	0.134881 [a]	9182	0.39
27	Crude Fertilize	0.0026 [a]	-7.68E-06 [a]	0.097 [a]	0.068 [a]	0.224 [a]	0.113159 [a]	8855	0.42
28	Metalliferous Ores	-0.0067 [a]	1.17E-06	0.048 [a]	0.010	0.130 [a]	0.047623 [a]	7553	0.37
29	Crude Animal n.e.s	-0.0090 [a]	1.17E-05 [a]	0.129 [a]	-0.110 [a]	0.483 [a]	0.133234 [a]	16666	0.29
32	Coal, Coke	0.0002	-5.90E-06 [b]	0.030 [a]	-0.046	0.156 [a]	-0.000791	708	0.28
33	Petroleum,	0.0034 [b]	-2.45E-05 [a]	0.127 [a]	0.300 [a]	0.325 [a]	0.219934 [a]	5488	0.42
34	Gas, Natural	0.0003	-9.05E-07 [c]	0.008 [a]	0.016 [c]	0.027 [a]	0.014679 [a]	1120	0.32
41	Animal Oils	-0.0001	2.80E-07	0.005 [a]	0.012 [c]	0.042 [a]	0.013547 [a]	1185	0.54
42	Vegetable Fats	0.0036 [a]	-3.41E-06	0.084 [a]	0.246 [a]	-0.079 [b]	0.167014 [a]	3441	0.50
43	Animal Or Veget fats	-0.0035 [c]	8.86E-06 [a]	0.081 [a]	0.204 [a]	0.085	0.135481 [a]	1310	0.28
51	Organic Chemical	-0.0009 [a]	-1.51E-07	0.071 [a]	0.111 [a]	0.189 [a]	0.08809 [a]	74121	0.47
52	Inorganic Chemicals	-0.0020 [a]	-5.65E-07	0.084 [a]	0.074 [a]	0.251 [a]	0.0935 [a]	23002	0.51
53	Dyeing, Tanning	-0.0084 [a]	2.62E-06	0.258 [a]	0.157 [a]	0.826 [a]	0.306172 [a]	15528	0.55
54	Pharmaceuticals	-0.0015 [b]	-5.09E-06 [a]	0.132 [a]	0.165 [a]	0.550 [a]	0.192947 [a]	13195	0.48
55	Essential Oils	-0.0145 [a]	7.40E-06 [a]	0.263 [a]	0.266 [a]	0.589 [a]	0.440115 [a]	12699	0.53
56	Fertilizers	0.0007	-4.33E-06 [a]	0.032 [a]	-0.001	0.164 [a]	0.038065 [a]	1793	0.44
57	Plastics In Primary	-0.0255 [a]	2.70E-05 [a]	0.364 [a]	0.701 [a]	1.153 [a]	0.77289 [a]	11866	0.67
58	Plastics In Nonprimary	-0.0202 [a]	2.49E-05 [a]	0.273 [a]	0.276 [a]	0.960 [a]	0.525632 [a]	14738	0.61
59	Chemical Materials nes	-0.0071 [a]	6.14E-06 [a]	0.177 [a]	0.305 [a]	0.616 [a]	0.315745 [a]	16971	0.53

Table 2 -- Location Selection
(Probits on Trade, No Trade)

