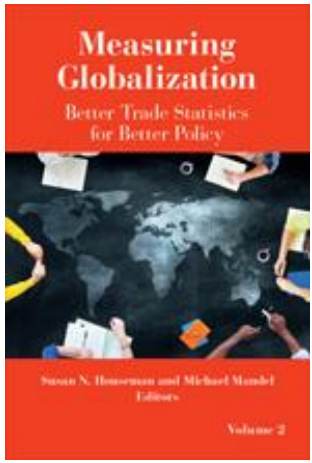
W.E. UPJOHN INSTITUTE
FOR EMPLOYMENT RESEARCH

Upjohn Institute Press

A Formulary Approach for Attributing Measured Production to Foreign Affiliates of U.S. Parents



Dylan G. Rassier
U.S. Bureau of Economic Analysis

Jennifer Koncz-Bruner
Formerly of the U.S. Bureau of Economic Analysis

Chapter 8 (pp. 229-262) in:
Measuring Globalization: Better Trade Statistics for Better Policy, Volume 2, Factoryless Manufacturing, Global Supply Chains, and Trade in Intangibles and Data
Susan N. Houseman and Michael Mandel, eds.
Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2015
DOI: 10.17848/9780880994903.vol2ch8

8
A Formulary Approach for Attributing Measured Production to Foreign Affiliates of U.S. Parents

Dylan G. Rassier
U.S. Bureau of Economic Analysis

Jennifer Koncz-Bruner
formerly of the U.S. Bureau of Economic Analysis

The *Balance of Payments and International Investment Position Manual, Sixth Edition* (BPM), and the *System of National Accounts 2008* (SNA) both recommend attributing production to countries based on the residence of productive entities. The residence of an entity is generally determined to be the country in which a significant amount of production takes place. In cases where an entity has little or no physical presence, residence is determined as the country in which the entity is legally incorporated or registered. In the case of a multinational enterprise (MNE), the residency-based framework of the BPM and the SNA requires that the activities of affiliated entities resident in different countries be measured separately in order to accurately attribute the economic activity of each entity to the country in which it is resident.[1] Likewise, the residency-based framework requires that cross-border transactions between affiliated entities resident in different countries be included in balance of payments statistics.

For practical reasons, statisticians generally measure production and other attributes of MNEs based on accounting data. While the BPM (International Monetary Fund 2009) and the SNA (European Commission et al. 2009) recommend the residency-based framework for attributing measured production, attribution under the framework is not limited to a specific accounting treatment. In this chapter, we focus on formulary apportionment as an alternative treatment to sepa-

rate accounting, which is the basis for current measures of production. Under separate accounting, accounting records are maintained separately for each entity within an MNE. As a result, accounting measures such as costs and profits are attributed to affiliated entities based on each entity's purpose within the structure of the MNE and not necessarily on the economic activity of the entity. In other words, accounting measures recorded under separate accounting may not accurately reflect the economic activity of the entity. Formulary apportionment is commonly required by U.S. state corporate income tax regulations to determine the income attributable to the state for a corporation that operates in multiple states. Rather than keeping separate accounting records for operations in each state, the corporation keeps consolidated records and attributes income to a state based on prescribed apportionment factors—such as employment, property, and sales—that reflect where income is actually earned.

Residency-based separate accounting may be particularly problematic for statisticians in cases where production is accomplished with inputs that are shared by multiple entities within the same MNE. Shared inputs may include intangible property such as patents, trademarks, formulas, processes, and so forth, or they may include headquarter services such as accounting, finance, and marketing, which do not need to be physically located at an entity in order to provide service (Helpman 1984; Markusen 1984, 1997). If a statistician is able to directly observe the economic activity of the entity in order to determine actual production, residency-based separate accounting may pose no particular problem. However, if the statistician only has accounting data for the entity, then identifying the location of production, which is the essence of the residency-based framework, is particularly difficult when the entity employs relatively few or no local inputs such as labor or property, plant, and equipment (PPE) but reports relatively significant accounting measures related to shared inputs. As shared inputs become more common and as MNE activities increase, challenges encountered under the residency-based framework become more important in the U.S. international transactions accounts (ITAs) and the U.S. National Income and Product Accounts (NIPAs) (Lipsey 2009, 2010; United Nations Economic Commission for Europe 2011).

As is consistent with the residency-based framework, the U.S. Bureau of Economic Analysis (BEA) attributes production to a foreign

affiliate of a U.S. parent according to the country in which the affiliate is resident. If the affiliate has little or no physical presence in the country, the BEA follows the BPM and SNA recommendations to attribute production to the affiliate as long as the affiliate is legally incorporated or registered in the country. In addition, the BEA measures production based on accounting measures reported for the affiliate, and the accounting measures are determined under separate accounting according to generally accepted U.S. accounting principles. Thus, if an MNE is structured in a way that attributes accounting measures to an affiliate based on economic activity resulting from shared inputs that are not actually employed by the affiliate, production may be attributed to an affiliate with no economic activity.

In this chapter, we use formulary apportionment, which is also consistent with the residency-based framework, as an alternative for separate accounting to measure value-added at foreign affiliates of U.S. parents. We find that overall reattributions from foreign affiliates to U.S. parents are relatively small—less than 5 percent of total value-added attributed to all majority-owned foreign affiliates and U.S. parents under separate accounting. In contrast, reattributions across global regions including Africa, Asia, Europe, Latin America, and the Middle East are greater than 10 percent of value-added under separate accounting. Moreover, reattributions for foreign affiliates are greater than 10 percent of value-added under separate accounting for all industry sectors except administration, information, and transportation.

In addition to applying formulary apportionment to reattribute value-added, we report preliminary results to reattribute service imports and exports between U.S. parents and their foreign affiliates. We find a relatively large decrease in imports but no meaningful change in exports. The overall effect on gross domestic product (GDP) is only a small increase—approximately 0.1 percent. Based on our preliminary results, we expect to be able to provide a complete picture of the U.S. current account under formulary apportionment in a future paper.

Using factor shares to evaluate the results, we conclude that value-added attributed to foreign affiliates and U.S. parents under formulary apportionment yields a picture of measured production by industry sector and country that is more congruent with economic activity than related measures generated under separate accounting. Thus, formulary apportionment appears to be a viable alternative to separate accounting under the residency-based framework of the BPM and the SNA.

Following this introductory section, the chapter is organized into the five sections that follow. The next section provides an overview of related literature. The third section outlines the BEA's current framework for measuring production based on residency-based separate accounting and outlines the proposed framework for attributing production based on residency-based formulary apportionment. The fourth section describes the BEA's survey data on the operations of MNEs. The fifth section presents the results of the formulary apportionment. The last section offers a conclusion.

RELATED LITERATURE

To provide context for our work, we draw upon four distinct but related lines of literature. First, we borrow features from the industrial-organization (IO) literature on foreign direct investment (FDI) and trade to outline a simple production model for foreign affiliates that underlies our choice of formulary apportionment. Second, we describe the international guidelines that provide a framework for organizing official statistics on FDI and trade. Third, we review the literature that identifies challenges encountered under the residency-based framework and proposes alternative frameworks for organizing official statistics on FDI and trade. Fourth and finally, we discuss the literature on formulary apportionment as it is applied in international taxation and identify features of formulary apportionment as a tool for attributing measured production to entities within an MNE.

Industrial-Organization Literature

The IO literature on FDI and trade focuses on adapting general equilibrium trade models to include endogenous MNEs. Early work explains the origination of MNEs based on the organization of production into one of two types (Caves 1971): 1) vertical integration (Brainard 1993; Helpman 1984) and 2) horizontal integration (Brainard 1997; Markusen 1984). However, Markusen (1997) argues that the outcomes identified by vertical and horizontal models face limitations based on underlying assumptions; he constructs an alternative knowledge-capital model.

