Headquarter Services in the Global Integration of Production

Marilyn Ibarra-Caton[1]

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Abstract

This paper examines knowledge management within multinational enterprises by analyzing whether greater interdependence of production between U.S. parent companies and their foreign subsidiaries increases the provision of headquarter (HQ) services from the home country. The findings suggest that U.S. parents provide more assistance to their foreign subsidiaries that are linked in a global value chain than to those that are not involved in production sharing. When analyzing by the type of HQ service provided, the degree of production sharing is positively associated with services such as rights related to industrial processes, research and development, maintenance, and legal services. These types of HQ services may be viewed as complementary to production activities of vertically integrated foreign subsidiaries. Furthermore, the findings suggest there is substantial heterogeneity both across countries and within industries in the types of knowledge flows provided by U.S parents to their subsidiaries. These findings will help BEA assess the quality of reporting of intra-firm trade in services and to understand the effects of production sharing on the U.S. economy.

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1. Introduction

Recent advances in technology and reductions in trade barriers have allowed multinational enterprises (MNEs) to relocate their operations to better allocate production activities geographically based on comparative advantage. For example, products are designed by parent companies in high-skill/high-wage countries and assembled by subsidiaries in lower-skill/lower-wage countries. These transactions typically involve a flow of technical assistance and, perhaps, intermediate inputs from parents to subsidiaries followed by a flow of finished goods from subsidiaries to parents. This combination of product flows and knowledge flows can be explored within the framework of Gupta and Govindarajan (1991). Most of the empirical tests of that seminal paper have dealt only with knowledge flows. This paper contributes to the more limited empirical research that deals with product flows combined with knowledge flows. Unlike most previous studies, and consistent with the preceding example, this paper finds a positive correlation between knowledge flows from parents to subsidiaries and product flows from subsidiaries to parents.

According to Gupta and Govindarajan (1991), transactions within MNEs occur along three key dimensions: capital flows, product flows and knowledge flows. For each of these types of transactions, the flows can be classified based on two dimensions: the magnitude of the transactions, which is measured by the volume of intra-firm transactions; and the directionality of the transactions, which is measured by whether the subsidiary is the sender or receiver. Based on these criteria they define, as shown in Figure 1, four subsidiary roles: the global innovator (GI), the integrated player (IP), the implementor (IM), and the local innovator (LI). In a subsequent study, Gupta and Govindarajan (2000) empirically test the determinants of the directionality and magnitude of knowledge flows in MNEs and find that the knowledge flows

from a parent to a subsidiary are a positive function of five measures: (1) the formal mechanisms for knowledge sharing (e.g. liaison personnel, task forces, and permanent committees), (2) the networking that occurs when presidents of subsidiaries are involved in vertical socialization mechanisms with headquarters (HQ), (3) whether the subsidiary manager's bonuses are determined solely by performance of the subsidiary itself, (4) a low level of economic development in the host country than that of the parent country, and (5) a low level of autonomy of the subsidiaries.

Another empirical test and extension of this typology of subsidiary roles is presented in Harzing and Noorderhaven (2006), who find that different subsidiary roles are associated with different control mechanisms and product flows. For IP and IM, the authors expect and find that higher knowledge inflows from the HQ are associated with higher levels of internal product inflows. This pattern is expected, for example, because the HQ may be specialized in knowledge intensive activities, such as design, whereas the subsidiary is specialized in labor intensive activities, such as assembly. The authors posit an opposite pattern for product outflows from subsidiaries to parents on the assumption that a large portion of product outflows would go to external customers. Nevertheless, they do not find empirical support for this hypothesis.

Contrary to Harzing and Noorderhaven (2006), I posit that product outflows from IM subsidiaries to HQ will be positively associated with knowledge flows from HQ because of the two-way trade that often occurs within global value chains. I find evidence that vertically integrated foreign subsidiaries, or IMs, receiving technical assistance proxied by research and development (R&D) services and intermediate inputs from the HQ are more likely to transfer flows of finished products to the HQ. My findings suggest that the LI subsidiary, that operates to meet the demands of the local market (i.e. involved in horizontal production), exhibits low

knowledge and product flows to and from the parent because of greater autonomy of the subsidiary to purchase inputs in the local market.

My exploration of two-way trade between parents and subsidiaries is one contribution to the strand of the international business literature that begins with Gupta and Govindarajan (1991). Another contribution lies in the nature of the data used in this study. The data used here cover the universe of U.S. multinationals and U.S. trade in services. Results from past studies may not be generalizable because of the studies' small sample sizes (Harzing and Noorderhaven 2006). Also, the data are granulated by the type of knowledge (i.e. type of service supplied by the HQ) in a way that provides a little more detail than past studies which have used highly aggregated measures of knowledge flows. Finally, the level of knowledge flows is quantifiable in my data because it is denominated in dollars.

This study analyzes whether greater interdependence between the HQ and the subsidiary increases the likelihood of the subsidiary receiving HQ services from the United States. The level of interdependence between the HQ and the subsidiaries is measured by the subsidiaries' level of integration in the firm's global value chain. The most relevant HQ services for this study are knowledge-intensive intangible services such as intellectual property research, research, development and testing, market research, engineering and design. If a firm can generate competitive advantage through cooperative headquarter-subsidiary relations in these high value services, the advantage is likely to improve the cost efficiency of their foreign operations (Mudambi and Navarra 2004; Nohria and Ghoshal 1994).

The rest of the paper proceeds as follows. Section 2 outlines the empirical framework of the importance of HQ services as inputs in the global value chain of a firm. Section 3 describes the data and presents stylized facts. Section 4 presents the empirical results. Section 4.1 considers

all HQ services without distinguishing by the type of HQ service. Section 4.2 allows the impact of varying degrees of vertical integration on the twelve types of HQ services to vary across industries. Section 5 concludes.

