

# An Overview of U.S. Intrafirm-trade Data Sources

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This note provides background information and analysis of the two sources of data on U.S. imports and exports of goods between associated parties: The intrafirm trade data collected by the Bureau of Economic Analysis (BEA) and the related party trade data collected by the U.S. Census Bureau. Along some dimensions the two data sources are comparable, although differences in the coverage of import transactions is an important exception. Generally, the Census data provide greater detail about the composition of goods being traded by associated parties, while the BEA data provide greater detail about the entities participating in the transaction. Although the data are derived from different sources and vary in their coverage, the two resulting data sets are largely consistent with each other.

## 1 BEA Intrafirm Trade and Census Related-Party Trade

There are two sources of data on U.S. imports and exports of goods between associated parties: The *intrafirm trade* data collected by the Bureau of Economic Analysis in its surveys of multinational companies, and the *related party trade* data collected by the U.S. Census Bureau from U.S. customs declarations. Here I use the catch-all term “associated parties” to mean two parties in a relationship, broadly defined. This is in contrast to the concepts of the “related party” from Census and the “multinational firm” from BEA, each of which have specific—and not always coincident—definitions. Both the BEA and Census datasets have been used by researchers studying the behavior of multinational companies.<sup>1</sup> In this note I provide an overview of the two data sources, and discuss some of the characteristics of the resulting data sets.

In section 3, I compare the definitions used by the two agencies in compiling the data, and point out some important differences. Most notably, the Census definition of a related party for U.S. import transactions is broader than that used by BEA, and allows for transactions that do not occur within the firm. Caution should be taken in using the Census import data as a measure of intrafirm trade by multinational corporations.

In section 4, I compare the BEA and Census measures of associated party trade in goods, both in total trade and across partner countries. The two data sources are largely consistent, although differences exist. The most striking differences are in U.S. imports from China and Mexico.

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<sup>1</sup>Examples of research using the BEA data include Brainard (1997), Helpman, Melitz and Yeaple (2004), and Hanson, Mataloni and Slaughter (2005). Examples of research using the Census data include Nunn and Trefler (2008), Bernard, Jensen and Schott (2009), and Bernard, Jensen, Redding and Schott (2010).

## 2 Data Collection and Construction

In this section I discuss the origins of the BEA and Census data. Readers familiar with international trade data will find the Census related party data familiar—the related party dataset is simply a partitioning of the standard data collected at the border. The BEA intrafirm trade variables are one part of a larger set of financial and operating data collected in the surveys.

### 2.1 BEA Intrafirm Trade

The intrafirm trade data compiled by BEA are collected through its surveys of multinational companies. There are two separate surveys: A survey of U.S. multinational companies and their foreign affiliates, and a survey of the U.S. affiliates of foreign parents. An overview of the data collected in the surveys of U.S. multinationals is in Mataloni (1995); an overview of the data collected in the surveys of U.S. affiliates of foreign parents is in Quijano (1990).<sup>2</sup> Compliance with the surveys is required under the International Investment and Trade in Services Survey Act (22 U.S.C. § 3101–3108).

Intrafirm trade data from the survey of foreign-owned U.S. affiliates is available from 1977 onward, and data from the survey of foreign affiliates of U.S. parents is available from 1982 onward: Total intrafirm trade—the sum of the two—is available from 1982 onward. The surveys are conducted annually. Benchmark surveys are conducted every 5 years; benchmark surveys ask a larger set of questions than the interim surveys. A broad analysis of U.S. intrafirm trade patterns gathered from this dataset can be found in Zeile (1997) and Zeile (2003).

In the BEA methodology, in accordance with the definition of international direct investment used for balance-of-payments statistics, a business enterprise is considered an affiliate of a person—here, the *parent*—if the person owns at least 10 percent of the enterprise’s voting stock or equivalent.<sup>3</sup> An important concept in the BEA methodology is that of the majority-owned affiliate. A *majority-owned affiliate* is an affiliate in which ownership of its parent(s) exceeds 50 percent. BEA surveys collect more data from majority-owned affiliates. As discussed in U.S. Bureau of Economic Analysis (2006), majority-owned affiliates are considered by many to be the most relevant unit of direct investment analysis, as these affiliates are unambiguously under the control of the parent.

