Strategic movement of intellectual property within U.S. multinational enterprises

Derrick Jenniges, Raymond Mataloni Jr., Sarah Stutzman, and Yiran Xin

February 2018

Abstract

Strategic behavior by U.S. multinational enterprises (MNEs) to shift profits between countries to reduce their worldwide tax burden has been well studied. Much of the existing research has focused on the use of debt payments and intrafirm intellectual property licensing agreements to explain why and how MNEs shift income across national borders. Although these tax strategies may become less important following the U.S. Tax Reform Act of 2017, there is evidence they have had a large impact on measures of economic activity in recent years. This paper explores how U.S. MNEs have used cost sharing agreements between U.S. parent companies and their foreign affiliates to shift profits to lower tax jurisdictions. The results are consistent with our hypothesis that having a cost sharing agreement is associated with lower profitability for U.S. parents and higher profitability for foreign affiliates. The results provide a microeconomic view of how strategic movement of intellectual property affects key measures in the national and international economic accounts, such as GDP and the trade balance.

This paper benefited from comments received from Sally Thompson and other colleagues at the U.S. Bureau of Economic Analysis. The views expressed in this paper are solely those of the authors and not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce.

I. Introduction

The shifting of profits abroad by U.S. multinational enterprises (MNEs) through the movement of intellectual property (IP) has been widely documented. Profit shifting can occur through the use of internal transactions such as royalty license agreements and research and development (R&D) cost sharing agreements (CSAs). These arrangements, which can be written to take advantage of ambiguities in tax laws, allow MNEs to legally shift the location of ownership of IP assets within the firm at a price below actual cost. This trend was documented in a 2015 Credit Suisse report:

> *Transfer pricing determines where profits on intercompany transactions are booked for tax purposes…….. By entering into transactions with themselves…, using transfer pricing to price them, a dose of intercompany finance and a few loopholes, companies can move profits to low tax countries and costs to high tax countries* (Credit Suisse, 2015, pp.35).

Although the ultimate effects of the recent changes to U.S. tax law remain to be seen, there is reason to believe that the incentives for this behavior have not disappeared. The behavior may continue due to the growing importance of intangibles in the production of goods and services, the difficulty in obtaining comparable market prices for these transactions, and the ability to sell ownership of intangible assets, like any other asset, within the firm.

Concerns over tax base erosion has led the U.S. government to investigate this behavior. In 2012 the U.S. Senate Permanent Subcommittee on Investigations questioned Microsoft's use of an intrafirm CSA, suggesting that aggressive transfer pricing was used to shift its IP assets from the U.S. headquarters to subsidiaries in Puerto Rico, Ireland, and Singapore in an effort to avoid or reduce its U.S. taxes (U.S. Congress Senate Committee on Homeland Security and Governmental Affairs, 2012). According to the Senate testimony, the majority of Microsoft's research and development (R&D) was conducted in the United States. However, using a CSA, Microsoft Singapore and Microsoft Ireland reimbursed its U.S. parent for some R&D costs in exchange for the right to collect royalties on the resulting IP in certain geographic markets. The Senate testimony indicates that Microsoft Singapore and Microsoft Ireland then marked-up and relicensed these IP assets to other subsidiaries, paying 2.74 percent and 5.76 percent effective tax rates, respectively, to their host governments on income earned in 2011; these tax rates are significantly lower than the statutory U.S. corporate tax rate of 35 percent, which prevailed at the time. Similarly, in 2013 the U.S. Senate subcommittee concluded that Apple used a CSA, a variety of offshore structures, and favorable transfer pricing to shift billions of dollars of profits to Ireland from the United States (U.S. Congress Senate Committee on Homeland Security and Governmental Affairs, 2013). The subcommittee found that over the period 2009-2011, Apple Sales International (ASI), the subsidiary

that holds most of Apple's intellectual property abroad, earned $38 billion in profits, but paid only $21 million in taxes for an effective tax rate of 0.06 percent.

In this study, we explore profit-shifting behavior of U.S. MNEs through the use of CSAs. We hypothesize that having a CSA is associated with lower profits for the U.S. parent and higher profits for its foreign affiliates. We test this hypothesis on a sample of R&D-intensive MNEs over the 2006-2015 period and find support for our hypothesis. Specifically, parents with CSAs tend to be less profitable than similar parents without CSAs in the same industry while foreign affiliates of parents with CSAs tend to be more profitable than their U.S. parent compared with affiliates of parents without CSAs. Our study also offers an explanation for the paucity of research on this topic. It is very difficult to find public information identifying U.S. MNEs with CSAs, and efforts by the U.S. government to collect and publish this information have not been successful.

II. Literature review

Many studies examine how U.S. MNEs shift profits to subsidiaries in low tax countries (e.g. Desai et. al, 2006; Dyreng and Lindsey, 2009; Evers et al., 2015; Huizinga and Laeven, 2008; Weichenrieder, 2009). These studies tend to find a positive link between MNE-wide profitability measures and the existence of subsidiaries in tax haven countries. Some of these studies examine how the location of IP assets or R&D can explain differences in parent and affiliate income and profits. Dischinger and Riedel (2011) examine European MNEs and find a positive link between subsidiaries with lower tax rates relative to other affiliates and the location of intangible property assets within the MNE. Karkinsky and Riedel (2012) and Griffith et al. (2014) find a negative relationship between tax rates and the number of patents filed at subsidiaries of U.S. and European MNEs. Bridgman (2014) shows how strategic movement of IP affects the location of profits of U.S. MNEs by demonstrating how excluding intangible assets from the calculation of FDI returns impacts U.S. returns from the rest of the world compared with domestic returns. Grubert (2003) shows that income derived from R&D-based intangible assets comprised roughly half of the income that MNEs shifted from parents and subsidiaries in high-tax jurisdictions to subsidiaries in low-tax jurisdictions. Grubert (2012) shows that decreases in the effective foreign tax rates are linked with increases in foreign shares of income, lower domestic profit margins, and greater foreign profit margins. His results are more pronounced for R&D-intensive U.S. parents. Heckemeyer and Overesch (2017) conduct a metadata analysis of estimates of tax elasticities (i.e. the percent change in subsidiary profits given a percent change in the tax rate). The studies they examine

confirm the negative correlation between profits earned by the different geographic units of MNEs and the local tax rates they face. A significant portion of this correlation tends to be associated with the use of transfer pricing and royalty license fees.

Other studies have examined the effect of this activity on economic measurement. Lipsey (2009) shows that profits of U.S. MNEs in tax haven countries are disproportionate to measures of real activity in those countries, which he speculates is related to the strategic movement of IP. Feenstra et al. (2010) identify challenging measurement topics in the area of international trade and investment. They argue that measures of production are distorted by the strategic movement of IP, which they demonstrate by showing a correlation between intracompany charges within U.S. MNEs and determining factors such as tax incentives, industry (mainly high-tech industries), and firm size. Guvenen et al. (2017) propose a formulary apportionment method, which attributes worldwide earnings of MNEs to locations based on apportionment factors tied to production such as sales and employee compensation to better reflect the location of economic activity. Although this research helps to broadly quantify the impact of the strategic movement of IP, it does not quantify the role of specific tax strategies.

Only a few studies specifically address how CSAs are used by U.S. MNEs to shift income to low tax jurisdictions. De Simone and Samsing (2017) examine an MNE's choice to either develop IP at home independently or engage in a CSA with a foreign affiliate. They find that the tendency to use CSAs is positively associated with more valuable IP assets, assets that are difficult to value, and having affiliates in tax jurisdictions that engage in less joint enforcement with the IRS. Mutti and Grubert (2009) find that U.S. parent R&D expenses have a smaller impact on affiliate royalty payments to U.S. parents than on the level of affiliate earnings or profits, suggesting that parents do not receive payments from their affiliates commensurate with their domestic R&D activity. This pattern was more pronounced for affiliates in tax haven countries such as Ireland, Bermuda, the Cayman Islands, and Luxembourg, which is consistent with MNEs using CSAs to transfer IP assets to affiliates in low-tax jurisdictions.

