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DEFINING AND MEASURING THE LOCATION OF FDI OUTPUT

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ABSTRACT

The standard measures of flows and stocks of FDI view FDI as a financial flow and its accumulation as a stock, but most uses of FDI data require measures of employment, payrolls, capital inputs, and output from FDI. Judging by data for the United States, the flow and stock data provide rough approximations to country distributions of FDI sources and destinations, but are poor approximations to industry distributions of FDI and to changes over time in country and industry distributions. One important reason for the poor match between the two types of measures is that more and more of production is the output from intangible and financial assets, the location of which is determined by the firm itself, and not easily subject to outside verification. That development is combined with the increasing use of holding companies and chains of ownership to reduce tax burdens on the firms without necessarily altering the physical location of inputs or production. These developments have drawn the attention of tax authorities and led to some proposals that would reduce firms' ability to manipulate the location of assets and profits. However, these maneuvers also lead to ambiguities in the meaning of economic measures, such as the balance of payments and national product. The effects on economic measurements, which may influence many types of economic policy, have been submerged in the concern for tax revenues.

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Introduction

The measurement of foreign direct investment serves two broad purposes. One, the traditional one, views foreign direct investment as a financial flow. For the source countries, it is one of the ways in which they allocate their savings. For the recipient countries, it is one of the ways in which their capital formation or the acquisition of other assets is financed. The stocks of direct investment, often calculated by cumulating the flows over time, are, for the source countries, one of the forms in which they hold assets abroad. For the recipient countries, they are a measure of foreigners' claims on their capital, the income on which, like the interest on foreign borrowing, is a burden on their current accounts. Markusen (2002) described the formal economics literature of the late 1970s, and could have similarly included the earlier theoretical literature, as dealing with direct investment and multinationals "...if they were treated at all...as just part of the theory of portfolio capital flows...Much data existed on direct investment stocks and flows, but very little existed on what the multinational firms actually produced and traded" (Pp. xi and xii).

The other purpose of the measurement of direct investment is to measure the activities of multinational firms, the determinants of these activities and their effects on the home countries and host countries involved. For most economists and most policy makers now, the role of direct investment in the flow of financial capital is a minor part of what FDI does. The major importance of FDI is as a vehicle for the transmission of ideas, technological knowledge, organizational knowledge, and business knowledge. This transmission takes place through FDI operations: production, employment, capital investment, and R&D. Economists study FDI, for

example, to answer questions about “...the relationship between trade and affiliate production, the effects of trade versus investment liberalization on factor prices, and the location of production” and “...how the pattern of affiliate production in the world economy should relate to country characteristics “ (Markusen, p. xiv). Policy makers are mainly interested in how FDI, both inward and outward, affects their economies’ growth and the composition of their production. There is no summary measure that serves as a proxy for all of these aspects of multinational firms, but the flow and stock numbers do not represent any of them.

Markusen concludes that “...viewing multinationals and direct investment as part of capital theory was largely a mistake. The sourcing of finances for direct investments are often geographically disjoint from the actual parent country...” (*ibid.*, p. xii).

This interest in the effects of multinational firms on their home and host country economies leads to a need for entirely different measures of foreign direct investment, measures of FDI production, or input and output. The studies of the impacts of multinational firms on individual home and host countries summarized in Lipsey (2004) and other surveys mostly rely for their measures of multinationals’ activities on data for production, sales, employment, R&D, and plant and equipment, of both parent firms and their foreign affiliates. That is particularly the case for studies based on microdata for individual plants and firms. However, the scope of these studies is limited by the fact that few countries collect operations data on their own firms’ foreign activities. More countries, but still a minority, collect data on foreign firms’ operations within their borders distinguished from those of domestically-owned firms. For that reason, investigators who want to draw conclusions about these issues are often led to fall back on the almost universally available stock and flow data, despite their deficiencies. It is therefore

important in assessing this literature to know how well the stock and flow data represent the operations data.

Flows and Stocks of Foreign Direct Investment

The only measures of foreign direct investment that are available for almost every country in the world, and for many countries over long periods, are the outward and inward flows of FDI from the balance of payments and the related estimates of outward and inward stocks of FDI. These are published by UNCTAD in the World Investment Reports and by the International Monetary Fund in the Balance of Payments Yearbooks. One of the last holdouts, Bermuda, began reporting according to the framework of IMF (1993) in 1996, although it continues to treat the “international exempt sector” as non-resident in its balance of payments and GDP accounts, where IMF (1993) calls for treatment of the sector as resident (Bermuda, Department of Statistics, 2006). Because the stock and flow data are so widely available, users are grateful for them, and they are probably used in more scholarly papers and news reports than any other measures.

The early calculations of stocks of U.S. direct investment abroad by country of location, such as Lewis (1938), measured total investment by the total book values of holdings, distributed geographically, as far as possible, “...according to the actual location of the properties represented...” (p. 577). The location was presumably that of the land, mines, factories, warehouses, and retail operations that made up these book values. Although that principle is carried over to the latest IMF definitions, it is not clear that it is effectively carried out in a world in which much production is intangible, and even for production of tangible products, important parts of the assets that enter production are intangible. The latest IMF rules on location say that “An enterprise is said to have a center of economic interest and be a resident unit of a

country...when the company is engaged in a significant amount of production of goods and services there or when the enterprise owns land or buildings located there. The enterprise must maintain at least one production establishment in the country...” (IMF, 1993, p.22). The location of the investment is based on the legal location of the enterprise, except for the requirement that there must be some ownership of tangible assets there or some amount of production of goods or services.