Regardless of how production is organized, a useful feature of each of the IO models of FDI and trade is the inclusion of a local input and a firm-specific shared input, which can be used jointly by multiple affiliates. Firm-specific inputs do not need to be physically present for production to take place, but firm-specific inputs cannot generate production without the local input. General equilibrium in each model results under assumptions that include foreign affiliates that produce with constant returns to scale and operate in perfectly competitive markets. The models also assume that production is separable across affiliates and that markets are segmented.

International Guidelines

The international guidelines explain how official FDI and trade statistics should be constructed. In paragraph 4.11 of the BPM, an economy is defined as comprising "all the institutional units that are resident in a particular economic territory."[2] One of the attributes of an institutional unit is the existence of a complete set of accounting records (BPM para. 4.13[d]; SNA para. 4.2[d]), which implies that the possibility of separate accounting is required under the residency-based framework. In addition, the international guidelines consider the possibility that production may be located somewhere other than the economic territory where an entity is legally incorporated or registered. In particular, paragraph 4.134 of the BPM states, "A legal entity is resident in the economic territory under whose laws the entity is incorporated or registered. . . . It must not be combined with entities resident in other economies. If [the entity] has substantial operations in another economy, a branch may be identified there." In this case, the branch is treated as an institutional unit subject to the criterion for accounting records (BPM para. 4.27[a]), and the operations of the branch are to be attributed to the corresponding economic territory (BPM para. 4.26). Thus, as is consistent with the IO literature on FDI and trade, the international guidelines consider the possibility that factors of production may be located somewhere within an MNE other than with an affiliate to which production would be attributed based merely on legal incorporation or registration of the affiliate. Furthermore, the criterion for accounting records does not rule out formulary apportionment as an alternative to separate accounting for either the measurement or the attribution of production at the affili-

ate. The intent of the guidelines is that production is attributed where it is actually taking place.

Alternative Measurement Frameworks

Challenges in implementing the residency-based framework are widely addressed in international discourse and academic literature. The United Nations recently published a collection of papers that address the impact of globalization on national accounts (United Nations Economic Commission for Europe 2011). An entire chapter is dedicated to identifying and explaining challenges associated with allocating production to national economies under a residency-based framework. Among the challenges are the transfers of intangible property and the attribution of associated income. However, the chapter does not offer any analysis to identify the extent to which allocation of production may be incongruent with actual economic activity. Lipsey (2009, 2010) offers evidence of possible distortions in U.S. outbound FDI and trade flows present in aggregate data published by the BEA for service industries. Lipsey suggests the distortions are a result of global structuring of MNEs and the mobility of productive resources in the service industries. As a result, he suggests but does not develop an alternative location-based framework to accompany the residency-based framework for measuring trade in services.

Early work also suggests supplemental frameworks for organizing FDI and trade statistics based on ownership. Baldwin and Kimura (1998) find that net sales activities of U.S. affiliates of foreign-based MNEs to Americans and of foreign affiliates of U.S.-based MNEs to foreigners are almost as high as measured U.S. imports and exports, respectively. Kimura and Baldwin (1998) find that FDI has an even larger role in the Japanese economy. In each case, the authors use their results to highlight the usefulness of an ownership-based framework. Landefeld, Whichard, and Lowe (1993) explain and evaluate ownership-based trade measures and propose an alternative residency-based trade measure that includes an adjustment for the net effect on the U.S. economy of the operations of U.S.-owned companies abroad and of foreign-owned companies in the United States. As a result of the early work on alternative organizing frameworks, the BEA publishes annual ownership-based measures of the current account of the

ITAs as a supplement to the residency-based framework (Whichard and Lowe 1995). The ownership-based framework is fully consistent with the international standards of the BPM and the SNA and combines with the residency-based measures of U.S. imports and exports the transactions of affiliates that are not captured in the residency-based framework. While the ownership-based framework may address some of the challenges encountered under the residency-based framework, the ownership-based framework is not intended to identify the location of production, which is the centerpiece for national economic accounting purposes.

Formulary Apportionment Literature

While formulary apportionment is historically used in U.S. multistate taxation practice, the treatment of global income under formulary apportionment is also explored in research. In particular, some researchers suggest formulary apportionment as an alternative to the complexities of determining transfer prices and applying the arm's length standard in the determination of international tax obligations of MNEs. Martens-Weiner (2006) discusses the problems related to replacing separate accounting for companies operating in Europe with a system of formulary apportionment for the European Union. The issues span a spectrum including business attitudes toward formulary apportionment, designing an apportionment formula, and tax administration and compliance.

In related work, Fuest, Hemmelgarn, and Ramb (2007) find that smaller European countries that currently attract a relatively large tax base under separate accounting would have a much smaller tax base under formulary apportionment. Avi-Yonah and Clausing (2007) propose a system of formulary apportionment that would include sales as a single apportionment factor. Avi-Yonah and Clausing argue that their proposed method would protect the U.S. tax base by preventing the practice of income-shifting to low-tax countries. Avi-Yonah (2010) proposes a hybrid system in which separate accounting is used to the extent that income can be attributed based on observed determinants and the residual profit is attributed under formulary apportionment. Altshuler and Grubert (2010) simulate firm behavior and U.S. revenue collection and find that different responses to tax incentives yield simi-

lar revenue under separate accounting and formulary apportionment. In contrast, Hines (2010) presents evidence that the determination of international tax obligations under formulary apportionment may distort actual income attributable to a given country because of income that is unexplained by apportionment factors; this may lead to inefficient allocation of productive resources because of differences in tax rates across countries.

We are not aware of any previous study that applies formulary apportionment to attribute measured production to entities within an MNE, but the attribution of measured production under formulary apportionment does not invoke the policy concerns described above for international taxation, because MNEs presumably do not make operating decisions based on surveys intended solely for statistical purposes. However, formulary apportionment could affect the picture of global production, which could have policy implications. Given the definitions and concepts underlying the international guidelines for measuring official FDI and trade statistics and the challenges encountered under the resulting residency-based framework when applied to MNEs, we next draw upon the related IO literature to outline a simple production model for foreign affiliates and construct a formulary framework for attributing measured production to foreign affiliates of U.S. parents.

MEASURING PRODUCTION

Before we outline the formulary framework to attribute production to foreign affiliates of U.S. parents, we discuss a production model based in part on Bartelsman and Beetsma (2003), Helpman (1984), and Markusen (1984, 1997). Consider an MNE with one U.S. parent and one or more foreign affiliates. An affiliate engages in actual production, denoted as Q^*, with locally purchased inputs such as labor and PPE, denoted as L, and shared inputs such as intangible property and headquarter services, denoted as H, as follows:[3]

$$(8.1) \quad Q^* = f(L,H) .$$

While we do not assume a particular functional form, we do assume that shared inputs cannot be utilized without local inputs (i.e., $L > 0$). In

contrast, we assume that local inputs do not necessarily require shared inputs (i.e., $H \geq 0$).

In practice, a statistician does not observe actual production for the affiliate. However, value-added, denoted as Q^{ε}, can be measured for the affiliate with one of two approaches. As one approach, value-added can be measured as the difference between gross sales and intermediate inputs. In this case, a discrepancy exists between actual production and measured production to the extent that gross sales and intermediate inputs include related party transactions that do not reflect market prices. Alternatively, value-added can be measured as the sum of costs incurred (other than costs of intermediate inputs) and profits earned in production. In this case, costs and profits reflect returns to local inputs and shared inputs, and a discrepancy exists between actual production and measured production to the extent that returns accruing to local and shared inputs are over- or underattributed to the affiliate. While we can assume returns accruing to local inputs are properly attributed because they are generally determined from market transactions, we cannot be sure that returns to shared inputs are properly attributed, given the mobility of shared inputs and their related returns as well as the possible lack of associated market transactions. In either case, the discrepancy, denoted as ε, between actual production, Q^{*}, and measured production, Q^{ε}, can be written as follows:

$$\varepsilon = Q^{*} - Q^{\varepsilon}. \quad (8.2)$$

The objective is to choose a measurement approach to minimize ε. Determining the magnitude of ε is difficult, but Lipsey (2009, 2010) provides some evidence of possible distortions in statistics measured for foreign affiliates of U.S. parents.

