

TRADE IN R&D-RELATED SERVICES: A NEW INDICATOR OF INDUSTRIAL KNOWLEDGE FLOWS

by Francisco Moris

The flow of knowledge through trade in services represents the convergence of two recent trends in U.S. industrial science and technology (S&T): an increase in R&D performance in the service sector and an increase in external and overseas innovation linkages. R&D-related data on affiliated trade in international services represent a new indicator of international industrial knowledge and technology flows. Other such indicators include high-technology goods trade, patent royalties and license fees, and foreign direct investment (NSB 2006a, 2006b).

International trade in research, development, and testing (RDT) services is contributing to the U.S. trade surplus in business services overall, according to data from the Bureau of Economic Analysis (BEA). Trade in RDT services can be separated into its component parts: affiliated (intracompany) and unaffiliated (cross-company) trade. Newly available data on affiliated trade show that since at least 2001, U.S. trade surpluses in RDT services have been driven more by U.S. affiliates of foreign multinational corporations (MNCs) and their relatively large exports of services than by parent companies of U.S. MNCs. This finding is consistent with the growing share these affiliates have in U.S. industrial R&D. In contrast, the unaffiliated trade surplus in RDT services has been down since 2001, due to the faster growth in imports than in exports of these services.

Trade Terminology and Definitions

U.S. MNC comprises a U.S. parent company and its foreign affiliates. An *affiliate* is a business that is located in one country but is owned or controlled by a

parent company located in another country. In this *InfoBrief*, the *parent company* of a U.S. MNC is a fully consolidated U.S. enterprise that owns or controls at least 10 percent of the voting securities, or equivalent, of a foreign business enterprise. A *foreign MNC* is a multinational corporation whose parent company is located outside the United States. By definition, MNCs are engaged in foreign direct investment: the ownership of productive assets outside the home country.

BEA services trade data presented here are published by type of service, not by industry of the respondent, and cover international transactions in private services, which exclude government transactions. The category *research, development, and testing services* (RDT) is a component of *business, professional, and technical services* (BPT). Examples of other categories within BPT are computer and information services and management and consulting services. BPT, in turn, is a major category of *private services*. Other categories within private services include financial services, travel services, telecommunications, and royalties and licensing fees.

An *international transaction* (cross-border trade) is a transaction between a U.S. resident and a foreign resident, regardless of ownership considerations. In international trade statistics, "residency" refers to both location and economic activity in a given country. Thus, affiliates of MNCs are regarded as residents of the countries where they are located rather than as residents of the countries of their owners. Separately, cross-border trade among entities within and outside of MNCs can be identified, allowing a profile of trade statistics for private services in terms of intracompany



or *affiliated* trade and cross-company or *unaffiliated* trade. Unaffiliated and affiliated trade data are available with different details: the former by country of trading partner; the latter by ownership.¹

Trade balance is defined as exports minus imports. Services exports are measured by receipts, or sales. Services imports are payments, or purchases. *Trade surplus* refers to a positive trade balance.

Trade Flows in Private, Business, and RDT Services

The United States has had annual trade surpluses in overall private services of at least \$60 billion since the early 1990s, including a surplus of \$65.9 billion in 2003, according to international transactions data from BEA (Borga and Mann 2004). BPT together with royalties and license fees accounted for most of the trade surplus within private services in 2003 (\$28.9 billion and \$28.1 billion, respectively). In terms of trade volume (exports plus imports), travel services constituted the largest sector.

Between 2001 and 2003, RDT services represented 6 to 7 percent of the trade surplus in overall private services and 14 to 17 percent of the surplus within BPT (figure 1).

Between 2001 and 2003, total exports (affiliated and unaffiliated) of RDT services fluctuated annually around \$7 billion, compared with total annual imports of RDT services of under \$3 billion, for trade surpluses up to \$4.8 billion within this period (table 1). Within BPT, RDT services had the third largest surplus in 2003.