III. Challenges of measuring IP asset movement within MNEs

III.a Definition of IP assets

The 2008 System of National Accounts (SNA) defines five types of IP assets: R&D; mineral exploration and evaluation; computer software and databases; entertainment, literary, and artistic

originals; and other IP assets. The ownership of IP assets can be retained, in whole or in part, by the developer of these assets or transferred between entities within an MNE. Transferring the ownership of these rights occurs either through selling the rights outright or leasing them and is governed by licensing and royalty contracts. U.S. tax law on transfers of IP within an MNE are based on the arm's length standard, which requires that the price paid for the IP asset be commensurate with the expected income flows from that asset. Receipts and payments for the use of IP assets between U.S. MNEs and foreign entities are recorded by the U.S. Bureau of Economic Analysis (BEA) in the U.S. international transactions accounts (ITAs) as exports and imports of services.

III.b IP assets have an important role in U.S. trade in services

IP assets play an important role in U.S. trade in services, especially within MNEs. In 2016, U.S. net exports of services were $247.7 billion, up from $78.5 billion in 1999. Of this surplus in 2016, $80.1 billion (32 percent) was accounted for by charges for the use of intellectual property (sometimes referred to as licensing). Moreover, $47.4 billion (59 percent) of this surplus occurred within U.S. MNEs; that is, trade between U.S. parents and their foreign affiliates. R&D services are another category of IP-related services transactions. In 2016, the United States had exports of $37.2 billion and imports of $34.2 billion of R&D services, for a net surplus of $2.9 billion.

III.c Movement of IP assets within MNEs and its effects on measures of production

For tax purposes, and for economic accounting purposes, an IP asset is taxed based on the geographic location of its owner. This convention creates an incentive for MNEs to transfer ownership of IP that has been generated in their home country to affiliates in countries with lower tax rates at a price less than an arm's length price to reduce global income taxes. When successful, this practice often leads to large discrepancies between the location of productive economic activity generated through the use of IP assets and the location of legal ownership of these same IP assets. Under the SNA guidelines, many economic statistics, including stocks of IP assets, are collected and presented based on the concept of economic ownership. Economic ownership is said to accrue to the entity that bears the risks, and reaps the rewards, of using the IP. As a practical convenience, economic ownership is ascribed to the legal owner or paying user of the IP and is therefore attributed to that entity's place of legal incorporation or registration. In MNEs, the legal ownership of IP assets sometimes does not reflect the true economic ownership of these assets. This discrepancy causes official economic statistics, which are presented based on the legal ownership concept, to not fully represent where actual production

associated with the IP takes place. The incidence of creating IP assets in higher tax countries and transferring legal ownership of them to related entities in lower tax countries leads to increased exports of services and higher gross domestic product (GDP) estimates in low-tax countries, and reduced exports of services and lower GDP estimates in higher tax countries.

IV. Cost sharing agreements

IV.a Description of cost sharing agreements

Cost sharing agreements (CSAs) are defined under section 1.482-7 of the U.S. Tax Code regulations as an agreement under which the parties agree to share the costs of developing one or more intangibles in proportion to the share of reasonably anticipated benefits from exploiting the intangibles assigned to them under the arrangement. By sharing in the costs, the parties agree to share in the associated royalties if the outcome of the R&D has value. The most common method for assigning the division of royalties is based on territory (Bose, 2002, pp. 10), often with the U.S. parent retaining rights to collect license fees from sales in the United States and the affiliate receiving rights to collect license fees from sales to the rest of the world. CSAs do not involve a full transfer of ownership. Instead, through joint funding of the development of these assets, the firms jointly share in the ownership of these assets. Under the agreements, each participant is assigned a portion of the worldwide territory in which it can sell goods or services produced using these IP assets and/or to which they can license these IP assets to other affiliates and third parties. Each party separately collects and retains royalty license payments from affiliates and third parties. Cross-border payments by foreign affiliates to U.S. parents under CSAs are recorded as R&D services exports in the ITAs and the U.S. national income and product accounts (NIPAs).

IV.b History of cost sharing agreement regulations

U.S. tax laws regarding the intrafirm transfer of intangible assets are longstanding but the codification and enforcement of those laws has become more developed in the last few decades. Bose (2002) notes that these guidelines have existed in some form since the creation of the 1918 Revenue Act but that, in the last few decades, firms have tried to develop tax strategies that exploit ambiguities in those guidelines and the IRS has, in turn, tried to tighten its guidelines to eliminate ambiguity. The guiding principle for U.S. tax treatment of the within-firm-transfers of intangible assets originated with

the Tax Reform Act of 1986, which amended section 482 to require that when intangible assets are transferred between units of an MNE the receiving unit must pay a price to the providing unit that is commensurate with the expected income from that asset. In addition, the IRS was given the authority to re-allocate costs between related parties under transfer pricing arrangements, including CSAs. This authority allowed the IRS to conduct company-level review of the profitability of intangible assets in generating past sales and reset the previous intracompany IP asset sale prices, royalty rates, or development cost estimates.

Nine years later, additional modifications to section 482 resulted in changes including the introduction of buy-in payments to account for the value of pre-existing technology. In 2005, proposed regulations introduced new valuation methods for determining arm's-length buy-in payments and platform contributions to account for the value of other U.S. headquarters services embedded in the product or service. Temporary regulations were issued in 2008 and final regulations were issued in 2011.

Over the past decade, concern that MNEs were using transfer pricing to undervalue and move IP assets abroad has led to a greater degree of IRS enforcement surrounding CSAs. Litigation during this period, including IRS vs. Veritas (2009), IRS vs. Xilinx (2010), IRS vs. Altera (2015), IRS vs. Medtronic (2016), and IRS vs. Amazon (2017), sought to address the scope of the IRS's right to apply ex-post profitability information to prior CSA estimates as well as to reconcile the arm's-length and commensurate-with-income standards. Under IRS vs. Xilinx (2010) and IRS vs. Altera (2015), the courts concluded that companies did not need to include the costs of employee stock options in CSAs, as they would not be applied in an arm's-length transaction between two unrelated parties, and that the commensurate-with-income standard complements but does not override the arm's-length standard.

IV.c Impacts of cost sharing agreements on official statistics

Transfer pricing through cost sharing receipts by U.S. parents from foreign affiliates in low-tax regions will impact the NIPAs as well as the trade in services and the primary income components of the current account of the U.S. ITAs. These impacts will carry through to key economic aggregates, including GDP. Specifically, these impacts will affect the value of exports of services from the parent to the affiliate. If the parent charges the affiliate less than the true costs of developing the IP asset, the parent's exports of R&D services and the affiliate's imports of R&D services will be understated. If the

affiliate earns revenue from the IP abroad commensurate with the true value of these underlying assets, then its earnings will be increased by the transfer pricing. This will lead to an undervaluation of U.S. GDP and an overvaluation of GDP in the affiliate's country (United Nations, 2011, pp. 113).

The parent's portion of the income earned by the affiliate from the sale of goods or services embodying these IP assets is recorded in the ITAs under direct investment income. Because the undervaluation of the IP assets provided to the affiliate lowers the affiliate's costs, the parent's direct investment income receipts will be increased. Assuming that the affiliate is fully owned by the parent, the effects of the parent's reduced exports of R&D services will be effectively offset by increased direct investment income, so that the current account of the ITAs and GNP, which both take into account the trade in R&D services and investment income, will not be affected. However, for the affiliate, the increased earnings on the IP assets will result in an increase in the GDP of its host country. According to a 2011 United Nations report:

> *The recognition of IPPs [intellectual property products] as produced assets, and the associated recognition of the payments for use as service payments, has caused a growing gap between estimates of GDP and GNI [gross national income] in some countries ……. This outcome is not at odds with national accounts practices, but it does complicate economic analysis, and, arguably, reduces the relevance of GDP, as is already being seen in countries with significant outward flows of property income* (United Nations, 2011, pp. 116).