In the survey of U.S. multinational companies, intrafirm trade values are collected from both parents and their affiliates.<sup>4</sup> Parents report the total value of trade with their foreign affiliates, but no further detail. Foreign affiliates may report shipments to and from their U.S. parent, as well as shipments to affiliated and unaffiliated parties in other countries. How much data an affiliate is required to report varies with the year of the survey and the characteristics of the affiliate. Large majority-owned foreign affiliates are always asked to report intrafirm trade values. Note that the

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<sup>2</sup>The surveys of U.S. multinational companies are BE-10 and BE-11; the surveys of U.S. affiliates of foreign parents are BE-12 and BE-15. The survey forms are available at the BEA website.

<sup>3</sup>A person could be an “individual, branch, partnership, associated group, association, estate, trust, corporation, or other organization,” including a government. (U.S. Bureau of Economic Analysis 2004, M–4)

<sup>4</sup>For reporting purposes, the *parent* consists of the consolidated parent.

data collected on the parent survey includes trade with all of its affiliates, including those affiliates too small to report intrafirm trade on the affiliate form.

In the survey of U.S. affiliates of foreign companies, intrafirm trade data are collected from the U.S. affiliates only. U.S. affiliates report the value of imports and exports with their consolidated foreign parent company. As in the survey of U.S. multinational companies, the data an affiliate is required to report depends on the affiliate's size and whether it is majority owned.

Note that, in the BEA data, trade within U.S. multinationals can be separated out from trade within foreign multinationals operating in the United States. This is not possible in the Census data: The related party trade data should not be considered representative of U.S. multinational corporations. Most of the research using the BEA data has focused on the intrafirm trade of U.S. multinational corporations, where more data is reported for the parent.

The results from the surveys, aggregated to the industry and country level, are available online. The tables that accompany the surveys of direct investment abroad are available at <http://bea.gov/international/di1usdop.htm>. The tables that accompany the surveys of direct investment in the United States are available at <http://bea.gov/international/di1fdiop.htm>.

## 2.2 Census Related-Party Trade

The Census related party trade data are compiled from the U.S. customs documentation.<sup>5</sup> The U.S. customs declaration documentation includes a yes-no question that asks if the cross border shipment is between related parties.<sup>6</sup> This is a mandatory question, so the related party trade indicator covers, in theory, the universe of shipments. While a response to this question is required, importers and exporters do not always provide an answer. The Census Bureau does not estimate related party trade for those declarations with missing indicators: The trade related to these incomplete declarations is tagged as "nonreported."

For U.S. imports, a related party transaction is a transaction between two parties in which (among many possibilities) "any person directly or indirectly owning, controlling or holding power to vote, 5 percent or more of the outstanding voting stock or shares of any organization."<sup>7</sup> For U.S. exports, a related party transaction is "A transaction involving trade between a U.S. principal party in interest and an ultimate consignee where either party owns directly or indirectly 10 percent or more of the other party."<sup>8</sup>

Census related party trade data are available through an online database at <http://sasweb.ssd.census.gov/relatedparty>. The data are available from 2002 at the NAICS 6-digit level, disaggregated by country. Data are available in the annual press releases for a handful of countries and in-

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<sup>5</sup>A guide to the collection and publication of Census trade data is available at <http://www.census.gov/foreign-trade/reference/guides/tradestatsinfo.html>.

<sup>6</sup>For U.S. imports, a "Y" or "N" must be recorded in column 32 of CBP Form 7501 for each line item. For U.S. exports, the "Related Company Indicator" is one of the commodity data elements that make up a commodity data filing in the automated export system (AES). Prior to the AES, form 7525-V, question (c) contained a tick box for "Related" and a tick box for "Non-related" parties to the transaction.

<sup>7</sup>19 U.S.C. §1401a(g)(F)

<sup>8</sup>Foreign Trade Regulations, 15 C.F.R. §30.1

dustries from 1998–2001 at [http://www.census.gov/foreign-trade/Press-Release/related\\_party](http://www.census.gov/foreign-trade/Press-Release/related_party). The press releases prior to 1998 are available from the Census Bureau and in the online data appendix to this article.