2. Empirical Framework

The unit of analysis is the U.S. parent firm *i* which may transfer its knowledge flows to the foreign subsidiary located in host country *j* in year *t*. The basic model of knowledge flows is as follows:

(1)

$$HQ\ Share_{ijt} = \alpha_0 + \alpha_j + \alpha_t + \beta_1 Production\ Sharing_{ijt} + \beta_2 X_{jt} + \beta_3 Employment_{ijt} + \beta_4 Multi_{ijt} + \beta_5 R\&D\ Expenditure_{ijt} + \beta_6 Tax\ Haven_{ijt} + \beta_7 Wage_{ijt} + \varepsilon_{ijt}$$

where the outcome variable $HQ\ Share_{ijt}$ is a measure of the subsidiary's reliance on the knowledge flow via the provision of HQ services from the parent *i* measured as the ratio of the parents' HQ services to the total sales of the foreign subsidiary in country *j* at time *t*. The independent variable $\beta_1 Production\ Sharing_{ijt}$ is the level of dependence between the HQ and the subsidiaries. I examine the sensitivity of the results to the measure used for the level of dependence between the HQ and the subsidiaries. Three measures of the subsidiaries' level of dependence on the firm's global value chain are: (1) the subsidiaries' share of sales destined to the local market to total sales in country *j* at time *t* (a measure of subsidiary *in*dependence from the firm's global value chain), (2) the subsidiaries' share of sales to the U.S. parent and sales to the subsidiaries in other countries to total sales in country *j* at time *t*, and (3) the subsidiaries' share of sales to the U.S. parent to total sales in country *j* at time *t*. For the first measure,

denoted as $Local_{ijt}$, by implication, when this share is small, subsidiary sales are directed to the parent, other U.S. persons, or persons in third countries. The second measure denoted as $Affiliated_{ijt,}$ is a measure of production sharing anywhere within the firm. The third measure, denoted as $Parent_{ijt,}$ is a strict measure of production sharing between the parent and the subsidiaries. X_{jt} is a vector of time-varying host country controls, including the level of real gross domestic product (GDP), a dummy variable which equals one if the country's official language is English, and the strength of patent protection in host country *j* at time *t*. $Employment_{ijt}$ is the firm's foreign subsidiary total employment in country *j* at time *t*. $Multi_{ijt}$ is a dummy variable that is one if the firm has multiple foreign subsidiaries in the country *j* at time *t*. $R\&D\ Expenditure_{ijt}$ is the subsidiary R&D intensity, measured by the ratio of the foreign subsidiary's R&D expenditure to its sales in the country *j* at time *t*. $Tax\ Haven_{ijt}$ is a measure of the intensity of tax management strategies of the firm, measured as the ratio of number of foreign subsidiaries of the firm in tax haven countries to the total number of foreign subsidiaries of the firm in all countries. $Wage_{ijt}$ is the average wage paid to workers in a firm's foreign subsidiaries in the country *j* at time *t*. Next, α_j and α_t are the country and year fixed effects. Last, α_0 is the constant term and ε_{ijt} is the stochastic error term.

An important question is how to accurately measure the knowledge and product flows. Past studies have used highly aggregated measures of knowledge flows. Gupta and Govindarajan (2000) collected knowledge flow data on seven items: 1) marketing know-how, 2) distribution know-how, 3) packaging design/technology, 4) product designs, 5) process designs, 6) purchasing know-how, and 7) management systems and practices. Harzing and Noorderhaven (2006) utilize four of these seven knowledge flows. The data used here are granulated by the type of knowledge (i.e. type of service supplied by the HQ) in a way that provides a little more

detail than past studies. Knowledge flows are measured for twelve HQ service types: accounting, advertising, computer and data processing, database and other information, industrial engineering, education and testing, engineering, rights related to industrial processes (industrial processes), legal, maintenance, management, and R&D. Also, unlike past studies which have used scale survey questions to measure knowledge flows, the level of knowledge flows in my data is more quantifiable because it is denominated in dollars.[2]

Measuring vertical integration cannot generally be done using publically available information and so researchers often rely on more qualitative measures. This study uses business confidential survey data on intrafirm sales and purchases of inputs by foreign subsidiaries. In the international business literature, Harzing and Noorderhaven (2006) measure intrafirm product flows by asking managers to estimate the percentage of their subsidiary's input from (or output to) different entities: HQ and other subsidiaries or external suppliers in the same country or abroad. In the international economics literature, Alfaro et al (2014) combine information on plant activities and ownership structure with input-output data to construct an index of vertical integration for a subsidiary in a given industry and country. This paper adopts three measures for the continuous variable, $Production\ Sharing_{ijt}$, which is a measure of the level of dependence between production by the HQ and its subsidiaries. For example, our measure on the percent of local sales destined to the local market might be assumed to be inversely related to production sharing between parents and subsidiaries.

LI subsidiaries are assumed to be focused on the local market (i.e. involved in horizontal production) and to exhibit low knowledge and product flows with the parent because of their greater autonomy to purchase inputs in the local market. The connection between product

[2] To measure managerial knowledge transfers Berry (2014) uses the number of expatriates in a firm's foreign operations.

outflows from IM subsidiaries to HQ and knowledge flows from HQ differs across industries according to the type of HQ services (i.e., intermediate inputs) used in production. For example, there are sizable HQ services for U.S. parents in the *Pharmaceutical* and *Integrated Petroleum and Refining and Extraction* industries. Pharmaceutical multinational enterprises tend to exhibit vertical integration, participating in a broad range of drug discovery and development, manufacturing and quality control, marketing, sales and distribution. The high level of internalization in this industry probably reflects an effort to protect the firm's proprietary knowledge assets. In the case of the *Integrated Petroleum and Refining and Extraction* industry subsidiaries are often engaged in projects that require services from their U.S. headquarters, such as engineering services to design and develop new methods for extracting oil and gas.

I account for differences in vertical integration in the industries that use a particular HQ service most intensely by adding a dummy variable for the industry which accounts for the largest share of headquarter services. Using a single industry dummy is appropriate since specific types of headquarter services are typically concentrated in a single industry (see table 3). This augmented model is as specified as:

(2)

$$HQ\ Share_{ijt} = \alpha_0 + \alpha_j + \alpha_t\, \beta_1 Production\ Sharing + \beta_2\ Industry_{kjt} + \beta_3\ Industry_{kjt} \times Production\ Sharing_{jt} + \beta_4\ X_{jt} + \beta_5 Employment_{ijt} + \beta_6 Multi_{ijt} + \beta_7 R\&D\ Expenditure_{ijt} + \beta_8\ Tax\ Haven_{ijt} + \beta_9 Wage_{ijt} + \varepsilon_{ijt}$$

where $Industry_{kjt}$ is a dummy variable for parent firms *i* in country j and industry *k* where the particular HQ service is most highly concentrated. For example, the largest percentage (47%) of U.S. parents that provide industrial processes services to their foreign subsidiaries are in the *Pharmaceutical and Medicines* industry. In this case, the independent variable

$Industry_{kjt}$ would represent a dummy variable equal to one if the firm *i* is in *Pharmaceuticals and Medicines*. The regression equation also includes the interaction term $Industry_{kjt}\ x\ ProductionSharing_{jt}$ in equation (2) to control for the industry specific marginal impact of vertical integration on HQ services. For the various types of services, industry controls are included for *Pharmaceuticals and Medicines; Integrated Petroleum Refining and Extraction*; *Other Food Products*; *Aerospace Products and Parts*; *Industrial Machinery*; *Other Information Services*; *Agriculture, Construction, and Mining Machinery*; and *Education Services*

