Country Competition and U.S. Overseas Assembly

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Abstract

To examine the role of international competition in outsourcing production decisions, I study the decisions of producers who used the U.S. Overseas Assembly Program (OAP) to conduct assembly operations in developing countries. The evidence, which is based on U.S. OAP imports between 1991 to 2000, shows that production costs and corporate tax policies both shaped production decisions. While increases in own country costs reduced the size of a developing country's OAP shipments, increases in competitor costs helped to increase a country's shipments. The effects of competitor country cost changes were relatively large, as the analysis suggests that a ten percent increase in competing country costs would increase a country's OAP outsourcing activities by 5.8 percent, while a ten percent increase in competitor country taxes would increase a country's OAP exports by 1.6 percent.

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Introduction

Much of the debate and political concern about the growth of overseas outsourcing focuses on the impact of outsourcing on domestic employment and economic activity. Such concern is grounded in the belief that outsourcing intensifies country competition, since firms select outsourcing production locations based on comparisons of country costs. Nonetheless, while popular concern is based on the notion that lower wages induce firms to substitute away from highly paid workers in developed countries to workers in developing country locations, the actual effects are likely to be much more nuanced.

While it is true that wages are relatively high in the rich countries of the North, such wage differences may nonetheless be supported by the higher skill and education levels of Northern workers. And these differences may be further reinforced by systematic international differences in the quality of institutions, information, or infrastructure. As a result, if workers of the North and South are imperfect substitutes, then wage differentials may not generate much competitive pressure for firm relocation between countries that are at different levels of development. For example, while Swenson (2000, 2005b) observes that U.S.-based firms substitute away from U.S.-produced parts, components and assembly when U.S. costs rise, the small economic magnitude of these shifts suggest that cross country substitution is small.

In contrast, the degree of international competition, as evidenced by the relocation of economic activities, may be much more pronounced for developing countries that offer roughly similar bundles of wages, worker skills and country amenities. In related work, Wheeler and Mody (1992), Blonigen and Davis (2004) and Blonigen and Wang (2005) note that foreign investment in developing and developed county appear to be differentially affected by economic conditions. Similarly, it may be sensible to separately study the effects of outsourcing location responses for developing countries.

To provide further insight into the determinants of developing country outsourcing, this paper focuses on two factors which influence the international allocation of outsourcing activities: production costs and corporate taxes. Production costs are worthy of study since their actual impact is ambiguous; while trade theories of outsourcing include factor costs as a determinant of outsourcing decisions, many models note that other factors may reduce the degree of cross-country cost competition for outsourcing assembly.[1] In particular, if the selection of partners entails fixed costs, and search is characterized by uncertainty, low factor costs will only induce firms to conduct the search for a suitable outsourcing partner when the search is expected to yield cost savings are sufficiently large in magnitude. Thus, when search is costly and uncertain, the costs of partner search dull the incentives for firms to respond to international changes in production costs, and a country's low wage may be a symptom of the search environment, rather than a pure inducement to new outsourcing operations.

The small literature on outsourcing decisions shows that country costs do influence the level of outsourcing activity.[2] To provide further evidence on the magnitudes and limits of outsourcing cost responses, Swenson (2005a) has examined outsourcing choices at the industry level for firms conducting offshore assembly through the Overseas Assembly Provision (OAP). This work finds that the cost responsiveness of

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[1] For example, in describing outsourcing motives, Deardorff (2001) focuses on factor costs, while Yi highlights Ricardian productivity differences. Grossman and Helpman (2005) highlight the effects of search and modification costs on outsourcing equilibria.

[2] See Gorg (2000) for evidence on US processing trade in the EU, and Egger and Egger (2005) for the levels of trade associated with inward and outward processing trade of the EU.

outsourcing activities varies with industry characteristics. For industries that are more capital intense, the effects of country costs changes are blunted. If one assumes that search costs are higher and match requirements are generally more stringent in capital-intense industries, this evidence suggests that the cost responsiveness of outsourcing production choices is smaller for industries which are characterized by the largest search and relocation costs.

In contrast with earlier work, Swenson (2005a) also seeks to define which countries compete with each other, since country cost changes will only induce firms to relocate their outsourcing activities, or shift production from one outsourcing assembler to another, when the cost reduction occurs in a country that is capable of providing the outsourced products. In reality, some countries may be unsuitable for particular outsourcing operations, if they are unable to offer the appropriate infrastructure, or a suitably skilled work force. In other cases, distance may preclude the formation of outsourcing relationships when the cost of shipping inputs back and forth from a distant location offsets any of the production cost savings that are offered by the distant country. When "competitors" are defined as those countries that were observed exporting products through OAP channels, in at least one year, the results show that country OAP activities fell when costs in competitor countries decreased. Cost responses are also found to vary with the number of country competitors in an industry; the sensitivity of outsourcing activity to country costs is magnified in industries that are populated by a larger number of competing countries. This finding supports the notion of "thick markets" since it suggests that international cost changes will cause more firm relocation when firms have a greater number of alternative country partners to choose from.

To extend the work on international competition, this paper provides a fuller examination of tax effects. To date, the large literature on taxes and the foreign activities of firms has examined how corporate taxes affect the location of multinational firm activity, investment and income across countries.[3] Most studies in this area find that nations with higher corporate tax rates attract less foreign investment, and have lower multinational firm employment. The reported corporate income for these countries is also lower. While many studies have examined how international tax conditions affect foreign direct investment, the effect of taxes on outsourcing activities has yet to receive widespread consideration. The most similar work to date is Egger and Egger (2005) which finds that higher corporate taxes discouraged the trade flows associated with outward processing trade from the EU, while differences in tax rates appeared to have no effect on the level of inward processing trade volumes for EU countries engaged in processing trade. However, the dearth of work on outsourcing and taxes means that there is no established consensus about the responsiveness of outsourcing to international tax conditions.