### 3 Comparing Methodologies

In this section I provide further detail regarding the definitions used by BEA and Census in compiling their data, and discuss ways in which the datasets are compatible and ways in which they are not. Section 3.1 should be of particular interest to researchers studying the multinational firm, as it points out ways in which the Census data capture trade that is not necessarily intrafirm.

#### 3.1 Defining Associated Parties

In the export data, the definition of a related party in the Census data and the definition of an affiliate in the BEA data are both meant to capture trade between parties that are related by ownership, and both definitions use the balance-of-payments threshold for foreign direct investment of a 10 percent ownership stake.

In the import data, the BEA definition of an affiliate is also a 10 percent ownership stake, but the Census definition of a related party is broader. As noted in the previous section, a related party in a U.S. import transaction needs only a 5 percent ownership share, and 19 U.S.C. §1401a(g) enumerates 7 different ways parties may be related—only one of which is ownership-based.<sup>9</sup> In this expanded definition, related parties include, among others, “employer and employee” and “partners.” These two extra criteria are potentially important: Under these definitions, the Census data may consider shipments within certain contract-based production sharing arrangements to be related party imports, while BEA would not capture these shipments, as they do not occur within a multinational corporation.

It is also worth noting that the Census data do not require any documentation of the related party status. The exporter or importer is responsible for determining the related party nature of the transaction, and provides a yes-or-no answer on the customs documentation. In the BEA data, reporting affiliates submit both the voting interest and equity interest of the parent in the affiliate, so it is possible to verify that the shipments are occurring within a single firm, and to know the extent to which the two parties are related.

Given the broader definition of a related party in the import data, some caution should be taken in considering related party trade to be “intrafirm” trade.

#### 3.2 Classification of Products and Industries

An associated-party transaction can be classified by the type of good being traded and by characteristics of the entities taking part in the transaction. The related party trade data report a description of the good actually being traded: The traded goods are classified according to the prevailing product classification scheme, currently, the North American Industrial Classification

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<sup>9</sup>The complete definition can be found in appendix A.

System (NAICS). The BEA intrafirm data do not generally describe the good being traded—only the value of trade is typically known. For a subset of responding affiliates in benchmark years, however, shipments are classified into broad categories, roughly equivalent to 3-digit NAICS.

The BEA data provide a classification of the industry of operation of the parent and the affiliate, and intrafirm shipments are often reported according to the industry of the affiliate.<sup>10</sup> The Census data do not contain the industry of operation of the buyer and the seller, but Bernard et al. (2009) have linked the Census customs records—including the related party trade indicator—to other datasets that describe U.S. enterprises. This data link allows the researchers to see some characteristics of the U.S. side of the transaction, but not the foreign side.

Note the fundamental difference between the two data sources: The Census NAICS code describes the goods that cross the border, while the BEA ISI codes describe the industries of operation of the transactors. While the industry of the firm and the goods that it produces are likely related, they do not have to be identical. Generally, the Census data provide more information about the products being traded by associated parties. The BEA data provide more information about the buyer and the seller.

### 3.3 Country of Origin and Destination

In contrast to the product or industry codes, the country of origin and destination data for the associated-party transactions are meant to convey the same information in the two data sources. In the Census data, the country of origin for imports and the destination country for exports are reported on the customs documentation. These data are reported on a “shipped” basis that is meant to reflect the physical flow of goods across countries.

The BEA survey forms also ask for import and export data to be reported on a shipped basis. It is common, however, for affiliates to keep their accounting records on a “charged” basis that reflects the flow of funds associated with a shipment rather than the destination of the goods actually being shipped. Instructions in the BEA surveys are explicit regarding these accounting differences and provide a checkbox to indicate cases when an affiliate is converting its “charged” basis shipments to a “shipped” basis for reporting.<sup>11</sup>

## 4 Consistency across Data Sources

The BEA and Census datasets are derived from completely different sources and use differing definitions, but the two are broadly consistent. In figure 1, I plot—as a fraction of total trade—total associated-party imports and exports as measured by BEA and Census. The data underlying this figure are found in table 1.