Comparison of Affiliated and Unaffiliated Trade in RDT Services

International trade data in private services are available for two major categories of customers or suppliers: trade among unaffiliated companies and trade among affiliates of the same company. For private services overall, the unaffiliated portion of exports and imports

¹ BEA has collected data on international trade in unaffiliated RDT services since 1992. BEA data on affiliated RDT services trade became available in 2001. The definition of RDT services in unaffiliated and affiliated trade from BEA surveys is essentially the same (the definition within unaffiliated transactions contains additional information on exclusions/inclusions). See "Data Notes" for more information on data collection.

has been larger than the affiliated portion since at least 1992. The reverse has been true for BPT services and its subcomponent, RDT services—affiliated exports and imports have been larger than unaffiliated exports and imports—since data have been available (1997 and 2001, respectively) (table 1).

Annual unaffiliated exports in RDT services were slightly greater than imports in the period 2001 to 2003, resulting in small trade surpluses (table 1). Indeed, the unaffiliated trade surplus in RDT services has been relatively flat since the early 1990s and has been trending down since 2001, due to stronger growth in imports than in exports (figure 2). Further, when Japan is excluded from unaffiliated trade (the largest export destination for RDT services), small trade surpluses turn into small deficits in 2002 and 2003 (table 2).

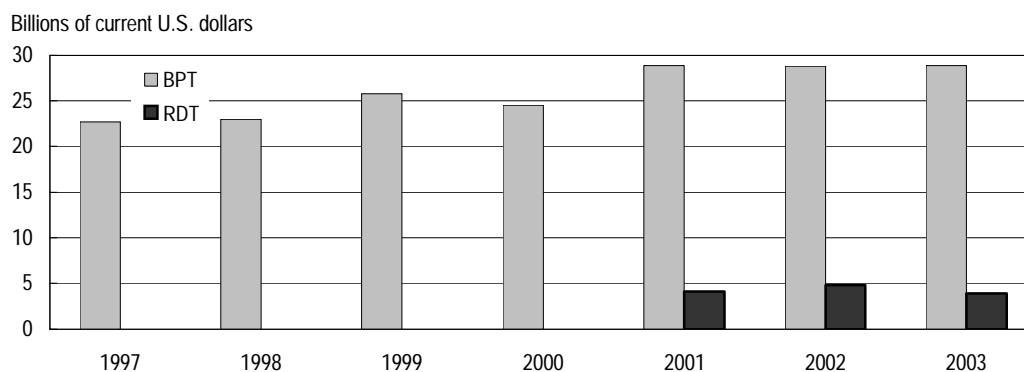
Affiliated trade in RDT services is larger than unaffiliated trade and has recorded relatively large trade surpluses: from 2001 to 2003 annual exports fluctuated around \$6 billion, whereas annual imports remained under \$2 billion, resulting in trade surpluses between \$4 and \$5 billion over this period (table 1).

Affiliated trade in business services, particularly R&D-related services, may reflect advantages of internally managing, exploiting, and protecting complex or strategic transactions involving proprietary technical information (Caves 1996, McEvily et al. 2004). The prominence of affiliated trade in advanced economies is tied to trends in foreign direct investment (FDI) (Markusen 2004). For the United States, the large size of affiliated relative to unaffiliated trade in RDT is consistent with stronger U.S. FDI activity (Mataloni 2005), which increases the number of potential affiliated trading partners. It is also consistent with expanded R&D by MNCs (NSB 2006b), increasing opportunities for intracompany knowledge flows.

Affiliated RDT Trade within U.S. and Foreign MNCs

Table 3 shows U.S. affiliated trade in RDT services in terms of the identity of the U.S.-located trading partner (parent company of U.S. MNC or U.S. affiliate of a foreign MNC) and the foreign trading partner (foreign affiliate of a U.S. parent or foreign parent of a U.S. affiliate), thus, making possible an examination of intra-MNC trade.

FIGURE 1. U.S. international trade balance in BPT and RDT services: 1997–2003



BPT = business, professional, and technical services.

RDT = research, development, and testing services, a component of BPT.

NOTE: Total RDT services not separately available prior to 2001 because affiliated trade data were not available.

SOURCE: Bureau of Economic Analysis, U.S. International Services, cross-border trade, table 1, <http://www.bea.gov/bea/di/1001serv/intlsvr.htm>. Data accessed August 2005.

