Industry-level Output Price Indexes for R&D: An Input-cost Approach with R&D Productivity Adjustment

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Abstract:

The expanding recognition of intangible assets in the production of economic output brings renewed attention to difficult measurement issues. Price and quantity measures are needed to incorporate these components of real investment in the national accounts. This paper describes the construction of industry-specific R&D price indexes that deflate nominal R&D output and investment in the absence of market prices and quantity measures. Building from a standard input cost approach we include a transparent adjustment for the unobserved productivity of the innovator. Our simple model says that the growth rate in R&D can, on average, be best understood by the growth rate in R&D inputs plus the growth rate in productivity in the conduct of R&D. The key question we face is the measure of productivity change in the production of R&D activity. Because we have very limited empirical evidence and the range of informed opinion varies very broadly, this is the most difficult question we face. We choose a broad economy-wide measure of multifactor productivity from the Bureau of Labor Statistics.

Our price indexes are relatively simple to implement for national accounts and capture variations in input types and input prices across industries. The indexes can be implemented and updated with publicly available statistical data, and build on the approach recommended by the OECD for capital intensive intangibles. We estimate that the price index for U.S. business R&D rose by 1.2 percent between 1998 and 2007; this compares to a 2.4 percent growth rate for the GDP price index.

We show experimental price indexes for five industries as well as the resulting growth rates of R&D investment for these industries based on these price indexes. These industries are pharmaceutical manufacturing, semiconductor manufacturing, motor vehicle manufacturing, computer system design and related services, and scientific R&D services. Our results show that the composition and price growth of inputs leads the growth rates of the indexes to differ by more than a percentage point. The alternative method of using a common deflator for R&D investment underestimates the growth in semiconductor-related R&D and overestimates the growth in pharmaceutical-related R&D. However, we also find that aggregate R&D investment and contributions to GDP growth are similar using either a single deflator for all business R&D or using the combined effect of separate industry R&D deflators.

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1. Introduction

R&D and other intangibles are widely understood to make a long-lasting contribution to the creation of economic output and growth. Estimating how big that contribution is, how much of that growth accrues to firms, and how much accrues to consumers are all questions of economic analysis that rely on a quantity measure of R&D output. Translating nominal expenditures into such a quantity measure in turn requires a price index for R&D output. Thus the decision to choose a particular approach to price index measurement has implications for how we understand the role of R&D in the economy. As R&D activity becomes a routinely measured component of the national capital stock, readily updatable price indexes are needed to estimate the quantity of R&D investment in the national economic accounts.

The standard method would be to base an index on the movement in market prices over time for units of R&D output. For R&D this approach is difficult for two reasons. First, prices are unobserved as most business R&D is performed for internal use. Second, the heterogeneous nature of R&D activity makes it difficult to standardize a unit of R&D output. R&D output measurement is further complicated by the different ways that economists and policy analysts define R&D output. For the purpose of measuring investment in the national economic accounts, we define R&D output as additions to the stock of productive knowledge created by systematic R&D expenditures. For businesses, this productive knowledge is used to create further output. R&D expenditures fund both valuable additions to the stock of knowledge and complete flops. The magnitude of each is based on technological opportunity, regulatory influences, demand driven conditions, managerial and entrepreneurial expertise, and innumerable other random influences. Deflated R&D expenditures are therefore broad averages.

Our goal is to estimate a market-based measure of the price of R&D to the firm, given systematic expenditure measures that are industry aggregates. Systematic R&D expenditure as a measure of R&D output is a less specific measure of R&D output than one that could be applied at the firm level for R&D projects. The firm may be able to identify and objectively measure ex post the discounted stream of revenue from a particular successful project and measure R&D output in this way. While less specific than a successful project measure, using systematic R&D expenditure is a measure of a firm's R&D output is also a more limited concept than one that accounts for *outcomes*. In addition to the value of R&D output to the firm, these outcomes could include the value to society of the extra years that a new drug may add to life expectancy, or the enhanced well-being families achieve from cell phone contact. While these outcomes are arguably some of the most important product of R&D activity, these outcomes are not priced explicitly and are a separate measurement concept. Similarly, although the spillovers from innovative knowledge are widely considered to be important sources of economic growth, national accounts do not, as a rule, explicitly measure externalities. The market-based measure of the price of R&D to the firm is one that allows R&D expenditures to be treated as additions to a quantity of R&D assets for an economic owner rather than the benefit of R&D to the economy as a whole.

This paper describes the construction of industry-specific R&D price indexes. Building from a standard input cost approach we include a transparent adjustment for unobserved productivity of the innovator. Our indexes are straightforward to implement for national accounts and capture variations in input types and input prices across industries. The indexes can be updated with publicly available statistical data, and build on the approach recommended by the Organization for Economic Cooperation and Development (OECD) for intangible capital.

The OECD has two related recommendations with respect to R&D output prices, first, that conceptually, output prices should reflect the difference between input prices and the productivity growth in the production process. Second, they recommend that input prices should be used until a consensus is reached on appropriate "pseudo output" prices.¹ Our proposed method provides both a detailed method for input prices and an example of how to derive productivity-adjusted output prices. The method can also be further simplified with the increasingly available KLEMS data on industry inputs.²

The indexes are based on industry cost weights from National Science Foundation (NSF) R&D expenditure data, wages from the Bureau of Labor Statistics (BLS) and intermediate input data from the Bureau of Economic Analysis (BEA). These cost weights are for wages for scientists and engineers, wages for support personnel, materials and supplies, current cost depreciation, and other R&D costs. These resulting input cost indexes are adjusted to account for unobserved productivity in the knowledge-creation process. For this unobserved productivity, we use BLS multifactor productivity for the non-farm business sector. This choice is based on a simple assumption that this productivity measure is a good estimate of the average of innovator productivity. Finally, we compare a data intensive approach that estimates R&D costs separately for industries with an approach that uses a common deflator for R&D performed in different industries.

We find that the weighted average of these productivity-adjusted input cost indexes for R&D grows at an average annual of 1.2 percent between 1998 and 2007. This compares to a growth rate of R&D input costs of 2.7 percent and a growth rate of the gross domestic product

¹ The Handbook on Deriving Capital Measures of Intellectual Property Products (2010) recommends that input prices be used until a consensus is reached on appropriate "pseudo output" prices. The 2008 System of National Accounts defines these pseudo output prices in paragraph 15.117.

² KLEMS stands for capital, labor, energy, materials, and purchased services.

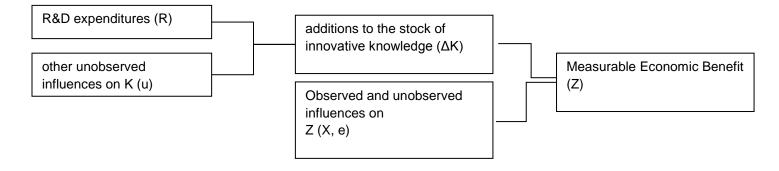
(GDP) price index of 2.4 percent over the same period. We also find that using a common deflator for the R&D of different industries matters primarily at the industry level. Not surprisingly, the use of a common deflator for R&D investment implies more rapid R&D investment growth for industries that have experienced relatively rapid increases input costs compared with an industry-specific deflator.

Sections 2 and 3 provide background information on alternative approaches to R&D price and quantity measurement. Section 4 describes the construction of R&D input cost indexes. Section 5 describes the productivity adjustment. Section 6 describes the results and a comparison to deflation of R&D with a single index. Section 7 concludes. The appendix sections are arranged in the following order: 1) a mathematical appendix on the use of a multifactor productivity adjustment; 2) a series of data tables on the price index results, real R&D investment, and the growth rate of real R&D; 3) a methodological appendix with details on the construction of the input cost indexes.

2. Background

Lacking market prices for units of R&D output or R&D characteristics, we begin with the model of knowledge production presented by Griliches (1984). In this model, research expenditures, R, combine with other unobserved factors, u, to produce an increment to knowledge capital, ΔK , which is also unobserved. This unobserved knowledge capital combines with other influences to produce a measurable benefit, Z (figure 1). The production of additional increments of knowledge capital is what we are trying to measure. However, one of the main difficulties in measuring these increments is that they can be embodied in a number of heterogeneous forms, such as recipes, blueprints, and working plans, where their values are hard to quantify.

Figure 1. The Production of Innovative Knowledge



These relationships can be expressed in the following form:

$$Z = f(\Delta K, X, e).$$

where the increment to knowledge capital, together with other factors (X, e), provides an economic benefit. This benefit can be narrowly focused, such as profits, or a broadly focused, such as social benefit associated with a higher rate of GDP growth. This benefit is sometimes measured with a proxy variable, such as patents or operating income.

The two approaches most frequently used to measure ΔK are to use upstream inputs, such as R&D expenditures or R&D employment, and to use an indicator of innovative output, such as patents or other downstream outcome measures. However, as Griliches explains, unobserved variables produce measurement errors in both approaches. Additional factors that contribute to the measurement error include uncertainty in the production of innovative knowledge and market structure.

Market structure can affect both the production of innovative knowledge and the production of downstream products. The relationship of market structure and innovation is an unsettled topic: Schumpeter (1946) holds that firms with market power innovate to maintain their dominant position. This view leads to a positive relationship between product market

concentration and innovation (1946). Alternatively, Arrow (1962) holds that competitive firms have a greater incentive to innovate because they do not have an existing product that the innovation would compete with. When the market for R&D is separate from the downstream market (R&D is not internal to the firm), the case is stronger for market power as a central element in the price of R&D. Significant price power should accrue to innovators who can create and sell a unique product.

For R&D that is performed for internal use, market structure as well as public good qualities influence price formation. Hirschleifer's (1956) view is that internal transfers should take place at market prices when a commodity can be sold in a competitive market. When a commodity is sold in an imperfectly competitive market or in a situation where no external market exists, then internal transfers should take place at a price between marginal cost and the market price. For R&D and other intangibles, nonexcludability can make it difficult to control third party use in market transactions, limiting the extent to which a firm can both sell the R&D and use it internally. In this case, the competitive market price provides a benchmark target.

3. Measuring R&D prices

Following the process shown in figure 1, four broad methods to measure R&D prices can be identified. We review them briefly in turn: 1) an output or downstream approach; 2) an inputcost or upstream approach; 3) an approach based on modeling the unobserved production of knowledge; and 4) variants that combine one or more methods.

Observable downstream approach

An implicit approach to price measurement is to use a measurement parameter of downstream output to identify the change in the unobserved quantity of knowledge created with R&D activity. The simplest implementation of this is the change in the price of all downstream

goods and services as a proxy for the unobserved price change of R&D. A quantity measure can then be calculated from nominal expenditures with this implicit price. A GDP price index is one typical measure. This approach is frequently used in international comparisons and is currently used by the National Science Foundation to create constant-dollar measures of R&D expenditures. A variation on this approach is used in the BEA's R&D satellite accounts to deflate R&D outputs. This variation assumes that the unobserved R&D price changes are equal to the price changes for downstream goods produced directly by the industries that perform R&D. Product innovation increases demand for the downstream goods, leading to a rise in the equilibrium price of the firm's downstream products. This follows when the innovator has monopoly power and can capture the price increase for downstream goods in the price of the innovation. ³

Compared with the movements of a broad GDP price index, this BEA R&D price index falls much faster due to the output price movement of R&D intensive industries. An important component of this faster falling index is the influence of hedonically-deflated semiconductor and electronic equipment industry outputs. These industries have price indexes that fall more than those of many other industries. Two limitations of this particular variation of the output approach are that it is assumes that R&D produces an incremental innovation and that the price change of R&D is the biggest influence on price change in the downstream good.

Downstream operating income is an additional measure that has been used to quantify R&D output. Aboody and Lev (2001) estimate R&D productivity at the firm level for the chemical industry and for the software industry using operating income as an indicator of ΔK . In the context of a deflator for national economic accounting, a limitation of this particular measure is

³ This approach is discussed in Copeland, Medeiros, and Robbins (2007).

that R&D productivity is calculated as a residual after adjusting for other types of intangible capital. As a result, the implied productivity measures appear to be highly sensitive to unobserved influences.

Patents are another downstream measure used as proxies for the quantity of R&D output. Patent data are used in an extensive literature that investigates the determinants of R&D on productivity measures. However, the value of patents differs widely, with many patents having very little private economic value and a small number having a large value (Lanjouw and Shankerman, 2004). As a result, compared to a simple measure of patent counts several refinements have been made to improve this approach. These refinements include the use of patent renewal data as measured through the payment of maintenance fees (Pakes and Shankerman, 1985, Pakes and Simpson, 1989), the number of claims on the patent document (Tong and Frame, 1994), the number of countries where a patent is filed or granted (OECD 2009), and patent citations (Jaffe and Trajtenberg, 2002). A limitation to this approach for a price index for business R&D in the national accounts is that these indexes are created with data that are released with a substantial lag of several years.

In addition to patents, pharmaceutical-related R&D activity has output measures in the form of new drug applications, biologics license applications, and new drug approvals.⁴ By linking the spending for R&D for the development of new drugs to the pace of new drug applications and approvals, these output measures can be used to estimate the cost of developing a new drug. By comparing the growth in R&D spending over time to the growth in these output measures, conclusions can be drawn about the rate of productivity growth for pharmaceutical-related R&D. Based on this type of evidence there has been slowing productivity in pharmaceutical R&D (see

⁴ Papers in this area include Vernon and Gusan (1974) and Berndt, Cockburn, and Grepin (2006).

for example DiMasi, 2003). Reviewing the evidence in this area, Cockburn (2006) concludes that the ratios of new drug counts to R&D expenditures suggest an apparent slowing since 1996 in approval rate for new molecular entities. The issue of quality adjustment for these outputs remains an unresolved issue.

Input-cost approach

For the national economic accounts, the use of input price change as a proxy for output price change is a standard approach when market prices are unobserved or nonexistent. Price changes of R&D inputs have been used since the early 1970s to create price indexes for R&D output. Historically, these price indexes were created to test the robustness of the more common deflator for R&D, a gross national product deflator (GNP), and to improve on it as an indicator of real R&D output. Jaffe's (1972) proposal of a weighted index based on labor compensation and the implicit price index for the nonfinancial corporate sector is early work that was endorsed by Griliches (1984) as the best that could be produced with secondary data sources.

Mansfield, Romeo, and Switzer (1983) extend the input-cost index approach using detailed cost information about company-financed R&D in the U.S. Their indexes all increase more than the GNP deflator, leading them to conclude that the use of the GNP deflator overestimated the growth over time in real R&D output. Jankowski (1990) updates the work of Mansfield, Romeo and Switzer by extending the index to annual measures of price change. Dougherty, Inklaar, McGuckin, and van Ark (2007) extend this approach across countries, finding that cross country variation in labor costs have the largest impact on relative prices for R&D.

Even though input-cost measures are commonly used, they suffer from one major shortcoming. In particular, these indexes do not allow changes in productivity to affect the real

measures of R&D output that should be measured in a set of national economic accounts. Considering the widely held view that R&D expenditures are an important source for increases in productivity, we consider more complex alternatives that model the unobserved knowledge creation process.

Unobserved knowledge creation approach

A third approach to measuring R&D prices and quantities is to model the production of unobserved innovative knowledge. Corrado, Goodridge, and Haskel (2011) do this using a twosector model to isolate an estimate of total factor productivity (*TFP*) growth in the knowledge creating sector. Using steady state assumptions that the growth in real R&D capital stock is equal to the growth rate of R&D investment assets (τs_Y^N), they model conventionally-measured TFP into two parts, one unobserved part that is attributable to the downstream industry (*Y*) and a residual that is attributable to the knowledge production process (N) :

$$\Delta lnTFP^{measured} = \Delta lnTFP^{Y} + \tau s_{Y}^{N} \Delta lnTFP^{N}$$

Since measured productivity includes the impact of both sectors, the challenge here is to estimate the unobserved productivity of the downstream industry and the capital income share of the innovation assets. With these two measures the residual can be calculated. They do this by assuming that unobserved downstream industry productivity is independent of innovation intensity at the industry level. They can then identify the productivity growth of each sector with a regression of measured productivity on R&D intensity as measured by R&D surveys:

$$\Delta lnTFP^{measured} = a + b \cdot s_{G,i,t}^{N measured} + e_{i,i}$$

Unobserved downstream industry productivity growth is estimated by a and productivity in the knowledge production process is estimated by b. As the authors note, these parameters can best be understood as the underlying trends in the two unobservable productivities. After calibrating

their results for a measure of market power in the knowledge-producing sector, their results show that R&D prices in the United Kingdom fall at an average annual rate of seven and a half percent per year from 1981 to 2005.

By this measure conventional methods of deflating R&D output substantially underestimate the growth of real R&D investment. The result is an important contribution to understanding the sources of economic growth in a growth accounting framework. With its assumption of long run equilibrium conditions, it provides a general measure of long range tendencies. However, this approach does not yield a price index that is appropriate for current period deflation in the national accounts. Specifically, a price index for the national accounts needs to account more immediately for changes in prices and productivity. A further concern with this approach is that a large component of the TFP residual is allocated to the unobserved knowledge creation process. Some of this residual clearly is due to the knowledge input used by business. However, there are other factors as well that are part of the TFP residual. In addition to spillovers from other companies' R&D, these factors include both omitted variables and measurement error. For a related discussion of the TFP residual, see Hulten (2012).

Mixed approach

Copeland and Fixler (2012) used a combination of approaches to create a price index for R&D for the specific industry devoted to scientific R&D services, classified by the North American Industrial Classification system as 5417. They used an indicator that combines an output measure in the form of growth in scientific R&D services industry patent counts and an input measure in the form of growth in scientific R&D services industry employment. By incorporating patent counts they improve on a simple input-cost price index by allowing for changes in productivity. The resulting price index rises faster than a traditional R&D input price

index. This faster rise consequently implies slower growth in the quantity of R&D output. A remaining question is whether this single index based on the scientific R&D services industry (NAICS 5417) sufficiently captures industry variation in the R&D process, since this activity can take place in many different industries.

4. Methodology for input cost indexes

Our industry-specific price indexes for R&D activity combine two of the approaches described in section 3. First, in the spirit of Mansfield and Jankowski, we create industry-specific R&D input cost indexes. In our second step, we adjust the input cost indexes to reflect the unobserved productivity changes in R&D activity using the growth rate of a broad multifactor productivity aggregate. Thus at the conceptual level there are similarities between our approach and that of Corrado, Goodridge, and Haskel. However, as we will describe, our results are substantially different.

Five-component input cost indexes

We start by creating and evaluating R&D input cost indexes for scientific R&D services, pharmaceutical manufacturing, semiconductor manufacturing, motor vehicle manufacturing, and computer system design and related services. Each industry input cost index uses a Fisher formula to combine prices and quantities for multiple goods and services into a single index. Fisher indexes are constructed by taking the geometric average of a Laspeyres and a Paasche index. Their general properties are described in more detail in BEA (2011). The particular formula we use is one that combines prices and expenditures from two adjacent time periods and is described in Copeland, Medeiros, and Robbins (2007).

We also create two multi-industry input cost indexes to make economy-wide comparisons that account for all business sector R&D. One is for all-other goods R&D and one

is for all-other services R&D. Further, because there is substantial overlap in the economic output measured as computer software-related R&D and own-account software, we use BEA's price index for custom and own-account software for computer software-related R&D.

Each industry has five cost components with a matching component price sub-index.⁵ These cost component weights and price sub-indexes are combined into industry-specific input cost indexes using a Fisher formula. The five cost component weights are based on NSF business R&D data in five basic spending categories: Wages for scientists and engineers; wages for support personnel, materials and supplies; current cost depreciation; and other R&D costs. According to NSF (2006) other R&D costs are composed of utilities, such as telephone, electricity, water, and gas; travel costs and professional dues; property taxes and other taxes (except income taxes); insurance expenses; and company overhead including: personnel, accounting, procurement and inventory, and salaries of research executives not on the payroll of the R&D organization. Table 1 shows the average expenditure shares for each category for our target industries, based on NSF data.

Industry	Wages for scientists and engineers	Wages for support personnel	Materials and supplies	Current cost depreciation	Other R&D costs
Scientific R&D Services	26.2	11.8	15.2	5.6	41.2
Computer systems design services	28.4	32.5	4.9	4.8	29.4
Pharmaceutical manufacturing	21.0	11.2	10.6	6.0	51.2
Semiconductor manufacturing	31.6	17.4	12.3	8.6	30.1
Motor vehicle and related parts	20.9	23.9	23.6	3.2	28.4
All other goods	27.1	15.6	15.2	4.7	37.4
All other services	29.8	15.8	13.5	4.6	36.3
Based on National Science Foundation	on Business R&D	survey data and F	SFA calculations		

⁵ Appendix table D shows the data sources used for the component price indexes for our approach.

The five sub- indexes that correspond to these five component weights are created with weights and price indexes from BLS and BEA. The wage sub-indexes for scientists and engineers are created using BLS average wages for three occupational categories: Computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations. The wage sub-index for R&D support personnel is created from BLS average wages for production workers. Integrating the NSF data in table 1 with the BLS wage data requires an additional explanation about these data sources.

Industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Scientific R&D services	70.0	74.9	80.0	86.0	91.2	92.3	94.5	97.9	100.0	104.9	108.5
Scientists and engineers (1)	69.3	74.1	79.0	85.0	90.0	91.0	93.0	97.4	100.0	105.0	110.0
Production workers	71.7	76.8	82.2	88.2	94.1	95.2	97.9	99.1	100.0	104.8	105.1
Computer system design services	80.4	84.3	88.5	92.9	97.6	92.7	96.8	97.9	100.0	103.6	106.4
Scientists and engineers	76.0	80.5	85.1	90.7	95.0	92.8	95.3	98.6	100.0	103.7	108.0
Production workers	84.4	87.7	91.6	94.9	100.0	92.6	98.1	97.2	100.0	103.4	105.0
Pharmaceutical manufacturing	71.4	76.8	81.7	88.5	92.2	93.3	95.8	98.1	100.0	104.0	108.6
Scientists and engineers	69.7	75.0	79.7	86.6	91.2	93.0	94.3	97.0	100.0	105.1	111.9
Production workers	74.7	80.4	85.6	92.2	94.2	93.7	98.6	100.4	100.0	101.9	102.7
Semiconductor manufacturing	75.1	79.3	83.5	88.5	93.0	92.5	93.6	96.8	100.0	103.7	107.2
Scientists and engineers	75.0	78.8	82.7	87.5	91.4	91.0	92.3	96.1	100.0	103.9	107.9
Production workers	75.4	80.1	85.0	90.4	95.9	95.3	96.0	98.0	100.0	103.4	105.9
Motor vehicle and related parts	75.4	80.1	85.0	90.4	95.9	95.3	96.0	98.0	100.0	103.4	105.9
Scientists and engineers	73.8	78.3	82.9	88.6	92.8	93.7	93.9	97.0	100.0	104.5	108.4
Production workers	76.3	81.0	86.0	91.5	96.9	97.8	98.5	99.7	100.0	103.1	105.3

Table 2 Industry Sub-Indexes Wages of Scientists and Engineers and Production Workers 2005 = 100

(1) These indexes are created using wages and employment from the broad BLS occupational categories computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations.

Table 2 shows the variation across industries in the wage sub-indexes created from the BLS data. An important point to keep in mind is that although table 1 (based on NSF data) and table 2 (based on BLS data) both show cross-industry variation in input costs, the industry categories are conceptually different. NSF and BLS use different industry classification standards that are organized either by companies (NSF) or by establishments (BLS). For BLS data along with BEA industry data and much of the Census Bureau data, industries are classified based on the activity of each establishment. The NSF data are generally classified based on the

industry to which the consolidated reporting company is assigned. Thus the cost weights in table 1 represent the combined R&D activity within the reporting firm that can take place in a combination of dedicated R&D establishments, company headquarters establishments, as well as production or testing establishments. To match this in the cost component sub-indexes we use inputs and prices from a combination of establishments.