Prior to 2002, the BEA collected intrafirm trade flows between all U.S. affiliates and their for-

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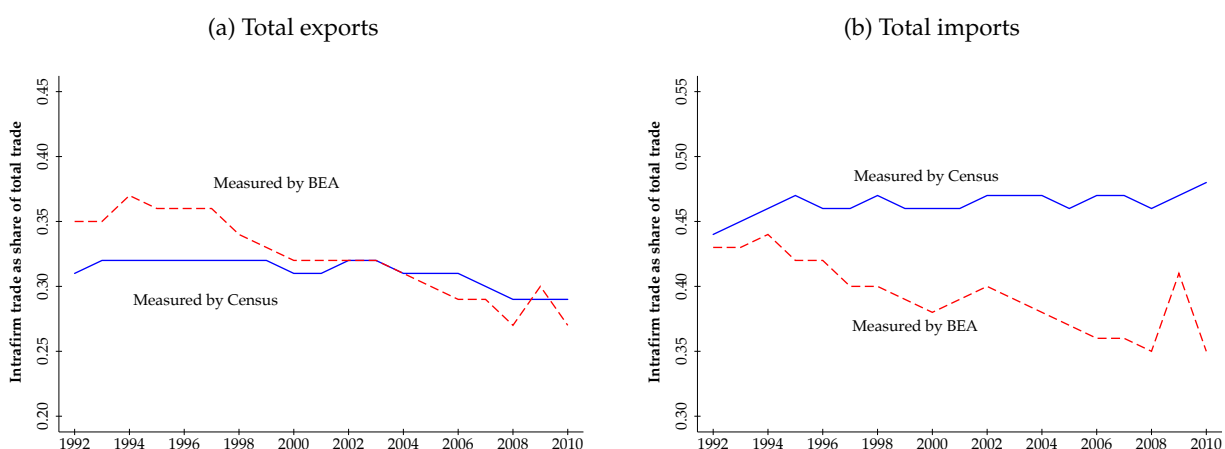
<sup>10</sup>The BEA uses the International Surveys Industry classification of industries, which is currently based on the NAICS system: The ISI is roughly equivalent to the 4-digit NAICS. An earlier ISI system was based on the Standard Industrial Classification system.

<sup>11</sup>The survey questions are found, for example, in U.S. Bureau of Economic Analysis (2004, p. 306, Part IV) for outbound FDI and U.S. Bureau of Economic Analysis (2011, p. 184, Part II) for inbound FDI.

oreign parents. After 2002, intrafirm trade data are only collected from majority-owned U.S. affiliates. For 2002–2010, I estimate the intrafirm trade for minority-owned U.S. affiliates: Details can be found in appendix B. Intrafirm trade is predominately carried out by majority-owned affiliates. For 1992–2001, where a direct comparison is possible, majority-owned U.S. affiliates were responsible for 98 percent of total exports from U.S. affiliates to their foreign parents and 96 percent of imports from foreign parents to their U.S. affiliates.

As can be seen in panel (a), the BEA data and Census data provide measures of associated-party exports that are very similar. Generally, the BEA data find larger trade flows earlier in the sample and the Census data find larger flows later in the sample, but the two never differ by more than 5 percentage points of total exports.

Figure 1: Intrafirm trade and related party trade, as a share of total trade



In the early 1990s, the BEA and Census measures of associated-party imports are also quite similar. Beginning in the late 1990s, though, the BEA measure of intrafirm imports as a share of total imports begins to fall while the Census measure remains flat. Beginning in the early 2000s, the BEA measure of intrafirm imports again falls relative to the Census measure. The timing of the divergence of the two series suggests its cause: The increase in Mexico’s importance in U.S. imports in the late 1990s and the increase in China’s importance in the early 2000s.

In the next section, I show that the difference in measured associated-party imports between the two data sources is largely driven by Mexico and—later in the sample—China. In the next section I discuss the potential measurement issues in these countries, but, looking ahead to table 4, associated-party trade measured by the two sources, but excluding Mexico and China, are similar.