TABLE 1. U.S. trade in research, development, and testing services: 2001–03

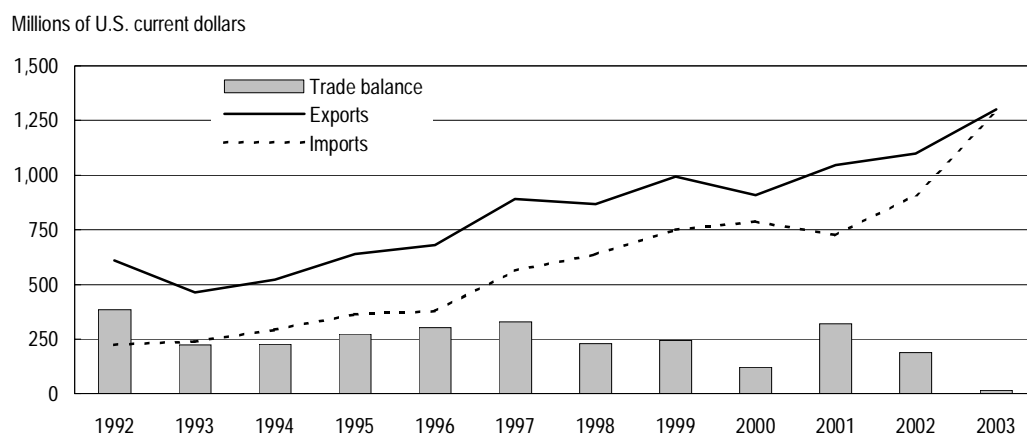
(Billions of current U.S. dollars)

Year	Exports			Imports			Trade balance		
	Total	Unaffiliated	Affiliated	Total	Unaffiliated	Affiliated	Total	Unaffiliated	Affiliated
2001	6.5	1.0	5.5	2.4	0.7	1.7	4.1	0.3	3.8
2002	7.2	1.1	6.1	2.4	0.9	1.5	4.8	0.2	4.6
2003	6.8	1.3	5.5	2.9	1.3	1.6	3.9	*	3.9

* = less than \$0.05 billion.

SOURCE: Bureau of Economic Analysis, U.S. International Services, cross-border trade, table 1, <http://www.bea.gov/bea/di/1001serv/intlsvr.htm>. Data accessed August 2005.

FIGURE 2. U.S. unaffiliated trade in research, development, and testing services: 1992–2003



SOURCE: Bureau of Economic Analysis, U.S. International Services, cross-border trade, table 1, <http://www.bea.gov/bea/di/1001serv/intlsvr.htm>. Data accessed August 2005.

TABLE 2. U.S. trade in research, development, and testing services: affiliated and unaffiliated trade, and unaffiliated trade by selected region/country: 2001–03

(Millions of current U.S. dollars)