One of the most interesting developments in the work on international taxes is the discovery that the responsiveness of foreign direct investment to cross country differences in tax rates appears to have grown over time.[4] This suggests that rising investor tax sensitivity arose with, and may have influenced, tax reforms that reduced tax costs in a number of international locations. To illustrate the recent reductions in corporate taxes, I present the average corporate tax rates for countries that assembled

[3] See Hines (1999), Mutti (2003) and Clausing (2005) for reviews which discuss the various stages at which tax differences and tax systems may effect the decisions of multinational firms, or offshoring decisions.

[4] Altshuler, Grubert and Newlon (2001), Mutti (2003) and the meta-study of de Mooj and Ederveen (2003) all observe an increased responsiveness of foreign investment to taxes during the 1980's and early 1990s.

goods for sale through the OAP. As Figure 1 demonstrates, the average corporate rate levied by this subset of developing countries was 39 percent in 1991, and it declined to just below 33 percent by 2000. This decrease in country tax rates provides an opportunity to study the effects of taxes on OAP assembly decisions. Further, in extending the work of Swenson (2005a) this paper introduces the corporate taxes of competitor countries as an additional factor influencing country outsourcing choices.

A number of findings emerge when I examine U.S. overseas assembly imports from developing countries. First, country variables do help to determine outsourcing activities. Increases in country tax rates or production costs are both associated with reductions in OAP outsourcing imports. Second, competitor country variables work in the opposite direction. A country's OAP outsourcing assembly declines when competitor country production or tax costs fall. Third, the magnitudes of these effects differ somewhat across subgroups in the data; the large responses for the electronics industry support the conventional wisdom that electronics production assembly is particularly footloose. Finally, the effects suggest that competitive effects exert influence outsourcing activities, not only through their effects on production volumes, but also through their selection effects which influence the set of countries that is active in outsourcing production in any given year.

2. Outsourcing through the Overseas Assembly Program

Vertical specialization, which moves intermediate goods from one location to the next through internationally integrated supply chains, has helped to fuel the growth of international trade.[5] Nonetheless, the difficulty of obtaining detailed data on outsourcing transactions inhibits the study of outsourcing. The most common method for measuring outsourcing imputes the level of outsourcing activity by combining information from national input/output tables with information on country imports.[6] While this technique provides a straightforward method for calculating outsourcing activities, that can be applied to a broad range of countries and industries, the limitation of this technique is that it is subject to measurement error if domestic and outsourcing production differ in their mix of inputs. While there is no evidence that covers all industries or all countries, Swenson (1997) and Blonigen (2001) show that U.S.-owned and foreign-owned auto production facilities in the U.S. differed significantly in their reliance on imported inputs. If such differences are common across a wide range of industries, then the assumptions underpinning estimated outsourcing volumes are not innocuous, as they almost certainly are affected by measurement error.

The operation of multinational firms provides an alternative opportunity to follow a slice of overseas outsourcing operations, since multinationals' foreign affiliates mediate many outsourcing relationships. However, this view is incomplete too, since the study of multinational firm activities will not capture overseas outsourcing relationships conducted between multinational firms, and unaffiliated partners overseas.

The final option is to study the operation of particular programs designated to assist outsourcing firms, as Gorg (2000) or Egger and Egger (2005) do. To learn more

[5] See Feenstra (1998) and Ng and Yeats (2001) for surveys of trends in international sourcing. Hummels, Ishii and Yi (2001) and Yi (2003) estimate that vertical specialization may account for 30 percent of the growth in trade flows.

[6] These computations assume that the importance of imported materials in production are directly proportional to the ratio of imports over domestic production. Ex: the contribution of imported rubber to production is assumed to be proportional to imported rubber, divided all domestic use of rubber.

about overseas outsourcing choices, this paper turns to data on U.S. outsourcing activities that were conducted under the U.S. Overseas Assembly Program (OAP).[7] The OAP provides tariff reductions for products imported to the U.S. that include U.S.-produced parts or components. Since U.S.-produced parts are exempted from tariff under the provisions of the OAP, the operation of the program involves the collection of product-level information on the portion of an import's value that can be attributed to U.S. parts and components, in addition to information on shipment value and shipment quantity. Since the U.S. Customs Department assembles information on OAP imports, one can pinpoint a cross-section of U.S. imports that involve overseas outsourcing, thus observing the selection of production locations of production techniques for those firms involved in the program. While the OAP is only one component of all U.S. outsourcing activity, almost eight percent of all U.S. imports during the 1990's entered through the program.

Figure 2 displays the evolution of OAP imports between 1991 and 2000. While the dutiable portion of OAP import value was always larger than the portion attributable to U.S.-origin parts and materials, U.S. inputs represented 31.6 percent of import value during the sample years. The largest volume of OAP imports entered in 1997, though 1999 OAP imports were virtually as large. This plateauing of OAP activities is probably driven by two factors. First, participation in the OAP program is predicated on a firm's usage of U.S.-origin parts or materials. To the extent that the range of manufacturing sectors in which the U.S. has comparative advantage has declined, products that originally incorporated some U.S.-origin parts in their assembly overseas, many of the producers may be producing the same products, but sourcing their parts from other

[7] The OAP was created by the Tariff Act of 1930. See Hanson (1997) for a historical description of the program's development.

countries. In this case, products that were previously imported through the OAP program will be replaced by ordinary imports of items that include no U.S.-origin inputs. The second factor is the phase-in of NAFTA tariff reductions in the late 1990s. The NAFTA tariff reductions meant that an increasing number of Mexican-based assemblers, who previously used the OAP program, may have chosen to enter their products through the NAFTA instead. In fact, if one examines official Mexican trade statistics there was no drop in U.S.-Mexico outsourcing in the late 1990's.[8] Thus, the apparent reduction in OAP outsourcing should not be interpreted as a decline in outsourcing assembly, but a change in the preferred method of entry.