IV.d Potential methods to identify MNEs with CSAs

The incidence of transfer pricing in the intra-firm movement of IP assets has generated substantial interest in the academic, fiscal, and statistical communities. Information on this activity is collected by the IRS, but firm-level information is not publicly available. Under subsection 26 Code of Federal Regulations (CFR) 1.482-7 of the U.S. tax code governing CSAs, taxpayers participating in a qualified CSA must attach to their U.S. tax returns (or to a Schedule M of forms 5471 or 5472 for firms that pay foreign taxes) a statement indicating that they participate in a qualified cost sharing arrangement. They must also provide names and information of the other participants, the method to

determine the share of each participant's intangible development costs, any prior research and buy-in payments, and any allocations for stock-based compensation for plans filed after 2003.[1]

Some relevant firm-level information is provided by U.S. Patent and Trademark Office (USPTO) records. However, it is difficult to link patent data to specific U.S. MNEs and it is even more difficult to match foreign patent data with foreign affiliates of U.S. MNEs. Patent data provides information only on the patent titleholder and generally not on other participants, and the data are often not updated to reflect the transfer of IP assets to different entities within the MNEs. Because of these difficulties, in January of 2014, the USPTO proposed updating its rules "to facilitate the examination of patent applications and to provide greater transparency concerning the ownership of patent applications and patents."[2] However, the USPTO has not yet implemented this proposal.

We also explored using microdata collected on BEA's benchmark (BE-120) and quarterly (BE-125) surveys of transactions in selected services and intellectual property with foreign persons (henceforth, services surveys). U.S. firms engaging in CSAs with foreign persons, including foreign affiliates, are required by law to report exports of R&D services on these surveys. One difficulty of using this information is that the surveys do not separately identify transactions related to CSAs. When possible, we linked the microdata from these surveys to BEA's Activities of Multinational Enterprises (AMNEs) surveys, the BE-10 benchmark and BE-11 annual surveys, but differences in reporter names, coverage, and reporting thresholds on the services and AMNE surveys limited this approach.[3]

[1] Ultimately, we hope to obtain access to this information under an interagency data sharing agreement. Obtaining these records would allow us to construct an accurate and precise measure of firms with CSAs for each year. It would also improve on our current measure of CSAs by providing affiliate and country level detail. These arrangements, however, could not be made in time to be incorporated in this paper.

[2] Changes To Require Identification of Attributable Owner, Volume 79, No. 16, *Federal Register* (January 24, 2014)

[3] Reporters to the BE-120 services survey data used in this study, covering 2006 and 2011, were required to report receipts from (sales to) affiliated or unaffiliated foreign persons of a particular type of service or intellectual property greater than $2 million by country and by type of service. For the BE-125 services survey data used in this study, covering the other years, the cutoffs were $6 million for receipts and $4 million for payments, respectively. For the BE-10 benchmark AMNE survey data used in this study, covering 2009 and 2014, affiliates with assets, sales, or net income (+/-) of at least $80 million were required to report all of the data items used in this study. For the BE-11 annual AMNE survey data used in this study, covering the other years, the cutoff was $150 million for 2006-2008 and $60 million for 2010-2013 and 2015.

IV.e Method for identifying U.S. MNEs with a CSA

We identify U.S. MNEs with CSAs by linking U.S. MNEs from BEA surveys to Securities and Exchange Commission (SEC) 10-K filings using clerical name matching and searching for evidence of intrafirm CSAs using text searches of the 10-Ks. We limit our analysis to R&D-intensive U.S. MNEs because these firms are more likely to create and transfer valuable IP assets to subsidiaries (e.g. Mutti and Grubert, 2007 and De Simone et al., 2016). We define R&D-intensive U.S. MNEs as those having domestic R&D expenditures to sales ratios greater than or equal to 10 percent. To help avoid any arbitrary exclusions, any U.S. MNE meeting this criterion in any of five selected years (2003, 2006, 2009, 2012, or 2015) was included in our study. Applying this definition resulted in a list of 237 R&D-intensive U.S. MNEs from BEA's AMNE surveys.

The text searches of 10-K filings were done primarily using the SEC Edgar online search engine. Using a keyword search for "cost sharing" or "cost-sharing," we looked for evidence that the company had an intrafirm CSA in place. This search was done by company and by year for the period 2003-2015. Within Edgar, we also attempted to search for intracompany CSA references by firm across all documents filed with the SEC. Unfortunately, the option to search across all documents for a given year in Edgar is limited to filings during the past 4 years. Expanding our search in this way resulted in identifying only a few more cost sharing agreements, which did not have a significant impact on our analysis. In addition to the SEC's public Edgar search engine, we searched for CSA references within company filings and other documents using the commercial SEC document search engine BamSEC. This commercial search platform allowed us to search for CSA references across all SEC filings, news releases, and transcripts of earnings calls for a given U.S. MNE in our database. As with the comprehensive Edgar text search, utilizing this commercial search engine identified only a small number of additional U.S. MNEs with CSA references so it did not materially change our results. Nevertheless, employing these different methods gave us confidence that the main strategy of focusing on 10-K reports was robust and that the 10-K reports provide a systematic and reliable way to identify most of the large firms with intrafirm CSAs.

There are limitations to the 10-K search approach. Only U.S. MNEs listed on a U.S. stock exchange are required to file 10-Ks. As a result, we excluded from our analysis firms that did not file a 10-K record. Most importantly, the 10-K reports do not indicate the years in which the firm participated in a CSA or the level of CSA payments. Timing is important because during the time in which an affiliate is making its cost sharing installment payments to its U.S. parent, its profits will be depressed. After it

has completed those payments, its profits will be boosted by the favorable return on investment in those assets. The 10-K reports also do not necessarily indicate the country of the affiliate with whom the parent company enters into a CSA.[4] Additionally, the absence of country information requires that the CSA variable be applied at the parent level and to all affiliates of the given parent, whereas in reality, innovation and cost sharing activity is usually concentrated among a few affiliates (Bilir and Morales, 2016) and in one or two specific countries.

We linked our list of MNEs engaging in CSAs with profits and other data from BEA's AMNE surveys and with data on the level of cost sharing payments, as indicated by R&D services exports from parents to affiliates reported on BEA's services surveys.

IV.f Characteristics of U.S. MNEs with CSAs

From our list of 237 R&D-intensive U.S. MNEs reporting on the AMNE surveys, we identified 42 of them as having an intrafirm CSA at some time during our period of study. The remaining MNEs without a CSA reference were split into public corporations that filed a 10-K during the 2006-2015 sample period (152 MNEs) and private and other corporations that did not file a 10-K during the same period (43 MNEs). These results are summarized in table 1 and figure 1.