Residency-Based Separate Accounting

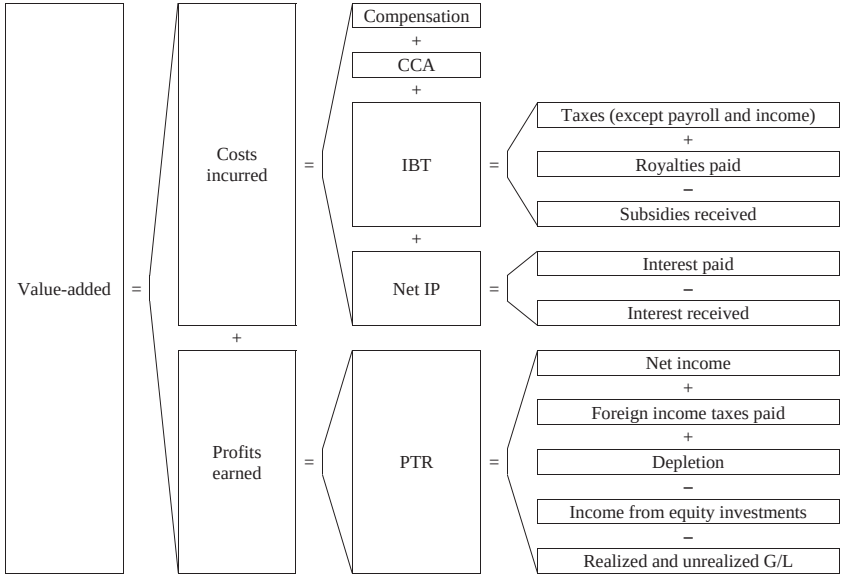
As is consistent with the residency-based framework of the BPM and the SNA, the BEA attributes value-added to a foreign affiliate according to the country in which the affiliate is resident. If the affiliate has little or no physical presence in the country, the BEA follows the BPM and SNA recommendations to attribute value-added to the affiliate, as long as the affiliate is legally incorporated or registered in the

country. The BEA measures value-added as the sum of costs incurred and profits earned in production. Both costs and profits are determined under separate accounting, according to generally accepted U.S. accounting principles. Under separate accounting, accounting records are maintained separately for each entity within an MNE. As a result, if the MNE is structured in a way that attributes costs and profits to an affiliate based partially or solely on economic activity related to shared inputs, measured value-added may be attributed to an affiliate with relatively few or no local inputs and relatively little or no economic activity. In other words, value-added attributed to the affiliate may be distorted to the extent that costs and profits reflect economic activity related to shared inputs that are not actually employed by the affiliate.[4]

Figure 8.1 depicts each of the components and subcomponents of value-added that are published as part of the BEA's multinational statistics. Costs incurred include four components: 1) compensation, 2) capital consumption allowance (CCA), 3) indirect business taxes (IBT), and 4) net interest paid (IP). Compensation includes payroll taxes. CCA is an accounting rather than an economic measure of depreciation.[5] IBT includes taxes related to business registry and operations other than income taxes and payroll taxes.[6] IBT is adjusted for government subsidies received and production royalty payments to foreign governments for natural resources. Net IP includes interest expensed or capitalized less interest income. The profits component is referred to as profit-type return (PTR) in the BEA's multinational statistics and includes net income adjusted for foreign income taxes paid, depletion, income from equity investments in foreign affiliates, and realized and unrealized gains and losses.

Using the context of our production model, we identify the components of value-added that reflect returns to local inputs and to shared inputs. In particular, we consider compensation and CCA to only reflect returns to local inputs. Compensation and CCA are returns for services provided by labor and PPE, respectively, which need to be physically located at an affiliate in order to provide service. In contrast, IBT reflects payments to the host government for the privilege of existing in a location, such as fees for licenses and registration, in addition to payments for conducting operations in the location, such as sales taxes and property taxes. Licenses and registration do not require a physical location, but we do consider sales taxes for unaffiliated sales and prop-

Figure 8.1 Measurement Framework for Value-Added Attributable to Foreign Affiliates and U.S. Parents



NOTE: "CCA" stands for capital consumption allowance; "IBT" stands for indirect business taxes; "IP" stands for interest paid; "PTR" stands for profit-type return; and "G/L" stands for gain/loss.
SOURCE: Authors' summary based on Table 10 of Mataloni and Goldberg (1994).

erty taxes to require a physical location. Likewise, net IP and PTR can reflect returns to local inputs, shared inputs, or both. However, absent any compensation and CCA (and IBT related to operations), measured value-added that includes only net IP and PTR (and IBT related to registration) under separate accounting cannot be correct, according to our model. According to our assumption for L in Equation (8.1), production is impossible without local inputs. In other words, separate accounting may not minimize ε in Equation (8.2). We refer to IBT, net IP, and PTR collectively as the shared input components of value-added. We turn now to formulary apportionment as an alternative to separate accounting for attributing value-added to foreign affiliates.

Residency-Based Formulary Apportionment

While the BPM and the SNA recommend the residency-based framework for attributing measured production to entities within an MNE, attribution under the framework is not limited to separate accounting and may presumably include formulary apportionment. In contrast to separate accounting, formulary apportionment is based on consolidated accounting measures. Formulary apportionment is commonly required by U.S. state corporate income tax regulations to determine the income attributable to the state for a corporation that operates in multiple states. Rather than keeping separate accounting records for operations in each state, the corporation keeps consolidated records and attributes income to states based on prescribed apportionment factors that ideally reflect where income is actually earned based on economic activity. Apportionment factors generally include factors related to employment, property, and sales, which reflect the presence of local inputs and economic activity specific to the entity.

As is consistent with our production model, consider an MNE m with one U.S. parent and one or more foreign affiliates. Let q_n denote measured production under separate accounting for each entity n (i.e., the U.S. parent and its foreign affiliates) belonging to the MNE m. For flexibility, q may include total value-added or simply include the shared-input components of value-added. Likewise, let $x_{j,n}$ denote apportionment factor j for each entity n, and let α_j denote the weight associated with apportionment factor j, where $\sum_j \alpha_j = 1$. Apportionment factor j should reflect economic activity. Under formulary apportionment, measured production (denoted as $\bar{q}_n$) attributable to entity n within MNE m is calculated as follows:

$$(8.3) \quad \bar{q}_n = \underbrace{\left(\sum_j \alpha_j \frac{x_{j,n}}{\sum_n x_{j,n}} \right)}_{\substack{\text{Apportionment} \\ \text{Weight}}} \underbrace{\left(\sum_n q_n \right)}_{\substack{\text{MNE} \\ \text{Production}}} \quad \forall \; n \in m .$$

As noted under the horizontal brackets in Equation (8.3), measured production attributable to an entity under formulary apportionment, $\bar{q}_n$, is a weighted average of the consolidated measured production deter-

mined for the MNE (i.e., the U.S. parent and its foreign affiliates) under separate accounting. Each apportionment weight is a combination of each apportionment factor and its associated weight.

We apply data to q in Equation (8.3) for the shared-input components of value-added (i.e., IBT, net IP, and PTR) for foreign affiliates and their U.S. parents. We then add the shared input components attributed to each entity under formulary apportionment to the local input components of value-added (i.e., compensation and CCA) attributed to each entity under separate accounting in order to obtain a new measure of value-added for each entity under formulary apportionment.[7]

DATA

We use survey data for 2009 that are collected by the BEA from MNEs on direct investment operations and that are used to compile the BEA's published statistics on the activities of MNEs. The data include apportionment factors related to employment, property, and sales. We focus attention on results obtained for foreign affiliates classified in select service-industry sectors because services are a growing component of MNE activities and because of the role shared inputs potentially play in the production attributed to foreign affiliates classified in the select service industry sectors (Lipsey 2010). The select service industry sectors include administration; finance; information; insurance; management of companies; miscellaneous; professional, scientific, and technical (PST); and real estate and leasing.