When the composition of OAP imports from developing countries is displayed in Figures 3 and 4, the importance of Mexico becomes apparent. Mexico's share of developing country OAP imports, and the share of U.S.-origin inputs contained in developing country OAP products, were both 53%. This represented a drop from Mexico's shares in 1995, which were 60% of developing country imports, and 62% of the U.S.-content used in OAP products assembled in developing countries. The prominence of nearby countries in the top five providers of OAP imports, suggests that distance was an important factor in OAP assembly location decisions. Notably, while the value of OAP goods assembled in China rose during the 1990's, only 3.5% of the OAP imports exported by developing countries in 2000 were assembled in China.

[8] Mexico's trade statistics show that Mexico's outsourcing exports to the U.S., that were sent through the Maquiladora and PITEX programs, grew to $126.8 billion dollars in 2000. However, the alternative methods for entering the U.S. may have caused firms to lose the "incentive to complete the documents required to declare eligibility for reduced duties under the production-sharing provisions" of the OAP. Source: Watkins, Ralph. (2001) "Production-Sharing Update: Developments in 2000", *Industry Trade and Technology Review*, pp12-13.

3. *Approach*

To examine how own and competitor country costs affected outsourcing demand, I estimate how the volume of outsourcing imports was related to production and tax costs in a host country and in its competitors. The specification I use is:

$$(1)\ \ln(q_{ict}) = \alpha + \beta_1{*}\ln(cost_{ct}) + \beta_2{*}\ln(1\text{-}corp\_tax_{ct}) + \delta_1 \ln{*}(compet\_cost_{ict}) + \delta_2 \ln(1\text{-}compet\_corp\_tax_{ict}) + \varepsilon_{ict}$$

The dependent variable (q_{ict}) is the quantity of imports of HS8 product i from country c, in year t. The 8-digit HS level of disaggregation separates products into finely detailed product categories. While the U.S. Customs records U.S. imports at the even more disaggregated 10-digit HS level, tariffs are applied at the HS 8 level of disaggregation. For example, HS8 61023000 is "Women's or Girls' overcoats made of manmade fibers", while 61023005 is "Women's or Girls' overcoats made of man made fibers, for which leather is 25% or more of the weight of the product". Other examples of HS8 products are 66031040 which is "umbrella handles or knobs:, and 70072110 which is "windshields made of laminated safety glass".

The regression specification relates the demand for OAP product imports to two underlying host country costs. The first variable, ($cost_{ct}$), measures production costs in country c. The second variable, ($1\text{-}corp\_tax_{ct}$), which is intended to measure the tax cost of operations in different locations, measures fraction of income that producers kept after paying corporate taxes location of assembly.[9] Profit maximization implies that the coefficient β_1 will be negative, while β_2 is positive.

The regression specification also includes cost terms and tax terms for the countries that competed with host country c. If firms view the countries as substitutes for each other, we can predict that the coefficient δ_1 will be positive, since cost increases in country c's competitors may cause firms to relocate at least some of their production to country c. Similarly, the coefficient δ_2 is expected to have a negative sign, since tax reduction in competitor countries may lure investment away from host country c.

Since changes in production costs or tax rates have an equivalent effect on profits, we might predict that all cost changes will have the same effect on production decisions. For example, a 10% rise in costs due to increased labor costs, should be equivalent in its effect on profits, as a 10% in costs caused by an increase in tax rates. If so, the magnitudes of the cost coefficients are predicted to be as follows: $\beta_1 = \beta 2$, and $\delta_1 = \delta_2$. However, the equality of the coefficients will only arise if firms are equally certain about the permanence of the changes in production costs or corporate tax rates. In reality, firms might believe that a change in tax rates would last a long time, given the international trend towards lower rates of tax on corporate profits, while they might predict that a production cost reduction would be temporary, since it might be reversed in the future by an exchange rate shock, for example. The equality might also break down if firms have some scope for tax avoidance, or if changes in tax rates are accompanied by changes in

[9] Country cost is measured by the variable p in the Penn World Table, which is the price level of gross domestic product.[Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002, available at http://pwt.econ.upenn.edu/]. Corporate tax rates are measured by the maximum corporate tax rate, as

the tax base, since the full effect of the tax rate change will no longer be perfectly measured by the tax variable, (1-corp_tax_{ct}).

In estimating equation (1) I choose to use panel techniques which assume that the error term has two components:

(1a) $\varepsilon_{ict} = \Phi_{ic} + \eta_{ict}$

While η_{ict} is an iid error term, the error term is also based on a full set of product-country error terms Φ_{ic} that are intended to capture the underlying attractiveness of a country as a provider of product i assembly services. The Φ_{ic} terms can be thought of as encompassing a number of elements which affect a countries suitability for assembling product i through the OAP. It captures all country characteristics that do not vary over time, such as the effects of distance from the U.S. or the general quality of a country's infrastructure, which generally change,s only slightly, if at all, over short time intervals. Another alternative is to run gravity regressions that directly include a larger set of country characteristics. However, such an approach is likely to omit unobserved country-product characteristics that influence the demand for OAP assembly in a particular country. For example, using data on clothing imports Evans and Harrigan (2005) show that the location of overseas outsourcing is determined in part by retailer demand for timely delivery. While there is no universally available variable that allows one to include this measure in the analysis, the use of country-product fixed effects allows one to capture the net effect of this element and others, which are specific to a country product pair. Thus, the effects of changes of production costs or corporate taxes are identified by examining how changes in import quantities over time were related to changes in costs.

