Research Activities Tax Credit

Tax Credits Program Evaluation Study

December 2021

By
Cody J. Schmidt, Fiscal and Policy Analyst

Research and Policy Division
Iowa Department of Revenue

Preface

Iowa Code Section 2.48 directs the Legislative Tax Expenditure Committee to review all tax expenditures with assistance from the Department of Revenue. This law also provides a schedule for such reviews and requires a review in 2021 of the Research Activities Tax Credit. In addition, the Department was directed to assist the legislature by performing periodic economic studies of tax credit programs. This is the fourth evaluation study of the Research Activities Tax Credit expenditure, with prior evaluation studies completed in 2008, 2011, and 2016.

As part of the evaluation, Robin Anderson, Tony Girardi, and Angela Gullickson reviewed this report. In addition, an advisory panel was convened to provide input and advice on the study's scope and analysis.

Liesl Eathington	Iowa State University
Mike Ralston	Iowa Association of Business and Industry
Paul Stuekradt	Iowa Economic Development Authority
Tom Sands	Iowa Taxpayers Association
Peter Orazem	Iowa State University

The author wishes to thank the members of the panel and other reviewers. The assistance of an advisory panel implies no responsibility on their part for the content and conclusions of the evaluation study.

This study and other evaluations of Iowa tax credits can be found on the evaluation study web page on the Iowa Department of Revenue website.

Table of Contents

Executive Summary

The Iowa Research Activities Tax Credit (RAC) is available for incremental increases in qualified expenditures associated with research conducted in Iowa. Introduced in 1985, the Iowa RAC allows taxpayers to claim a refundable credit and can be applied against corporation income tax, individual income tax, and fiduciary tax. The amount of the credit can be calculated in one of two ways, termed the Regular Method and the Alternative Simplified method. Both methods are based on rules governing the federal research and experimentation tax credit.

The Iowa RAC is considered an automatic tax credit and can be claimed by any qualified taxpayer. As part of the High Quality Jobs Program, a taxpayer may also be awarded an additional credit, the Supplemental Research Activities Tax Credit (SRAC), by the Iowa Economic Development Authority.

The purpose of this evaluation study is to analyze tax data and other pertinent information in order to assess the RAC in terms of utilization and economic impact.

The major findings of the study are these:

Tax Credits for Research Activities across the United States

- Since 1981, the federal government has offered a credit for research and development (R&D) equal to 20 percent of incremental expenditures over a base amount. Iowa was the third state to adopt an R&D tax credit.

- As of 2021, 35 states, including Iowa, offer a tax credit for research activities. While many of the early adopters of research activities tax credits are located in the Midwest, research activities tax credits have diffused across the United States. Since 1998 every region of the US (Midwest, West, Northeast, and South) has at least one state that implements a research activities tax credit. Six out of twelve states in the Midwest and four of the six states that border Iowa have a research activities tax credit program.

- Only seven states that previously offered a credit have ceased its implementation: Missouri in 2005, Montana in 2010, Michigan in 2012, West Virginia in 2013, Washington in 2014, North Carolina in 2015, and Oregon in 2018.

- Program features of R&D credits vary significantly across the United States. State tax credit rates for qualified research expenditures varies from a low of three percent in Colorado to a high of 20 percent in Hawaii. Arkansas offers a 33 percent rate for certain qualifying expenditures. The Iowa tax credit rate under the regular calculation is 6.5 percent.

- 16 states limit the amount of the tax credit in some capacity, either by limiting the dollar amount or reduction of tax liability. Seven programs impose a statewide cap on the amount of credits that can be earned and/or awarded. Iowa is among 19 states (54 percent) that do not limit the amount of the credit and does not have a statewide cap.

- Iowa's research activities tax credit is fully refundable. Most states do not offer a refundable credit. Of the 35 states with incremental research activities tax credits, eight states (23 percent), including Iowa offer broadly refundable credits.

Literature Review: R&D Tax Credits, Research Activity, Innovation, and Economic Activity

- While private R&D has significant benefits for both the individual company and society as a whole, the private rate of return is often below the social rate of return (Lucking et al, 2019). As such private R&D is considered to be lower than socially optimal and governments have developed three broad policies to stimulate private R&D: R&D tax credits and direct subsidies, support of the university research system to stimulate human capital, and support of formal R&D cooperation across a variety of institutions (Becker, 2015).

- Several studies have found that firms are sensitive to the user cost of research. For instance, Bloom et al. (2002) estimate a long-run elasticity of R&D with respect to its user cost of around -1.0 in

OECD countries for 1979-1997. While other studies have found lower elasticities, studies at the country level suggest that R&D tax credits, which reduce the user cost of research, increase research expenditures. However, the exact magnitude of research stimulated appears to be low, particularly for state-level credits. Evidence at the state level is much more mixed and any estimated increases are due to states attracting already existing research activities from other states (Wilson, 2009).

- Measuring research activity is challenging. Most studies utilize R&D expenditures, R&D intensity, or patents counts. However, R&D expenditure is hard to measure accurately as definitions used in datasets differ significantly. Measuring R&D activity through patent counts have several other drawbacks: economic value of patents counts is heterogenous, proponent to patent varies across industries, and a high count may not mean a high level of innovation because some patents may not be implemented (Becker, 2015).

- Measuring R&D tax credits is equally complicated. Most studies measure a tax credit as a binary indicator variable equal to one if the credit exists and zero otherwise. Other studies utilize a price variable that captures the marginal cost of R&D. Recent studies have inferred a tax credit effect from compared 'treated', i.e. subsidy-receiving, and 'untreated' firms.

- Methodologically most studies utilize ordinary least squares regression in which R&D tax credits are used to predict R&D expenditures. However, unobserved differences between and among states may induce biased results. As such, many studies will incorporate fixed effects into the model which control for differences across industries, states, and/or countries.

- Iowa research and development activity has historically been relatively low compared to other states. In 2017, Iowa ranked 24th in terms of business R&D, 25th for higher education R&D, 30th in federal R&D, 40th in state R&D, and 27th in overall R&D activity.

- While the level Iowa's R&D activity is small relative to other states, between 1997 and 2018 it had one of the fastest growing private R&D sectors in the United States. In 1997, Iowa ranked 34th in total private R&D, 33rd in private R&D per capita, and 34th in private R&D as a percent of private gross state product. By 2018, Iowa's rank increased to 24th, 14th, and 17th respectively. Only Oregon experienced a greater increase in state rank.

Research Activities Tax Credit Claims and Awards

- The 517 businesses conducting qualified research in Iowa during tax year 2018 reported $2,288 million of research in the state. In tax year 2019, data for which is incomplete, 501 businesses reported $1,863 million of research.

- RAC recipients report expenditures divided into four categories: wages, supplies, rental or lease of personal property such as computers, and contract expenditures. In general, approximately 59 percent of research expenditures are associated with wages. Supplies account for an additional 32 percent. Contract expenditures account for 9 percent. Expenditures for the lease of personal property are negligible.

- Based on their qualified research expenditures in tax year 2018, businesses using the regular method of calculating the RAC earned $18 million in both automatic and supplemental credits. This equates to 3.3 cents per dollar of total Iowa research. Businesses using the Alternative Simplified method earned $47 million. This equates to 2.7 cents per total Iowa research dollar.

- For tax year 2018, claims by corporations represented just 6 percent of total regular RAC claims (16 percent for SRAC) yet represent 74 percent of regular claim amounts (89 percent for SRAC).

- In tax year 2018, 67 percent of RAC credits claimed by corporation taxpayers were paid as refunds; 41 percent of RAC credits claimed by individual taxpayers were paid as refunds. In total, for TY

2006 to 2019, there were $709 million RAC claims, $541 of which—or 76 percent—were paid as refunds. This number will only continue to grow as taxpayers continue making claims on previous tax years.

- For FY 2020, the RAC and SRAC programs had a total fiscal cost of $82 million. For FY 2021, these programs had a cost of $71 million. Between FY 2007 and FY 2021, in total these programs had a cost of $828 million.

Evaluation of the Research Activities Credit

- Data on research activities tax credit programs for all 50 states from 1969 to 2021 was collected to examine the effect of such programs on research inputs and outputs. Research inputs include resources that are used in the research process: private R&D expenditures and private employment. Research outputs include the products that are the result of the research process: utility patents and private gross state product activity. The data is converted to a per capita or per 1,000 residents to increase comparability across all states.

- The study uses three methodologies to evaluate the effect of RAC programs and their features on research inputs and outputs.

- First, the study tests the difference of means in research inputs and outputs across RAC and non-RAC states. If RAC programs are associated with increases in research inputs and outputs, the mean for RAC states should be higher than non-RAC states. Findings indicate that on average research inputs and outputs are higher in RAC states than non-RAC states.

- Second, the study uses multiple regression to control for differences among states and temporal dependence in research expenditures. There are two problems with only looking at the difference of means. First, it does not account for omitted factors that could be associated with having a research activities tax credit program and research inputs and outputs in the state. It could be that RAC states tend to have a research friendly environment that is not related to the program (industrial makeup, demographics, low corporate income tax, educated workforce etc.). Failure to control for these factors when comparing RAC to non-RAC states can make results biased. Second, it does not control for temporal dependence, or stickiness, in the data. A state that has a lot of research activity will likely have a lot of research activity in the future, regardless of the existence of the RAC. Multiple regression analysis allows the researcher to control for such issues. The results suggest that in general RAC programs do not have a robust positive effect on research inputs and outputs. Instead, the previous findings of RAC states having higher research inputs and outputs is due to RAC states tending to have a more favorable environment for research activities that is unrelated to the presence of a RAC incentive.

- Third, the study uses the multiple regression results to predict economic outcomes under different scenarios to assess the impact of the RAC program in Iowa. In general, the model predicts worse economic outcomes under the presence of the RAC program for the state of Iowa, especially compared to alternative policies.

- While the results of the study are robust there are some limitations. There are two major concerns. First, the study does not consider the relative decline in RAC as a tax incentive as more states adopt such credits. Second, the study’s methodology is not a true randomized experiment. While the study’s methodology was crafted in consultation with leading academics and stakeholders, the author acknowledges the causal limitations of the analysis.

I. Introduction

The Iowa Research Activities Tax Credit (RAC) was introduced in tax year 1985, four years after the creation of the federal research and experimentation tax credit. The credit is available for incremental increases in qualified research expenditures associated with research conducted in Iowa. Similar to tax credits available in a number of other states, the RAC is based on rules governing the federal research and experimentation tax credit. Since its initial enactment, the RAC, like the federal tax credit, has been modified on several occasions, including limiting the credit to select industries for tax years beginning on or after January 1, 2017.

The goal of the credit is to incentivize increases in private research and development expenditures, which is thought to drive innovation and economic development. Firms tend to undersupply the amount of research that is socially optimal and R&D tax credits are used in order to entice firms to increase research closer to the socially optimal amount. At the state level, a research tax credit may serve more as an incentive for companies to locate and expand research activities within the state than a pure correction for a market failure.

The purpose of this evaluation study is to analyze tax data and other pertinent information in order to assess the RAC in terms of its utilization and economic impact. This is the Iowa Department of Revenues (IDR) fourth study on the RAC. The first evaluation study of the RAC, published in 2008, focused on corporate credits. IDR's second evaluation study was published in 2011 and provided data on corporate and individual credits through tax year 2009 with data collected from the IA 147 Tax Credits Schedule. The study also presented findings from a survey of businesses in Iowa about their utilization of the RAC. The third study, published in 2016, built on the previous studies by presenting data on research expenditures, credits earned, and credit refunds for tax years 2010 to 2014. It also evaluated the impact of the Alternative Simplified Calculation method on claims and associated research. The current study builds on the work of the prior studies.

Section II of the present study provides a background of the Iowa Research Activities Tax Credit, with particular attention to the various methods that can be used to compute the federal and Iowa credit, including some example credit calculations. Section III provides a synopsis of research tax credits across the country and highlights how program features vary considerably from one state to the next. Section IV briefly reviews the current literature on research activities tax credits and presents the general findings of the literature. The section notes the complexities and challenges that evaluators face while trying to assess the impact of such credits. Section V presents research tax credit claims, awards, and refunds in the state of Iowa. Section VI attempts to discern RAC program's impact on research, innovation, and economic activity by comparing states with RAC programs to states without such programs.

