

**Linking Frascati-based R&D Spending to the System of National Accounts:
An Application to U.S. Data
U.S. Link Tables for 2001, A Work in Progress**

Carol A. Robbins, U.S. Bureau of Economic Analysis, March 17, 2005

Table Number	Title
Summary Table A	Sector Summary of R&D Gross Output for U.S. in \$ millions, current dollar
Summary Table B	Summary of Differences between 2001 R&D Expenditures and 2001 Gross Output
1	Business Sector to Nonfinancial Corporate Sector
2	Business Sector to Financial Corporate Sector
3	Government Sector to General Government Sector
4	Federal Government to General Government Subtable
5	Federally Funded R&D Centers to General Government Subtable
6	Higher Education Sector to General Government Subtable
7	State and Local Government to General Government Subtable
8	Private Non-Profit Sector to Households and Non-profits serving households Sector
9	Private Non-Profit Organizations Subtable
10	Higher Education Sector to Non-profit Higher Education Subtable
11	Abroad to Rest of World Sector

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

A. Sector Summary of 2001 R&D Expenditures for U.S. in \$ millions, current dollar

	Nonfinancial Corporate	Financial Corporate	General Government	Non-profit Institutions Serving Households and Households	
	Table 1	Table 2	Table 3	Tables 8	Total
I. Gross Output of R&D Services	206,852	2,552	59,778	20,779	289,962
II. Net Exports	(1,261)	-	(440)	-	(1,701)
III. Net Additions to Capital	12,493	154	4,108	1,350	18,105

B. Summary of Differences between 2001 R&D Expenditures and 2001 Gross Output

	Nonfinancial Corporate	Financial Corporate	General Government	Non-profit Institutions Serving Households and Households	Total
I. GERD (Note 1)	196,466	2,424	55,087	20,728	274,705
II. Scope adjustments +			874	192	1,066
III. Intermediate Inputs +	-	-	3,352	-	3,352
IV. Embedded additions to Gross Fixed Capital -	-	-	2,673	460	3,133
V. Adjustments to move from expenditures to market price +	10,386	128	2,492	319	13,325
VI. State and Local R&D +			647		647
VII. Gross Output Total	206,852	2,552	59,778	20,779	289,962

Note 1. GERD is the Frascati-based total for U.S. performance of R&D. It is equal to the Total U.S. Expenditure on R&D in current dollars for 2001 (\$274,211 million) plus the estimate of federal government capital expenditure for 2001 (\$494 million).

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
I. Output							
1	Frascati-Based Output		Business Expenditures on R&D (BERD)	200,525	OECD (2004), Main Science and Technology Indicators, Electronic Version (mst2004.xls, worksheet 49A-HP_RS) and "National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS (2004a).		This is the sum of industry performed R&D and Industry FFRDCs
2	Minus expenditures for FFRDCs run by industries.	-		2,020	NSF (2003a), <i>National Patterns of R&D Resources: 2002 Data Update</i> , Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS	The Frascati-based numbers from the OECD include the expenditures of FFRDCs run by corporations in the business sector. They will be moved to Table 5.	
3	Minus expenditures for financial corporations	-		2,424	NSF (2004a) DSRS; <i>Science and Engineering Indicators 2004</i> , Arlington, VA (NSF 04-01) [May 2004]. page 4-16. This is estimated based on the ratio of R&D performance in NAICS 52 and 53 to all the rest of industry performed R&D.	This sector is non-financial corporations only.	In a further refinement of the estimates, these industries can be linked to NAICS through a Census concordance and tabulated separately.