The disconnection between the published data for the direction of flows and location of stocks of FDI and inputs into and output from FDI operations are highlighted by recent reported trends. After stressing the important role of Hong Kong as an outward direct investor, the largest among developing countries, UNCTAD (2004) reported that more than half of the outward stock was accounted for by four tax havens, the British Virgin Islands, Bermuda, Panama, and the Cayman Islands (p. 26). These were clearly not the ultimate destinations of these investments or the locations of much production resulting from them, if there was any. Luxembourg was reported to be the world’s largest outward investor and the largest FDI recipient in 2002, accounting for 19 percent of world inflows and 24 percent of world outflows, although its share of EU GDP was only 0.2 percent (UNCTAD,2003, p. 69) “...because it offers favorable conditions for holding companies and for corporate HQ, such as certain tax exemptions...” (*ibid.*). The bulk of production associated with these flows must have taken place somewhere else.

FDI Stocks and Factor Inputs

The Bureau of Economic Analysis of the U.S. Department of Commerce, which produces both the direct investment flow and stock data and the data on the activity of U.S. firms and their foreign affiliates, has pointed to the rising share of U.S. direct investment abroad that is

conducted through holding companies. Affiliates classified as holding companies accounted for more than a third of the U.S. outward investment stock in 2004, a large rise from their 9 percent share in 1982 (Koncz and Yorgason, 2006, p. 24). The holding company share fell to 30 percent in 2005 as a result of large earnings repatriations induced by the American Jobs Creation Act of 2004, but the decline was almost certainly temporary. That means that the location of production associated with about a third of the total U.S. outward stock is unknown in these data. Not only the location, but the industry composition of that third is also unknown, except in the nominal sense that it passed through holding companies. For several important host countries, more than half of the U.S. outward investment stock was in holding companies in 2004. These include Luxembourg, Netherlands, Sweden, and Switzerland, within Europe, and Argentina and United Kingdom Islands in the Caribbean, in the Western Hemisphere (U.S. Bureau of Economic Analysis, 2005, p. 161).

The rise in the role of holding companies means that much of the flow of resources that the data are supposed to represent is concealed, with respect to the geographical destination and the industry of use. Even if that ambiguity were removed, it would still be unclear as to how well the flows of direct investment reflect any additions to or subtractions from the resources that the host country has for its use. Particularly when the flows are between parent firms and their wholly-owned affiliates, they may be simply a rearrangement of intangible or financial assets for tax purposes, without any change in their function or control or in the location of the firms' production. To the extent that intangible or financial assets do not have any tangible physical location, it is not obvious what is learned about flows of capital by observing changes in their nominal or legal location.

One test of the data on stocks of direct investment is how well they approximate the country, or industry, or country by industry distribution of production from direct investment enterprises. Unfortunately, there is no measure of production that is completely immune to manipulation for tax purposes. However, employment and fixed assets are major inputs into production that are relatively observable and therefore less subject to manipulation than intangible or financial assets.

If the location of stocks of investment represented the location of production well, the geographical distribution of employment should match that of investment reasonably well, except to the extent that capital intensities in production differ across countries. Fixed assets are a smaller input into production in most industries, but are also an unlikely candidate for manipulation.

An earlier study of data for United States outward FDI, based on 1989 stocks and employment, found that the country distribution of U.S. outward stocks was fairly well correlated with that of employment, with a simple correlation coefficient of .88, implying that the investment stock explained about 80 percent of the distribution of employment. The degree of explanation was better in manufacturing than in other industries, for which only about two thirds of the distribution was explained by the stock. The country distribution of changes in the investment stock, on the other hand, explained much less of the change in the employment distribution between 1966 and 1989, 16 percent for manufacturing and only 10 percent in other industries.

For the country distribution of foreign-owned production and factor inputs in the United States, the story was similar. The inward investment stock provides a reasonably good approximation for the distribution of foreign-owned production and inputs by source country in

1990, better in manufacturing than in other industries. However, it provides a poor approximation to changes from 1980 to 1990 in the source-country distribution of production and inputs (UNCTAD, 2001, Appendix D).

As mentioned above, the Bureau of Economic Analysis has recently emphasized the growing importance of holding companies in U.S. direct investment abroad, a trend that might be expected to reduce the connection between investment stock measures and production or factor input. No benchmark survey results have yet been published since those for 1999, so we may have missed recent developments, but the relation between investment stocks and inputs in 1994 and 1999 and changes from 1994 to 1999 were as shown in Table 1.

