Research and Development Data Link Project
Final Report

A Project Conducted by the:
Census Bureau, Bureau of Economic Analysis, and
National Science Foundation/ Division of Science Resources Statistics

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Executive Summary

There is a need for better data on the domestic and international dimensions of U.S. research and development (R&D) activity. The trend towards globalization has made it difficult for government officials to formulate sound economic policy because existing data on overall U.S. R&D activity focus primarily on domestic activity. The need for comprehensive R&D data includes more detailed data on the international R&D activities of U.S. companies and data on the U.S. R&D activities of foreign companies. Such data could answer key questions such as:

- Are U.S. affiliates of foreign multinational companies engaging in significant R&D activities in the United States?
- Do U.S. companies curtail or increase their R&D activities after they become foreign-owned?
- Do the foreign affiliates of U.S. multinational companies conduct significant R&D overseas?

In recognition of this need, the Division of Science Resources Statistics (SRS) of the National Science Foundation (NSF) proposed and funded a feasibility study to determine whether an integrated data set on U.S. R&D performance and funding—including domestic and foreign ownership detail and related international R&D activities—could be created by linking U.S. Census Bureau data on the R&D activity of all U.S. companies with Bureau of Economic Analysis (BEA) data on the R&D activity of U.S. and foreign multinational companies.

To implement the project, the Census Bureau and BEA entered into an agreement, funded by the NSF/SRS, to match data from BEA's 1997 Benchmark Survey of Foreign Direct Investment in the United States and 1999 Benchmark Survey of U.S. Direct Investment Abroad with data from the Survey of Industrial Research and Development (SIRD), which the Census Bureau conducts as a joint project with the NSF/SRS. The project was the first data-sharing project in the U.S. Government undertaken under the Confidential Information Protection and Statistical Efficiency Act of 2002 (CIPSEA).

The project both demonstrated the feasibility of linking the Census Bureau and BEA survey data and resulted in a richer data set on the domestic and international dimensions of U.S. R&D activity. Among the new information generated by the project is data on the R&D activities of U.S. and foreign multinational companies, including data on R&D spending by character of work (basic research, applied research, development) and the location of U.S. R&D activity by state. The project also allowed for a higher degree of integration between data on the domestic dimensions of R&D and data on the international dimensions. Finally, the project has provided tangible benefits to both the Census Bureau and BEA through improvements in sample frames and in the quality of

reported data.

Based on these promising initial results, the Census Bureau, NSF/SRS, and BEA concur that future links of the SIRD and BEA data likely would produce significant benefits and agree that consideration should be given to conducting the linking exercise involving more current data.

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At the NSF, Francisco Moris, Analyst, provided analytical direction and input with assistance from Raymond Wolfe, Senior Analyst, both from the RDS program. Jeri Mulrow, Senior Statistician, Office of the Division Director, NSF/SRS, provided statistical input and review.

At the Census Bureau, Kimberly P. Moore, Assistant Chief for Special Studies and M3 Programs of the MCD, directed the Bureau's portion of the project and obtained administrative approvals. Julius Smith, Jr., Chief of the Special Studies Branch, supervised the review of the linked data and tabulations. Andrea A. MacCarthy, Survey Statistician, of the Special Studies Branch reviewed the linked data and tabulations. Paul L. Hsen, Assistant Chief for Research and Methodology, and Stacey J. Cole, Chief of the Manufacturing Programs Methodology Branch directed the methodology and programming support for the project. Cathy R. Gregor, Mathematical Statistician, of the Manufacturing Programs Methodology Branch provided the programming to link and tabulate the data.

At BEA, Ned G. Howenstine, Chief of the Research Branch of IID, directed the agency's portion of the project. Thomas W. Anderson, Economist, of the Research Branch, produced the tables created by BEA and provided statistical support.

Research and Development Data Link Project: Final Report

I. Background

In June 2002, the Division of Science Resources Statistics (SRS) of the National Science Foundation (NSF) approached the U.S. Census Bureau and the Bureau of Economic Analysis (BEA) and proposed a project to conduct a research study to determine the feasibility of an annual linking of data from the Census Bureau's Survey of Industrial Research and Development (SIRD) to BEA's annual and benchmark surveys of foreign direct investment in the United States (FDIUS) and United States direct investment abroad (USDIA). The Census Bureau conducts the SIRD under an interagency agreement with NSF/SRS.

The project was proposed with the expectation that the linked data would advance a better understanding of the international features of R&D activity in the United States and of U.S. R&D activity overseas. More specifically, linking the surveys would provide an integrated data set on U.S. R&D performance and funding with domestic and foreign ownership detail, and on related international R&D activities.

At a meeting of representatives from the three agencies, held at BEA in July 2002, benefits to all three agencies were identified from conducting the feasibility study. The NSF/SRS could receive tabular summaries from the integrated data set on U.S. R&D performance and would benefit from improvements in data quality. The Census Bureau could identify unmatched companies on the BEA files that conduct research and development activities and add them to the R&D survey to improve the survey's sample. BEA could augment its existing R&D-related data, identify data quality issues arising from reporting differences, and improve its survey sample frame.