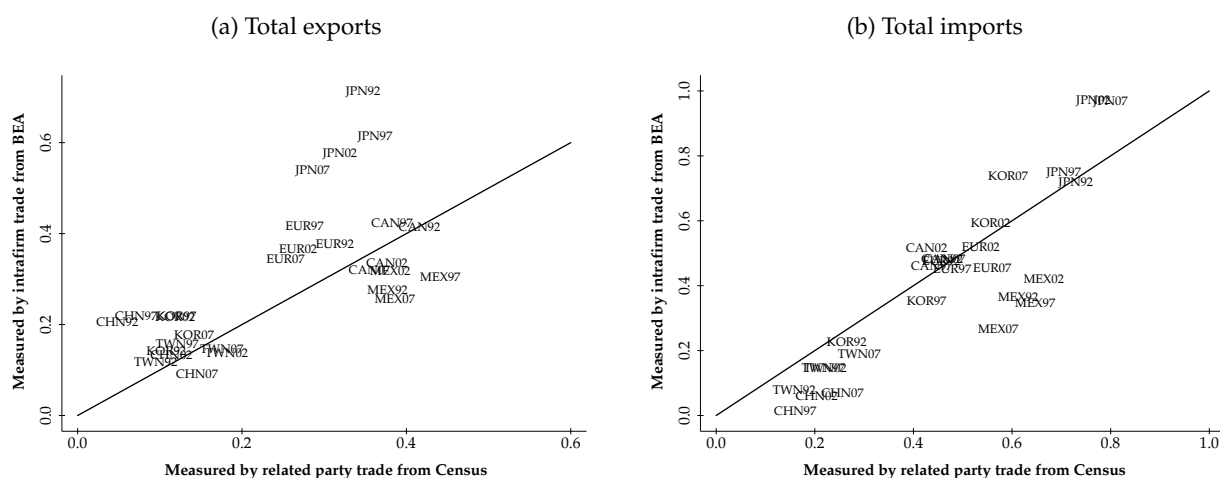
#### 4.1 Comparison by Destination and Origin Country

In this section I compare the BEA and Census measures of associated-party trade to and from several partner countries. In the BEA data, country of origin of imports and destination of exports for U.S. affiliates of foreign parents is only collected in benchmark survey years (1992, 1997,

2002, and 2007), so I must restrict the comparisons to these periods. The intrafirm trade data from BEA are typically available by transactor country for majority-owned affiliates. The Census data cannot be restricted to include only trade with majority-owned affiliates, so I estimate the value of intrafirm trade carried out by minority-owned affiliates. The details of the estimation are in appendix C. With the exception of imports from foreign affiliates of U.S. companies in Japan and Korea, majority-owned affiliates carry out much of intrafirm trade, so the adjustments are relatively small in most cases.

In figure 2, I plot associated-party trade as measured by BEA and Census for Europe, Canada, Mexico, Japan, China, Korea, and Taiwan.<sup>12</sup> The data are presented as shares of total bilateral trade between the United States and the partner country. For example, in panel (a), associated-party trade with Europe in 2002, EUR02, was 37 percent of total exports to Europe in the BEA data, and 27 percent of total exports to Europe in the Census data. In panel (b), BEA-measured associated-party imports from Europe in 2002 were 52 percent of total imports from Europe and 54 percent of total imports from Europe as measured in the Census data.

Figure 2: Intrafirm trade and related party trade by country, as a share of total bilateral trade



In general, the BEA and Census measures of associated-party trade for this set of countries are similar. If the two measures were identical, the points in figure 2 would fall on the 45 degree line plotted in the figure. In the export data, the outlier is Japan: Associated-party trade in U.S. exports to Japan is significantly larger in the BEA data than in the Census data. For U.S. imports, associated-party trade from Mexico and China are smaller in the BEA data compared to the Census measure.

Table 3 reports the 2002 associated-party trade shares plotted in figure 2b. As a share of bilateral imports, the BEA measures Mexican intrafirm imports as 0.42, while Census measures related party imports as 0.66. For China, the discrepancy is larger: BEA's intrafirm share is 0.06, while Census related party share is 0.20. The differences between the BEA and Census measures are

<sup>12</sup>The set of countries is dictated by the data available in the Census press releases from the 1990s.

similar in the four years that direct comparisons are possible. The discrepancy between the two measures for China has only recently become important for aggregate trade. In the 1992 and 1997 calculations, China's share of total U.S. imports is small.