II. Background of the Research Activities Tax Credit

A. Tax Credit Description

The Iowa Research Activities Tax Credit, or RAC, is a tax credit based on Iowa's apportioned share of qualifying expenditures for increasing research activities. The RAC can be calculated two ways based on the rules governing the federal research and experimentation tax credit. Taxpayers conducting basic research in Iowa earn credits for associated expenses as qualified research, along with research-related wages and supply costs for in-house research, and payments for contract research conducted in Iowa.

The RAC is refundable and may not be sold or traded. Tax credits earned by a pass-through entity are claimed by its owners based on their respective share of the entity's income

B. Methods for Calculating the Research Activities Tax Credit (RAC)

For Iowa tax purposes, since tax year 2010 a taxpayer can elect each year whether to calculate the RAC using one of two methods. These are referred to as the regular method and the alternative simplified method. Between tax years 2000 and 2009, the alternative incremental method was available. A separate tax form is applicable to each method and the value of the RAC is calculated for each method, and form, as follows:

Regular Method (Form IA 128)

- 6.5 percent of incremental basic research, or
- 6.5 percent of incremental qualified research expenditures apportioned to Iowa over the of the base period amount or 50 percent of current year research expenditures.

Alternative Simplified Method (Form IA 128S)

- 6.5 percent of incremental basic research, or
- 4.55 percent of qualified research expenses above 50 percent of average qualified research expenses in Iowa over the prior three years; or,
- 1.95 percent of total qualified research expenses in the current year when no prior research has been conducted.

For example, consider a company with a base research amount of $5 million that conducts $10 million in qualified research in Iowa during calendar year 2020. Under the regular method, the company is eligible to claim a tax credit equal to 6.5 percent of its incremental research expenditures.

2020 Qualified Research Expenditures:	$10,000,000
Base Research Expenditure Amount:	-$ 5,000,000
Incremental Qualified Research Expenditures:	$ 5,000,000

Research Activities Tax Credit $5,000,000 x .065 = $325,000

The company can claim a Research Activities Tax Credit of $325,000.

C. Supplemental Research Activities Tax Credit

Taxpayers who are approved by the Iowa Economic Development Authority (IDEA) under the Enterprise Zone Program or High Quality Job Program may receive a Supplemental Research Activities Tax Credit. Supplemental RAC amounts are awarded by application to the EDA. Since 2010, the tax credit rate for the Supplemental RAC varies based on whether the recipient's gross revenues are more than or less than $20 million.

For businesses using regular method with annual gross revenues of $20 million or less, the supplemental credit is the sum of:

- 10 percent of excess of qualified research expenses during the tax year over the base amount for the tax year based upon Iowa's apportioned share of the qualifying expenses for increasing research activities; and
- 10 percent of the basic research payments during the tax year based upon Iowa's apportioned share of the qualifying expenses for increasing research activities.

For businesses with gross revenues exceeding $20 million the amount of the supplemental credits is the sum of:

- 3 percent of excess of qualified research expenses during the tax year over the base amount for the tax year based upon Iowa's apportioned share of the qualifying expenses for increasing research activities; and
- 3 percent of the basic research payments during the tax year based upon Iowa's apportioned share of the qualifying expenses for increasing research activities.

As with the RAC, the Supplemental RAC may be calculated using the regular method or using the alternative simplified method, but must be calculated using the same method used for the RAC in a given year.

D. Renewable Energy Components Research Activities Tax Credit
Since 2005, an additional RAC has been available for expenses related to the development and deployment of innovative renewable energy generation components manufactured or assembled in Iowa. This additional tax credit is known as the Renewable Energy Components Research Activities Tax Credit. Initially capped at $1 million, this tax credit has been capped at $2 million since 2009. Expenses associated with this tax credit are not eligible for the federal research tax credit. A business eligible for this credit must be approved by the EDA.

E. Limits and Other Provisions
The RAC does not require any award to claim and is thus said to be "automatic." The Supplemental RAC may only be awarded by IEDA. Approval from IDEA is also required for awards to the Renewable Energy Components RAC.

The RAC can be claimed against corporation income, individual income taxes, and the estates and trusts tax. There is no limit on the RAC amount a business may claim except that the Renewable Energy Components RAC, which is granted on a first-come, first-served basis, is limited to $2 million in aggregate.

Since 2009, awards of the Supplemental RAC are subject to the cumulative EDA tax credit award cap. Initially set at $185 million per fiscal year; this cap was reduced to $120 million in 2010, then increased to $170 million effective 2012. The cap is temporarily reduced to $105 million for fiscal years 2017 through 2021.

Taxpayers making RAC or Supplemental RAC claims that total $500,000 or more on a tax return filed after July 1, 2009, must be reported annually to the Legislature.

During the 2018 legislative session, the Iowa Research Activities Tax Credit was limited, for tax years beginning on or after January 1, 2017, to businesses conducting qualified research in manufacturing, life sciences, software engineering, or the aviation and aerospace industry. In addition, to be eligible to claim the Iowa credit, the researching entity must claim and be eligible for the Federal Credit for Increasing Research Activities under IRC section 41 for the same taxable year.

During the 2019 legislative session agriscience was added as a qualifying industry.

F. Relevant Iowa Code Citations:

- Iowa Code Citations: Section 15.119, Section 15.335, Section 422.10, Section 422.33 (5)
- Administrative Rules Citations: 261 IAC 59.6(3)(d), 261 IAC 68.4(6), 701 IAC 42.11, 701 IAC 42.29(1), 701 IAC 52.7, 701 IAC 52.14(3), 701 IAC 52.28(1)

G. Federal Research and Experimentation Tax Credit
The Iowa RAC is modeled on the Research and Experimentation Tax Credit, a federal tax credit provided by section 41 of the Internal Revenue Code (IRC). Often referred to as the R&E tax credit, the credit is perhaps more widely known as the R&D tax credit in reference to the more conventional jargon of research and development, or simply the federal research tax credit. It is an income tax credit equal to 20 percent of qualified research expenditures (QREs) incurred in the United States above a base amount. Unlike the

Iowa RAC, the federal research credit is not refundable. Unused credits can be carried back one year or forward up to 20 years. But, similar to the Iowa RAC, the federal research credit is automatic, with no application or prior approval required to make a claim.

Initially enacted in 1981, the federal research tax credit was a temporary credit that had been extended 16 times until 2015, when it was made permanent by the Protecting Americans from Tax Hikes (PATH) Act. Since 1981, the credit had been available for every period but one, lapsing between July 1, 1995 and June 30, 1996.

The federal research tax credit actually incorporates three tax credits. These include a credit for basic research payments, a credit for energy research, and the main research credit. Basic research payments are amounts paid by a corporation to qualified organizations, such as universities and other research entities, for investigations into the advancement of scientific knowledge not having a specific commercial objective. Energy research is the support of otherwise qualified research by organizations that are organized and operated primarily to conduct energy-related research in the public interest.

The main research credit is provided for incremental research expenditures; that is, for increases in research expenditures above a base amount. The main research credit can be calculated using either the regular method or the alternative simplified credit (ASC), a calculation method introduced for federal tax purposes in 2007. For tax years 1996 through 2008, the alternative incremental research credit (AIRC) method was also available. Unlike the Iowa RAC, under which taxpayers may select either the regular or alternative simplified method at their own discretion, for the federal research credit, taxpayers who choose to compute their main credit using the alternative method are required to continue to use that method in future tax years unless given IRS authorization to change credit calculation methods.

As defined by the Internal Revenue Code (IRC), and applicable to both the federal research credit and the RAC, eligible research must meet four criteria:

1. Research must qualify under IRC section 174 research expensing rules;
2. Research must be undertaken to discover information that is technological in nature;
3. The goal of research must be the development of a new or improved product, process, formula, or invention;
4. Research must constitute elements of a process of experimentation.

For in-house research, qualified research expenditures include wages and salaries for qualified research services, the cost of supplies used in conducting qualified research, and the rental or lease cost of personal property, such as computers, used to conduct qualified research. For contract research, research funded by the taxpayer but not conducted at the taxpayer's business, only 65 percent of amounts paid are eligible. This percentage increases to 75 percent for research performed by non-profit organizations and to 100 percent for research performed by small firms, universities, or federal laboratories. Costs associated with purchased equipment or buildings, overhead costs, and fringe benefits for employees are examples of non-eligible expenditures.

The main research credit is an incremental credit, which means that qualified research expenditures that exceed the larger of a base amount or 50 percent of current year expenditures are eligible for the credit. Under the ASC method, firms may take a credit equal to 14 percent of QREs that exceed 50 percent of average QREs of the three preceding tax years. For firms that have no QREs in the any of the three previous years, the ASC is six percent of current year QREs.

III. Tax Credits for Research Activities across the United States

This section provides a review of R&D tax credits among the states with particular attention to recent changes. It must be noted at the outset there are numerous research-related tax incentives in the states and some states offer more than one kind of incentive. For example, Kentucky and New York both offer a tax credit for construction costs of research facilities and Mississippi offers a tax credit for new jobs that require research and development skills. However, of these states, only New York also offers a tax credit for more direct costs of research and development along the lines of the federal R&D credit. The analysis here is focused on such tax credits that relate to the proximate costs of conducting research.

As of 2021, 35 states, including Iowa, offer a tax credit for research (see Table 1). Among them are four of the six states that border Iowa, including Illinois, Minnesota, Nebraska, and Wisconsin. Missouri and South Dakota do not offer R&D tax credits although Missouri did formerly. Missouri's credit was allowed to expire in 2005. Illinois's credit lapsed in 2011, but it was subsequently extended through 2027. Since the most recent Iowa RAC evaluation study, only one state—Oregon in 2018—has allowed their R&D tax credit to expire and did not later extend the credit.

A. Programs over Time

Figures 1 and 2 show the trend in the number of states with research activities tax credit programs from 1981 to 2021. In 1981, Minnesota became the first state to enact an R&D tax credit along the lines of the federal credit. Iowa followed suit four years later, just the third state to adopt an R&D tax credit and one of nine states to adopt the tax credit in the 1980s. From 1982 to 2021, on average one additional state has adopted a RAC program each year. However, in more recent years the number of states with RAC has been stable or in relative decline compared to earlier periods. In 10 years since the creation of the federal credit, 11 states had RAC programs—22 percent of U.S. states. By 2001, the number had increased to 32 (64 percent) and peaked at 39 (78 percent) in 2010. However, by 2021 the number of states with RAC declined to 35—or 70 percent of U.S. States. In 14 of the last 21 years since 2000 the number of states with RAC has either declined or remained stable, suggesting a substantial slowdown in the adoption of tax credits for research activities.

Early adopters of such credits tended to be in the Midwest. By 1990, six Midwest states—or half of the region—had research activities tax credit programs. This represented 60 percent of the total number of states with such credits. By 2000, each region of the U.S. had at least one state with a RAC program other regions began to adopt credits at a rate similar to the Midwest. Since 2015, nine Midwest states—or 75% of states in the region—have RAC programs. Only the Northeast has a higher percentage of states with RAC programs.

B. Basis for State Tax Credits

Under the most typical format for state R&D credits, tax credit amounts are based on incremental growth in research expenditures conducted within that state. As of 2021, in 31 of the 35 states with R&D tax credits, the credit represents a percentage of incremental increases in in-state research expenditures; however, such increases are defined by each state (Table 2). From 1981 to 2021, 85 to 100 percent of states with R&D credits calculate their credits as a percent of incremental expenditures. In five states, the statutory rate either must be or may be applied to the amount of the federal R&D credit attributable to research conducted in the state. Since 1981, the proportion of states with R&D tax credits that calculate the credit based on a percentage of the federal credit has steadily increased from 0 percent in 1981 to 14 percent in 2021.

For most states, qualified expenditures are defined in the same way as for the federal R&D credit. However, in five states, credits can be claimed on basic research expenditures, or research that does not have an intended commercial objective. In only one state, all research expenditures rather than only incremental can be claimed. Alternatively, in New Hampshire eligible expenditures include only wages paid in New Hampshire for research activities.