code	Name	days	dist	lnl	lnky	lnhl	lntfp	obs	adj R2
61	Leather manufactures	0.0037 [a]	-1.29E-05 [a]	0.245 [a]	0.160 [a]	0.439 [a]	0.422971 [a]	9740	0.43
62	Rubber Manufactures	-0.0083 [a]	1.45E-05 [a]	0.146 [a]	0.248 [a]	0.466 [a]	0.257821 [a]	26483	0.65
63	Cork And Wood Manufactures	-0.0160 [a]	2.64E-05 [a]	0.176 [a]	0.249 [a]	-0.078 [a]	0.239621 [a]	21506	0.47
64	Paper, Paperboard	-0.0215 [a]	2.35E-05 [a]	0.258 [a]	0.295 [a]	0.899 [a]	0.370188 [a]	22177	0.61
65	Textile Yarn	-0.0077 [a]	1.00E-05 [a]	0.229 [a]	0.188 [a]	0.280 [a]	0.393299 [a]	172930	0.46
66	Nonmetallic Manufactures	-0.0145 [a]	1.74E-05 [a]	0.280 [a]	0.450 [a]	0.474 [a]	0.366447 [a]	50332	0.57
67	Iron And Steel	0.0009 [a]	-1.30E-06 [a]	0.128 [a]	0.209 [a]	0.381 [a]	0.220049 [a]	59767	0.51
68	Nonferrous Metals	-0.0042 [a]	8.11E-07	0.138 [a]	0.182 [a]	0.519 [a]	0.217972 [a]	23674	0.45
69	Manufactures Of metals nes	-0.0159 [a]	2.29E-05 [a]	0.278 [a]	0.133 [a]	0.900 [a]	0.427129 [a]	99030	0.59
71	Power Generating Machinery	-0.0110 [a]	8.34E-06 [a]	0.326 [a]	0.841 [a]	1.213 [a]	0.657369 [a]	32968	0.66
72	Machinery Specialized	-0.0077 [a]	7.06E-06 [a]	0.311 [a]	0.674 [a]	1.208 [a]	0.717239 [a]	64290	0.62
73	Metalworking Machinery	-0.0080 [a]	9.43E-06 [a]	0.255 [a]	0.415 [a]	1.056 [a]	0.477115 [a]	28281	0.63
74	General Industrial Machinery	-0.0091 [a]	9.10E-06 [a]	0.232 [a]	0.514 [a]	0.893 [a]	0.434834 [a]	102093	0.66
75	Office Machines	-0.0098 [a]	2.09E-05 [a]	0.095 [a]	0.263 [a]	0.355 [a]	0.189461 [a]	30541	0.63
76	Telecommunications	-0.0335 [a]	7.11E-05 [a]	0.251 [a]	0.587 [a]	0.973 [a]	0.369752 [a]	43390	0.60
77	Electrical Machinery	-0.0225 [a]	3.72E-05 [a]	0.184 [a]	0.427 [a]	0.637 [a]	0.316592 [a]	110363	0.62
78	Road Vehicles	-0.0164 [a]	2.42E-05 [a]	0.363 [a]	0.289 [a]	1.201 [a]	0.670616 [a]	33297	0.65
79	Transport Equip	-0.0056 [a]	4.10E-06 [c]	0.231 [a]	0.294 [a]	0.997 [a]	0.455582 [a]	11415	0.68
81	Prefabricated Buildings	-0.0115 [a]	9.87E-06 [a]	0.138 [a]	0.043 [c]	0.397 [a]	0.166272 [a]	10747	0.57
82	Furniture	-0.0053 [a]	7.58E-06 [a]	0.051 [a]	0.027 [a]	0.139 [a]	0.060028 [a]	35043	0.54
83	Travel Goods	-0.0135 [a]	1.78E-05 [a]	0.124 [a]	-0.097 [a]	0.172 [a]	0.118202 [a]	18985	0.48
84	Apparel	-0.0282 [a]	4.21E-05 [a]	0.187 [a]	-0.200 [a]	0.024 [a]	0.211926 [a]	211249	0.38
85	Footwear	-0.0299 [a]	3.87E-05 [a]	0.302 [a]	0.514 [a]	-0.110 [a]	0.292531 [a]	38747	0.53
87	Scientific Instruments	-0.0127 [a]	2.08E-05 [a]	0.228 [a]	0.458 [a]	1.005 [a]	0.42069 [a]	48122	0.62
88	Photographic Equipment	-0.0148 [a]	3.14E-05 [a]	0.230 [a]	0.951 [a]	0.755 [a]	0.283263 [a]	57924	0.55
89	Miscellaneous Manufactures	-0.0154 [a]	2.43E-05 [a]	0.173 [a]	0.049 [a]	0.517 [a]	0.213738 [a]	126959	0.55

Table 3. Mode Selection.
(Probits on P(Mode=Air))