The Census Bureau and BEA agreed that the study should be undertaken, with the Census Bureau taking the lead role in the matching operation and table preparation. The study would link records from the 1997 SIRD, which collects data on R&D performing companies in the United States and is the basis for estimates of total R&D activities of U.S. businesses, with records from BEA's 1997 benchmark survey of FDIUS, which obtains R&D and other data on the operations of U.S. affiliates of foreign multinational companies (MNCs). It would also link records from the 1999 SIRD with records from BEA's 1999 benchmark survey of USDIA, which obtains R&D and other data on the operations of U.S. MNCs (U.S. parent companies and their foreign affiliates).

It was determined that the Census Bureau and BEA would conduct research that would (1) determine the comparability of the data files including the definition of respondents and data items, (2) determine the quality of the resulting matches, and (3) project the

number and types of tables that could be supported by future links. The NSF/SRS would provide technical expertise in the development and analysis of the data.

The timing of the NSF/SRS proposal, fortuitously, coincided with the passage of the Confidential Information Protection and Statistical Efficiency Act (CIPSEA) of 2002. CIPSEA authorizes the sharing of business data among the Census Bureau, BEA, and the Bureau of Labor Statistics (BLS); however, it does not require data sharing among these agencies. As the first data sharing project conducted under CIPSEA, determining the administrative requirements to implement the project was a learning experience for all involved.

Although provisions of the Internal Revenue Code (Title 26) permit the Census Bureau to obtain selected Internal Revenue Service (IRS) data for statistical purposes, no Title 26 data were utilized in the linking operation or subsequent tabulations or reports for this study. Title 26 data were not contained in either the BEA or the Census Bureau data sets used for this project, as none are used as sampling frame data or otherwise obtained in the BEA surveys, and all original Federal Tax Information (FTI) were replaced by respondent data for the Census Bureau surveys being linked. No FTI, including information enabling the determination of fact of filing, was retained on any Census Bureau file used for this project. The Census Bureau informed the IRS of the project to alleviate any questions or concerns the IRS might have. The IRS concurred with language in the MOU that specified that Title 26 data would not be used in the project.

II. Conducting the Link

The study was conducted in three phases. In Phase I, BEA data for U.S. affiliates of foreign MNCs from the 1997 benchmark survey were linked to 1997 data from the SIRD. In Phase II, BEA data for the U.S. parent companies from the 1999 benchmark survey were linked to 1999 data from the SIRD. In Phase III, R&D data from BEA's 1999 benchmark survey were extracted for the majority-owned foreign affiliates of multi-unit U.S. parent companies that matched to the SIRD in Phase II.

Phase I consisted of several steps. The first step was a computer match of the BEA records for U.S. affiliates to records for the corresponding company in the Census Bureau's Business Register, which is a database covering all U.S. companies and their establishments. The Business Register includes names, addresses and other identification information, as well as key economic data obtained from Census Bureau surveys and administrative records. The computer match was made using Employer Identification Numbers (EINs) that are reported in BEA surveys and included in the Census Bureau Business Register. EINs are used by companies and their establishments when they file Federal and State payroll and income taxes. For some

U.S. affiliates that failed to link in the computer match of EINs, other identification information, such as names and addresses, was used to link U.S. affiliates to Census Bureau companies. The second step was to link U.S. affiliates to the SIRD using Census Bureau ID numbers obtained from the Business Register. Additional steps were required to verify the matches, evaluate the accuracy of the matched data, and tabulate the SIRD data for U.S affiliates.

The Phase II matching process was similar to that in Phase I, except that in this phase the Census Bureau data were matched to BEA data for U.S. parent companies. Phase III was a relatively straight forward process in which BEA ID numbers for the multi-unit U.S. parent companies that matched in Phase II were used to extract data on the R&D activities of the parents' majority-owned U.S. affiliates from BEA's 1999 benchmark survey of USDIA.

III. Summary of Methodological and Analytical Findings

A. Key Methodological Findings

The study unequivocally demonstrated that it is feasible to link data from the SIRD to BEA's data on U.S. affiliates of foreign MNCs and on U.S. MNCs. All three phases of the link were successful:

- In Phase I, U.S. affiliates that linked accounted for almost 80 percent of BEA's published total of $19.9 billion for the R&D spending by all U.S. affiliates.

- In Phase II, U.S. parents that linked accounted for 92 percent of BEA's published total of $126.3 billion for the R&D spending by all U.S. parent companies.

- In Phase III, the majority-owned foreign affiliates of matched multi-unit U.S. parent companies accounted for 92 percent of BEA's published total of $18.2 billion for the R&D spending by all majority-owned foreign affiliates.

The overall strategy in the matching methodology and the subsequent validation was both effective and efficient. The computer matches in Phases I and II based on EINs worked well even though both phases involved matching files that were independently developed by the Census Bureau and BEA. Some work was required to investigate and fix discrepancies or omissions in the various data files, but this research was limited and within expectations. The Census Bureau was unable to match some BEA records to Census Bureau files, but these unmatched records were not material in determining the feasibility of the link project.