Table 1: R&D-intensive[1] U.S. MNEs by CSA reference, 2006-2015

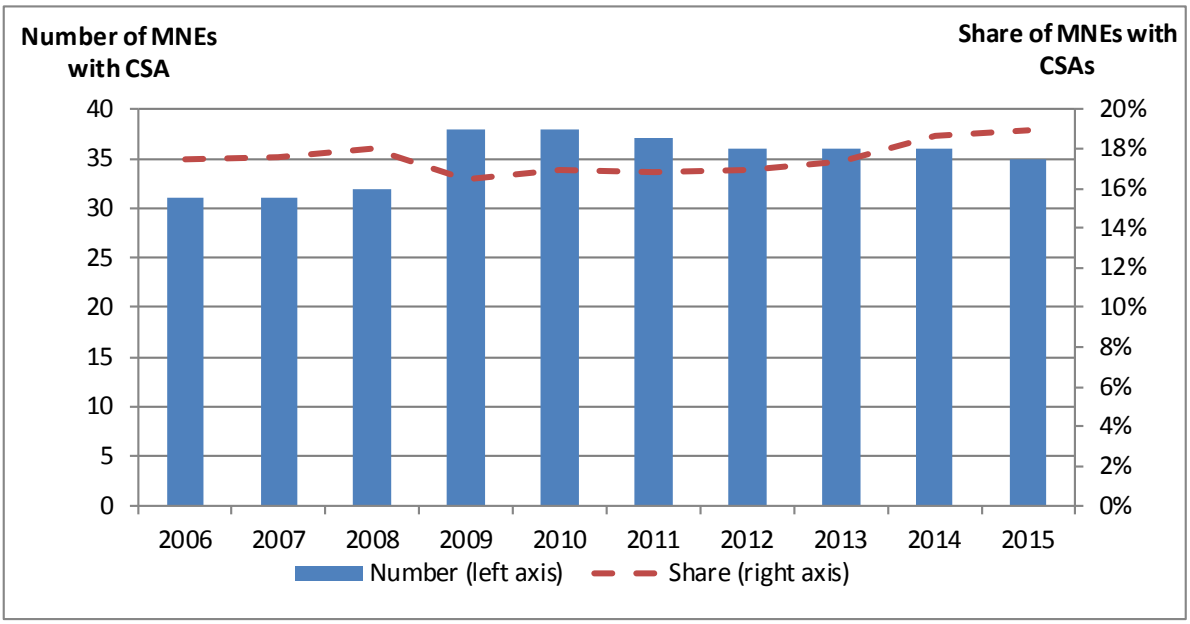
Cost Sharing Reference	Number of U.S. Parents	Percent of Total
Yes	42	18%
No and listed[2]	152	64%
No and private or not listed	43	18%
Total	237	100%

[4] While supplementing our search using the Edgar SEC database with commercially available databases, such as BamSEC and Bloomberg, can provide additional firm-level information on CSAs, these databases do not solve the root issues with using 10-K reports to identify firms with CSAs. These include the danger of false negatives. That is, just because we do not find a CSA reference is not a complete guarantee that the company does not have a CSA. In addition, the information in these datasets is generally based on corporate 10-K information collected by the SEC so the dataset is restricted to listed firms. Moreover, it may also be biased toward firms that have been listed for a longer time and, as a result, filed more documents with the SEC, and larger MNEs, which are likely to have filed more detailed financial documents with the SEC.

[1]R&D intensive = R&D expenditures-to-sales ratio >= 10 percent in any of the following years: 2006, 2009, 2012, or 2015.

[2]Listed means the corporation was listed on a U.S. stock exchange and filed a 10-K in at least one of the years in the sample period.

Figure 1: Number and share of U.S. MNEs having a CSA reference, 2006-2015

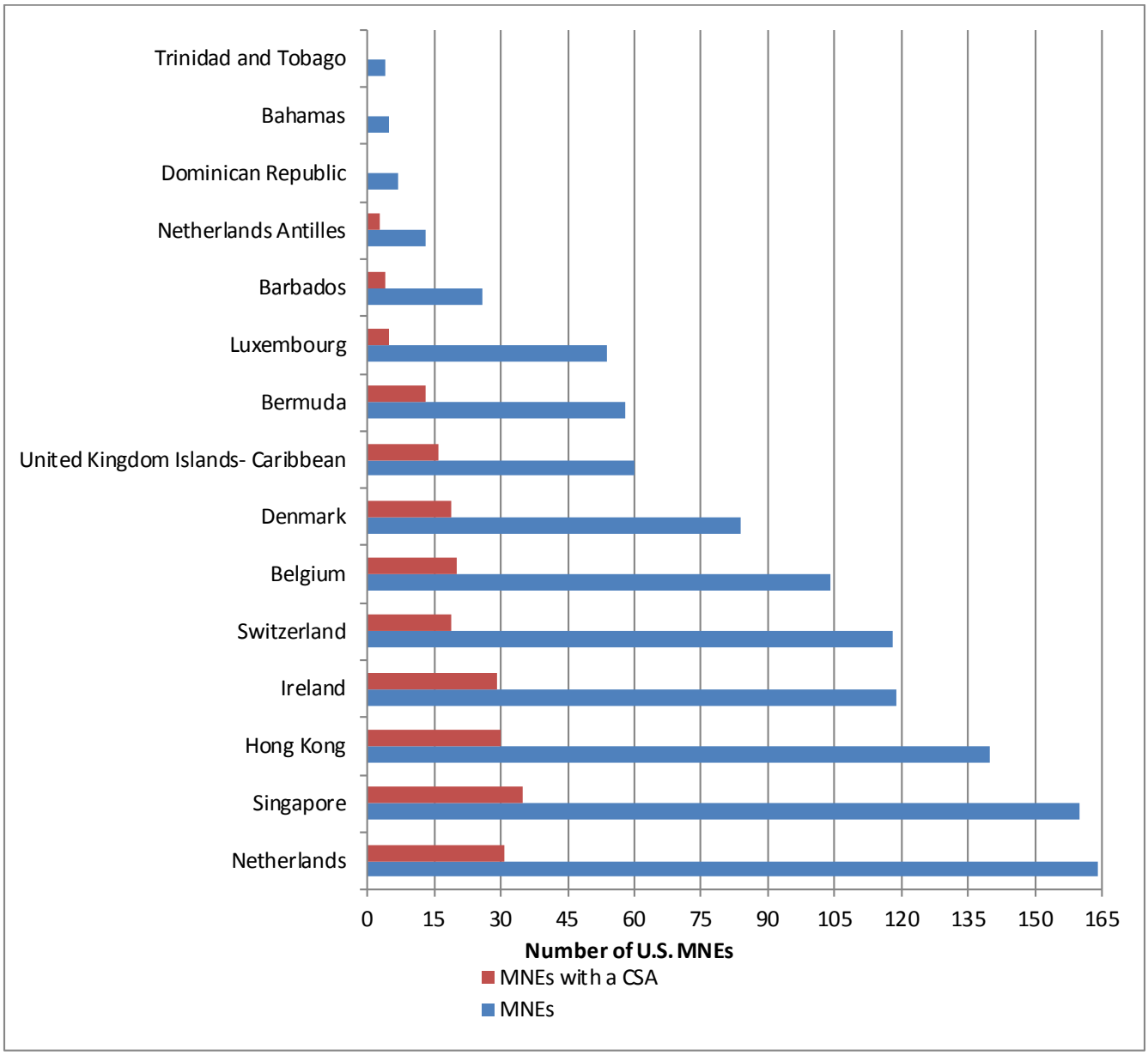


The share of MNEs reporting a CSA in their 10-K report was relatively stable in 2006-2015, although there was a slight rise after 2009.

U.S. MNEs have established foreign affiliates in many tax haven countries, as shown in figure 2.[5] It is most common for U.S. MNEs having CSAs with foreign affiliates to have affiliates located in the tax haven countries of Singapore, the Netherlands, Hong Kong, Ireland, Belgium, and Switzerland.

[5] The list of tax haven countries is based on the list provided in Sullivan (2004).