As noted above, there are five states whose statutory tax credit rate can represent a percentage of the federal credit. In Alaska, Nebraska, New York, and Vermont, this method of calculation is mandatory. In Delaware, it is an option; the taxpayer may compute the credit as either ten percent of incremental research expenditures or fifty percent of the apportioned federal research tax credit computed under the alternative simplified method. Among these five states, statutory rates vary from 15 percent to 50 percent of the federal rate under either the regular or the alternative simplified method, as specified. It should be noted that for federal tax purposes taxpayers have the option to either calculate the full R&D credit to which they are entitled and reduce their research expense deduction by the credit amount or elect to reduce their federal R&D credit by 35 percent and claim a full deduction for research expenditures. Meanwhile, federal taxable income is the starting point for calculating state taxable income for many states, including Iowa. Thus, for those states in which the R&D tax credit is a percentage of the federal credit, the requirement ensures that taxpayers receive a reduced state R&D tax credit when they claim the research expense deduction for federal tax purposes.

In Utah, credit amounts include a credit for all qualified research expenditures in addition to expenditures that represent an incremental increase over a base amount. For all qualified expenditures the rate is 7.5 percent compared to the incremental rate of 5 percent. Formerly, Michigan, West Virginia, North Carolina, and Washington had similar credits, however all such programs have expired as of 2021.
As of 2021, tax credits in at least nine states—26 percent of states with R&D tax credits— are either limited to or offer preferences for research in certain industries. The tax credits in Iowa, Florida, Georgia, Hawaii, Maine, and New York are available to research in specified strategic industries like manufacturing, telecommunication, computer programming, and biotech. The tax credits in Arizona, Arkansas, North Dakota, and Wisconsin offer rate premiums for research in targeted subjects. Colorado requires that eligible research is conducted in an Enterprise Zone.

Tax credits in nine states limit the credit to or offer preferences for small businesses. New Mexico's R&D tax credit is in fact limited to firms with no more than 50 employees. Other states that give preferences to small businesses are Arizona, Connecticut, Delaware, Louisiana, New York, North Dakota, and Pennsylvania. Maryland and Pennsylvania set devote a portion of their statewide cap specifically for small businesses. For Maryland, Arizona, and Connecticut, the credit is refundable for small businesses. Formerly West Virginia's credit was refundable for small businesses only, but West Virginia's program expired in 2012. Credits in Florida and Kansas are limited to C corporations. Wisconsin formerly limited tax credits to C corporations but effective January 1, 2013 has allowed the credit to be claimed by corporations, individuals, and shareholders of a passthrough entity.

C. Credit Rates

Statutory rates for the federal credit are 20 percent for the regular credit and 14 percent for the ASC. Among those 35 states in which the R&D tax credit can be calculated as a percentage of the incremental increase in research expenditures the tax credit rate for qualified research expenditures varies from a low of 3 percent to a high of 33 percent.

However, a number of states offer more than one rate, with rates tiered by research expenditure levels or some other mechanism; this is the case with most states that offer the highest rates. Indeed, the highest rate, 33 percent, belongs to the tiered Arkansas R&D tax credit program; its base rate is 10 percent and the higher rate is offered only for research in specified strategic areas. More typically for states with tiered rates, rates are tiered with respect to level of research expenditures. For example, the second highest tax credit rate offered for incremental expenditures is offered by North Dakota. That state's highest rate is 25 percent but applies only to the taxpayer's first $100,000 of qualified research expenditures. For expenditures over this threshold, the rate is 8 percent. Maryland is a special case in that it grants a credit for 10 percent of qualified research expenditures conducted in the state that exceed the Maryland base amount and 3 percent of expenditures that fall below.

Among the state tax credit programs based on incremental research expenditures, again including those for which these rates are calculated from the federal credit, the highest rate that is applicable to all expenditures—i.e., the highest rate for a state whose program rates are not tiered—is 20 percent. This is the applicable rate for Connecticut, Arkansas, and Hawaii. However, Connecticut limits the tax credit amount available to a taxpayer to no more than 70 percent of tax liability. Arkansas limits the credit to no more than $10,000 per year. Hawaii makes no limit on the extent to which the credit reduces tax liability or the amount of the credit. Considering the highest rate offered for incremental expenditures in each state, the most common rate is ten percent, with ten states offering this rate. Seven other states offer a five percent rate. Along with Iowa, only Kansas and Illinois offer a regular rate of 6.5 percent.

For 2021, among the states with credits based, in whole or in part, on incremental increase in research expenditures, the average rate is 10.5 percent and the median tax credit rate is ten percent. Figure 3 reports the average (mean) credit rate by region over time. Note that this rate includes zeros for states that lack such credits. On average, Midwestern states reported a higher rate compared the rest of the country until 1993. This mostly reflects early adoption of the credit in the Midwest. The Northeast replaced the Midwest as the region that offers the largest average credit rate in 1994. Since the early 2000s, average rates across regions have stabilized, with some evidence of a decline after 2010. In general, Midwestern states offer competitive rates for research activities credits compared to the rest of the country—lower rates than the Northeast, but higher than the South and West.

D. Caps and other limitations

Aside from differences in rates, states provide various limits on their tax credits. For states that do impose limits on credit amounts, they might apply to the state program as a whole, to the amount of tax credits which a taxpayer may claim, or both. Connecticut's limitation of the tax credit to no more than 70 percent of tax liability is an example of a way in which states limit credit amounts. Including Connecticut, there are currently sixteen states that limit the amount of tax credits that a taxpayer may claim. Pennsylvania and Virginia's Major R&D expense credit limit the amount to 75 percent of liability. Florida, Georgia, Rhode Island, and South Carolina limit the taxpayer credit amount to 50 percent of a tax liability. Maine and Massachusetts limit the credit to 75 percent of liability beyond $25,000. Maryland limits the credit to $250,000, New Hampshire limits the credit to $50,000, while Arkansas limits the credit to $10,000 to $50,000 per year depending on whether the research was conducted through the Arkansas Science and Technology Authority.

Colorado and Kansas employ a somewhat different approach. In these two states, no more than one quarter of an allowable credit may be taken in any one tax year, with the remaining amount credited to the succeeding three years. In Florida, which also limits tax credits to 50 percent of taxpayer liability, an additional limit applies to businesses that are less than four years old; for these new businesses, the Florida tax credit is reduced by one quarter for each taxable year the business did not exist.

The foregoing limitations apply at the taxpayer level. Seven states also cap their R&D tax credits on a statewide basis. These statewide program caps vary from $7 million in New Hampshire to, by far the largest, $250 million in New York. The state with the next highest cap is Pennsylvania, whose cap is $55 million, of which $11 million is reserved for small businesses. For its bifurcated program, Virginia provides two caps, $7 million for its standard credit and $20 million for its Major R&D Expense Credit. The statewide cap for the Florida tax credit was set to $23 million for 2016 only and returned to $9 million in 2017. The caps in Florida and New York are applied on a first-come, first-served basis. Arizona's cap of $5 million applies to the refundable portion of its program. The caps in the other four states are prorated across tax credit recipients.

Altogether, eighteen states impose some kind of limit on their R&D tax credits beyond the application of statutory rates, whether at the statewide or taxpayer level or both. Iowa is among the other 19 states that do not.

E. Refundability

In the event that tax credits earned exceed tax liability, states make various provisions for their refundability or carryforward. Iowa is one of twelve states whose R&D tax credit is at least partially refundable. However, four states—Arizona, Connecticut, Massachusetts, and Wisconsin— only offer partial refundability and in three states—Arizona, Connecticut, and Maryland—only small businesses can be refunded.

Along with Iowa, the other states whose tax credits are more broadly refundable are Delaware, Hawaii, Louisiana, Massachusetts, Nebraska, New York, and Virginia. Beginning in tax year 2016, Virginia's standard 15 percent R&D tax credit on the first $300,000 of research, which has a statewide cap of $7 million, is refundable; tax credits awarded under Virginia's Major R&D Expense Credit program, which is capped at $20 million, are not refundable. Delaware's 10 percent R&D tax credit is refundable effective in tax year 2017. Refundability of the Massachusetts credit is somewhat restricted. The 10 percent Massachusetts tax credit may be used towards the first $25,000 of tax liability and 75 percent of any liability over that amount; after applying these rules, Massachusetts taxpayers may elect a refund of 90 percent of any balance of the tax credit. Of the three states that border Iowa and have an R&D tax credit, only Nebraska offers refundability. Formerly, Minnesota's R&D tax credit had been refundable for tax years 2010 through 2012.

Unused R&D tax credits may be carried forward for many states. The carryforward period is unlimited in Colorado, California, and Kansas, and virtually so in New Mexico where unused tax credits may be carried forward 99 years. The most common carryforward period is 15 years, the length allowed by eight states. Six states have ten-year carryforward periods. The median length of carryforward is ten years. The shortest length of carryforward is that of Florida, Illinois, and New Hampshire, which allow unused credits to be carried forward five years.

F. Recent Changes

While most programs have remained relatively unchanged since 2015, there are exceptions. Several states renewed their programs or pushed back their sunset dates: Arizona (2022 to 2023), Illinois (renewed in 2015), Hawaii (renewed in 2019), Louisiana (renewed in 2019), Maine (renewed in 2014), and Maryland (renewed in 2020). Several states have let their programs expire and did not introduce a new credit: North Carolina in 2015 and Oregon in 2018. They join the following states that let their credits expire but did not renew in the past: Missouri (2005), Montana (2010), Washington (2014), and West Virginia (2013). Several other programs are set to expire in the next five years and will either expire or be renewed: Virginia (2021), Wyoming (2021), Nebraska (2022), Hawaii (2024), and Texas (2026).

Several states have changed their rates. Arkansas's rate increased from 10 to 20 percent and Minnesota's rate increased from 2.5 to 4 percent. However, Louisiana has decreased their rate from 8 to 5 percent. Other states have made their programs refundable: Delaware in 2017 and Wisconsin in 2018. Hawaii has capped refundability at $5 million. Other states have expanded statewide program caps. For example, New Hampshire increased their cap from $2 million to $7 million. Maryland increased their cap from $6 million to $12 million.

Several states, including Iowa, have recently made the credit available to only certain industries and have clarified several rules that may make it harder for taxpayers to qualify. For example, during the 2018 legislative session, the Iowa Research Activities tax Credit was limited to businesses conducting qualified research in manufacturing, life sciences, software engineering, or the aviation and aerospace industry and made it a requirement that the researching entity be eligible to claim the federal credit. In 2019, agriscience was added as a qualifying industry. This fits with the general trend across the country to make R&D tax credits more targeted.

G. Summary of Competitiveness of the Iowa RAC

Iowa's tax credit on incremental research activities is quite competitive compared to other states. As noted above, Iowa was among the first states to adopt an R&D tax credit. From the outset, Iowa's RAC was among the most remunerative available across the country due to it being fully refundable. It is currently one of just seven states that offer a fully refundable credit. Of the other six states, Delaware, Hawaii, Louisiana, Nebraska, New York, and Virginia, only Nebraska is a regional competitor. Most of the others are located on the eastern seaboard and are all coastal states. Hawaii has a cap on how much can be refunded, Louisiana's and Nebraska's rates are lower than Iowa's, and Virginia's refundable credit is implicitly capped at $45,000 since the credit is limited to 15 percent of the first $300,000 in incremental qualified research expenditures.

At first glance, Iowa's rate may appear low compared to other U.S. states. However, there are a few other programs features besides refundability that make Iowa's rate fairly competitive. Iowa's credit is not tiered. Under the regular method the credit rate is either 4.55 percent under the alternative simplified method or 6.5 percent under the regular method. Several states that have non-tiered programs have a lower rate: Colorado, Nebraska, Alaska, Idaho, Louisiana, Maine, South Carolina, Texas, Utah, Vermont, and Wisconsin. Especially compared to other Midwest states, Iowa's rate is relatively competitive. For example, Nebraska's rate is 15 percent of the federal credit which equates to only three percent, Minnesota's rate is 4 to 10 percent depending on if the taxpayer has more than $2 million in qualified expenditures above the base amount, Wisconsin's rate is 5.75 percent, Missouri lacks a credit, and Illinois's and Kansas's rate is the same as Iowa's. However, again only Nebraska's credit is refundable. Iowa's tax credit also does not have a limit on taxpayer amount, nor has a statewide cap. 15 of the other 28 states with non-tiered programs have such limits.