3. Data

The empirical analysis is based on firm-level data from the BE-125 Quarterly Survey of Transactions in Selected Services and Intellectual Property with Foreign Persons and the BE-11 Annual Survey of U.S. Direct Investment Abroad collected by the U.S. Bureau of Economic Analysis (BEA). Data from the BE-125 survey on sales of HQ services by parent to subsidiaries are used as evidence of the parents' provision of HQ services to their subsidiaries. The BE-11 survey data on sales of goods by subsidiaries by destination are used as evidence of production sharing. Specifically, I rely on BE-125 survey data from 2006-2011 for twelve broad service types: accounting, advertising, computer and data processing, database and other information, industrial engineering, education and testing, engineering, rights related to industrial processes, legal, maintenance, management, and R&D. These types of services share the common characteristics that they are high value business activities with large investments in human capital and significant strategic potential (Mudambi and Venzin 2010). I rely on the BE-11 annual survey data from 2006-2011 for the percentage of sales by foreign subsidiaries destined to the local market to total foreign subsidiary sales. Also, using data from the BE-11 survey, I

include country-level control variables for a firm's total subsidiary employment, R&D expenditures, average wages paid to workers, and an indicator variable of whether the firm's has multiple foreign subsidiaries in a country. The total number of employees of the firm in a given country controls for firm size and should be positively associated with higher HQ services. Collaborative innovation between the parent and the subsidiaries proxied by subsidiary R&D expenditures should result in strong knowledge flows from the U.S. parent to its subsidiaries. Higher wages paid by the foreign affiliates suggest a high level of worker skill and a high level of technical absorptive capacity and therefore should be associated with a higher level of HQ services. The indicator variable for multiple establishments is a proxy for within-country knowledge networks that facilitate coordination across the firm and should be positively associated with higher HQ services. In the analysis, the data on subsidiary operations needed to be collapsed to the parent company-host country level because that is the finest level at which the data on intrafirm service flows are collected.

Table 1 provides a description of all the variables used in the models. Gross domestic product (GDP), which controls for local market size, comes from the World Bank's World Development Indicator series. Using CEPII data on the official language of countries, I test whether parents and subsidiaries sharing a common language facilitate trade in HQ services (Egger and Lassman 2012).[3]

To control for any relationship between the strength of a country's patent protection and the provision of HQ services I use the Walter Park patent index (Park 2008). The index is based on five factors: the type of intellectual property; the length of patent protection; the mechanisms for enforcing patent rights; membership in international patent agreements; and restrictions or

[3] See http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=19

limitations on the use of patent rights. For each of these categories, a country is given a score (ranging from 0 to 1) indicating the strength of the country's intellectual property rights along that dimension. The strength or weakness of intellectual property protection may influence a firm's decision to provide HQ services in two ways. On the one hand, stronger intellectual property protection may encourage firms to increase HQ services because there is less risk of misappropriation. This is consistent with Branstetter et. al (2006) who find that patent reform abroad increased knowledge flows (i.e. technology transfers) from parent firms to affiliates, particularly when parents use patent rights heavily. On the other hand, the relationship between intellectual property rights protection and HQ services may be weak because internalization reduces the risk of misappropriation. For example, Yang and Maskus (2001) argue that their weak findings between IPR and affiliated licensing are consistent with the internalization theory of multinational investment. The relationship between the strength of intellectual property protection and HQ services remains theoretically ambiguous.

Lastly, the ability to measure the provision of HQ services from the BEA data may be impacted by companies' corporate structure and internal accounting methods aimed at tax management. For example, a U.S. multinational firm could have an incentive to provide knowledge assets to a foreign subsidiary, with an associated charge for HQ services, so that the subsidiary can, in turn, collect charges for those assets from subsidiaries in other countries. In addition, different tax jurisdictions may treat the allocation of HQ services costs differently. To capture the effects of differences in tax rates across countries, I include a measure of the intensity of tax management activities of the firm measured as the number of foreign subsidiaries of the firm in tax haven countries to the total number of foreign subsidiaries of the firm in all countries. I categorize host countries of foreign subsidiaries as tax havens or non-tax havens based on the

classification of Hines and Rice (1990). Table 2 provides the list of countries classified by those authors as tax haven countries.[4]

Three important patterns are apparent from the data. First, as shown in Table 3, over four-fifths of HQ services are concentrated in three of the twelve types of services in the data: rights related to industrial processes and products; management, consulting, and public relations services; and research, development, and testing services. By industry of the parent, pharmaceutical manufacturing accounts for the largest industry rendering these three types of services.

Second, as shown in Table 4, firms supply a disproportionately high share of their HQ services to Europe and a disproportionately low share to Asia and North America. Table 5 shows how the European countries rank based on the distribution of headquarter services, sales and employment. In Europe, two countries, Ireland and Switzerland, receive a disproportionate high share of HQ services, while the United Kingdom and "Other Europe" receive a disproportionately low share. Lastly, as shown in Table 6, a large concentration of HQ services is in tax haven countries. This result suggests that HQ services may be associated with tax management strategies such that transactions may be booked in the country with no or little real economic activity.

[4] Based on the BE-11 data on income and tax withheld on income, the average tax rate for countries classified as tax havens was 1.2 percent (standard deviation of 1.6 percent) in 2006-2011 compared with 3.2 percent (standard deviation of 5.8 percent) for other countries.

4. Headquarter Services and the Global Value Chain

This section examines the effects of vertical integration on the provision of HQ services. The results are presented in two parts. Section 4.1 provides estimates of equation (1) using our three measures of production sharing and considering all HQ services without distinguishing by the type of HQ service. Section 4.2 estimates equation (2) to examine the effects by the twelve types of HQ services. Equation (2) is the preferred specification since it accounts for heterogeneity across industries. Both equations are estimated using a Tobit model, which accounts for censoring of HQ services.

4.1 Aggregate Results

Table 7 shows the results for equation (1). The three variables of interest that measure the production sharing between the parent and the subsidiary are: $Local_{ijt}$, $Affiliated_{ijt}$, and $Parent_{ijt}$. All the regressions include fixed effects for each country and year. For all HQ services, the regression results are shown for the basic model with the different measures of production sharing in columns (1), (3) and (5). The model in column (2) includes the industry control for $Pharmaceuticals_{kjt}$ and the interaction term $Pharmaceuticals_{kjt} \times Local_{ijt}$ to control for the industry specific marginal effects of vertical integration. Similar interactions with the other measures of production sharing are included in columns (4) and (6).

The coefficient on the measure of production sharing, $Local_{ijt}$ is not statistically significant in column (1) where $HQ\ Share_{ijt}$ is the outcome variable. However this result is misleading because it does not account for heterogeneity across industries. The estimates in column (2) support the hypothesis that the impact of vertical integration on the provision of HQ

services depends on the industry of the parent: the coefficient on $Pharmaceuticals_{kjt} \times Local_{jt}$ is negative and highly statistically significant.