Data

This project is based on HS8 import data from the OAP program between 1991 and 2000. Since the OAP program involves U.S. imports of products that were assembled overseas utilizing U.S.-origin parts, components or materials it only covers one component of overseas outsourcing. However, OAP imports represented eight percent of total U.S. imports during the period of analysis. The presence of OAP imports is noted by customs officials when products in the program enter the U.S. The quantity of imports, which is the subject of this study, is taken from the custom's declarations. During the ten year interval, there were 3,809 distinct products that were imported from developing countries through the OAP program.[10] The most frequent developing country participants, based on country-level counts of OAP import transactions between 1991 and 2000, are listed in Table 1.

To measure county costs, I combined data on country prices that were collected from the Penn World Tables with information on production techniques, transportation costs, and trade policy. As in Swenson (2005a), the cost of producing product i in country c is calculated as

(2) $C_{ic} = [\alpha_{us,ic} * c_{us} + (1 - \alpha_{us,ic}) * c_c)] * [1 + g_{ic} (1 + \alpha_{us,ic}) + (1 - \alpha_{us,ic}) * \tau_i],$

In the cost equation, $\alpha_{us,ic}$ represented the U.S. percentage of content when product i was produced in country c, c_{us} and c_c represented costs of production in the U.S. and in assembly country c, g_{ic} denoted the ad-valorem transportation costs for shipping product i from country c to the U.S., and τ_i was the tariff rate applied to product i.[11]

[10] Countries that were not members of the OECD by 1985 were classified as developing.

[11] The values of c_{us} and c_c were based on country price levels taken from the Penn World Table [Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002, available at

By recognizing differences in production techniques, which are captured by the relative reliance on U.S. inputs ($\alpha_{us,ic}$), changes in country costs have very different implications for different producers. For example, if the Mexican Peso depreciated by five percent, it would lower the production cost much more for Mexican assemblers who had a lower reliance on U.S.-origin inputs ($\alpha_{us,ic}$ low). Although Swenson (2005b) finds that the reliance on U.S. inputs was affected by cost shocks, the economic magnitude of these changes were very small. As a result, the average value for the U.S. percentage should provide a reasonably accurate indicator of differences in input-composition across product-country pairs.

The tax rates are collected from the World Tax Database which is maintained at the University of Michigan Business School. To ensure the greatest breadth of coverage across countries and time, I chose the “Top Corporate Tax” rate as my measure of corporate taxes. Since there were some breaks in the data due to missing observations, missing rates were replaced with interpolated rates. For example, since Sri Lanka was recorded as having a 50% top corporate rate in 1991, and a 45% rate in 1995, a linear interpolation was used to provide tax rate values for the years 1992 to 1994.

To measure competitor costs and competitor tax rates, I had to define which countries were “competitors”. The definition I use classifies countries as competitors in an HS8 product category if the country exported any of that product through the OAP program during any of the years in the sample period. By choosing known providers, this definition excludes countries that never provided OAP products, and were probably unable to do so in a particular product category. The main disadvantage of this definition

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http://pwt.econ.upenn.edu/], $\alpha_{us,ic}$ was calculated from the OAP data, while tariff and transportation costs were collected from Peter Schott’s web site, http://www.som.yale.edu/faculty/pks4/sub_international.htm.

of competition is that it may potentially exclude countries whose presence at the competitive fringe disciplined and influenced the universe of OAP producers, though they never managed to enter into OAP production. Competitor countries were not defined by presence in general trade flows, since a country that successfully exports an item to the U.S. may or may not be a suitable assembler of OAP products. In particular, since the cost of exporting U.S. inputs to a distant location may overwhelm any assembly cost advantages associated with production in that country, a country may never engage in OAP assembly of certain products, even if it exports final goods from that industry to the U.S. Alternatively, the cost of managing OAP assembly in a distant country may have been prohibitive, for reasons related to the value of timely delivery, or due to high requirements for oversight. In these cases too, one might observe general U.S. imports of a product, that could not be economically assembled through the OAP program. While it is not feasible to pin down why some countries exported products to the U.S., but never engaged in OAP for those products, the fact that they never produced the product under OAP auspices suggests that OAP production was an unprofitable alternative for that particular country.

Based on my definition of competitor countries, the average transaction faced thirteen competitor countries, while the median faced nine. However, there was great variability in the presence of competitors. Products in the 10th percentile were characterized by two competitors, while products in the 90th percentile were characterized by thirty.

To measure movements of competitor costs and tax rates, I formed variables that were the weighted average of competing country costs. The weights were the real value of country c's OAP exports of product i for the full sample period V_{ci}.. Thus, the competitor cost measure for country c' in year t is defined as:

$$(3)\quad CompetitorCost_{c'i} = \sum_{c \neq c'} \left[\frac{V_{ci}}{\sum_{c \neq c'} V_{ci}} * \ln(C_c) \right]$$

An increase in the Competitor Cost variable indicated that competitor country costs increased. The Competitor Tax variable was constructed in the same way. However, the competitor tax measure was based on the weighted average of ln(1-corptax$_{ct}$) rather than on competitor production costs. As a result, an increase in the Competitor tax variable indicates that the tax burden of operation in competitor countries had eased.