The price indexes used for the cost components *materials and supplies*, *current cost depreciation*, and *other R&D costs* are based on BEA price indexes and described in more detail in the sections below. The resulting industry-level price indexes shown in the top panel of Appendix Table A (R&D Price Index Comparison) are industry-specific R&D price indexes for scientific R&D services; pharmaceutical manufacturing R&D; semiconductor manufacturing R&D, motor vehicle and related manufacturing R&D; and computer system design-related R&D. Each index shares a core set of sub-inputs specific to R&D activity and also includes industryspecific inputs. The next section describes the construction of the index that contains the core set of sub-inputs specific to R&D services.

Scientific R&D services

Scientific R&D services companies are engaged in conducting original research on a systematic basis to gain new knowledge and create new or significantly improved products or processes (OMB, 2002). They may sell R&D as contracted services to other firms or operate as entrepreneurs to develop, patent, and commercialize innovations. R&D services establishments may perform these activities as well as operate as auxiliaries for other units within the same company, providing specialized R&D services.

For the scientific R&D services input cost index we start with the component weights shown in Table 1 that are based on NSF business R&D survey data.⁶ The sub-indexes for each component are based on establishment data. BLS average wage data for establishments classified as scientific R&D services are used for wages for scientists and engineers and for support personnel. For materials and supplies and for other costs we use BEA annual industry data. These BEA data provides both the input expenditures used in scientific R&D services establishments of matching input prices. The source of the BEA input data on expenditures is the 2002 Business Expenditure Survey (BES) component of the quinquennial Economic Census and the Census Bureau's Annual Services Report for 2005 and beyond. The BEA input prices are based primarily on BLS producer price indexes. For current cost depreciation, a measure of capital services, we use the BEA deflator for consumption of fixed capital services for miscellaneous business and professional services (NAICS 5412OP). This is the broader industry aggregate in BEA's account in which scientific R&D services is a component.

These five components and their matching sub-indexes combine to create an input cost index. Each five-component index may be compared to a labor cost index that combines the wage costs and expenditures for the two types of labor shown in Table 1. Both the five-component Fisher input cost index and the labor cost indexes are shown for four industries in Figures 2 -6.

⁶ Scientific R&D services companies are engaged in conducting original research on a systematic basis to gain new knowledge and create new or significantly improved products or processes (OMB, 2002). These companies may sell R&D as contracted services to other firms or operate as entrepreneurs to develop, patent, and commercialize innovations. R&D services establishments can also operate as auxiliaries for other units within the same company, providing specialized R&D services.

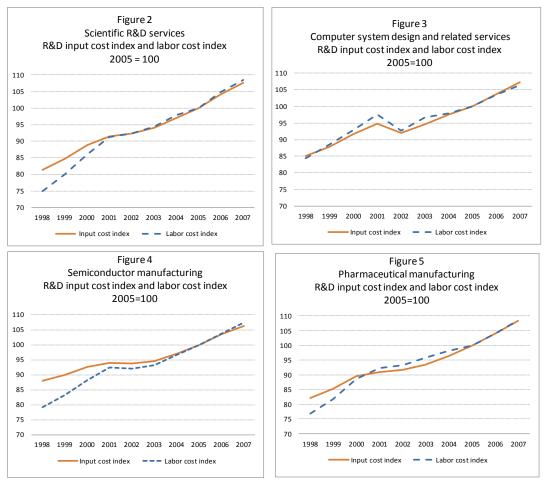
Accounting for other industry costs

One goal of our work is to understand how much difference accounting for heterogeneity in R&D input costs would make to real measures of R&D investment across industries. For pharmaceutical and medicine manufacturing-related R&D, semiconductor and other component manufacturing R&D, motor vehicles-related R&D, and computer system design and related services R&D we use industry-level information to tailor R&D inputs to costs to that industry. Our approach accounts for differences in both industries and in phases of R&D activity.

For each industry listed above we use industry-specific cost component weights from the NSF data (Table 1), labor costs from BLS, and input prices from BEA. We add another layer of complexity to the process by using the classification of R&D activity by type from the NSF data to divide each industry's R&D into basic research, applied research and experimental development phases. We vary input costs and prices based on both industry and phase of R&D activity. Basic and applied research phases are constructed with weights that are heavy in R&D and engineering inputs. Experimental development is weighted toward the inputs of the R&D performing industry.

This procedure is described in more detail in the methodology section of the appendix (page 50). The methodology section of the appendix also includes a description of the inputs used for the all other goods and all other services R&D input cost indexes (appendix table E).

The resulting R&D input cost indexes and labor cost indexes are shown in Figures 2 through 5 for scientific R&D services, semiconductor manufacturing, computer system design and related services, and pharmaceutical manufacturing, The motor vehicle R&D cost indexes are presented in the appendix tables, though not shown below.



Source: BLS

Figures 2-5: R&D Labor and Input Cost Indexes, 2005 = 100

The concern that the use of the GDP price index to create constant price measures of R&D expenditures could overestimate real R&D activity was an early motivation for the development of input price indexes for R&D (Griliches, 1984). For the period 1998-2007 our results show more rapid input price growth rates for pharmaceutical-related R&D and for scientific R&D services compared to the GDP price index. For R&D performed by other industries the growth rate of the GDP price index is quite close over the period 1998-2007 (Appendix Table A).

The growth rate of the industry-specific input price indexes ranges from an annual growth rate of 2.1 percentage points for semiconductor-related R&D to 3.2 percent for scientific R&D services. The range for labor costs alone is wider. The industry-specific labor cost index for computer system design and related services grew at an annual rate of 2.6 percentage points over the period while for pharmaceutical-related R&D the growth rate was 3.9 percentage points.

By construction the pharmaceutical-related R&D index is very similar to the scientific R&D services index. For the basic and applied research phases the weights and prices are 50 percent scientific R&D services and 50 percent pharmaceutical manufacturing. For the experimental development component of pharmaceutical and medicine manufacturing-related R&D, where clinical trials play a large role, input weights and prices from the medical and diagnostic laboratories industry are included. The resulting labor costs rise relatively faster than other costs during this period, an average annual rate of 3.8 percent for labor costs compared to 3.1 percent for all inputs.

The two cost indexes shown in Figure 5 for pharmaceutical and medicine manufacturing can be compared to the survey-based Biomedical Research and Development Price Index (BRDPI), an index created specifically to estimate inflation in the inputs to biomedical R&D that is funded by the National Institutes of Health. Between 1998 and 2007 the BRDPI index rises at an average annual rate of 3.8 percent,⁷ nearly the same as our pharmaceutical R&D index.

Input costs for computer system design-related R&D show the effect of the technology buildup in the late 1990s and the subsequent drop in 2001 associated with the dotcom industries. Compared with other industries the input costs for semiconductor-related R&D are climbing at a more moderate rate. The input cost indexes for motor vehicle related R&D are not shown in the

⁷ National Institutes of Health, 2012.

charts but are included in Table A. These costs rise at an average annual rate of 2.5 percent, just above the growth rate of the GDP price index, 2.4 percent.

5. Productivity adjustments

More than thirty years ago Griliches and Mansfield were interested in understanding whether R&D costs were rising faster than the GNP deflator. To understand the magnitude of R&D investment by industry or in an economy as a whole, this issue still has relevance. As Corrado, Goodridge, and Haskell (2011) point out, a conclusion that real R&D effort as a share of GDP is stagnating is partly determined by the deflator used. While the input cost indexes described above provide a constant price measure of R&D *inputs*, the lack of productivity adjustment clearly understates the overall growth of real R&D over time. The constant price measure we are aiming for is the innovative knowledge that is used in the production of other goods and services. We describe the intuition briefly here and in more detail in the mathematical appendix to the paper.

Our model is one of an innovator producing innovative knowledge (*N*) with a Cobb-Douglas production function. The innovator is a price-taker and sells the innovative knowledge at price P^N . With no productivity growth in the production of innovative knowledge the growth rate of P^N can be simply represented as the share-weighted growth rate of input costs, W^N . This W^N is the familiar input cost index combined with a Fisher formula as described in section 4.

With productivity growth in the production of innovative knowledge, the growth rate of input costs will exceed the growth rate in the price of innovative knowledge P^N . On average, this difference can be best understood by the growth rate in R&D input prices less the growth rate in productivity in the conduct of R&D, A^N . That is to say, a productivity-adjusted input cost index for the innovative knowledge embodied in R&D activity can be calculated as:

$$\Delta P^N = \Delta W^N - \Delta A^N$$

In the absence of measurable units of output for R&D (innovative knowledge) A^N cannot be calculated directly. What indirect approach best reflects productivity change in the production of R&D activity? Because we have very limited empirical evidence and the range of informed opinion varies very broadly, this is the most difficult question we face.

On one hand, based on recent work by Corrado, Goodridge, and Haskell (2011), the overall price of R&D falls at an average rate of 7.5 percent per year between 1985 and 2005. This implies rapid gains in R&D productivity. On the other hand, based on observable measures of output such as new drug applications and biologics license applications, R&D productivity in pharmaceutical-related R&D has been declining (DiMasi, et al, 2003).

A preferred option for adjusting R&D input costs would be a regularly updated productivity index for the scientific R&D services industry. For all the difficulty measuring appropriate output, the Bureau of Labor Statistics (BLS) does not produce one. The R&D services industry is classified as part of professional and technical services, a broad category wherein BLS produces labor productivity measures (output per hour) for tax preparation services, architectural services, engineering services, advertising agencies, and photography studios. Some of these industries are, like scientific R&D services, knowledge intensive. However, either a "standard" output project or standardized characteristics of output are necessary for prices and productivity measures that can be updated regularly. For architectural services, engineering services, and computer software publishers, these requirements are met. A fourth industry where prices and productivity are measured by BLS is outside of business and professional services but has some similar activities to R&D. This industry is medical and diagnostic labs.

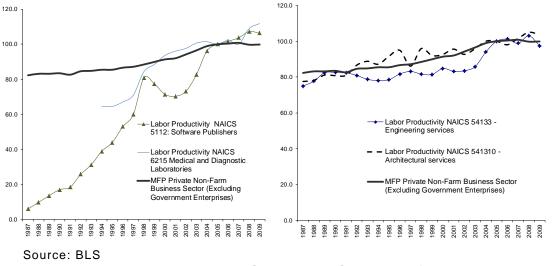


Figure 6 Productivity Indexes, 2005 = 100

While the production of innovative knowledge through R&D activity bears similarities to production in these industries, using any of these industries' productivity as a proxy for R&D productivity is a large leap. Because the productivity trends differ across these industries, the choice of any specific industry or group of industries would have a large and potentially arbitrary impact on the result.

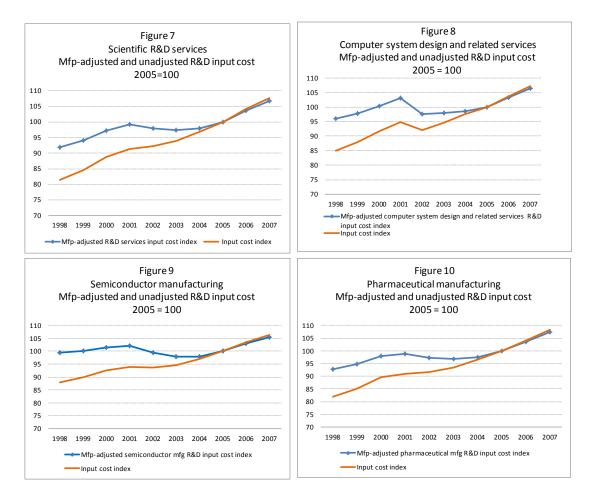
Figure 6 shows BLS labor productivity for architectural services and engineering services in the left hand panel and medical and diagnostic laboratory services as well as software publishers in the right hand panel. In each case the industry series are compared to a much broader measure: BLS's multifactor productivity index for the private non-farm business sector. In the absence of a convincing and regularly updated measure of productivity in the knowledge creation, we chose a simple measure: multifactor productivity for the private nonfarm business sector. We use this economy-wide measure of multifactor productivity as the estimate of unobserved R&D productivity for each industry-specific R&D price index. The use of this broad multifactor productivity adjustment implies that input costs for R&D vary by industry but a single measure reasonably captures the growth of R&D productivity across industries. We view this as a second best solution to industry-specific measures of R&D output and R&D productivity. The change in the price index from the base year is calculated as the change in the labor cost index minus the change in the labor productivity index, shown in Table 3. We use 2005 as the base year, where the index = 100.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Input cost index for pharmaceutical-related										
R&D activity (source: BEA, BLS, and NSF										
1 data)	82.1	85.2	89.6	91.0	91.6	93.5	96.5	100.0	104.0	108.2
2 Calculate growth rate of input cost index		3.8%	5.1%	1.6%	0.7%	2.0%	3.2%	3.6%	4.0%	4.1%
MFP index (source: BLS private non-farm										
3 business sector)		89.9	91.4	92.0	94.2	96.5	98.9	100.0	100.4	100.8
Calculate growth rate of multifactor										
4 productivity		1.7%	1.6%	0.7%	2.4%	2.4%	2.5%	1.1%	0.4%	0.4%
Adjust the growth rate of the input cost index										
to account for productivity change in the										
5 conduct of R&D activity (line 2- line 4)		2.2%	3.5%	0.9%	-1.7%	-0.4%	0.7%	2.6%	3.6%	3.7%
Convert to an index where 2005 = 100: Mfp-										
adjusted pharmaceutical mfg R&D input cost										
6 index	92.7	94.7	98.0	98.9	97.2	96.8	97.5	100.0	103.6	107.4

Table 3 Productivity Adjustment Example

6. Results

The resulting multifactor productivity (mfp)-adjusted indexes use industry-specific input cost information and an economy-wide productivity adjustment factor. They are shown in the third panel of Appendix Table A (page 42). Comparing these to simple input cost indexes (shown in Figures 2-5), we see the impact of the increase in multifactor productivity growth between 1999 and 2004 and slowing of productivity growth thereafter on each of the four indexes in Figures 7 -10.



Source: Authors' calculations

Figures 7-10 Mfp-adjusted and unadjusted R&D input cost indexes

The multifactor productivity adjustment trims the growth rate of the input cost indexes the same amount for each industry. Each of the resulting indexes grows more slowly than the GDP price index, leading to a larger quantity of innovative knowledge than would be implied by the standard procedures of either input costs or the GDP price index.

One industry-specific R&D price index that we can compare to is Copeland and Fixler (2012)'s scientific R&D services price index. Their index is constructed with an output measure that is based on 1) the growth of patent counts in fields where R&D services establishments do research and 2) the growth in scientific R&D services employment. The Copeland-Fixler index

rises at an average annual rate of 2.3 percent compared to 1.7 percent for our multifactor productivity adjusted industry-specific input cost for scientific R&D services. This faster rate of growth for the Copeland-Fixler index implies relatively slower growth of real R&D output.

The area where we view our productivity-adjusted results with caution is pharmaceutical R&D. Our productivity-adjusted input cost index implies modestly increasing productivity growth for pharmaceutical R&D. As noted earlier, analysis based on new drug applications and biologics license applications as measures of R&D output suggest recent declining R&D productivity. The decision to make the adjustment to this industry's input cost index is based on two main considerations. First, in the absence of R&D productivity measures, the single adjustment for all industries is simple and transparent. Second, the measurement of declining productivity in pharmaceutical R&D is still a subject of continued research. Although the ratios of new drug counts to R&D expenditures suggest an apparent slowing since 1996 in approval rate for new molecular entities (NMEs), both quality adjusting these counts moderates the findings (Cockburn 2006) as does the inclusion of supplementary approvals for existing products (Berndt, Cockburn, and Grepin (2006)). A conservative approach to measuring this industry's real R&D output might be to consider the unadjusted input cost index as a lower boundary measure or to take the average of an adjusted and unadjusted index.

To evaluate the impact of different deflators on each industry we calculate the industry's real R&D investment. In Appendix table B (page 43) we compare estimates of R&D investment by industry based on BEA's 2010 R&D satellite account with our indexes well as other deflation approaches. We show the alternative indexes in four categories, output-based indexes that use the price change of downstream goods, input-cost based indexes, productivity adjusted input cost indexes, and the Copeland-Fixler index that uses both patents and employment.

Industry R&D investment

One of the questions this paper aims to answer is how much difference it makes to use industry-specific R&D price indexes compared with one deflator for all R&D. The differences we are interested in include industry-level investment and contributions to GDP growth.

When R&D is deflated with industry-specific productivity-adjusted R&D price indexes, total real R&D investment grew by 4.1 percent annual rate between 1998 and 2007 (page 46). This compares to a rate of 2.8 percent over the same period deflating R&D investment with the input cost index from BEA's R&D satellite account and 5.5 percent with the aggregate output price index of the satellite account.

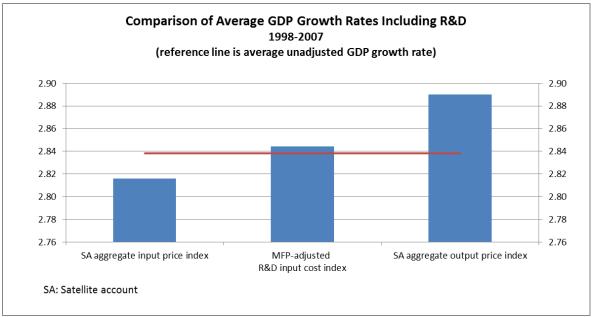
Comparing results across industries, the different impacts are greater. For semiconductorrelated R&D, real investment grows at an average annual rate of 7.5 percent between 1998-and 2007 with the industry-specific productivity adjusted index. The comparison rates for the satellite account aggregate input cost and output prices indexes are 4.8 percent and 9.0 percent, respectively.

Contributions to Growth

To calculate contributions to GDP growth using alternative indexes, we deflate all business R&D, including the R&D conducted by industries other than pharmaceutical manufacturing, semiconductor manufacturing, motor vehicle manufacturing, computer system design and related services, and scientific R&D services. For software-related R&D we simply used the BEA price index for custom and own-account software. This is an index that is also based on both input costs and productivity adjustment. For the remainder of private R&D we calculated two aggregates, all-other goods R&D and all-other services R&D. We next calculate

R&D investment and compare the results with two price indexes used in BEA's 2010 R&D satellite account, the aggregate output price index and the aggregate input price index.

Figure 11 compares the GDP growth rate impact of the mfp-adjusted price indexes with the aggregate output price index and the aggregate input cost index from BEA's 2010 update of the R&D satellite account.⁸ Using the mfp-adjusted index the average annual growth rate in GDP from 1998 and 2007 would have been 2.84 percentage points, falling between the growth rates estimated using the aggregate output price index and the aggregate input cost index. Capitalized business R&D would have contributed a 2.2 percent share of the average growth rate from 1998 to 2007, compared with 3.5 percent share with the aggregate output price index. Table 4 shows the annual growth rates and contributions to growth for these indexes.



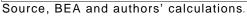


Figure 11 Average Real GDP Growth Rates Including R&D, 1998-2007

⁸ The satellite account input price index is similar but not identical to the input cost index we create in this paper. A comparison is shown in Appendix table D on page 49. For further detail on the satellite account indexes, see Copeland, Medeiros, and Robbins, 2007.

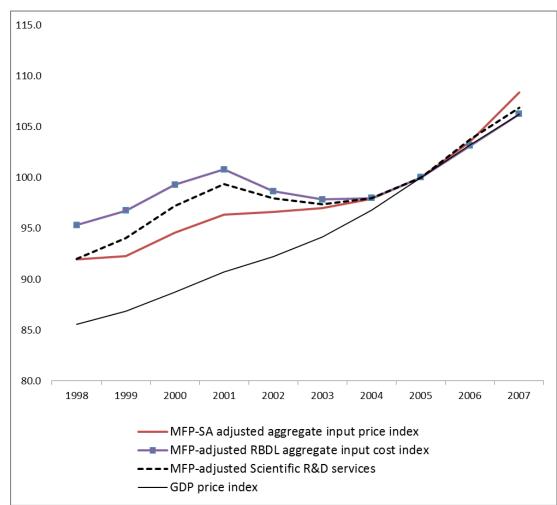
	Average 1998-									
	2007	1999	2000	2001	2002	2003	2004	2005	2006	2007
Unadjusted real GDP growth rate* [percent change]	2.84	4.83	4.14	1.08	1.81	2.49	3.57	3.05	2.67	1.95
1. SA aggregate output price index										
R&D-adjusted real GDP growth rate [percent change]	2.88	4.89	4.24	1.14	1.73	2.48	3.57	3.11	2.74	2.09
Business R&D contribution to adjusted real GDP [percentage points	0.10	0.18	0.20	0.09	-0.05	0.03	0.06	0.10	0.11	0.17
Business R&D share of adjusted real GDP growth [percent]	3.45	3.70	4.78	7.48	N/A	1.30	1.69	3.29	3.88	8.36
2. SA aggregate input price index										
R&D-adjusted real GDP growth rate	2.81	4.80	4.14	1.04	1.66	2.42	3.52	3.08	2.69	2.00
Business R&D contribution to adjusted real GDP	0.03	0.09	0.10	-0.02	-0.12	-0.03	0.01	0.07	0.06	0.09
Business R&D share of adjusted real GDP growth	0.98	1.81	2.41	N/A	N/A	N/A	0.15	2.42	2.11	4.36
3. MFP-adjusted R&D input cost index										
R&D-adjusted real GDP growth rate	2.84	4.80	4.16	1.06	1.74	2.48	3.57	3.10	2.70	2.04
Business R&D contribution to adjusted real GDP	0.06	0.09	0.12	0.00	-0.04	0.03	0.06	0.09	0.07	0.12
Business R&D share of adjusted real GDP growth	2.18	1.95	2.99	0.37	N/A	1.40	1.60	2.96	2.60	6.01
*Unadjusted real GDP growth rate reflects the vintage of the NIPAs pu SA: fron the R&D satellite account	ublished at	the tir	ne of tl	าe 201	0 R&D	satellite	accoui	nt relea	se, pric	or to

Table 4 Annual Growth Rate of Real GDP, Adjusted for R&D Investment

One index to deflate them all?

Data limitations lead to both simplifying assumptions in our index construction and the combination of company and establishment data for industries. A single mfp-adjusted index for all R&D has the obvious benefit of simplicity. We test several alternative constructions of a single index: 1) the aggregate input price index from the R&D satellite account, 2) the index of the industry-specific input cost indexes combined with a Fisher formula (referred to as RBDL to differentiate it from the satellite account index), and 3) the input cost index for scientific R&D services.

Figure 12 shows these three price indexes with the GDP price index. The aggregate input price index from the R&D satellite account and the scientific R&D services index are constructed using similar data.⁹



Source: BEA and authors' calculations

Figure 12: Comparison of Single Deflators for R&D, 2005 = 100

Compared with these two indexes the RBDL index uses a more inclusive set of industry-

specific wage and input price data.¹⁰ As Table 2 (page 16) shows, although wages for scientists

⁹ The main difference between them is the wage data used. For details, see Appendix table D.

¹⁰ This index differs from the mfp-adjusted input cost index shown in line 3 of Table 4 in the following way. That index is the aggregate of mfp-adjusted industry-specific R&D input cost indexes. The mfp-adjusted RBDL index is a single input cost index with the multifactor productivity adjustment calculated as a last step.

and engineers in the pharmaceutical manufacturing industry rise at a similar pace to that or R&D services, for scientists and engineers in the computer science, semiconductor manufacturing, and motor vehicle manufacturing, wages rise more slowly. This slower growth rate helps to account in part for the slower growth in the aggregate RBDL index shown in Figure 12. The other key difference between the indexes is the inclusion of industry-specific inputs to adjust the cost structure of R&D activity across industries. From an economy-wide perspective using a single mfp-adjusted R&D price index produces very little difference in the growth rate of real GDP across these different indexes. As Table 5 shows, the average annual growth rate of real GDP is 2.84 percentage points for the mfp-adjusted SA aggregate input price index or the mfp-adjusted R&D services index and 2.85 percentage points for the mfp-adjusted RBDL index.