Table 1: Relation of Country Distribution of U.S. Affiliate Employment and Net Property, Plant, and Equipment to that of U.S. Outward FDI Stock, Adjusted RSQs for 1994 and 1999

	1994	1999	1999/1994	1999 - 1994
Employment (All Industries) ¹	0.7243	0.6991		
Employment (Nonbank)	0.7714	0.6450	0.0006	0.0523
PPE (Nonbank)	0.8558	0.8108	0.3134	0.1062
Employment & PPE (Nonbank) ²	0.8098	0.7234	0.0989	0.1119

Note:

1. Data for 1994 and 1999 are not compatible for All Industries.

2. A combination of two inputs, weighting labor input by two and capital input by one.

Source: BEA (1998) and (2004)

The cross-country relationships of investment positions to factor inputs were all weaker in 1999 than in 1994. The changes in the country distribution of the outward investment stock explained less than a third of relative changes in property, plant, and equipment (PP&E), and only 10 percent of absolute changes, virtually none of the changes in employment, and less than 10-12 percent of changes in a combination of employment and fixed capital that roughly represents production from factors unambiguously located in each country.

We cannot examine changes in industry composition in the same way as changes in country distribution because of the shift in industry classification systems from the US SIC to NAICS in 1997. However, the relationship between the investment position and each input can be estimated for each year separately. The data for both 1994 and 1999 show that the industry distribution of the investment stock is completely unrelated to the distribution of nonbank employment, fixed capital, and a combination of the two inputs, as a proxy for production (Table 2). In no case is as much as 5 percent of the cross-industry variance explained.

Table 2: Relation of Industry Distributions of U.S. Nonbank Affiliate Employment and Net Property, Plant, and Equipment to that of U.S. Outward FDI Stock, Adjusted RSQs for 1994 and 1999

	1994	1999
Employment (Nonbank)	0.0131	0.0097
PPE (Nonbank)	0.0404	0.0267
Employment & PPE (Nonbank) ¹	0.0477	0.0234

Note:

1. A combination of two inputs, weighting labor input by two and capital input by one.

Source: BEA (1998) and (2004)

For 1999, we can ask how well the outward investment stock explains the country-by-industry distribution of employment and physical capital. About 60 percent of the variance in the country-by-industry distribution of US affiliates' employment and plant and equipment stocks is explained by the distribution of the investment stock. That is a smaller share than for the country distribution alone, but a much larger share than for the industry distribution alone.

In general, it appears that the U.S. outward investment stock in 1994 and 1999 was fairly well correlated across countries with the aggregate PP&E and aggregate employment of U.S. multinationals, but poorly correlated across industries. Changes in the stock of outward FDI were poorly correlated with changes in both employment and physical capital across countries.

On the inward side, the country distribution of the U.S. inward investment stock is closely correlated with the source country distribution of employment and PP&E., with adjusted RSQs of over 95 percent in 1997 and over 90 percent in 2002 (Table 3). That might mean that little foreign direct investment in the United States is made through intermediate countries.

Table 3: Relation of Country Distribution of U.S. Affiliate Employment and Gross Property, Plant, and Equipment to that of U.S. Inward FDI Stock, Adjusted RSQs for 1997 and 2002

	1997	2002	2002/1997	2002 - 1997
Employment (All Industries)	0.9872	0.9483	-0.0277	0.8887
PPE (All Industries)	0.9659	0.9146	0.0435	0.3697
Employment & PPE (All Industries) ¹	0.9945	0.9734	-0.0143	0.7712
Employment (Nonbank)	0.9797	0.9069	0.0502	0.4153
PPE (Nonbank)	0.9598	0.9149	0.6282	0.4597
Employment & PPE (Nonbank) ¹	0.9903	0.9237	0.4572	0.6585

Note:

1. A combination of two inputs, weighting labor input by two and capital input by one.
2. The employment and PPE of All Industries in 2002 are for majority-owned affiliates.

Source: BEA website

For all industries combined, the country distribution of changes in FDI stocks was useless for explaining relative changes in the distribution of employment and fixed assets, but much better as a guide to absolute changes. When the comparison is confined to nonbank industries, the changes in inward investment stocks are more closely related to relative changes in at least fixed capital inputs. They provide a mediocre approximation to each of the two factor input measures, but a better one to the combination of the two.

The relation of the industry distribution of the U.S. inward investment stock to the industry distribution of foreign-owned firms' employment and physical capital stock in the United States is much weaker (Table 4). The industry distribution of the inward stock explained only about a quarter of the distribution of PP&E and less than 10 percent of the distribution of employment in 1997, and much less of both inputs in 2002. The industry distribution of changes

in the investment stock did a little better, explaining more than half of the percentage changes in the fixed capital stock of affiliates and more than a quarter of changes in employment. The degree of explanation of absolute changes in employment and physical capital stock was considerably smaller.

Table 4: Relation of Industry Distribution of U.S. Nonbank Affiliate Employment and Gross Property, Plant, and Equipment to that of U.S. Inward FDI Stock, Adjusted RSQs for 1997 and 2002

	1997	2002	2002/1997	2002 - 1997
Employment (All Industries)	0.0650	0.0344	0.2884	0.0439
PPE (All Industries)	0.2635	0.0886	0.5125	0.1493
Employment & PPE (All Industries) ¹	0.2133	0.0580	0.3678	0.1111
Employment (Nonbank)	0.0692	-0.0023	0.3391	0.0863
PPE (Nonbank)	0.3098	0.1693	0.5426	0.3067
Employment & PPE (Nonbank) ¹	0.2375	0.0328	0.3896	0.1892

Note:

1. A combination of two inputs, weighting labor input by two and capital input by one.
2. The employment and PPE of All Industries in 2002 are for majority-owned affiliates.