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
4	Plus business expenditures for R&D in areas not covered by NSF survey data: Humanities, Social Sciences	+		0	No survey data	The Frascati definition of R&D includes the Humanities and Social Sciences, this is a data source adjustment, rather than Frascati to SNA adjustment. The SIRD excludes R&D in the humanities and social sciences.	While the SIRD does not go to firms classified as in the Agriculture sector, NAICS 5417, most agriculture-related R&D is done by firms classified in other covered industries.
5	Plus expenditures for non-profits serving business	+		385	Research and Development Funding and Performance by Nonprofit Organizations, NSF(2001b)Table A-11. 'These were identified in the 1996 and 1997 data, the average ratio to total respondents, not weighted total, for those years is applied to the Non-profit performance to separate out this share.	Both Frascati and SNA assign the non-profits serving business to the business or corporate sector. The NSF-based data assign them to the non-profit sector.	These are the non-profits identified as trade associations and industrial consortiums. Updated information could be gathered from the IRS 990 filings of non-profit institutions.
6	Plus R&D purchased as an intermediate input to production of R&D in the corporate sector	+			Special tabulation requested from NSF 2001 Survey of Industrial R&D; RD1 Question 6 (B) parts 1, 2, and 3 .	SNA-based gross output includes intermediate consumption, including the cost of any purchased R&D	There is a direct estimate of this based on the sector that performed the purchased work on the RD-1A form.
7	Plus drawing down of materials and supplies inventories	+		0	No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
8			Remove any embedded additions to gross capital				
9	Subtract software purchases and own account software developed for internal use	-		0	These expenditures cannot be separated out based on the SIRD survey form (memo from J. Jankowski and F. Moris, 1/25/05).	Software is considered as investment in the SNA and expenditures for its purchase or creation need to be subtracted from current expenses to avoid double-counting.	Instructions for Form RD-1 Question 4 indicate that the cost of software used in R&D activities is to be included as an R&D cost. This expenditure will be included either in 9(C) materials and supplies consumed, or 9(D), all other R&D expenses
10	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure.	Likely quite small
11			Adjustments to move from expenditures to full value of output				
12	Minus historical cost depreciation	-			Special tabulation requested from NSF 2001 '2001 Survey of Industrial R&D ; RD-1 Question 9(D) will provide historical cost depreciation.		

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	Components						
13	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		10386	Estimated with NIPA CFC at current cost and the estimated investment from section III.	The SNA includes consumption of fixed capital valued at current cost, the SIRD numbers use the historical depreciation estimate in its place.	
14	Plus other taxes on production less subsidies	+		-			
15	Plus Net Operating Surplus	+		-	No survey data	The mark up or net operating surplus is part of the full value of output for market production.	
16	Gross Output			206,852			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
			Components				
17	II. Exports and Imports of R&D Output						
18	Adjustment for exports: R&D receipts		Exports		BEA Trade in R&D Services, Receipts from Affiliated and Unaffiliated Companies	On RD-1 there is no measure for R&D performed then sold to a firm, government or institution in another country.	
19	Affiliated Trade in R&D Services --receipts	+					
20	Plus_Unaffiliated Trade in R&D Services--receipts	+		1,065			
21	Adjustment for imports: outlays for foreign R&D services						
22			Imports				
23	Affiliated Trade in R&D Services --payments	-		1,500	BEA International Division		
24	Unaffiliated Trade in R&D Services-- payments	-		826	BEA International Division		
25	Subtotal			-1,261			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 1 Business Sector to Nonfinancial Corporate Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
26	III. Gross Capital Formation						
27			Fixed Investment				
28	Investment in structures	+		1,753	No survey data	This estimate is based on the ratio of investment in structures to gross output for NAICS 5417	
29	Investment in Equipment	+		10,741	No survey data	This estimate is based on the ratio of investment to gross output for NAICS 5417, and is for both equipment and software	
30	Investment in Software	+		-	An unknown amount of software expenditures are embedded in the performance numbers.		
31	Net Disposals	-			- No survey data		Likely very small
32	Fixed Investment Subtotal			12,493			
33	Investment in inventories	+	Inventory Change		No appropriate question to identify these expenditures		Likely very small
34	Gross Capital Formation			12,493			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 2 Business Sector to Financial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Frascati-Based Output		Business Expenditures on R&D (BERD)	200,525	OECD Table 2 for 2001 and 'NSF/DSRS (2003a), National Patterns of R&D Resources: 2002 Data Update, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS		
2	Minus expenditures for FFRD Centers run by industries.	-		2,020	NSF/DSRS (2003a), <i>National Patterns of R&D Resources: 2002 Data Update</i> , Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS	The Frascati-based numbers from the OECD include the expenditures of FFRDCS run by corporations in the business sector. They will be moved to Table 5.	
3	Minus expenditures for non-financial corporations	-		196,081	NSF (2004a) SRS; <i>Science and Engineering Indicators 2004</i> , Arlington, VA (NSF 04-01) [May 2004]. page 4-16. Estimated based on the ratio of R&D performance in NAICS 52 and 53 to all the rest of industry performed R&D.	this sector is financial only	The NSF will provide these data based on an ISIC to NAICS concordance; Sum of expenditures from RD-1 for non-financial corporations