There are several potential reasons that the BEA and Census measures differ for Mexican and Chinese imports. One possibility is the broader definition of a related party in the Census custom documentation. As discussed in section 3.1, 19 CFR § 152.102(g) allows for several ways in which two parties may be related—only one of which is through investment—while the BEA only considers parties related by direct investment. On-contract processing trade is an important component of U.S. trade with both Mexico (e.g., maquiladoras) and China (e.g., Foxconn). It is likely that some of this on-contract trade is being recorded in the Census data as taking place between related parties, while none of it would be measured by BEA, since it is not trade occurring within a firm. In addition, the Census data may be picking up trade through coethnic networks, which have been shown to be important for Chinese imports (Rauch and Trindade 2002).

A second possibility is an undercount of intrafirm trade in the BEA affiliate-reported data. If this is the case it is likely driven by small affiliates who do not report intrafirm trade. For example, in the 1999 survey of foreign affiliates of U.S. parents, affiliates with less than \$7 million in sales, assets, and net income do not report. Note that these small affiliates would also have to be significant exporters to the United States.

Whatever the reason, the difference in measurement in these two countries is important, as these two countries are important in total U.S. imports. The last column in table 3 reports the difference between the BEA intrafirm trade and the Census related party trade as a share of total imports. For Mexico, the difference between the two data sources accounts for 3 percent of total imports, and for China 2 percent. (In 2007, these numbers are 3 percent for Mexico and 3 percent for China.) In table 4, I report total associated-party imports for all countries except Mexico and China. Total associated-party trade, once we exclude China and Mexico, is similar across the two data sources: In 1997 the Census share of imports is 2 percentage points larger than the BEA-measured share; in 2002 the Census share is 3 percentage points larger and; in 2007 the Census share is 5 percentage points larger.



Table 1: Associated-party trade in U.S. exports.

	Exports				Imports			
	Intrafirm (mil. USD)	Related party (mil. USD)	Intrafirm (export share)	Related share	Intrafirm (mil. USD)	Related party (mil. USD )	Intrafirm share	Related share
1992	154,766	138,399	0.35	0.31	231,692	236,114	0.43	0.44
1993	161,112	148,066	0.35	0.32	247,901	260,811	0.43	0.45
1994	189,428	165,116	0.37	0.32	289,522	305,296	0.44	0.46
1995	209,902	185,966	0.36	0.32	313,495	350,955	0.42	0.47
1996	222,582	198,368	0.36	0.32	334,816	367,369	0.42	0.46
1997	249,551	217,649	0.36	0.32	349,807	396,586	0.40	0.46
1998	233,882	216,113	0.34	0.32	361,549	425,710	0.40	0.47
1999	228,790	222,458	0.33	0.32	396,847	474,831	0.39	0.46
2000	248,945	245,863	0.32	0.31	464,748	563,084	0.38	0.46
2001	236,074	223,695	0.32	0.31	448,628	526,691	0.39	0.46
2002	219,603	220,967	0.32	0.32	459,759	549,402	0.40	0.47
2003	231,886	232,784	0.32	0.32	492,432	593,833	0.39	0.47
2004	250,744	252,086	0.31	0.31	551,543	697,561	0.38	0.47
2005	273,821	283,190	0.30	0.31	614,981	775,730	0.37	0.46
2006	293,030	319,038	0.29	0.31	659,064	862,657	0.36	0.47
2007	327,976	343,584	0.29	0.30	706,527	920,369	0.36	0.47
2008	347,510	373,646	0.27	0.29	743,018	975,096	0.35	0.46
2009	321,798	307,200	0.30	0.29	643,245	740,481	0.41	0.47
2010	349,754	372,902	0.27	0.29	677,310	922,202	0.35	0.48

Intrafirm exports are from BEA. Related party trade and total trade data are from Census. See appendix B for details on the data construction.