The results shown in column (4) using a broad definition of production sharing—measured by the sales to the U.S. reporter and affiliated subsidiaries in other countries—that support the industry heterogeneity findings. However, the results in column (6) show a negative effect of production sharing on HQ services. Additional work should focus on understanding how our different measures of vertical integration yield these mixed results for the aggregate results, especially for those in column (6).

Across the different specifications, the results for $Tax\ haven_{jt}$ in column (1)-(6) suggest that firms that utilize more tax management strategies provide more HQ services. This result may reflect the transfer of knowledge assets to low-tax jurisdictions. Also, the results further show that host country market size and a shared language are negatively associated with HQ services, while the effect is positive for firms' employment, wages and whether the firm has multiple foreign subsidiaries in a country. The estimated impact of foreign subsidiary R&D intensity is statistically insignificant for all the specifications.

4.2 Type of Headquarter Services Results

The estimated impact of vertical integration on each type of HQ service varies substantially from the aggregate results.. Table 8 presents the regression results for the top three types of HQ services: industrial processes, management, and R&D. The results in column (1) and column (3) show that the impact of production sharing on the provision of HQ services for industrial processes and R&D services is positive and statistically significant. This result holds irrespective of the parent industry. These types of HQ services may be viewed as

complementary to production activities of vertically integrated foreign subsidiaries. For management services, the results in column (2) show that the effect of changes in the degree of vertical integration varies by industry of the parent.

For three types of services, the regression results are consistent across the three measures for production sharing, except for industrial processes. The regression results for industrial processes and R&D in columns (1)-(6) support the finding that the more vertically integrated a subsidiary is increases the provision of HQ services by the U.S. parent. However, the results in column (7) do not support the hypothesis: the coefficient on $Affiliated_{ijt}$ is negative and statistically significant. For management services, the regression results are consistent across the three types of measures for production sharing: the impact of vertical integration is negatively associated with HQ services.

Table 9 shows the results for the three types of HQ services—computer, engineering and legal services—where the largest parent industry is in *Integrated Petroleum Refining and Extraction*. All measures of vertical integration are positively associated with legal services for nonpetroleum related parents and there is some evidence of an inverse relationship between vertical integration and computer services of petroleum parents.

Table 10-12 shows the results for the remaining types of services. There is evidence that across all measures of vertical integration of a positive association with design and maintenance services for parents in industries are not the largest user of these services and evidence from some measures of vertical integration of a positive association with accounting and education services for parents in industries that are not the largest users of these services.

5. Conclusion

This paper has examined knowledge management within multinational enterprises (MNEs) by analyzing whether shared production between parents and subsidiaries is associated with more assistance via headquarter (HQ) services. Seminal contributions in the international business literature identified the connection between the transfer of knowledge from the U.S. parent to its subsidiaries and the flow of products between the U.S. parent and its subsidiaries. This study moves beyond previous work by focusing on the composition of HQ services and the cross-industry differences in the impact of the level of vertical integration of the firm's subsidiary on the provisions of HQ services. It advances the findings in the international business literature by demonstrating that product outflows from the implementor (IM) subsidiaries to the parent are positively associated with knowledge flows from the parent because of the two-way trade that often occurs within global value chains.

The analysis uses data from the Bureau of Economic Analysis (BEA) on sales of HQ services by parent to subsidiaries over the period 2006-2011. This data covering the universe of U.S. MNEs and U.S. trade in services are granulated by the type of HQ services and denominated in dollars. In contrast, past studies have used small sample sizes, and used scale survey questions to measure highly aggregated measures of knowledge flows.

This study improves our understanding of the link between knowledge and product flows in MNEs within the increasingly important global value chains of the firm. The results show that the relationship is complex. Overall, there is substantial heterogeneity both across countries and within industries in the types of knowledge flows provided by U.S parents to their subsidiaries. These findings will help BEA assess the quality of reporting of intra-firm trade in services and to understand the effects of production sharing on the U.S. economy.

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Figure 1
Variations in Subsidiary Strategic Contexts: A Knowledge Flows-Based Framework

Outflows of knowledge from the local subsidiary to the rest of the corporations		**Low**	**High**
	High	Global Innovator	Integrated Player
	Low	Local Innovator	Implementor

Inflows of knowledge from the rest of the corporation to the focal subsidiary

Source: Gupta and Govindarajan (1991)