Code	Name	No Selection Correction				Selection Corrected		
		Rates	Days	Days/Rate	R2	Rates	Days	Days/Rate
1	Meat And Meat Products	5.845	-0.081	0.014*	0.339	4.183	-0.094	0.023*
		(1.561)	(0.018)			(1.649)	(0.017)	
2	Dairy Products	7.357	-0.063	0.009*	0.246	6.675	-0.066	0.010
		(1.33)	(0.013)					
3	Fish	-1.776	-0.020	-0.011*	0.193	1.071	-0.031	0.029
		(0.611)	(0.005)			(0.665)	(0.005)	
4	Cereals	-0.846	-0.004	-0.004	0.115	-0.548	-0.002	-0.003
		(0.747)	(0.007)			(0.805)	(0.008)	
5	Vegetables And Fruits	-2.611	0.000	0	0.202	-2.991	0.003	0.001
		(0.465)	(0.005)			(0.497)	(0.005)	
6	Sugars, Sugar Prep	-2.237	-0.005	-0.002	0.132	-1.906	0.001	0.000
		(1.156)	(0.009)			(1.063)	(0.009)	
7	Coffee, Tea	-2.000	-0.004	-0.002	0.179	-1.925	-0.003	-0.001
		(0.556)	(0.005)			(0.576)	(0.005)	
8	Feeding Stuff	23.272	-0.005	0	0.453	21.487	0.011	-0.001
		(6.647)	(0.036)			(8.706)	(0.035)	
9	Misc food products	-1.351	-0.005	-0.003	0.096	-1.211	-0.005	-0.004
		(0.421)	(0.006)			(0.438)	(0.006)	
11	Beverages	19.824	-0.007	0	0.434	19.455	-0.003	0.000
		(1.048)	(0.006)			(1.101)	(0.006)	
12	Tobacco	-7.954	-0.010	-0.001	0.214	-9.904	0.003	0.000
		(1.923)	(0.011)			(2.082)	(0.011)	
21	Hides, Skins	18.369	-0.050	0.003	0.457	10.373	-0.037	0.004
		(7.501)	(0.041)			(4.358)	(0.028)	
22	Oil Seeds	-64.746	0.284	0.004	0.585	-66.316	0.315	0.005
		(40.917)	(0.194)			(42.608)	(0.221)	
23	Crude Rubber	12.496	-0.020	0.002	0.433	10.744	0.002	0.000
		(1.316)	(0.016)			(1.471)	(0.018)	
24	Cork And Wood	19.353	0.010	-0.001	0.715	21.793	0.020	-0.001
		(2.345)	(0.018)			(3.215)	(0.021)	
25	Pulp And Waste	12.895	-0.120	0.009	0.532	1.579	-0.005	0.003
		(11.951)	(0.189)					
26	Textile Fibers	11.190	-0.005	0	0.382	10.207	0.001	0.000
		(1.087)	(0.012)			(1.237)	(0.012)	
27	Crude Fertilize	26.064	-0.004	0	0.419	27.101	0.004	0.000
		(2.693)	(0.011)			(3.277)	(0.011)	
28	Metalliferous Ores	2.291	-0.029	0.013	0.202	0.483	0.009	-0.018
		(1.651)	(0.016)			(1.31)	(0.015)	
29	Crude Animal n.e.s	-11.563	0.000	0	0.277	-11.548	0.003	0.000
		(0.732)	(0.004)			(0.755)	(0.005)	
32	Coal, Coke		-2.057	0	1.000	-1.455	0.011	0.007
						(2905.512)	(147.426)	
33	Petroleum,	1.606	-0.020	0.013	0.115	2.642	0.008	-0.003
		(1.116)	(0.013)			(1.098)	(0.014)	
41	Animal Oils	-46.948	0.093	0.002	0.508	-44.110	0.094	0.002
		(11.817)	(0.058)			(12.595)	(0.06)	
42	Vegetable Fats	-0.793	-0.023	-0.028	0.191	0.077	-0.016	0.206
		(1.306)	(0.012)			(1.384)	(0.014)	
43	Animal Or Veget fats	1.612	-0.027	0.017	0.174	1.936	-0.033	0.017
		(1.838)	(0.023)			(1.967)	(0.023)	