Table 2: U.S. Associated-party exports by country, 2002

	Value (millions USD)		Share of bilateral imports		Share of total imports
	Intrafirm	Related party	Intrafirm	Related party	IFT-RPT
Europe	60,132	43,899	0.37	0.27	0.02
Canada	54,165	60,612	0.34	0.38	-0.01
Japan	29,741	16,423	0.58	0.32	0.02
Mexico	31,142	37,089	0.32	0.38	-0.01
Taiwan	2,551	3,334	0.14	0.18	0.00
China	2,985	2,526	0.13	0.11	0.00
Korea	4,928	2,679	0.22	0.12	0.00

Intrafirm exports are from BEA. Related party trade and total export data are from Census. See appendix C for details on the data construction.

Table 3: U.S. associated-party imports by country, 2002

	Value (millions USD)		Share of bilateral imports		Share of total imports
	Intrafirm	Related party	Intrafirm	Related party	IFT-RPT
Europe	135,445	140,000	0.52	0.54	0.00
Canada	108,258	89,287	0.52	0.43	0.02
Japan	118,350	92,906	0.97	0.77	0.02
Mexico	56,691	89,458	0.42	0.66	-0.03
Taiwan	4,752	7,111	0.15	0.22	0.00
China	7,581	25,538	0.06	0.20	-0.02
Korea	21,126	19,791	0.59	0.56	0.00

Intrafirm imports are from BEA. Related party trade and total import data are from Census. See appendix C for details on the data construction.

Table 4: U.S. associated-party imports, adjusted for Mexico and China

	All countries		Without Mexico and China	
	Intrafirm imports	Related party imports	Intrafirm imports	Related party imports
1992	0.43	0.44	0.41	0.40
1997	0.40	0.46	0.36	0.38
2002	0.40	0.47	0.34	0.37
2007	0.36	0.47	0.32	0.37

Associated-party trade flows are expressed as shares of total imports. Intrafirm imports are from BEA. Related party trade and total import data are from Census.

## A Related Party Definition

The following definition of a related party in a U.S. import transaction is from 19 U.S.C. §1401a.

(g) Special rules

- (1) For purposes of this section, the persons specified in any of the following subparagraphs shall be treated as persons who are related:
  - (A) Members of the same family, including brothers and sisters (whether by whole or half blood), spouse, ancestors, and lineal descendants.
  - (B) Any officer or director of an organization and such organization.
  - (C) An officer or director of an organization and an officer or director of another organization, if each such individual is also an officer or director in the other organization.
  - (D) Partners.
  - (E) Employer and employee.
  - (F) Any person directly or indirectly owning, controlling, or holding with power to vote, 5 percent or more of the outstanding voting stock or shares of any organization and such organization.
  - (G) Two or more persons directly or indirectly controlling, controlled by, or under common control with, any person.

## B Construction of BEA total intrafirm trade

Two flows are needed to construct total intrafirm exports: Exports from U.S. parents to their foreign affiliates, and exports from the U.S. affiliates of foreign parents to their foreign parent groups. Below I describe how to construct total intrafirm exports from the BEA data; total intrafirm imports are constructed in an analogous way.

Total exports from U.S. parents to their foreign affiliates,  $X_t^{pa}$ , is reported on the reporter's form and listed in the publicly-available tables from BEA. Total exports from U.S. affiliates of foreign parents,  $X_t^{ap}$ , are reported for all non-bank U.S. affiliates until 2001. In column 2 of table 1 for 1992–2001, total intrafirm trade is simply

$$X_t^{IF} = X_t^{pa} + X_t^{ap}. \quad (1)$$

In the years following 2001, BEA surveys asked only majority-owned U.S. affiliates of foreign parents (MOUSA) to report exports to their foreign parent group. To estimate exports from all U.S. affiliates to their parent groups, I use the total exports of U.S. affiliates to all parties,  $X_t^a$ , and the total exports of majority-owned U.S. affiliates to all parties,  $X_t^{\text{MOUSA}}$ , to create a proportionality factor to apply to intrafirm trade,

$$\hat{X}_t^{ap} = \frac{X_t^a}{X_t^{\text{MOUSA}}} \times X_t^{\text{MOUSA},p}, \quad (2)$$