Table 1. Description of Variables

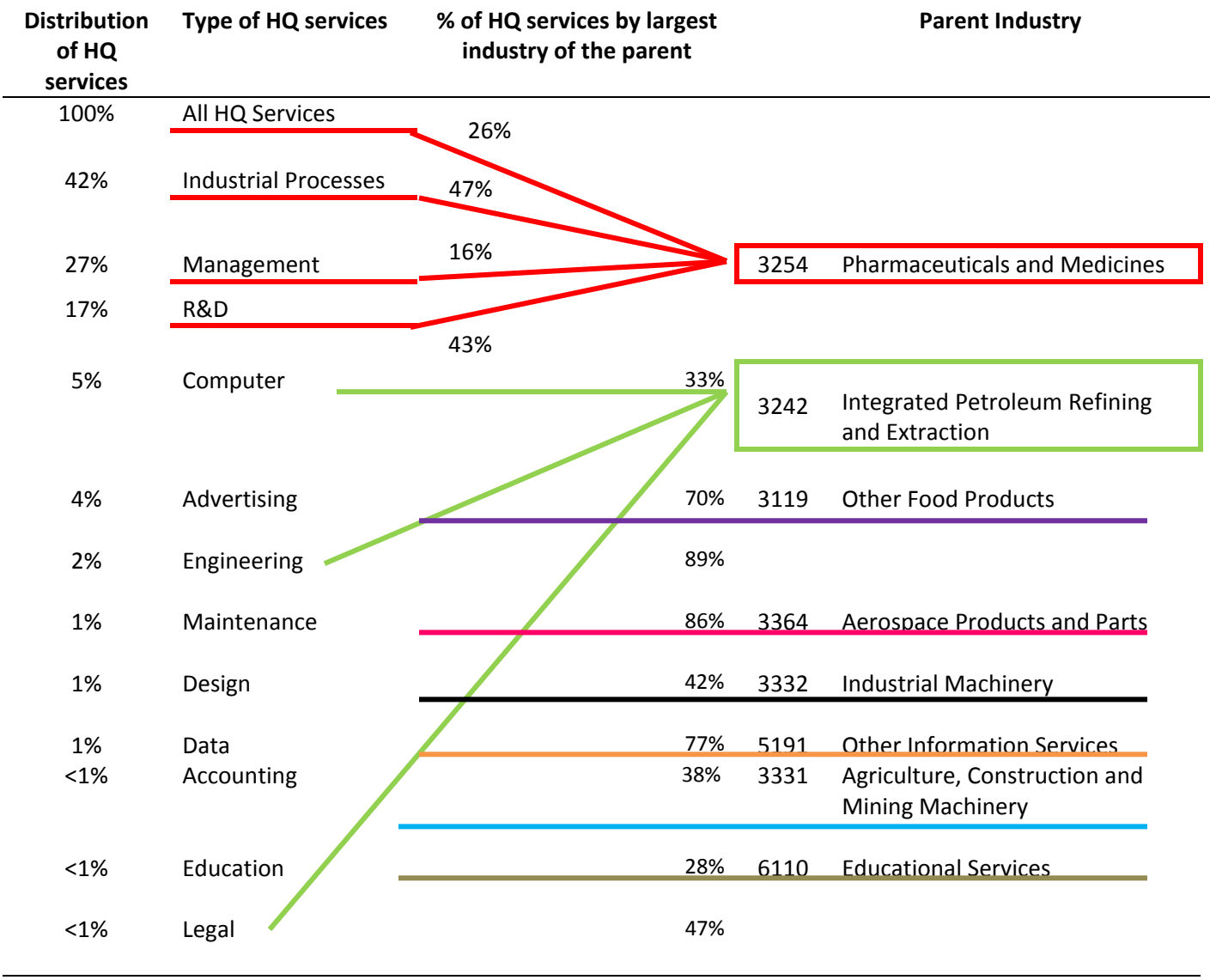
Variable	Description
HQ Services:	
Accounting	Receipts for accounting, auditing and bookkeeping services as a share of total firm sales in the country
Advertising	Receipts for advertising services as a share of total firm sales in the country
Computer	Receipts for computer and data processing services as a share of total firm sales in the country
Data	Receipts for data base and other information services as a share of total firm sales in the country
Design	Receipts for industrial engineering services as a share of total firm sales in the country
Education	Receipts for educational and training services as a share of total firm sales in the country
Engineering	Receipts for engineering, architectural, and surveying services as a share of total firm sales in the country
HQ services	Receipts for all headquarter services as a share of total firm sales in the country
Industrial	Receipts of the rights related to the industrial processes and products as a share of total firm sales in the country
Legal	Receipts for legal services as a share of total firm sales in the country
Maintenance	Receipts of maintenance, installation, alteration, and training services as a share of total firm sales in the country
Management	Receipts of management, consulting, and public relations services as a share of total firm sales in the country
R&D	Receipts of research, development, and testing services as a share of total firm sales in the country
Other Variables:	
Employment	Log of a firm's foreign subsidiaries' employment in the country
GDP	Log GDP of a the country
Language	An indicator variable that is one if the country's official language is English
Local	Foreign subsidiary's local sales as a share of total sales
Affiliated	Foreign subsidiary's sales to the U.S. reporter and to other affiliated subsidiaries as a share of total sales
Mgmt	An indicator variable that is one if the parent industry is in NAICS 3254 and 5221
Mixed	An indicator variable that is one if the parent industry spread out over multiple industries.
Multi	An indicator variable that is one if the firm has multiple foreign subsidiaries in the country
Parent	Percent of foreign subsidiary's sales to the U.S. reporter to total sales
Patent Index	Walter Park index to measure the strength of a country's patent protection (Walter 2008)
Petroleum	An indicator variable that is one if the parent industry is in NAICS industry 3242
Pharmaceutical	An indicator variable that is one if the parent industry is in NAICS industry 3254
R&D Expenditure	R&D expenditures of the foreign subsidiaries in the country
Tax Haven	The ratio of the number of foreign subsidiaries of the firm in tax haven countries to total number of foreign affiliates of the firm in all countries.
Wage	Log of the average wage paid to workers in a firm's foreign subsidiaries in the country

Table 2. Hines and Rice List of Tax Haven Countries

Andorra	Hong Kong	Netherlands Antilles
Anguilla	Ireland	Panama
Antigua and Barbuda	Jordan	Saint Kitts and Nevis
Aruba	Lebanon	Saint Lucia
Bahamas	Liberia	Saint Vicente and the Grenadines
Bahrain	Liechtenstein	Samao
Barbados	Luxembourg	San Marino
Belize	Macao	Seychelles
Bermuda	Maldives	Singapore
British Virgin Islands	Malta	Switzerland
Cook Islands	Marshall Islands	Tonga
Cyprus	Mauritius	Turks and Caicos Islands
Dominica	Monaco	Vanuatu
Gibraltar	Montserrat	
Grenada	Nauru	

Source: Hines and Rice (1990)

Table 3. Distribution of Headquarter Services by Type of Service and by Largest Parent Industry

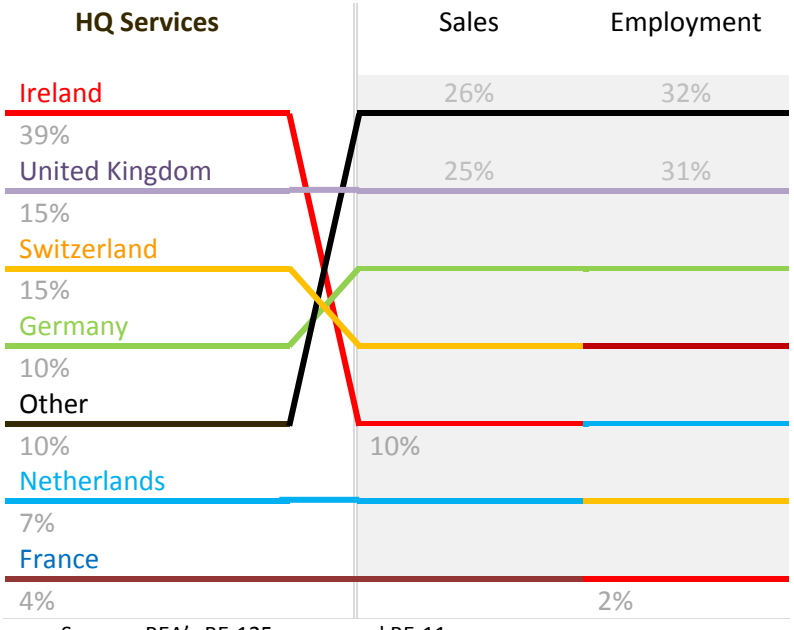


Source: BEA's BE-125 survey and BE-11 survey

Table 4. Average Distribution of HQ services, sales and employment by region
2006-2011

	HQ Services	Sales	Employment
Europe	67%	54%	39%
North America	10%	16%	20%
Africa	2%	2%	1%
Asia	13%	20%	29%
Latin American and Other Western Hemisphere	8%	7%	10%
Middle East	1%	1%	1%