Figure 2: Number of R&D-intensive U.S. MNEs with affiliates in tax haven countries, 2006-2015[1]

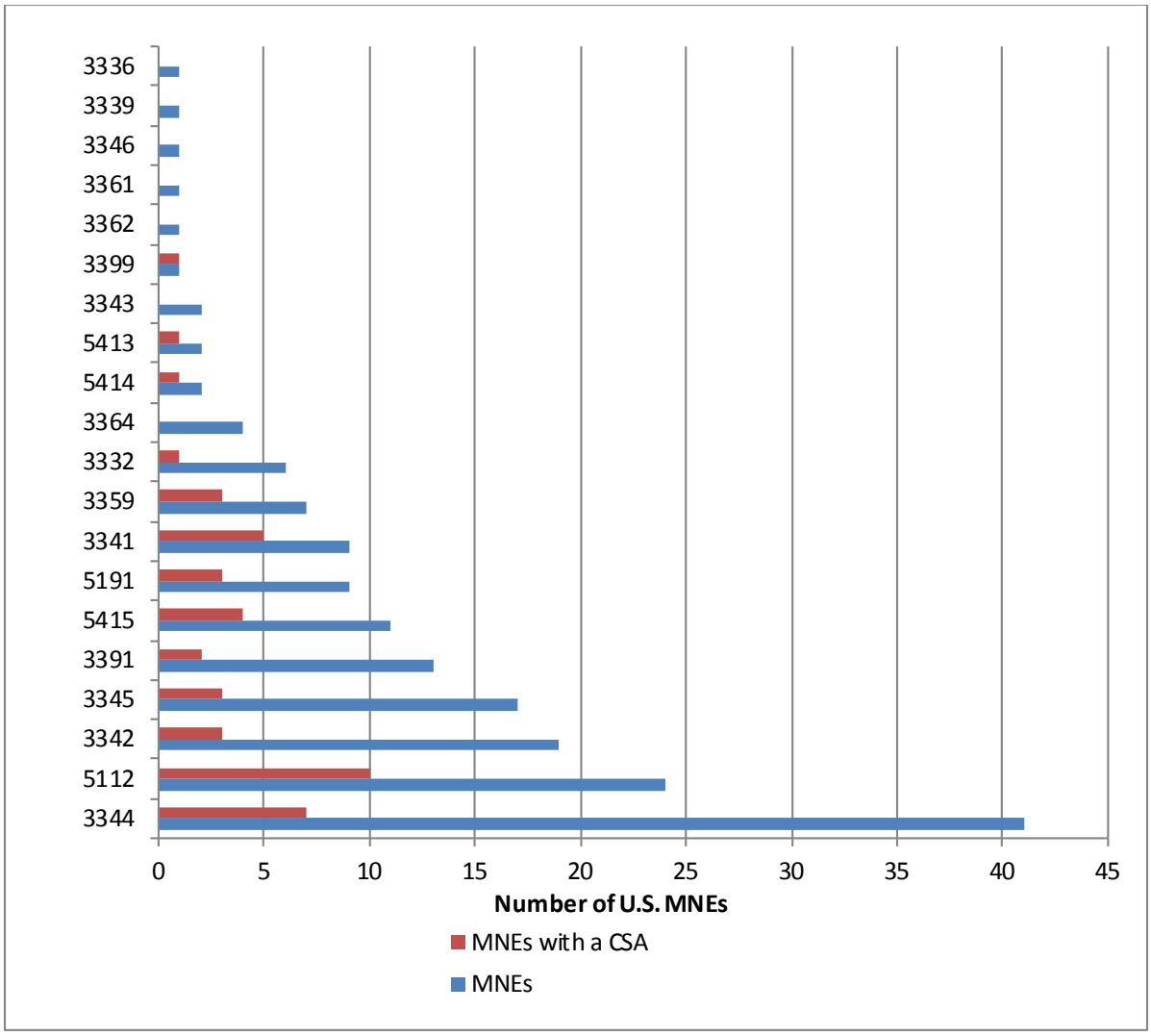


[1] The list of tax haven countries is based on the list provided in Sullivan (2004). Based on the BEA AMNE data, none of the MNEs with a CSA had affiliates in Trinidad and Tobago, the Bahamas, or the Dominican Republic between 2006 and 2015.

U.S. MNEs with CSAs are concentrated within a few key industry sectors. The majority of U.S. MNEs with CSAs fall within the following North American Industry Classification System (NAICS) industry sectors: metals and machinery manufacturing (NAICS 33), excluding chemicals; information (NAICS sector 51); and professional, scientific, and technical services (NAICS sector 54). Figure 3 present counts of MNEs in the four digit NAICS industries in these industry sectors, for all MNEs and for those having a CSA. These industry sectors may be considered "high-tech" and R&D intensive. Firms within the

information and professional, scientific, and technical services industry sectors tend to have a relatively large portion of their total assets in intangible capital. Previous research (such as Grubert, 2012) has found stronger links between parents in high-tech industries, the establishment of subsidiaries in low-tax countries, and the movement of IP for profit-shifting activities.

Figure 3: R&D-intensive U.S. MNEs by industry of U.S. parent, 2006-2015



NAICS code	Description
3332	Industrial Machinery Manufacturing
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing
3339	Other General Purpose Machinery Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical and Control Instruments Manufacturing
3346	Manufacturing and Reproducing Magnetic and Optical Media
3359	Other Electrical Equipment and Component Manufacturing
3361	Motor Vehicle Manufacturing
3362	Motor Vehicle Body and Trailer Manufacturing
3364	Aerospace Product and Parts Manufacturing
3391	Medical Equipment and Supplies Manufacturing
3399	Other Miscellaneous Manufacturing
5112	Software Publishers
5191	Other Information Services
5413	Architectural, Engineering, and Related Services
5414	Specialized Design Services
5415	Computer Systems Design and Related Services

V. Model, data, and empirical results

V.a Methodology and model

Our model is motivated by a basic return on assets framework for parents and affiliates, which measures the profitability of an operating unit within an MNE as generated by its stock of tangible and intangible assets. A similar approach was taken by Mutti and Grubert (2007), who estimate how the profitability of an operating unit within an MNE is related to its sales. Denoting *i* as the operating unit (U.S. parent or foreign affiliate), the rate of return is given by profit-type return (PTR) scaled by a firm's stock of assets, which consists of physical assets, such as building structures, land, and equipment, as well as intangible assets, such as intellectual property. [6]

[6] PTR is BEA's measure of income from current production based on its AMNE surveys. It is derived from financial accounting data and is calculated as net income before taxes minus capital gains and losses, depletion, and income from equity investment. For details, see the technical note to Mataloni and Goldberg (1994).

$$Rate\ of\ Return_i = \frac{PTR_i}{Physical\ assets_i + Intangible\ assets_i}$$

A unit's profitability is a function of its physical asset stock and its intangible asset stock, which can be either created in-house or purchased. We use the value of net property, plant, and equipment as the measure of the stock of physical assets. As a measure of the stock of intangible assets, we utilize data on R&D performed by the unit for its own use, R&D services payments and receipts, and affiliated IP royalty payments. The R&D stock is calculated using the perpetual inventory method where the flows equal R&D performed for own account, minus R&D services exports, plus R&D services imports. In the model, we also include affiliated royalty payments since they represent compensation for shared R&D assets within an MNE; royalty payments represent period-specific leasing of R&D assets rather than an accumulation of R&D assets over time so they are simply added to the denominator rather than being included in the perpetual inventory calculation. This approach acknowledges that the stock of intangible assets within a unit of an MNE may be either created in house or purchased from outside. Both intangible and tangible assets are expected to generate a return for the unit, resulting in the following profit equation for U.S. parents:

$$PTR_{USP,t} = \beta_0 + \beta_1 PPE_{USP,t} + \beta_2 R\&D\ Stock_{USP,t} + \beta_3 Royalty\ Payments_{USP,t} + \beta_4 Cost\ Sharing_{USP,t} + \varepsilon_{USP,t} \quad (1)$$

The inclusion of the parent PPE accounts for firm size, and we limit the analysis to R&D-intensive parents. Equation 1, which is estimated with panel data for U.S. parents (*USP*), is also estimated with industry fixed effects.