The project confirmed that, for the most part, the data reported to the Census Bureau and BEA are comparable, although there are some minor definitional differences. The agencies' definitions of two items that were critical to establishing the accuracy of the links—total employment and R&D expenditures—are essentially the same. The definitions of some of the other R&D items differed somewhat. For example, R&D employment is reported to the Census Bureau on a full-time equivalent basis but is reported to BEA as the number of full-time and part-time employees who devote a majority of their time to R&D activities. Another difference is that the Census Bureau data are collected on a calendar-year basis while the BEA data are collected on a fiscal-year basis. However, the differences do not significantly impair the comparability of the data or the usefulness of the integrated data set.

For future links, the quality of the linked data would support the publication of a variety of tables by the agencies covering the R&D activities of matched U.S. affiliates and matched U.S. parent companies and their foreign affiliates. These tables would provide a range of useful information similar to that presented and discussed in the following section on the analytical findings of the study. Tables could be produced that provide data disaggregated by industry, by state, and by country of foreign direct investor in the case of U.S. affiliates; by industry and by state in the case of U.S. parent companies; and by industry and country of location in the case of foreign affiliates. If the tables contained an appropriate level of industry and country detail, the requirement to protect the confidentiality of data of individual companies should not result in an unacceptably large number of suppressed cells.

B. Other Methodological Findings

As noted above, a number of U.S. affiliates that reported R&D spending to BEA did not match to the SIRD. In some cases, this occurred because the SIRD is a sample survey and some U.S. affiliates may have corresponded to companies that were not included in the SIRD sample. However, it is likely that most of the affiliates that did not match for this reason were relatively small and, taken together, did not account for a significant portion of overall affiliate R&D spending. In principle, the SIRD sample includes all companies with significant R&D spending and most U.S. affiliates meet the criteria for being included in the sample. However, a number of such affiliates did not match to SIRD companies. After researching these cases, the Census Bureau added over 500 companies (2.8% of total R&D in BEA's 1997 FDIUS file) to the sample for the 2003 SIRD, thereby improving the survey's sample frame. Similarly, there were some U.S. parent companies that reported R&D spending to BEA that did not match to the SIRD; using information obtained for these cases, the Census Bureau added over 60 companies (0.8% of total R&D in BEA's 1999 USDIA file) to the 2004 SIRD sample frame.

In addition to enhancing the quality of national R&D totals derived from the SIRD, these sample frame improvements should improve the quality of the matches for any future link exercises of BEA MNC data and the Census Bureau SIRD data.

In all three phases, cases were found in which Census Bureau and BEA R&D figures for the same company differed. Although some of the differences were quite large, link-related improvements in the quality of the Census Bureau and BEA data (resulting from the analysis of data discrepancies between the BEA and Census Bureau surveys) should significantly reduce such differences for future years. The remainder of this section provides additional information on these cases.

In the Phase I match between the BEA data for U.S. affiliates and the Census Bureau SIRD data, there were 8 cases where the BEA and Census Bureau data for total R&D spending for the matched companies differed by more than $200 million. In most of these cases, the differences were due to two factors: 1) A company that reported in the SIRD was matched to a U.S. affiliate that consisted only of a subsidiary and not the whole company, and 2) A company was going through a reorganization during 1997.

In 5 of the cases, a SIRD company matched to a U.S. affiliate that consisted of only a subsidiary of the company. These situations occurred because a foreign investor held a minority ownership interest in the subsidiary but no ownership interest in the remainder of the company.[1] This problem was largely eliminated when the link was applied to just majority-owned U.S. affiliates. Partly for this reason, the tabulations presented in this report cover majority-owned U.S. affiliates.

In the cases where companies were undergoing a reorganization, the entity covered by the report in the SIRD differed from that reported to BEA because the company had either sold or acquired a major operation and the SIRD report reflected the activities of the company before (after) the reorganization while the BEA report reflected the activities of the company after (before) the reorganization.

Difference between reports in the SIRD and BEA survey also occurred because the data provided to one of the agencies was incorrect. In a few instances, the company incorrectly included data for its foreign R&D operations rather than just for its domestic U.S. operations in its report to one of the agencies. Finally, some difference resulted because data were reported in one survey but imputed (estimated) in the other, and the imputed and reported data differed significantly.

As in Phase I, cases were found in Phase II where the BEA and Census Bureau data for total R&D spending for the matched companies differed significantly. There were 11

1. In the BEA MNC data, a U.S. affiliate is a U.S. company in which a foreign-investor has an ownership interest of 10 percent or more.

cases where the BEA and Census Bureau data for total R&D spending for the matched U.S. parent companies differed by more than $500 million. The differences occurred primarily because data were reported incorrectly to either the Census Bureau or BEA or because a value was imputed by the Census Bureau and that estimate differed from the actual value reported to BEA. Information developed as a result of researching the 8 Phase I cases and 11 Phase II cases are expected to result in improvements in the quality of the data reported in the future in both the Census Bureau SIRD survey and the BEA FDIUS and USDIA surveys.