Table 5. How Do European Countries Rank Based on Distribution of Various Factors



Source: BEA's BE-125 survey and BE-11 survey

Table 6. Average Distribution of HQ Svcs, Sales and Employment by Tax Haven and Non Tax Haven 2006-2011

	HQ Services	Sales	Employment
Non tax haven	54%	81%	96%
Tax haven	46%	19%	4%

Source: BEA's BE-125 survey and BE-11 survey

Table 7. Headquarter services and the global value chain: Aggregate results

Production Sharing Independent Variable:	Sales Destined to Local Market		Sales to the U.S. Reporter and Subsidiaries in other countries		Sales to U.S. Reporter	
Dependent Variable (as a share of total firm sales in country):	HQ services (1)	HQ services (2)	HQ services (3)	HQ services (4)	HQ services (5)	HQ services (6)
Employment	93.40*** (36.88)	93.42*** (36.89)	93.72*** (36.98)	93.778*** (37.00)	94.40*** (37.27)	94.48*** (37.30)
GDP	-4.15*** (1.75)	-4.16*** (1.76)	-4.152*** (1.75)	-4.17*** (1.76)	-4.11*** (1.74)	-4.12*** (1.74)
Language	-79.77*** (38.00)	-80.52*** (38.33)	-80.28*** (38.14)	-81.48*** (38.62)	-75.80*** (36.55)	-76.12*** (36.70)
Pharmaceuticals	--	64.104** (34.356)	--	-33.78** (18.41)	--	-10.25 (10.92)
Local	5.13 (8.04)	9.289 (8.95)	--	--	--	--
Pharmaceuticals × Local	--	-93.52** (48.42)	--	--	--	--
Affiliated	--	--	-20.24 (12.54)	-31.95*** (16.01)	--	--
Pharmaceuticals × Affiliated	--	--	--	178.91*** (79.48)	--	--
Parent	--	--	--	--	-179.11*** (73.42)	-183.05*** (75.06)
Pharmaceuticals × Parent	--	--	--	--	--	120.53 (104.06)
Multi-unit	115.43*** (50.07)	115.49*** (50.11)	115.75*** (50.14)	115.72*** (50.13)	116.19*** (50.34)	116.298*** (50.39)
Patent Index	1.96 (8.45)	2.052 (8.45)	1.95 (8.45)	2.10 (8.44)	1.79 (8.46)	1.79 (8.46)
R&D Expenditures	-0.03 (0.05)	-0.035 (0.05)	-0.033 (0.04)	-0.03 (0.05)	-0.03 (0.04)	-0.03 (0.04)
Tax Haven	260.86*** (100.91)	260.10*** (100.56)	259.51*** (100.66)	258.91*** (100.42)	252.72*** (97.94)	252.04*** (97.65)
Wage	84.56*** (38.07)	84.78*** (38.19)	84.71*** (37.14)	84.94*** (38.26)	84.46*** (38.05)	84.68*** (38.16)
Constant	492.007 (383.508)	495.675 (384.148)	496.664 (384.538)	507.880 (386.400)	489.65 (383.39)	492.73 (383.92)

Note: *** p<0.01, ** p<0.05, *p<0.01. Number of observations are 96,355. All Tobit regressions include year fixed effects and country fixed effects.

Table 8. Headquarter services and the global value chain: Top three types of HQ services

Production Sharing Independent variable:	Sales Destined to Local Market			Sales Destined to U.S. Reporter and other countries			Sales to the U.S. Reporter		
Dependent Variable (as a share of total firm sales in country):	Industrial Processes (1)	Manage-ment (2)	R&D (3)	Industrial Processes (4)	Manage-ment (5)	R&D (6)	Industrial Processes (7)	Manage-ment (8)	R&D (9)
Employment	43.31*** (21.36)	100.03*** (48.48)	0.27*** (0.05)	43.16*** (21.29)	100.52** (48.71)	0.27*** (0.05)	44.16*** (21.75)	100.89*** (48.88)	0.28*** (0.06)
GDP	-0.97 (0.66)	-5.28** (2.81)	-0.008 (0.006)	-1.00 (0.66)	-5.27** (2.80)	-0.008 (0.006)	-1.00 (0.66)	-5.16** (2.75)	-0.008 (0.006)
Language	-65.68** (34.42)	-16.52 (21.54)	-0.56*** (0.16)	-66.09** (34.60)	-17.14 (21.61)	-0.56*** (0.16)	-65.56** (34.23)	-7.82 (20.60)	-0.58*** (0.006)
Pharmaceuticals	84.23*** (42.81)	--	0.59*** (0.18)	25.85** (13.97)	--	0.08 (0.13)	42.38*** (21.27)	62.95** (33.63)	0.25*** (0.10)
Local	-33.40*** (15.16)	77.1** (43.760)	-0.54*** (0.12)	--	--	--	--	--	--
Pharmaceuticals × Local	-51.14* (29.23)	--	-0.49** (0.26)	--	--	--	--	--	--
Mgmt	--	194.08** (103.15)	--	--	31.58 (21.41)	--	--	--	--
Mgmt × Local	--	-169.78** (96.13)	--	--	--	--	--	--	--
Affiliated	--	--	--	23.95*** (11.86)	-86.45** (47.29)	0.62*** (0.14)	--	--	--
Pharmaceuticals × Affiliated	--	--	--	102.38** (53.40)	--	0.51*** (0.26)	--	--	--
Mgmt × Affiliated	--	--	--	--	258.94** (139.19)	--	--	--	--
Parent	--	--	--	--	--	--	-41.96* (24.37)	-274.09** (141.60)	0.44*** (0.13)
Pharmaceuticals × Parent	--	--	-	--	--	--	104.17 (68.25)	--	0.32 (0.35)
Mgmt × Parent	--	--	--	--	--	--	--	241.12 (159.6)	--
Multi-unit	37.40** (20.12)	126.35** (68.88)	0.67*** (0.14)	38.29** (20.49)	12.87** (67.99)	0.67*** (0.14)	39.26** (20.94)	124.70** (67.90)	0.69*** (0.15)
Patent Index	-1.38 (5.11)	1.09 (12.71)	-0.01 (0.07)	-1.368 (5.107)	1.255 (12.708)	-0.01 (0.07)	-1.50 (5.11)	0.80 (12.74)	-0.01 (0.07)
R&D Expenditures	-0.04 (0.05)	-0.30 (0.28)	-0.00 (0.00)	-0.053 (0.05)	-0.29 (0.26)	-0.00 (0.00)	-0.05 (0.05)	-0.30 (0.29)	-0.00 (0.00)
Tax Haven	45.36 (29.00)	304.82*** (152.11)	-1.55*** (0.58)	41.87 (27.96)	313.10*** (156.90)	-1.62*** (0.59)	35.94 (26.03)	307.27*** (154.09)	-1.68*** (0.59)
Wage	32.47** (16.69)	115.77*** (57.96)	0.48*** (0.11)	31.67** (16.34)	116.986** (58.620)	0.47*** (0.11)	31.61** (16.31)	116.84*** (58.55)	0.47*** (0.10)
Constant	-192.59 (223.28)	481.47 (583.18)	-0.96 (2.86)	-201.23 (115.48)	525.90 (592.82)	-1.08 (2.85)	-194.17 (223.37)	475.24 (582.10)	-1.16 (2.85)

Note: 96,355 observations. *** p<0.01, ** p<0.05, *p<0.01. All Tobit regressions include year fixed effects and country fixed effects.