Table 3. Mode Selection.
(Probits on P(Mode=Air))

Code	Name	No Selection Correction				Selection Corrected		
		Rates	Days	Days/Rate	R2	Rates	Days	Days/Rate
51	Organic Chemical	0.817	-0.009	0.011*	0.083	0.435	-0.004	0.009
		(0.272)	(0.003)			(0.297)	(0.003)	
52	Inorganic Chemicals	-1.797	-0.020	-0.011*	0.103	-1.581	-0.002	-0.001
		(0.545)	(0.006)			(0.618)	(0.007)	
53	Dyeing, Tanning	-3.154	-0.003	-0.001	0.075	-1.825	0.008	0.004
		(0.4)	(0.004)			(0.451)	(0.004)	
54	Pharmaceuticals	-3.636	0.000	0	0.089	-3.478	0.005	0.001
		(0.548)	(0.007)			(0.597)	(0.008)	
55	Essential Oils	-8.720	0.007	0.001*	0.232	-8.593	0.010	0.001*
		(0.401)	(0.003)			(0.434)	(0.004)	
57	Fertilizers	2.032	-0.011	0.005*	0.097	2.186	0.010	-0.005*
		(0.314)	(0.004)			(0.332)	(0.005)	
58	Plastics In Primary	-2.895	-0.006	-0.002	0.081	-2.776	0.001	0.000
		(0.206)	(0.003)			(0.225)	(0.004)	
59	Plastics In Nonprimary	-3.331	-0.001	0	0.108	-2.855	0.014	0.005*
		(0.437)	(0.005)			(0.496)	(0.006)	
61	Leather manufactures	-1.557	0.002	0.001	0.067	-1.643	0.004	0.002
		(0.466)	(0.004)			(0.491)	(0.005)	
62	Rubber Manufactures	-2.536	-0.002	-0.001	0.114	-2.058	0.001	0.001
		(0.167)	(0.002)			(0.178)	(0.003)	
63	Cork And Wood Manufacture	-2.547	-0.006	-0.002	0.091	-2.057	-0.009	-0.004*
		(0.536)	(0.003)			(0.566)	(0.003)	
64	Paper, Paperboard	-4.357	0.004	0.001	0.112	-3.787	0.013	0.004*
		(0.31)	(0.003)			(0.328)	(0.004)	
65	Textile Yarn	-0.536	-0.008	-0.015*	0.083	-0.386	-0.007	-0.018*
		(0.115)	(0.001)			(0.119)	(0.001)	
66	Nonmetallic Manufactures	-1.181	-0.007	-0.006*	0.096	-0.805	-0.003	-0.004
		(0.217)	(0.002)			(0.228)	(0.002)	
67	Iron And Steel	0.018	-0.029	1.651	0.116	-0.256	-0.017	-0.068
		(0.288)	(0.004)			(0.334)	(0.004)	
68	Nonferrous Metals	-2.199	-0.011	-0.005*	0.116	-2.023	-0.001	0.000
		(0.401)	(0.005)			(0.449)	(0.005)	
69	Manufactures Of metals nes	-5.835	0.010	0.002*	0.143	-5.408	0.013	0.002*
		(0.119)	(0.001)			(0.126)	(0.001)	

Table 3. Mode Selection.
(Probits on P(Mode=Air))