Cases were also found in both Phase I and Phase II where the industry classification of a company differed in the SIRD and BEA surveys. The Census Bureau classifies companies by industry based on payroll and BEA classifies companies based on sales and this probably accounts for some of the difference. However, there may be other reasons. Further research on these differences will be conducted in future link exercises. Among other things, findings from this research could be useful in an ongoing NSF/SRS investigation regarding industry classifications of R&D-intensive companies with significant operations in wholesale and retail trade. Currently, about one-third of the R&D performed by companies classified in non-manufacturing industries in the SIRD is in trade; the comparable shares for trade in the data for matched U.S. affiliates and matched U.S. parent companies are 29 and 54 percent, respectively.

C. Analytical Findings

An important goal of the linking exercise was to assess the analytical usefulness of an integrated data set. Because the focus of the project was on the technical feasibility of linking and because the data linked in this study are somewhat dated—covering 1997 and 1999—the agencies did not expect extensive analytical results from this first-time effort. Nonetheless, the study produced a more integrated data set on the domestic and international dimensions of R&D and a more comprehensive and detailed picture of the R&D activities of U.S. companies. The new data make it possible to examine a number of heretofore unexplored issues concerning the R&D activities of U.S. companies. Data of particular analytic interest include:

- Data on the distribution of U.S. affiliate and U.S. parent R&D expenditures by character of work (basic research, applied research, development)

- Number of R&D performing U.S. affiliates and number of U.S. parents with R&D performing affiliates

- Total U.S. R&D spending, R&D spending of U.S. affiliates, and overseas R&D spending by the foreign affiliates of U.S. MNCs (total, federally-funded, company-

funded)

- Employment, R&D employment, and other operating variables for R&D performers (e.g., sales)

- Location of U.S. affiliate and U.S. parent R&D spending by state[2]

These new data were obtained by combining R&D estimates and State location data from SIRD with ownership information from BEA's surveys. Tables 1 and 2 present selected summary data from the study; additional data appear in the tables in the Appendix.[3]

The analytical benefits from linking the survey microdata are evident given that none of the individual surveys by themselves were able to provide the data presented here.

Key analytical findings of the study are:

Phase I (U.S. affiliates of foreign companies)

- The majority of the R&D expenditures by U.S. affiliates that linked was devoted to development activities and was funded by company and other non-Federal sources (Table 1).

- R&D performed by U.S. affiliates that linked accounted for 8 percent of the U.S. industrial R&D expenditures reported by companies covered by the 1997 SIRD sample. However, the U.S. affiliate share of spending for basic research was twice as large (16 percent). (Appendix Table 1).

- U.S. affiliates accounted for a relatively large share of U.S. spending for basic research because affiliates tend to devote a comparatively large share of their overall R&D spending to basic research--12 percent of R&D for majority-owned U.S. affiliates compared with 6 percent for all SIRD companies

2. Tabulations of data broken down by state are not included in this report because the goal of the study was primarily to determine whether it was feasible to obtain the state data and significant resources would have been required to perform disclosure analysis needed in order to produce the tabulated state data.
3. The data presented in the tables are aggregations of unweighted microdata. The SIRD is a sample survey, with the sample stratified by size and industry. Estimates for total U.S. R&D activity are computed by expanding the sample data in the SIRD to universe totals. This is accomplished by weighting the reported sample data to account for the nonsample companies. The U.S. affiliate and U.S. parent data were matched to data for companies that were included in the SIRD sample and, in the tabulations presented in this report, the data cover only affiliates and parents included in the sample. That is, the SIRD data for matched U.S. affiliates and U.S. parents have not been weighted, so that they do not represent the universe of all such companies.

(Appendix Table 2).

- In dollar terms, development was the largest category for both U.S. affiliates and SIRD companies.

- Matched U.S. affiliates that linked employed 8 percent of the U.S. industrial R&D employees of companies in the SIRD sample[4] (Appendix Table 5).

Phase II (U.S. parent companies)

- In 1999, U.S. parent companies that linked accounted for 75 percent of the U.S. industrial R&D expenditures reported by companies included in the SIRD sample and for two-thirds of the R&D employees (Appendix Tables 1 and 5).

- In manufacturing, linked parent companies accounted for 86 percent of Federally-funded R&D expenditures of the SIRD sample. The corresponding share for trade was 52 percent (Appendix Table 4).

Phase III (Majority-owned foreign affiliates)

- Two-thirds of overseas R&D by majority-owned affiliates of linked parent companies was performed in five G7 countries in 1999: United Kingdom, Germany, Canada, France, and Japan (Table 2).

- Among the individual countries shown in Table 2, R&D employees accounted for the largest share of total foreign affiliate employment in Japan, the United Kingdom, and Germany.