Data on Operations

We use operations data collected for U.S. parents and their majority-owned foreign affiliates (MOFAs) in the 2009 Benchmark Survey of U.S. Direct Investment Abroad. A foreign affiliate is an enterprise that has more than 10 percent of its voting stock owned by a U.S. parent. A MOFA is a foreign affiliate in which the combined direct and indirect ownership interest of all U.S. interests is more than 50 percent. A U.S. parent is defined as a U.S. person with an investment interest,

either directly or indirectly, of 10 percent or more in a foreign business enterprise.

Benchmark-operations survey forms are required to be completed for all U.S. parents (Form BE-10A). In addition, benchmark-operations survey forms are required for each MOFA with more than $80 million in assets, sales, or net income (net loss) (Form BE-10B).[8] Data used in this study for a given U.S. parent pertain only to the activities of the parent. Data for a given foreign affiliate pertain only to the activities of the affiliate. Data collected on the operations survey forms include income statement information and balance sheet information. Income statement information includes sales by type (i.e., goods, services, and investment income), location, and affiliation. In addition, income statement information includes detailed expenses such as compensation, depreciation, interest, and taxes. The BEA uses information from the income statement to measure value-added for each affiliate. Balance sheet information includes details regarding assets, liabilities, and owner's equity. Asset details include PPE.

Apportionment Factors

The choice of apportionment factors and their associated weights influences the results obtained from formulary apportionment. We consider three apportionment factors that are available in the operations data: 1) compensation, 2) net PPE, and 3) unaffiliated sales. Compensation and net PPE reflect local inputs employed in production. Unaffiliated sales may also reflect local inputs that may not be reflected in compensation and net PPE. If an affiliate has no compensation or net PPE, production is still attributed to the affiliate under formulary apportionment if unaffiliated sales are greater than zero. Likewise, if an affiliate has no unaffiliated sales, production is still attributed to the affiliate under formulary apportionment if compensation or net PPE is greater than zero. In other words, production attributed to the affiliate by Equation (8.3) is assumed to be proportional to the economic activity reported for the affiliate.[9]

We report the results from weighting compensation by 60 percent, net PPE by 25 percent, and unaffiliated sales by 15 percent.[10] We determine the factor weights based on each factor's share of the mean value-added, as calculated by using coefficients from a regression of

value-added on the apportionment factors. We initially determine factor weights separately for two subsamples of the data: 1) MOFAs and U.S. parents classified in select service industry sectors and 2) MOFAs and U.S. parents classified in all other industry sectors. However, even though the coefficient estimates are statistically different for the two subsamples, the resulting factor weights from each subsample are nearly identical because of differences in the subsample means.[11] Thus, we apply the factor weights obtained from the combined sample of MOFAs and U.S. parents classified in any industry sector. In addition to obtaining reasonable factor weights, the explanatory power of the apportionment factors is high (i.e., adjusted *r*-squared = 0.84).

RESULTS

Our goal is to use formulary apportionment as a substitute for separate accounting to reattribute measured value-added to foreign affiliates of U.S. parents. Our primary approach is to consolidate the shared-input components of value-added (i.e., IBT, net IP, and PTR) measured under separate accounting for a given MNE (i.e., the U.S. parent and its MOFAs) and reattribute to all entities within the MNE (i.e., the U.S. parent and its MOFAs) based on each entity's apportionment weight. In this case, value-added for an entity within the MNE includes compensation and CCA under separate accounting plus the shared-input components reattributed under formulary apportionment.

We divide the discussion of the results into four subsections: 1) reporting value-added and the related reattributions under formulary apportionment, 2) evaluating value-added under formulary apportionment relative to value-added under separate accounting, 3) interpreting the results in the context of our production model, and 4) discussing implications for the U.S. current account.

Value-Added and Reattributions under Formulary Apportionment

Table 8.1 summarizes value-added by industry sector and by global region for MOFAs and U.S. parents. For reference, the first three columns report published value-added determined under separate account-

Table 8.1 Value-Added by Industry Sector and by Global Region (billions of US$)

		Separate accounting			Formulary apportionment		
		MOFAs	U.S. parents	Total	MOFAs	U.S. parents	Total
	Select service industry sectors						
1	Administration	25.1	59.1	84.2	27.2	60.6	87.8
2	Finance	66.9	192.7	259.6	48.7	206.7	255.4
3	Information	51.0	287.6	338.7	50.7	294.6	345.2
4	Insurance	13.8	67.4	81.2	9.9	74.7	84.6
5	Management of companies	−14.5	−1.3	−15.7	3.2	– 0.6	2.7
6	Miscellaneous services	10.3	28.1	38.4	8.4	28.9	37.3
7	Professional, scientific, technical	78.5	177.5	256.1	88.3	176.2	264.5
8	Real estate and rental and leasing	22.7	34.5	57.2	14.1	35.7	49.9
9	Subtotals	254.0	845.6	1,099.6	250.6	876.8	1,127.4
	Other industry sectors						
10	Accommodation and food services	14.3	52.7	67.0	18.2	49.1	67.3
11	Construction	4.9	22.1	27.0	(D)	(D)	(D)
12	Farming, fishing, forestry	0.9	2.2	3.1	(D)	(D)	(D)
13	Health care and social assistance	1.5	31.8	33.3	(D)	(D)	(D)
14	Manufacturing	478.2	1,034.1	1,512.3	411.1	1,147.7	1,558.8
15	Mining	153.7	76.1	229.8	104.4	81.4	185.7
16	Retail trade	57.1	238.6	295.7	50.8	241.0	291.7
17	Transportation and warehousing	18.1	106.1	124.3	17.0	106.9	123.9
18	Utilities	9.5	62.0	71.5	(D)	(D)	(D)

19	Wholesale trade	152.7	124.4	277.1	122.4	128.6	251.1
20	Subtotals	891.0	1,750.1	2,641.1	741.1	1,872.2	2,613.3
21	Totals for industry sectors	1,145.0	2,595.8	3,740.7	991.7	2,749.0	3,740.7
	Global regions						
22	Africa	44.9		44.9	29.7		29.7
23	Asia	241.1		241.1	210.7		210.7
24	Canada	113.7		113.7	111.3		111.3
25	Europe	599.2		599.2	523.7		523.7
26	Latin America	128.4		128.4	102.3		102.3
27	Middle East	17.7		17.7	14.0		14.0
28	United States		2,595.8	2,595.8		2,749.0	2,749.0
29	Totals for global regions	1,145.0	2,595.8	3,740.7	991.7	2,749.0	3,740.7

NOTE: A “(D)” denotes data suppressed to avoid disclosure of data of individual companies. Blank cell = data not applicable. Some totals or subtotals may be slightly off because of rounding.

SOURCE: The first three columns, under the heading "Separate accounting," include statistics published online in the BEA’s financial and operating data on direct investment and multinational companies (http://www.bea.gov/iTable/index_MNC.cfm). The second three columns, under the heading "Formulary apportionment," include the authors’ calculations after value-added is attributed under Equation (8.3).

ing. The second three columns of Table 8.1 present results determined under formulary apportionment in Equation (8.3). Table 8.2 reports the dollar differences and the percentage differences between value-added under formulary apportionment and value-added under separate accounting from Table 8.1. Table 8.2 shows overall reattributions, reattributions by global region, and reattributions by industry sector.

Overall Reattributions

Line 21 of Table 8.2 shows that the overall reattribution of value-added from MOFAs to U.S. parents is $153.3 billion under formulary apportionment. The percentage decrease in value-added attributable to MOFAs is 13.4 percent (column 4), and the percentage increase in value-added attributable to U.S. parents is 5.9 percent (column 5). Overall, reattributions are small relative to total value-added attributed to all MOFAs and U.S. parents under separate accounting—less than 5 percent.