	Average									
	1998-2007	1999	2000	2001	2002	2003	2004	2005	2006	200
Unadjusted real GDP growth rate* [percent change]		4.83	4.14	1.08	1.81	2.49	3.57	3.05	2.67	1.9
Mfp-adjusted SA aggregate input price index										
R&D-adjusted real GDP growth rate [percent change]	2.84	4.83	4.17	1.05	1.70	2.46	3.56	3.10	2.69	2.0
Business R&D contribution to adjusted real GDP [percentage points]	0.05	0.12	0.13	0.00	-0.08	0.02	0.05	0.09	0.06	0.0
Business R&D Share of Adjusted GDP Growth	1.88	2.41	3.10	N/A	N/A	0.62	1.34	2.98	2.36	4.7
Mfp-adjusted aggregate RBDL input cost index										
R&D-adjusted real GDP growth rate [percent change]	2.85	4.81	4.17	1.06	1.75	2.49	3.57	3.10	2.70	2.0
Business R&D contribution to adjusted real GDP [percentage points]	0.06	0.10	0.13	0.00	-0.03	0.04	0.06	0.09	0.07	0.1
Business R&D Share of Adjusted GDP Growth	2.26	1.99	3.04	0.41	N/A	1.47	1.70	3.02	2.64	6.0
Mfp-adjusted Scientific R&D Services input cost index used for all R&D										
R&D-adjusted real GDP growth rate [percent change]	2.84	4.79	4.15	1.05	1.74	2.48	3.56	3.10	2.69	2.0
Business R&D contribution to adjusted real GDP [percentage points]	0.06	0.08	0.11	-0.01	-0.05	0.03	0.05	0.09	0.06	0.1
Business R&D Share of Adjusted GDP Growth	1.98	1.71	2.74	N/A	N/A	1.34	1.47	3.01	2.25	6.0
*Unadjusted real GDP growth rate reflects the vintage of the NIPAs published at the	time of the 2010 F	R&D sate	llite acco	ount rele	ase, prio	r to the 2	011 an nu	al revisi	on.	
SA: fron the R&D satellite account										
RBDL: Robbins, Belay, Donohoe and Lee aggregate index from this paper										

Table 5: Annual Growth Rate of Real GDP, Adjusted for R&D Investment

More difference exists in the deflation approaches in the level and growth rate of R&D investment. The average growth rate of R&D investment between 1997 and 2007 is 3.7 percent when R&D is deflated with the mfp-adjusted satellite account aggregate input price index and 3.8 percent with the mfp-adjusted industry-specific R&D services index. Using the broader-

based mfp-adjusted RBDL index the growth rate of total R&D investment for the same period is slightly faster, 4.1 percent.¹¹

The substantive impact of choosing a single index to deflate R&D activity emerges for industries where labor and other input costs have a different growth rate from the single index chosen. In general, when the industry-specific R&D price index is similar to the scientific R&D services index then deflation with the more broadly-based index will result in a more slowly rising price index for R&D and faster growing real R&D investment. An example of this is pharmaceutical R&D, where the average growth rate of investment between 1998 and 2007 is about a half a percentage point higher with the aggregate RBDL index (16.8 percent) compared to any of the other productivity-adjusted indexes (16.1 to 16.3 percent).

Conversely, when the industry-specific R&D price index is either falling or rising more slowly than the aggregate index used for deflation, an aggregate index will slow the implied rate of real R&D investment. Another way to see these differences is through differences in the price indexes themselves. The table below shows each industry-specific price index relative to the mfp-adjusted RBDL index.

Mfp-adjusted aggregate RBDL* input cost index	95.3	96.7	99.3	100.8	98.7	97.8	98.0	100.0	103.1	106.2
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Pharmaceutical and medicine manufacturing	-2.7	-2.1	-1.3	-1.9	-1.5	-1.0	-0.5	0.0	0.5	1.2
Semiconductor and other electronic component manufacturing	4.2	3.3	2.2	1.3	0.9	0.1	0.0	0.0	0.0	-0.8
Motor vehicles, bodies and trailers, and parts manufacturing	0.7	0.5	0.4	0.7	1.4	0.7	0.5	0.0	0.1	-0.5
Computer systems design and related services	-3.3	-2.7	-2.1	-1.4	-0.7	-0.5	0.0	0.0	0.6	0.6
Software publishers**	-5.0	-3.5	-2.1	-2.0	-0.5	0.9	0.7	0.0	-0.9	-2.1
Scientific R&D services	-3.3	-2.7	-2.1	-1.4	-0.7	-0.5	0.0	0.0	0.6	0.6
All other goods industries	-1.0	-1.0	-0.8	-0.6	-0.3	-0.5	-0.2	0.0	0.3	0.0
All other service industries	-0.6	-1.0	-1.4	-1.6	-1.0	-0.3	-0.4	0.0	-1.2	0.1
Note: percentage point difference between an mfp-adjusted aggregate index and industry-specific indexes, where 2005 is the base year										
*RBDL is the Robbins, Belay, Donahoe, Lee index that is a Fis	her of indus	try-speci	ific Fishe	r indexes	S.					
** Software index is BEA's price index for custom and own-account software.										

Table 6: Index Numbers Comparison: Aggregate v Industry-specificpercentage point difference compared to a common index

¹¹ The annual level of real R&D investment and the growth rates are shown in Appendix Tables B and C.

7. Conclusions

For real measures of R&D as investment in national economic accounts, internationally comparable alternatives for deflating R&D activity include either the GDP price index or an input cost index that is specific to R&D activity. Neither alternative is entirely satisfying. The use of the GDP price index does not account for industry variation in R&D performance. While the input cost index captures the impact of industry-specific increasing costs, it does not allow for any productivity change in the conduct of R&D. Our approach is to adjust industry-specific R&D input costs for the unobserved productivity in the conduct of R&D-- the productivity of the innovator.

The approach that we use is a conventional perfect competition framework. While this approach enables us account for both input costs and an average measure of productivity growth, it does not allow us to incorporate the impact of increasing returns to scale and industry-level externalities. Further work developing quality-adjusted measures of R&D output will be required for these improvements.

In this paper we have done several things: constructed industry-specific input cost indexes, adjusted these indexes for productivity in the conduct of R&D, and compared the resulting growth in real R&D investment across different approaches to R&D deflators. We then compare our more complicated approach of using different deflators for industry-specific R&D with a common deflator for all R&D. While there are tradeoffs at the industry level a common deflator for all business R&D makes the estimation of the real impacts of R&D significantly simpler to estimate and integrate into measures of real investment. Additional simplifications to evaluate include the use of simple KLEMS data on inputs instead of the more complex procedure used here.

In sum, we find that at the macro level the impact on R&D investment and GDP is not substantially affected by the choice of industry-specific or aggregate deflators. Given the tradeoff between computational complexity and precision, an aggregate deflator for business R&D had substantial appeal.

The impact of choosing industry-specific or aggregate deflators shows up at the level of each industry. Since we use a single productivity adjustment for all industries, the variation across industries in the price indexes is a function of input cost variation. This variation in input costs is substantial: Our input cost index for semiconductor-related R&D rises at an average annual rate of 2.1 percent between 1997 and 2007 while our input cost index for scientific R&D services rises at a rate of 3.1 percent. The greatest difference between industry-specific and aggregate deflators shows up in industries where labor and other input costs have a different growth rate from the single index chosen. For example, when compared with an aggregate deflator constructed with inputs from many R&D performing industries, an aggregate deflator constructed with inputs costs) will tend to *underestimate* real R&D for semiconductor-related R&D. Conversely, deflating scientific R&D services activity with an aggregate deflator constructed with inputs from many R&D performing industries will tend to *overestimate* real R&D for scientific R&D services.

A. Mathematical Appendix

This section provides a theoretical justification for the input-cost based estimate used in the text. We introduce a simplified model of innovation, and show that if innovators are price-takers, then the growth in the price of the innovator's output can be derived from the growth in input costs and the marginal productivity of the inputs. We confront two measurement issues: first, the marginal productivity of inputs are usually not measured, and only average measures of productivity are available. Second, if the growth rate in prices is measured using an average of the costs of several inputs, the average of the marginal productivities must be used; however, we may only have a multifactor productivity measure available. If the innovator's production function is Cobb-Douglas, then we show that average measures of productivity may be used in place of marginal measures, and that multifactor productivity may be used in place of average marginal productivity.

Simple Model of an Innovator

Suppose we have a price-taking innovator who sells innovations at a price p. Assume he uses two inputs, K and L, and that the quantity of innovations produced, Q_T , has production function

$$Q_T = F(A, K, L) \tag{0.1}$$

A represents total factor productivity in the R&D producing industry - anything that impacts output in this industry which is not attributable to input changes. Assuming that the innovator is a price-taker, the optimal choices of K and L will be those that maximize his profits function,

$$\max_{K,L} \left\{ pF(A,K,L) - rK - wL \right\},\,$$

where w is the wage rate and r is the rental rate for capital. Taking first order conditions, the innovator's optimal choices of K and L will satisfy the following two equations:

$$pF_{\kappa}(A,K,L) \tag{0.2}$$

$$pF_L(A,K,L), (0.3)$$

where F_{κ} and F_{L} are the marginal productivities of capital and labor, respectively (equivalently, the partial derivatives of the production function with respect to capital and labor). By expressing equations (0.2) and (0.3) as growth rates, and taking the growth rate of the marginal product of capital and labor to the right side of the equation, the growth rate in the price of R&D must satisfy the following 2 equations:

$$\Delta \ln(p) = \Delta \ln(r) - \Delta \ln(F_K(A, K, L)) \tag{0.4}$$

$$\Delta \ln(p) = \Delta \ln(w) - \Delta \ln(F_L(A, K, L)).$$
(0.5)

Equations (0.4) and (0.5) provide two ways to estimate the growth rate in the R&D price: we can use the growth rate in the capital cost, and subtract off the growth in the marginal productivity of capital, or we can use the growth rate in wages, and subtract off the marginal productivity of labor. In order to use this approach, we need to observe the growth rate of the cost of at least one input, as well as the growth rate of the marginal productivity of at least one input. If the marginal productivities of the inputs are unavailable, one might try to proxy for the missing measure using the productivity growth of a different industry, or the productivity growth of a downstream industry.

Alternatively, we may also use some average of equations (0.4) and (0.5) to estimate the growth in the R&D price:

$$\Delta \ln(p) = \omega \Delta \ln(r) + (1 - \omega) \Delta \ln(w) - (\omega \Delta \ln(F_{\kappa}(A, K, L)) + (1 - \omega) \Delta \ln(F_{L}(A, K, L)))$$
(0.6)

Equation (0.6) is the weighted average of equations (0.4) and (0.5), where $\omega \in [0,1]$ is the weight applied to equation (0.4). Equation (0.6) says that the growth rate in the price of R&D can be expressed as the average growth in input prices, minus the average growth in the marginal productivities of the inputs. In practice, we might choose ω to be the cost share of capital used in R&D production.

Using Average Productivity as a Substitute for Marginal Productivity

One problem that immediately arises is that the marginal productivity of capital and labor, $F_K(A, K, L)$ and $F_L(A, K, L)$, are usually unobserved. The Bureau of Labor Statistics produces indexes that reflect the average productivity of inputs, which for labor is F(A, K, L)/L. In order to substitute average productivity for marginal productivity into equation (3), it must be the case that

$$\Delta \ln(F_{K}(A, K, L)) = \Delta \ln\left(\frac{F(A, K, L)}{K}\right)$$

$$\left(\frac{F(A, K, L)}{K}\right)$$

$$\Delta \ln(F_L(A, K, L)) = \Delta \ln\left(\frac{F(A, K, L)}{L}\right)^2$$

That is, the growth rate in the marginal product of an input must equal the growth rate of the average product. One production function that guarantees this is Cobb-Douglas. If we assume that

$$F(A, K, L) = AK^{\alpha}L^{\beta} \tag{0.7}$$

where α and β measure the output elasticities of capital and labor, then

$$F_L(A, K, L) = \beta A K^{\alpha} L^{(\beta-1)}$$
$$\frac{F(A, K, L)}{L} = A K^{\alpha} L^{(\beta-1)} \cdot$$

We assume that α and β are constant over time. Since the average productivity and the marginal productivity only differ by a constant β , the growth rate in the average productivity equals the growth rate in the marginal productivity.

Using Multifactor Productivity of the Innovator

In order to use equation (0.6) to estimate the growth in the price of R&D, we need to observe both capital and labor productivity. The BLS produces labor productivity for many industries, but capital productivity is not as readily available. In this case, we might consider using multifactor productivity of the innovator as a substitute for the average productivity. This approach is viable if production is Cobb-Douglas. To see this, we first note that the definition of multifactor productivity growth used by the BLS is a Tornqvist index:¹

$$\Delta \ln(MFP^{T}) = \Delta \ln(Q^{T}) - \Delta \ln(I^{T}). \qquad (0.8)$$

 $\Delta \ln(I^T)$ is weighted average of Tornqvist indexes for capital and labor

$$\Delta \ln(I^T) = s\Delta \ln(K) + (1-s)\Delta \ln(L),$$

¹ The Bureau of Labor Statistics' technical report located at http://www.bls.gov/mfp/mprtech.pdf explains how the agency constructs productivity indexes.

where *s* is the cost share of capital.

Using the fact that $Q^T = F(A, K, L)$ and the preceding equation, we can rewrite the index for MFP in equation (0.8) as

$$\Delta \ln(MFP^T) = \Delta \ln(F(A, K, L)) - s\Delta \ln(K) - (1-s)\Delta \ln(L).$$
(0.9)

If $\omega = s$, then the average growth in marginal productivity, which is the last term in brackets in equation (0.6), is

$$s\Delta \ln(F_{K}(A,K,L)) + (1-s)\Delta \ln(F_{L}(A,K,L))$$
. (0.10)

In general, equations (0.9) and (0.10) will not be equal. However, if the production function is Cobb-Douglas as in equation (0.7), then the two equations will be the same. To see this, notice that plugging equation (0.7) for F(A, K, L) into (0.9) gives us

$$\begin{split} \Delta \ln(F(A,K,L)) - s\Delta \ln(K) - (1-s)\Delta \ln(L) &= \Delta \ln(AK^{\alpha}L^{\beta}) - s\Delta \ln(K) - (1-s)\Delta \ln(L) \\ &= \Delta \ln(A) + \alpha\Delta \ln(K) + \beta\Delta \ln(L) - s\Delta \ln(K) - (1-s)\Delta \ln(L) \\ &= \Delta \ln(A) + (\alpha - s)\Delta \ln(K) + (\beta - (1-s))\Delta \ln(L). \end{split}$$

We can do something similar with equation (0.10). Noting that (0.7) implies that

$$F_{K}(A, K, L) = \alpha A K^{(\alpha-1)} L^{\beta}$$
$$F_{L}(A, K, L) = \beta A K^{\alpha} L^{(\beta-1)}$$

we can rewrite equation (0.10) as

$$s\Delta \ln(F_{K}(A, K, L)) + (1-s)\Delta \ln(F_{L}(A, K, L)) = s\Delta \ln(\alpha A K^{(\alpha-1)} L^{\beta}) + (1-s)\Delta \ln(\beta A K^{\alpha} L^{(\beta-1)})$$

$$= s\Delta \ln(A) + s(\alpha - 1)\Delta \ln(K) + s\beta\Delta \ln(L) + (1-s)\Delta \ln(K) + (1-s)(1-\beta)\Delta \ln(L)$$

$$= \Delta \ln(A) + (\alpha - s)\Delta \ln(K) + (\beta - (1-s))\Delta \ln(L).$$

To summarize, under Cobb-Douglas equations (0.9) and (0.10) are both equal to

$$\Delta \ln(A) + (\alpha - s) \Delta \ln(K) + (\beta - (1 - s)) \Delta \ln(L).$$

meaning that we can rewrite the price growth of R&D in equation (0.6) as

$$\Delta \ln(p) = s \Delta \ln(K) + (1 - s) \Delta \ln(L) - \Delta \ln(MFP^{T}).$$
(0.11)

Appendix Table A: R&D Price Index Comparison, 2005 = 100

Industry-specific input cost indexes for R&D	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 growth rate
Pharmaceutical and medicine manufacturing	82.1	85.2	89.6	91.0	91.6	93.5	96.5	100.0	104.0	108.2	3.1
Semiconductor and other electronic component manufacturing	88.0	89.9	92.6	93.9	93.7	93.5	97.0	100.0	104.0	106.3	2.1
Motor vehicles, bodies and trailers, and parts manufacturing	85.0	87.5	92.0	93.9	94.2	94.5	97.5	100.0	103.5	106.6	2.1
, , , , , , , , , , , , , , , , , , , ,	85.0	87.9	91.0	93.4 94.8	94.2 92.0	95.1 94.7	97.5 97.5	100.0	103.6	106.6	2.5
Computer systems design and related services	81.5	84.6	88.8	94.0 91.4	92.0	94.7 94.0	97.0	100.0	103.6	107.2	3.2
Scientific R&D services	83.5	86.2	90.0	91.4	92.3 92.7	94.0 94.0	97.0	100.0	104.1	107.1	2.8
All other goods industries	83.5	86.2	90.0 89.4	92.1	92.7	94.0 94.1	96.8 96.6	100.0	103.8	107.1	2.8
All other service industries	83.8	86.2	89.4	91.3	92.0	94.1	96.6	100.0	102.3	107.2	
											1998-2007 growth
Industry-specific labor cost indexes for R&D	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	rate
Pharmaceutical and medicine manufacturing	76.8	81.7	88.5	92.2	93.3	95.8	98.1	100.0	104.0	108.6	3.9
Semiconductor and other electronic component manufacturing	79.1	83.3	88.2	92.5	92.0	93.1	96.6	100.0	103.8	107.4	3.5
Motor vehicles, bodies and trailers, and parts manufacturing	79.8	84.5	90.2	95.0	95.9	96.3	98.4	100.0	103.7	106.7	3.3
Computer systems design and related services	84.3	88.5	92.9	97.6	92.7	96.8	97.9	100.0	103.6	106.4	2.6
Scientific R&D services	74.9	80.0	86.0	91.2	92.3	94.5	97.9	100.0	104.9	108.5	4.2
All other goods industries	78.4	83.1	88.7	93.5	94.0	94.8	97.3	100.0	103.9	107.4	3.6
All other service industries	83.2	86.4	90.3	93.0	93.4	95.8	97.4	100.0	100.8	107.0	2.8
											1998-2007
Mfp-adjusted industry-specific input cost indexes for R&D	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 growth rate
Mfp-adjusted industry-specific input cost indexes for R&D Pharmaceutical and medicine manufacturing	1998 92.7	1999 94.7	2000 98.0	2001 98.9	2002 97.2	2003 96.8	2004 97.5	2005 100.0	2006 103.6	2007 107.4	growth
											growth rate
Pharmaceutical and medicine manufacturing	92.7	94.7	98.0	98.9	97.2	96.8	97.5	100.0	103.6	107.4	growth rate 1.7
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing	92.7 99.5	94.7 100.1	98.0 101.4	98.9 102.1	97.2 99.5	96.8 97.9	97.5 98.0	100.0 100.0	103.6 103.1	107.4 105.4	growth rate 1.7 0.6
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing	92.7 99.5 96.1	94.7 100.1 97.3	98.0 101.4 99.7	98.9 102.1 101.5	97.2 99.5 100.0	96.8 97.9 98.5	97.5 98.0 98.5	100.0 100.0 100.0	103.6 103.1 103.2	107.4 105.4 105.7	growth rate 1.7 0.6 1.1
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services	92.7 99.5 96.1 92.0	94.7 100.1 97.3 94.1	98.0 101.4 99.7 97.2	98.9 102.1 101.5 99.3	97.2 99.5 100.0 98.0	96.8 97.9 98.5 97.4	97.5 98.0 98.5 98.0	100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7	107.4 105.4 105.7 106.9	growth rate 1.7 0.6 1.1 1.7
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers*	92.7 99.5 96.1 92.0 90.3	94.7 100.1 97.3 94.1 93.2	98.0 101.4 99.7 97.2 97.2	98.9 102.1 101.5 99.3 98.8	97.2 99.5 100.0 98.0 98.2	96.8 97.9 98.5 97.4 98.7	97.5 98.0 98.5 98.0 98.7	100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2	107.4 105.4 105.7 106.9 104.2	growth rate 1.7 0.6 1.1 1.7 1.6
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services	92.7 99.5 96.1 92.0 90.3 92.0	94.7 100.1 97.3 94.1 93.2 94.1	98.0 101.4 99.7 97.2 97.2 97.2	98.9 102.1 101.5 99.3 98.8 99.3	97.2 99.5 100.0 98.0 98.2 98.0	96.8 97.9 98.5 97.4 98.7 97.4	97.5 98.0 98.5 98.0 98.7 98.0	100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7	107.4 105.4 105.7 106.9 104.2 106.9	growth rate 1.7 0.6 1.1 1.7 1.6 1.7
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries	92.7 99.5 96.1 92.0 90.3 92.0 94.3	94.7 100.1 97.3 94.1 93.2 94.1 95.8	98.0 101.4 99.7 97.2 97.2 97.2 97.2 98.5	98.9 102.1 101.5 99.3 98.8 99.3 100.1	97.2 99.5 100.0 98.0 98.2 98.0 98.4	96.8 97.9 98.5 97.4 98.7 97.4 97.3	97.5 98.0 98.5 98.0 98.7 98.0 97.8	100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4	107.4 105.4 105.7 106.9 104.2 106.9 106.3	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8	98.0 101.4 99.7 97.2 97.2 97.2 98.5 97.8	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9	107.4 105.4 105.7 106.9 104.2 106.9 106.3 106.4	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1998-2007 growth
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8	98.0 101.4 99.7 97.2 97.2 97.2 97.2 98.5	98.9 102.1 101.5 99.3 98.8 99.3 100.1	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 2003	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 97.6 2004	100.0 100.0 100.0 100.0 100.0 100.0 100.0 2005	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006	107.4 105.4 105.7 106.9 104.2 106.9 106.3 106.4 2007	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1.3 1.3 1998-2007 growth rate
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 1999 95.7	98.0 101.4 99.7 97.2 97.2 97.2 98.5 97.8 97.8 2000	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 2003 97.5	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 2005 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2	107.4 105.4 105.7 106.9 104.2 106.9 106.3 106.4 2007 106.3	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1998-2007 growth
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries Aggregate price indexes for R&D Aggregate of mfp-adjusted industry-specific indexes Aggregate of industry-specific input cost indexes	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.2	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 1999 95.7 87.0	98.0 101.4 99.7 97.2 97.2 97.2 98.5 97.8 2000 98.4 90.7	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 2003	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 97.6 2004	100.0 100.0 100.0 100.0 100.0 100.0 100.0 2005	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006	107.4 105.4 105.7 106.9 104.2 106.3 106.4 2007 106.3 107.1	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1998-2007 growth rate 1.3
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries All other service industries	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.2 84.4 107.7	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 1999 95.7 87.0 104.3	98.0 101.4 99.7 97.2 97.2 97.2 97.2 97.2 97.8 97.8 2000 98.4 90.7 102.8	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7 99.9	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2 98.2 93.0 98.9	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 97.5 97.5 94.5 98.3	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9 97.0 98.5	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 2005 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2 103.5 101.1	107.4 105.4 105.7 106.9 106.9 106.3 106.4 2007 106.3 107.1 101.2	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1.3 1998-2007 growth rate 1.3 2.7 -0.7
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries Aggregate price indexes for R&D Aggregate of mfp-adjusted industry-specific indexes Aggregate of industry-specific input cost indexes SA aggregate output price index SA aggregate input price index	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.7 84.4 107.7 81.4	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 95.8 95.7 87.0 104.3 83.1	98.0 101.4 99.7 97.2 97.2 97.2 97.2 97.2 97.8 97.8 2000 98.4 90.7 102.8 86.5	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7 99.9 88.7	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2 98.2 93.0 98.9 91.1	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 97.5 97.5 94.5 98.3 93.7	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9 97.0 98.5 96.9	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2 103.5 101.1 104.0	107.4 105.4 105.7 106.9 106.9 106.3 106.4 2007 106.3 107.1 101.2 109.2	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1.3 1998-200 growth rate 1.3 2.7 -0.7 3.3
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries Aggregate price indexes for R&D Aggregate of mfp-adjusted industry-specific indexes Aggregate of industry-specific input cost indexes Sagregate output price index SA aggregate input price index Mfp-adjusted SA aggregate input price index	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.2 84.4 107.7	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 1999 95.7 87.0 104.3 83.1 92.3	98.0 101.4 99.7 97.2 97.2 97.2 97.2 97.2 97.8 97.8 2000 98.4 90.7 102.8	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7 99.9 88.7 96.4	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2 98.2 93.0 98.9	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.5 97.5 97.5 94.5 98.3	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9 97.0 98.5	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2 103.5 101.1 104.0 103.6	107.4 105.4 105.7 106.9 104.2 106.9 106.3 106.4 2007 106.3 107.1 101.2 109.2	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1.3 1998-2007 growth rate 1.3 2.7 -0.7
Pharmaceutical and medicine manufacturing Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other service industries All other service industries Aggregate price indexes for R&D Aggregate of mfp-adjusted industry-specific indexes Aggregate of industry-specific indexes SA aggregate output price index SA aggregate input price index	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.2 84.4 107.7 81.4 92.0	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 95.8 95.7 87.0 104.3 83.1	98.0 101.4 99.7 97.2 97.2 98.5 97.8 97.8 97.8 97.8 98.4 90.7 102.8 86.5 94.6	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7 99.9 88.7	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2 93.0 98.9 93.0 98.9 91.1	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.4 97.3 97.5 94.5 94.5 98.3 93.7 97.0	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9 97.0 97.9 97.0 98.5 96.9 97.9	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2 103.5 101.1 104.0	107.4 105.4 105.7 106.9 106.9 106.3 106.4 2007 106.3 107.1 101.2 109.2	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1998-2007 growth rate 1.3 2.7 -0.7 3.3 1.8
Semiconductor and other electronic component manufacturing Motor vehicles, bodies and trailers, and parts manufacturing Computer systems design and related services Software publishers* Scientific R&D services All other goods industries All other goods industries All other service industries Aggregate price indexes for R&D Aggregate of mfp-adjusted industry-specific indexes Aggregate of industry-specific input cost indexes SA aggregate output price index SA aggregate input price index Mfp-adjusted SA aggregate input price index	92.7 99.5 96.1 92.0 90.3 92.0 94.3 94.7 1998 94.2 84.4 107.7 81.4 92.0	94.7 100.1 97.3 94.1 93.2 94.1 95.8 95.8 95.8 1999 95.7 87.0 104.3 83.1 92.3	98.0 101.4 99.7 97.2 97.2 98.5 97.8 97.8 97.8 97.8 98.4 90.7 102.8 86.5 94.6	98.9 102.1 101.5 99.3 98.8 99.3 100.1 99.2 2001 99.9 92.7 99.9 88.7 96.4	97.2 99.5 100.0 98.0 98.2 98.0 98.4 97.6 2002 98.2 93.0 98.9 93.0 98.9 91.1	96.8 97.9 98.5 97.4 98.7 97.4 97.3 97.4 97.3 97.5 94.5 94.5 98.3 93.7 97.0	97.5 98.0 98.5 98.0 98.7 98.0 97.8 97.6 2004 97.9 97.0 97.9 97.0 98.5 96.9 97.9	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	103.6 103.1 103.2 103.7 102.2 103.7 103.4 101.9 2006 103.2 103.5 101.1 104.0 103.6	107.4 105.4 105.7 106.9 104.2 106.9 106.3 106.4 2007 106.3 107.1 101.2 109.2	growth rate 1.7 0.6 1.1 1.7 1.6 1.7 1.3 1.3 1998-2007 growth rate 1.3 2.7 -0.7 3.3 1.8