Source: BEA website

It would be desirable to perform similar calculations for other countries' distributions of FDI production or input against country and industry distributions of FDI stocks, but the data are very thin and often not comparable in coverage. The most complete data are those for Germany, published regularly in Deutsche Bundesbank (2006) and earlier issues, which go back to 1989. Table 5 shows the relationships for 1995 and 2004, and for the change between those dates. We do not show the calculations for the earlier period because many of the countries that later became important destinations for German FDI were closed to it in the early period.

Table 5: Relation of Country Distribution of German Affiliate Employment to That of German Outward FDI Stock, Adjusted RSQ For 1995 and 2004

	1995	2004	2004/1995	2004 - 1995
Employment	0.8301	0.7741	0.6027	0.0008

Source: Deutsche Bundesbank website.

As is true for the United States, the country distribution of the outward FDI stock is a fairly good representation of the distribution of employment in both years, with some decline in the accuracy of the representation. The relative change in country investment levels explained about 60 percent of relative changes in employment, but the absolute growth in investment in a country explained none of the absolute increase in employment.

The industry distribution of German outward FDI is a poorer representation of the industry distribution of employment than was the case for the country distribution, and the correlation between the two measures deteriorated substantially from 1995 to 2004 (Table 6). The change in investment in relative terms did reflect most of the relative change in employment, but the change in absolute terms did not.

Table 6: Relation of Industry Distribution of German Affiliate Employment to That of German Outward FDI Stock, Adjusted RSQ For 1995 and 2004

	1995	2004	2004/1995	2004 - 1995
Employment	0.4231	0.1241	0.5977	0.1751

Source: Deutsche Bundesbank website.

For inward FDI in Germany, the distribution of employment among countries of origin was extremely well measured by the country-of-origin distribution of investment stocks in both 1995 and 2004, with the RSQs over .90 in both years and only a slight decline in the RSQ between the two years (Table 7). The distribution of employment change in relative or percentage terms was less well predicted by the investment changes; less than half of the distribution of absolute employment changes was explained by investment stock changes. The distribution across industries of employment in foreign-owned firms was poorly explained by the industry distribution of the inward investment stock, especially in 2004 (Table 8). Neither absolute nor relative changes in the distribution of employment were well correlated with the changes in the industry distribution of investment.

Table 7: Relation of Country Distribution of German Affiliate Employment to That of German Inward FDI Stock, Adjusted RSQ For 1995 and 2004

	1995	2004	2004/1995	2004 - 1995
Employment	0.9684	0.9210	0.4126	0.7108

Source: Deutsche Bundesbank website.

Table 8: Relation of Industry Distribution of German Affiliate Employment to That of German Inward FDI Stock, Adjusted RSQ For 1995 and 2004

	1995	2004	2004/1995	2004 - 1995
Employment	0.4522	0.1475	0.0648	0.0547

Source: Deutsche Bundesbank website.

A comparison for inward FDI in France, based on data in OECD (2001) and (2004), shows that the country distribution of the inward investment stock explains about 85 percent of the country distribution of employment in 1998. However, the industry distribution of the investment stock explained less than 30 percent of a very aggregated industry distribution of employment.

On the whole, it appears that while the country distribution of outward and inward FDI stocks roughly approximates those of inputs into outward and inward FDI production, the industry distribution does not. And changes in the country and industry distributions of outward and inward FDI stocks explain little of changes in the country or industry distributions of production of affiliates abroad or foreign affiliates in a host country, and are therefore unreliable guides to such changes.

Tax Havens and the Measurement of FDI Production

The European Union has held some discussions about the possibility of introducing a standard way of allocating corporate tax bases among countries for companies that operate in more than one country. The motivation for the proposals is, of course, taxation rather than measurement, but the issues that arise for taxation involve some of the same questions about the

location of multinational firm activity. They involve the difference between measures of the actual location of production and the location shown by company accounts, tax returns, and reports on the location of FDI. A recent study of German firms (Fuest, Hemmelgarn, and Ramb, 2006), using the Deutsche Bundesbank’s data on foreign direct investment and matched data for the domestic operations of German firms, calculated the effects of imposing a system of formula apportionment of profits across countries in place of the reported country location of profits. The study concluded that under such a uniform system, “...countries with special tax incentives for MNCs ...would lose tax basebecause, under the current S.A. (separate accounting) system, these countries attract a share of the EU wide tax base which is higher than their share in real economic activity...” Some examples of the change in each country’s share of the EU tax base under formula allocation are shown in Table 9.

Table 9

Share (%) of EU Tax Base under Separate Accounting
and under Formula Apportionment

	SA	FA
Germany	57.52	61.40
Great Britain	4.29	5.07
Ireland	.66	.42
Luxembourg	.68	.53
Netherlands	10.76	3.52
Sweden	2.35	1.29

SA = Separate Accounting
FA = Formula Apportionment

Source: Fuest, Hemmelgarn, and Ramb (2006), Table 4.

Under the formula apportionment described in the paper, countries that had attracted FDI stocks, but not FDI production, by favorable tax treatment would lose large parts of their shares of EU-15 profits. Ireland would lose almost 40 percent, Netherlands, two thirds, and Sweden, 45 percent. High tax countries would gain share, 7 percent for Germany, and almost 20 percent for Great Britain.