Results

Examination of OAP country assembly choices provides evidence of competition among developing countries for outsourcing assembly. First, sourcing decisions appear to depend on a comparison of country production costs, as OAP assembly in a country rose when a country's costs fell, or when its competitor's costs increased. In addition, tax competition also appears to have conditioned production decisions, as counties gained OAP assembly when their taxes declined, while they lost OAP assembly when their competitor's taxes fell.

The first set of results, which are presented in Table 2, begin with a fixed-effects regression that includes all OAP assembly conducted in developing countries. To form a benchmark for comparison, the results in column (1) examine how outsourcing imports respond to changes in own-country production or tax costs. As predicted, a rise in either cost is associated with a decline in OAP outsourcing imports. The coefficient on the tax term is larger than the coefficient on own costs, which may reflect differences in producers' beliefs about the permanence of changes. Such a result makes sense if producers anticipate that tax reductions will have a longer duration, than will equal magnitude reductions in production costs.

In column (2) of Table 2, competitor values for production and tax costs are added. The results show that import quantities rise when own country costs decline, or competitor costs rise. They also indicate that import quantities rise when a country's own taxes fall, or competitor country taxes rise. The competitor-cost coefficient in column 2 suggests that a ten percent increase in competing country costs would increase a country's OAP outsourcing activities by 5.8 percent, as demand for the country's assembly services rose. The economic effect of competitor tax changes is somewhat smaller. In this case, the estimated coefficients imply that a ten percent increase in competitor country taxes, which would reduce the value of the competitor tax variable ln(1-competitor tax), would increase U.S. shipment quantities by 1.6 percent. Table 2 also shows that even after one controls for country-product fixed effects, there was a strong trend towards increased outsourcing assembly in the products produced through the OAP program. In addition, the fixed-effects which control for HS8 product-country were highly significant, meeting statistical significance at better than the 1% level.

The initial regression with competitor costs assumes that competitor taxes are best characterized by a weighted average of the tax rates in competing assembly countries. However, if, all else equal, firms are attracted to the country that offers the lowest tax rate, the appropriate measure of competing taxes will be the minimum tax rate levied in the subset of competing countries, where competition is defined by the OAP provision of the product. To test this idea the tax term for competing countries is replaced by ln(1-minimnum competitor tax) in the regression shown in column (3). The coefficient on minimum tax is negative, and somewhat larger than coefficient on weighted average tax which was displayed in column (2). This suggests that there is a tendency for firms to seek to locate production in the lowest cost countries. However, the fact that the tax coefficient is not infinite, or even extraordinarily large in magnitude, suggests that tax differences are not decisive in of themselves. The effect of lower taxes may be dampened in part, if lower tax countries generally unable to provide as much infrastructure or services than their higher tax counterparts. It is notable the use of the minimum tax variable does not affect the estimated coefficients for the other variables.

To explore the strength of the general results, I turn to two subsets of the data that provide additional insight into the nature of competition among countries. First, in column (4) I restrict the analysis to the subset of transactions that were in the electronics industry.[12] I choose electronics since electronics assembly is thought to represent a particularly footloose segment of outsourcing activity. Another reason for choosing electronics is that it comprises a large subset of the observations in the sample, representing almost ten percent of all positive product-country import pairs during the sample period. When the regression is run for the electronics industry, as shown in column (4), the main change is that the coefficients imply much bigger effects of own costs, or own taxes on the quantities of OAP products sold by a country. In addition, the

[12] I define the electronics industry all products that are included in chapter 85 of the 2-digit HS industries, which is defined as "Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles."

bigger coefficient on competitor country costs implies that a reduction in competitor costs will cause a country to experience a bigger decline in OAP outsourcing than is true for the full sample, on average. Thus, the larger size of the coefficients in column (4) support the idea that electronics producers do respond more vigorously to country cost differentials. However, the one puzzling element of the results in Column (4) is the coefficient on the competitor country tax variable, which implies that higher competitor taxes lure production away. However, while this result is perverse, it should be noted that the coefficient is not statistically significant. Finally, the time trend variable is larger for electronics than it was for the full sample, which indicates that the U.S. was increasing its imports of OAP electronics outsourcing goods at a particularly fast rate.

The final column of Table 2 reports results for the subset of the overseas assembly data that includes developing Asian countries, while excluding textiles. I select Asian countries, since we may assume that geographical proximity and a general similarity in areas of comparative advantage, cause them to compete more intensively with each other than other groups of countries generally do. The countries included in this subset are China, Hong Kong, Indonesia, Malaysia, Singapore, the Philippines, Taiwan and Vietnam. In addition, textiles are excluded from this subset of the data since the detailed set of quotas put in place by the Multifibre Agreement (MFA) may have reduced the amount of cross-country competition, and thus reduced the magnitude of all cost-based coefficients. When I examine the more limited set of the data, the competitor cost and competitor tax variables are redefined to only include values related to the countries in the new subsample.

When I analyze the responses for the Asian, non-textile subset of the data, the own-county production cost, and own-country tax coefficients increase in magnitude compared with the sample averages reported in column (2). In contrast, the coefficient on competitor country costs, and competitor country tax rates do not change in magnitude. This may be because the new definitions of competition (only other Asian producers), include most, but not all, of the relevant competitors.