* Software index is BEA's price index for custom and own-account software.

**RBDL is the Robbins, Belay, Donahoe, Lee index that is a Fisher of industry-specific Fisher indexes.

Appendix Table B: Real R&D Investment by Industry (continues)

Total R&D investment, including government and non-profit R&D*	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output-price based indexes										
Down-stream product output price index	256,903	278,991	300,533	313,104	311,478	322,405	331,665	345,313	363,127	389,518
SA aggregate output price index	243,748	267,880	292,110	307,091	306,261	318,799	329,913	345,313	364,854	393,577
Input-cost based indexes										
SA aggregate input price index	293,226	311,349	327,163	331,582	322,735	328,711	333,337	345,313	358,298	374,60
Industry specific R&D input cost index	286,569	302,035	317,090	322,240	318,599	327,007	333,172	345,313	359,313	379,478
Industry specific R&D labor cost index	296,388	308,085	319,377	319,682	316,480	324,621	331,652	345,313	359,442	378,95
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	266,578	283,758	300,830	307,126	307,562	320,457	331,225	345,313	360,079	381,21
Mfp-adjusted SA aggregate input price index	270,889	290,738	308,754	314,411	310,795	321,491	331,149	345,313	359,195	376,50
Mfp-adjusted aggregate RBDL R&D input cost index	264,587	281,843	299,034	305,341	306,716	319,785	330,983	345,313	360,217	381,42
Mfp-adjusted Scientific R&D services input cost index	270,897	287,159	303,263	308,204	308,063	320,788	331,002	345,313	358,797	379,99
Copeland-Fixler Price Index	284,895	297,684	313,954	321,685	315,889	328,447	334,527	345,313	367,614	384,56
Pharmaceutical and Medicine Manufacturing (3254)	1998	1999	2000	2001	2002	2003	2004	2005	2006	200
Output-price based indexes	10				evels in Mi				40	
Down-stream product output price index	18,527	23,196	25,366 20,794	27,824 23.981	32,968 29,404	37,848	44,513	45,199 45,199	48,445	62,198
SA aggregate output price index Input-cost based indexes	13,893	18,360	20,794	23,981	∠9,404	35,184	42,934	45,199	50,270	66,620
SA aggregate input price index	18,380	23,045	24,708	27,003	31,915	36,919	43,636	45,199	48,878	61,765
Industry specific R&D input cost index	18,244	22,467	23,860	26,328	31,738	36,996	43,818	45,199	48,874	62,313
Industry specific R&D labor cost index	19,483	23,437	24,141	25,977	31,172	36,115	43,087	45,199	48,857	62,117
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	16,154	20,217	21,806	24,231	29,915	35,727	43,369	45,199	49,063	62,802
	16 000	20,749	22,598	24,869	30,088	35,652	43,187	45,199	49,067	62,24
Mfp-adjusted SA aggregate input price index	16,280									
Mfp-adjusted aggregate RBDL R&D input cost index	15,704	19,787	21,520	23,778	29,474	35,355	43,153	45,199	49,284	
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index				23,778 24,122 25,772	29,474 29,677 30,870	35,355 35,530 36,872	43,153 43,157 43,881	45,199 45,199 45,199	49,284 48,983 50,861	63,12
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344)	15,704 16,273	19,787 20,351	21,520 21,982	24,122 25,772 2001	29,677 30,870 2002	35,530 36,872 2003	43,157 43,881 2004	45,199	48,983	63,124 64,330
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes	15,704 16,273 17,596 1998	19,787 20,351 21,527 1999	21,520 21,982 23,206 2000	24,122 25,772 2001	29,677 30,870 2002 evels in Mi	35,530 36,872 2003 lions of 200	43,157 43,881 2004 05 Dollars	45,199 45,199 2005	48,983 50,861 2006	63,124 64,330 200
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index	15,704 16,273 17,596 1998 4,250	19,787 20,351 21,527 1999 5,983	21,520 21,982 23,206 2000 8,599	24,122 25,772 2001 12,554	29,677 30,870 2002 evels in Mit 13,526	35,530 36,872 2003 lions of 200 15,614	43,157 43,881 2004 05 Dollars 17,527	45,199 45,199 2005 19,211	48,983 50,861 2006 20,286	63,124 64,330 200 22,226
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index	15,704 16,273 17,596 1998	19,787 20,351 21,527 1999	21,520 21,982 23,206 2000	24,122 25,772 2001	29,677 30,870 2002 evels in Mi	35,530 36,872 2003 lions of 200	43,157 43,881 2004 05 Dollars	45,199 45,199 2005	48,983 50,861 2006	63,124 64,330 200 22,226
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes	15,704 16,273 17,596 1998 4,250	19,787 20,351 21,527 1999 5,983 10,566	21,520 21,982 23,206 2000 8,599	24,122 25,772 2001 12,554	29,677 30,870 2002 evels in Mit 13,526	35,530 36,872 2003 lions of 200 15,614	43,157 43,881 2004 05 Dollars 17,527	45,199 45,199 2005 19,211	48,983 50,861 2006 20,286	63,124 64,330 200 22,226 19,199
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index	15,704 16,273 17,596 1998 4,250 8,852	19,787 20,351 21,527 1999 5,983	21,520 21,982 23,206 2000 8,599 12,339	24,122 25,772 2001 12,554 14,791	29,677 30,870 2002 Levels in Mii 13,526 15,712	35,530 36,872 2003 lions of 200 15,614 17,194	43,157 43,881 2004 05 Dollars 17,527 18,306	45,199 45,199 2005 19,211 19,211	48,983 50,861 2006 20,286 19,244	63,12 64,330 200 22,226 19,199 17,800
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712	19,787 20,351 21,527 1999 5,983 10,566 13,263	21,520 21,982 23,206 2000 8,599 12,339 14,662	24,122 25,772 2001 12,554 14,791 16,655	29,677 30,870 2002 .evels in Mil 13,526 15,712 17,054	35,530 36,872 2003 lions of 200 15,614 17,194 18,042	43,157 43,881 2004 5 Dollars 17,527 18,306 18,605	45,199 45,199 2005 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711	63,124 64,330 2007 22,226 19,199 17,800 18,295
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Productivity-adjusted Indexes	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987	29,677 30,870 2002 evels in Mii 13,526 15,712 17,054 16,574 16,883	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742	63,12 64,330 200 22,226 19,199 17,800 18,295 18,094
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Productivity-adjusted Indexes Mfp-adjusted indexes Mfp-adjusted indexes	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376 12,499	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477	29,677 30,870 2002 .evels in Mil 13,526 15,712 17,054 16,574 16,883 15,614	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263	43,157 43,881 2004 25 Dollars 17,527 18,605 18,669 18,669 18,398	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871	63,12 64,330 200 22,226 19,199 17,800 18,295 18,094 18,439
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 14,376 12,499 13,410	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339	29,677 30,870 2002 .evels in Mii 13,526 15,712 17,054 16,574 16,883 15,614 16,077	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,423	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783	63,12 64,330 200 22,226 19,195 17,800 18,295 18,094 18,435 17,93
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Productivity-adjusted indexes Mfp-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,941	21,520 21,982 23,206 23,206 2000 8,599 12,339 14,662 13,687 14,376 14,376 12,499 13,410 12,770	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,389 14,666	29,677 30,870 2002 .evels in Mi 13,526 15,715 16,574 16,574 16,883 15,614 16,077 15,749	35,530 36,872 2003 1ions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278	43,157 43,881 2004 55 Dollars 17,527 18,805 18,589 18,695 18,899 18,899 18,398 18,413 18,399	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,787 18,783 18,786	63,12 64,330 200 22,226 19,195 17,800 18,295 18,094 18,435 17,93 18,29
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 14,376 12,499 13,410	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339	29,677 30,870 2002 .evels in Mii 13,526 15,712 17,054 16,574 16,883 15,614 16,077	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,423	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783	63,12 64,330 200 22,226 19,199 17,800 18,295 18,094 18,439 17,93 18,439 18,439 18,439 18,439
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate R&D input price index Mfp-adjusted aggregate R&D input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,200 11,011 11,941 11,387	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666	29,677 30,870 2002 evels in Min 13,526 15,712 17,054 16,574 16,674 16,674 15,614 15,614 15,749 15,858	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,263 17,278	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,876 18,866	63,495 63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,933 18,295 18,295 18,539 2007
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 11,712 9,589 10,373 10,007 10,369 11,212 1998	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999	21,520 21,982 23,206 23,206 23,206 8,599 12,339 14,662 13,687 14,376 14,376 14,376 13,449 13,410 12,770 13,045 13,771 2000	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896	29,677 30,870 2002 evels in Mi 13,526 15,712 15,712 15,614 16,574 15,614 15,614 15,614 15,614 15,858 16,495 2002 evels in Mi	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,363 18,019 2003 Ilions of 200	43,157 43,881 2004 95 Dollars 17,527 18,306 18,605 18,589 18,669 18,341 18,398 18,413 18,399 18,401 18,709 2004 95 Dollars	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 2005	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,875 18,866 18,751 19,470 2006	63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,931 18,539 18,539 2007
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D labor cost index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted specific R&D agregate input price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index	15,704 16,273 17,596 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 11,212	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166	21,520 21,982 23,206 23,206 23,206 2,320 12,339 12,339 12,339 12,339 13,662 13,662 13,662 13,645 13,771 13,771 2000 19,518	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,4666 14,878 15,896 2001 14,878	29,677 30,870 2002 evels in Min 13,526 15,712 17,054 16,574 16,683 15,614 16,677 15,749 15,858 16,495 2002 evels in Min 17,126	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 18,019 2003 lions of 200 19,380	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,669 18,669 18,398 18,401 18,398 18,401 18,709 2004 15 Dollars 17,538	45,199 45,199 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,873 18,866 18,751 19,470 2006 18,642	63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,937 18,299 18,439 18,539 18,539 18,539 18,557
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index S	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 11,712 9,589 10,373 10,007 10,369 11,212 1998	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999	21,520 21,982 23,206 23,206 23,206 8,599 12,339 14,662 13,687 14,376 14,376 14,376 13,449 13,410 12,770 13,045 13,771 2000	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896	29,677 30,870 2002 evels in Mi 13,526 15,712 15,712 15,614 16,574 15,614 15,614 15,614 15,614 15,858 16,495 2002 evels in Mi	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,363 18,019 2003 Ilions of 200	43,157 43,881 2004 95 Dollars 17,527 18,306 18,605 18,589 18,669 18,341 18,398 18,413 18,399 18,401 18,709 2004 95 Dollars	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 2005	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,875 18,866 18,751 19,470 2006	63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,931 18,539 18,539 2007
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Indexes Mfp-adjusted Indexes Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Scopeland-Fixler Price Index Scopeland-Fixler Price Index Scagergate output pri	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 90,373 10,007 10,369 11,212 1998 11,212 1998 14,688 13,628	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 14,376 14,376 13,410 12,770 13,045 13,771 2000 19,518 19,103	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 14,878 15,896	29,677 30,870 2002 evels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,614 15,858 16,495 15,858 16,495 2002 evels in Mi 17,126 17,117	35,530 36,872 2003 10,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,363 18,019 2003 18,019 19,380 19,380	43,157 43,881 2004 95 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401 18,709 2004 95 Dollars 17,538 17,746	45,199 45,199 2005 19,211 19,2	48,983 50,861 2006 20,286 19,244 18,711 18,788 18,742 18,871 18,783 18,766 18,751 19,470 2006 18,642 18,642 18,409	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,439 18,199 18,199 18,197 18,539 200 18,157 18,092
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Productivity-adjusted indexes Mfp-adjusted aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Scientific R&D services Scientific R&D services input cost index Scientific R&D services Scientific R&D services Scientific R&D services Scientific R&D services Scientific Scientific R&D services Scien	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,944 11,94	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2,000 19,518 19,518 19,103 22,699	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,676 14,878 15,896 14,878 15,896	29,677 30,870 2002 evels in Min 13,526 15,712 17,054 16,574 16,674 16,674 16,674 16,674 16,674 16,674 16,674 16,674 15,614 15,614 15,749 15,858 16,495 2002 evels in Min 17,126 17,117 17,117 18,579	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,401	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401 18,709 2004 25 Dollars 17,538 17,746 18,036	45,199 45,199 2005 19,211 19,2	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,899	63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,93 18,539 18,197 18,157 18,539 18,157 18,092 16,773
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate IRBDL R&D input cost index Mfp-adjusted SC entific R&D services input cost ind	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 23,120 21,948	21,520 21,982 23,206 8,599 12,339 12,339 12,339 12,339 12,499 13,410 12,770 13,045 13,471 13,771 13,771 13,771 13,771 13,771 13,771	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,477 15,339 14,477 15,339 14,477 15,339 14,477 17,642 17,647 19,870 18,885	29,677 30,870 13,526 13,526 15,712 17,054 16,574 16,574 16,883 15,614 16,077 15,749 15,858 16,495 2002 .evels in Mii 17,126 17,126 17,179 17,964	35,530 36,872 2003 lions of 200 15,614 17,194 17,081 18,146 17,263 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,401 19,442 20,401	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,689 18,669 18,689 18,669 18,398 18,413 18,399 18,401 18,709 2004 5 Dollars 17,538 17,746 18,036 17,924	45,199 45,199 19,211 19,212 19,24 20,52 10,5	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,742 18,743 18,783 18,866 18,751 19,470 2006 2006 18,642 18,409 17,899 17,899	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,439 18,295 18,295 18,295 18,295 18,535 18,5555 18,5555 18,5555 18,5555 18,5555 18,5555 18,5555 18,55555 18,
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index Mfp-adjusted Scientific R&D services index for R&D activity Mfp-adjusted Indexes Mfp-adjusted Scientific R&D services index Mfp-adjusted Scientific R&D services index Mfp-adjusted SA aggregate nput price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index SA aggregate output price index Input-cost based indexes SA aggregate output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index SA aggregate output price inde	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,944 11,94	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2,000 19,518 19,518 19,103 22,699	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,676 14,878 15,896 14,878 15,896	29,677 30,870 2002 evels in Min 13,526 15,712 17,054 16,574 16,674 16,674 16,674 16,674 16,674 16,674 16,674 16,674 15,614 15,614 15,749 15,858 16,495 2002 evels in Min 17,126 17,117 17,117 18,579	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,401	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401 18,709 2004 25 Dollars 17,538 17,746 18,036	45,199 45,199 2005 19,211 19,2	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,899	63,12 64,330 200 22,226 19,199 17,800 18,809 18,436 17,93 18,29 18,436 17,93 18,29 18,537 18,537 18,537 18,537 18,537 18,537 18,052 16,775 17,187
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate IRBDL R&D input cost index Mfp-adjusted SC entific R&D services input cost ind	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 23,120 21,948	21,520 21,982 23,206 8,599 12,339 12,339 12,339 12,339 12,499 13,410 12,770 13,045 13,471 13,771 13,771 13,771 13,771 13,771 13,771	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,477 15,339 14,477 15,339 14,477 15,339 14,477 17,642 17,647 19,870 18,885	29,677 30,870 2002 .evels in Mil 13,526 15,712 17,054 16,574 16,883 15,614 16,883 15,614 16,883 15,614 16,883 15,614 16,895 16,495 2002 .evels in Mil 17,126 17,126 17,127 17,964 17,264 17,649 16,923	35,530 36,872 2003 lions of 200 15,614 17,194 17,081 18,146 17,263 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,401 19,442 20,401	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,669 18,669 18,669 18,669 18,413 18,399 18,401 18,709 2004 15 Dollars 17,538 17,746 18,036 17,924 17,780	45,199 45,199 19,211 19,212 19,942 17,942 17,942 17,942	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,742 18,743 18,783 18,866 18,751 19,470 2006 2006 18,642 18,409 17,899 17,899	63,12 64,330 200 22,226 19,199 17,800 18,809 18,436 17,93 18,29 18,436 17,93 18,29 18,436 17,93 18,29 18,537 18,092 18,157 18,092 16,775 17,187 17,186 17,187 17,186
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index for R&D activity Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate Input price index SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index Mfp-adjusted SA aggregate output price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate input price index Mfp-	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,030 17,276 18,030 17,276 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 14,011 11,941 11,941 11,941 12,389 1999 19,166 18,419 23,120 21,948 22,721 21,948	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 14,376 14,377 12,499 13,410 12,770 13,045 13,771 22,000 26,699 21,568 21,578 21,578	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,666 14,878 15,896 14,666 14,878 15,896 17,612 17,647 17,647 19,870 18,8857 17,373 18,300	29,677 30,870 2002 evels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,677 15,749 15,858 16,495 16,495 16,495 2002 evels in Mi 17,126 17,117 17,964 17,157 17,964 17,519 17,649 17,519	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,263 17,278 17,278 17,278 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,099 19,843 20,099	43,157 43,881 2004 95 Dollars 17,527 18,306 18,605 18,689 18,609 18,398 18,413 18,413 18,399 18,401 18,709 2004 95 Dollars 17,538 17,746 18,036 17,924 17,788	45,199 45,199 19,211 19,212 17,942 17,942 17,942 17,942 17,942 17,942 17,942	48,983 50,861 2006 20,286 19,244 18,711 18,788 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,964 17,966	63,12 64,330 200 22,226 19,196 17,800 18,296 18,094 18,436 17,93 18,299 18,199 18,157 18,157 18,092 18,157 18,092 18,157 18,092 16,773 17,164 17,325
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Indexes SA aggregate input price index Industry specific R&D input cost index Mfp-adjusted indexes SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services index Mfp-adjusted Scientific R&D services index Mfp-adjusted indexes SA aggregate input price index Mfp-adjusted Scientific R&D services index Mfp-adjusted indexes Mfp-adjusted Scientific R&D services index Mfp-adjusted Scientific R&D services index Mfp-adjusted Scientific R&D services index Mfp-adjusted Scientific	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 10,373 10,007 10,369 11,212 1998 11,212 1998 14,688 13,628 14,688 13,628 18,030 17,276 15,970 15,286	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,941 11,947 12,389 1999 19,166 18,419 23,120 21,948 22,721 19,738 20,816	21,520 21,982 23,206 23,206 2,999 12,339 14,662 13,687 14,376 14,376 14,376 14,376 13,647 14,376 13,647 13,045 13,771 13,045 13,771 22,699 21,562 21,562 21,770 19,677 20,760 19,770	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 14,878 15,896 14,878 15,896 14,878 15,896 17,612 17,677 19,870 18,885 18,567 17,373 18,300 17,497	29,677 30,870 2002 evels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495 2002 evels in Mi 17,126 17,157 17,964 17,915 17,515	35,530 36,872 2003 10,000 f 20 15,614 17,194 18,042 17,263 17,278 17,278 17,278 17,278 17,278 17,278 17,363 18,019 2003 19,380 19,380 19,380 19,380 19,380 19,843 20,401 20,099 19,843	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401 18,709 2004 05 Dollars 17,538 17,758 17,758 17,780 17,788 17,783	45,199 45,199 19,211 19,212 19,92 1	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,871 18,871 18,871 18,871 19,470 2006 18,642 18,642 18,642 17,964 17,964 17,964 17,964	63,12: 64,330 200 22,226 19,199 17,800 18,299 18,094 18,436 17,93 18,299 18,199 18,536 18,536 18,157 18,092 18,157 18,092 18,157 18,092 18,157 18,157 18,092 16,773 17,187 16,900 17,220 17,220 17,220 17,187 17,187 16,900 17,220 17,187 17,187 16,900 17,187 17,187 16,900 17,187 17,187 16,900 17,187 16,900 17,187 16,900 17,187 16,900 17,187 16,900 17,187 16,900 16,773 16,900 16,900 17,187 16,900 17,900 16,9000 16,9000 16,9000 16,9000 16,9000 16,9000 16,9000
Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index for R&D activity Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate Input price index SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index Mfp-adjusted Indexes SA aggregate output price index Mfp-adjusted SA aggregate output price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate output price index SA aggregate output price index Mfp-adjusted SA aggregate input price index Mfp-	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,030 17,276 18,030 17,276 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 13,263 12,249 14,011 11,941 11,941 11,941 12,389 1999 19,166 18,419 23,120 21,948 22,721 21,948	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 14,376 14,377 12,499 13,410 12,770 13,045 13,771 22,000 26,699 21,568 21,578 21,578	24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,666 14,878 15,896 14,666 14,878 15,896 17,612 17,647 17,647 19,870 18,8857 17,373 18,300	29,677 30,870 2002 evels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,677 15,749 15,858 16,495 16,495 16,495 2002 evels in Mi 17,126 17,117 17,964 17,116 17,649 17,549 17,649	35,530 36,872 2003 lions of 200 15,614 17,194 18,042 17,263 17,278 17,278 17,278 17,278 17,278 17,363 18,019 2003 lions of 200 19,380 19,442 20,099 19,843 20,099	43,157 43,881 2004 95 Dollars 17,527 18,306 18,605 18,689 18,609 18,398 18,413 18,413 18,399 18,401 18,709 2004 95 Dollars 17,538 17,746 18,036 17,924 17,788	45,199 45,199 19,211 19,212 17,942 17,942 17,942 17,942 17,942 17,942	48,983 50,861 2006 20,286 19,244 18,711 18,788 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,964 17,966	63,12 64,33 200 22,226 19,199 17,800 18,299 18,094 18,439 18,199 18,53 18,299 18,19 18,53 200 18,157 18,092 18,157 18,092 16,773