Although the type of formula apportionment proposed does not undo, or compensate for, all the effects of tax avoidance maneuvers, it does reveal that because German firms allocate their profits to minimize their tax bills, their accounts do not give a realistic picture of the location of their production. Since company accounts are the ultimate basis for FDI data, the misrepresentation of location in those accounts leads to a similar distortion of the estimates of the location of FDI activity and of aggregate production.

What in the accounts of multinational firms produces these large differences between the location of FDI represented by FDI stocks and flows and the location of FDI activity represented by employment and capital assets in FDI affiliates? The main factor appears to be that firms operating internationally shift assets and sales nominally to low-tax countries to minimize taxes. I refer to these shifts as nominal because they are bookkeeping transactions that have no counterpart in movements of production.

The nature of these transactions is obscured in most countries' accounts because they are mixed in with more genuine movements of real resources, and hard to distinguish from them. However, certain small tax havens have so little real productive activity taking place within their borders that the tax-avoiding transactions can be observed clearly. These small tax havens may not account for most of the world's tax avoidance activity, but they can reveal the way in which

it takes place and the kind of effect it has on the measurement of the location of multinational firms' production.

There has been a substantial literature on the operations of tax havens, mostly involving their impact on home country tax revenue rather than their impact on the measurement of the location of production. Hines (2005) reviews some of this literature on the effect of low tax rates in attracting inward FDI, some of which involves production, but much of which involves only the shifting of income to reduce tax bills. The 30 tax havens he lists accounted in 1999 for 0.7 percent of the world's population, and 2.1 percent of world GDP, but for 4.8 percent of the net property, plant, and equipment and 3.7 percent of the employment of US firms' foreign affiliates. The shares of fixed capital and employment probably represent the effect of low tax rates in attracting FDI production, and are not of concern with respect to the measurement of the location of production. However, these same foreign affiliates accounted for 15.7 percent of the gross foreign assets of US affiliates, 13.4 percent of sales, and "...a staggering 30 percent of total foreign income..." (*ibid.*, p. 78). "Much of the tax haven income consists of financial flows from other foreign affiliates that parents own indirectly through their tax haven affiliates. Clearly, American firms locate considerable financial assets in foreign tax havens, and their reported profitability in tax havens greatly exceeds any measure of their physical presence there" (*ibid.*). Desai, Foley, and Hines (2003) explain this contrast as "...the ability of multinational firms to adjust the reported location of their taxable profits" (p. 68), but the result is also a change in the reported location of production.

The ability of firms to shift the reported location of financial and intangible assets, sales, and profits by paper transactions internal to the firm makes the location of the firm's production ambiguous. That is particularly the case in banking and other financial services where the

product is intangible, but the problem exists in other industries where the product is tangible, but has an intangible element, such as a patent or a trademark that can be assigned by the firm to a low-tax location, or where part of the revenue consists of profits earned from financial holdings of the same firm's affiliates in other countries.

An example of the shifting of intangible assets that was reported in the press, that cannot be verified from published data, but illustrates the possibilities, was the reported allocation of intellectual property by Microsoft to an Irish subsidiary. According to the press report, the subsidiary collected licensing fees from Microsoft sales to many other countries (“Microsoft Slashes Taxes With Aid From Irish Unit,” Wall Street Journal, November 7, 2005, p. 1). The subsidiary had “...a thin roster of employees...” and the software had mostly been developed outside Ireland, but the subsidiary “...controls more than \$16 billion in Microsoft assets” (*ibid.*).

Whatever the precise mechanism, the move seemed to be a success. The subsidiary, with few employees and little in the way of facilities, reported over 3 billion Euros in pretax profits for fiscal 2004. Another U.S. company's affiliate, with only one employee, reported earnings of 475 million Euros (“Microsoft Unit is No. 1 Earner In Ireland,” Wall Street Journal, December 20, 2005). In 2006, the Microsoft subsidiary was reported to have applied to reorganize in such a way as to avoid the necessity for filing “...detailed public statements of their accounts” (“Microsoft Reorganizes Irish Units to Reduce Disclosure of Assets,” Wall Street Journal, March 11-12, 2006).

The shifting of intangible assets need not be confined to software. One news article referred to “...patents on drugs, ownership of corporate logos, techniques for manufacturing processes, and other intellectual assets...” and quoted a tax lawyer as calling such moves routine “...international tax planning 101.” He added that “... most of the assets that are going to be

relocated as part of a global repositioning are intellectual assets... that is where most of the profit is. When you buy a pair of sneakers for \$250, it's the swoosh symbol, not the rubber, you pay for." ("Key Company Assets Moving Offshore," New York Times, Nov. 22, 2002).

The allocation of assets within US multinationals is illustrated by Table 10, showing the ratios of total assets to measures of labor input, employment and payroll, of US-owned affiliates in the world as a whole outside the United States, and in certain countries, particularly some of those known as tax havens. Affiliates in "Other Western Hemisphere," essentially islands in the Caribbean, own enormous assets relative to their labor input, measured by employment or labor compensation. The average assets per employee in US affiliates around the world in 2004 was \$873,000 but the ratios in Ireland, Netherlands, and Switzerland were all over \$3.3 million. Assets per employee in affiliates in "Other Western Hemisphere" were almost \$12 million, higher in some of the individual countries in that group, such as Bermuda (almost \$73 million) and UK Islands in the Caribbean (over \$30 million).