The estimates presented in Table 2 are based on constructed cost measures. However, the data on OAP imports do contain information that make it possible to generate country-product measures of import prices. In particular, unit values, which are computed using annual data as [(Import Value)$_{cit}$/(Import Quantity)$_{cit}$], provide information on the average price of all imported OAP units of a product i sold by country c in year t. An advantage of this measure is that it provides a more accurate measure of country prices when mark-ups vary dramatically across products and countries. The use of unit values, as a measure of import prices, is also valuable if markups change over time. However, a disadvantage of this measure is that one can not use the unit values for competitor countries to compute the level of costs in competitor countries, since competitor unit values were only observed in the years when competitors shipped OAP products to the U.S. As a result, I continue to measure competitor costs using the weighted average of production costs, where competitor costs were calculated according to equation (2). The advantage of pursuing this approach is that we gain insight into competitive pressures that are exerted by the full set of competitor countries, including years where a competitor location may have been temporarily inactive, but at the competitive fringe.

Table 3 displays the results for the new set of regressions that replace own-country costs with own-country unit values. In general the results are almost identical to those presented in Table 2, since there is almost no change in the estimated coefficients for competitor costs, own-country taxes, competitor country taxes, or the year trends. The one exception is the coefficient on the unit value, or price of OAP imports. Here, the coefficient on unit values is somewhat bigger in magnitude than the coefficients on own-country costs that were reported in Table 2. However, such a difference is sensible. In Table 2, we can observe whether costs went up in an assembly country. However, we don't know whether the costs were passed-through to OAP import prices. If they weren't, then all else equal, there should be no change in OAP imports, and the estimated value of the coefficient on own-country production costs would be biased downward. The new results for the full sample imply that a ten percent increase in own-country prices caused OAP imports to decline by 9.3 percent.[13]

Since the dependent variable in Tables 2 and 3 is the natural log of OAP import quantities, the estimates are based only on transactions that materialized. However, if competitive effects influence not just import quantities, but whether a country is selected to perform OAP assembly, we are ignoring the information that is conveyed by the years in which a country does not export. To deal with this issue, the dependent variable in Table 4 is replaced with the $\ln(q_{cit} + 0.001)$. Now, countries are included in the estimation, not only when they exported OAP items, but also in years where they were out of the market due to an absence of shipments. I continue to use to fixed-effects estimation,

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[13] The use of unit values will give a more precise view of price effects as long as firms do not engage in systematic manipulation of transfer prices. The fact that Table 3's tax coefficients do not change in magnitude suggests that transfer price manipulation for tax minimization purposes is not common in this context.

which controls for country-product effects. The coefficient signs for this new set of regressions are generally the same as those reported in the earlier tables. The one perverse result occurs in the subset of the data which describe decisions for Asian non-textile observations. Here, the coefficient on the own tax rate term switches sign, though the remaining variables retain their predicted coefficients.

The notable change in Table 4 is the fact that the estimated effects of competitor costs and competitor tax policy are now much larger than those presented in the earlier tables. The growth in the value of these coefficients suggests that the effects of competition work not just on shipment levels for those countries that are active in the OAP assembly market, but that competition also has a big effect through its selection of country producers in to and out of OAP assembly. For example, the results for the full sample that are reported in column (1) imply that an overseas assembler would experience a twenty-two percent decrease its OAP shipments if its competitors had a ten percent reduction in their costs. When compared with the magnitude of the earlier effects, these results suggest that changes in competitor costs had an especially large effect on country selection, though changes in competitor costs also influence the quantities supplied by those countries in the market.

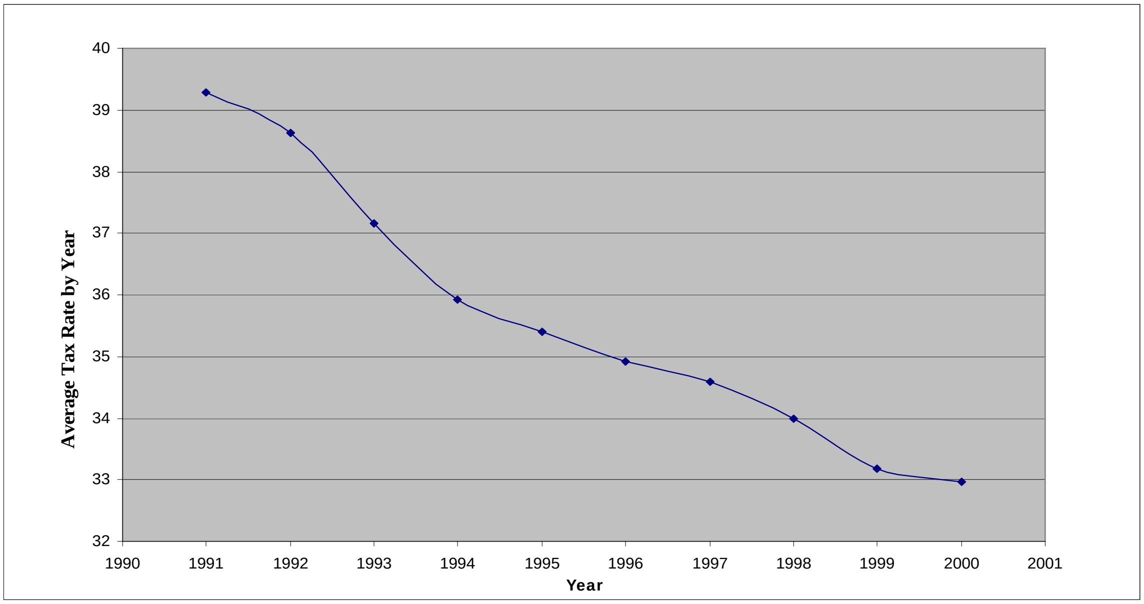
Conclusions

The growth of outsourcing activities has triggered policy concern about the effects of international competition on economic activity. Concerns about international competition have also helped to spur recent declines in corporate taxes. To study how competition shaped outsourcing production decisions, I study the OAP assembly decisions in developing countries. The evidence, which is based on data from U.S. OAP imports between 1991 to 2000, shows that production costs and corporate tax policies both shaped production decisions. While increases in own country costs reduced the size of a developing country's OAP shipments, increases in competitor costs helped to increase a country's shipments.