Code	Name	No Selection Correction				Selection Corrected		
		Rates	Days	Days/Rate	R2	Rates	Days	Days/Rate
71	Power Generating Machinery	-4.827	0.010	0.002*	0.119	-4.465	0.015	0.003*
		(0.202)	(0.003)			(0.223)	(0.003)	
72	Machinery Specialized	-8.493	0.019	0.002*	0.204	-7.812	0.022	0.003*
		(0.228)	(0.002)			(0.25)	(0.002)	
73	Metalworking Machinery	-9.248	0.002	0	0.210	-8.292	0.010	0.001
		(0.471)	(0.004)			(0.591)	(0.014)	
74	General Industrial Machinery	-6.248	0.015	0.002*	0.131	-5.501	0.020	0.004*
		(0.125)	(0.001)			(0.136)	(0.002)	
75	Office Machines	-7.067	0.022	0.003*	0.133	-6.677	0.028	0.004*
		(0.313)	(0.003)			(0.321)	(0.004)	
76	Telecommunications	-4.776	0.010	0.002*	0.104	-4.347	0.015	0.004*
		(0.24)	(0.003)			(0.243)	(0.003)	
77	Electrical Machinery	-6.870	0.013	0.002*	0.163	-6.412	0.016	0.002*
		(0.135)	(0.002)			(0.142)	(0.002)	
78	Road Vehicles	-5.086	0.014	0.003*	0.090	-4.293	0.014	0.003*
		(0.241)	(0.002)			(0.258)	(0.002)	
79	Transport Equip	-7.652	0.011	0.001	0.265	-6.892	0.017	0.002*
		(0.918)	(0.007)			(0.949)	(0.007)	
81	Prefabricated Buildings	-4.870	0.013	0.003*	0.110	-4.644	0.016	0.004*
		(0.337)	(0.003)			(0.348)	(0.003)	
82	Furniture	-2.780	-0.011	-0.004*	0.110	-2.559	-0.011	-0.004*
		(0.233)	(0.002)			(0.242)	(0.002)	
83	Travel Goods	-2.147	0.014	0.006*	0.056	-1.899	0.016	0.008*
		(0.196)	(0.002)			(0.199)	(0.002)	
84	Apparel	-1.325	0.002	0.001*	0.033	-1.241	0.000	0.000
		(0.113)	(0.001)			(0.114)	(0.001)	
85	Footwear	6.313	0.002	0	0.119	6.762	-0.001	0.000
		(0.264)	(0.002)			(0.272)	(0.002)	
87	Scientific Instruments	-7.285	0.013	0.002*	0.148	-6.451	0.013	0.002*
		(0.232)	(0.003)			(0.246)	(0.003)	
88	Photographic Equipment	-3.122	0.012	0.004*	0.096	-2.720	0.020	0.007*
		(0.276)	(0.003)			(0.285)	(0.003)	
89	Miscellaneous Manufactures	-3.129	0.010	0.003*	0.098	-2.853	0.012	0.004*
		(0.107)	(0.001)			(0.112)	(0.001)	

Table 4 -- Modal Selection
Selection corrected probit P(mode=air); no commodity fixed effects

Code	Name	Correlated		
		Rates	Days	Days/Rate
51	Organic Chemical	-2.642 (0.087)	-0.002 (0.003)	-0.001
52	Inorganic Chemicals	-2.052 (0.126)	0.007 (0.006)	0.004
53	Dyeing, Tanning	-2.650 (0.13)	0.003 (0.004)	0.001
54	Pharmaceuticals	-1.465 (0.171)	-0.001 (0.007)	-0.001
55	Essential Oils	-1.760 (0.087)	-0.001 (0.003)	0.000
57	Fertilizers	-2.180 (0.103)	0.013 (0.006)	0.006*
58	Plastics In Primary	-1.943 (0.071)	0.004 (0.004)	0.002
59	Plastics In Nonprimary	-2.252 (0.118)	0.010 (0.006)	0.005*
61	Leather manufactures	-0.954 (0.105)	0.001 (0.004)	0.001
62	Rubber Manufactures	-1.552 (0.048)	0.001 (0.003)	0.000
63	Cork And Wood Manufactures	-2.753 (0.099)	-0.005 (0.003)	-0.002
64	Paper, Paperboard	-2.089 (0.078)	0.019 (0.004)	0.009*
65	Textile Yarn	-1.557 (0.03)	-0.007 (0.001)	-0.005*
66	Nonmetallic Manufactures	-2.475 (0.051)	-0.005 (0.002)	-0.002*
67	Iron And Steel	-3.066 (0.114)	-0.004 (0.005)	-0.001
68	Nonferrous Metals	-2.526 (0.126)	-0.006 (0.006)	-0.002
69	Manufactures Of metals nes	-2.311 (0.033)	0.004 (0.001)	0.002*