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 2 Business Sector to Financial Corporate Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
			Components				
4	Plus business expenditures for R&D in areas not covered by NSF survey data: Humanities, Social Sciences	+			No survey data	The Frascati definition of R&D includes the Humanities and Social Sciences, this is a data source adjustment, rather than Frascati to SNA adjustment. The SIRD excludes R&D in the humanities and social sciences.	While the SIRD does not go to firms classified as in the Agriculture sector, NAICS 5417, most agriculture related R&D is done by firms classified in other covered industries.
5	Plus R&D purchased as an intermediate input to production of R&D in the corporate sector	+			2001 Survey of Industrial R&D; RD1 Question 6 (B) parts 1, 2, and 3	SNA-based gross output includes intermediate consumption, including the cost of any purchased R&D	There is a direct estimate of this based on the sector that performed the purchased work on the RD-1A form.
6	Plus drawing down of materials and supplies inventories	+			No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small
7			Remove any embedded additions to gross capital				
8	Minus software purchases and own account software developed for internal use	-			These expenditures cannot be separated out based on the SIRD survey form (memo from J. Jankowski and F. Moris, 1/25/05).	Software is considered as investment in the SNA and expenditures for its purchase or creation need to be subtracted from current expenses to avoid double-counting.	Instructions for Form RD-1 Question 4 indicate that the cost of software used in R&D activities is to be included as an R&D cost. This expenditure will be included either in 9(C) materials and supplies consumed, or 9(D), all other R&D expenses

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 2 Business Sector to Financial Corporate Sector

				2001 Amount in millions of Current Dollars			
			Components		Data or Survey Source	Explanation of Adjustment	Comments
9	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure	Likely quite small
10			Adjustments to move from expenditures to full value of output				
11	Minus historical cost depreciation	-			Special tabulation requested from NSF 2001 '2001 Survey of Industrial R&D ; RD-1 Question 9(D) will provide historical cost depreciation	SNA-based CFC is calculated based on current cost.	
12	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		128	Estimated with NIPA current cost CFC to investment ratio for private nonresidential investment using the estimated investment from section II.	The SNA includes consumption of fixed capital valued at current cost, the SIRD numbers use the historical depreciation estimate in its place	
13	Plus other taxes on production less subsidies	+					
14	Plus Net Operating Surplus	+				The mark up or net operating surplus is part of the full value of output for market production.	
15	Gross Output			2,552			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 2 Business Sector to Financial Corporate Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
16	II. Exports and Imports of R&D Output						
17			Exports		On RD-1 there is no measure for R&D performed then sold to a firm, government or institution in another country.		
18	Affiliated Trade in R&D Services -- receipts	+					
19	Plus_Unaffiliated Trade in R&D Services--receipts	+					
20			Imports				
21	Affiliated Trade in R&D Services -- payments	-					
22	Unaffiliated Trade in R&D Services-- payments	-					
23	Net Exports						

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 2 Business Sector to Financial Corporate Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
24	III.Gross Capital Formation						
25			Fixed Investment				
26	Investment in structures	+		22	No survey data	This estimate is based on the ratio of investment in structures to gross output for NAICS 5417	
27	Investment in Equipment	+		133	No survey data	This estimate is based on the ratio of investment to gross output for NAICS 5417, and is for both equipment and software	
28	Investment in Software	+			An unknown amount of software expenditures are embedded in the performance numbers.		
29	Net Disposals	-			No survey data		Likely very small
30	Fixed Investment Subtotal						
31	Investment in inventories	+	Inventory Change		No appropriate question to identify these expenditures		Likely very small
32	Gross Capital Formation			154			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 3 Total General Government Sector

		Components	2001 Amount in millions of Current Dollars	Data or Survey Source
1	I. Output			
2		Federal Government	24,297	Table 4
3		FFRDCs	11,438	Table 5
4		Government Higher Education	23,396	Table 6
5		State and Local Government	647	Table 7
6	Gross Output		59,778	
7	II. Net Exports of R&D Output			
8		Federal Government	(440)	Table 4
9		FFRDCs	-	Table 5
10		Government Higher Education	-	Table 6
11		State and Local Government	-	Table 7
12	Net Exports		(440)	
13	III. Gross Capital Formation			
14		Federal Government	1,092	Table 4
15		FFRDCs	1,602	Table 5
16		Government Higher Education	1,333	Table 6
17		State and Local Government	81	Table 7
18	Gross Capital Formation		4,108	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 4 General Government Sector to General Government Sector, Federal Government Performance

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Frascati-Based Output		GOVERD Government Performance of R&D	21,542	OECD's Main Science and Technology Indicators, ('mst2004.xls, worksheet 52A-GV_NC) and National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS, but NSF adds an adjustment for capital expenditures		This is "federal intramural" R&D; the agencies of the federal government
2	R&D purchased as an intermediate input to production of R&D	+		3,352	No survey data. The estimate is made based on federally funded performance of R&D in industry 5417 from NSF/DSRS (2004a); Science and Engineering Indicators 2004, Arlington, VA (NSF 04-01) [May 2004]. page 4-16.	SNA-based gross output includes intermediate consumption, including the cost of any purchased R&D. This is a measure of government purchases of the output of contract R&D industry.	
3	Plus drawing down of materials and supplies inventories	+		0	No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small
4			Remove any embedded additions to gross capital				