Reattributions by Global Region

In contrast to overall reattributions from MOFAs to U.S. parents, reattributions across some global regions are relatively large. In particular, the percentage decreases in value-added are greater than 10 percent for Africa, Asia, Europe, Latin America, and the Middle East but less than 10 percent for Canada (Table 8.2, column 4). Under both formulary apportionment and separate accounting, more value-added is attributed to MOFAs in Europe than in any other global region (Table 8.1, line 25). However, Canada and Latin America change places under formulary apportionment in the distribution of value-added by global region (Table 8.1, lines 24 and 26). Under formulary apportionment, more production is attributable to MOFAs in Canada than in Latin America. Thus, in addition to less measured production attributable to MOFAs in each of the six global regions, there are interregional changes in the distribution of measured production attributable to MOFAs of U.S. parents as a result of formulary apportionment.

Reattributions by Industry Sector

Reattributions across some industry sectors are also relatively large. The percentage changes in value-added are greater than 10 percent for MOFAs classified in all industry sectors except administration, information, and transportation (Table 8.2, column 4). Reattributions greater than 10 percent also result for U.S. parents classified in insurance, management, and manufacturing (Table 8.2, column 5).

Under both formulary apportionment and separate accounting, more value-added is attributed to MOFAs classified in PST than for any other select service sector (Table 8.1, line 7), and more value-added is attributed to MOFAs classified in manufacturing than for any of the other industry sectors (Table 8.1, line 14). The distribution of value-added under formulary apportionment is also the same for MOFAs classified in all other select service sectors except finance and information (Table 8.1, lines 2 and 3, respectively). However, the distribution of value-added under formulary apportionment changes for MOFAs classified in accommodation, mining, transportation, and wholesale (Table 8.1, lines 10, 15, 17, and 19, respectively). The industry distribution of value-added under formulary apportionment does not change for U.S. parents. Thus, we observe an interindustry change in the distribution of measured production attributable to MOFAs but not to U.S. parents.

As is consistent both with overall reattributions and with reattributions by global region, value-added reported in Table 8.1 for each industry sector is generally higher under formulary apportionment for U.S. parents and lower for MOFAs. While this is not directly observable in Table 8.2, we look at the underlying data to trace reattributions to U.S. parents from MOFAs. Reattributions to U.S. parents classified in manufacturing are due in large part to reattributions from MOFAs classified in manufacturing and mining. Likewise, increases for U.S. parents classified in information and manufacturing are explained in large part by decreases for MOFAs classified in leasing. There are also reattributions from MOFAs classified in finance to U.S. parents classified in insurance. The remaining reattributions are among MOFAs classified in management and MOFAs and U.S. parents classified in finance, insurance, miscellaneous, PST, retail, and wholesale.

Table 8.2 Value-Added Reattributable under Formulary Apportionment

		Billions of US$			Percentage		
		MOFAs	U.S. parents	Total	MOFAs	U.S. parents	Total
	Select service industry sectors						
1	Administration	2.0	1.5	3.6	8.1	2.6	4.3
2	Finance	−18.2	14.0	−4.2	−27.2	7.3	−1.6
3	Information	−0.4	6.9	6.6	−0.7	2.4	1.9
4	Insurance	−3.9	7.3	3.4	−28.0	10.8	4.2
5	Management of companies	17.7	0.7	18.4	122.5	53.5	116.9
6	Miscellaneous services	−1.9	0.8	−1.0	−18.1	2.9	−2.7
7	Professional, scientific, technical	9.8	−1.3	8.4	12.4	−0.7	3.3
8	Real estate and rental and leasing	−8.6	1.2	−7.3	−37.8	3.6	−12.8
9	Subtotals	−3.4	31.2	27.8	−1.3	3.7	2.5
	Other industry sectors						
10	Accommodation and food services	3.8	−3.5	0.3	26.6	−6.7	0.4
11	Construction	(D)	(D)	(D)	(D)	(D)	(D)
12	Farming, fishing, forestry	(D)	(D)	(D)	(D)	(D)	(D)
13	Health care and social assistance	(D)	(D)	(D)	(D)	(D)	(D)
14	Manufacturing	−67.0	113.5	46.5	−14.0	11.0	3.1
15	Mining	−49.3	5.2	−44.1	−32.1	6.9	−19.2
16	Retail trade	–6.3	2.4	–4.0	−11.1	1.0	−1.3

17	Transportation and warehousing	−1.1	0.8	−0.3	−6.1	0.7	−0.3
18	Utilities	(D)	(D)	(D)	(D)	(D)	(D)
19	Wholesale trade	−30.3	4.2	−26.1	−19.8	3.4	−9.4
20	Subtotals	−149.9	122.1	−27.8	−16.8	7.0	−1.1
21	Totals for industry sectors	−153.3	153.3	0.0	−13.4	5.9	0.0
	Global regions						
22	Africa	−15.2		−15.2	−33.8		−33.8
23	Asia	−30.4		−30.4	−12.6		−12.6
24	Canada	−2.4		−2.4	−2.1		−2.1
25	Europe	−75.5		−75.5	−12.6		−12.6
26	Latin America	−26.2		−26.2	−20.4		−20.4
27	Middle East	−3.6		−3.6	−20.5		−20.5
28	United States		153.3	153.3		5.9	5.9
29	Totals for global regions	−153.3	153.3	0.0	−13.4	5.9	0.0

NOTE: A "(D)" denotes data suppressed to avoid disclosure of data of individual companies. The values for "Billions of US$" (first three columns) are calculated by subtracting value-added under separate accounting from value-added under formulary apportionment. Percentages (second three columns) are calculated by dividing the values for "Billions of US$" by the absolute value of value-added under separate accounting. Some totals or subtotals may be slightly off because of rounding. Blank cell = data not applicable.

SOURCE: Authors' tabulations.

Evaluation of Value-Added under Separate Accounting and Formulary Apportionment

We calculate approximate factor shares of value-added using the local input components and shared input components of value-added. Factor shares are informative because they reveal the relative contributions of local inputs and shared inputs to total measured production. We interpret factor shares using global factor shares as a reference. Published returns to local inputs as a share of published value-added are 52.8 percent for all MOFAs and 75.3 percent for all U.S. parents. Published returns to local inputs for all MOFAs and all U.S. parents combined are 68.4 percent of published value-added for all MOFAs and all U.S. parents combined. Thus, we use 68.4 percent as a reference for factor shares based on local inputs for both separate accounting and formulary apportionment. Likewise, we use 31.6 percent as a reference for factor shares based on shared inputs. In other words, we expect the relative contributions of local inputs and of shared inputs to total measured production to be about 68.4 percent and 31.6 percent, respectively.

Given differences in production functions, we expect some variation in factor shares across MOFAs and U.S. parents, across industry sectors and global regions, and across industries and countries. In addition, the factor shares are affected to the extent that returns to local inputs are included in the shared input components of value-added. However, given our model, in which affiliate production is a function of both local inputs and shared inputs, we consider differences in factor shares between formulary apportionment and separate accounting based on local inputs to be indicative of possible over- or underattributed returns to entities, based on shared inputs under separate accounting.[12]

Table 8.3 reports factor shares based on local input components under separate accounting and under formulary apportionment. Table 8.4 reports factor shares based on shared input components. Overall, the factor shares reflect the net reattribution of value-added from MOFAs to U.S. parents presented in Table 8.2. In particular, the local input shares of value-added increase for MOFAs and decrease for U.S. parents under formulary apportionment (Table 8.3, line 21). In contrast, the shared input shares of value-added decrease for MOFAs and increase for U.S. parents (Table 8.4, line 21). Local input shares are lower for MOFAs

than for U.S. parents, and shared input shares are higher for MOFAs than for U.S. parents; however, local input shares and shared input shares for MOFAs and U.S. parents combined are generally closer to the global reference points under formulary apportionment.