Region/country	2001			2002			2003		
	Exports	Imports	Trade balance	Exports	Imports	Trade balance	Exports	Imports	Trade balance
Affiliated and unaffiliated trade	6,546	2,425	4,121	7,199	2,411	4,788	6,801	2,885	3,916
Affiliated	5,500	1,700	3,800	6,100	1,500	4,600	5,500	1,600	3,900
Unaffiliated	1,046	725	321	1,099	911	188	1,301	1,285	16
Region/country									
Canada	82	91	-9	93	118	-25	108	175	-67
Europe	461	419	42	560	555	5	702	788	-86
Belgium-Luxembourg	22	16	6	22	11	11	18	21	-3
France	59	30	29	61	38	23	55	43	12
Germany	102	42	60	115	84	31	158	130	28
Italy	9	6	3	9	14	-5	13	15	-2
Netherlands	14	10	4	15	19	-4	16	28	-12
Norway	4	3	1	3	3	0	4	9	-5
Spain	7	6	1	6	3	3	10	3	7
Sweden	15	14	1	15	19	-4	19	20	-1
Switzerland	79	42	37	127	40	87	137	59	78
United Kingdom	98	187	-89	139	254	-115	203	358	-155
Latin America and other Western Hemisphere	54	37	17	49	31	18	55	95	-40
Argentina	7	7	0	2	7	-5	4	17	-13
Bermuda	13	9	4	D	3	NA	12	3	9
Brazil	7	6	1	11	6	5	6	32	-26
Chile	1	2	-1	1	1	0	1	3	-2
Mexico	13	3	10	10	5	5	18	22	-4
Venezuela	4	1	3	4	*	NA	3	1	2
Africa	60	60	0	29	49	-20	21	59	-38
South Africa	42	32	10	9	15	-6	11	9	2
Middle East	44	28	16	38	8	30	48	14	34
Israel	12	23	-11	11	7	4	15	11	4
Saudi Arabia	19	4	15	13	*	NA	14	*	NA
Asia and Pacific	338	91	247	323	150	173	359	154	205
Australia	19	11	8	17	12	5	16	21	-5
China	12	9	3	13	5	8	10	4	6
Hong Kong	3	1	2	3	4	-1	3	3	0
India	8	16	-8	4	14	-10	9	24	-15
Indonesia	5	3	2	5	5	0	4	9	-5
Japan	235	22	213	240	20	220	273	32	241
Korea, Republic of	27	3	24	15	3	12	20	3	17
Malaysia	2	*	NA	1	1	0	2	1	1
New Zealand	1	*	NA	1	*	NA	1	7	-6
Philippines	2	1	1	2	1	1	2	1	1
Singapore	5	14	-9	4	D	NA	4	17	-13
Taiwan	12	4	8	9	13	-4	7	15	-8
Thailand	4	2	2	6	3	3	7	5	2
Selected groupings									
Unaffiliated, excluding Japan	811	703	108	859	891	-32	1028	1253	-225
Asia and Pacific, excluding Japan	103	69	34	83	130	-47	86	122	-36
European Union	358	333	25	410	472	-62	531	677	-146
Eastern Europe	18	34	-16	15	36	-21	18	41	-23

*Less than \$500,000.

D = suppressed to avoid disclosure of data of individual companies.

NA = not available.

NOTE: Total for unaffiliated data includes international organizations and unallocated data not shown separately.

SOURCE: Bureau of Economic Analysis, U.S. International Services, cross-border trade, tables 7.16–7.18, <http://www.bea.gov/bea/di/1001serv/intlserv.htm>.

Data accessed August 2005.

From 2001 to 2003, annual exports of RDT services from U.S. parents to their foreign affiliates fluctuated narrowly around \$2.1 billion, compared with up to \$1 billion in annual imports from their foreign affiliates, resulting in trade surpluses within U.S. MNCs of \$1.2 to \$1.6 billion over this period (table 3). Over the same period, RDT services exports by affiliates of foreign MNCs in the United States to their foreign parents (and other foreign members of the company) were larger—\$3 to \$4 billion annually—with annual imports up to \$1.1 billion, resulting in trade surpluses within foreign MNCs between \$2.2 and \$3.2 billion (table 3). In short, these estimates show that in recent years U.S. trade surpluses in research, development, and testing services within U.S. MNCs have been smaller than within foreign MNCs with activities in the United States.

Affiliated RDT Trade and U.S. Industrial R&D

Comparisons between R&D-related trade and R&D expenditures data should be treated with caution because RDT services and R&D expenditures are related but distinct concepts. One difference between R&D expenditures as collected by NSF and RDT services trade data as collected by BEA is that trade data include testing services beyond R&D-based testing activities (which are limited to nonroutine and preproduction activities).² Nevertheless, R&D performance is a precursor for many R&D-related services exports. Thus, relative R&D performance levels across MNCs or across countries may contribute to trade balances in R&D-related services.

The discussion above of affiliated trade suggests that the U.S. trade surplus in RDT services is fueled by relatively large exports by U.S. affiliates of foreign MNCs. Their share in U.S. R&D has been rising (NSB 2006b), although they still perform less than 15 percent of U.S. industrial R&D. However, a substantial portion of affiliates' RDT activities appears to be services for their foreign parents (and other foreign members of the company). In particular, RDT services exports of \$3.4 billion from U.S. affiliates of foreign MNCs to their foreign parents in 2003 was the equivalent of 11.4 percent of the \$29.5 billion in R&D expenditures

² In addition, data on R&D services traded in the open market reflect operating surplus, unlike most measures of R&D expenditures.

performed by these affiliates, according to NSF and BEA data.³

Compared with U.S. affiliates of foreign MNCs, parents of U.S. MNCs performed a larger proportion of U.S. industrial R&D—69 percent, or \$140.1 billion of \$204.0 billion in total U.S. industrial R&D in 2003—according to data from the NSF survey of industrial R&D and BEA data (Mataloni 2005). However, U.S. parents' \$2.2 billion in RDT services exports to all their overseas affiliates was just 1.5 percent of their R&D expenditures.