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 4 General Government Sector to General Government Sector, Federal Government Performance

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
5	Minus capital expenditures, including those for land and structures	-		494	Table C-2. Summary of Federal funds for research and development and for R&D plant: fiscal years 2001, 2002, and 2003; and fiscal years 2002, 2003, and 2004. NSF/DSRS (2004a): Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003; (NSF 04-310)	'FM includes all expenditures, including those for capital assets, SNA excludes expenditures for capital assets. Subtract expenditures for R&D plant.	This is structures and large fixed equipment.
6	Minus current expenditures for non-plant machinery and equipment, as well as purchased and own-account software	-		1,092	No survey data, estimated with ratio of equipment and software to gross output for NAICS 5417	SNA current expenditures excludes capital assets, non-plant test equipment in these totals and should be excluded. Software is considered as investment in the SNA and expenditures for its purchase or creation need to be subtracted from current expenses to avoid double-counting.	
7	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure	Likely quite small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 4 General Government Sector to General Government Sector, Federal Government Performance

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
8			Adjustments to move from expenditures to full value of output				
9	Plus consumption of fixed capital	+		989	CFC estimate based on BEA measures of capital stocks for equipment and software, and survey-based measures for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	The SNA includes consumption of fixed capital as part of the total production cost.	
10	Plus other taxes on production less subsidies	+					
11	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
12	Gross Output			24,297			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 4 General Government Sector to General Government Sector, Federal Government Performance

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	Components						
13	II. Exports and Imports of R&D Output						
14	1. Plus receipts for trade in R&D services	+			No survey data.		
15	2. Minus payments for trade in R&D services	-		440	This is R&D by foreign performers. From Table C- 2.Summary of Federal funds for research and development and for R&D plant: fiscal years 2001, 2002, and 2003; and fiscal years 2002, 2003, and 2004. NSF/DSRS (2004a): Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003; Arlington, VA (NSF 04-310) [April 2004], 2002, 2003, 2004 update provided by Ron Meeks of NSF.		Since this excludes R&D performed by the U.S. government and its agencies abroad, it undercounts these imports.
16	Subtotal			(440)			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 4 General Government Sector to General Government Sector, Federal Government Performance

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
			Components				
17	III. Gross Capital Formation						
18			Fixed Investment				
19	Investment in structures	+			'Table C-2.Summary of Federal funds for research and development and for R&D plant: fiscal years 2001, 2002, and 2003; and fiscal years 2002, 2003, and 2004. NSF/DSRS (2004a): Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003; Arlington, VA (NSF 04-310) [April 2004], 2002, 2003, 2004 update provided by Ron Meeks of NSF.	Although this measure includes land, the SNA allows the total to be used as long as the value of the land is considered less than half of total	This is plant and fixed equipment
20	Investment in equipment	+		1,092	No separate survey data.	This is an estimate for equipment and software based on BEA data.	
21	Investment in software	+					
22	Net Disposals	-		-	No separate survey data		likely very small
23	Fixed Investment Subtotal			1,092			
24	Investment in inventories	+	Inventory Change		No separate survey data		likely very small
25	Gross Capital Formation			1,092			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 5 Federally Funded R&D Centers from other sectors to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Run by Corporations	+	FFRDCS	2,020	National Patterns of R&D., Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS (2003a). From FY 2001 forward these data come	Because finance and control come from the Federal Government, these FFRDCS are	These are current expenditures only.
2	Run by Universities	+	FFRDCS	6,225			
3	Run by Non-profits	+	FFRDCS	2,192			
4	Plus R&D purchased as an intermediate input to the production of R&D at FFRDCs	+			No survey data	Gross output includes the cost of intermediate inputs used in the production of R&D, this entry reflects the acquisition of R&D services used in producing R&D output.	
4	Plus drawing down of materials and supplies inventories	+		0	No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small
5			Remove any embedded additions to gross capital				
5	Minus current expenditures for non-plant machinery and equipment	-			No survey data.	Uncapitalized research equipment with a useful life of more than one year is considered capital under the SNA and must be removed from current expenses.	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 5 Federally Funded R&D Centers from other sectors to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
6	Minus software purchases and own account software developed for internal use	-			No survey data.	Software is considered as investment in the SNA, thus uncapitalized expenditures for software need to be subtracted to avoid double-counting.	
7	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure	Likely quite small
8			Adjustments to move from expenditures to full value of output				
9	Minus historical cost depreciation	-			Item 1 on the NSF form for R&D at FFRDCs asks for total current fund expenditures including indirect costs; these are assumed to include depreciation charges, however they are not separately reported.		
10	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		1,001	CFC estimate based on BEA measures of capital stocks for equipment and software, and for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	The SNA includes consumption of fixed capital as part of the total production cost.	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 5 Federally Funded R&D Centers from other sectors to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
11	Plus other taxes on production less subsidies	+					
12	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
13	Gross Output			11,438			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 5 Federally Funded R&D Centers from other sectors to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
14	II. Exports and Imports of R&D Output						
15	1. Plus receipts for trade in R&D services	+			No survey data	SNA-based output includes that sold to non-resident units	For Aerospace Corporation, there is a share of foreign funding that is conducted in the US. Under some circumstances, this may be an export of R&D services.
16	2. Minus payments for trade in R&D services	-			No survey data	Purchases of R&D output from non-resident units should be subtracted from Gross output	The National Astronomy and Ionosphere Center is located in Arecibo Puerto Rico. This spending should be an import of R&D services.
	Net Exports						