These data, together with further developments in future linking exercises, will advance the understanding of the structure and impact of R&D investment by foreign and U.S. MNCs.

4. SIRD R&D employment data are based on full-time equivalents (FTEs). To report FTE counts, companies are asked to include scientists and engineers that perform R&D functions on a full-time basis plus an adjusted number of employees whose activities are not solely devoted to R&D (based on the proportion of their time devoted to R&D activities). BEA R&D employment data are counts of full-time and part-time employees that devote the majority of their time to R&D activities.

Table 1. U.S. R&D Expenditures By Character of Work and Source of Funding, Total Employment, and R&D Employment, by Major NAICS Sector: 1997 or 1999 (SIRD data)

Linked Majority-Owned U.S. Affiliates, 1997

	R&D expenditures							Employment	
	Total	By character of work				By source of funding			
		Basic	Applied	Develop-ment	Undistrib-uted	Company	Federal government	Total	R&D (FTE)
Number of companies (all industries)[1]	*289*	*84*	*138*	*227*	*NA*	*288*	*20*	*289*	*284*
	Millions of U.S. dollars							Thousands of employees	
All industries	11,797	1,367	1,976	8,161	294	11,706	91	1,176	66
Manufacturing	9,865	1,271	1,532	6,768	294	9,775	90	1,045	56
Trade	555	D	D	359	NA	D	D	32	3
Other industries	1,377	D	D	1,034	NA	D	D	99	8

Linked U.S. Parent Companies, 1999

	R&D expenditures							Employment	
	Total	By character of work				By source of funding			
		Basic	Applied	Develop-ment	Undistrib-uted	Company	Federal government	Total	R&D (FTE)
Number of companies (all industries)[1]	*1,035*	*247*	*448*	*760*	*NA*	*1,033*	*97*	*1,035*	1,009
	Millions of U.S. dollars							Thousands of employees	
All industries	115,690	4,945	15,004	57,307	38,435	101,027	14,663	9,360	593
Manufacturing	88,558	4,043	12,313	38,473	33,728	74,273	14,285	6,431	405
Trade	14,554	341	1,007	12,189	1,017	14,518	36	662	85
Other industries	12,578	561	1,684	6,644	3,689	12,237	342	2,266	103

D Suppressed to avoid disclosure of data of individual companies.
NA Not available or not applicable
FDIUS Foreign Direct Investment in the United States
FTE Full-time equivalent
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
USDIA U.S. Direct Investment Abroad
1. Number of companies that reported a non-zero value for a given item.
Note: Detail may not add to totals because of rounding. A total 387 SIRD companies matched to U.S. affiliates records from BEA's survey of FDIUS, of which 319 were majority-owned; 289 of these majority-owned companies reported nonzero R&D expenditures in the SIRD.
A total of 1,321 SIRD companies matched to U.S. parent companies from BEA's survey of USDIA, of which 1,035 reported nonzero R&D expenditures in the SIRD.

Table 2. Number of Linked U.S. Parent Companies and Their Majority-Owned Foreign Affiliates (MOFA's) and R&D Expenditures and Employment of MOFAs, 1999 (BEA data)

Total and selected host country where affiliates are located	Number of linked U.S. parent companies with MOFA's that performed R&D[1]	MOFAs			
		Number	R&D expenditures (millions of U.S. dollars)	Employment (thousands of employees)	
				Total	R&D
Total……	377	1,721	16,619	1,778	107
Canada……	100	131	1,547	174	6
France……..	106	158	1,363	135	10
Germany……..	130	189	2,982	253	22
Japan……	71	88	1,362	59	7
United Kingdom……..	169	228	3,737	265	23
Other countries……..	258	927	5,627	891	39

1. The given U.S. parent is counted once in the all-countries total. It is also counted once in each country in which it has a majority-owned foreign affiliate. Because a U.S. parent may have majority-owned foreign affiliates in more than one country, the sum across countries exceeds the all-countries total.
Note: R&D employees are full- and part-time employees who devote the majority of their time to R&D activities.

IV. Conclusions and Recommendations

There is a need for better data on the domestic and international dimensions of U.S. R&D activity. The trend towards globalization has made it difficult for officials at both the Federal and State levels to formulate sound economic policy because existing data on overall U.S. R&D activity focus primarily on domestic activity. The need is for a comprehensive R&D data set that includes data on the international R&D activities of U.S. companies and the U.S. R&D activities of foreign companies. Increasingly, questions are aimed at the international operations of domestic companies as well as foreign companies operating in the United States. We need to anticipate these data requests and begin to assemble the infrastructure to provide measurements that reflect the changing dynamics of business. An on-going program that will be better able to track the trends in R&D expenditures on a global basis would be an important first step in this direction.