Data Notes

BEA collects data on affiliated and unaffiliated trade from different surveys, and then integrates them into the U.S. international transactions account and the U.S. balance of payments.

Data on affiliated services trade are collected by BEA's quarterly balance of payments surveys on affiliates: Transaction of U.S. Affiliates, Except U.S. Banking Affiliates, with Foreign Parent (survey form BE-605) covers affiliates of foreign MNCs in the U.S.; Direct Transactions of U.S. Reporter with Foreign Affiliate (survey form BE-577) covers U.S. MNCs. In these affiliates' surveys, RDT services are defined as "Commercial and noncommercial research, product development services, and testing services." Affiliated trade data in RDT services, a component of business, professional, and technical services (BPT), have been available since 2001. BPT affiliated trade data have been available since 1997. Before then, these components were included in the overall trade figures but were not separately available.

Data on unaffiliated services trade in RDT services are collected by BEA's surveys on transactions with unaffiliated foreign persons or entities, along with other

³ U.S. industry R&D data are from the NSF Survey of Industrial R&D. BEA data (Zeile 2005) are for majority-owned affiliates of foreign MNCs (a majority-owned affiliate is owned or controlled by more than 50 percent of the voting securities [or equivalent] by its parent company); R&D by all affiliates is not available for 2003. Because R&D by all affiliates is by definition a larger amount, the desired comparison would be lower than the 11.4 percent reported in the text. R&D by majority-owned affiliates of foreign MNCs represented an increasing share of R&D by all affiliates of foreign MNCs reaching about 90 percent in the late 1990s. Applying the later ratio to the 2003 data, the ratio reported in the text would be lower by one percentage point.

TABLE 3. U.S. affiliated trade in research, development, and testing services disaggregated by U.S. and foreign MNCs: 2001–03

(Billions of current U.S. dollars)

Year	U.S. affiliated trade			Within U.S. MNCs			Within foreign MNCs				
	Exports	Imports	Trade balance	Exports		Imports	Trade balance	Exports		Imports	Trade balance
				From U.S. parents to foreign affiliates	From foreign affiliates to U.S. parents			From U.S. affiliates to foreign parents ^a	From foreign parents to U.S. affiliates ^a		
2001	5.5	1.7	3.8	2.2	0.6	1.6	3.3	1.1	2.2		
2002	6.1	1.5	4.6	2.1	0.7	1.4	4.0	0.8	3.2		
2003	5.5	1.6	3.9	2.2	1.0	1.2	3.4	0.6	2.8		

MNC = multinational corporation.

^a Data include transactions with other foreign members of the MNC.

NOTE: Detail may not add to total because of rounding.

SOURCE: Bureau of Economic Analysis, U.S. International Services, cross-border trade, table E, 1997–2004, <http://www.bea.gov/bea/di/1001serv/intlserv.htm>. Data accessed August 2005.

business, professional, and technical services (BEA 1998). These surveys are the Benchmark Survey of Selected Services Transactions With Unaffiliated Foreign Persons (survey form BE-20), conducted every 5 years (the last was performed in 2001), and the Quarterly Survey of Transactions Between U.S. and Unaffiliated Foreign Persons in Selected Services and in Intangible Assets (survey form BE-25) for non-benchmark years. These surveys for unaffiliated transactions define RDT services as “Commercial and noncommercial research, product development services, and testing services. Includes fees for the conduct of experiments or performance of research and development activities aboard spacecrafts. Excludes medical and dental laboratory services.”

Services sold to, or purchased from, unaffiliated foreign persons are reported regardless of whether the services were performed in the United States or abroad. Data are consolidated by enterprise for all U.S. reporters. “United States” means the 50 U.S. states, the District of Columbia, the Commonwealth of Puerto Rico, and all territories and possessions of the United States (BEA 1990).

Full historical tables on international transactions in private services are available at <http://www.bea.gov/bea/di/1001serv/intlserv.htm>.

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