Differences in assets per employee could represent simply differences in industry composition, because some industries, especially financial institutions, are particularly capital intensive, whatever their ownership or their geographical location. In the data on US affiliates abroad, it is possible to check whether the same wide geographical differences in assets per employee exist within the financial sector.

In the case of Depository Institutions, the world average assets per employee in US affiliates in 1999 were a little over \$10 million, while affiliates in "Other Western Hemisphere" owned assets per employee of \$117 million, more than ten times the world average (Table 11).

Table 10: Ratios of Total Assets to Employment & Compensation of Employees: Nonbank Foreign Affiliates of US Nonbank Parents, 1999 & 2004

	Ratio of Total Assets ³ to Employment ³		Ratio of Total Assets ³ to Compensation of Employees	
	1999	2004	1999	2004
All countries	502	873	16	24
Canada	345	581	11	15
Europe	671	1,253	16	24
Ireland	1,060	3,315	32	63
Netherlands	1,644	3,355	35	58
Switzerland	2,098	3,919	29	52
United Kingdom	1,032	1,524	23	29
Latin America and Other Western Hemisphere	366	624	23	39
Central & South America	220	211	14	14
Other Western Hemisphere	4,914	11,787	176	433
Bermuda	15,950~31,901	72,772	(D)	1,296
UK Islands, Caribbean ¹	12,130	30,512	210	533
Other, Western Hemisphere ²	1,496~3,739	(D)	(D)	(D)
Middle East	582	836	14	21
Asia Pacific	418	568	15	19
China	103	140	15	15
Hong Kong	769	1,247	20	42
Singapore	638	1,120	21	36

Note:

1. "United Kingdom Islands, Caribbean" comprises of British Antilles, British Virgin Islands, Cayman Islands, Montserrat.
 2. "Other, Western Hemisphere" refers to Anguilla, Antigua and Barbuda, Aruba, Bahamas, Cuba, Dominica, French Islands (Caribbean), Grenada, Haiti, Jamaica, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, United Kingdom Islands (Atlantic).
 3. Thousands of dollars per employee.
- (D): refers to the suppression of data.

Source: US Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov

Table 11: Ratios of Total Assets to Employment & Compensation of Employees: US Affiliates in Depository Institutions, 1999

	Ratios of Total Assets ³ to	
	Employment ³	Compensation of Employees
All countries	10,245	168
Canada	2,744	106
Europe	11,766	147
Ireland	3,570~8,922	(D)
Netherlands	(D)	(D)
Switzerland	6,970	55
United Kingdom	20,080	195
Latin America and Other Western Hemisphere	12,013	264
Central & South America	2,394	53
Other Western Hemisphere	117,367	2,347
Bermuda	0	0
UK Islands, Caribbean ¹	153,283	1,703
Other, Western Hemisphere ²	(D)	(D)
Middle East	16,593	215
Other Middle East ⁴	(D)	(D)
Asia Pacific	7,434	155
China	8,653	288
Hong Kong	6,402	130
Singapore	15,921	195

Note:

1. "United Kingdom Islands, Caribbean" comprises of British Antilles, British Virgin Islands, Cayman Islands, Montserrat.
2. "Other, Western Hemisphere" refers to Anguilla, Antigua and Barbuda, Aruba, Bahamas, Cuba, Dominica, French Islands (Caribbean), Grenada, Haiti, Jamaica, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, United Kingdom Islands (Atlantic).
3. Thousands of dollars per employee.
4. "Other Middle East" refers to Bahrain, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Syria and Yemen.
(D): refers to the suppression of data.

Source: US Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov

For affiliates in Finance (except depository institutions), and Insurance, world average assets per employee of affiliates in 2004 were about \$11 million, but they were twice to three times the world average in Netherlands and Switzerland (Table 12). In Bermuda and UK Islands in the Caribbean, affiliate assets per worker were almost four to ten times the world average in 1999, and in 2004, affiliates in Bermuda had assets per worker 15 times the average. Thus, the allocation of assets to tax havens is not simply a consequence of the composition of concentration of investment in the finance sector, but takes place within that sector as well.

The point of these calculations is not that labor and tangible capital are the only inputs that produce the output of these affiliates. The output may be produced mostly by intangible or financial assets, but the geographical location of these assets, and therefore of the production, is ambiguous. Do we wish to say that the location of output has changed because, for example, firms have chosen to place their holdings of their affiliates' stock in their Irish subsidiaries? Do we wish to say that the location of output has changed because firms have chosen to place ownership of their patents or corporate logos, which they use all around the world, in Ireland or in some Caribbean Island?

What kinds of assets were involved in these shifts to low tax countries? They were not property, plant and equipment, as can be seen in Table 13. Worldwide, US affiliates' total assets were about ten times PP&E in 2004, but they were twenty to forty-five times as large as PP&E in Ireland, Netherlands, and Switzerland, and 50 times as large in Other Western Hemisphere. Most of the affiliate assets, especially in the low-tax countries, are intangible or financial assets. Since it is hard to define the location of these assets, one could say that only statistical convention places the output from them in these affiliates' host countries.