where  $X_t^{\text{MOUSA},p}$  is total exports from majority-owned U.S. affiliates to their foreign parent groups. In column 2 of table 1 for 2001–2010, total intrafirm trade is

$$X_t^{IF} = X_t^{pa} + \hat{X}_t^{ap}. \quad (3)$$

Note that for 1992–2001, I can calculate  $\hat{X}_t^{ap}$  and compare it to the actual value of exports of U.S. affiliates to their parent groups,  $X_t^{ap}$ . The average difference between the estimate and the actual reported value is about 8 percent of the reported value for exports and 2 percent of the reported value for imports.

## C Construction of BEA intrafirm trade by country

Constructing estimates of intrafirm trade by country from the BEA data requires exports from U.S. parents to their foreign affiliates, and exports from the U.S. affiliates of foreign parents to their foreign parent groups by country. Two difficulties arise in constructing these series: Exports from U.S. affiliates of foreign parents by destination country are available only in benchmark years, and exports from U.S. parents to their foreign affiliates are available only for exports to majority-owned affiliates.

Benchmark surveys of U.S. parents and their foreign affiliates (outbound FDI) are not coincident with the benchmark surveys of U.S. affiliates of foreign parents (inbound FDI). Recent out-

bound FDI benchmark years are 1994, 1999, 2004, and 2009 while inbound FDI benchmark years are 1992, 1997, 2002, and 2007. As destination country data is only collected in the benchmark surveys of inbound FDI, I can only construct estimates of total intrafirm trade by country for the years 1992, 1997, 2002, and 2007.

### C.1 Constructing exports from U.S. parents to their foreign affiliates

As I am restricted to inbound FDI benchmark survey years, I am necessarily working with non-benchmark surveys of U.S. parents and their foreign affiliates.

In non-benchmark years, intrafirm trade flows broken out by country of origin are only collected for majority-owned foreign affiliates, so the exports of goods to foreign affiliates that are not majority owned must be estimated. I use the nearest benchmark survey, in which intrafirm flows by country are collected for all reporting affiliates, to make these estimates. Denote total exports from U.S. parents to their majority-owned foreign affiliates (MOFA) in country  $j$  at time  $t$  as  $X_{j,T}^{\text{MOFA},p}$ . Let  $T$  be the year of the nearest benchmark survey of outbound FDI; for example, when constructing intrafirm trade in 1997,  $T = 1999$ . In benchmark survey years intrafirm trade data is collected for all reporting affiliates,  $X_{j,T}^{ap}$ , as well as for MOFAs. I apply the ratio of intrafirm exports from all affiliates to majority-owned affiliates from the benchmark year to the intrafirm trade of majority-owned affiliates in the year of interest to arrive at our estimate,

$$\widehat{X}_{j,t}^{pa} = \frac{X_{j,T}^{pa}}{X_{j,T}^{p,\text{MOFA}}} \times X_{j,t}^{p,\text{MOFA}}. \quad (4)$$

In constructing the 2007 data, the nearest benchmark survey (2009) did not report trade by country of all nonbank foreign affiliates for several countries. This data was suppressed to avoid disclosure of firm-level data, implying that there must be very few minority owned firms in these cells. The scaling factors from the 2004 survey were used instead.

### C.2 Constructing exports to foreign parents from their U.S. affiliates

In benchmark year 1997, export data from all reporting U.S. affiliates is available directly. For 1992, 2002, and 2007, only majority-owned U.S. affiliates report trade with their parent group by country, so I must estimate trade flows for affiliates that are not majority owned.

As there are no country-specific trade data for minority-owned affiliates, I scale intrafirm trade for majority-owned affiliates by the ratio of intrafirm exports by all affiliates relative to intrafirm exports of majority-owned affiliates in 1997, the one year in which data are available for all affiliates. Estimated exports from U.S. affiliates to their foreign parent by country is

$$\widehat{X}_{j,t}^{ap} = \frac{X_{1997}^{ap}}{X_{1997}^{\text{MOUSA},p}} \times X_{j,t}^{\text{MOUSA},p}. \quad (5)$$

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