Table 4 -- Modal Selection
Selection corrected probit P(mode=air); no commodity fixed effects

Code	Name	Correlated		
		Rates	Days	Days/Rate
71	Power Generating Machinery	-1.566 (0.063)	0.013 (0.003)	0.008*
72	Machinery Specialized	-2.140 (0.05)	0.003 (0.002)	0.001
73	Metalworking Machinery	-1.905 (0.084)	0.003 (0.004)	0.001
74	General Industrial Machinery	-1.683 (0.031)	0.012 (0.002)	0.007*
75	Office Machines	-0.833 (0.054)	0.018 (0.003)	0.022*
76	Telecommunications	-1.816 (0.058)	0.006 (0.003)	0.004*
77	Electrical Machinery	-1.238 (0.031)	0.013 (0.002)	0.011*
78	Road Vehicles	-1.778 (0.052)	0.016 (0.002)	0.009*
79	Transport Equip	-0.963 (0.116)	0.009 (0.006)	0.009
81	Prefabricated Buildings	-2.671 (0.096)	0.016 (0.004)	0.006*
82	Furniture	-2.480 (0.054)	-0.008 (0.002)	-0.003*
83	Travel Goods	-1.380 (0.053)	0.015 (0.002)	0.011*
84	Apparel	-1.538 (0.023)	0.003 (0.001)	0.002*
85	Footwear	-2.037 (0.06)	0.007 (0.002)	0.003*
87	Scientific Instruments	-0.830 (0.054)	0.006 (0.003)	0.007*
88	Photographic Equipment	-1.034 (0.057)	0.021 (0.003)	0.02*
89	Miscellaneous Manufactures	-1.594 (0.024)	0.008 (0.001)	0.005*

Table 5 -- Composition of Trade Growth
(Value Shares by Category)

SITC	Commodity	US Imports 1969	US Imports 1998	US Imports % Change 1969-95	World Imports 1970	World Imports 1997	World Imports % Change 1970-1997
0	Food & Live Animals	12.3	3.7	-70.3	11.2	6.5	-42.4
1	Beverages & Tobacco	2.4	0.8	-65.3	1.3	1.1	-15.1
2	Crude Materials	9.8	2.3	-76.1	9.5	3.6	-62.2
3	Mineral Fuels	8.2	5.9	-28.3	8.7	7.5	-14.1
4	Animal & Vegetable Oils	0.4	0.2	-55.4	0.7	0.5	-34.7
5	Chemicals	3.0	6.1	99.7	6.8	8.9	31.1
6	Manufactures (by material)	23.0	11.6	-49.7	19.8	14.9	-24.7
7	Machinery & Transport Equip	26.8	46.1	71.6	26.0	38.7	48.8
8	Misc Manufactures	10.5	17.9	70.3	8.0	13.1	62.4