The project demonstrated the technical feasibility of matching the Census Bureau SIRD and BEA benchmark surveys. It also demonstrated that the new information on the R&D activities of U.S. foreign MNCs and the more integrated data set on the domestic and international dimensions of R&D obtained as a result of the project give a more comprehensive and detailed picture of U.S. R&D activities. In addition, the new data from the link make it possible to examine a number of heretofore unexplored issues concerning the R&D activities of MNCs. This study also provided tangible benefits to the Census Bureau and BEA through improvements in sample frames and in the quality of reported data. The improved sampling frames translate into increased survey efficiency and, potentially, in reduced costs. Although NSF/SRS is not included in the CIPSEA, it is a beneficiary of the findings resulting from the data sharing between the Census Bureau and the BEA.

Based on these positive results, the Census Bureau, NSF/SRS, and BEA concur that future links of the SIRD and BEA annual and benchmark surveys of FDIUS and USDIA would produce significant benefits. Further, BEA and Census find that the operational and statistical procedures to match SIRD data with data from BEA annual surveys are not likely to be materially different from the procedures tested in this feasibility study, which pertained to BEA benchmark surveys. In summary, the agencies' "go/ no-go" recommendation as to whether work should be undertaken to extend the links between the Census Bureau's SIRD and BEA's surveys of FDIUS and USDIA is "go."

Accordingly, it is recommended that the agencies begin discussions to conduct a link between the SIRD and BEA's 2002 FDIUS and USDIA data. The agencies should also discuss the expected benefits from conducting this project on an annual basis versus only periodically, and subsequently make a recommendation on the frequency of future

links. Annual links are likely to be contingent on a number of factors such as funding and other resource priorities, which are difficult to assess in advance. At the same time, agreeing to annual linking exercises in principle would avoid the inefficiencies of periodic inter-agency paperwork and “start-up” costs. Perhaps the most expedient tool is to enter into a multi-year agreement with built-in flexibility in terms of the actual activities expected to be completed annually.

APPENDIX

Tables

Appendix Table 1

R&D Expenditures by Character of Work: Comparison of Data for Linked U.S. Affiliates and Linked U.S. Parent Companies with Data for SIRD Sample Companies, by Major NAICS Sector, 1997 or 1999

SIRD sample companies and linked U.S. affiliates, 1997

	R&D expenditures										Majority-owned U.S. affiliates as a percentage of SIRD sample companies				
	SIRD sample companies					Majority-owned U.S. affiliates									
	Total	Basic	Applied	Devel-opment	Undistri-buted	Total	Basic	Applied	Devel-opment	Undistri-buted	Total	Basic	Applied	Devel-opment	Undistri-buted
Number of companies (all industries)[1]……	3,741	776	1,643	2,780	*NA*	*289*	*84*	*138*	*227*	*NA*	*8*	*11*	NA	NA	NA
	Millions of U.S. dollars														
All industries……..	139,914	8,514	28,198	103,202	0	11,797	1,367	1,976	8,161	294	8	16	7	8	NA
Manufacturing……..	113,326	D	D	84,470	0	9,865	1,271	1,532	6,768	294	9	D	D	8	NA
Trade……	D	D	D	D	0	555	D	D	359	NA	D	D	D	D	NA
Other industries……..	D	D	D	D	0	1,377	D	D	1,034	NA	D	D	D	D	NA

Table 1 continues.

Appendix Table 1 (continued)

R&D Expenditures by Character of Work: Comparison of Data for Linked U.S. Affiliates and Linked U.S. Parent Companies with Data for SIRD Sample Companies, by Major NAICS Sector, 1997 or 1999

SIRD sample companies and linked U.S. parent companies, 1999

	R&D expenditures										U.S. parent companies as a percentage of SIRD sample companies				
	SIRD sample companies					U.S. parent companies									
	Total	Basic	Applied	Devel-opment	Undistri-buted	Total	Basic	Applied	Devel-opment	Undistri-buted	Total	Basic	Applied	Devel-opment	Undistri-buted
Number of companies (all industries)[1]……	3,671	962	1,486	2,594	*NA*	*1035*	*247*	*448*	*760*	*NA*	*28*	*26*	NA	NA	NA
	Millions of U.S. dollars														
All industries……..	153,589	12,350	30,465	110,773	0	115,690	4,945	15,004	57,307	38,435	75	NM	NM	NM	NA
Manufacturing……..	106,762	D	D	75,968	0	88,558	4,043	12,313	38,473	33,728	*83*	D	D	NM	NA
Trade……..	16,953	558	1,582	14,813	0	14,554	341	1,007	12,189	1,017	*86*	NM	NM	NM	NA
Other industries……..	29,874	D	D	19,992	0	12,578	561	1,684	6,644	3,689	*42*	D	D	NM	NA

D Suppressed to avoid disclosure of data of individual companies
NA Not available or not applicable
NAICS North American Industry Classification System
NM Not meaningful because a large share of the total value was undistributed.
SIRD Survey of Industrial Research and Development
1. Number of companies that reported a non-zero value for a given item.
Note: Detail may not add to totals because of rounding. The data presented in this table are aggregations of unweighted microdata. The SIRD is a sample survey, with the sample stratified by size and industry. Estimates for total U.S. industrial R&D activity published elsewhere are computed by expanding the sample data in the SIRD to universe totals. This is accomplished by weighting the reported sample data to account for the nonsample companies. The data for SIRD sample companies in this table do not cover total U.S. industrial R&D activity; instead, they cover only companies included in the SIRD sample. The U.S. affiliate and U.S. parent data were matched to data for companies that were included in the SIRD sample and the data presented in this table cover only affiliates and parents included in the sample. That is, the matched SIRD data for U.S. affiliates and U.S. parents have not been weighted, so that they do not represent the universe of all such companies.