Table 9. Types of HQ services where the largest parent industry is in integrated petroleum manufacturing

Production Sharing Independent variable:	Sales Destined to Local Market			Sales to the U.S. Reporter and other countries			Sales to the U.S. Reporter		
Dependent Variable (as a share of total firm sales in country):	Computer (1)	Engineering (2)	Legal (3)	Computer (4)	Engineering (5)	Legal (6)	Computer (7)	Engineering (8)	Legal (9)
Employment	1.77*** (0.65)	19.69*** (8.26)	0.0005*** (0.0001)	1.77*** (0.66)	20.11*** (8.44)	0.005*** (0.0001)	1.78*** (0.66)	19.83*** (8.31)	0.000** (0.000)
GDP	-0.08*** (0.04)	-0.87 (0.89)	-0.000 (0.00002)	-0.08*** (0.04)	-0.87 (0.89)	0.00 (0.0009)	-0.08*** (0.04)	-0.85 (0.89)	-.000 (0.00)
Language	-3.10*** (1.40)	59.04** (30.44)	0.002*** (0.0009)	-3.11*** (1.40)	57.57** (29.87)	0.002*** (0.0009)	-2.93*** (1.34)	60.34** (30.98)	0.002*** (0.00)
Petroleum	12.83*** (4.65)	284.02*** (124.76)	0.003** (0.002)	15.87*** (5.69)	223.19*** (96.49)	0.005*** (0.002)	16.18*** (5.79)	254.48*** (110.06)	0.004*** (0.001)
Local	0.52 (0.40)	2.26 (8.71)	-0.001*** (0.0004)	--	--	--	--	--	--
Petroleum × Local	4.73*** (2.01)	-61.35 (42.51)	0.002 (0.001)	--	--	--	--	--	--
Affiliated	--	--	--	-0.99 (0.61)	-27.82 (17.68)	0.001*** (0.0005)	--	--	--
Petroleum × Affiliated	--	--	--	0.10 (1.56)	143.70** (76.05)	-0.003** (0.002)	--	--	--
Parent	--	--	--	--	--	--	-3.91*** (1.64)	-2.11 (17.52)	0.001*** (0.000)
Petroleum × Parent	--	--	--	--	--	--	-12.62* (7.25)	-211.95 (161.49)	-0.0002 (0.002)
Multi-unit	2.45*** (0.84)	34.09*** (17.17)	0.00*** (0.00)	2.46*** (0.85)	35.05*** (17.52)	0.009*** (0.0003)	2.45*** (0.84)	33.83*** (17.02)	0.00*** (0.000)
Patent Index	0.14 (0.37)	-0.61 (10.45)	-0.00 (0.00)	0.14 (0.37)	-0.38 (10.43)	-0.000 (0.003)	0.13 (0.37)	-0.66 (10.48)	-0.000 (0.000)
R&D Expenditures	0.001 (0.001)	-132.22 (81.53)	-0.00* (0.00)	0.001 (0.001)	-118.55 (76.05)	-0.004* (0.002)	0.00 (0.001)	-133.80 (82.81)	-0.003* (0.002)
Tax Haven	12.62*** (4.56)	73.25 (90.68)	0.00 (0.00)	12.63*** (4.57)	70.79 (90.51)	0.001 (0.001)	12.55*** (4.55)	73.31 (90.75)	0.001 (0.001)
Wage	2.26*** (0.90)	20.32*** (9.08)	0.000 (0.000)	2.26*** (0.90)	20.55*** (9.18)	0.001 (.0001)	2.26*** (0.90)	20.63*** (9.21)	0.000 (0.000)
Constant	-9.88 (15.21)	-271.16 (428.20)	-0.01 (0.01)	-9.26 (15.10)	-267.01 (427.23)	-0.018 (0.016)	-10.07 (15.18)	-281.93 (431.75)	-0.018 (0.016)

Note: 96,139 observations. *** p<0.01, ** p<0.05, *p<0.01. All Tobit regressions include year fixed effects and country fixed effects.

Table 10. HQ services and the global value chain: Additional types of services

Production Sharing Independent Variable:	*Sales Destined to the Local Market*					
Dependent Variable (as a share of total firm sales in country):	Accounting (1)	Advertising (2)	Data (3)	Design (4)	Education (5)	Maintenance (6)
Employment	0.334*** (0.109)	48.287** (26.531)	0.385*** (0.132)	0.003*** (0.0005)	0.007*** (0.001)	27.623*** (11.905)
GDP	-0.010 (0.015)	0.748 (3.158)	0.027 (0.032)	0.000 (0.000)	0.000 (0.0005)	-0.883 (1.190)
Language	1.953*** (0.820)	319.832** (174.483)	0.491 (0.474)	0.011*** (0.002)	0.029*** (0.008)	134.012*** (68.292)
Mixed	2.796*** (1.078)	--	--	--	0.028*** (0.006)	--
Food	--	450.022* (266.252)	--	--	--	--
Other Information	--	--	4.359*** (1.452)	--	--	--
Industrial	--	--	--	0.005 (0.003)	--	--
Aerospace	--	--	--	--	--	259.525*** (104.933)
Local	-0.368*** (0.170)	-5.497 (26.812)	0.088 (0.231)	-0.005*** (0.001)	0.0006 (0.003)	-58.405*** (26.317)
Mixed × Local	-0.141 (0.323)	--	--	--	0.027*** (0.007)	--
Food × Local	--	214.615 (182.630)	--	--	--	--
Other Information × Local	--	--	-0.091 (0.617)	--	--	--
Industrial × Local	--	--	--	0.006 (0.006)	--	--
Aerospace × Local	--	--	--	--	--	78.113 (63.981)
Multi-unit	0.746*** (0.339)	73.166* (42.966)	0.542*** (0.188)	0.003*** (0.0008)	-0.008*** (0.002)	57.034*** (24.985)
Patent Index	0.105 (0.170)	48.264 (123.00)	0.054 (0.250)	0.0002 (0.001)	0.012 (0.016)	16.491 (17.508)
R&D Expenditures	0.0000 (0.0002)	0.034 (0.044)	0.000 (0.000)	-0.009*** (0.004)	-0.093*** (0.034)	-82.240* (49.346)
Tax Haven	-0.534 (0.758)	48.264 (123.00)	-1.253 (1.441)	-0.007 (0.006)	0.012 (0.016)	-105.873 (74.835)
Wage	0.068 (0.060)	22.575 (14.704)	0.468*** (0.212)	0.000 (0.000)	0.003*** (0.001)	-32.712 (23.335)
Constant	-5.617 (7.643)	-2306.35 (1975.3)	-27.069 (17.957)	-.089 (0.063)	-0.458 (0.278)	-115.434 (510.067)

Note: 96,139 observations. *** p<0.01, ** p<0.05, *p<0.01. All Tobit regressions include year fixed effects and country fixed effects.