Table A-1
Regressions Used to Predict Air/Ocean Freight Rates

SITC Code	Description	Air Freight Rate Regressions weight	value	dist	airshare	obs	Adj R2	Ocean Freight Rate Regressions weight	value	dist	airshare	obs	Adj R2
00	Live Animals	0.62	0.31	0.30	-0.03	386	0.72	-0.78	2.58		-2.33	4	.
01	Meat And Meat Products	0.42	0.55	0.93	0.05	258	0.77	0.39	0.56	0.09	-0.09	1129	0.89
02	Dairy Products	0.44	0.47	0.60	-0.33	193	0.75	0.23	0.70	0.11	0.00	909	0.85
03	Fish	0.50	0.47	0.45	0.02	2092	0.86	0.49	0.45	0.03	-0.08	6176	0.88
04	Cereals	0.53	0.41	0.48	0.03	350	0.57	0.36	0.59	0.13	-0.06	3086	0.84
05	Vegetables And Fruits	0.62	0.37	0.42	0.00	1401	0.87	0.49	0.48	0.07	-0.10	11258	0.87
06	Sugars, Sugar Prep	0.39	0.53	0.25	-0.30	230	0.55	0.20	0.72	0.05	-0.16	1799	0.88
07	Coffee, Tea	0.46	0.43	0.24	-0.04	941	0.59	0.25	0.66	0.18	-0.08	4454	0.87
08	Feeding Stuff	0.10	0.66	0.40	-0.32	90	0.23	0.41	0.46	0.07	-0.31	330	0.80
09	Misc food products	0.49	0.33	0.35	0.05	526	0.59	0.31	0.62	0.13	-0.07	2896	0.78
11	Beverages	0.45	0.44	0.18	0.13	510	0.49	0.49	0.47	0.12	-0.05	7247	0.78
12	Tobacco	0.57	0.31	0.32	-0.03	604	0.72	0.42	0.41	0.25	-0.07	785	0.80
21	Hides, Skins	0.07	0.58	0.27	-0.12	309	0.54	0.17	0.64	0.15	-0.12	120	0.74
22	Oil Seeds	0.29	0.67	0.68	-0.01	64	0.45	0.35	0.60	-0.07	0.03	328	0.88
23	Crude Rubber	0.37	0.44	0.40	-0.12	302	0.60	0.36	0.50	0.28	-0.10	1237	0.66
24	Cork And Wood	-0.14	0.87	0.05	-0.80	205	0.30	0.33	0.62	0.22	-0.05	2768	0.78
25	Pulp And Waste	1.30	-1.37			7	.	0.53	0.39	-0.21	-0.07	141	0.79
26	Textile Fibers	0.37	0.39	0.08	-0.25	666	0.57	0.41	0.43	0.15	0.03	1479	0.82
27	Crude Fertilize	0.26	0.53	0.27	-0.13	623	0.56	0.33	0.57	0.18	-0.02	1571	0.73
28	Metalliferous Ores	0.47	0.32	0.32	0.36	207	0.71	0.44	0.40	0.00	-0.01	1387	0.78
29	Crude Animal n.e.s	0.50	0.40	0.31	0.01	2859	0.80	0.39	0.51	0.15	-0.02	3293	0.75
32	Coal, Coke	-0.59			-1.05	3	.	0.49	0.38	1.01	-0.51	61	0.70
33	Petroleum,	0.37	0.53	0.27	-0.17	344	0.49	0.26	0.68	0.25	-0.01	1752	0.92
34	Gas, Natural	0.62	-0.40	0.24	0.78	14	0.28	0.22	0.75	0.92	0.09	83	0.74
41	Animal Oils	0.28	0.85	-0.22	0.72	56	0.46	0.20	0.71	-0.44	0.18	133	0.49
42	Vegetable Fats	0.45	0.42	0.20	-0.07	112	0.64	0.25	0.63	0.04	0.00	895	0.83
43	Animal Or Veget fats	0.49	0.15	-0.32	-0.10	46	0.34	0.52	0.39	0.07	0.18	267	0.87
51	Organic Chemical	0.42	0.33	0.41	-0.15	7831	0.69	0.39	0.48	0.19	0.04	10928	0.79
52	Inorganic Chemicals	0.44	0.35	0.27	-0.21	2022	0.67	0.37	0.50	0.05	-0.10	4669	0.77
53	Dyeing, Tanning	0.52	0.36	0.37	-0.19	2955	0.66	0.36	0.52	0.19	-0.03	4991	0.73
54	Pharmaceuticals	0.46	0.32	0.34	-0.09	3431	0.76	0.26	0.57	0.25	-0.09	1365	0.75
55	Essential Oils	0.49	0.45	0.24	-0.10	4139	0.72	0.26	0.65	0.07	-0.04	5019	0.74
56	Fertilizers	0.72	0.52	-0.57	-0.38	38	0.61	0.27	0.61	-0.24	-0.06	259	0.81
57	Plastics In Primary	0.48	0.35	0.24	-0.14	3668	0.63	0.34	0.48	0.12	-0.11	4969	0.73
58	Plastics In Nonprimary	0.54	0.34	0.19	-0.08	6345	0.73	0.30	0.59	0.17	0.00	6297	0.79
59	Chemical Materials nes	0.49	0.35	0.25	-0.18	3141	0.69	0.37	0.51	0.04	-0.14	4697	0.75