IV. Literature Review

Previous evaluation studies have provided a thorough overview of published studies regarding research and development tax credits as well as their potential economic impacts on society (Gullickson and Harris, 2008; Gullickson et al. 2011; Girardi, 2016). Each study has highlighted the economic rationale for research tax credit programs: research is thought to produce positive externalities but in the absence of government intervention research is undersupplied (Arrow 1962; Romer 1986, 1990; Aghion & Howitt 1998; CBO, 2007; Guenther, 2007; Becker, 2015). R&D investments are considered “public goods” and have two characteristics that make optimal provision challenging. First, public goods are non-rival, which means the consumption by one user does not reduce the consumption of another. Second, public goods are non-excludable, which means consumers of the good cannot be easily barred for failing to provide or pay for the good. If the private rate of return is lower than the social rate of return, a firm is not willing to produce the good at the socially desirable level. In the case of research, scholars have estimated a marginal social return of 58 percent compared to a private rate of just 14 percent (Lucking, Bloom, & Van Reenen 2019). This indicates there are significantly high social spillovers from private R&D spending, yet research is undersupplied.

Government intervention can help mitigate the classic public goods problem through various mechanisms. For example, government may directly provide the good by undertaking its own research initiatives, subsidizing research by supporting venture capital programs for technology firms (La Croix & Mak 2021), or indirectly by incentivizing research through R&D tax credits (Wilson 2009). From a tax policy perspective, the cost of the intervention is often justified on the basis of stimulated future tax revenues: if research drives innovation, productivity, and economic development, then policymakers can recoup the direct cost of the government intervention in the form of future tax revenues. For a review of the connection between research, productivity, and economic growth see Gullickson et al. (2011).

Governments have many different types of policy tools at their disposal, but these interventions can be grouped into three categories: R&D tax credits and direct subsidies, support for higher education, and support of formal R&D cooperation (Becker, 2015, p. 918). In general, studies find that public intervention tends to increase research and innovation but the magnitude of the effect is contingent upon the exact policy, firm size, support, sector, and type of tax system (Petrin, 2018). Some studies suggest policies may complement each other. For example, Huergo and Moreno (2017) compare the effect of participating in different public R&D funding programs on firm R&D activities. Using a sample of firms in Europe from a variety of countries, they find that subsidies and loans mutually reinforce each other. Yet other studies suggest that different policies will have vastly different effects. For example, Szarowska (2017) uses data from twenty European Union member-states to examine whether public or private R&D expenditure drives economic growth. Szarowska finds that direct R&D expenditure by a government increases economic growth but business R&D does not, suggesting that policies may differ in their impact.

By far, R&D tax credits and direct subsidies have received the greatest attention in the literature. Whereas subsidies directly fund specific investments, tax credits are thought to be a more “hands-off” and market-based approach to simulating research (La Croix & Mak, 2021). Credits are said to incentivize research by lowering the effective price of research. In general, findings of studies that seek to evaluate the efficacy of R&D tax credits are mixed and sensitive to research design decisions, like estimation strategy and model specification (Hall and Van Reenen, 2000). As a result, some scholars have voiced concerns over research tax credits as an effective instrument of increasing research, especially at the state level (Hall & Wosinska 1999; Tax Foundation, 2007; Fichtner & Michel, 2015; Kennedy & Atkinson, 2017). Many scholars claim that research credits complicate the tax system and create uncertainty which lowers the potential societal benefits (Tax Foundation, 2007, p. 15; Fichtner & Michel, 2015).

Instead, critics suggest removing such credits and lowering the corporate tax rate with the savings (Kennedy & Atkinson, 2017). These arguments are made often with regards to state-level credits because positive externalities are not constrained by state boundaries and competition between states may drive fiscal benefits of a tax credit for research to zero or even negative after considering administrative costs

(Hall & Wosinska, 1999; CBO, 2007; Hall & Van Reenen, 2000). There is also evidence of the so-called "relabeling problem" in which expenses are simply relabeled as R&D expenditures in order to increase the number of credits a firm may qualify for. Studies have estimated that approximately 24 percent of such increases in R&D expenditures can be attributed to relabeling (Chen et al., 2018).

A. Empirical Evaluation and Research Design Challenges

Studies vary significantly in their research designs which makes broad generalizations difficult (Hall and Van Reenen, 2000; Becker, 2015). Ideally, to accurately evaluate a credit a study would consider the opportunity cost of the program and compare the social benefits gained from the additional research induced by the credit to the social costs of foregoing other public services (CBO, 2007; Guenther, 2007; Ibele & Vasche, 2004; Hall & Van Reenen, 2000). However, given data limitations most studies compare the direct cost of the program. For example, comparing the amount of incremental research induced by the credit to the loss in tax revenue because of the credit (Gullickson & Harris, 2008).

Becker (2015) provides a summary of common research design features and challenges that studies face while trying to evaluate the fiscal and economic impact of R&D tax credits. The first issue raised is data quality and measurement. In order to evaluate the efficacy of a tax credit, researchers need "…to measure and compare R&D across firms, industries and countries" (p. 918). Becker (2015) distinguishes two types of measures: input measures, which seek to quantify the amount of resources that go into the research process such as R&D expenditure or R&D intensity[1], and output measures, which seek to quantify what the research process actually produces such as patent counts. Becker notes that while input and output measures tend to be correlated (Acs & Audretsch, 1988), input measures are preferred because the economic value of input measures "…can be taken as homogenous" (p. 918) whereas the economic value of output measures is not necessarily uniform. For example, as Becker (2015) notes some firms, industries, and countries have a higher propensity to patent over others that is not directly attributable to differences in innovation but instead due to the nature of the products and services provided.

Most studies focus on input measures, but there are concerns with comparability across studies. Becker notes the difficulty in measuring R&D expenditure accurately as firms have significant discretion in what they classify as research and development (p. 918). Chen et al. (2018) explore the extent of the relabeling problem in the context of a Chinese policy that awards tax cuts to firms with R&D investments over a threshold amount. They find that relabeling accounts for over 24 percent of research and development expenditures, validating Becker's concerns. While Becker notes that there are internationally agreed standards published by the OECD, it is not always clear to what extent prominent datasets follow these definitions (OECD, 2002; Becker, 2015, p. 919). There are also concerns over the extent to which such measures capture "innovativeness" as high R&D spending may not produce innovation or enhance productivity. However, output measures suffer from this problem as well as patents may not necessarily be implemented.

A central challenge of evaluations concern causation and the estimation of the effect of the credit. Most studies utilize a so-called "R&D Equation", which is estimated using observational data. This provides significant challenges for causal inference, as the counterfactual—a firm or state not having a credit—is not observed. Instead, studies pool data on firms, industries, states, or countries and will control for factors by including relevant covariates in the R&D equation. Usually a study will measure a tax credit as a binary indicator (0,1), which indicates if a firm, industry, state, or country qualifies for a tax credit on R&D and then regress the binary variable on the research input or output. The coefficient that is estimated on the binary variable then tells the researcher the difference between firms that had a credit and firms that did not, controlling for the other factors included in the model.

While this estimation strategy is straightforward Becker (2015) notes that it suffers from imprecision: different firms and states may have different credit levels. By utilizing a binary variable, the researcher is losing information and in combination of other techniques used to control for unobserved differences in the

[1] Measured as the ratio of R&D expenditures to firm sales.

firms, industries, or states, complicating the exact effect of the tax credit. Instead, recent studies use "…a price variable such as the user cost of R&D, that captures the marginal cost of R&D, whereby the estimated R&D response is converted to a price elasticity." (Becker, 2015, p. 919). That is, researchers can estimate the extent to which a firm will demand more research given the reduction in the user cost of research due to the credit.

Lastly, since firms often decide on the level of their R&D investments in prior years, studies need to address the temporal dependence in their data (Becker, 2015, p. 920). For example, many studies control for time by including a lagged-dependent variable in the R&D equation, which is the value of the relevant research input or output for earlier time periods. This converts the static R&D equation into a dynamic model. However, the correction introduces endogeneity into the model, which violates the fundamental assumptions regarding regression analysis. Becker (2015) notes that many studies suggest an instrumental variable technique, specifically the first-differences generalized methods of moments (GMM) estimator (p. 920).

B. Findings on Federal and State Level Research Tax Credits

While there are significant challenges in designing studies that directly examine the fiscal and economic impact of research and development tax credits, there are broad generalizations about the findings of the literature. Since credits may have differing impacts depending on whether they are applied at a federal or regional level, studies can be organized according to whether the study examines federal credits, such as the U.S. Federal Research and Experimentation Tax Credit, or state credits, such as the Iowa Research Activities Tax Credit. While both types of studies find that credits increase research, state-level studies often find that the net effect of state-level credits is zero because firms relocate their existing research activities to states with credits rather than increasing aggregate levels (Wilson 2009).

Many studies have been devoted to the U.S. Federal Research and Experimentation Tax Credit and take advantage of program changes to evaluate the economic impact of the credit (Berger, 1993; Billings et al., 2001; Guenther, 2007; Gupta et al., 2011; Roa, 2016; Finley et al., 2015). While studies often find a positive effect on research conducted by firms due to the credit, the magnitude of the estimate varies significantly across studies and generally is low—ranging from 1.3 to 3.9 percent (Carroll et al., 2011; Hemphill, 2009). Three studies capitalize on policy changes to the credit to evaluate the credit's potential effect and find larger effects. Gupta et al. (2011) utilized the 1989 redefinition of base amount to analyze the credit and found that every dollar claimed induced over two dollars in a firm's R&D expenditure. Using IRS corporate return data from 1981 to 1991, Rao (2016) estimated a ten percent reduction in the user cost of R&D leads an average firm to increase its research intensity by approximately twenty percent. Finley, Lusch, and Cook (2015) find a similar effect—two dollars induced per one dollar claimed—for the Alternative Simplified Credit, which was adopted in 2010 as an alternative means to calculate the federal credit.

Several studies move beyond the US case and compare research tax credits across countries (Hall & Van Reenen, 2000; Bloom et al., 2002) or analyze non-US data entirely (Harris et al. 2009; Parisi & Sembenelli 2003; Lokshin & Mohnen 2012; Mulkay & Mairesse 2013; Yang et al., 2012). These studies have estimated a price elasticity of -0.5 to -2.0, suggesting that R&D tax credits positively impact research spending. Although, as Guenther (2007) notes that the actual stimulated research is often low and speculates that this is due to problematic characteristics, particularly non-refundable status and ambiguous definitions of qualified research.

A literature studying the effect of state-level credits has begun to form, although it is important to note that state-level initiatives face several challenges that the federal credit does not. As Wilson (2005) notes, there has been a dramatic rise in the spread of state research tax credits in the United States. State governments carefully consider fiscal incentives as a means to attract firms to their states. While this has given rise to a general concern for a "race to the bottom", states do not appear to adopt R&D tax credits in response to their neighbors adopting such credits (Miller & Richard, 2010).

Many studies are concerned with if state-level R&D tax credits have an impact on research activities of private firms in general or if the effect is conditional upon firm size or sector (La Croix and Mak 2021). Several studies answer this question and find that while R&D tax credits are associated with a decrease in the user cost of research and consequentially an increase in private R&D, it often comes from other states (Wilson, 2009; Thomson, 2017; Blandinieres et al., 2020). Wilson (2009) estimates a short run user cost elasticity of -1.21 and a long run user cost elasticity of -2.18 for private firms. This means that a 10 percent decrease in the user cost of research in a state is associated with an increase of 12.1 percent in research within the state (p. 434). However, Wilson (2009) finds that almost all of the increased research comes from neighboring states. Thomson (2017) finds a smaller effect in the short run, but a longer effect in the long run compared to Wilson (2009). In a meta-analysis, Blandinieres et al. (2020) find that while firms in U.S. states appear more responsive to research spending costs than in other countries, one dollar of in R&D tax credits corresponds to roughly one dollar in additional research spending. Evaluation studies that review state-specific tax credits have similarly failed to find robust, positive effects (Hall & Wosinka, 1999; Paff, 2005; La Croix & Mak, 2021; Eathington & Swenson, 2010). Eathington and Swenson (2010) is particularly relevant as it examined whether Iowa's research credit was associated with positive economic outcomes, like increased number of R&D conducting firms, number of high-tech jobs, and value of capital investment linked to R&D activities. The authors find that Iowa's R&D effort as a fraction of gross domestic product is much lower than the national average and conclude that the credits efficacy is not evident.