SA: BEA Satellite Account RBDL: Robbins, Belay, Donahoe, and Lee version * Government and non-profit R&D deflated with input cost index

Appendix Table B Real R&D Investment by Industry (continues)

Total R&D investment, including government and non-profit R&D*	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output-price based indexes	1550	1999			2002	2005	2004		2000	200
Down-stream product output price index	256,903	278,991	300,533	313,104	311,478	322,405	331,665	345,313	363,127	389,51
SA aggregate output price index	243,748	267,880	292,110	307,091	306,261	318,799	329,913	345,313	364,854	393,57
Input-cost based indexes										
SA aggregate input price index	293,226	311,349	327,163	331,582	322,735	328,711	333,337	345,313	358,298	374,60
Industry specific R&D input cost index	286,569	302,035	317,090	322,240	318,599	327,007	333,172	345,313	359,313	379,47
Industry specific R&D labor cost index	296,388	308,085	319,377	319,682	316,480	324,621	331,652	345,313	359,442	378,95
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	266,578	283,758	300,830	307,126	307,562	320,457	331,225	345,313	360,079	381,21
Mfp-adjusted SA aggregate input price index	270,889	290,738	308,754	314,411	310,795	321,491	331,149	345,313	359,195	376,50
Mfp-adjusted aggregate RBDL R&D input cost index	264,587	281,843	299,034	305,341	306,716	319,785	330,983	345,313	360,217	381,42
Mfp-adjusted Scientific R&D services input cost index	270,897	287,159	303,263	308.204	308,063	320,788	331.002	345,313	358,797	379,99
Copeland-Fixler Price Index	284,895	297,684	313,954	321,685	315,889	328,447	334,527	345,313	367,614	384,56
Pharmaceutical and Medicine Manufacturing (3254)	1998	1999	2000	2001	2002	2003	2004	2005	2006	200
Output-price based indexes	10				Levels in Mi					
Down-stream product output price index	18,527	23,196	25,366	27,824	32,968	37,848	44,513	45,199	48,445	62,198
SA aggregate output price index Input-cost based indexes	13,893	18,360	20,794	23,981	29,404	35,184	42,934	45,199	50,270	66,620
SA aggregate input price index	18,380	23,045	24,708	27,003	31,915	36,919	43,636	45,199	48,878	61,765
Industry specific R&D input cost index	18,244	22,467	23,860	26,328	31,738	36,996	43,818	45,199	48,874	62,313
Industry specific R&D labor cost index	19,483	23,437	24,141	25,977	31,172	36,115	43,087	45,199	48,857	62,117
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	16,154	20,217	21,806	24,231	29,915	35,727	43,369	45,199	49,063	62,802
			22,598	24.869	30,088	35,652	43,187	45,199	49,067	62,24
Mfp-adjusted SA aggregate input price index	16,280	20,749		/						
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index	15,704	19,787	21,520	23,778	29,474	35,355	43,153	45,199	49,284	
Mfp-adjusted SA aggregate input price index				/	29,474 29,677 30,870	35,355 35,530 36,872	43,153 43,157 43,881	45,199 45,199 45,199	49,284 48,983 50,861	63,12
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component	15,704 16,273 17,596	19,787 20,351 21,527	21,520 21,982 23,206	23,778 24,122 25,772	29,677 30,870	35,530 36,872	43,157 43,881	45,199 45,199	48,983 50,861	63,12 64,330
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344)	15,704 16,273	19,787 20,351	21,520 21,982	23,778 24,122 25,772 2001	29,677 30,870 2002	35,530 36,872 2003	43,157 43,881 2004	45,199	48,983	63,124 64,330
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component	15,704 16,273 17,596	19,787 20,351 21,527	21,520 21,982 23,206	23,778 24,122 25,772 2001	29,677 30,870	35,530 36,872 2003	43,157 43,881 2004	45,199 45,199	48,983 50,861	63,12 64,330 200
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes	15,704 16,273 17,596 1998	19,787 20,351 21,527 1999	21,520 21,982 23,206 2000	23,778 24,122 25,772 2001	29,677 30,870 2002 Levels in Mi	35,530 36,872 2003 Ilions of 20	43,157 43,881 2004 05 Dollars	45,199 45,199 2005	48,983 50,861 2006	63,12 64,330 200 22,226
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes	15,704 16,273 17,596 1998 4,250 8,852	19,787 20,351 21,527 1999 5,983 10,566	21,520 21,982 23,206 2000 8,599 12,339	23,778 24,122 25,772 2001 12,554 14,791	29,677 30,870 2002 Levels in Mi 13,526 15,712	35,530 36,872 2003 Ilions of 200 15,614 17,194	43,157 43,881 2004 05 Dollars 17,527 18,306	45,199 45,199 2005 19,211 19,211	48,983 50,861 2006 20,286 19,244	63,124 64,330 200 22,226 19,199
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate input price index	15,704 16,273 17,596 1998 4,250 8,852 11,712	19,787 20,351 21,527 1999 5,983 10,566 13,263	21,520 21,982 23,206 2000 8,599 12,339 14,662	23,778 24,122 25,772 2001 12,554 14,791 16,655	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042	43,157 43,881 2004 05 Dollars 17,527 18,306 18,605	45,199 45,199 2005 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711	63,124 64,330 200 22,226 19,199 17,800
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687	23,778 24,122 25,772 2001 12,554 14,791 16,655 15,741	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881	43,157 43,881 2004 05 Dollars 17,527 18,306 18,605 18,589	45,199 45,199 2005 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798	63,124 64,330 200 22,226 19,199 17,800 18,295
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712	19,787 20,351 21,527 1999 5,983 10,566 13,263	21,520 21,982 23,206 2000 8,599 12,339 14,662	23,778 24,122 25,772 2001 12,554 14,791 16,655	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042	43,157 43,881 2004 05 Dollars 17,527 18,306 18,605	45,199 45,199 2005 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711	63,124 64,330 200 22,226 19,199 17,800 18,295
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate input price index SA aggregate input price index SA aggregate input price index Industry specific R&D labor cost index Industry specific R&D labor cost index Productivity-adjusted indexes	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376	23,778 24,122 25,772 2001 12,554 14,791 16,655 15,741	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883	35,530 36,872 2003 Ilions of 20 15,614 17,194 18,042 17,881 18,146	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687	23,778 24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881	43,157 43,881 2004 05 Dollars 17,527 18,306 18,605 18,589	45,199 45,199 2005 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,439
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate nupt price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770	23,778 24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,574 16,674 15,614 16,077 15,749	35,530 36,872 2003 Ilions of 20 15,614 17,194 17,881 18,146 17,263 17,423 17,278	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,643 18,399	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866	63,12 64,330 200 22,226 19,196 17,800 18,296 18,094 18,436 17,93 18,29
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045	23,778 24,122 25,772 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,466 14,477 14,477 14,666 14,878	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,749 15,858	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 18,146 17,263 17,278 17,278 17,278	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,413 18,399 18,401	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,874 18,874 18,875 18,866 18,751	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,435 17,93 18,299 18,19,
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate nupt price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted aggregate RBDL R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770	23,778 24,122 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,574 16,674 15,614 16,077 15,749	35,530 36,872 2003 Ilions of 20 15,614 17,194 17,881 18,146 17,263 17,423 17,278	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,589 18,669 18,398 18,643 18,399	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,435 17,93 18,299 18,19,
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes S Mfp-adjusted aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted Sa aggregate input price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D servic	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771	23,778 24,122 25,772 25,772 2001 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,263 17,278 17,363 18,019	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,699 18,413 18,399 18,411 18,709	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470	63,49 63,12 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,933 18,539 18,539
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted indexes Productivity-adjusted indexes Mfp-adjusted indextes SE Mfp-adjusted industry specific input cost index Mfp-adjusted specific R&D labor cost index Mfp-adjusted specific R&D labor cost index Mfp-adjusted industry specific input cost index Mfp-adjusted specific R&D agregate nout price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D service	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712	21,520 21,982 23,206 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045	23,778 24,122 25,772 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 2001	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,749 15,858 16,495 16,495	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,423 17,278 17,363 18,019 2003	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,669 18,413 18,398 18,413 18,399 18,401 18,709	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,874 18,874 18,875 18,866 18,751	63,124 64,330 2000 22,226 19,199 17,800 18,295 18,094 18,439 17,935 18,439 17,935 18,439 18,439 18,439
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted industry specific input cost index Mfp-adjusted industry specific input cost index Mfp-adjusted sA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted SA aggregate	15,704 16,273 17,596 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771	23,778 24,122 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 2001	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,749 15,749 15,858 16,495 2002 Levels in M	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,263 17,263 17,278 17,263 18,019 2003 Ilions of 200	43,157 43,881 2004 35 Dollars 17,527 18,306 18,605 18,689 18,689 18,689 18,689 18,413 18,399 18,401 18,709 2004 25 Dollars	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 2005	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,873 18,866 18,751 19,470 19,470 2006	63,124 64,330 2007 22,226 19,199 17,800 18,295 18,094 18,439 17,933 18,299 18,193 18,539 2007
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted indexes Productivity-adjusted indexes Mfp-adjusted indextes SE Mfp-adjusted industry specific input cost index Mfp-adjusted specific R&D labor cost index Mfp-adjusted specific R&D labor cost index Mfp-adjusted industry specific input cost index Mfp-adjusted specific R&D agregate nout price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D service	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389	21,520 21,982 23,206 2000 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771	23,778 24,122 25,772 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 2001	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,749 15,858 16,495 16,495	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,146 17,263 17,423 17,278 17,363 18,019 2003	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,669 18,413 18,398 18,413 18,399 18,401 18,709	45,199 45,199 2005 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211 19,211	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470	63,12- 64,330 200 22,226 19,199 17,800 18,295 18,094 18,435 17,93 18,29 18,29 18,539
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D labor cost index Mfp-adjusted indexes SA aggregate input price index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted industry specific input cost index of R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted Services input cost index So aggregate output price index So aggregate output price index So aggregate output price index SA aggregate output price index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2000 19,518 19,103	23,778 24,122 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 14,878 15,896 2001 17,612 17,647	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495 16,495 2002 Levels in Mi 17,126 17,117	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 18,042 17,263 17,423 17,278 17,363 18,019 2003 Ilions of 200 19,380 19,442	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,659 18,669 18,689 18,413 18,399 18,413 18,399 18,401 18,709 2004 55 Dollars 17,538 17,746	45,199 45,199 2005 19,211	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409	63,12- 64,330 22,226 19,199 17,800 18,295 18,094 18,439 18,439 18,439 18,439 18,536 18,536 18,536 18,157 18,092
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted industry specific input cost index Mfp-adjusted aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted sA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted saggregate RBDL R&D input cost index Mfp-adjusted saggregate RBDL R&D input cost index Mfp-adjusted SA aggregate and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 22000 19,518 19,103 22,699	23,778 24,122 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,666 14,878 15,896 14,477 15,339 14,666 14,878 15,896 2001 17,612 17,612 17,647 19,870	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,614 15,614 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579	35,530 36,872 2003 Ilions of 20 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 17,278 17,363 18,019 2003 Ilions of 20 19,380 19,442 20,401	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,605 18,605 18,605 18,605 18,609 18,609 18,609 18,413 18,399 18,413 18,399 18,413 18,709 2004 25 Dollars 17,538 17,746 18,036	45,199 45,199 2005 19,211 19,212 19,2	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,899	63,12 64,330 200 22,226 19,199 17,800 18,295 18,094 18,436 17,93 18,29 18,436 17,93 18,29 18,436 17,93 18,29 18,19 18,536 18,092 18,157 18,092 16,773
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted scare RBDL R&D input cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Scientific R&D services input cost index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index SA aggregate input pr	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 21,948	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2000 13,045 13,771 2000 19,518 19,103 22,699 21,562	23,778 24,122 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,477 15,339 14,468 15,896 2001 17,612 17,647 19,870 18,885	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,574 16,674 16,883 15,614 16,077 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579 17,964	35,530 36,872 2003 Ilions of 20 15,614 17,194 18,042 17,881 18,146 17,263 17,263 17,263 17,263 17,278 17,263 18,019 2003 Ilions of 20 19,380 19,442 20,401 20,099	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,609 18,699 18,699 18,413 18,399 18,413 18,399 18,413 18,399 18,401 18,709 2004 25 Dollars 17,538 17,746 18,036 17,924	45,199 45,199 2005 19,211 19,212 17,942 17,942 17,942	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,899 17,964	63,12 64,330 22,222 19,199 17,800 18,299 18,092 18,436 17,93 18,29 18,19 18,539 18,19 18,539 18,157 18,092 18,157 18,092 16,773 17,187
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted industry specific input cost index Mfp-adjusted specific R&D aper cost index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted Services input cost index SA aggregate output price index SA aggregate output price index SA aggregate output price index SA aggregate input price index SA aggregate input price index Industry specific R&D lapor cost index Industry specific R&D lapor cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 22000 19,518 19,103 22,699	23,778 24,122 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,666 14,878 15,896 14,477 15,339 14,666 14,878 15,896 2001 17,612 17,612 17,647 19,870	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 15,614 15,614 15,614 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579	35,530 36,872 2003 Ilions of 20 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 17,278 17,363 18,019 2003 Ilions of 20 19,380 19,442 20,401	43,157 43,881 2004 25 Dollars 17,527 18,306 18,605 18,605 18,605 18,605 18,605 18,609 18,609 18,609 18,413 18,399 18,413 18,399 18,413 18,709 2004 25 Dollars 17,538 17,746 18,036	45,199 45,199 2005 19,211 19,212 19,2	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,642 18,409 17,899	63,12 64,330 22,222 19,190 17,800 18,299 18,094 18,436 17,93 18,29 18,199 18,539 18,155 18,092 18,155 18,092 16,773 17,185
Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D input cost index Mfp-adjusted Scientific input cost index for R&D activity Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Modulaty specific R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,407	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 21,948 22,721	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2000 19,518 19,103 22,699 21,562 21,772	23,778 24,122 25,772 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 14,878 15,896 2001 17,612 17,647 19,870 18,885 18,567	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579 17,964 17,649	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 17,423 17,263 17,423 17,278 17,363 18,019 2003 Ilions of 200 19,380 19,442 20,401 20,099 19,843	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,669 18,669 18,413 18,399 18,413 18,399 18,401 18,709 18,401 18,709 2004 55 Dollars 17,538 17,746 18,036 17,924 17,760	45,199 45,199 2005 19,211 19,212 19,222 17,942 17,942 17,942	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,873 18,866 18,751 19,470 2006 18,642 18,642 18,642 18,642 18,642 17,899 17,964	63,12 64,330 22,220 19,199 17,800 18,299 18,092 18,433 17,93 18,299 18,199 18,530 18,155 18,092 18,155 18,092 16,773 17,185
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input price index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted services input price index SA aggregate output price index SA aggregate output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes SA aggregate input price index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted indexes SA aggregate input price index Mfp-adjusted indexes Mfp-adjusted indexes SA aggregate input price index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes SD against index Mfp-adjusted indexes Mfp-adjusted industry specific R&D labor cost index Mfp-ad	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,407 15,286	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,947 11,712 12,389 1999 19,166 18,419 23,120 21,948 22,721 19,738	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2,000 19,518 19,103 22,699 21,562 21,772 19,697	23,778 24,122 25,772 25,772 12,554 14,791 15,547 14,477 15,339 14,666 14,878 15,896 14,477 15,339 14,666 14,878 15,896 2001 17,612 17,612 17,647 19,870 18,885 18,8567 17,373	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,574 15,614 16,077 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579 17,964 17,964 17,649 16,923	35,530 36,872 2003 Ilions of 20 15,614 17,194 18,042 17,881 18,146 17,263 17,278 17,278 17,278 17,278 17,263 18,019 2003 Ilions of 20 19,380 19,442 20,401 20,099 19,843 19,404	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,605 18,605 18,609 18,609 18,609 18,413 18,399 18,413 18,399 18,413 18,399 18,401 18,709 2004 05 Dollars 17,538 17,746 18,036 17,924 17,738	45,199 45,199 2005 19,211 19,221 17,942 17,942 17,942 17,942	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,866 18,751 19,470 2006 18,642 18,409 17,899 17,964 17,936	63,12 64,330 22,220 19,199 17,800 18,299 18,439 18,439 18,439 18,439 18,439 18,439 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,737 17,18 16,773 17,18 17,164
Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (344) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate output price index Industry specific R&D input cost index Mfp-adjusted Scientific input cost index for R&D activity Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted Scientific R&D services input cost index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Modulaty specific R&D input cost index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,407	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 21,948 22,721	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2000 19,518 19,103 22,699 21,562 21,772	23,778 24,122 25,772 25,772 25,772 12,554 14,791 16,655 15,741 15,987 14,477 15,339 14,666 14,878 15,896 14,878 15,896 2001 17,612 17,647 19,870 18,885 18,567	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,117 18,579 17,964 17,649	35,530 36,872 2003 Ilions of 200 15,614 17,194 18,042 17,881 17,423 17,263 17,423 17,278 17,363 18,019 2003 Ilions of 200 19,380 19,442 20,401 20,099 19,843	43,157 43,881 55 Dollars 17,527 18,306 18,605 18,669 18,669 18,413 18,399 18,413 18,399 18,401 18,709 18,401 18,709 2004 55 Dollars 17,538 17,746 18,036 17,924 17,760	45,199 45,199 2005 19,211 19,212 19,222 17,942 17,942 17,942	48,983 50,861 20,286 19,244 18,711 18,798 18,742 18,871 18,871 18,873 18,866 18,751 19,470 2006 18,642 18,642 18,642 18,642 18,642 17,899 17,964	63,12 64,330 22,220 19,199 17,800 18,299 18,439 18,439 18,439 18,439 18,439 18,439 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19 18,539 18,19
Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted scientific R&D services input cost index Copeland-Fixler Price Index Semiconductor and Other Electronic Component Manufacturing (3344) Output-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Sa aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Mfp-adjusted price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D labor cost index Industry specific R&D labor cost index Mfp-adjusted indexes SA aggregate input price index Industry specific R&D labor cost index Mfp-adjusted indexes SA aggregate input price index Industry specific R&D labor cost index Mfp-adjusted SA aggregate input price index	15,704 16,273 17,596 1998 4,250 8,852 11,712 10,843 12,056 9,589 10,373 10,007 10,369 11,212 1998 14,688 13,628 18,030 17,276 18,407 	19,787 20,351 21,527 1999 5,983 10,566 13,263 12,249 13,230 11,011 11,941 11,387 11,712 12,389 1999 19,166 18,419 23,120 21,948 22,721 19,738 20,816	21,520 21,982 23,206 8,599 12,339 14,662 13,687 14,376 12,499 13,410 12,770 13,045 13,771 2000 19,518 19,103 22,699 21,562 21,772 21,562 21,772	23,778 24,122 25,772 25,772 2001 12,554 14,791 16,655 15,741 15,389 14,4666 14,878 15,896 2001 7,612 17,647 19,870 18,885 18,567 17,373 18,300	29,677 30,870 2002 Levels in Mi 13,526 15,712 17,054 16,574 16,883 15,614 16,077 15,749 15,858 16,495 2002 Levels in Mi 17,126 17,17 17,964 17,649 16,923 17,515	35,530 36,872 2003 11,614 17,194 18,042 17,881 18,146 17,263 17,263 17,263 17,263 17,263 17,263 17,263 17,263 18,019 2003 19,380 19,442 20,001 19,380 19,442 20,099 19,843 19,404 19,701	43,157 43,881 5 Dollars 17,527 18,306 18,605 18,589 18,669 18,689 18,69 17,53 17,746 17,758 17,769 17,769	45,199 45,199 2005 19,211 19,212 17,942 17,942 17,942 17,942 17,942 17,942 17,942	48,983 50,861 2006 20,286 19,244 18,711 18,798 18,742 18,871 18,783 18,871 18,783 18,871 18,783 18,742 18,771 19,470 2006 18,642 18,642 18,409 17,964 17,964 17,968	63,12 64,33 200 22,226 19,195 17,800 18,295 18,092 18,433 17,93 18,29 18,155 18,092 18,155 18,092 18,157 18,092 16,775 17,187 19,195 18,195 17,187 17

SA: BEA Satellite Account

RBDL: Robbins, Belay, Donahoe, and Lee version *government and non-profit R&D deflated with input cost indexes

Appendix Table B: Real R&D Investment by Industry (continues)