Table 11. HQ services and the global value chain: Additional types of services

Production Sharing Independent Variable:	*Sales to the U.S. Reporter and other countries*					
Dependent Variable (as a share of total firm sales in country)::	Accounting (1)	Advertising (2)	Data (3)	Design (4)	Education (5)	Maintenance (6)
Employment	0.33*** (0.11)	49.08** (27.01)	0.37*** (0.12)	0.003*** (0.0005)	0.007*** (0.001)	27.52*** (11.87)
GDP	-0.01 (0.015)	0.73 (3.14)	0.02 (0.03)	0.000 (0.000)	0.004 (0.0005)	-0.86 (1.18)
Language	1.93*** (0.815)	316.92** (172.83)	0.46 (0.47)	0.011*** (0.002)	0.029*** (0.008)	133.14*** (67.89)
Mixed	2.77*** (1.02)	--	--	--	0.05*** (0.008)	--
Food	--	626.46** (320.72)	--	--	--	--
Other Information	--	--	4.22*** (1.29)	--	--	--
Industrial	--	--	--	0.010*** (0.002)	--	--
Aerospace	--	--	--	--	--	322.24*** (147.32)
Affiliated	0.56* (0.33)	-42.25 (47.19)	0.67 (0.51)	0.007*** (0.002)	0.018*** (0.006)	59.94*** (28.26)
Mixed × Affiliated	-0.21 (0.57)	--	--	--	-0.03*** (0.013)	--
Food × Affiliated	--	--	--	--	--	--
Other Information × Affiliated	--	--	0.61 (0.88)	--	--	--
Industrial × Affiliated	--	--	--	-0.005 (0.007)	--	--
Aerospace × Affiliated	--	--	--	--	--	-85.56 (67.13)
Multi-unit	0.75*** (0.34)	74.02* (43.36)	0.53*** (0.18)	0.003*** (0.0008)	-0.009*** (0.002)	58.02*** (25.44)
Patent Index	0.10 (0.17)	5.84 (32.55)	0.05 (0.25)	0.0002 (0.001)	0.001 (0.003)	16.00 (17.30)
R&D Expenditures	0.000 (0.00)	0.03 (0.04)	0.0002 (0.002)	-0.008** (0.004)	-0.10*** (0.03)	-73.20 (45.68)
Tax Haven	-0.58 (0.75)	43.37 (122.52)	-1.19 (1.43)	-0.007 (0.006)	0.01 (0.016)	-113.61 (76.88)
Wage	0.06 (0.06)	22.86 (14.88)	0.47*** (0.21)	0.000 (0.000)	0.003*** (0.001)	-33.15 (23.54)
Constant	-5.85 (7.63)	-2301.31 (1967.0)	-26.78 (17.88)	-0.09 (0.06)	-0.45* (0.27)	-158.61 (504.74)

Note: 96,139 observations. *** p<0.01, ** p<0.05, *p<0.01. All Tobit regressions include year fixed effects and country fixed effects.

Table 12. HQ services and the global value chain: Additional types of services

Production Sharing Independent Variable:	Sales to the U.S. Reporter					
Dependent Variable (as a share of total firm sales in country)::	Accounting (1)	Advertising (2)	Data (3)	Design (4)	Education (5)	Maintenance (6)
Employment	0.33*** (0.11)	48.12** (26.45)	0.37*** (0.12)	0.003*** (0.0005)	0.007*** (0.001)	27.93*** (12.05)
GDP	-0.01 (0.015)	0.69 (3.14)	0.02 (0.03)	0.0004 (0.0002)	0.004 (0.0005)	-0.88 (1.18)
Language	1.93*** (0.815)	317.28** (173.42)	0.46 (0.47)	0.010*** (0.002)	0.029*** (0.008)	130.11** (66.86)
Mixed	2.77*** (1.02)	--	--	--	0.05*** (0.008)	--
Food	--	--	--	--	--	--
Other Information	--	--	4.22*** (1.29)	--	--	--
Industrial	--	--	--	0.01*** (0.002)	--	--
Aerospace	--	--	--	--	--	309.94*** (140.41)
Parent	0.56* (0.33)	35.77 (53.24)	0.67 (0.51)	0.007*** (0.002)	0.018*** (0.006)	59.94*** (28.26)
Mixed × Parent	-0.21 (0.57)	--	--	--	-0.03*** (0.013)	--
Food × Parent	--	644.69* (363.00)	--	--	--	--
Other Information × Parent	--	--	0.61 (0.88)	--	--	--
Industrial × Parent	--	--	--	-0.016 (0.016)	--	--
Aerospace × Parent	--	--	--	--	--	-26.52 (51.72)
Multi-unit	0.75*** (0.34)	71.60* (42.05)	0.53*** (0.18)	0.003*** (0.0008)	-0.009*** (0.002)	58.92*** (25.81)
Patent Index	0.10 (0.17)	5.97 (32.54)	0.05 (0.25)	0.0002 (0.0014)	0.001 (0.003)	16.17 (17.36)
R&D Expenditures	0.000 (0.00)	0.03 (0.04)	0.0002 (0.002)	-0.008** (0.004)	-0.10*** (0.03)	-69.73 (43.57)
Tax Haven	-0.58 (0.75)	51.05 (123.13)	-1.19 (1.43)	-0.007 (0.006)	0.01 (0.016)	-114.73 (77.07)
Wage	0.06 (0.06)	22.01 (14.52)	0.47*** (0.21)	0.000 (0.000)	0.003*** (0.001)	-33.10 (23.56)
Constant	-5.85 (7.63)	-2284.55 (1959.63)	-26.78 (17.88)	-0.09 (0.06)	-0.45* (0.27)	-151.18 (504.77)

Note: 96,139 observations. *** p<0.01, ** p<0.05, *p<0.01. All Tobit regressions include year fixed effects and country fixed effects.