Conceptually one might imagine a similar equation for individual foreign affiliates because, just like U.S. parents, both their tangible and intangible assets are expected to generate a return. However, two data limitations prevent the estimation of such an equation for affiliates. First, our data do not identify specific foreign affiliates with which U.S. parents had CSAs. As a result, the binary variable denoting a CSA is a firm-level variable. The second limitation is that the services surveys (the surveys that collect data for royalty payments and R&D exports and imports) are collected only at the country level, not at the foreign affiliate level, which becomes an issue when an MNE has more than one foreign affiliate in a particular country.

As a result of these data limitations, we aggregate data to the country of the affiliate and construct an equation that compares the profitability of the parent and foreign affiliate units of a U.S.

MNE to uncover evidence that is consistent with U.S. parents shifting profits abroad through the use of CSAs. We begin with an equation similar to equation 1 except instead of variables representing the data for U.S. parents, they represent the sum of that data item for all affiliates of a given parent in a given country:

$$PTR_{C,t} = \beta_0 + \beta_1 PPE_{C,t} + \beta_2 R\&D\ Stock_{C,t} + \beta_3 Royalty\ Payments_{C,t} + \beta_4 Tax\ rate_C + \varepsilon_{C,t}, \quad (2)$$

where *C* denotes the sum of data for foreign affiliates of a particular MNE in a particular country. We add a variable denoting the median effective tax rate faced by affiliates in a country in 2006-2015. Then, we subtract equation (1) from equation (2) to examine the difference in the profitability of affiliates and parents. The resulting equation is given by:

$$(PTR_C - PTR_{USP})_t = \alpha_0 + \alpha_1 (PPE_C - PPE_{USP})_t + \alpha_2 (R\&D\ Stock_C - R\&D\ Stock_{USP})_t + \alpha_3 (Royalty\ Payments_C - Royalty\ Payments_{USP})_t + \alpha_4 Cost\ Sharing_{USP,t} + \alpha_5 Tax\ rate_C + \eta_t \quad (3)$$

In equation 3, variables with the subscript *C* denote the sum of the data for all foreign affiliates of a particular MNE in a particular country. For example, if a U.S. parent has three affiliates in Belgium, then the R&D stock for each of these three affiliates would be aggregated into a single R&D stock in Belgium for that U.S. parent. The Tax rate variable captures the effect of host country tax rates.

V.b Variable definitions and sources

Details about the definitions and data sources used to construct the variables in equations 1 and 3 are provided in table 2.

Table 2: Variable definitions and sources

Variable	Definition	Source
PTR	Profit-type return; equals net income + host country income taxes – capital gains/losses – income on equity.	BEA BE-10/11 surveys
PPE	Net property, plant, and equipment.	BEA BE-10/11 surveys
R&D Stock	R&D performed for own account – R&D services exports + R&D services imports, where flow data are converted to a stock using perpetual inventory method.	BEA BE-10/11 and BE-120/125 surveys
Royalty Payments	Royalty payments paid by the U.S. parent (foreign affiliates) to the foreign affiliates (U.S. parent).	BEA BE-120/125 surveys
Cost Sharing	A binary variable that equals 1 if U.S. parent has a cost sharing agreement with its foreign affiliates; equals zero otherwise.	SEC 10-K text searches
Tax Rate	The median tax rate faced by foreign affiliates in the host country in 2006-2015	BEA BE-10/11 surveys

V.c Summary statistics

Table 3 provides summary statistics for these variables at the U.S. parent level for all industries and for key CSA industries. Key CSA industries are those in which we find references to U.S. MNEs with CSAs in 10-K reports; they correspond to NAICS industry sectors metals and machinery manufacturing (33), information (51), and professional, scientific, and technical services (54). For U.S. MNEs within these key CSA industry sectors, table 4 provides summary statistics for parents and table 5 does the same for foreign affiliates according to whether the U.S. parent has a CSA with its foreign affiliates.

Table 3: Summary statistics for all R&D-intensive U.S. parents, 2006-2015
(USD millions, except for number counts)

Panel A: All industries			
Variable	**Mean**	**Modified median[1]**	**Standard deviation**
PTR_{USP}	638.9	43.5	2,523.7
PPE_{USP}	982.8	160.7	2,395.2
$R\&D\ Stock_{USP}$	5,970.2	1,060.9	14,566.0
$Royalty\ Payments_{USP}$	4.8	0.0	48.3
Number of U.S. parents[2]	196		
Panel B: Key CSA industries[3]			
Variable	**Mean**	**Modified median[1]**	**Standard deviation**
PTR_{USP}	1,805.8	118.0	4,145.3
PPE_{USP}	1,830.5	376.9	3,396.1
$R\&D\ Stock_{USP}$	13,734.2	2,932.4	25,350.6
$Royalty\ Payments_{USP}$	10.5	0.0	87.7
Number of U.S. parents	172		

[1] To maintain the confidentiality of individual companies, the mean of the middle 11 observations (the median, the five observations above the median, and the five observations below the median) is reported.

[2] The number of parents is less than that in table 1 because the number here does not include privately held parents, which are excluded from the regression analysis.

[3] Key CSA industry sectors are NAICS 33, 51, and 54.

Table 4: Summary statistics for U.S. parents in key CSA industry sectors, 2006-2015 (USD millions, except for number counts)[1]

Panel A: U.S. parents with CSAs			
Variable	**Mean**	**Modified median[2]**	**Standard deviation**
PTR_{USP}	794.5	62.6	2,318.3
PPE_{USP}	1,029.9	247.0	2,541.1
$R\&D\ Stock_{USP}$	5,915.1	1,846.8	12,604.3
$Royalty\ Payments_{USP}$	7.3	0.0	28.8
Number of U.S. parents	40		
Panel B: U.S. parents without CSAs			
Variable	**Mean**	**Modified median[2]**	**Standard deviation**
PTR_{USP}	2,107.8	141.2	4,507.1
PPE_{USP}	2,069.6	454.3	3,577.9
$R\&D\ Stock_{USP}$	16,069.5	3,723.2	27,630.6
$Royalty\ Payments_{USP}$	11.5	0.0	98.7
Number of U.S. parents	132		

[1] Key CSA industry sectors are NAICS 33, 51, and 54.

[2] To maintain the confidentiality of individual companies, the mean of the middle 11 observations (the median, the five observations above the median, and the five observations below the median) is reported.

Table 5: Summary statistics for foreign affiliates in key CSA industry sectors, 2006-2015 (USD millions, except for number counts and Tax Rate)[1]

Panel A: U.S. parents with CSAs			
Variable	**Mean**	**Modified median[2]**	**Standard deviation**
PTR_{AFF}	23.9	0.36	338.3
PPE_{AFF}	10.8	0.60	51.5
$R\&D\ Stock_{AFF}$	2.2	0.0	112.2
$Royalty\ Payments_{AFF}$	1.1	0.0	10.4
$Tax\ Rate_{AFF}$ (%)	16.1	14.1	9.5
Number of affiliates	882		
Panel B: U.S. parents without CSAs			
Variable	**Mean**	**Modified median[2]**	**Standard deviation**
PTR_{AFF}	28.4	0.56	275.5
PPE_{AFF}	24.8	0.90	157.8
$R\&D\ Stock_{AFF}$	1.00	0.0	33.8
$Royalty\ Payments_{AFF}$	10.5	0.0	121.9
$Tax\ Rate_{AFF}$ (%)	16.9	17.4	9.7
Number of affiliates	2,878		

[1] Key CSA industry sectors are NAICS 33, 51, and 54.

[2] To maintain the confidentiality of individual companies, the mean of the middle 11 observations (the median, the five observations above the median, and the five observations below the median) is reported.

Note: For each U.S. parent in each year, data for all affiliates are summed together for each variable.