Appendix Table 2

Distribution of R&D Expenditures by Character of Work for Linked U.S. Affiliates and Linked U.S. Parent Companies, 1997 or 1999

Linked majority-owned U.S. affiliates, 1997

	R&D expenditures						Percentage of U.S. affiliate total (SIRD)			
	Total		R&D spending detail from the SIRD							
	Based on BEA's survey of FDIUS	Based on the SIRD	Basic	Applied	Devel-opment	Undistrib-uted	Basic	Applied	Devel-opment	Undistrib-uted
Number of companies (all industries)[1]……..	*331*	*289*	*84*	*138*	*227*	NA	*29*	*48*	*79*	NA
	Millions of U.S. dollars									
All industries……	14,164	11,797	1,367	1,976	8,161	294	12	17	69	2
Manufacturing……..	12,308	9,865	1,271	1,532	6,768	294	13	16	69	3
Trade……	1,106	555	D	D	359	NA	D	D	65	NA
Other industries……..	750	1,377	D	D	1,034	NA	D	D	75	NA

Table 2 continues.

Appendix Table 2 (continued)

Distribution of R&D Expenditures by Character of Work for Linked U.S. Affiliates and Matched U.S. Parent Companies, 1997 or 1999

Linked U.S Parent Companies

	R&D expenditures						Percentage of U.S. parent company total (SIRD)			
	Total		R&D spending detail from the SIRD							
	Based on BEA's survey of USDIA	Based on the SIRD	Basic	Applied	Devel-opment	Undistrib-uted	Basic	Applied	Devel-opment	Undistrib-uted
Number of companies (all industries)[1]	*849*	*1,035*	*247*	*448*	*760*	NA	*24*	*43*	*73*	NA
	Millions of U.S. dollars									
All industries	109,034	115,690	4,945	15,004	57,307	38,435	4	13	50	33
Manufacturing	91,541	88,558	4,043	12,313	38,473	33,728	5	14	43	38
Trade	4,218	14,554	341	1,007	12,189	1,017	2	7	84	7
Other industries	13,275	12,578	561	1,684	6,644	3,689	4	13	53	29

D Suppressed to avoid disclosure of data of individual companies
NA Not available or not applicable
FDIUS Foreign direct investment in the United States
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
USDIA U.S. direct investment abroad
1. Number of companies that reported a non-zero value for a given item.
Note: Detail may not add to totals because of rounding. Also, see note to Appendix Table 1.

Appendix Table 3

Distribution of R&D Expenditures of Linked Majority-Owned U.S. Affiliates by Country of Owner, by Major NAICS Sector 1997

	R&D expenditures						Percentage of BEA total for U.S. affiliates accounted for by affiliates with owners in:			
	Total based on the SIRD	Based on data from BEA's survey of FDIUS								
		Total	By country of owner							
			Canada	Europe	Japan	Other countries	Canada	Europe	Japan	Other countries
Number of companies (all industries)[1]……..	*289*	*331*	*18*	*215*	*73*	*25*	*5*	*65*	*22*	*8*
	Millions of U.S. dollars									
All industries……..	11,797	14,164	1,501	9,729	1,123	1,811	11	69	8	13
Manufacturing……..	9,865	12,308	1,424	9,126	645	1,113	12	74	5	9
Trade……..	555	1,106	D	325	258	NA	D	29	23	NA
Other industries……..	1,377	750	D	279	219	NA	D	37	29	NA

D Suppressed to avoid disclosure of data of individual companies
NA Not available or not applicable
FDIUS Foreign Direct Investment in the United States
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
1. Number of companies that reported a non-zero value for a given item.
Notes: The country of owner is the country of the company or person that ultimately owns or controls the U.S. affiliate.
Also see note to Appendix Table 1.

Appendix Table 4

R&D Expenditures by Source of Funding: Comparison of Data for Linked Majority-Owned U.S. Affiliates and Linked U.S. Parent Parent Companies with Data for SIRD Sample Companies, by Major NAICS Sector, 1997 or 1999 (SIRD Data)

SIRD sample companies and linked majority-owned U.S. affiliates, 1997

	R&D expenditures						U.S. affiliates as percentage of SIRD sample companies		
	SIRD sample companies			Linked U.S. affiliates					
	Total	By source of funding		Total	By source of funding		Total	By source of funding	
		Company	Federal government		Company	Federal government		Company	Federal government
Number of companies (all industries)[1]……	3,741	3,667	490	*289*	*288*	*20*	*8*	*NA*	*4.1*
	Millions of U.S. dollars								
All industries……..	139,914	117,048	22,866	11,797	11,706	91	8	10	0.4
Manufacturing……	113,326	93,846	19,480	9,865	9,775	90	9	10	0.5
Trade……	D	4,882	D	555	D	D	D	D	D
Other industries……..	D	18,320	D	1,377	D	D	D	D	D

Table 4 continues.