Across all industry sectors, local input shares and shared input shares display considerable variation under separate accounting and under formulary apportionment. Local input shares are generally higher for the select service industry sectors than for the other industry sectors. Local input shares for MOFAs classified in finance, information, leasing, management, manufacturing, mining, miscellaneous, transportation, and wholesale increase under formulary apportionment. Conversely, local input shares for MOFAs classified in accommodation, administration, insurance, and PST decrease under formulary apportionment. These results imply that separate accounting may result in over- or underattributed returns to local inputs in some industries.

Across global regions, local input shares increase by more than 10 percentage points for Africa, Latin America, and the Middle East and by less than 10 percentage points for Asia, Canada, and Europe. Increases in Latin America are driven in large part by considerable increases in Barbados, Bermuda, and the UK Caribbean islands. Increases in Asia are explained primarily by increases in Hong Kong, Malaysia, Singapore, and Thailand. Increases in Europe are a result in part of increases in Denmark, Finland, Hungary, Ireland, Luxembourg, and Norway. We do not report numerical results for individual countries, in order to avoid disclosure of individual companies.

Economic Interpretation

According to our production model and the related empirical framework, value-added may be overattributed to a MOFA under separate accounting based on the availability of shared inputs within an MNE. The shared input components of value-added (i.e., IBT, net IP, and PTR) reflect, in part, returns to shared inputs that may not actually be employed by the MOFA to the extent reflected under separate accounting. In contrast, formulary apportionment attributes returns to shared inputs based on the MOFA's proportion of economic activity reflected in the chosen apportionment factors. As is consistent with our produc-

Table 8.3 Factor Shares Based on Local Input Components

		Separate accounting (%)			Formulary apportionment (%)		
		MOFAs	U.S. parents	Total	MOFAs	U.S. parents	Total
	Select service industry sectors						
1	Administration	89.5	86.4	87.3	82.8	84.2	83.8
2	Finance	72.9	91.4	99.3	99.9	97.2	97.7
3	Information	63.8	66.0	65.7	64.3	64.5	64.4
4	Insurance	92.1	81.2	83.9	82.0	87.0	86.4
5	Management of companies	12.5	20.4	13.2	73.8	29.8	94.1
6	Miscellaneous services	61.2	82.3	76.6	74.7	78.8	77.8
7	Professional, scientific, technical	74.5	73.5	73.8	66.2	74.0	71.4
8	Real estate and rental and leasing	51.8	81.2	69.5	83.2	78.4	79.8
9	Subtotals	77.0	85.6	83.6	78.0	82.5	81.5
	Other industry sectors						
10	Accommodation and food services	77.1	71.4	72.6	60.9	76.5	72.2
11	Construction	76.3	89.7	87.3	(D)	(D)	(D)
12	Farming, fishing, forestry	79.8	99.1	93.4	(D)	(D)	(D)
13	Health care and social assistance	73.3	79.1	78.8	(D)	(D)	(D)
14	Manufacturing	51.3	72.8	66.0	59.7	65.6	64.1
15	Mining	28.2	57.5	37.9	41.5	53.8	46.9
16	Retail trade	46.5	60.5	57.8	52.3	59.9	58.6
17	Transportation and warehousing	69.9	76.7	75.7	74.4	76.1	75.9
18	Utilities	39.9	49.7	48.4	(D)	(D)	(D)

19	Wholesale trade	39.5	74.7	55.3	49.3	72.3	61.1
20	Subtotals	45.9	70.3	62.1	55.2	65.8	62.7
21	Totals for industry sectors	52.8	75.3	68.4	60.9	71.1	68.4
	Global regions						
22	Africa	29.1		29.1	44.0		44.0
23	Asia	51.8		51.8	59.3		59.3
24	Canada	63.0		63.0	64.3		64.3
25	Europe	54.6		54.6	62.5		62.5
26	Latin America	46.3		46.3	58.2		58.2
27	Middle East	45.2		45.2	56.9		56.9
28	United States		75.3	75.3		71.1	71.1
29	Totals for global regions	52.8	75.3	68.4	60.9	71.1	68.4

NOTE: A "(D)" denotes data suppressed to avoid disclosure of data of individual companies. We calculate factor shares based on local inputs by dividing the sum of compensation and CCA by the sum of compensation, CCA, and the absolute value of shared inputs [i.e., local input share = (compensation + CCA) ÷ (compensation + CCA + | IBT + net IP + PTR |)]. Blank cell = data not applicable.
SOURCE: Authors' tabulations.

Table 8.4 Factor Shares Based on Shared Input Components

		Separate accounting (%)			Formulary apportionment (%)		
		MOFAs	U.S. parents	Total	MOFAs	U.S. parents	Total
	Select service industry sectors						
1	Administration	10.5	13.6	12.7	17.2	15.8	16.2
2	Finance	27.1	8.6	0.7	0.1	2.8	2.3
3	Information	36.2	34.0	34.3	35.7	35.5	35.6
4	Insurance	7.9	18.8	16.1	18.0	13.0	13.6
5	Management of companies	87.5	79.6	86.8	26.2	70.2	5.9
6	Miscellaneous services	38.8	17.7	23.4	25.3	21.2	22.2
7	Professional, scientific, technical	25.5	26.5	26.2	33.8	26.0	28.6
8	Real estate and rental and leasing	48.2	18.8	30.5	16.8	21.6	20.2
9	Subtotals	23.0	14.4	16.4	22.0	17.5	18.5
	Other industry sectors						
10	Accommodation and food services	22.9	28.6	27.4	39.1	23.5	27.8
11	Construction	23.7	10.3	12.7	(D)	(D)	(D)
12	Farming, fishing, forestry	20.2	0.9	6.6	(D)	(D)	(D)
13	Health care and social assistance	26.7	20.9	21.2	(D)	(D)	(D)
14	Manufacturing	48.7	27.2	34.0	40.3	34.4	35.9
15	Mining	71.8	42.5	62.1	58.5	46.2	53.1
16	Retail trade	53.5	39.5	42.2	47.7	40.1	41.4
17	Transportation and warehousing	30.1	23.3	24.3	25.6	23.9	24.1
18	Utilities	60.1	50.3	51.6	(D)	(D)	(D)

19	Wholesale trade	60.5	25.3	44.7	50.7	27.7	38.9
20	Subtotals	54.1	29.7	37.9	44.8	34.2	37.3
21	Totals for industry sectors	47.2	24.7	31.6	39.1	28.9	31.6
	Global regions						
22	Africa	70.9		70.9	56.0		56.0
23	Asia	48.2		48.2	40.7		40.7
24	Canada	37.0		37.0	35.7		35.7
25	Europe	45.4		45.4	37.5		37.5
26	Latin America	53.7		53.7	41.8		41.8
27	Middle East	54.8		54.8	43.1		43.1
28	United States		24.7	24.7		28.9	28.9
29	Totals for global regions	47.2	24.7	31.6	39.1	28.9	31.6

NOTE: A "(D)" denotes data suppressed to avoid disclosure of data of individual companies. We calculate factor shares based on shared inputs by dividing the absolute value of shared inputs by the sum of compensation, CCA, and the absolute value of shared inputs [i.e., shared input share = (| IBT + net IP + PTR |) ÷ (compensation + CCA + | IBT + net IP + PTR |)]. Blank cell = data not applicable.
SOURCE: Authors' tabulations.

tion model, our results for value-added imply that too much production is attributed to MOFAs and too little production is attributed to U.S. parents under separate accounting.

Given the economic activity embodied in each of the apportionment factors (i.e., compensation, net PPE, and unaffiliated sales), the modest overall reattributions from MOFAs to U.S. parents in Table 8.2 and the relatively large reattributions across some global regions in Table 8.2 imply an overstatement of economic activity for MOFAs under separate accounting. Likewise, the relatively large reattributions across some industry sectors in Table 8.2 and across MOFAs and U.S. parents by industry sector in Table 8.2 reveal considerable differences in economic activity as reflected under formulary apportionment and in economic activity as reflected under separate accounting. Value-added measures constructed under a method of separate accounting generally imply more economic activity than under a method of formulary apportionment for MOFAs classified in finance, information, insurance, leasing, manufacturing, mining, miscellaneous, retail, transportation, and wholesale and for U.S. parents classified in accommodation and PST. In contrast, less economic activity is generally implied under separate accounting than under formulary apportionment for MOFAs classified in accommodation, administration, management, and PST and for U.S. parents classified in industry sectors other than accommodation and PST.