Oppopting based indexes Image: Proceeding of the Proceeding of											
Domessen product subject for the 2.070 4.035 5.625 11.200 16.67 14.312 11.421 11.621 15.244 14.116 14.116 Bod and indexes 3.084 4.977 3.084 14.010 15.244 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 15.245 </th <th>Computer Systems Design and Related Services (5415)</th> <th>1998</th> <th>1999</th> <th>2000</th> <th>2001</th> <th></th> <th>2003</th> <th></th> <th>2005</th> <th>2006</th> <th>2007</th>	Computer Systems Design and Related Services (5415)	1998	1999	2000	2001		2003		2005	2006	2007
SA aggress output picks intex 2773 3.962 5.777 11.900 16.358 14.918 14.118	· ·	2 970	4.035	5 625					13 524	14 166	14,559
Implementation Impleme											14,642
Instart specific RAD input cost index 3.515 4.722 6.747 12.541 17.727 15.460 11.520 13.541 13.831 13 Instart specific RAD inter cost index 13.544 4.648 4.567 12.500 14.501 11.500 11.600 13.524 13.544 13.541 14.511 11.601 13.544<	Input-cost based indexes										
Industry specific RAD table cost noise 3.54 4.68 6.87 17.49 15.155 11.68 13.24 13.84											13,575
Productive adjusted indexes											13,826 13,930
Mine-scientic for appendix registering up on a code for BAD parking. 3.28 4.302 6.107 11.670 15.268 11.528 15.208 11.528 15.208 11.671 15.268 11.671 15.268 11.671 15.268 11.671 15.268 15.208 <		3,344	4,000	0,007	12,100	17,443	15,155	11,002	13,324	15,050	15,350
Understand aggregate RBL RAB upta cost index 3.14 4.270 6.279 1.126 1.628 1.421 1.621 </td <td></td> <td>3,248</td> <td>4,392</td> <td>6,107</td> <td>11,970</td> <td>16,506</td> <td>15,065</td> <td>11,673</td> <td>13,524</td> <td>13,824</td> <td>13,874</td>		3,248	4,392	6,107	11,970	16,506	15,065	11,673	13,524	13,824	13,874
Messakesi Sisemire RAD services index 3.248 4.328 4.107 11.070 16.504 11.667 13.242 13.241 14 CeptaindFluik Price Network 3.512 4.646 6.447 9.718 11.654 11.666 13.624 15.24 45.44 14 Computer Software Publishers @112 1998 2001 2002 2003 2004 2005											13,681
Copeland-Fister Price Index 3.512 4.640 6.447 17.08 17.08 15.824 14.384											13,955
Opportunct based indexes Increasing and probe output price index Bits of the set of th											13,874 14,138
Opportunct based indexes Increasing and probe output price index Bits of the set of th						1					
Demonstratem product stay probe index 8.542 10.014 11.345 11.865 12.427 11.211 16.089 16.427 SA apgregate outpot prion index 8.512 10.338 12.16 13.250 13.624 16.444 16.427 16.324 16.444 16.427 16.324 16.444 16.427 16.324 16.444 16.427 16.324 16.444 16.327 16.324 16.444 16.327 16.324 16.444 16.327 16.324 16.444 16.327 16.324 16.342 16.328 16.327 16.328 16.327 17.324 17.326 16.327 16.328 16.327 17.324 17.324 17.326 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.327 16.328 16.328 16.328<	Computer Software Publishers (5112)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
SA approprint ondex 8.512 10.386 11.280						Levels in Mi	llions of 20	05 Dollars			
Input-cost based indexes 1 <td></td> <td>18,944</td>											18,944
SA aggregate input price noise 11,265 12,274 14,444 14,300 14,331 10,703 16,774 16,774 17,805 17,703 16,774 16,826 17,805 11,805 12,805 13,805 13,805 14,807 10,802<		8,513	10,336	12,156	13,250	13,664	16,228	16,494	16,497	18,405	18,943
Productivity-adjusted indexes Inc.		11 263	12 974	14 444	14 920	14 831	17 029	16 764	16 497	17 895	17,563
BEA notes for custom and own account software 10,158 11,681 12,861 13,400 13,780 16,441 16,447 16,447 14,648 16,447 14,649 14,647 13,382 16,447 16,587 15,581 36,38 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587 16,587		11,200	12,314		14,020	1,001	11,023	10,704	10,437	17,000	11,000
Imbgedgeted agregates RBQL RAD input cost index 9.623 11,140 12.88 13.188 13.688 16.307 16.572 16.497 11.934 11 Copeland-Fixter Price Index 10.782 12.119 13.586 14.240 14.345 17.007 16.687 16.497 17.934 11 Copeland-Fixter Price Index 10.782 12.119 13.586 14.240 14.345 17.007 16.687 16.697	BEA index for custom and own account software	10,158									18,412
Imbgrageted Scientific RAD services input cost index 9.72 11.457 12.851 13.328 13.701 16.388 16.802 16.477 17.934 18.935 18.935 18.935 18.935 18.935 18.935 18.935 18.935 18.935 18.935 18.935											17,700
Copeland-Pixter Price Index 10,782 12,119 13,566 14,240 14,346 17,007 16,858 16,497 18,621 18 Copeland-Pixter Price Index 10,782 12,119 13,566 14,240 14,346 17,007 16,858 16,497 18,621 18 Output-price based Indexes 7,725 6,329 10,420 10,594 8,557 7,508 8,346 5,517 6,548 5,517 6,549 5,517 6,509 9 Deversites modular price index 7,478 8,121 10,317 10,481 8,656 7,368 8,212 8,517 6,399 9 Industry specific RAD input cost index 7,478 7,970 10,049 10,178 8,492 7,346 8,115 6,155 6,176 6,115 6,178 8,497 7,456 8,115 8,497 7,456 8,117 8,409 16 6,116 6,115 6,116 6,115 6,116 6,115 7,117 9,179 9,382 8,050 7,016											18,055
Scientific RAD Services (5417) 1998 1999 2000 2011 2002 2003 2004 2005 2006 Outputprice based indexes Improved tacking upper index 7.725 8.329 10.420 10.564 8.680 7.026 8.446 8.470 8.631 9.081 7.976 7.028 8.421 8.4517 8.539 9.0 8.577 8.539 9.0 8.577 8.539 9.0 8.577 8.539 9.0 8.577 8.539 9.0 8.577 8.539 9.0 8.517 8.539 9.0 8.517 8.539 9.0 8.517 8.539 9.0 9.001 10.141 10.564 8.542 7.248 8.217 8.376 9.9 7.022 8.001 8.517 8.376 9.376 7.022 8.001 8.212 8.517 8.430 9.33 8.022 7.245 8.517 8.431 9.3 9.055 8.162 7.161 8.128 8.517 8.439 9.3 9.349 9.349 9.349											17,949 18,292
Outputpice based indexes Levels in Millions of 2005 Dollars Image: Constraint output price index 5.498 9.50 So aggregate output price index 6.663 6.470 6.663 9.300 7.508 8.548 8.517 8.549 9.50 So aggregate input price index 7.478 8.277 10.4201 8.688 7.388 8.212 8.517 8.378 9.307 7.508 8.207 8.517 8.378 9.307 10.4317 10.481 8.668 7.388 8.212 8.517 8.376 9 7.041 7.376 1.327 10.431 10.485 8.647 7.308 8.228 8.517 8.376 9 Productivity-agolific RAD barb cost index 6.624 7.312 9.438 9.653 8.162 7.168 8.128 8.517 8.439 9 Mip-adjusted Segregate RBDA RAD RAD input cost index 6.621 7.172 9.179 9.328 9.650 7.068 8.122 8.517 8.439 9 500 10.033 8.374 7.359 8.537 <t< td=""><td></td><td>10,782</td><td>12,119</td><td>13,300</td><td>14,240</td><td>14,343</td><td>17,007</td><td>10,000</td><td>10,497</td><td>10,021</td><td>10,292</td></t<>		10,782	12,119	13,300	14,240	14,343	17,007	10,000	10,497	10,021	10,292
Outputpice based indexes Levels in Millions of 2005 Dollars Image: Control Co	Colontific DPD Services (5447)	4008	1000	2000	2004	2002	2002	2004	2005	2006	2007
Downstream product output price index 7.725 8.292 10.420 10.840 7.688 8.446 8.517 8.637 8.639 Sh aggregate output price index 7.479 8.121 10.420 10.420 7.022 8.098 8.517 8.639 9 Sh aggregate input price index 7.479 8.121 10.317 10.481 8.656 7.368 8.212 8.517 8.379 9 Industry specific R&D labor cost index 7.478 7.479 6.121 10.317 7.365 8.122 8.517 8.437 9 Productivity-adjusted index se		1990	1999	2000					2005	2000	2007
SA aggregate output price index 5.663 6.470 8.683 9.002 7.976 7.022 8.080 8.517 8.630 9.303 SA aggregate input price index 7.479 8.121 10.317 10.481 8.658 7.388 8.212 5.517 8.376 9 Industry specific RAD input cost index 8.130 8.436 10.374 10.198 8.547 7.305 8.125 8.517 8.376 9 Productivy aggregate riput price index 6.130 6.578 5.968 8.162 7.116 6.128 8.517 8.423 5 Mip-adjusted Scientific RAD pert cost index 6.630 6.578 5.968 9.229 7.995 7.056 6.122 8.517 8.400 5 Mip-adjusted Scientific RAD pervices input cost index 6.630 6.578 8.968 9.032 7.059 7.056 8.259 8.517 8.400 5 All Other Goods (ACG) 1998 1999 2000 2001 2002 2003 2004 2005 2006		7.725	8.329	10.420					8.517	8,549	9,344
SA aggregate input price index 7.479 8.121 10.317 10.481 8.658 7.388 8.212 8.517 8.3371 9.3371 Industry specific RAD labor cost index 8.130 8.436 10.374 10.4033 10.173 8.5421 7.344 8.207 8.151 8.3375 9 Industry specific RAD labor cost index 8.130 8.436 10.374 10.198 8.547 7.305 8.122 8.517 8.423 9 MB-adjusted SA aggregate RDL RAD rout cost index 6.621 7.172 9.436 9.653 8.162 7.116 8.122 8.517 8.409 5 Copaland Fixler Price Index 7.160 7.586 9.690 7.061 8.229 8.517 8.731 9 All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes 71.641 72.560 80.348 80.767 77.777 77.343 86.301 93 SA aggregate input price in											9,803
Industry specific R&D labor cost index 7.476 7.970 10.493 10.173 8.542 7.344 8.207 8.517 8.376 9 Industry specific R&D labor cost index 6.624 7.342 8.157 8.376 9 Mip-adjusted agregate input price index 6.624 7.312 9.436 9.653 8.162 7.116 8.128 8.117 8.400 5 Mip-adjusted agregate RBDL R&D input cost index 6.621 7.172 9.179 9.362 6.050 7.091 8.122 8.117 8.400 5 Copeland-Fixier Price Index 7.160 7.586 9.690 10.003 8.374 7.399 8.259 8.517 8.731 9 All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 7.043 85.300 92 SA aggregate on plote index 71.041 72.580 77.174 78.646 70.355 70.627 71.714 77.343 85.301 92 10.917 71.343 8	Input-cost based indexes										
Industry specific R&D labor cost index 8,130 8,448 10,374 10,196 6,547 7,305 8,125 8,517 8,316 9 Productivity-adjusted indexes 6,624 7,312 9,436 9,653 8,162 7,116 8,128 8,517 8,440 5 Mp-adjusted Scientific R&D services input cost index 6,621 7,172 9,179 9,362 0,050 7,091 8,122 8,517 8,400 5 Copeland-Fixler Price Index 7,160 7,586 9,690 10,003 8,374 7,399 8,259 8,517 8,731 9 All Other Goods (AOG) 1998 1999 2000 2001 2002 2004 2005 2006 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2006 2005 2005 2006											9,088
Productivity-adjusted indexes n											9,216
Imp-adjusted SA aggregate ENDL price index 6.624 7.312 9.436 9.663 8.162 7.116 8.128 8.517 8.429 52 Mtp-adjusted Scientific R&D part cost index 6.320 6.973 8.986 9.229 7.995 7.0566 8.122 8.517 8.409 9 Copeland-Fixler Price Index 7.160 7.586 9.690 10.003 8.374 7.359 8.259 8.517 8.731 9 All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes 71.041 72.560 80.788 72.787 72.467 77.743 86.310 33 Induxtry specific RAD labor cost index 66.035 66.105 77.778 78.468 70.557 77.433 86.310 33 177.457 78.464 73.650 70.627 71.777 77.443 86.319 36.310 33 177.343 86.310 33 177.343 86.310 83.510 33		8,130	8,430	10,374	10,196	8,547	7,305	8,125	8,517	8,315	9,151
Mb-adjusted aggregate RBD. RAD input cost index 6,390 6,973 8,986 2,29 7,996 7,066 8,122 8,517 8,460 5 Copeland-Fixler Price Index 7,160 7,596 9,090 10,003 8,374 7,359 8,259 8,517 8,409 5 All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes 71,041 72,560 80,346 80,786 72,787 72,487 72,569 77,434 85,530 92,23 Saggregate output price index 66,093 68,105 77,777 77,785 78,648 70,355 70,627 71,715 77,343 85,530 92,27 74,943 85,530 92,27 74,343 85,391 93,91		6,624	7,312	9,436	9,653	8,162	7,116	8,128	8,517	8,423	9,159
Copeland-Fixter Price Index 7,160 7,586 9,690 10,003 8,374 7,359 8,259 8,517 8,731 9 All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes 71,041 72,680 72,487 72,595 77,343 86,300 92, 348 86,708 70,647 71,715 77,343 86,300 92, 348 86,708 70,648 70,355 70,627 71,715 77,343 86,310 93, 349,319 86, 368,105 77,178 78,648 70,355 70,627 71,715 77,343 84,310 93, 349,319 86, 310,317 36,415 73,461 72,867 77,343 84,326 88, 316 37,306 77,343 84,259 88, 316 36,415 73,067 72,361 72,343 84,358 73,067 73,438 84,358 87 30,66 74,064 72,617 72,438 84,358 88,366 76,564 70,647 72,437 <		6,390	6,973	8,986	9,229	7,995	7,056	8,122	8,517	8,460	9,343
All Other Goods (AOG) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes 71,041 72,560 80,348 80,788 72,787 72,481 84,581 83 85,516 73,652 74,109 72,581 77,343 84,587 88,956 73,661 72,681 77,343 84,587 88,956 73,652 71,311 72,256 77,343 84,587 88,956 73,652 71,311 72,256 77,343 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>9,289</td></td<>											9,289
Output-price based indexes Levels in Millions of 2005 Dollars Point Down-stream product output price index 71,041 72,560 80,348 72,787 72,487 72,559 77,343 85,930 92, SA aggregate output price index 66,093 68,105 77,178 78,648 70,355 70,267 71,715 77,343 86,300 93, Input-cost based indexes 87,443 85,485 91,705 88,559 76,362 74,109 72,887 77,343 84,299 88, Industry specific R&D input cost index 85,202 82,387 88,193 85,415 75,166 73,383 73,006 77,343 84,289 88 Productivity-adjusted industry specific index for R&D activity 77,449 76,968 83,871 81,560 74,064 73,061 72,581 77,343 84,567 88 Mhp-adjusted adgregate RBDL R&D input cost index 77,449 76,968 83,871 71,990 71,007 71,320 77,343 84,616 88 Mp-adjusted Scientific RAD services input cost inde	Copeland-Fixler Price Index	7,160	7,586	9,690	10,003	8,374	7,359	8,259	8,517	8,731	9,466
Output-price based indexes Levels in Millions of 2005 Dollars Point Down-stream product output price index 71,041 72,560 80,348 72,787 72,487 72,559 77,343 85,930 92, SA aggregate output price index 66,093 68,105 77,178 78,648 70,355 70,267 71,715 77,343 86,300 93, Input-cost based indexes 87,443 85,485 91,705 88,559 76,362 74,109 72,887 77,343 84,299 88, Industry specific R&D input cost index 85,202 82,387 88,193 85,415 75,166 73,383 73,006 77,343 84,289 88 Productivity-adjusted industry specific index for R&D activity 77,449 76,968 83,871 81,560 74,064 73,061 72,581 77,343 84,567 88 Mhp-adjusted adgregate RBDL R&D input cost index 77,449 76,968 83,871 71,990 71,007 71,320 77,343 84,616 88 Mp-adjusted Scientific RAD services input cost inde	All Other Counts (400)	4000	4000	0000	0004	0000	0000	0004	0005	0000	0007
Down-stream product output price index 71,041 72,660 80,348 80,788 72,487 73,438 84,549 88 104		1998	1999	2000					2005	2006	2007
As aggregate output price index 66,093 68,105 77,178 78,648 70,355 70,627 71,715 77,343 86,310 93, 93, 93, 93, 93, 94,100 SA aggregate input price index 87,443 85,485 91,705 88,595 76,362 74,109 72,887 77,343 86,310 93, 93,006 Industry specific R&D input cost index 85,202 82,357 88,193 85,415 75,156 73,853 73,006 77,343 84,259 88, 98,805 Mbp-adjusted industry specific R&D labor cost index for R&D activity 75,411 74,086 80,565 78,594 70,823 71,311 72,256 77,343 84,587 88 Mfp-adjusted industry specific input cost index 77,449 76,968 83,871 81,560 71,990 71,566 72,137 77,343 84,245 87 Mfp-adjusted Scientific R&D services input cost index 77,418 75,491 81,588 79,100 71,020 72,087 77,343 84,100 88 Copeland-Fixler Price Index 83,712 79,851 84,083 <td></td> <td>71 041</td> <td>72 560</td> <td>80.348</td> <td></td> <td></td> <td></td> <td></td> <td>77 343</td> <td>85 930</td> <td>92,232</td>		71 041	72 560	80.348					77 343	85 930	92,232
Input-cost based indexes Input-cost based indexes Industry specific R&D input cost index 87,443 85,485 91,705 88,559 76,362 74,109 72,887 77,343 83,919 86, Industry specific R&D input cost index 85,202 82,387 88,145 75,156 73,863 73,006 77,343 84,259 88, Industry specific R&D labor cost index 89,562 84,626 88,985 84,066 74,064 73,061 77,343 84,328 87, 84,388 87 Productivity-adjusted industry specific input cost index for R&D activity 75,411 74,086 80,585 78,594 70,823 71,311 72,266 77,343 84,587 88 Mfp-adjusted aggregate input price index 77,449 76,958 83,571 81,560 71,990 72,080 77,343 84,616 82 Mfp-adjusted Scientlific R&D services input cost index 77,418 75,491 81,588 79,108 71,097 72,080 77,343 84,616 82 Output-price Index 78,411 75,491 81,588 79,108 70,007 72											93,262
Industry specific R&D input cost index 85,202 82,357 88,193 85,415 75,156 73,853 73,006 77,343 84,259 88, 84,259 88, 98,562 84,626 88,986 84,066 74,064 73,061 72,581 77,343 84,388 87, 77,343 84,388 87, 84,388 87, 84,256 78,594 70,823 71,311 72,256 77,343 84,587 88 Mfp-adjusted industry specific input cost index for R&D activity 75,411 74,996 80,585 78,594 70,823 71,311 72,256 77,343 84,587 88 Mfp-adjusted aggregate input price index 77,449 76,968 83,871 81,580 71,990 71,556 72,137 77,343 84,610 88 Copeland-Eixler Price Index 77,441 75,397 79,871 77,981 70,077 72,080 77,343 87,324 90 Output-price based indexes 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price hase 1998 1999 2000 2001 2002 2003 20,459 <td>Input-cost based indexes</td> <td></td>	Input-cost based indexes										
Industry specific R&D labor cost index 89,562 84,626 88,985 84,066 74,064 73,061 72,581 77,343 84,388 87, 97,041 Productivity-adjusted indexes Mp-adjusted indexy specific input cost index for R&D activity 75,411 74,086 80,585 78,594 70,823 71,311 72,256 77,343 84,587 88 Mp-adjusted industry specific input cost index 77,449 76,968 83,871 81,560 71,990 71,566 72,137 77,343 84,616 88 Mp-adjusted Scientific R&D services input cost index 77,418 75,491 81,588 79,108 71,007 71,320 77,343 84,100 88 Copeland-Fixler Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 87,324 90 Output-price based indexes 84,520 73,861 74,015 73,296 77,343 87,324 90 Output-price based indexes											86,465
Productivity-adjusted indexes 74,086 80,585 78,594 70,823 71,311 72,256 77,343 84,587 88 Mip-adjusted aggregate input price index 77,449 76,968 83,871 81,560 71,990 71,566 72,137 77,343 84,245 87 Mip-adjusted aggregate RBDL R&D input cost index 77,417 73,397 79,871 77,981 70,950 71,320 72,087 77,343 84,265 88 Mip-adjusted Scientific R&D services input cost index 77,418 75,491 81,588 79,108 71,007 71,320 72,087 77,343 84,100 88 Copeland-Fixier Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 87,324 90 Output-price based indexes 74,015 73,296 77,343 87,324 90 Output-price based indexes											88,144
Mfp-adjusted industry specific input cost index for R&D activity 75,411 74,086 80,585 78,594 70,823 71,311 72,256 77,343 84,587 88 Mfp-adjusted SA aggregate input price index 77,449 76,968 83,871 81,560 71,990 71,566 72,137 77,343 84,245 87 Mfp-adjusted aggregate RBDL R&D input cost index 74,711 73,397 79,871 77,981 70,521 70,970 72,080 77,343 84,616 88 Copeland-Fixler Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 84,616 88 All Other Services (AOS) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Coupt-price based indexes 79,853 34,063 29,248 29,559 19,857 20,459 22,835 23,040 24 Down-stream product output price index 21,549 25,524 28,700 22,570 19,319 20,102 22,835 23,040 24 34,083 29,248		03,302	04,020	00,900	04,000	/ 4,004	13,001	12,001	11,343	04,300	87,995
Mfp-adjusted SA aggregate input price index 77,449 76,968 83,871 81,560 71,990 71,566 72,137 77,343 84,245 837 Mfp-adjusted aggregate RBDL R&D input cost index 74,711 73,397 79,871 77,981 70,521 70,970 72,080 77,343 84,616 88 Mfp-adjusted Scientific R&D services input cost index 77,418 75,491 81,588 79,108 71,007 71,320 72,087 77,343 84,100 88 Copeland-Fixler Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 87,324 90 Output-price based indexes		75,411	74,086	80,585	78,594	70,823	71,311	72,256	77,343	84,587	88,839
Mip-adjusted aggregate RBDL R&D input cost index 74,711 73,397 79,871 77,981 70,521 70,970 72,080 77,343 84,616 88 Mip-adjusted Scientific R&D services input cost index 77,418 75,491 81,588 79,108 71,007 71,320 72,087 77,343 84,100 88 Copeland-Fixler Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 87,324 90 All Other Services (AOS) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes Levels in Millions of 2005 Dollars 30,402 24,853 23,040 24,853 23,040 24,853 23,040 24,853 23,040 24,853 23,040 24,853 23,047 25,853 23,040 24,853 23,040 24,853 23,040 24,853 23,040 24,853 23,040 24,853 23,040											87,140
Copeland-Fixler Price Index 83,712 79,853 86,130 84,520 73,861 74,015 73,296 77,343 87,324 90 All Other Services (AOS) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes Levels in Millions of 2005 Dollars Levels in Millions of 2005 Dollars		74,711	73,397	79,871	77,981	70,521	70,970	72,080	77,343	84,616	88,886
All Other Services (AOS) 1998 1999 2000 2001 2002 2003 2004 2005 2006 Output-price based indexes Levels in Millions of 2005 Dollars 20,859 20,859 20,859 22,835 23,040 24,359 24,829 22,959 19,857 20,459 22,835 23,047 25 100 18,411 19,778 22,835 23,047 25 101 20,500 18,411 19,778 22,835 23,047 25 10,9319 20,102 22,835 23,049 23,049 28,050 22,250 19,319 20,102 22,835 23,089 23 1ndustry specific R&D labor cost index 27,757 30,882 32,940 28,050 22,651 14,414 20,145 22,835 23,441<	Mfp-adjusted Scientific R&D services input cost index	77,418	75,491	81,588	79,108	71,007	71,320	72,087	77,343	84,100	88,368
Dutput-price based indexes Levels in Millions of 2005 Dollars Polyation Down-stream product output price index 28,258 31,832 34,083 29,248 22,959 19,857 20,459 22,835 23,040 24, SA aggregate output price index 21,549 25,524 28,710 20,500 18,411 19,778 22,835 23,040 24, SA aggregate input price index 21,549 25,524 28,740 25,710 20,500 18,411 19,778 22,835 23,040 24, SA aggregate input price index 28,550 32,037 34,149 28,950 22,250 19,319 20,102 22,835 23,089 23, Industry specific R&D labor cost index 27,757 30,882 32,940 28,029 21,969 19,241 20,145 22,835 23,2841 24, Productivity-adjusted indexes 28,592 31,287 32,925 27,551 21,649 18,676 20,014 22,835 23,376 24 Mp-adjusted indexes 28,592 37,287 30,100 25,793 20,704 18,578 19,938 22,835 23,376	Copeland-Fixler Price Index	83,712	79,853	86,130	84,520	73,861	74,015	73,296	77,343	87,324	90,055
Output-price based indexes Levels in Millions of 2005 Dollars Polynom-stream product output price index 28,258 31,832 34,083 29,248 22,959 19,857 20,459 22,835 23,040 24, 24, 24,257 SA aggregate output price index 21,549 25,524 28,740 25,710 20,500 18,411 19,778 22,835 23,040 24, 24,354 Input-cost based indexes 0											
Down-stream product output price index 28,258 31,832 34,083 29,248 22,959 19,857 20,459 22,835 23,040 24, 24,SA aggregate output price index 21,549 25,524 28,740 25,710 20,500 18,411 19,778 22,835 23,040 24, 24,571 25,710 20,500 18,411 19,778 22,835 23,747 25, 25,252 Input-cost based indexes 28,510 32,037 34,149 28,950 22,250 19,319 20,102 22,835 23,089 23, 23,089 23, 23,089 23, 24,029 21,969 19,241 20,145 22,835 23,285 24, 24,855 23,285 24, 10,0157 29,835 23,285 24, 10,0157 20,145 22,835 23,285 24, 10,0157 20,145 22,835 23,285 24, 10,0157 20,011 22,835 23,285 24,341 24, Productivity-adjusted indexes 28,592 31,287 32,925 27,551 21,649 18,967 20,011 22,835		1998	1999					2004	2005	2006	2007
SA aggregate output price index 21,549 25,524 28,740 25,710 20,500 18,411 19,778 22,835 23,747 25 Input-cost based indexes 28,510 32,037 34,149 28,950 22,250 19,319 20,102 22,835 23,747 25 Industry specific R&D input cost index 28,510 32,037 34,149 28,950 22,250 19,319 20,102 22,835 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,285 23,244 24 Industry specific R&D labor cost index 28,592 31,287 32,925 27,551 21,649 18,967 20,011 22,835 23,344 24 Productivity-adjusted industry specific R&D labor cost index for R&D activity 24,568 27,781 30,100 25,793 20,704 18,578 19,938 22,835 23,376 24 Mfp-adjusted S aggregate input price index 25,252 28,845											
Input-cost based indexes <											24,129
SA aggregate input price index 28,510 32,037 34,149 28,950 22,250 19,319 20,102 22,835 23,089 23, 23,089 23, 24,085 Industry specific R&D input cost index 27,757 30,882 32,940 28,029 21,969 19,241 20,145 22,835 23,285 24, 24,283 Industry specific R&D labor cost index 28,592 31,287 32,925 27,551 21,649 18,967 20,111 22,835 23,285 24,41 Productivity-adjusted indexes 24,568 27,781 30,100 25,793 20,704 18,578 19,938 22,835 23,376 24 Mfp-adjusted industry specific input cost index for R&D activity 24,568 27,781 30,100 25,793 20,704 18,578 19,938 22,835 23,376 24 Mfp-adjusted industry specific input cost index 25,252 28,845 31,232 26,662 20,976 18,656 19,895 22,835 23,179 24 Mfp-adjusted aggregate RBDL R&D input cost index 24,359 27		21,549	25,524	28,740	∠5,710	∠0,500	18,411	19,778	22,835	23,141	25,791
Industry specific R&D input cost index 27,757 30,882 32,940 28,029 21,969 19,241 20,145 22,835 23,285 24 Industry specific R&D labor cost index 28,592 31,287 32,925 27,551 21,649 18,967 20,011 22,835 23,241 24 Productivity-adjusted indexes 9 9 9 9 9 19,938 22,835 23,341 24 Mfp-adjusted industry specific input cost index for R&D activity 24,568 27,751 30,100 25,793 20,704 18,578 19,938 22,835 23,376 24 Mfp-adjusted industry specific input cost index 25,252 28,845 31,232 26,662 20,976 18,656 19,895 22,835 23,179 24 Mfp-adjusted aggregate RBDL R&D input cost index 24,359 27,507 29,743 25,492 20,548 18,501 19,879 22,835 23,281 24 Mfp-adjusted Scientific R&D services input cost index 25,242 28,292 30,382 25,860 20,		28.510	32.037	34.149	28.950	22.250	19.319	20.102	22.835	23,089	23,912
Industry specific R&D labor cost index 28,592 31,287 32,925 27,551 21,649 18,967 20,011 22,835 23,441 24 Productivity-adjusted indexes											24,375
Mfp-adjusted industry specific input cost index for R&D activity 24,568 27,781 30,100 25,793 20,704 18,578 19,938 22,835 23,376 24 Mfp-adjusted SA aggregate input price index 25,252 28,845 31,232 26,662 20,976 18,656 19,895 22,835 23,179 24 Mfp-adjusted aggregate RBDL R&D input cost index 24,359 27,507 29,743 25,492 20,548 18,501 19,879 22,835 23,281 24 Mfp-adjusted Scientific R&D services input cost index 25,242 28,292 30,382 25,860 20,690 18,592 19,881 22,835 23,139 24	Industry specific R&D labor cost index										24,378
Mfp-adjusted SA aggregate input price index 25,252 28,845 31,232 26,662 20,976 18,656 19,895 22,835 23,179 24 Mfp-adjusted aggregate RBDL R&D input cost index 24,359 27,507 29,743 25,492 20,548 18,501 19,879 22,835 23,281 24 Mfp-adjusted Scientific R&D services input cost index 25,242 28,292 30,382 25,860 20,690 18,592 19,881 22,835 23,139 24					05		40	40			04
Mfp-adjusted aggregate RBDL R&D input cost index 24,359 27,507 29,743 25,492 20,548 18,501 19,879 22,835 23,281 24 Mfp-adjusted Scientific R&D services input cost index 25,242 28,292 30,382 25,860 20,690 18,592 19,881 22,835 23,139 24							1	1			24,567
Mfp-adjusted Scientific R&D services input cost index 25,242 28,292 30,382 25,860 20,690 18,592 19,881 22,835 23,139 24											24,099
											24,581
Loperand-Fixier Frice moex 21,294 29,920 32,073 21,521 19,295 20,214 22,835 24,026 24											24,438
SA: BEA Satellite Account		21,294	29,920	32,073	21,029	21,521	19,295	20,214	22,835	24,020	24,905