Table 12: Ratios of Total Assets to Employment & Compensation of Employees: US Affiliates in Finance (except Depository Institutions) and Insurance, 1999 & 2004

	Ratio of Total Assets ³ to Employment ³		Ratio of Total Assets ³ to Compensation of Employees	
	1999	2004	1999	2004
All countries	6,637	11,260	97	128
Canada	(D)	(D)	(D)	(D)
Europe	11,131	17,166	121	130
Ireland	15,089	(D)	268	(D)
Netherlands	(D)	25,809	(D)	352
Switzerland	22,222	33,864	175	302
United Kingdom	13,608	19,877	121	116
Latin America and Other Western Hemisphere	5,015	12,230	137	418
Central & South America	1,488	(D)	50	(D)
Other Western Hemisphere	(D)	(D)	378	(D)
Bermuda	27,725	178,319	398	1,608
UK Islands, Caribbean ¹	63,540	(D)	304	(D)
Other, Western Hemisphere ²	(D)	46,973	(D)	2,349
Middle East	(D)	(D)	(D)	(D)
Asia Pacific	3,334	5,810-11,619	51	(D)
China	489-978	(D)	(D)	(D)
Hong Kong	4,342	13,521	30	92
Singapore	(D)	6,293	(D)	67

Note:

1. "United Kingdom Islands, Caribbean" comprises of British Antilles, British Virgin Islands, Cayman Islands, Montserrat.
 2. "Other, Western Hemisphere" refers to Anguilla, Antigua and Barbuda, Aruba, Bahamas, Cuba, Dominica, French Islands (Caribbean), Grenada, Haiti, Jamaica, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, United Kingdom Islands (Atlantic).
 3. Thousands of dollars per employee.
- (D): refers to the suppression of data.

Source: US Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov

Table 13: Ratio of Total Assets to Net Property, Plant and Equipment of Majority-owned Nonbank Affiliates of Nonbank US Parents, 1999 & 2004

	1999	2004
All countries	7	10
Canada	4	5
Europe	9	14
Ireland	11	21
Netherlands	18	34
Switzerland	31	45
United Kingdom	10	15
Latin America and Other Western Hemisphere	6	11
Central & South America	4	4
Other Western Hemisphere	22	50
Bermuda	38	94
UK Islands, Caribbean ¹	37	75
Other, Western Hemisphere ²	6	14
Middle East	4	5
Asia Pacific	5	8
China	3	4
Hong Kong	8	27
Singapore	7	13

Note:

1. "United Kingdom Islands, Caribbean" comprises of British Antilles, British Virgin Islands, Cayman Islands, Montserrat.
 2. "Other, Western Hemisphere" refers to Anguilla, Antigua and Barbuda, Aruba, Bahamas, Cuba, Dominica, French Islands (Caribbean), Grenada, Haiti, Jamaica, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, United Kingdom Islands (Atlantic).
- (D): refers to the suppression of data.

Source: US Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov

One outcome of the placement of assets is shown in Table 14, which displays the “profit-type return” of nonbank majority-owned affiliates in various countries relative to the compensation of employees in 1999 and 2004. The “profit –type return” is defined by the BEA as measuring “...profits before income taxes...” excluding “... nonoperating items (such as special charges and capital gains and losses) and income from equity, investments” (U.S. Bureau of Economic Analysis, 2004, p. M-19). The worldwide average in 2004 was .79, a little over three quarters of labor compensation, but for Ireland profit-type return was almost 5 times employee compensation. For countries in “Other Western Hemisphere” as a group, profit-type returns were 13 times employee compensation, and for some of the individual island countries, they were as high as 40 or 70 times employee compensation. In these countries, the affiliates managed to produce profits virtually without labor and without tangible capital, and all of these differences would probably be larger if income from equity were added.

Is this what we want to define and measure as the location of production?

“Residence” and the Location of Production

The keys to the disconnection between the location of multinationals’ production and the apparent location of investment in affiliates and the location of affiliate production are the concept of residence in the balance of payments and the extent to which intangible assets, with no clearly definable physical location, and financial assets, for which the location is a matter of bookkeeping, have become important inputs into production.

The problems with the definition of residence are old ones for the calculation of the balance of payments. The Review Committee for Balance of Payments Statistics (1965) suggested that “balance of payments data are peculiarly elusive” because “The basic criterion for a balance of payments transaction is that it is between a domestic and a foreign ‘resident’ ... The

Table 14: Ratio of Profit-type Return to Compensation of Employees by Majority-owned Nonbank Affiliates of US Nonbank Parents

	1999	2004
All countries	0.557	0.791
Canada	0.586	0.705
Europe	0.439	0.563
Ireland	3.964	4.854
Netherlands	0.793	0.890
Switzerland	0.867	1.758
United Kingdom	0.333	0.343
Latin America and Other Western Hemisphere	0.771	1.495
Central & South America	0.466	0.863
Other Western Hemisphere	6.161	13.129
Barbados	30.884	72.667
Bermuda	13.007	46.600
United Kingdom Islands, Caribbean ¹	4.249	9.060
Other, Western Hemisphere ²	1.655	4.630
Middle East	1.084	1.611
Other Middle East ³	5.887	8.180
Asia Pacific	0.755	1.127
China	0.670	1.583
Hong Kong	0.898	1.205
Singapore	1.420	2.065

Note:

1. "United Kingdom Islands, Caribbean" comprises of British Antilles, British Virgin Islands, Cayman Islands, Montserrat.
 2. "Other, Western Hemisphere" refers to Anguilla, Antigua and Barbuda, Aruba, Bahamas, Cuba, Dominica, French Islands (Caribbean), Grenada, Haiti, Jamaica, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, United Kingdom Islands (Atlantic).
 3. "Other Middle East" refers to Bahrain, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Syria and Yemen.
- (D): refers to the suppression of data.