The reattributions reported in Table 8.2 and the factor shares reported in Tables 8.3 and 8.4 generally support formulary apportionment as an alternative to separate accounting. Given the results obtained for value-added, formulary apportionment appears to yield measures of production that are more congruent with economic activity for MOFAs and U.S. parents and more consistent with expectations based on global factor shares. Thus, formulary apportionment appears to be a viable alternative to separate accounting under the residency-based framework of the BPM and the SNA.

Implications for the U.S. Current Account

In addition to applying formulary apportionment to reattribute value-added, we apply formulary apportionment to reattribute service imports and exports between U.S. parents and their foreign affiliates.

Since imports and exports are components of GDP, our results enable us to assess the effect on GDP of formulary apportionment as we apply it here. However, given data limitations and other practical considerations, our work with the current account is very preliminary and does not yet incorporate income payments and receipts. Based on our preliminary results, we expect to be able to provide a complete picture of the U.S. current account under formulary apportionment in a future paper.

We use cross-border transactions data collected from U.S. parents on service imports and exports with their foreign affiliates for 2008 because the cross-border transactions data for 2008 have already been linked with the operations data, which contain the apportionment factors (Barefoot and Koncz-Bruner 2012).[13] Based on our model, in which production is a function of local inputs and shared inputs, we do not expect exports by U.S. parents to their foreign affiliates to be as affected under formulary apportionment as imports by U.S. parents from their foreign affiliates, because the data indicate U.S. parents generally have a meaningful amount of local inputs. As is consistent with our expectations, exports are nearly unchanged under formulary apportionment. However, the overall reattribution of imports from foreign affiliates to U.S. parents is $10.9 billion, which is almost 13 percent of published private-service imports from affiliated parties (an amount totaling $85.2 billion) but only about 3 percent of published total private service imports ($371.2 billion).

Given the role imports and exports play as components of GDP, we also assess the overall effect of reattributing service imports and exports under formulary apportionment. U.S. goods and services imports decrease by approximately 0.4 percent, but exports remain unchanged. Net exports increase by approximately 1.5 percent. The overall effect on GDP is only an approximate 0.1 percent increase. Thus, while reattributions of U.S. service imports and exports under formulary apportionment have a relatively moderate effect on the foreign transactions component of GDP and a bit larger effect on the closely related statistics of the ITAs, the impact on GDP is relatively small.[14]

SUMMARY AND CONCLUSIONS

The BEA currently measures value-added of foreign affiliates and U.S. parents based on separate accounting. Based on a simple production model and a related empirical framework, value-added may be overattributed to foreign affiliates under separate accounting; this is due to the availability of shared inputs within an MNE. In particular, the shared-input components of value-added (i.e., IBT, net IP, and PTR) reflect, in part, returns to shared inputs that may not actually be employed by foreign affiliates to the extent reflected under separate accounting. In this chapter, we use formulary apportionment as an alternative for separate accounting to reattribute measured value-added to foreign affiliates of U.S. parents.

We find that overall reattributions from foreign affiliates to U.S. parents are relatively small—less than 5 percent of total value-added attributed to all majority-owned foreign affiliates and U.S. parents under separate accounting. In contrast to overall reattributions, reattributions across global regions including Africa, Asia, Europe, Latin America, and the Middle East are greater than 10 percent of value-added under separate accounting. In addition, reattributions for foreign affiliates are greater than 10 percent of value-added under separate accounting for all industry sectors except administration, information, and transportation.

In addition to applying formulary apportionment to reattribute value-added, we report preliminary results to reattribute service imports and exports between U.S. parents and their foreign affiliates. We find a relatively large decrease in imports but no meaningful change in exports. The overall effect on GDP is only a small increase—approximately 0.1 percent. Based on our preliminary results, we expect to be able to provide a complete picture of the U.S. current account under formulary apportionment in a future paper.

Given the economic activity embodied in each of the apportionment factors (i.e., compensation, net PPE, and unaffiliated sales), the reattributions summarized here imply an overstatement of economic activity for MOFAs under separate accounting. Using factor shares to evaluate the results, we conclude that value-added attributed to foreign affiliates and U.S. parents under formulary apportionment yields a picture of measured production by industry sector and country that is more congruent with economic activity than related measures generated

under separate accounting. Thus, formulary apportionment appears to be a viable alternative to separate accounting under the residency-based framework of the BPM and the SNA.

Notes

The statistical analysis of firm-level data on U.S. multinational enterprises and companies engaged in international transactions was conducted at the Bureau of Economic Analysis, U.S. Department of Commerce, under arrangements that maintain legal confidentiality requirements. The views expressed in this chapter are solely those of the authors and not necessarily those of the U.S. Department of Commerce or the Bureau of Economic Analysis.

1. Throughout the chapter, we use "MNE" or "enterprise" to refer to a group of affiliated entities that includes both U.S. parents and foreign affiliates. We use "entity" to refer to individual establishments within the MNE; such individual establishments may be either a U.S. parent or a foreign affiliate. We also use "parent" or "affiliate" to refer to a U.S. parent or a foreign affiliate, respectively.
2. Economic territory is discussed in paragraphs 4.3–4.11 of the BPM, institutional units are discussed in paragraphs 4.12–4.56, and residence is discussed in paragraphs 4.113–4.168.
3. We do not distinguish between nominal output and real output. In the absence of data to adjust for price differences, we treat real output as proportional to nominal output.
4. The BEA publishes estimates of value-added for MNEs as part of the annual statistics on direct investment and multinational companies.
5. In the NIPAs, consumption of fixed capital is the measure of economic depreciation. Given that depreciation is a cost in affiliates' accounting records, any difference between CCA and consumption of fixed capital is reflected in profits. Thus, measured value-added is unaffected (Mataloni and Goldberg 1994).
6. IBT includes sales tax, value-added tax, consumption tax, excise tax, taxes on property and other assets, duties, license fees, fines, penalties, and any other taxes other than payroll taxes and income taxes.
7. Equation (8.3) inevitably changes the industry and country composition of value-added from that measured under separate accounting, because there are no restrictions by industry or country. In other words, value-added attributed under separate accounting to an affiliate classified in one industry may be reattributed under formulary apportionment to an affiliate classified in another industry. Likewise, value-added attributed to an affiliate located in one country may be reattributed to an affiliate located in another country. If returns accruing to shared inputs are under- or overattributed to an entity under separate accounting, then statistics by industry and country do not accurately reflect actual output, and reattributing across industries and countries is presumably justified. However, we also restrict

reattributions by industry while assuming the same production function across countries within a given industry, because entities in different countries belong to the same MNE. While restricting reattributions by industry does affect the results under formulary apportionment, the restriction does not affect our conclusions.