SA: BEA Satellite Account RBDL: Robbins, Belay, Donahoe, and Lee version

Total R&D investment, including government and non-profit R&D*	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 growth rate
Output-price based indexes				annua	growth	rate				
Down-stream product output price index	8.6	7.7	4.2	-0.5	3.5	2.9	4.1	5.2	7.3	4.7
SA aggregate output price index	9.9	9.0	5.1	-0.3	4.1	3.5	4.7	5.7	7.9	5.5
Input-cost based indexes			-							
SA aggregate input price index	6.2	5.1	1.4	-2.7	1.9	1.4	3.6	3.8	4.5	2.8
Industry specific R&D input cost index	5.4	5.0	1.6	-1.1	2.6	1.9	3.6	4.1	5.6	3.2
Industry specific R&D labor cost index	3.9	3.7	0.1	-1.0	2.6	2.2	4.1	4.1	5.4	2.8
Productivity-adjusted indexes	0.0	0.1	0		2.0					
Mfp-adjusted industry specific input cost index for R&D activity	6.4	6.0	2.1	0.1	4.2	3.4	4.3	4.3	5.9	4.1
Mfp-adjusted SA aggregate input price index	7.3	6.2	1.8	-1.1	3.4	3.0	4.3	4.0	4.8	3.7
Mfp-adjusted aggregate RBDL R&D input cost index	6.5	6.1	2.1	0.5	4.3	3.5	4.3	4.3	5.9	4.1
Mfp-adjusted Scientific R&D services input cost index	6.0	5.6	1.6	0.0	4.1	3.2	4.3	3.9	5.9	3.8
Copeland-Fixler Price Index	4.5	5.5	2.5	-1.8	4.0	1.9	3.2	6.5	4.6	3.4
	4.0	0.0	2.0	1.0	1.0	1.0	0.2	0.0	1.0	1998-2007
Pharmaceutical and Medicine Manufacturing (3254)	1999	2000	2001	2002	2003	2004	2005	2006	2007	growth rate
Output-price based indexes				annua	growth	rate				
Down-stream product output price index	25.2	9.4	9.7	18.5	14.8	17.6	1.5	7.2	28.4	14.4
SA aggregate output price index	32.2	13.3	15.3	22.6	19.7	22.0	5.3	11.2	32.5	19.0
Input-cost based indexes	05.4			10.0	45.7	10.0				
SA aggregate input price index	25.4 23.2	7.2 6.2	9.3 10.3	18.2 20.5	15.7 16.6	18.2 18.4	3.6 3.2	8.1 8.1	26.4 27.5	14.4 14.6
Industry specific R&D input cost index Industry specific R&D labor cost index	20.3	3.0	7.6	20.0	15.9	19.3	4.9	8.1	27.5	14.0
Productivity-adjusted indexes	20.0	0.0	7.0	20.0	10.0	10.0	4.0	0.1	27.1	10.1
Mfp-adjusted industry specific input cost index for R&D activity	25.2	7.9	11.1	23.5	19.4	21.4	4.2	8.5	28.0	16.3
Mfp-adjusted SA aggregate input price index	27.5	8.9	10.1	21.0	18.5	21.1	4.7	8.6	26.9	16.1
Mfp-adjusted aggregate RBDL R&D input cost index	26.0	8.8	10.5	24.0	20.0	22.1	4.7	9.0	28.8	16.8
Mfp-adjusted Scientific R&D services input cost index	25.1	8.0	9.7	23.0	19.7	21.5	4.7	8.4	28.9	16.3
Copeland-Fixler Price Index	22.3	7.8	11.1	19.8	19.4	19.0	3.0	12.5	26.5	15.5
Semiconductor and Other Electronic										1998-2007
Component Manufacturing (3344)	1999	2000	2001	2002	2003	2004	2005	2006	2007	growth rate
Output-price based indexes					growth					
Down-stream product output price index	40.8	43.7	46.0	7.7	15.4	12.3	9.6	5.6	9.6	20.2
SA aggregate output price index Input-cost based indexes	19.4	16.8	19.9	6.2	9.4	6.5	4.9	0.2	-0.2	9.0
SA aggregate input price index	13.2									
Industry specific R&D input cost index		10.6	13.6	24	5.8	3.1	33	-2.6	-4 9	4.8
		10.6	13.6 15.0	2.4 5.3	5.8 7.9	3.1 4.0	3.3 3.3	-2.6 -2.1	-4.9 -2.7	4.8 6.0
Industry specific R&D labor cost index	13.0 9.7	10.6 11.7 8.7	13.6 15.0 11.2	2.4 5.3 5.6	5.8 7.9 7.5	3.1 4.0 2.9	3.3 3.3 2.9	-2.6 -2.1 -2.4	-4.9 -2.7 -3.5	4.8 6.0 4.6
	13.0	11.7	15.0	5.3	7.9	4.0	3.3	-2.1	-2.7	6.0
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity	13.0 9.7 14.8	11.7 8.7 13.5	15.0 11.2 15.8	5.3 5.6 7.9	7.9 7.5 10.6	4.0 2.9 6.6	3.3 2.9 4.4	-2.1 -2.4 -1.8	-2.7 -3.5 -2.3	6.0 4.6 7.5
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index	13.0 9.7 14.8 15.1	11.7 8.7 13.5 12.3	15.0 11.2 15.8 14.4	5.3 5.6 7.9 4.8	7.9 7.5 10.6 8.4	4.0 2.9 6.6 5.7	3.3 2.9 4.4 4.3	-2.1 -2.4 -1.8 -2.2	-2.7 -3.5 -2.3 -4.5	6.0 4.6 7.5 6.3
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index	13.0 9.7 14.8 15.1 13.8	11.7 8.7 13.5 12.3 12.1	15.0 11.2 15.8 14.4 14.8	5.3 5.6 7.9 4.8 7.4	7.9 7.5 10.6 8.4 9.7	4.0 2.9 6.6 5.7 6.5	3.3 2.9 4.4 4.3 4.4	-2.1 -2.4 -1.8 -2.2 -1.8	-2.7 -3.5 -2.3 -4.5 -3.0	6.0 4.6 7.5 6.3 6.9
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	13.0 9.7 14.8 15.1 13.8 13.0	11.7 8.7 13.5 12.3 12.1 11.4	15.0 11.2 15.8 14.4 14.8 14.1	5.3 5.6 7.9 4.8 7.4 6.6	7.9 7.5 10.6 8.4 9.7 9.5	4.0 2.9 6.6 5.7 6.5 6.0	3.3 2.9 4.4 4.3 4.4 4.4	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0	6.0 4.6 7.5 6.3 6.9 6.4
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index	13.0 9.7 14.8 15.1 13.8	11.7 8.7 13.5 12.3 12.1	15.0 11.2 15.8 14.4 14.8	5.3 5.6 7.9 4.8 7.4	7.9 7.5 10.6 8.4 9.7	4.0 2.9 6.6 5.7 6.5	3.3 2.9 4.4 4.3 4.4	-2.1 -2.4 -1.8 -2.2 -1.8	-2.7 -3.5 -2.3 -4.5 -3.0	6.0 4.6 7.5 6.3 6.9
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	13.0 9.7 14.8 15.1 13.8 13.0	11.7 8.7 13.5 12.3 12.1 11.4	15.0 11.2 15.8 14.4 14.8 14.1	5.3 5.6 7.9 4.8 7.4 6.6	7.9 7.5 10.6 8.4 9.7 9.5	4.0 2.9 6.6 5.7 6.5 6.0	3.3 2.9 4.4 4.3 4.4 4.4	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8	6.0 4.6 7.5 6.3 6.9 6.4
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV)	13.0 9.7 14.8 15.1 13.8 13.0 10.5	11.7 8.7 13.5 12.3 12.1 11.4 11.2	15.0 11.2 15.8 14.4 14.8 14.1 15.4	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004	3.3 2.9 4.4 4.3 4.4 4.4 2.7	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers,	13.0 9.7 14.8 15.1 13.8 13.0 10.5	11.7 8.7 13.5 12.3 12.1 11.4 11.2	15.0 11.2 15.8 14.4 14.8 14.1 15.4	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002	7.9 7.5 10.6 8.4 9.7 9.5 9.2	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004	3.3 2.9 4.4 4.3 4.4 4.4 2.7	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annua	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate	3.3 2.9 4.4 4.3 4.4 4.4 2.7 2005	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001 -9.8	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annual -2.8	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 growth 13.2	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3	-2.1 -2.4 -1.8 -2.2 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8 2007 -2.6	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2	11.7 8.7 13.5 12.3 12.1 11.4 11.4 11.2 2000 1.8 3.7 -1.8	15.0 11.2 15.8 14.4 14.4 14.4 14.1 15.4 2001 -9.8 -7.6 -7.6 -12.5	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annual -2.8 -3.0 -6.5	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 growth 13.2 13.6 9.8	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -11.6	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8 2007 9 -2.6 -1.7 -6.3	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based input price index SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index	13.0 9.7 14.8 13.0 10.5 1999 30.5 35.2 28.2 27.0	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8 3.7 -1.8 -1.8	15.0 11.2 15.8 14.4 14.4 14.1 15.4 2001 -9.8 -7.6 -12.5 -12.4	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annual -2.8 -3.0 -6.5 -4.9	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 growth 13.2 13.6 9.8 11.9	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -9.5 -8.7 -11.6 -10.8	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5 0.1	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2 0.1	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8 2007 9 -2.6 -1.7 -6.3 -4.3	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8 -0.1
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D labor cost index	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2	11.7 8.7 13.5 12.3 12.1 11.4 11.4 11.2 2000 1.8 3.7 -1.8	15.0 11.2 15.8 14.4 14.4 14.4 14.1 15.4 2001 -9.8 -7.6 -7.6 -12.5	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annual -2.8 -3.0 -6.5	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 growth 13.2 13.6 9.8	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -11.6	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8 2007 9 -2.6 -1.7 -6.3	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D labor cost index Productivity-adjusted indexes	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2 27.0 23.4	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8 3.7 -1.8 -1.8 -1.8 -4.2	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001 -9.8 -7.6 -12.5 -12.4 -14.7	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annua -2.8 -3.0 -6.5 -4.9 -4.9	7.9 7.5 10.6 8.4 9.7 9.2 2003 growth 13.2 13.6 9.8 11.9 12.4	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -11.6 -10.8 -10.5	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5 0.1 1.0	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2 0.1 0.0	-2.7 -3.5 -4.5 -3.0 -3.0 -4.8 2007 -2.6 -1.7 -6.3 -4.3 -4.3 -4.3	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8 -0.1 -0.8
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate input price index SA aggregate input price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted index R&D input cost index Notor Section R&D input cost index for R&D activity	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2 27.0 23.4 29.1	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8 3.7 -1.8 -1.8 -4.2 -0.2	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001 -9.8 -7.6 -12.5 -12.4 -14.7 -11.8	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annua -2.8 -3.0 -6.5 -4.9 -4.9 -2.6	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 1 growth 13.2 13.6 9.8 11.9 12.4 14.7	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -11.6 -10.8 -10.5 -8.6	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5 0.1 1.0 1.1	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2 0.1 0.0 0.5	-2.7 -3.5 -4.5 -3.0 -3.0 -4.8 2007 -2.6 -1.7 -6.3 -4.3 -4.3 -4.3 -3.9	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8 -0.1 -0.8 -0.1 -0.8
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D labor cost index Mfp-adjusted SA aggregate input price index Down-stream product output price index SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted indexes Down-stream product output price index Nfp-adjusted SA aggregate input price index Nfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate input price index	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2 27.0 23.4 29.1 30.3	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8 3.7 -1.8 -1.8 -1.8 -4.2 -0.2 -0.3	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001 -9.8 -7.6 -12.5 -12.4 -14.7 -11.8 -11.8	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annua -2.8 -3.0 -6.5 -4.9 -4.9 -2.6 -4.3	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 1 growth 13.2 13.6 9.8 11.9 12.4 14.7 12.5	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -8.7 -11.6 -10.8 -10.5 -8.6 -9.4	3.3 2.9 4.4 4.3 4.4 4.4 2.7 2005 2.3 1.1 -0.5 0.1 1.0 1.1 0.5	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 2006 3 .9 2.6 -0.2 0.1 0.0 0.5 0.5	-2.7 -3.5 -2.3 -4.5 -3.0 -3.0 -4.8 2007 2007 -2.6 -1.7 -6.3 -4.3 -4.3 -4.3 -4.3 -3.9 -5.9	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8 -0.1 -0.8 -0.1 -0.8 1.4 0.6
Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted industry specific input cost index for R&D activity Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index Motor Vehicles, Bodies and Trailers, and Parts Manufacturing (336MV) Output-price based indexes Down-stream product output price index SA aggregate input price index SA aggregate input price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index Industry specific R&D input cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted index R&D input cost index Notor Section R&D input cost index for R&D activity	13.0 9.7 14.8 15.1 13.8 13.0 10.5 1999 30.5 35.2 28.2 27.0 23.4 29.1	11.7 8.7 13.5 12.3 12.1 11.4 11.2 2000 1.8 3.7 -1.8 -1.8 -4.2 -0.2	15.0 11.2 15.8 14.4 14.8 14.1 15.4 2001 -9.8 -7.6 -12.5 -12.4 -14.7 -11.8	5.3 5.6 7.9 4.8 7.4 6.6 3.8 2002 annua -2.8 -3.0 -6.5 -4.9 -4.9 -2.6	7.9 7.5 10.6 8.4 9.7 9.5 9.2 2003 1 growth 13.2 13.6 9.8 11.9 12.4 14.7	4.0 2.9 6.6 5.7 6.5 6.0 3.8 2004 rate -9.5 -8.7 -11.6 -10.8 -10.5 -8.6	3.3 2.9 4.4 4.3 4.4 2.7 2005 2.3 1.1 -0.5 0.1 1.0 1.1	-2.1 -2.4 -1.8 -2.2 -1.8 -2.4 1.3 2006 3.9 2.6 -0.2 0.1 0.0 0.5	-2.7 -3.5 -4.5 -3.0 -3.0 -4.8 2007 -2.6 -1.7 -6.3 -4.3 -4.3 -4.3 -3.9	6.0 4.6 7.5 6.3 6.9 6.4 5.7 1998-2007 growth rate 2.4 3.2 -0.8 -0.1 -0.8 -0.1 -0.8

Appendix Table C: Growth Rate of Real R&D Investment by Industry (continues)

SA: BEA Satellite Account

RBDL: Robbins, Belay, Donahoe, and Lee version *government and non-profit R&D deflated with input cost indexes

Appendix Table C: Growth Rate of Real R&D Investment by Industry (continues)