V.d Results

Our econometric results support our hypothesis that having a CSA is generally associated with lower profitability for U.S. parents and higher profitability for foreign affiliates. The first stage of our analysis is to examine the profitability of U.S. parents with and without CSAs. All else equal, we would expect those with CSA's to be less profitable. Using panel analysis to estimate equation 1, the results in table 6 below show that, in general, there is not a statistically significant relationship between the profitability of U.S. parents with CSAs and parents without CSAs. This result holds whether examining all industries (column 1) or whether the analysis is limited to the industries where CSAs are concentrated

(column 2). However, the lack of significance partly reflects differences in the importance of having a CSA across industries (column 3). In 3 of the 10 NAICS industries were CSAs are concentrated, there is a significant negative relationship between the profitability of U.S. parents and engaging in CSAs with their foreign affiliates. For example, parents in software publishing with CSAs had average profits that were $128 million lower than similarly endowed parents in that industry without CSAs. In 1 of the 10 industries, there is a significant positive relationship between parent profits and engaging in CSAs. In 6 of the 10 NAICS industries, there is not a statistically significant relationship. Although the evidence is mixed, on balance, there is more evidence for our hypothesis than against it. The mixed nature of these results is not surprising given our crude measure of CSA activity and the volatility of our profit measure.

Table 6: U.S. parent results, 2006-2015

Variable	All industries	Key CSA industry sectors[1]	Key CSA industry sectors[2]	Number of Parents
Constant	293.064 (209.382)	21.840 (55.400)	52.438 (52.306)	
PPE_{USP}	0.123 (0.088)	0.217* (0.091)	0.215* (0.091)	
$R\&D\ Stock_{USP}$	0.071*** (0.018)	0.056** (0.020)	0.054** (0.020)	
$Royalty\ Payments_{USP}$	2.336** (0.880)	7.080 (3.658)	7.240* (3.556)	
$Cost\ Sharing\ Agreement_{USP}$ (CSA)	-6.891 (46.030)	-17.422 (40.627)		
*CSA*NAICS* 3332_{USP} (Industrial Machinery Manufacturing)			221.206*** (46.328)	6
*CSA*NAICS* 3341_{USP} (Computer and Peripheral Equipment Manufacturing)			42.453 (87.008)	9
*CSA*NAICS* 3342_{USP} (Communications Equipment Manufacturing)			120.015 (145.479)	18
*CSA*NAICS* 3344_{USP} (Semiconductor and Other Electronic Component Manufacturing)			-1.456 (52.08)	40
*CSA*NAICS* 3345_{USP} (Navigational, Measuring, Electromedical and Control Instruments Manufacturing)			473.728 (246.516)	17
*CSA*NAICS* 3359_{USP} (Other Electrical Equipment and Component Manufacturing)			-60.005 (34.620)	6
*CSA*NAICS* 3391_{USP} (Medical Equipment and Supplies Manufacturing)			-123.052** (41.305)	13
*CSA*NAICS* 5112_{USP} (Software Publishers)			-127.909* (53.891)	23
*CSA*NAICS* 5191_{USP} (Other Information Services)			-164.290** (59.097)	8
*CSA*NAICS* 5415_{USP} (Computer Systems Design and Related Services)			-105.943 (97.473)	9
Year fixed effects	Yes	Yes	Yes	
Two-digit NAICS fixed effects	Yes	Yes	No	
Number of observations	1,303	1,124	1,124	
Number of U.S. parents	187	164	164	
R squared	0.370	0.364	0.583	

Notes:

The regressions were estimated after trimming the 5-percent tails in the dependent and independent variables.
The dependent variable is the dollar value of profit-type return for U.S. parents.
Coefficient estimates with heteroscedasticity-robust standard errors in parentheses. Significant coefficients are denoted by ***, **, * at the one, five, and ten percent significance levels, respectively.
1 Columns 2 includes U.S. MNEs classified in the two-digit NAICS sectors 33, 51, and 54
2 Columns 3 includes U.S. MNEs classified in the two-digit NAICS sectors 33, 51, and 54 and estimates cost sharing dummies for all 4-digit U.S. parent NAICS codes where MNEs with CSA were identified within these two-digit NAICS sectors and the number of parents was greater than one.

Although U.S. parent results are generally consistent with our hypothesis, they provide only a partial understanding of the relationship between CSAs and the location of MNE profits. The U.S. parent estimates provide information about the relative profitability of those with CSAs and those without CSAs, but they do not explain why we observe this relationship. Is it because parents with CSAs are truly less able to generate profits than those without CSAs or is it the case that parents with CSAs appear less profitable because they shift profits to foreign affiliates in lower tax countries? To help answer this question, we turn to equation 3, which estimates the impact of CSAs on the difference between profitability of foreign affiliates and profitability of their U.S. parent. The results of estimating equation 3 using panel analysis are provided in table 7 below.

Table 7: Affiliate-parent difference results, 2006-2015

Variable	All industries	Key CSA industry sectors[1]	Key CSA industry sectors[2]
Constant	-355.087*** (85.766)	53.074 (46.702)	-136.898** (48.046)
$PPE_C - PPE_{USP}$	-0.002 (0.016)	0.132*** (0.017)	0.115*** (0.017)
$R\&D\ Stock_C - R\&D\ Stock_{USP}$	0.079*** (0.003)	0.078*** (0.004)	0.084*** (0.004)
$Royalty\ Payments_C - Royalty\ Payments_{USP}$	-0.534* (0.241)	0.230* (0.113)	0.195 (0.110)
$Cost\ Sharing\ Agreement_{USP}$ (CSA)	57.000* (26.246)	103.163*** (25.753)	
$Tax\ Rate_C$	-292.385 (227.587)	-271.336 (203.476)	-322.644 (213.738)
$CSA*NAICS\ 3332_{USP}$ (Industrial Machinery Manufacturing)			-169.469*** (18.596)
$CSA*NAICS\ 3341_{USP}$ (Computer and Peripheral Equipment Manufacturing)			-134.183* (65.177)
$CSA*NAICS\ 3342_{USP}$ (Communications Equipment Manufacturing)			926.084*** (111.193)
$CSA*NAICS\ 3344_{USP}$ (Semiconductor and Other Electronic Component Manufacturing)			-37.220 (19.751)
$CSA*NAICS\ 3345_{USP}$ (Navigational, Measuring, Electromedical and Control Instruments Manufacturing)			-652.024*** (66.947)
$CSA*NAICS\ 3359_{USP}$ (Other Electrical Equipment and Component Manufacturing)			-183.057*** (19.751)
$CSA*NAICS\ 3391_{USP}$ (Medical Equipment and Supplies Manufacturing)			109.416*** (22.538)
$CSA*NAICS\ 5112_{USP}$ (Software Publishers)			123.313*** (19.832)
$CSA*NAICS\ 5191_{USP}$ (Other Information Services)			532.812*** (129.525)
$CSA*NAICS\ 5415_{USP}$ (Computer Systems Design and Related Services)			52.510** (18.447)
Year fixed effects	Yes	Yes	Yes
Two-digit NAICS fixed effects	Yes	Yes	No
Number of observations	21,251	17,799	17,799
Number of parent-country pairs	3,851	3,281	3,281
R squared	0.454	0.605	0.582

Notes:

The regressions were estimated after trimming the 5-percent tails in the dependent and independent variables.
The dependent variable is the difference between the country-level aggregates of foreign affiliate profit-type return and the profit-type return of the corresponding affiliate's U.S. parent.
Coefficient estimates with heteroscedasticity-robust standard errors in parentheses. Significant coefficients are denoted by ***, **, * at the one, five, and ten percent significance levels, respectively.
1 Columns 2 includes U.S. MNEs classified in the two-digit NAICS sectors 33, 51, and 54
2 Columns 3 includes U.S. MNEs classified in the two-digit NAICS sectors 33, 51, and 54 and estimates cost sharing dummies for all 4-digit U.S. parent NAICS codes where MNEs with CSA were identified within these two-digit NAICS sectors and the number of parents was greater than one.