Appendix Table 4 (continued)

R&D Expenditures by Source of Funding: Comparison of Data for Liked Majority-Owned U.S. Affiliates and Linked U.S. Parent Companies with Data for SIRD Sample Companies, by Major NAICS Sector, 1997 or 1999 (SIRD Data)

SIRD sample companies and linked U.S. parent companies, 1999

	R&D expenditures						U.S. parent companies as a percentage of SIRD sample companies		
	SIRD sample companies			Linked U.S. parent companies					
	Total	By source of funding		Total	By source of funding		Total	By source of funding	
		Company	Federal government		Company	Federal government		Company	Federal government
Number of companies (all industries)[1]……	3,671	3,600	448	*1,035*	*1,033*	*97*	*28*	*NA*	*22*
	Millions of U.S. dollars								
All industries……..	153,589	132,725	20,864	115,690	101,027	14,663	75	76	70
Manufacturing……	106,762	90,068	16,694	88,558	74,273	14,285	83	82	86
Trade……	16,953	16,884	69	14,554	14,518	36	86	86	52
Other industries……..	29,874	25,773	4,101	12,578	12,237	342	42	47	8

D Suppressed to avoid disclosure of data of individual companies
NA Not available or not applicable
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
1. Number of companies that reported a non-zero value for a given item.
Note: See note to Appendix Table 1.

Appendix Table 5

Total Employment and R&D Employment: Comparison of Data for Linked Majority-Owned U.S. Affiliates and Linked U.S. Parent Companies with Data for SIRD Sample Companies, by Major NAICS Sector, 1997 and 1999

SIRD sample companies and linked majority-owned U.S. affiliates, 1997

	Employment				U.S. affiliates as a percentage of SIRD sample companies	
	SIRD sample companies		Linked U.S. affiliates			
	Total	R&D (FTE)	Total	R&D (FTE)		
Number of companies (all industries)[1]……..	3,741	3,583	289	284	8	8
	Thousands of employees					
All industries……..	14,570	782	1,176	66	8	8
Manufacturing……..	9,509	607	1,045	56	11	9
Trade……..	859	27	32	3	4	11
Other industries……..	4,202	147	99	8	2	5

Table 5 continues.

Appendix Table 5 (continued)

Total Employment and R&D Employment: Comparison of Data for
Linked Majority-Owned U.S. Affiliates and Linked U.S. Parent Companies with
Data for SIRD Sample Companies, by Major NAICS Sector, 1997 and 1999

SIRD sample companies and linked U.S. parent companies, 1999

	Employment				U.S. parents as a percentage of SIRD sample companies	
	SIRD sample companies		Linked U.S. parents			
	Total	R&D (FTE)	Total	R&D (FTE)		
Number of companies (all industries)[1]……..	3,671	3,483	1,035	1,009	28	29
	Thousands of employees					
All industries……..	14,197	814	9,360	593	66	73
Manufacturing……	8,774	505	6,431	405	73	80
Trade……	1,022	100	662	85	65	85
Other industries……..	4,401	210	2,266	103	51	49

FTE Full-time equivalent
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
1. Number of companies that reported a non-zero value for given item.
Note: See note to Appendix Table 1.

Appendix Table 6

Total Employment and R&D Employment of Linked U.S. Parent Companies and Their Majority-Owned Foreign Affiliates (MOFAs) by Major NAICS Sector, 1999

	U.S. parent companies (from SIRD)		MOFAs (from BEA survey of USDIA)		U.S. MNC total (U.S. parents plus MOFAs)		MOFAs as a percentage of U.S. MNC total	
	Total employment	R&D employment (FTE)	Total employment	R&D employment	Total employment	R&D employment	Total employment	R&D employment
Number of companies (all industries)[1]……..	1,035	1,009	1,709	1,586	NA	NA	NA	NA
	Thousands of employees							
All industries……..	9,360	593	1,778	107	11,137	700	16	15
Manufacturing……	6,431	405	1,625	94	8,056	499	20	19
Trade……	662	85	70	3	732	88	10	4
Other industries……..	2,266	103	83	9	2,349	112	4	8

FTE full-time equivalent
NA Not available or not applicable
MNC Multinational company
NAICS North American Industry Classification System
SIRD Survey of Industrial Research and Development
USDIA U.S. Direct Investment Abroad
1. Number of companies that reported a non-zero value for a given item.
Note: In the SIRD, R&D employees are measured as the number of full-time equivalent employees performing R&D. In BEA's survey of USDIA, R&D employees are measured as the number of full-time and part-time employees who devote the majority of their time to R&D activities. Also see note to Appendix Table 1.