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 5 Federally Funded R&D Centers from other sectors to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
17	III. Gross Capital Formation						
18	Investment in structures	+		1,032	Table C-2. Summary of Federal funds for research and development and for R&D plant: fiscal years 2001, 2002, and 2003; and fiscal years 2002, 2003, and 2004. NSF/DSRS (2004a): Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003; Arlington, VA (NSF 04-310) [April 2004], 2002, 2003, 2004 update provided by Ron Meeks of NSF.	Although this measure includes land, the SNA allows the total to be used as long as the value of the land is considered less than half of total	This is plant and fixed equipment
19	Investment in equipment	+		571	No survey data	This is an estimate for equipment and software based on BEA data.	
20	Investment in software	+			No survey data		
21	Net Disposals	-			No survey data		Likely quite small
22	Fixed Investment Subtotal			1,602			
23	Investment in inventories	+	Inventory Change	-	No survey data		'Likely quite small
24	Gross Capital Formation			1,602			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Frascati-based Output	+	Higher Education Expenditure on R&D (HERD)	39,744	OECD, Main Science and Technology Indicators, Electronic Version (mst2004.xls, worksheet 49A- HP_RS) and "National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS. The underlying source is NSF form 411, Survey of Research and Development at Universities and Colleges.		
2	Minus expenditures for Federally Funded R&D Centers administered by colleges and universities	-		6,225	"National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from NSF/DSRS (2003a).		These expenditures are entered separately with the other FFRDCs.

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
3	Minus expenditures at Private Colleges and universities	-		10,411	Special tabulation of NSF form 411, Survey of Research and Development at Universities and Colleges	Only the public universities are assigned to the government sector.	This is based on the ratios that include all passthroughs, rather than only academic passthroughs.
4	Plus R&D purchased as an intermediate input to the production of R&D at universities and colleges	+		-	No survey data.	Gross output includes the cost of intermediate inputs, this entry reflects the acquisition of R&D services used in producing R&D output.	NSF considers this to be very small.
5	Plus R&D in Non-Science and Engineering	+		874	Special tabulation of NSF form 411, Survey of Research and Development at Universities and Colleges	The Frascati definition of R&D includes the Humanities and Social Sciences, this is a data source adjustment, rather than Frascati to SNA	This figure does not contain an imputation for non-reporting
6	Plus drawing down of materials and supplies inventories	+		0	No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
7			Remove any embedded additions to gross capital				
8	Minus current expenditures for equipment	-		1,088	Item 3j on the NSF form for R&D at Universities and Colleges, this is equipment used in Science and Engineering. Special tabulation from NSF	Uncapitalized research equipment with a useful life of more than one year is considered capital under the SNA and must be removed from current expenses.	
9	Minus software purchases and own account software developed for internal use	-		-	No survey data.	Software is considered as investment in the SNA, thus uncapitalized expenditures for software need to be subtracted to avoid double-counting.	
10	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure	Likely quite small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
11			Adjustments to move from expenditures to full value of output				
12	Minus historical cost depreciation	-		624	This is an NSF provided estimate from FY 1997 of depreciation and use share of indirect costs for public universities (2.7%).	This step subtracts historical-based depreciation, it will be replaced below with a current cost estimate that is consistent with the SNA.	
13	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		1,126	CFC estimate based on BEA measures of capital stocks for equipment and software, and for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	The SNA includes consumption of fixed capital as part of the total production cost.	
14	Plus other taxes on production less subsidies	+					