8. Less information is collected for each MOFA with assets, sales, or net income (net loss) of less than $80 million (Form BE-10C or Form BE-10D).
9. In addition to compensation, net PPE, and unaffiliated sales, we consider other possible apportionment factors. In particular, we consider research and development expenditures, which are reported for MOFAs. However, R&D expenditures are likely in some cases to be made pursuant to intercompany cost-sharing arrangements. In addition, we are unable to discern the extent to which R&D expenditures reflect intercompany transactions. Thus, we limit the apportionment factors to compensation, net PPE, and unaffiliated sales.
10. We also weight compensation by 100 percent in Equation (8.3), which does not affect our conclusions. In addition to reflecting the number of employees employed by an affiliate, compensation reflects wages. Thus, if workers are paid according to their value marginal product, compensation reflects variation in economic activity across industries and countries. In other words, using compensation as an apportionment factor yields relatively more output attributable to high-margin industries and high-wage countries and relatively less output attributable to low-margin industries and low-wage countries. In addition, compensation is based on market transactions rather than accounting conventions, which may affect both net PPE and unaffiliated sales. Furthermore, unaffiliated sales may reflect local inputs or shared inputs. Thus, compensation may provide the most objective measure of economic activity.
11. The subsample of select service-industry sectors yields factor weights of 0.63, 0.28, and 0.09 for compensation, net PPE, and unaffiliated sales, respectively. The subsample of other industry sectors yields factor weights of 0.64, 0.21, and 0.15 for compensation, net PPE, and unaffiliated sales. The combined sample yields factor weights of 0.61, 0.24, and 0.15 for compensation, net PPE, and unaffiliated sales.
12. Since compensation and CCA are always nonnegative, the local input components are always nonnegative. However, since net IP or PTR may be negative, the shared input components and total value-added may be negative. In order to obtain factor shares between 0 and 100 percent, we calculate local input shares by dividing the sum of compensation and CCA by the sum of compensation, CCA, and the absolute value of shared inputs. Likewise, we calculate shared input shares by dividing the absolute value of shared inputs by the sum of compensation, CCA, and the absolute value of shared inputs.
13. The cross-border transactions include annual amounts reported on the Quarterly Survey of Insurance Transactions by U.S. Insurance Companies with Foreign Persons (Form BE-45), the Quarterly Survey of Transactions in Selected Services and Intangible Assets with Foreign Persons (Form BE-125), and the Quarterly Survey of Financial Services Transactions between U.S. Financial Services Providers and Foreign Persons (Form BE-185).

14. Small differences exist between foreign transactions published in the NIPAs and foreign transactions published in the ITAs because of adjustments for gold, U.S. territories, and other small statistical differences.

References

Altshuler, Rosanne, and Harry Grubert. 2010. "Formula Apportionment: Is It Better Than the Current System and Are There Better Alternatives?" *National Tax Journal* 63(4, Part 2): 1145–1184.

Avi-Yonah, Reuven S. 2010. "Between Formulary Apportionment and the OECD Guidelines: A Proposal for Reconciliation." *World Tax Journal* 2(1): 3–18.

Avi-Yonah, Reuven S., and Kimberly A. Clausing. 2007. "Reforming Corporate Taxation in a Global Economy: A Proposal to Adopt Formulary Apportionment." Hamilton Project Discussion Paper No. 2007-08. Washington, DC: Brookings Institution.

Baldwin, Robert E., and Fukunari Kimura. 1998. "Measuring U.S. International Goods and Services Transactions." In *Geography and Ownership as Bases for Economic Accounting*, Robert E. Baldwin, Robert E. Lipsey, and J. David Richardson, eds. NBER Studies in Income and Wealth 59. Chicago: University of Chicago Press, pp. 9–48.

Barefoot, Kevin, and Jennifer Koncz-Bruner. 2012. "A Profile of U.S. Exporters and Importers of Services." *Survey of Current Business* 92(6): 66–87.

Bartelsman, Eric J., and Roel M. W. J. Beetsma. 2003. "Why Pay More? Corporate Tax Avoidance through Transfer Pricing in OECD Countries." *Journal of Public Economics* 87(9–10): 2225–2252.

Brainard, S. Lael. 1993. "An Empirical Assessment of the Factor Proportions Explanation of Multinational Sales." NBER Working Paper No. 4583. Cambridge, MA: National Bureau of Economic Research.

———. 1997. "An Empirical Assessment of the Proximity-Concentration Trade-Off between Multinational Sales and Trade." *American Economic Review* 87(4): 520–544.

Caves, Richard E. 1971. "International Corporations: The Industrial Economics of Foreign Investment." *Economica* 38(149): 1–27.

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and World Bank. 2009. *System of National Accounts 2008*. New York: United Nations.

Fuest, Clemens, Thomas Hemmelgarn, and Fred Ramb. 2007. "How Would the Introduction of an EU-Wide Formula Apportionment Affect the Distribution and Size of the Corporate Tax Base? An Analysis Based on German Multinationals." *International Tax and Public Finance* 14(5): 605–626.

Helpman, Elhanan. 1984. "A Simple Theory of International Trade with Multinational Corporations." *Journal of Political Economy* 92(3): 451–471.

Hines, James R. 2010. "Income Misattribution under Formula Apportionment." *European Economic Review* 54(1): 108–120.

International Monetary Fund. 2009. *Balance of Payments and International Investment Position Manual, Sixth Edition (BPM6)*. Washington, DC: International Monetary Fund.

Kimura, Fukunari, and Robert E. Baldwin. 1998. "Application of a Nationality-Adjusted Net Sales and Value-Added Framework: The Case of Japan." In *Geography and Ownership as Bases for Economic Accounting*, Robert E. Baldwin, Robert E. Lipsey, and J. David Richardson, eds. NBER Studies in Income and Wealth 59. Chicago: University of Chicago Press, pp. 49–82.

Landefeld, J. Steven, Obie G. Whichard, and Jeffrey H. Lowe. 1993. "Alternative Frameworks for U.S. International Transactions." *Survey of Current Business* 73(12): 50–61.

Lipsey, Robert E. 2009. "Measuring International Trade in Services." In *International Trade in Services and Intangibles in the Era of Globalization*, Marshall Reinsdorf and Matthew J. Slaughter, eds. NBER Studies in Income and Wealth 69. Chicago: University of Chicago Press, pp. 27–74.

———. 2010. "Measuring the Location of Production in a World of Intangible Productive Assets, FDI, and Intrafirm Trade." *Review of Income and Wealth* 56(1): S99–S110.

Markusen, James R. 1984. "Multinationals, Multi-Plant Economies, and the Gains from Trade." *Journal of International Economics* 16(3–4): 205–226.

———. 1997. "Trade versus Investment Liberalization." NBER Working Paper No. 6231. Cambridge, MA: National Bureau of Economic Research.

Martens-Weiner, Joann. 2006. *Company Tax Reform in the European Union: Guidance from the United States and Canada on Implementing Formulary Apportionment in the EU*. New York: Springer.

Mataloni, Raymond J. Jr., and Lee Goldberg. 1994. "Gross Product of U.S. Multinational Companies, 1977–91." *Survey of Current Business* 74(2): 42–63.

United Nations Economic Commission for Europe. 2011. *The Impact of Globalization on National Accounts*. Geneva: United Nations.

Whichard, Obie G., and Jeffrey H. Lowe. 1995. "An Ownership-Based Disaggregation of the U.S. Current Account, 1982–93." *Survey of Current Business* 75(10): 52–61.

Measuring Globalization

Better Trade Statistics for Better Policy

Volume 2

Factoryless Manufacturing, Global Supply Chains, and Trade in Intangibles and Data

Susan N. Houseman
and
Michael Mandel
Editors

2015

W.E. Upjohn Institute for Employment Research
Kalamazoo, Michigan

Library of Congress Cataloging-in-Publication Data

Measuring globalization : better trade statistics for better policy / Susan N. Houseman and Michael Mandel, editors.
volumes cm
Includes bibliographical references and indexes.
ISBN 978-0-88099-488-0 (v. 1 : pbk. : alk. paper) — ISBN 0-88099-488-6 (v. 1 : pbk. : alk. paper) —ISBN 978-0-88099-489-7 (v. 1 : hardcover : alk. paper) — ISBN 0-88099-489-4 (v. 1 : hardcover : alk. paper)
1. Commercial statistics. I. Houseman, Susan N., 1956- II. Mandel, Michael J.
HF1016.M44 2015
382.01’5195—dc23

2014047579

W.E. Upjohn Institute for Employment Research
300 S. Westnedge Avenue
Kalamazoo, Michigan 49007-4686

Cover design by Alcorn Publication Design.
Index prepared by Diane Worden.
Printed in the United States of America.
Printed on recycled paper.