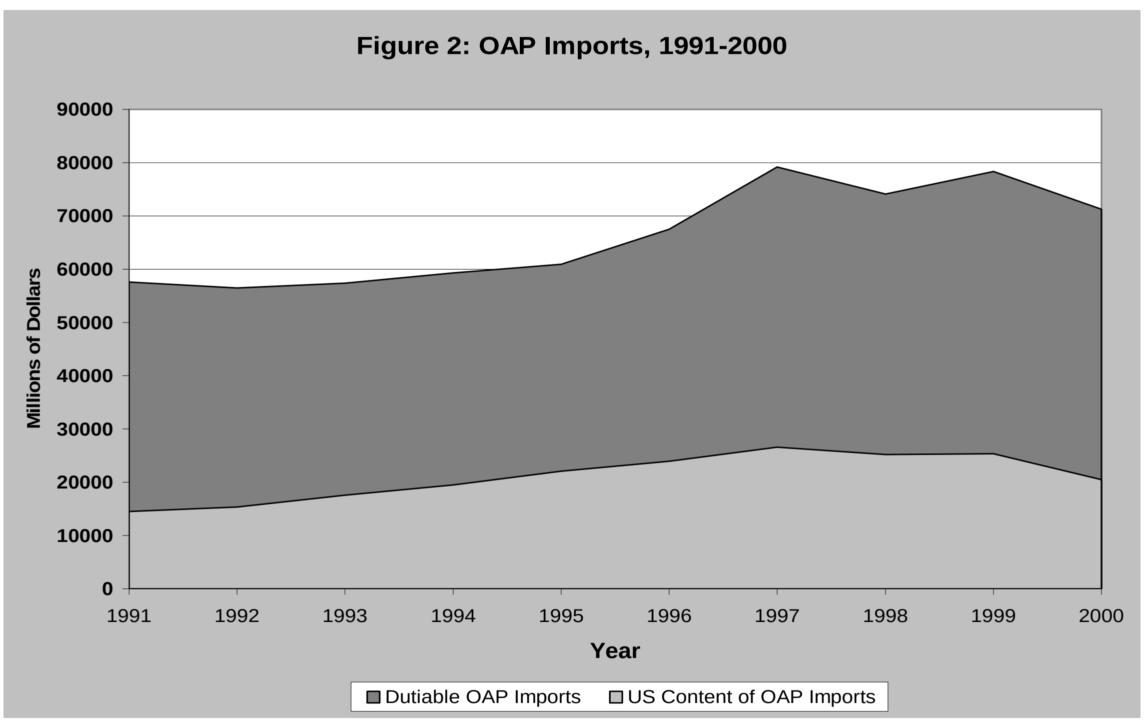
The effects of competitor country cost changes were relatively large, as the analysis suggests that a ten percent increase in competing country costs would increase a country's OAP outsourcing activities by 5.8 percent, while a ten percent increase in competitor country taxes would increase a country's OAP exports by 1.6 percent. These effects grow larger yet, if one examines groups that are believed to face a more competitive environment, such as those countries producing for the electronics industry, or the subset of Asian non-textile product producing relationships.

While the primary results are based on import quantities, when the analysis is extended to consider selection of countries in to, or out of, OAP exporting the effects of competitor variables become larger yet. Thus, it appears that the effects of competing country capabilities and policies affect both the selection of developing countries into outsourcing assembly, as well as their level of participation, conditional on being selected.

Figure 1: Average Corporate Tax Rate

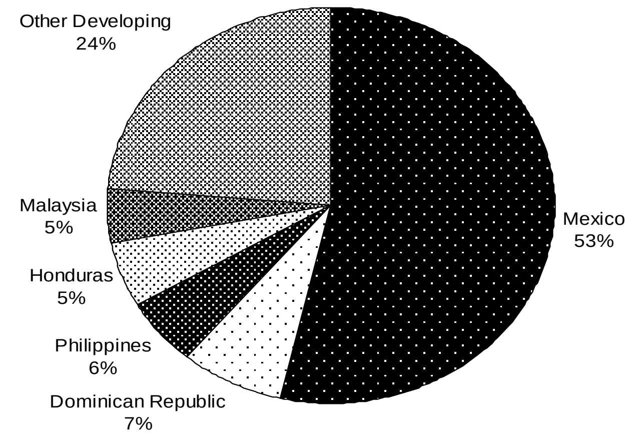


Source: Author's calculations based on tax data from the World Tax Database which is maintained at the University of Michigan Business School. The tax variable used is their "Top Corporate Rate"



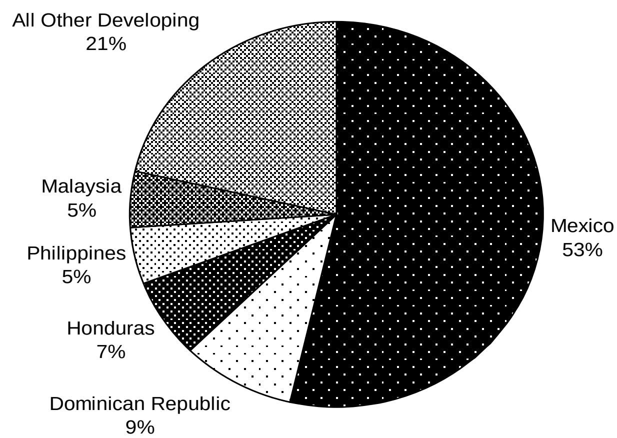
Source: Data from official statistics of the U.S. Department of Commerce as reported in the Industry Trade and Technology Review, July 2001, and in Table B1 of US International Trade Commission Publication 3265, "Production Sharing: Use of U.S. Components and Materials in Foreign Assembly Operations, 1995-1998", December 1999.