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
15	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
16	Gross Output			23,396			
17	II. Exports and Imports of R&D Output						
18	Receipts for Trade in R&D Services from foreign sources	+			No survey data.		
19	Payments for trade in R&D Services to foreign performers	-			No survey data.		
20	Subtotal			-			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 6 Higher Education Sector to General Government Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
21	III. Gross Capital Formation		Components				
22	Investment in structures	+		187	This is a BEA estimate, NSF Survey data from the Scientific and Engineering Research Facilities Survey provides total project costs, not annual expenditures.		
23	Investment in equipment and software	+		1,146	This is a BEA estimate for equipment and software		Item 3a on the NSF form for R&D at Universities and Colleges is 1,088.
24	Investment in software	+		-	No survey data, estimated above with equipment.		
25	Net Disposals	-			No survey data.		Likely quite small
26	Fixed Investment Subtotal			1,333			
27	Investment in inventories	+	Inventory Change		No survey data.		Likely quite small
28	Gross Capital Formation			1,333			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 7 State and Local Government Sub-sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Frascati-Based Output				None Available		
2	Plus government expenditures for R&D in areas not covered by NSF survey data	+	State and State-funded Local Government Performance	618	Table 95.4a Battelle and State Science and Technology Institute (1998). "Survey of State Research and Development Expenditures: Fiscal Year 1995." Report dated September 1998.	1995 values scaled up with growth in state and local current expenditures from NIPA Table 3.3.	
3	Minus expenditures for Commercialization included in the performance data	-		23	Table 95.1a provides state expenditures for R&D by character of work from all sources of funds. The ratio of commercialization funds to total is estimated (3.8%) and applied to state performed and state-funded local government performance.	This is a data source adjustment not a Frascati-to-SNA adjustment. Frascati-based R&D excludes commercialization expenses.	
4	Plus R&D purchased as an intermediate input to the production of R&D	+			No survey data.	Gross output includes the cost of intermediate inputs, this entry reflects the acquisition of R&D services used in producing R&D output.	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 7 State and Local Government Sub-sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
			Components				
5	Plus drawing down of materials and supplies inventories	+		0	No survey data	Materials and supplies purchased in a prior period and used for R&D production in the current period should be added to output.	Likely quite small
6			Remove any embedded additions to gross capital				
7	Minus current expenditures for equipment	-			No survey data.	Uncapitalized research equipment with a useful life of more than one year is considered capital under the SNA and must be removed from current expenses.	
8	Minus software purchases and own account software developed for internal use	-			No survey data.	Software is considered as investment in the SNA, thus uncapitalized expenditures for software need to be subtracted to avoid double-counting.	
9	Subtract expenditures that are additions to materials and supplies inventories	-		0	No survey data	Expenditures for materials and supplies that are not used in the current period for R&D output should be subtracted from the output measure	Likely quite small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 7 State and Local Government Sub-sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
10			Adjustments to move from expenditures to full value of output				
11	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		53	CFC estimate based on BEA measures of capital stocks for equipment and software, and for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	The SNA includes consumption of fixed capital as part of the total production cost.	
12	Plus other taxes on production less subsidies	+					
13	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
14	Gross Output			647			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 7 State and Local Government Sub-sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
			Components				
15	II. Exports and Imports of R&D Output						
16	Receipts for Trade in R&D Services from foreign sources	+			No survey data.		
17	Payments for trade in R&D Services to foreign performers	-			No survey data.		
18	Net Exports			-			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 7 State and Local Government Sub-sector

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
19	III. Gross Capital Formation						
20	Investment in structures	+		47		1995 values scaled up with growth in state and local current expenditures from NIPA Table 3.3.	
21	Investment in equipment	+		34	This is a BEA estimate for equipment and software		
22	Investment in software	+			Estimated with equipment above		
23	net disposals	-			No survey data.		Likely quite small.
24	Fixed Investment Subtotal			81			
25	Investment in inventories	+	Inventory Change	-	No survey data.		Likely quite small.
26	Gross Capital Formation			81			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output
Table 8 Total Non-profits and Household Sector

		Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
1	I. Output					
2		Non-Profit Institutions Serving Households	10,601	Table 9		
3		Non-Profit Higher Education	10,178	Table 10		
4		Non-market Household		There is no estimate for this	R&D activity conducted by households that is not sold in the market	Likely quite small.
5	Gross Output		20,779			
6	II. Exports and Imports of R&D Output					
7		Non-Profit Institutions Serving Households	0	Table 9		
8		Non-Profit Higher Education	0	Table 10		
9		Non-market Household		No survey data	R&D activity conducted by households that is not sold in the market	Likely quite small.
10	Net Exports		0			
11	III. Gross Capital Formation					
12		Non-Profit Institutions Serving Households	705	Table 9		
13		Non-Profit Higher Education	645	Table 10		
14		Non-market Household		No survey data	R&D activity conducted by households that is not sold in the market	Likely quite small.
15	Gross Capital Formation		1,350			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