Negligible findings of the literature have motivated modifications of the scope of research. For example, it could be that the effect of R&D credits is not constant across all firms and industries (Chen & Yang, 2019). Several studies have found support for this contention. Castellacci and Lie (2015) examine how the effects of credits depend upon the firm's industry and find that firms in the service sector and low-tech industries benefit disproportionately compared to other firms. Anandaran et al. (2010) find a similar pattern for operational performance, in which the effect of the credit is conditional upon firm size. In particular, they find that small, older firms with stagnating sales benefit the most from R&D tax credits.

C. Research Expenditures Across the United States

The review above indicates that while studies often find positive effects of R&D credits, the impact in the short run is often low and particularly low for state-level credits. The present evaluation study contributes to this vast literature by examining if states with research activities tax credit programs, like Iowa's RAC, is associated with having more research inputs and outputs. Specifically, this study leverages the significant cross-state variation in both research credits and expenditures. The National Science Foundation (NSF) collects data on research and development expenditures by state and entity (see Table 3). Nationwide, in 2017, the overwhelming majority of research expenditures were incurred by private businesses (75.35 percent), followed by the federal government (21.24 percent), academic institutions (13.39 percent), and finally state governments (0.47 percent). In Iowa, private businesses spent $2.94 billion on research during 2017, the 24th highest in the country. By far the top state was California, which constituted approximately 33 percent of the totality of US private research. California, Massachusetts, Washington, Michigan, and Texas are the top five states for private business research. Interestingly, this is not necessarily true for other research types. While states that are high on private research typically are ranked higher for other research types there are exceptions. For example, New Jersey which is ranked 6th in private business is ranked 22nd for academic research, and 18th in federal research. Michigan –ranked 4th nationally—has the highest amount of private research in the Midwest at $21 billion dollars. Iowa ranks 25th in academic research, 30th in federal research, and 40th in state government research. Iowa was ranked 27th for total research expenditures in 2017.

Private research per capita and as a percentage of gross state product is highest in Northeast U.S. (see Figures 4 and 5). In general, the Midwest appears to be relatively after controlling for population and economic size. While the level Iowa's R&D activity is small relative to other states, between 1997 and 2018 it had one of the fastest growing private R&D sectors in the United States (see Tables 4 and 5). In 1997, Iowa ranked 34th in total private R&D, 33rd in private R&D per capita, and 34th in private R&D as a percent of private gross state product. By 2018, Iowa's rank increased to 24th, 14th, and 17th respectively. Only Oregon experienced a greater increase in state rank.

V. Analysis of Iowa Research Activities Tax Credit Claims and Awards

A. Descriptions of QREs, RAC and SRAC amounts and number of firms conducting research as reported on the IA128 and IA128S

Businesses in Iowa that are eligible to earn the RAC report qualified research expenditures divided into four categories: wages, supplies, rental or lease of personal property such as computers, and contract expenditures (see Table 6). Firms using the regular method, or Form IA 128, to calculate the RAC over tax years 2006 through 2019 reported 61.4 percent of qualified research expenditures as wages. Supply costs accounted for the second-greatest share of expenditures, at 29.5 percent and contract expenditures comprised 8.7 percent of expenditures during the period. Expenditures reported for the lease of personal property were negligible, at 0.5 percent. For firms using the IA 128S, or the Alternative Simplified method, available data concern a more limited time period since the ASC has been in place only since tax year 2010. For these firms, reported expenditures across the four categories are distributed very similarly to firms using the regular method with wages at 56.3 percent and supplies at 34.2 percent.

In tax year 2018, businesses using the regular method to calculate the RAC reported approximately $6.5 billion in U.S. qualified research expenditures and $546.1 million in Iowa qualified research expenditures. Iowa research expenditures thus accounted for 8.4 percent of their total U.S. research expenditures. Not all businesses using the IA 128S report total U.S. research expenditures because the number is not necessary for the tax credit calculation. For firms using this calculation method, IA QREs amounted to $1.7 billion in tax year 2018, or 9.8 percent of the total reported U.S. QREs. Thus, 76.1 percent of Iowa QREs reported for the RAC in tax year 2018, the most current complete tax year, are associated with ASC claims.

Based on their qualified research expenditures in tax year 2018, businesses claiming the regular RAC earned $65.3 million in both automatic and Supplemental tax credits. This equates to 2.9 cents per dollar of total Iowa research. Recall that the RAC is provided for incremental research expenditures above a base amount rather than for total expenditures. For this reason, the calculated credit amount per dollar of total of research is somewhat lower than the rate allowed for incremental expenditures. For the regular credit, this rate is 6.5 cents per incremental research dollar. For the Alternative Simplified Credit, it is 4.55 cents. For businesses using this method, credits earned amounted to 2.7 cents per total Iowa research dollar in 2018.

Bearing in mind that data for tax year 2019 is incomplete, there were 501 firms earning RAC credits in that year (see Table 7). Of these, 339, or 68 percent, calculated the credit using the IA 128S, the requisite form for the Alternative Simplified method and 32 percent calculated by means of the regular method, which employs the IA 128. In 2010 when the ASC became available, 36.0 percent of firms earning RAC calculated the credit amount using ASC. Since then, the percentage of firms using the ASC to calculate the credit has grown each year.

Both the IA 128 and the IA 128S forms collect data from taxpayers concerning their four-year moving average of annual gross receipts (see Table 7). Taxpayers using the IA 128S, however, are not required to supply this data to calculate the tax credit. On average, between tax years 2010 and 2019, only 48 percent of taxpayers supplied this information each year, with 43 percent of taxpayers reporting for 2019. The sum of the four-year moving average of gross receipts reported by RAC claimants was $613.5 billion in tax year 2018. This represented a 23 percent decrease over the prior year. The four-year moving average of gross receipts by RAC claimants peaked in 2017, at $793.9 billion.

Except for 2012 and 2018, businesses using the regular method have accounted for well over half of the total four-year moving average of firm gross receipts since 2010, or the first-year taxpayers had the option to use the ASC. In 2012, 43 percent of the moving average gross receipts reported by RAC claimants came from firms using the regular method. In 2018, it was slightly lower at 40 percent.

In contrast, businesses using the ASC consistently account for a majority of qualified research expenditures (Table 7). In each year since 2010, at least 50 percent of RAC credit amounts have been calculated using the ASC and as of 2019 businesses using the regular method represented just 22 percent of QREs. This seems to suggest that businesses with lower average gross receipts, yet higher QREs, tend to select the ASC whereas the regular method of claiming the RAC is favored by firms that have, on average, higher gross receipts and lower QREs. On average, QREs represent 0.22 percent of the four-year average of gross receipts among firms using the regular method in 2018. Meanwhile, average research intensity among firms claiming the ASC has generally been higher, ranging from 0.40 percent in 2012 to 1.06 percent in 2019.

In year each since TY 2010 at least 50 percent of RAC credit amounts have been calculated using the ASC (see Figure 10). For tax years between 2010 and 2018, ASC's share of credit amounts has ranged from 50 percent (2010) to 71 percent (2018). Over time, RAC reported on the IA 128 and 128s has increased from $21 for TY 2006 to $62 million for TY 2018. For the last five tax years, the credit amount has ranged from a lot of $59 million (TY 2014) to a high of $67 million (TY 2015). This increase in RAC amounts reported is attributable to the rise in number of firms conducting qualified research. For TY 2006, 336 firms reported qualified incremental research. This number has steadily increased to a high of 700 for TY 2016 and a total of 492 for TY 2018, the most recent year for which data is complete. In the last five years, the number of firms conducting qualified research has ranged from 492 (TY 2018) to 668 (TY 2016). Most recently, there appears to be a downward trend in the number of firms reporting such research but more recent years will continue to grow as taxpayers may still be able to make claims against these years in the future.

Over time, SRAC reported by firms conducting research has increased from $4 million for TY 2006 to its peak of $16 million for TY 2011 and declined since to a low of $2 million for TY 2018 (see Figure 11). The number of firms reporting SRAC has only slightly mirrored this trend. In 2006 there were 39 firms reporting SRAC. This amount decreased until 2010 when the number of firms jumped to 41. Since then the number of firms reporting SRAC has declined to its lowest point of 17 in 2018.

The rate for SRAC varies according to firm size (see Table 8). Approximately 411 firms have claimed SRAC for TY 2006-2019, a total of $98.7 million in total credits reported. Approximately 38 percent of firms—or 158 firms— had less than $20 million in average annual gross receipts, representing approximately $29.2 million in credits reported. Approximately 62 percent of firms---or 253 firms— reported receipts of greater than $20 million, representing $69.5 million in credits.

B. Descriptions of QREs, RAC and SRAC amounts and claims as reported on the 148

As noted above, the businesses that earn the RAC are often not the taxpayers that claim the tax credits against tax liability. Claims against corporation income tax account for the great majority of claimed RAC amounts (see Table 9).[2] In tax year 2018, corporate claims accounted for 73.5 percent of total RAC dollars. Between 2006 and 2018, corporate claims as a share of total RAC claims has ranged from a high of 92.6 percent (2007) to a low of 73.5 percent (2018). In general, corporate claims share has declined since 2006. Corporate claims account for a much smaller percentage of the number of claims (5.56percent in 2018), and appears to be on the decline as well. This is because RAC tax credits earned by pass-through entities are claimed by their shareholders on individual income tax returns; thus, a single RAC tax credit earned by a pass-through entity might be claimed on any number of individual tax returns.

One of the significant trends over time is the increasing in the number of claims against individual income tax (see Figure 12). RAC claims against individual income tax have increased from just $3 million for TY 2006 to $16 million for TY 2018. While corporate claims have increased as well from $28 million for TY 2006 to $44 million for TY 2018, corporate claims relative to individual claims have declined (Table 9). The number of corporate claims has increased slightly from 2008 in 2016 to 360 in 2018, however the number of individual claims has grown significantly—from just 772 in 2006 to 6,316 in 2018.

SRAC claims—whether against corporate or individual income tax—have declined significantly from 2006 (see Table 10). For TY 2006, there were 33 SRAC claims against corporate income tax, representing $12.5 million. For tax years 2018 and 2019 there were just 16 SRAC claims against corporate income tax, representing a little over $3.4 million. A similar trend is observed for individual claims. In 2006, there were 193 SRAC claims against individual income tax, representing $0.7 million. For tax years 2018 and 2019,

[2] Note that total RAC reported on the IA 128 and IA 128s does not exactly match what is claimed on the IA 148. This is because some passthrough entities who are conducting research have not filed a corresponding IA 128 or IA 128S.

there were just 61 claims, representing $0.2 million. Interestingly, corporate claims as a percent of the number of claims or the percent of claimed amount has remained relatively constant, at 16 and 91 percent, respectively.

C. Descriptions of refunded claims and Fiscal Impact

As noted in Section III, Iowa is one of only eight states whose RAC is broadly refundable. For tax year 2006, approximately $28.7 million of $30.8 million, or 93.3 percent, of RAC claims were refunded to taxpayers (see Table 13). Of the $28.1 million of corporate RAC claims, $26.1 million, or 92.6 percent, was refunded and all ($2.6 million) of the RAC claims against individual income tax was refunded. The percentage of RAC tax credits paid as refunds has steadily declined from 2006 to 2012 and then increased to 75.8 percent in 2013. As of 2018, 59.4 percent of RAC claims were paid as refunds—66.6 percent of corporate claims and 41.3 percent of individual claims. In general, corporate claims have had a much higher percentage of paid refunds compared to individual claims. The difference likely reflects that individuals, as shareholders, have wages or other taxable income unrelated to the business carrying out the research that offset the credit claim. Also, the size of the average claim made by a corporation taxpayer is approximately $100,999 while individual taxpayers have an average claim of $2,526 (see Table 9). In total, 76.5 percent of claims have been refunded—81.3 percent of corporate claims compared to 55.2 percent of individual claims.

While all of the above metrics have been calculated on a tax year basis, a single fiscal year will contain claims from many different tax years. Table 12 shows RAC and SRAC numbers and amounts broken out by fiscal year. For FY 2007, RAC and SRAC amounted to $3.1 million, $2.3 and $0.7 million respectively. By FY 2017 it had increased to $74.9 million, $67.2 million in RAC and $7.5 million in SRAC. As of FY 2020, RAC and SRAC combined represented approximately $82.0 million. In total, from FY 2007 to FY 2021, RAC amounted to $695.4 million and SRAC $133.5 million, for a total impact of $828.9 million.