Computer Systems Design and Related Services (5415)	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007 growth rat
Output-price based indexes					growth					.
Down-stream product output price index	35.9	39.4	99.2	38.1	-7.5	-20.3	18.6	4.8	2.8	19.3
SA aggregate output price index	42.9	45.8	106.0	37.4	-8.8	-22.2	16.5	4.9	3.2	20.3
Input-cost based indexes										
SA aggregate input price index	35.6	38.0	95.2	32.5	-11.8	-24.6	14.6	2.0	-1.6	15.6
Industry specific R&D input cost index	33.8	37.7	93.7	40.1	-11.9	-24.3	15.3	2.3	-0.1	16.4
Industry specific R&D labor cost index	31.7	36.8	90.7	43.3	-13.1	-22.9	15.8	2.4	0.6	16.4
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	35.2	39.0	96.0	37.9	-8.7	-22.5	15.9	2.2	0.4	17.5
Mfp-adjusted SA aggregate input price index	37.8	40.2	96.6	35.6	-9.7	-22.7	15.8	2.4	-1.2	17.3
Mfp-adjusted aggregate RBDL R&D input cost index	36.2	40.0	97.4	38.9	-8.6	-22.1	15.9	2.8	0.3	18.0
Mfp-adjusted Scientific R&D services input cost index	35.2 32.3	39.0 38.8	96.0 98.4	37.9 34.3	-8.7 -8.9	-22.5 -24.1	15.9 13.9	2.2 6.1	0.4	17.5 16.7
Copeland-Fixler Price Index	32.3	30.0	90.4	34.3	-0.9	-24.1	13.9	0.1	-1.5	1998-200
Computer Software Publishers (5112)	1999	2000	2001	2002	2003	2004	2005	2006	2007	growth ra
Output-price based indexes					growth					
Down-stream product output price index	17.2	13.3	5.4	4.0	22.3	5.8	2.5	11.5	3.0	9.3
SA aggregate output price index	21.4	17.6	9.0	3.1	18.8	1.6	0.0	11.6	2.9	9.3
Input-cost based indexes										
SA aggregate input price index	15.2	11.3	3.3	-0.6	14.8	-1.6	-1.6	8.5	-1.9	5.1
Productivity-adjusted indexes										
BEA index for custom and own account software	13.8	11.1	4.3	2.7	17.5	1.8	0.2	10.4	1.1	6.8
Mfp-adjusted SA aggregate input price index	17.1	13.1	4.0	1.8	17.6	0.9	-0.6	8.9	-1.5	6.6
Mfp-adjusted aggregate RBDL R&D input cost index	15.8	12.9	4.4	4.3	19.1	1.7	-0.5	9.4	0.1	7.2
Mfp-adjusted Scientific R&D services input cost index	14.9	12.2	3.7	3.5	18.8	1.2	-0.5	8.7	0.1	6.7
Copeland-Fixler Price Index	12.4	11.9	5.0	0.7	18.6	-0.9	-2.1	12.9	-1.8	6.0
	4000	0000	0004		0000	0004	0005		0007	1998-200
Scientific R&D Services (5417)	1999	2000	2001	2002	2003	2004	2005	2006	2007	growth ra
Output-price based indexes	7.8	25.1	17	-16.5	growth		2.0	0.4	9.3	2.1
Down-stream product output price index		25.1 34.2	1.7 7.2	-16.5	-15.2 -12.0	11.2	2.0			2.1
SA aggregate output price index	14.5	34.2	1.2	-14.3	-12.0	15.1	5.4	1.3	13.6	6.3
SA aggregate input price index	8.6	27.0	1.6	-17.4	-14.9	11.5	3.7	-1.5	8.3	2.2
	0.0	27.0		-17.4		11.5	3.8	-1.5	10.0	2.2
	66	26.0		16.0						
Industry specific R&D input cost index	6.6	26.0	1.3	-16.0	-14.0					12
Industry specific R&D input cost index Industry specific R&D labor cost index	6.6 3.8	26.0 23.0		-16.0 -16.2	-14.0 -14.5	11.0	4.8	-2.4	10.0	1.3
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes	3.8	23.0	1.3 -1.7	-16.2	-14.5	11.2	4.8	-2.4	10.1	
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index	3.8 10.4	23.0 29.0	1.3 -1.7 2.3	-16.2 -15.4	-14.5 -12.8	11.2 14.2	4.8 4.8	-2.4 -1.1	10.1 8.7	3.7
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index	3.8 10.4 9.1	23.0 29.0 28.9	1.3 -1.7 2.3 2.7	-16.2 -15.4 -13.4	-14.5 -12.8 -11.7	11.2 14.2 15.1	4.8 4.8 4.9	-2.4 -1.1 -0.7	10.1 8.7 10.4	3.7 4.3
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	3.8 10.4 9.1 8.3	23.0 29.0 28.9 28.0	1.3 -1.7 2.3 2.7 2.0	-16.2 -15.4 -13.4 -14.0	-14.5 -12.8 -11.7 -11.9	11.2 14.2 15.1 14.5	4.8 4.8 4.9 4.9	-2.4 -1.1 -0.7 -1.3	10.1 8.7 10.4 10.5	3.7 4.3 3.8
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index	3.8 10.4 9.1	23.0 29.0 28.9	1.3 -1.7 2.3 2.7	-16.2 -15.4 -13.4	-14.5 -12.8 -11.7	11.2 14.2 15.1	4.8 4.8 4.9	-2.4 -1.1 -0.7	10.1 8.7 10.4	3.7 4.3
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	3.8 10.4 9.1 8.3	23.0 29.0 28.9 28.0	1.3 -1.7 2.3 2.7 2.0	-16.2 -15.4 -13.4 -14.0	-14.5 -12.8 -11.7 -11.9	11.2 14.2 15.1 14.5	4.8 4.8 4.9 4.9	-2.4 -1.1 -0.7 -1.3	10.1 8.7 10.4 10.5	3.7 4.3 3.8
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index	3.8 10.4 9.1 8.3	23.0 29.0 28.9 28.0	1.3 -1.7 2.3 2.7 2.0	-16.2 -15.4 -13.4 -14.0	-14.5 -12.8 -11.7 -11.9	11.2 14.2 15.1 14.5	4.8 4.8 4.9 4.9	-2.4 -1.1 -0.7 -1.3	10.1 8.7 10.4 10.5 8.4	3.7 4.3 3.8 3.2
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index	3.8 10.4 9.1 8.3 6.0	23.0 29.0 28.9 28.0 27.7	1.3 -1.7 2.3 2.7 2.0 3.2	-16.2 -15.4 -13.4 -14.0 -16.3 2002	-14.5 -12.8 -11.7 -11.9 -12.1	11.2 14.2 15.1 14.5 12.2 2004	4.8 4.8 4.9 4.9 3.1	-2.4 -1.1 -0.7 -1.3 2.5	10.1 8.7 10.4 10.5 8.4	3.7 4.3 3.8 3.2 1998-200
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG)	3.8 10.4 9.1 8.3 6.0	23.0 29.0 28.9 28.0 27.7	1.3 -1.7 2.3 2.7 2.0 3.2	-16.2 -15.4 -13.4 -14.0 -16.3 2002	-14.5 -12.8 -11.7 -11.9 -12.1 2003	11.2 14.2 15.1 14.5 12.2 2004	4.8 4.8 4.9 4.9 3.1	-2.4 -1.1 -0.7 -1.3 2.5	10.1 8.7 10.4 10.5 8.4	3.7 4.3 3.8 3.2 1998-20
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Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index	3.8 10.4 9.1 8.3 6.0 1999 2.1	23.0 29.0 28.9 28.0 27.7 2000 10.7	1.3 -1.7 2.3 2.7 2.0 3.2 2001	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9	-14.5 -12.8 -11.7 -11.9 -12.1 2003 I growth -0.4	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1	4.8 4.9 4.9 3.1 2005 6.6	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1	10.1 8.7 10.4 10.5 8.4 2007 7.3	3.7 4.3 3.8 3.2 1998-20 growth r
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Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index	3.8 10.4 9.1 8.3 6.0 1999 2.1 3.0	23.0 29.0 28.9 28.0 27.7 2000 10.7 13.3	1.3 -1.7 2.3 2.7 2.0 3.2 2001 0.5 1.9	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9 -10.5	-14.5 -12.8 -11.7 -11.9 -12.1 2003 growth -0.4 0.4	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1 1.5	4.8 4.9 4.9 3.1 2005 6.6 7.8	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1 11.6	10.1 8.7 10.4 10.5 8.4 2007 7.3 8.1	3.7 4.3 3.8 3.2 1998-200 growth ra 2.9 3.9
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Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index Input-cost based indexes SA aggregate input price index Industry specific R&D input cost index	3.8 10.4 9.1 8.3 6.0 1999 2.1 3.0 -2.2 -3.3	23.0 29.0 28.9 28.0 27.7 2000 10.7 13.3 7.3 7.1	1.3 -1.7 2.3 2.7 2.0 3.2 2001 0.5 1.9 -3.4 -3.4	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9 -10.5 -13.8 -12.0	-14.5 -12.8 -11.7 -11.9 -12.1 2003 growth -0.4 0.4 0.4 -3.0 -1.7	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1 1.5 -1.6 -1.1	4.8 4.9 4.9 3.1 2005 6.6 7.8 6.1 5.9	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1 11.6 8.5 8.9	10.1 8.7 10.4 10.5 8.4 2007 7.3 8.1 3.0 4.6	3.7 4.3 3.8 3.2 1998-20 growth r 2.9 3.9 -0.1 0.4
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D labor cost index	3.8 10.4 9.1 8.3 6.0 1999 2.1 3.0 -2.2 -3.3	23.0 29.0 28.9 28.0 27.7 2000 10.7 13.3 7.3 7.1	1.3 -1.7 2.3 2.7 2.0 3.2 2001 0.5 1.9 -3.4 -3.4	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9 -10.5 -13.8 -12.0	-14.5 -12.8 -11.7 -11.9 -12.1 2003 growth -0.4 0.4 0.4 -3.0 -1.7	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1 1.5 -1.6 -1.1	4.8 4.9 4.9 3.1 2005 6.6 7.8 6.1 5.9	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1 11.6 8.5 8.9	10.1 8.7 10.4 10.5 8.4 2007 7.3 8.1 3.0 4.6	3.7 4.3 3.8 3.2 1998-20 growth r 2.9 3.9 -0.1 0.4
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Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SA aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted SA aggregate input price index Industry specific R&D labor cost index Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted indexes Mfp-adjusted SA aggregate input price index	3.8 10.4 9.1 8.3 6.0 1999 2.1 3.0 -2.2 -3.3 -5.5 -1.8 -0.6	23.0 29.0 28.9 28.0 27.7 2000 10.7 13.3 7.3 7.3 7.3 7.1 5.2 8.8 9.0	1.3 -1.7 2.3 2.7 2.0 3.2 2001 0.5 1.9 -3.4 -3.1 -5.5 -2.5 -2.8	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9 -10.5 -13.8 -13.8 -13.8 -13.9 -11.9 -9.9 -11.7	-14.5 -12.8 -11.7 -11.9 -12.1 2003 growth -0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.7 -1.7	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1 1.5 -1.6 -1.1 -0.7 1.3 0.8	4.8 4.9 4.9 3.1 2005 6.6 7.8 6.1 5.9 6.6 6.1 5.9 6.6	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1 11.6 8.5 8.9 9.1 9.4	10.1 8.7 10.4 10.5 8.4 2007 7.3 8.1 2007 7.3 8.1 3.0 4.6 4.3 5.0 3.4	3.7 4.3 3.8 3.2 1998-20 growth r 2.9 3.9 -0.1 0.4 -0.2 1.8
Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted SA aggregate input price index Mfp-adjusted SG aggregate RBDL R&D input cost index Mfp-adjusted Scientific R&D services input cost index Copeland-Fixler Price Index All Other Goods (AOG) Dutput-price based indexes Down-stream product output price index SA aggregate output price index SA aggregate output price index Industry specific R&D input cost index Industry specific R&D labor cost index Productivity-adjusted indexes Mfp-adjusted indexes	3.8 10.4 9.1 8.3 6.0 1999 2.1 3.0 -2.2 -3.3 -5.5 -1.8	23.0 29.0 28.9 28.0 27.7 2000 10.7 13.3 7.3 7.3 7.3 7.3 8.8	1.3 -1.7 2.3 2.7 2.0 3.2 2001 0.5 1.9 -3.4 -3.4 -3.1 -5.5 -2.5	-16.2 -15.4 -13.4 -14.0 -16.3 2002 annua -9.9 -10.5 -13.8 -13.8 -12.0 -11.9 -9.9	-14.5 -12.8 -11.7 -11.9 -12.1 2003 growth -0.4 0.4 0.4 0.4 0.4 -1.7 -1.4 -0.7	11.2 14.2 15.1 14.5 12.2 2004 rate 0.1 1.5 -1.6 -1.1 -0.7 1.3	4.8 4.9 4.9 3.1 2005 6.6 7.8 6.1 5.9 6.6 6.6	-2.4 -1.1 -0.7 -1.3 2.5 2006 11.1 11.6 8.5 8.9 9.1 9.4 8.9	10.1 8.7 10.4 10.5 8.4 2007 7.3 8.1 3.0 4.6 4.3 5.0	3.7 4.3 3.8 3.2 1998-20 growth r 2.9 3.9 -0.1 0.4 -0.2 1.8 1.3

SA: BEA Satellite Account RBDL: Robbins, Belay, Donahoe, and Lee version

Appendix Table C: Growth Rate of Real R&D Investment by Industry (continued)

All Other Services (AOS)	1999	2000	2001	2002	2003	2004	2005	2006	2007 6	1998-2007 growth rate
Output-price based indexes	1000	2000	2001		I growth		2000	2000	2007 3	Jowania
Down-stream product output price index	12.6	7.1	-14.2	-21.5	-13.5	3.0	11.6	0.9	4.7	-1.7
SA aggregate output price index	18.4	12.6	-10.5	-20.3	-10.2	7.4	15.5	4.0	8.6	2.0
Input-cost based indexes										
SA aggregate input price index	12.4	6.6	-15.2	-23.1	-13.2	4.0	13.6	1.1	3.6	-1.9
Industry specific R&D input cost index	11.3	6.7	-14.9	-21.6	-12.4	4.7	13.4	2.0	4.7	-1.4
Industry specific R&D labor cost index	9.4	5.2	-16.3	-21.4	-12.4	5.5	14.1	2.7	4.0	-1.8
Productivity-adjusted indexes										
Mfp-adjusted industry specific input cost index for R&D activity	13.1	8.3	-14.3	-19.7	-10.3	7.3	14.5	2.4	5.1	0.0
Mfp-adjusted SA aggregate input price index	14.2	8.3	-14.6	-21.3	-11.1	6.6	14.8	1.5	4.0	-0.5
Mfp-adjusted aggregate RBDL R&D input cost index	12.9	8.1	-14.3	-19.4	-10.0	7.4	14.9	2.0	5.6	0.1
Mfp-adjusted Scientific R&D services input cost index	12.1	7.4	-14.9	-20.0	-10.1	6.9	14.9	1.3	5.6	-0.4
Copeland-Fixler Price Index	9.6	7.2	-13.9	-22.1	-10.3	4.8	13.0	5.2	3.7	-1.0

SA: BEA Satellite Account

RBDL: Robbins, Belay, Donahoe, and Lee version

	Mansfield, Romeo, and Switzer, 1983	Mansfield, 1987	Jankowski 1990	1994 R&D Satellite Account	2007 BEA R&D Satellite Account	2012 Experimental Estimates
Years covered by index	1979 relative to 1969	1969 - 1981	1969 -1988	1960-1992	1987-2006	1997-2007
Industries covered	Chemicals, Petroleum, Electrical Equipment, Primary Metals, Fabricated Metal Products, Rubber, Stone, Clay, and Glass, Textiles	Chemicals, Petroleum, Electrical Equipment, Primary Metals, Fabricated Metal Products, Rubber, Stone, Clay, and Glass, Textiles Aircraft, Food, Machinery, Automobiles, Instruments, Other	Food, Chemicals, Petroleum, Rubber, Stone, clay, and glass, Primary Metals, Fabricated Metals, Machinery, Electrical Equipment, Automobiles, Aircraft, Professional and Scientific Instruments	Food and kindred products, Chemicals and allied products, Petroleum refining and extraction, Rubber and miscellaneous plastics products, Stone, clay, and glass products, Primary metal industries, Fabricated metal products, Industrial machinery and equipment, Electronic and other electric equipment, Aircraft and missiles, Other transportation equipment, Instruments and related products, Other manufacturing industries, Nonmanufacturing industries	All-industry aggregate	Pharmaceutical manufacturing, Semiconductor manufacturing, Scientific R&D services, Computer System Design All other goods producing industries, All other service producing industries
Scientists and Engineers		Bureau of Labor Statistics mean pay for engineers and scientists	Bureau of Labor Statistics mean pay for engineers and scientists to 1983, thereafter industry specific data from American Association of Engineering Societies Engineering Manpower Commission survey.	Industry specific American Association of Engineering Societies Engineering Manpower Commission survey.	For 2000-06, judgmental estimates based on salaries for R&D scientists and engineers from R&D Magazine salary surveys and BEA's unpublished chain-type Laspeyres salary index based on engineer salaries in R&D organizations from the American Association of Engineering Societies (AAES) annual salary surveys. For 1987-99, BEA's unpublished chain-type Laspeyres salary index based on AAES data.	BLS wages for scientists and engineers, identified by the following occupations: computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations. Weights for each industry are based on the proportions shown in Appendix Table E
Other Support Personnel	Firm survey conducted by authors	Industry specific average hourly earnings of production workers	Industry specific average hourly earnings of production workers	Industry specific average hourly earnings of production workers	BLS average hourly earnings of production workers in research and testing services.	BLS average hourly earnings of production workers
Materials and Supplies		BEA index of cost of materials, tabulated until 1983	NBER productivity data indexes for materials and energy	Producer price index for industrial commodities less fuel	BEA unpublished composite index for materials in the scientific R&D services industry (NAICS industry 5417) from the KLEMS data	BEA intermediate inputs and supplies, weights are based on the proportions shown in Appendix Table E.
Services of R&D Plant and Equipment		Weighted average of BEA prices for producers durable equipment (2/3) and industrial nonresidential structures (1/3)	BEA prices for producers durable equipment and nonresidential structures	Implicit price deflator for private purchases of new industrial nonresidential structures and producers durable equipment	NIPA implicit price deflator for depreciation in NAICS industry 5412OP.	NIPA implicit price deflator for depreciation, weights are based on proportions in Appendix Table E
Other inputs		Median weekly salary of managers and administrators	Median weekly earnings for executives, administrators, and managers	Median weekly salaries of managers and administrators	BEA unpublished composite index for overhead in the scientific R&D services industry (NAICS industry 5417)	BEA intermediate inputs and supplies, weights are based on the proportions shown in Appendix Table E.

Appendix Table D: Comparison of Data Sources for R&D Input Cost Indexes

Methodological Appendix: industry-specific R&D inputs

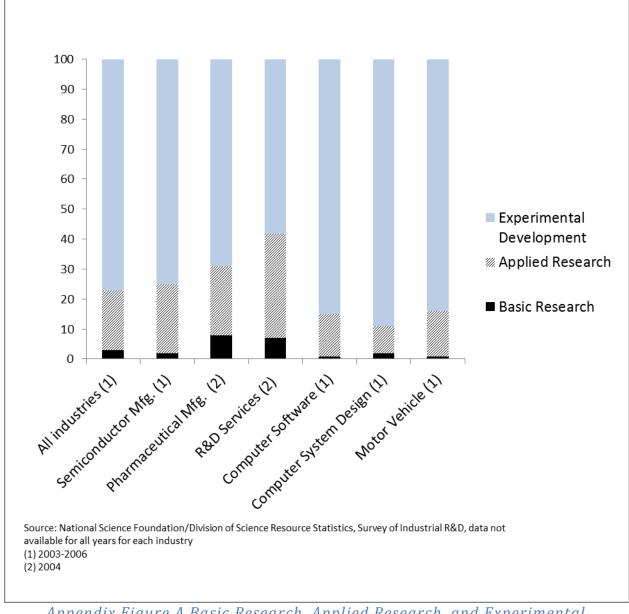
Each industry-specific input cost index shares a core set of sub-inputs specific to R&D activity, described in Section 4, and a sub-set of industry-specific inputs. This section describes the selection of the industry-specific inputs. The weight selection is primarily judgmental; for pharmaceutical R&D supplemental information provides support for choice of weights.² The split between basic research, applied research, and experimental development is shown in Appendix Figure A. The selection of weights by R&D performing industry is shown in Appendix Table E.

For R&D performed by manufacturing industries we assume that the basic and applied phases of R&D are activities that are more similar to scientific R&D services than the later phase of R&D activity, experimental development. Accordingly, basic and applied research inputs for pharmaceutical-related R&D are assumed to be half scientific R&D services and half industryspecific. For motor vehicle manufacturing inputs from industrial design services are included in the basic and applied research phases. We include inputs from testing laboratories in the experimental development phase of semiconductor-related R&D and all other goods R&D. For pharmaceutical R&D we include inputs from medical and diagnostic testing in the experimental development phase.

For R&D performed by the computer system design industry we assume that the inputs to R&D are similar to those of the industry itself, we simply include a one-fifth weight of scientific

² NSF data for 2004 shows that 31 percent of expenditures are in basic and applied research and 69 percent are in experimental development (Appendix Figure A.). As described by Scherer (2007), pharmaceutical R&D activity has two main phases. First is a preclinical phase, where new compounds or molecules are developed and tested for efficacy and safety on difference species of animals. Second is a clinical trials phase, where these drugs are tested on humans after the Food and Drug Administration issues an investigation of a new drugs permit. Accordingly, we use the classification of R&D activity by type from the NSF data to treat the basic and applied research expenditures as the preclinical phase of R&D activity and experimental development as the clinical trials phase. We assume that the inputs used in basic and applied research are different from those used in experimental development. This division corresponds closely to the functional distribution of US R&D for 2003 in Moses, et al (2005), where 32 percent of expenditures are for pre-human and preclinical activity.

R&D services. For all other services we simply make a fifty-fifty split between the industry – specific inputs and the inputs of scientific R&D services. For computer software R&D we use BEA's custom software index. This is an input cost index for software that already includes a productivity adjustment. Its use is recognition that there is substantial overlap between software and R&D.



Appendix Figure A Basic Research, Applied Research, and Experimental Development, 2003-2006.

Same weight pattern for all R&D ex	penditures		
Performing Industry		Composition of R&D Inputs for C	ost Weights
Scientific R&D services	100% Scientific R&D services (NAICS 5		
Computer system design R&D	80% Computer system design (NAICS 5	6415) 20% scientific R&D services (NAICS 5417)
Computer software R&D	100% Custom software		
All other services R&D	50% industry-specific inputs 50% R&D	services (NAICS 5417)	
Weight basic and applied research	differently from experimental develop	oment	
	Basic and Applie	d Research	Experimental Development
Pharmaceutical manufacturing R&D	50% Pharmaceutical manufacturing (NA 50% Scientific R&D services (NAICS 54		33% Pharmaceutical manufacturing (NAICS 3254) 33% Scientific R&D services (NAICS 5417) 33% Medical and diagnostic testing (NAICS 6215)
	Basic and Applie	d Research	Experimental Development
Motor vehicle manufacturing R&D	33% Motor vehicle and related parts ma 33% Industrial design services (NAICS 5 33% Scientific R&D services (NAICS 54	54142)	25% Motor vehicle and related parts manufacturing (NAICS 3361-3) 25% Scientific R&D services (NAICS 5417) 25% Engineering services (NAICS 54133) 25% Industrial design services (NAICS 54142)
Weight each type of R&D by a differ	ent weight		
	Basic Research	Applied Research	Experimental Development
Semiconductor manufacturing R&D	50% Semiconductor manufacturing (NAICS 3344) 50% Scientific R&D services (NAICS 5417)	33% Semiconductor manufacturing (NAICS 3344) 33% Scientific R&D services (NAICS 5417) 33% Engineering services (NAICS 54133)	50% Semiconductor manufacturing (NAICS 3344) 40% Engineering services (NAICS 54133) 10% Testing laboratories (NAICS 54138)
	Basic Research	Applied Research	Experimental Development
All other goods R&D	50% industry-specific inputs 50% Scientific R&D services (NAICS 5417)	33% industry-specific inputs 33% R&D Services (NAICS 5417) 33% Industrial design services (NAICS 54142)	25% industry-specific inputs 25% Scientific R&D services (NAICS 5417) 25% Engineering services (NAICS 54133) 25% Testing laboratories (NAICS 5418)

Appendix Table E: Industry Combination Weights

Table F shows the resulting input proportions for our input-cost structure for each industry specific category of R&D. For example, based on the ratios shown in Table E, the price index for pharmaceutical R&D is calculated using the intermediate input percentages show in the second column of Table F. Farm products make up 0.3 percent of intermediate inputs, mining products make up 0.4 percent, and utilities make up 1.4 percent.

Type of Intermediate Input		Semiconductor R&D	Motor Vehicles R&D	All Other Goods R&D	R&D Services	Computer System Design R&D	Computer Softw are	All Other Services R&D
Farm Products	0.3%	0.0%	0.2%	0.5%	0.7%	0.1%	0.0%	0.4%
Mining	0.4%	0.4%	0.8%	1.0%	0.6%	0.1%	0.0%	0.8%
Utilities	1.4%	1.7%	1.7%	1.9%	1.9%	0.7%	0.4%	1.7%
Construction	2.2%	1.1%	1.7%	1.8%	4.6%	1.1%	0.3%	3.0%
Apparel, Food, and other Non- durable Products	0.9%	0.1%	0.8%	0.8%	1.4%	0.3%	0.0%	1.3%
Chemicals, Plastic, Rubber, Paper, Wood, and Petroleum Products	27.0%	8.5%	8.0%	9.3%	7.9%	3.0%	1.8%	7.2%
Machinery, Fabricated Metal, and other Durable Products	3.5%	26.7%	24.0%	17.8%	5.9%	6.2%	4.2%	6.1%
Transportation and Warehousing Services	3.1%	2.2%	3.0%	3.1%	4.7%	4.1%	2.9%	4.6%
Information Services	2.6%	2.5%	3.0%	3.9%	4.2%	5.7%	6.8%	9.6%
Finance and Insurance Services	4.0%	5.9%	6.5%	6.6%	6.2%	8.0%	7.2%	8.3%
Real Estate and Rental and Leasing Services	8.8%	7.9%	9.5%	10.3%	11.8%	13.6%	13.4%	11.8%
Professional, Scientific, and Technical Services	22.6%	22.3%	21.2%	22.6%	27.8%	27.0%	26.3%	24.4%
Management of Companies and Enterprises	7.6%	6.0%	3.0%	3.7%	2.4%	2.6%	6.4%	2.4%
Administrative and Support and Waste Management and Remediation Services	7.8%	6.8%	7.9%	8.3%	13.1%	14.4%	22.9%	10.6%
Educational Services	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
Arts, Entertainment, and Recreation	0.2%	0.3%	0.3%	0.3%	0.3%	0.9%	0.6%	1.0%
Accommodation and Food Services	1.3%	3.4%	3.1%	3.1%	2.5%	6.9%	4.0%	2.8%
Other Services (except Public Administration)	2.4%	3.4%	4.6%	4.3%	2.8%	1.9%	1.1%	2.6%
Non-Comparable Imports	3.8%	0.6%	0.6%	0.4%	0.7%	3.1%	1.8%	1.0%
State and Local Government	0.2%	0.1%	0.1%	0.1%	0.4%	0.2%	0.1%	0.2%

Appendix Table F. Composition of Intermediate Inputs by R&D Industry

Source: BEA Annual Industry database and author's calculations

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