Source: US Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov

application of this set of concepts to concrete situations may involve subtle distinctions, and it is often difficult to determine residence even when all the facts are known” (pp. 16-17).

The residence of an enterprise requires (IMF, 1993, p. 22) “...a significant amount of production of goods and/or services there...” or ownership of land or buildings. The location of production of some goods is fairly easily defined and observed, but the location of the production of services is not, if the services are produced by intangible assets. The same is true to some extent of goods, if both tangible and intangible assets are used in production. Whether the intangible assets are financial assets, including shares in related affiliates in other countries, or patents or corporate logos or production techniques, their location is decided by the owners, and can be attributed to an affiliate in any country the parent firm finds desirable. The output from that asset appears to come from residents of that country. If the firm finds it convenient, it can shift the nominal location of that production, affecting exports and imports and national product, without any change in the labor or physical inputs to that production. Production that has taken place in a home country for home country consumption can be made to appear to take place abroad and be imported into the home country, without any change in the location of any real inputs. (For an example, see “Behind Big Wall Street Failure: An Unregulated Bermuda Unit,” Wall Street Journal, July 3, 2006, p. A1. “Refco Capital Markets was incorporated in Bermuda...it employed no one at all at its headquarters address in Bermuda. New York-based employees ran the unit”).

This issue of where production takes place, or the “attribution of assets” has attracted attention mainly in the taxation literature. Recently, the OECD has undertaken various meetings and publications on ways to avoid “...double taxation and non-taxation situations.” (OECD, 2006, p. 2). The interest in “non-taxation” or “less than single taxation” (p. 10) is relatively new.

The issue was traditionally the avoidance of double taxation, which the OECD traces back to “League of Nations drafts of 1927,...”).

In its latest publication on the subject, the OECD authors begin their section on “Attribution of Assets” with the statement that “...it is necessary to hypothesize the PE (Permanent Establishment) as if it were a distinct and separate enterprise...The factual position is that no one part of an enterprise owns assets; they belong to the enterprise as a whole. It is therefore necessary under the first step of the authorized OECD approach to find a means of attributing economic ownership.” (p. 15). They reject the alternative that would “...allow taxpayers to simply nominate which part of the enterprise economically owns the assets” because it would “...provide an incentive for taxpayers to attribute economic ownership of taxes in ways that would lead to inappropriate allocations of profit...” They report a consensus that assets “...are to be attributed to the part of the enterprise which performs the significant people functions relevant to the determination of economic ownership of assets.”

Concluding Remarks

While the consequences of shifts of assets and profits for tax revenues have been the subject of considerable discussion (see, for example, OECD, 1993), the consequences for economic measurement are rarely mentioned. Some of the consequences for measurement of trade in services are discussed in Lipsey (2006). The effects extend to the measurement of trade in goods, because goods trade often incorporates returns to the intangible assets owned by producing multinational firms, and the intangible assets can, on paper, be moved freely. The effects extend also more broadly to the measurement of national product and, within countries, to measurements of regional output.

The ownership-based current account for the United States, explained in Landefeld, Whichard, and Lowe (1993), the latest version of which appears in US Bureau of Economic Analysis (2007), partly solves the problem for an alternative balance of payments measure by locating production according to the ownership of the productive resources or of the firm in which production takes place, rather than the geographical location of the resources. In this way, they net out the effects of transfers of assets and profits among units of the firm. However, these accounts are not intended as substitutes for the standard accounts but only as supplementary information. And being aimed at an ownership measure, rather than a measure of the geography of production, such as national product, they allocate some part of affiliate production to the country of the parent rather than the country in which the production takes place.

The measurement difficulty goes beyond the distortions from tax-avoiding strategies. The underlying problem is that as production comes to depend more and more on intangible, particularly intellectual, assets, the location of production loses much of its meaning, because these assets have no clear geographical location. They may be located within a firm, by ownership, but if the firm is multinational, that ownership has no definite geographical implication. The tangible inputs to production can be associated with geographical locations, but not the intangible inputs, except in some arbitrary fashion.

The same issue arises for measures of regional production within a country. Some of the approximations used in the last 80 years of regional estimates for the United States are briefly described in Lipsey (2006), but none of them seem very satisfactory.

For purposes where a geographical measure of production is desired, one possible alternative to accepting the firm's allocation of assets might be to attribute intangible and financial assets to the home, or main, location of a multinational firm (itself not always a clear

concept), or even to the location of its owners, rather than to the location chosen by the firm.

Another possibility, along the lines of the OECD's suggestion that assets should be attributed to the parts of the firm that perform the relevant "significant people functions," might be to allocate them by in proportion to payroll, as representing something like employment weighted by skill.

Such attributions would upset long traditions of both corporate and national accounting. In the meantime, changes in the nature of productive assets, in combination with tax planning, are eating away at the meaning of standard measures of the location of production.

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