Overall, affiliates engaging in CSAs with their parents tend to be more profitable than their parents. In all industries, affiliates with CSAs have $57 million higher profits, on average, than similarly endowed U.S. parents. In the 3 NAICS sectors in which CSAs are concentrated, this gap is $103 million. Across the more detailed NAICS industries, the results are mixed but, overall, they tend to support our hypothesis. In 5 of the 10 NAICS industries were CSAs are concentrated, there is a significant positive relationship between the profitability of affiliates relative to their U.S. parents and the existence of a CSA. For example, affiliates in software publishing had average profits that were $123 million higher than similarly endowed parents in that industry when a CSA was present. In 4 of the 10 industries, there is a significant negative relationship between the relative profitability of foreign affiliates and the existence of a CSA. In 1 of the 10 NAICS industries, there is not a statistically significant relationship.

VI. Conclusions and next steps

The relationship between tax law and the real activities of MNEs has generated widespread interest. This study builds on Guvenen et al. (2017), which shows, at the aggregate level, how strategic movement of IP by MNEs can have important effects on key economic aggregates such as GDP and the trade balance. The apportionment technique used in that paper was mainly designed to answer 'how large' the effect of profit shifting by MNEs has been. With our research, we begin to address 'how they did' by identifying MNEs that have engaged in cost sharing agreements with their foreign affiliates and how those arrangements appear to have affected the geographic allocation of MNE profits.

We explore profit-shifting behavior by U.S. MNEs through the use of CSAs. Using a sample of R&D-intensive MNEs from BEA surveys, we use text searches of 10-K documents to identify which of these U.S. MNEs had CSAs between U.S. parents and their foreign affiliates in the 2006-2015 sample

period. We test our hypothesis that having a CSA is associated with relatively lower profits for the U.S. parent and relatively higher profits for foreign affiliates. The initial findings generally support our hypothesis that CSA activity between parents and affiliates is associated with profit shifting. Specifically, while evidence using data for parents alone is inconclusive, when combining data for parents and affiliates, we find that affiliates of parents with a CSA are more profitable relative to their parents than those without a CSA.

Obtaining information on CSAs as well as linking the data from the two sets of surveys were two of the greatest challenges in this project. Future research will include exploring potential additional sources for data on CSAs and continuing to improve the links between the BEA AMNE and services surveys. Additionally, we plan to further refine our estimates, perform robustness checks comparing different measures of rates of return, and explore industry specific results in further detail.

VII. References

Baldwin, R. E., R. E. Lipsey, and D. Richardson. 2007. Introduction in *Geography and ownership as bases for economic accounting*, ed. Baldwin, R. E., R. E. Lipsey, and D. Richardson ,1-7. Chicago: University of Chicago Press.

Bose, A. K. (2002): "The effectiveness of using cost sharing arrangements as a mechanism to avoid intercompany transfer pricing issues with respect to intellectual property," Virginia Tax Review, 21(4), 553–649.

Branstetter, L.G., Fisman, R. and C.F. Foley. 2006. Do stronger intellectual property rights increase international technology transfer? Empirical evidence from US firm-level panel data. *The Quarterly Journal of Economics*, *121*(1): 321-349.

Bridgman, B. 2014. Do intangible assets explain high US foreign direct investment returns? *Journal of Macroeconomics,* 40: 159-17.

Credit Suisse Securities Research and Analytics. 2015. *Foreign Tax Risk*. Available at https://research-doc.credit-suisse.com/docView?language=ENG&format=PDF&source_id=csplusresearchcp&document_id=1055969971&serialid=EAUpdkcVJ6i9dy7dkie%2FhLUtpF3rl%2BMkorPYog30zh0%3D

Desai, M.A., Foley, C.F. and J.R. Hines. 2006. The demand for tax haven operations. *Journal of Public economics*, *90*(3):.513-531.

De Simone, L., Mills, L.F. and B. Stomberg. 2016. *Using IRS Data to Identify Income Shifting Firms*. Working Paper. Available at https://web.stanford.edu/~lnds/dms_2017Aug22.pdf.

De Simone, L. and R. Sansing. 2017. Income Shifting Using a Cost Sharing Arrangement. Stanford Business School Working Paper No. 3265.

Dharmapala, D. and N. Riedel. 2013. Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals. *Journal of Public Economics*, *97*: 95-107.

Dischinger, M. and N. Riedel. 2011. Corporate taxes and the location of intangible assets within multinational firms. *Journal of Public Economic*s 95: 691-707.

Dyreng, S.D. and B.P. Lindsey. 2009. Using financial accounting data to examine the effect of foreign operations located in tax havens and other countries on US multinational firms' tax rates. *Journal of Accounting Research*, *47*(5): 1283-1316.

Evers, L., Miller, H. and C. Spengel. 2015. Intellectual property box regimes: effective tax rates and tax policy considerations. *International Tax and Public Finance*, *22*(3): 502-530.

Feenstra, R. C., Lipsey, R. E., Branstetter, L. G., Foley, C. F., Harrigan, J., Jensen, J. B., ... & Wright, G. C. (2010). *Report on the state of available data for the study of international trade and foreign direct investment* (No. w16254). National Bureau of Economic Research.

Griffith, R., H. Miller, and M. O'Connell. 2014. Ownership of intellectual property and corporate taxation. *Journal of Public Economics* 112: 12-23.

Grubert, H. 2003. Intangible income, intercompany transactions, income shifting, and the choice of location. *National Tax Journal*:.221-242.

Grubert, H. 2012. Foreign taxes and the growing share of US multinational company income abroad: Profits, not sales, are being globalized. *National Tax Journal*, *65*(2):.247.

Guvenen, F., R. J. Mataloni Jr, D. G. Rassier, and K. J. Ruhl. 2017. Offshore Profit Shifting and Domestic Productivity Measurement. National Bureau of Economic Research Working Paper No. 23324.

Heckemeyer, J.H. and M. Overesch. 2017. Multinationals' profit response to tax differentials: Effect size and shifting channels. *Canadian Journal of Economics/Revue canadienne d'économique*, *50*(4):.965-994.

Huizinga, H. and L. Laeven. 2008. International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, *92*(5): 1164-1182.

Lipsey, R.E. 2009. Measuring international trade in services in International trade in services and intangibles in the era of globalization, ed. M. Reinsdorf and M.J. Slaughter, Chicago, University of Chicago Press: 27-70.

Mataloni, R. and L. Goldberg. 1994. Gross product of U.S. multinational companies, 1977-91, Survey of Current Business 74(2): 42-63.

Mutti, J. and H. Grubert. 2009. The effect of taxes on royalties and the migration of intangible assets abroad. In *International trade in services and intangibles in the era of globalization*, ed. M. Reinsdorf and M.J. Slaughter, Chicago, University of Chicago Press: 111-137.

Sullivan, M. A. 2004. U.S. multinationals move more profits to tax havens. *Tax Notes International*, 33(7): 598-592.

United Nations. 2011. *The Impact of Globalization on National Accounts*. New York.

United States. Cong. Senate. Committee on Homeland Security and Government Affairs. 2012. *Offshore Profit Shifting and the U.S. Tax Code—Part 1 (Microsoft and Hewlett Packard*, Hearings, September 20, 2012. 112th Cong. 2nd sess. Washington: GPO.

United States. Cong. Senate. Committee on Homeland Security and Government Affairs. 2013. *Offshore Profit Shifting and the U.S. Tax Code—Part 2 (Apple)*. Hearings, May 21, 2013. 113th Cong. 1st sess. Washington: GPO.

Weichenrieder, A.J. 2009. Profit shifting in the EU: Evidence from Germany. *International tax and public finance*, *16*(3): .281-297.