			2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output					
1	Frascati-based Output	Non-profit expenditures on R&D	10,702	"National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from National Science Foundation/DSRS; estimated by the NSF from Federal Sources and the NSF sponsored Gallop survey, Research and Development Funding and Performance by Nonprofit Organizations from 1996 and 1997.		
2	Plus expenditures for R&D in non-science and engineering	+	-	No survey data	The Frascati definition of R&D includes the Humanities and Social Sciences, this is a data source adjustment, rather than Frascati to SNA	The survey instructions for R&D Funding and Performance by Nonprofit Organizations excludes nonscience & most humanities (NSF 2003a, Appendix One).

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

				2001 Amount in millions of Current Dollars			
			Components		Data or Survey Source	Explanation of Adjustment	Comments
3	Minus expenditures by non-profits serving business	-		385	NSF(2001b)Table A-11.'These were identified in the 1996 and 1997 data, the average ratio to total respondents, not weighted total, for those years is applied here as a proxy.	Both Frascati and SNA assign the non-profits serving business to the business or corporate sector. The NSF-based numbers assign them to the non-profit sector.	These are the non-profits identified as trade associations and industrial consortiums.
4	Plus R&D purchased as an intermediate input to the production of R&D at non-profit institutions	+			No survey data	SNA-based gross output includes intermediate consumption, including the cost of any purchased R&D	The discontinued Research and Development Funding and Performance by Nonprofit Organizations survey question 3 asks for extramural S&E R&D expenditures, which includes contracts, subcontracts, and passthroughs. This is too broad for intermediate inputs.
5	Plus any drawing down of inventories	+			No survey data		Likely very small

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

			2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
6		Remove any embedded additions to gross fixed capital				
7	Minus current expenditures for non-plant machinery and equipment		-	No survey data	Uncapitalized research equipment with a useful life of more than one year is considered capital under the SNA and must be removed from current expenses.	
8	Minus software purchases and own account software developed for internal use		-	No survey data	Software is considered as investment in the SNA, thus uncapitalized expenditures for software need to be subtracted to avoid double-counting.	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

				2001 Amount in millions of Current Dollars		Explanation of Adjustment	
			Components		Data or Survey Source		Comments
9			Adjustments to move from expenditures to full value of output				
10	Minus historical cost depreciation	-			Item 1 on the NSF form for R&D at FFRDCs asks for total current fund expenditures including indirect costs; these are assumed to include depreciation charges.		
11	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		284	CFC estimate based on BEA measures of capital stocks for equipment and software, and for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	Not included in Frascati expenditures, and must be added to account for the full value of production.	
12	Plus other taxes on production less subsidies	+					
13	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
14	Gross Output			10,601			
15	II. Exports and Imports of R&D Output						

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

				2001 Amount in millions of Current Dollars			
			Components		Data or Survey Source	Explanation of Adjustment	Comments
16	Receipts for Trade in R&D Services from foreign sources	+			No survey data		No good measure, these are mixed in with other sources of funds for science and engineering R&D in question 4 of Research and Development Funding and Performance by Nonprofit Organizations.
17	Payments for trade in R&D Services to foreign performers	-			No survey data		Expenditures on the Survey of Research and Development Funding and Performance by Nonprofit Organizations question 2 include expenditures abroad as well as domestic ones.
18	Net Exports						

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 9 Non-profit Sector to Households and Non-profit Institutions Serving Households Sector

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
19	III. Gross Capital Formation						
20	Investment in structures	+		99	This is a BEA estimate for structures based on the investment to output ratio for R&D services		
21	Investment in equipment	+		606	This is a BEA estimate for equipment and software based on the investment to output ratio for R&D services		
22	Investment in software	+			No survey data		
23	net disposals	-			No survey data		likely quite small
24	Fixed Investment Subtotal						
25	Investment in inventories	+	Inventory Change		No survey data		likely quite small
26	Gross Capital Formation			705			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 10 Higher Education Sector to Non-profit Higher Education

			Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	I. Output						
1	Frascati-based Output	+	Higher Education Expenditure on R&D (HERD)	39,744	OECD, Main Science and Technology Indicators, Electronic Version (mst2004.xls, worksheet 49A-HP_RS) and "National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from National Science Foundation/Division of Science Resources Statistics. The underlying source is NSF form 411, Survey of Research and Development at Universities and Colleges.		Notes attached to the HERD expenditure data note that it excludes most or all capital expenditure.
2	Minus expenditures for Federally Funded R&D Centers administered by colleges and universities	-		6,225	"National Patterns, Table B1 "National expenditures for R&D by performing sector and source of funding: 1993-2003" from National Science Foundation/Division of Science Resources Statistics.		These expenditures are entered separately with the other FFRDCs.
3	Minus expenditures at public colleges and universities	-		23,108	Special tabulation of NSF form 411, Survey of Research and Development at Universities and Colleges	Only the private universities are assigned to the non-profit sector.	This is based on the ratios that include all passthroughs, rather than only academic passthroughs.

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 10 Higher Education Sector to Non-profit Higher Education

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
4	Plus R&D purchased as an intermediate input to the production of R&D at universities and colleges	+			no survey data	Gross output includes the cost of intermediate inputs, this entry reflects the acquisition of R&D services used in producing R&D output.	Likely quite small
5	Plus R&D in Non-Science and Engineering	+		192	Special tabulation of NSF form 411, Survey of Research and Development at Universities and Colleges	The Frascati definition of R&D includes the Humanities and Social Sciences, this is a data source adjustment, rather than Frascati to SNA	This figure is not adjusted for non-reporting, and as such is likely an undercount.
6	Plus drawing down of inventories	+			No survey data		Likely very small
7			Remove any embedded additions to gross fixed capital				
8	Minus current expenditures for equipment	-		460	Item 3j on the NSF form for R&D at Universities and Colleges, this is equipment used in Science and Engineering. Special tabulation from NSF	Uncapitalized research equipment with a useful life of more than one year is considered capital under the SNA and must be removed from current expenses.	

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 10 Higher Education Sector to Non-profit Higher Education

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
9	Minus software purchases and own account software developed for internal use	-		-	No survey data	Software is considered as investment in the SNA, thus uncapitalized expenditures for software need to be subtracted to avoid double-counting.	
10			Adjustments to move from expenditures to market price				
11	Minus historical cost depreciation	-		510	This is an NSF provided estimate from FY 1997 of depreciation and use share of indirect costs for private universities (4.9%).	This step subtracts historical-based depreciation, it will be replaced below with a current cost estimate that is consistent with the SNA.	
12	Plus Consumption of fixed capital on structures, equipment, and software owned by R&D producers and used to perform R&D performed in the US.	+		545	CFC estimate based on BEA measures of capital stocks for equipment and software, and for structures, using depreciation rates for general government (0.906 for equipment and software, 0.469 for structures)	Not included in Frascati expenditures, and must be added to account for the full value of production.	
13	Plus taxes on production less subsidies	+					
14	Plus Net Operating Surplus	+				SNA stipulates no net operating surplus for nonmarket output.	
15	Gross Output			10,178			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 10 Higher Education Sector to Non-profit Higher Education

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
16	II. Exports and Imports of R&D Output						
17	Receipts for Trade in R&D Services from foreign sources				No survey data		
18	Payments for trade in R&D Services to foreign performers				No survey data		
19	Subtotal			-			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 10 Higher Education Sector to Non-profit Higher Education

				2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
20	III. Gross Capital Formation		Components				
21	Investment in structures	+		90	No survey data, this is a BEA estimate.		
22	Investment in equipment	+		555	This is a BEA estimate for equipment and software based on the investment to output ratio for R&D services		Item 3a on the NSF form for R&D at private Universities and Colleges is 460.
23	Investment in software	+			No survey data, estimated above with equipment.		
24	net disposals	-		-	No survey data		Likely quite small
25	Fixed Investment Subtotal			645			
26	Investment in inventories	+	Inventory Change	-	No survey data		Likely quite small
27	Gross Capital Formation			645			

Draft R&D Link Tables for U.S.: Frascati-based Expenditures to SNA-based Gross Output

Table 11 Rest of World

		Components	2001 Amount in millions of Current Dollars	Data or Survey Source	Explanation of Adjustment	Comments
	Exports of R&D Services					
1		Corporations	1,065	Table 1		MNCs only
2		General Government		Table 4		No survey data
3		Households and Non-profits Serving Households		Table 8		No survey data
4	Subtotal		1,065			
	Imports of R&D Services					
5		Corporations	2,326	Table 1		MNCs only
6		General Government	440	Table 4		This is for Federal only
7		Households and Non-profits Serving Households		Table 8		No survey data
	Subtotal		2,766			
8	Net Export Total		(1,701)			