VI. Evaluation of the Research Activities Tax Credit

Research activities tax credits—and R&D tax credits in general—seek to stimulate private investment in research due to its positive impact on economic growth and productivity. From a public policy perspective, these credits are implemented to alleviate a "classic goods" problem in which the private market undersupplies a good because the benefits of the product cannot be completely internalized by the producer. That is, the private rate of return on research and development is often considered lower than the societal rate of return. R&D tax credits are intended to incentivize additional research by decreasing firms' marginal cost of R&D and bringing the private and societal return on R&D into alignment. However, R&D tax credits represent a significant investment of state resources. Iowa's credit has cost the state nearly $695.4 million tax revenue since 2006 (see Table 12).

To help inform policymakers and the public regarding the efficacy of Iowa's research activities tax credit, this evaluation study addresses three core questions.

1. Do incremental research activity tax credit programs stimulate research inputs and outputs?
2. What specific program features (if any) are effective at stimulating research inputs and outputs?
3. How effective are incremental research activity tax credit programs compared to other public policies proposed to stimulate research inputs and outputs?

Each of these questions are addressed using data on incremental research activities tax credit programs[3] as well as data regarding research expenditures, private employment, utility patents, and private gross state product for all 50 states [4].

A. Do incremental research activity tax credit programs stimulate research inputs and outputs?

This analysis considers if the existence of an incremental research activity tax credit program in a state stimulates both research inputs and outputs. Research inputs refer to the resources used to conduct research activities whereas outputs refer to the potential outcomes of the research process. Most directly, research activities tax credits should stimulate research inputs, such as research expenditures or research intensity, because such credits make research activity cheaper for firms. However, there are several concerns with using such measures, in particular the comparability of what constitutes "research" across firms, industries, and states. Yet output measures, such as patents or innovation counts, "...need not imply a high level of innovation as some patents may never be implemented…" and propensity to patent varies significantly across firms, industries, and states (Becker, 2015, pp. 918). Given measurement concerns, this evaluation studies examines both inputs and outputs.

This study focuses on two input measures: private research expenditures and private employment. Private research expenditures are most closely associated with what incremental research activities tax credits intend to stimulate the research process, however, such credits may increase private employment directly by creation of jobs for scientists working on research and indirectly through innovations that may result from the research process. Data on total private research expenditures is provided by the National Science Foundation (NSF) and is available for all states between 1997 through 2018. Since private R&D data is measured as current dollars, a gross domestic product deflator is applied to the data in order to convert current dollars to 2015 dollars to enhance comparability across time. Data on employment in the private sector is provided by the Bureau of Economic Analysis (BEA) and is available for all states between 1969 through 2020.

.

This study also focuses on two output measures, the number of utility patents registered in a state (innovation) and private gross state product (private economic activity). The U.S. Patent and Trademark Office grants utility patents or "patents for invention". Specifically, this study is interested in the number of utility patents broken down by state residency of the inventor. Data on the number of utility patents granted by state is provided by the Patent Technology Monitoring Team (PTMT) for all states between 1963 through 2020. Total gross state product measures a state's economic output. Specifically, this study is interested in to what extent a tax credit increases a state's private economic output. Data on gross state product for private industries is provided by the BEA and is available for all states between 1969 through 2020. Gross

[3] For a more detailed description of program features by state see Section III.
[4] For a state by state description of research inputs data see Section IV.

state product is converted from current dollars to 2015 dollars using the same method used for private R&D expenditures.

This analysis seeks to evaluate the impact of the existence of a research activities tax credit program on a state's research inputs and outputs. Data on the existence of incremental research activities tax credits was collected from a variety of sources, including previous evaluation studies[5]. For a more detailed description of incremental research activities tax credits across the United States and over time see Section III of this study. The main independent variable of this analysis, existence of a research activities tax credit, is a binary indicator variable coded "1" if a credit is present in a given state-year and "0" otherwise. Section III revealed that over time many states have adopted a research activities tax credit. This means that the binary variable "turns on" for many states over the course of the time series and for some states this variable "turns off". For example, Iowa's RAC "turned on" in 1985 and has stayed on until the end of the time series. That is, for Iowa the main independent variable is recorded as a zero until 1985 and then one thereafter.

In order to evaluate the potential effect of a research activities tax credit on research inputs and outputs, consider the difference in average inputs and outputs between RAC and Non-RAC states (Tables 13 and 14; Figures 14 and 15). To maintain comparability across RAC and Non-RAC states, each variable is converted into a per capita (or per million) basis.[6] If research activities tax credits are effective at stimulating research inputs and outputs the RAC average should be higher than the non-RAC average. Table 13 and Figure 14 provides descriptive support for RAC programs increasing research inputs. Between 1997 and 2018, on average RAC states had consistently higher private R&D per capita compared to Non-RAC states, ranging from 37 percent (2018) to 177 percent (2011) higher in a given year. In fact, for all years in which data on private research expenditures are available, RAC states always reported higher expenditures than their non-RAC counterparts. On average, RAC states reported $898 in R&D per capita compared to $484 for non-RAC states between 1981 and 2019, for an average difference of $414—or 85 percent higher. A similar, albeit weaker pattern is observed for private employment per capita. Between 1981 and 2020 RAC states had consistently higher private employment per capita than non-RAC states. For only four years or 12.8 percent of the sample, Non-RAC states had a similar level of private employment compared to RAC states. On average, between 1981 and 2020 RAC states had 14 percent higher private employment per capita compared to Non-RAC states.

Table 14 and Figure 15 reports average levels for research outputs as well as differences between RAC and Non-RAC states. There is more robust descriptive support for RAC programs stimulating research outputs. Between 1981 and 2020 the average for RAC states is higher than the average for non-RAC states, ranging from a low of 6 percent higher in 1988 to a high of 160 percent in 2011. On average, RAC states reported 89 percent more utility patents per million residents than non-RAC states. Economic activity also appears higher in RAC states compared to Non-RAC states. Private gross state product per capita in RAC states are higher in 33 out of 39 years considered, with a high of 19 percent greater in 2014. Interestingly, from 1985 to 1990 Non-RAC states reported higher economic activity on average than states with RAC. On average, between 1981 and 2020 private GSP was 50 percent higher in RAC states compared to Non-RAC states.

The above descriptive analysis does not consider whether or not the difference is "statistically significant". That is, the difference observed between RAC and Non-RAC states could be due to random chance. In order to test if the difference is large enough to reject that the difference is due to random chance, this study conducts a two-sample t-test, which compares the average values of two samples to determine if both came from the same population (equation 1). The null hypothesis of a t-test assumes that the two means are equal (H_0). If the probability of observing the data, given that the null hypothesis is true, is low—less 0.05—then the null hypothesis is rejected in favor of the alternative hypothesis (H_a). In this case, the alternative hypothesis states that the two means are not equal. To find the probability of observing the data given that

[5] Sources include TaxCreditResearch.com (www.taxcreditresearch.com), C2ER State Business Incentives Database (www.stateincentives.org), KBKG (www.kbkg.com), various state revenue and legislature websites (e.g. www.revenue.state.mn.us, www.revenue.wi.gov, www.legislature.mi.gov), and news search engines.
[6] Population data is provided by BEA.

the null hypothesis is true, the difference in sample means is converted into a T-value using equation 2. Assuming t-values are distributed normally, the t-value is then used to derive a probability of the true difference being greater than zero.

$$H_0: \mu_1 = \mu_2 \qquad (1)$$
$$H_a: \mu_1 \neq \mu_2$$

To find the probability of observing the data given that the null hypothesis is true, the difference in sample means is converted into a T-value using equation 2. Assuming t-values are distributed normally, the t-value is then used to derive a probability of the true difference being greater than zero. Tables 12 and 13 report the average difference in each sample in the pooled row and indicate if this difference is large enough to rule out the possibility that the observed difference is simply due to random chance. For each input and output the null hypothesis is rejected meaning there is strong support for unequal means. That is, on average RAC states have higher private R&D, private employment, utility patents, and private gross state product and this difference is not due to random chance.

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{s_1^2}{n_1}\right) + \left(\frac{s_2^2}{n_2}\right)}} \qquad (2)$$

While the t-test does acknowledge that the differences observed may be due to random chance, it does not consider other factors that may be driving the differences between RAC and non-RAC states. For example, the reason why the research input and output were weighed for population size is because large states—like California—likely have more opportunity for all economic activity simply due to having a large population. Failure to model other factors that drive research inputs and outputs—especially when these factors are correlated with the existence of RAC programs[7]—provides a misleading picture of the effect of RAC programs on these inputs and outputs. In particular, it is likely that industrial composition (e.g. percent manufacturing, agriculture, mining, etc.), demographics (population, population density, etc.), and other fiscal policies (corporate income tax rate, support for higher education, sales tax rate, income tax, etc.) will have an impact on both the research inputs and outputs as well as the existence of tax credit for research activities. Instead, a multiple regression framework can be used that will allow controlling for other factors when modeling.

In this case an ordinary least squares (OLS) regression framework would model a state's research input or output based on the following equation

$$r_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} \qquad (3)$$

where *i* indexes cross-section units (states), *t* indexes time units (years), *X* denotes a vector of independent variables, α is a constant, and ε_{it} is the error term.[8] Importantly, the vector of independent variables includes a binary indicator variable for presence of RAC program (0 or 1) and a series of control variables for industrial composition, demographics, and other fiscal policies. β' refers to a series of coefficient estimates which indicate the effect of a one unit change in an independent variable on r_{it}. For example, if a coefficient estimate for existence of a RAC program is equal to two, it means that the existence of a RAC program increases private research and development per capita by two dollars, on average, holding all else constant. While OLS regression (equation 3) is a substantial improvement over simple t-tests, it is likely that the controls do not account for all observed or unobserved heterogeneity among states. That is, there are a variety of factors that influence research inputs and outputs and researchers only have a limited pool of data they can reasonably include in the model. Instead, unobserved heterogeneity between the cross-

[7] In a regression framework, failure to model variables that are correlated with both the dependent and independent variable introduces omitted variable bias.
[8] For a more detailed description of this equation and alternative modeling strategies, see Becker (2015).

section units (states) can be controlled for by including fixed effects[9] (FE) into equation 3. This is done by including a series of indicator variables that correspond to a state. That is, for all observations for Iowa there will be a "1" whereas for all other states the indicator will be "0" Now the coefficient estimate on the independent variables will be estimated controlling for the unobserved "uniqueness" of a state. However, there are likely technological shocks and other dynamic patterns amongst the data, especially since a firm's decision to devote resources to R&D is temporally dependent and often planned years ahead of the actual expenditure. To control for this, a two-way (state-year) fixed effect is included (equation 4).[10]

$$r_{it} = \gamma' X_{it} + f_{it} + \varepsilon_{it} \tag{4}$$

As indicated before, a series of control variables are included in equation 2. Given data availability from 1969 to 2019, three broad factors are included: industrial composition, population demographics, and other state fiscal policies. Industrial composition is captured through variables that represent the percent of private industry GSP that comes from that sector: agriculture, construction, finance, manufacturing, mining, retail, and services. Two demographic control variables are also included: population and population density. Lastly, three fiscal policy controls are included: income tax, sales tax rate, and corporate tax rate. Data on industrial composition of private GSP and population is provided by BEA. Data on fiscal policies is provided by the Correlates of State Policy Project. For descriptive statistics for each variable included in the model, see Table 14.

Table 16 reports OLS analysis (equation 3) of research outputs and inputs. Models 1 and 2 estimate the effect of RAC on research inputs: private R&D per capita and private employment per capita. Note that Model 1 has fewer observations than Model 2 because private R&D data is only available from 1997 to 2018. The R squared statistic indicates that each model is explaining a large proportion the variability in the dependent variable, 49 percent for private R&D and 57 percent for private employment. Considering the number of other factors that likely contribute to a state's private R&D and private employment an R squared of over 0.40 means the model is fitting the data reasonably well but not perfectly. Results from Model 1 suggest that having a RAC program is associated with more private R&D. The coefficient on RAC is positive and statistically significant at 0.05 level, suggesting that the positive relationship is not observed simply due to chance. Results from Model 2 suggest that having a RAC program also increases private employment, as the coefficient on RAC is positive and statistically significant. Models 3 and 4 estimate the effect of RAC on research outputs: count of utility patents per 1,000 residents and private GSP per capita. Once again, the models explain a fair amount of variability in each dependent variable—37 and 77 percent—and the coefficient on RAC for each model is statistically significant and positive. The results found in Table 15 suggest that RAC programs are correlated with higher research inputs and outputs.