Figure 3: Developing Country Shares of OAP Outsourcing, 2000



Source: Data from official statistics of the U.S. Department of Commerce as reported in the Industry Trade and Technology Review, July 2001, Appendix Table B1. The pie chart represents each country's contribution to the U.S.'s import of $36.2 billion of OAP products.

Figure 4: US Content in OAP Outsourcing, Developing Country Shares for 2000



Source: Data from official statistics of the U.S. Department of Commerce as reported in the Industry Trade and Technology Review, July 2001, Appendix Table B1. The pie chart represents fraction of the $19.2 billion of U.S. inputs used in developing country OAP that was attributable to each assembly location.

Table 1: Import Transactions, by country, for the most frequent OAP participants, 1991-2000.

Rank	Country	Number of Product-Year Observations
1	Mexico	2,693
2	Dominican Republic	961
3	Hong Kong	893
4	China	834
5	South Korea	730
6	Taiwan	698
7	Costa Rica	669
8	Colombia	644
9	Guatemala	638
10	India	601
11	Philippines	585
12	El Salvador	542
13	Haiti	511
14	Honduras	502
15	Jamaica	370

Source: Author's tabulation based on data set of OAP imports.

Table 2: Taxes, costs, and the demand for outsourcing product imports.

	(1)	(2)	(3)	(4)	(5)
	All Industries	All Industries	All Industries	Electronics	Asia, No Textiles
$\ln(\text{Own Cost}_c)$	-.155 (.098)	-.206[b] (.098)	-.223[a] (.083)	-1.039[b] (.429)	-.565 (.422)
ln(Competitor Cost)		.583[a] (.066)	.594[a] (.018)	.365 (.345)	.102 (.203)
$\ln(1\text{-tax}_c)$	.872[a] (.277)	.768[a] (.276)	.999[a] (.250)	2.489[c] (1.305)	4.936[b] (1.967)
ln(1-competitor tax)		-.158[a] (.045)		.148 (.181)	-.190 (.122)
ln(1-minimum competitor tax)			-.778[c] (.408)		
Yr	.084[a] (.006)	.049[a] (.007)	.080[a] (.006)	.114 (.025)	.026 (.025)
Controls (FE)	HS8-Country	HS8-Country	HS8-Country	HS8-Country	HS8-Country
Observations	30,316	30,316	30,316	3,261	4,316
R^2	.021	.021	.079	.017	.001

Notes: Dependent variable is the $\ln(\text{quantity}_{cit})$, where quantity_{cit} is the quantity of the product i imported from country c.
Standard errors are in ( ).

Table 3: Taxes, costs and the demand for outsourcing product imports.

	(1)	(2)	(3)	(4)
	All Industries	All Industries	Electronics	Asia, No Textiles
ln(Unit Value$_{ic}$)	-.930[a] (.017)	-.932[a] (.015)	-1.078[a] (.037)	-.894[a] (.036)
ln(Competitor Cost)	.593[a] (.062)	.582[a] (.017)	.392 (.291)	.256 (.181)
ln(1-tax$_c$)	.877[a] (.257)	1.076[a] (.233)	2.133[c] (1.102)	4.684[a] (1.642)
ln(1-competitor tax)	-.165[a] (.042)		.017 (.153)	-.109 (.110)
ln(1-minimum competitor tax)		-1.084[a] (.381)		
Yr	.052[a] (.006)	.084[a] (.005)	.114 (.021)	.021 (.021)
Controls (FE)	HS8-Country	HS8-Country	HS8-Country	HS8-Country
Observations	30,316	30,316	3,261	4,316
R^2	.147	.199	.298	.204

Notes: Dependent variable is the ln(quantity$_{cit}$), where quantity$_{cit}$ is the quantity of the product i imported from country c. Standard errors are in ( ).

Table 4: Taxes, costs, and the demand for outsourcing product imports.

	(1)	(2)	(3)	(4)
	All Industries	All Industries	Electronics	Asia, No Textiles
ln(Own $Cost_c$)	-.336[a] (.103)	-.259[a] (.100)	-.857[a] (.308)	-1.321[a] (.270)
ln(Competitor Cost)	2.226[a] (.076)	2.441[a] (.028)	2.460[a] (.213)	1.321[a] (.142)
ln(1-tax_c)	.531[c] (.307)	.551[c] (.304)	.945 (.954)	-1.924[c] (1.168)
ln(1-competitor tax)	-.993[a] (.006)		-.929[a] (.137)	-1.117[a] (.113)
ln(1-minimum competitor tax)		-.120 (.483)		
Yr	.092[a] (.006)	.084[a] (.005)	-.008 (.015)	.113 (.013)
Controls (FE)	HS8-Country	HS8-Country	HS8-Country	HS8-Country
Observations	134,625	134,625	20,984	30,932
R^2	.031	.078	.019	.018

Notes: Dependent variable is the ln($quantity_{cit}$ + 0.001), where $quantity_{cit}$ is the quantity of the product i imported from country c. Standard errors are in ( ).

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