Table A-1
Regressions Used to Predict Air/Ocean Freight Rates

SITC		Air Freight Rate Regressions						Ocean Freight Rate Regressions					
Code	Description	weight	value	dist	airshare	obs	Adj R2	weight	value	dist	airshare	obs	Adj R2
61	Leather manufactures	0.40	0.41	0.25	-0.06	4128	0.73	0.26	0.64	0.19	-0.03	1901	0.71
62	Rubber Manufactures	0.47	0.45	0.20	-0.16	12146	0.73	0.28	0.68	0.25	-0.04	13016	0.85
63	Cork And Wood Manufactures	0.46	0.46	0.50	-0.28	2544	0.56	0.40	0.53	0.30	-0.12	8191	0.80
64	Paper, Paperboard	0.58	0.32	0.28	-0.14	4192	0.61	0.37	0.54	0.15	-0.02	7906	0.79
65	Textile Yarn	0.48	0.36	0.22	-0.09	46539	0.75	0.28	0.60	0.15	0.07	33030	0.78
66	Nonmetallic Manufactures	0.47	0.40	0.29	-0.21	11720	0.64	0.39	0.54	0.17	-0.11	25074	0.78
67	Iron And Steel	0.49	0.37	0.33	-0.16	3617	0.63	0.38	0.55	0.13	0.03	16912	0.88
68	Nonferrous Metals	0.49	0.35	0.20	-0.12	3422	0.66	0.26	0.61	0.05	-0.01	5685	0.79
69	Manufactures Of metals nes	0.52	0.38	0.35	-0.18	32280	0.70	0.32	0.61	0.24	-0.08	49817	0.78
71	Power Generating Machinery	0.54	0.32	0.29	-0.05	15663	0.70	0.24	0.68	0.24	-0.02	9105	0.75
72	Machinery Specialized	0.56	0.31	0.29	-0.13	23611	0.70	0.34	0.52	0.11	-0.08	21035	0.74
73	Metalworking Machinery	0.49	0.36	0.26	-0.20	8096	0.70	0.33	0.55	0.17	-0.14	7582	0.75
74	General Industrial Machinery	0.50	0.38	0.31	-0.23	52627	0.68	0.29	0.63	0.17	-0.06	40543	0.75
75	Office Machines	0.58	0.31	0.13	-0.14	22181	0.70	0.40	0.56	0.06	-0.12	5838	0.79
76	Telecommunications	0.53	0.33	0.33	-0.23	19502	0.69	0.33	0.59	0.30	-0.13	10220	0.76
77	Electrical Machinery	0.52	0.38	0.24	-0.19	64737	0.74	0.32	0.64	0.24	-0.15	30502	0.78
78	Road Vehicles	0.51	0.39	0.40	-0.24	9083	0.64	0.33	0.60	0.25	-0.05	13884	0.81
79	Transport Equip	0.43	0.41	0.26	-0.13	4153	0.70	0.26	0.58	0.12	-0.31	1595	0.64
81	Prefabricated Buildings	0.59	0.30	0.38	-0.21	3258	0.64	0.39	0.54	0.29	-0.15	6443	0.80
82	Furniture	0.52	0.37	0.38	-0.21	6581	0.54	0.39	0.56	0.23	-0.11	27326	0.82
83	Travel Goods	0.59	0.33	0.34	-0.16	9369	0.78	0.34	0.60	0.26	-0.06	7863	0.81
84	Apparel	0.50	0.41	0.29	-0.06	84064	0.84	0.35	0.58	0.23	0.00	62590	0.81
85	Footwear	0.48	0.40	0.27	-0.11	11676	0.73	0.42	0.49	0.12	-0.06	12008	0.76
87	Scientific Instruments	0.46	0.37	0.26	-0.20	31960	0.67	0.29	0.64	0.27	-0.13	9890	0.74
88	Photographic Equipment	0.57	0.32	0.23	-0.08	15276	0.74	0.50	0.44	0.26	-0.02	7289	0.77
89	Miscellaneous Manufactures	0.49	0.40	0.29	-0.17	55681	0.69	0.35	0.58	0.19	-0.07	53659	0.79