However, Table 17, which reports FE analysis (equation 4) of research outputs and inputs, tells a considerably different story. Recall that the FE analysis is necessary because there are underlying characteristics unique to certain states that may impact the dependent variables. Unfortunately, data concerning these factors is unavailable—hence they are "unobserved". Failure to model a state's unique propensity to research results in bias. Similarly, there is likely temporal dependencies in the data and shocks that may impact the dependent variables in any given year. FE analysis controls for both unobservable factors and temporal dependence. Models 1 and 2 estimate the effect of RAC on research inputs. Now Models 1 and 2 are explaining almost all of the variability in each dependent variable—92 and 93 percent respectively. This is a sizable increase from the OLS models, suggesting better model fit. Once the unobserved heterogeneity across states and years are controlled for, the presence of a RAC program is either negatively correlated with the dependent variable (private R&D) or has no effect at all (employment). A similar pattern is also observed for research outputs (Models 3 and 4). Now the models are explaining 72.1 percent of utility patents arising in a given state and 90.3 percent of private gross state product. This suggests an improved model fit, but now the coefficient estimates place into question the

[9] A series of binary indicator variables indicating the State ID is included in the regression model. Due to multicollinearity one unit, in this case Iowa, will be dropped from the analysis. The coefficient estimate on the state fixed effect variable then is how much different that state's research activity is from Iowa.
[10] Now the model contains a series of binary indicator variables for years as well as State ID.

relationship between RAC and research outputs. RAC has a positive and statistically significant coefficient for utility patents (Model 3), but the coefficient on RAC for private GSP (Model 4) is statistically insignificant.

Using these models, we can predict economic outcomes for Iowa under difference scenarios by inputting observed values into equations 3 and 4. To do this, Iowa's observed value is put into the equation and compared to the results for when one variable is changed. For Iowa's observed values, see Table 18. Results can be found in Table 19. In this case, how much research inputs—private R&D and private employment—would Iowa have had in 2015 if Iowa did not have a RAC program? The ordinary least squares model predicts that Iowa would have $879.4 in private R&D per capita in 2015 with the RAC but would have had $674.7 without it. That is, private R&D would have been $204.7, or 23.3 percent, lower without the RAC. However, once unobservable factors and temporal dependence is controlled for by including twoway fixed effects, the model predicts $615.7 with the RAC and $787.7 without the RAC for an decrease of approximately 27.9 percent. The ordinary least squares model predicts private employment to decrease by 0.04, or 6.54 percent, if the state lacked a RAC program. However, again once both observed and unobserved factors are controlled for, the effect of RAC becomes indistinguishable from zero. The model predicts an increase in private employment per capita if the state did not have a RAC program in 2015, but the effect is very small—an increase of just 0.08 percent.

How much research outputs—utility patents and private GSP—without a RAC program in 2015? The ordinary least square model predicts 19 percent fewer utility patents per 1,000 residents and 10.6 percent less private gross state product per capita without the RAC in 2015. However, once we control for unobserved factors the model predicts a much weaker effect: a decline of 9.68 percent in utility patents and 0.08 percent in private gross state product.

In general, this analysis finds mixed support for the presence of RAC programs increasing research inputs and outputs in states. Descriptively it does appear that RAC states have higher inputs and outputs, but this is likely due to RAC states also having an underlying propensity to research that is independent of the research activities tax program. Once the relationship is probabilistically modeled with control variables (OLS) and when unobserved heterogeneity is accounted for (FE) the relationship appears negative for research inputs and only modestly positive for research outputs.

B. What specific program features are effective at stimulating research inputs and outputs?

This analysis considers whether specific program features—namely the credit's highest rate and refundability—stimulates research inputs and outputs. One problem of the previous analysis is that it fails to consider how RAC programs differ between states. As discussed in Section III, programs vary considerably from one state to the next, by credit rate, limited amount or liability, whether the credit is awarded, able to be carried forward, limited to types of taxpayers, industries, or geographies, small business incentives, and refundability of the credit. This section asks if program design can help or hinder the credit's ability to stimulate research inputs and outputs—specifically if higher rates and refundability increase the program's performance. Refundability in particular represents a significant fiscal impact for Iowa. As shown in Table 9, of the $706 million in research activities claims for TY 2006 through 2019, approximately $541 million was refunded—or 76.5 percent of all claims.

Many of the same sources used in the previous analysis and in Section III also contained data regarding various program features, including the highest rate of the credit and refundability. As of 2021, of the 35 states that offer a tax credit for incremental research activities, seven (19 percent) have a state tax credit rate of over 15 percent, 19 (52 percent) have a rate that is between 5 and 15 percent, and ten (27 percent) have a rate of less than five percent. The state tax credit rate for qualified research expenditures among tiered systems varies from a low of three percent in Colorado to a high of 20 percent in Hawaii. Arkansas offers a 33 percent rate for certain qualifying expenditures. The average RAC rate for all 50 states from 1981 to 2019 was 4 percent.[11] The Iowa tax credit rate under the regular calculation is 6.5 percent. Iowa's research activities tax credit is fully refundable. Most states do not offer a refundable credit. Of the 35 states with incremental research activities tax credits, 12 states (20 percent) offer partially or fully refundable credits, seven states offer fully refundable credits, four states offer partially refundable credits, and three

[11] This includes zeros for states that lack such credits.

states offer refundability for small businesses. Refundability is coded 1 if the state has a partially or fully refundable credit and 0 otherwise.

This analysis utilizes the same general strategy of the previous analysis. First, the study observes if there is a descriptive relationship between the independent variables and the research inputs/outputs. Since the rate of the program is a continuous measure that theoretically ranges from 0 to 1, with 0 indicating a lack of a program and 1 indicating a credit equal to 100% of research expenditures over a base amount, rate is plotted against each input and output. If there is a positive descriptive relationship, higher values of rate should be paired with high values of the input/output. That is, the plot should resemble an upward sloping line. The descriptive relationship between refundable credit and the research inputs and outputs is determined the same way in the previous analysis—by observing the average difference between states with refundable and without such credits. Second, the statistical significance of the descriptive relationship is determined. For rate, a Pearson's correlation coefficient, or r (equation 5), is estimated to determine if there is a linear relationship between rate and the inputs/outputs. For refundability, a t-test is conducted. Third, ordinary least squares regression, which can include controls, is estimated. Lastly, two-way fixed effects models are estimated to control for unobserved heterogeneity.

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}} \tag{5}$$

Figure 16 shows scatterplots of RAC program rates and the research inputs and outputs. All four scatterplots suggest a linear relationship. Table 19 reports the calculated Pearson's correlation coefficient and the probability of observing that coefficient provided there is no true correlation between the two variables. The rate of the credit is positively associated with each of the research inputs and outputs and is determined to be statistically significant. This suggests that there is some descriptive support for the relationship between the rate of the credit and research inputs/outputs, but again this relationship may be due to these states having an underlying propensity for research and is unrelated to the research activities tax credit.

Figures 17 and Table 21 report the value of research inputs for states with and without refundable RAC credits. Note that the first refundable credit—Iowa's—was adopted in 1985. There is considerable descriptive support for refundability increasing research inputs. In every year since 1997, states with refundable credits have higher private R&D on average, ranging from 16 percent higher in 2010 to 79 percent higher in 2002. Between 1997 and 2018, states with a refundable credit had a $265 higher mean on average—or 37 percent higher— compared to states without such a credit. The observed relationship between private employment and states with refundable credits is weaker. On average, between 1985 and 2020, states with refundable credits had only 10 percent more private employment compared to states that lacked such credits. However, the observed difference is significant for both inputs. Figure 18 and Table 22 report the value of outputs for states with and without refundable credits. On average, between 1985 and 2020, states with refundable credits had 51 percent higher average number of utility patents per 1,000 residents and 45 percent higher private gross state product per capita. Both differences are statistically significant. This suggests that there is strong descriptive support that refundable states have higher research inputs and outputs on average.

In general, the descriptive analysis suggests a strong and positive relationship between these two programs features and research inputs/outputs. Table 23 provides only partial support for this positive relationship once industrial composition, demographics, and other fiscal policies are controlled for. In general, the models are once again explaining a good proportion of variability in the dependent variables—at least 35 percent in each case. The coefficient on rate is positive and significant for all research inputs and outputs however, coefficients for refundability are negative for private R&D and patents, but indistinguishable from zero for employment and private gross state product.

The positive relationship becomes even more dubious when unobservable factors and temporal dependence is modeled (Table 24). Now rate of the credit has a negative and statistically significant coefficient for R&D, positive but insignificant coefficients for employment and patents, and a negative and insignificant coefficient on private gross state product. Now coefficients on refundability are negative for

R&D, employment, patents, and positive for gross state product. This all suggests that once observable and unobservable factors are controlled for there is very limited evidence that these two features drive research inputs and outputs.

The models can be used to predict economic outcomes under different scenarios (Tables 25 and 26). What if Iowa had a 10 percent rate rather than a 6.5 percent rate in 2015? The OLS model predicts that Iowa would have had 4.5 percent more private R&D, 1.1 percent more private employment per capita, 3.0 percent more utility patents per 1,000 residents, and 2.1 percent higher private gross state product per capita. However, the FE model predicts private R&D would have been reduced by 5.2 percent, employment reduced by 0.09 percent, utility patents increased by 0.86 percent, and private gross state product to be reduced by 0.08 percent.

What if Iowa lacked a refundable credit in 2015? The OLS model predicts that Iowa would have had 10.6 percent more private R&D, 1.4 percent more private employment per capita, 15.7 percent more utility patents per 1,000 residents, and 1.0 percent lower private gross state product per capita. However, the FE model predicts private R&D would have been increased by 6.8 percent, employment increased by 0.47 percent, utility patents increased by 2.9 percent, and private gross state product to be reduced by 4.2 percent if the state did not have a refundable credit.

In general, there is limited support for a positive effect for rate of the credit increasing research inputs and outputs, but the model predicts a negative effect for refundability.

C. How effective are incremental research activity tax credit programs compared to other public policies proposed to stimulate research inputs and outputs?

This analysis compares the impact of an incremental research activity tax credit program to other public policies that have been proposed to stimulate research inputs and outputs, namely the top corporate income tax rate and state support for higher education. As discussed in Section IV, state governments have several policies at their disposal that are thought to impact research activities. There are three different categories of such policies: tax incentives and direct subsidies, support of the university research system to increase high-skilled human capital, and formal R&D cooperation across industries and sectors (Becker, 2015). State governments can always directly increase research activity by hiring scientists and/or contracting firms and institutions to conduct research. However, most states have opted for a tax-incentive approach that lowers the cost of conducting research within the state. The idea is that if research is cheaper, technological start-ups will either migrate from other states or they will form within the state. The corporate income tax is another public policy that impacts migration and firm creation. Firms are assumed to respond to tax rates in a rational way, opting for states with lower rates compared to their peers. State corporate income tax indirectly impacts the cost of research since it is a cost of conducting business within the state. Several authors have suggested tax credit programs—such as Iowa's RAC—is too complicated and should be replaced with a simpler policy of lowering the state corporate income tax rate. If this is true, then corporate income tax rate should be negatively correlated with research inputs and outputs. State support of the university system is said to increase research inputs and outputs directly by supplying sectors that conduct R&D—chemical manufacturing, computer and electronics manufacturing, transportation equipment, information, etc.—need a labor force that is highly skilled and specialized. Indirectly, support for the university system may encourage technological spillovers from the public sector into the private sector, which would also stimulate research inputs and outputs. If these three public policies indeed impact research inputs and outputs in the theorized way, then they may be substitutes and public policymakers should consider the efficacy of investing tax dollars into one policy over another.

Data on state corporate income taxes is provided by the Correlates of State Policy Project, specifically the work from Caughey and Warshaw (2015) and is available from 1969 through 2015. Corporate income tax rates were updated from 2015 to 2020 by the author. Top corporate income tax rates for 2020 range from 0 percent (South Dakota and Wyoming)[12] to 12 percent (Iowa) and on average the corporate income tax rate was 6.17 percent. Data on state support for the university system is provided by the State Higher

---

[12] Nevada, Ohio, Texas, Washington impose gross receipts taxes instead of corporate income taxes. They are also set to zero in the data.

Education Executive Officers Association (SHEEO) and is available from 1980 through 2020. This variable is measured in current dollars and is converted to a 2015 dollars basis using the previously described method to increase comparability across time. Similarly, out of concern for state differences in size the variable is divided by the total number of enrollments that year. University support per enrollment in 2020 ranges from $2,935 (Arizona) to $20,603 (Hawaii). Iowa's value for 2020 is $6,543, slightly below the mean of $8,089.

This analysis utilizes the same general strategy of the previous analyses. Figure 19 shows the descriptive relationship between a state's top corporate tax rate and research inputs and outputs. Corporate income tax has a negative and statistically significant (see Table 20) relationship with research inputs and outputs. This suggests that as a state's corporate rate increases, research tends to decrease. However, the strength of the relationship varies significantly: relatively strong for patents per thousand residents, but weak for private employment per capita. Figure 20 shows the descriptive relationship between a state's support for university education per enrollment. In general, there is a negative but weak relationship with private R&D per capita and patents per thousand residents, but a positive and strong relationship with private employment per capita and private gross state product per capita. This suggests that as university support increases, private R&D and patents may decrease slightly, but private employment and private gross state product increases.

These results in combination with the results presented in Tables 13 and 14 call into question the substitutability of each policy. For example, the descriptive analysis showed RAC was the mean of research inputs and outputs was higher for RAC states—substantially so. However, the correlation results from Table 20 and Figure 19 suggest that top corporate tax rate is weakly positively associated with research inputs and outputs---directly counter to the theorized relationship. The same could be said with state support for education per enrollment: weak negative relationship with R&D and patents, but moderate positive relationship with employment and private gross state product (Table 20 and Figure 20). This suggests each policy may have differing effects on research inputs and outputs.

However, once the models control for industrial composition, demographics, and other fiscal policies, there is modest support the three fiscal policies operating as theorized, with the potential exception of university support (Table 27). RAC state has a positive and statistically significant coefficient across all models, suggesting that the existence of a RAC program stimulates research inputs and outputs. The coefficient on top corporate income tax rate is negative and significant for R&D and employment, but positive for and significant for patents, and negative but insignificant for private GSP. This implies that as a state's top corporate income tax increases, private R&D and employment is reduced, but patents increase. Lastly, university support's coefficient is positive and significant for employment and private GSP, but interestingly is negative for R&D and patents. Once unobserved heterogeneity is control for (Table 28), the results change significantly. Now RAC's coefficient is negative and significant in two models (R&D and employment) and insignificant in the remaining models (patents and private GSP). Top corporate income tax rate is negative and significant in two models (employment and GSP) and insignificant in the remaining two. University support is positive and significant for employment and private GSP, but positive and insignificant for patents and R&D.

Once again, the models can be used to predict economic outcomes under different scenarios (Tables 29-31). What if Iowa did not have a RAC in 2015? The OLS models predict that private R&D per capita would be 23.1 percent lower, private employment per capita 5.8 percent lower, utility patents per 1,000 residents 19.0 percent lower, and private GSP per capita 9.6 percent lower. However, the FE models suggest that private R&D per capita would have been 28.6 percent higher, private employment per capita 0.6 percent higher, utility patents per 1,000 residents 2.6 percent lower, and private GSP 0.9 percent higher without a RAC, holding all else constant.

What if Iowa decreased its top corporate tax rate to 9.8 percent in 2015? The OLS models predict that private R&D per capita would have been 4 percent higher, private employment per capita 0.5 percent higher, utility patents per 1,000 residents 2.6 percent lower, and private GSP per capita to be 0.4 percent higher if Iowa would have reduced its top corporate income tax rate. However, once unobserved heterogeneity is controlled for then the models predict small increases for all but private R&D per capita.

Lastly, what if Iowa had invested $7,467 per enrollment rather than $6,788 in higher education? The model predicts that private R&D would have declined by 0.5 percent, private employment increase by 0.4 percent, utility patents to fall by 1.6 percent, and private GSP to increase by 1.5 percent. However, the FE models predict moderate increases for private R&D, private employment, and private GSP, but a modest decrease in utility patents.

In general, this analysis suggests that the research activities tax credit has a weak—if any—effect on research inputs and outputs, even controlling for R&D inducing policies. Both the top corporate income tax rate and support for higher education have stronger impacts on research inputs and outputs albeit for different inputs and outputs. Results suggest reducing corporate income tax rates increases employment and economic activity whereas state support for higher education increases all but utility patents.

D. Conclusion and Limitations of the Study

Iowa's research activities tax credit is unique compared to other state programs: it is refundable, is not capped or limited in any way, and has a high rate for a non-tiered system (Section II). This has resulted in a significant fiscal impact of the program—approximately $80 million each fiscal year—and continues to grow (Section IV). The RAC—and R&D tax credits in general—seek to incentivize private research and development which drives innovation and economic activity. This section sought to evaluate if the RAC is successful in this goal and what features—if any—enhance performance of the credit. In the findings presented in this section, there is little evidence suggesting a robust and positive effect on research inputs and outputs. The state by state analysis suggested that RAC states tend to have more research, employment, innovation, and economic activity, but when observable (industrial makeup, demographics, and other fiscal policies) and unobservable (underlying propensities unique to a state) factors are controlled for the RAC is not associated with significantly more research inputs and outputs. The problem is that RAC states tend to have factors that drive research inputs and outputs and failure to include these factors leads to biased conclusions regarding the efficacy of the program.

However, the study's limitations should be acknowledged. First, this study analyses the effectiveness of the RAC at the state level. That is, the study is mostly using the differences across states to capture whether RAC has positive or negative impacts on research inputs and outputs. However, the decision whether to increase research and hire researchers ultimately rests upon the firm. R&D tax credits attempt to incentivize *firm* decisions, not decisions at the state level. Aggregation to the state is necessary in this case due to the lack of data at the firm level for states beyond Iowa, but nevertheless it is important to acknowledge the limitation. Using firm or industry level data would also more accurately capture actors who are more sensitive to R&D tax incentives. Some firms and industries do not conduct significant R&D due to the nature of the business rather than the lack of tax incentives. By aggregating to the state, the analysis is pooling actors who heavily rely on R&D with those who do not. A potential solution to this problem is that Iowa Department of Revenue, Iowa Workforce Development, and Iowa Economic Development Authority does have fine-grain data at the firm level. This data could be used to analyze the effect of the RAC as long as it is paired with a policy intervention—like limiting the credit by industry for tax years beginning on or after January 1, 2017. The researcher may then evaluate the effect of the credit by comparing firms who previously claimed the credit but can no longer claim the credit to firms that always or never claimed the credit in the first place.[13]

Second, this analysis does not consider the reality that many companies operate in two or more states. Firms do need to research and innovate to increase profitability, but firms have choices when deciding where that research will take place—especially if they operate in multiple states. Indirectly, the analysis tries to capture this phenomenon by comparing states to states, but an ideal research design would model what influences a firm's choice to research one state over another—including their already existing presence in the state. Unfortunately, currently this is limited by data availability.

Third, this analysis does not consider firm options more generally. Iowa was just the third state to adopt a RAC in the United States, but over time many states have adopted credits. This means that there are more options available for firms who seek to increase their research. Indirectly, the rise in the number of states with credits has decreased the competitiveness of Iowa's credit—at least relative to when Iowa was only

[13] Referred to academically as a "difference-in-difference" design.

one of three states to have such credits. Similarly, the analysis does not directly model the number of states with RAC neighboring a state. As the number of RAC neighbors increase, it may actually be harder to attract research to one state over another. As the distance between a RAC state and its nearest RAC neighbor increases, this ought to increase research conducted in the RAC state because locally firm options are more limited compared to when a RAC state is close to another RAC state. Future research should incorporate a spatial dimension in their state-by-state analysis by including the number of RAC states, the number of RAC neighbors of a state, and possibly a spatial weight matrix which controls for the diffusion of RAC programs across the US over time.

Fourth, this study has measurement concerns. Measuring RAC program as a binary variable rather than the total amount of credits that the state has is problematic because given the limited time series of research expense data, a binary variable is perfectly correlated with a variable that controls for unobservable propensity—or lack thereof—to research. This creates a methodological problem in which some states "drop out" of the analysis and the effect of the RAC is identified from only the states that either adopted a RAC or let a RAC expire during the time period analyzed. Having more variation in the independent variable (RAC program and its features) or having a longer time series for research expenditures would overcome the methodological problem. Similarly, there is a concern that what constitutes R&D in one industry is different than what constitutes R&D in another and whether the measurement of research is consistent across time. The study attempted to control for consistency across time by converting current dollars to 2015 dollars and controls for differences across industries by controlling for industrial composition but this likely only alleviates the measurement problem rather than solving it.

Lastly, this study's design utilizes statistical rather than causal inference. Causality can be readily inferred using the golden standard: a randomized experiment with a treatment and control group. It is impossible to conduct a randomized experiment to answer the research questions at the state level and impractical to conduct a randomized experiment at the firm level. Instead, observational studies must rely upon statistical inference which attempts to control for all factors that might be related to research inputs and outputs. By controlling for these factors, any observable differences are assumed to be attributable to the treatment—or the presence of a RAC program—but is possible that the model is omitting variables. Strategies to improve isolation of the true causal effect include a difference-in-difference design which evaluates the effect of a policy shock on treatment and control groups. Researchers can also leverage temporal variation to isolate if tax incentives are driving economic outcomes or if economic outcomes are driving tax incentives. Since an effect cannot precede a cause it is possible to utilize advanced time series analysis to make causal inferences. This study utilizes a two-way fixed effects design to make the findings more causal, but acknowledge there are potentially other ways to design a study to improve the causal implications of the findings.

References

Acs, Z.J. & Audretsch, D.B. (1988). Innovation in large and small firms. An empirical analysis. *American Economic Review,* 78(1): 678–690.

Aghion, P. & Howitt, P. (1998). *Endogenous Growth Theory*. Cambridge, MA: MIT Press.

Anandarajan, A., S. Chiang, & P. Lee. (2010). R&D Tax Credit and Operating Performance: Implications for Managers. *Management Decision* 48(9): 1198–1211. http://dx.doi.org.proxy.lib.uiowa.edu/10.1108/00251741011076744.

Arrow, K.J. (1962) The economic implications of learning by doing. *Review of Economic Studies* 29(1): 155–173.

Becker, B. (2015). Public R&d Policies and Private R&d Investment: A Survey of the Empirical Evidence. *Journal of Economic Surveys* 29(5) 917–42. https://doi.org/10.1111/joes.12074.

Berger, P. G. (1993). Explicit and Implicit Tax Effects of the R & D Tax Credit. *Journal of Accounting Research* 31(2): 131–71. https://doi.org/10.2307/2491268.

Billings, Anthony, Sergei Glazunov, & Melvin Houston. (2001). The Role of Taxes in Corporate Research and Development Spending. *R&D Management* 31, no. 4: 465. https://doi.org/10.1111/1467-9310.00232.

Blandinieres, F.; Steinbrenner, D.; Weiß, Bernd (2020). Which design works? A meta-regression analysis of the impacts of R&D tax incentives. ZEW Discussion Papers, No. 20-010, ZEW - Leibniz-Zentrum für Europäische Wirtschaftsforschung, Mannheim, Germany.

Bloom, N., Griffith, R., & Van Reenen, J. (2002). Do R&D Tax Credits Work? Evidence from a Panel of Countries, 1979–1997. *Journal of Public Economics,* 81(1): 1-31.

Carroll, R., Prante, G., & Quek, R. (2011). *The R&D Credit: An Effective Policy for Promoting Research Spending.* Ernst & Young LLP. Retrieved September 13, 2016, from http://investinamericasfuture.org/PDFs/EY_R%26D_Credit_Report-_2011_09_16.pdf

Castellacci, F., & C. M. Lie. (2015). “Do the Effects of R&D Tax Credits Vary across Industries? A Meta-Regression Analysis.” *Research Policy* 44(4): 819–32. https://doi.org/10.1016/j.respol.2015.01.010.

Chen, L., & W. Yang. (2019). R&D Tax Credits and Firm Innovation: Evidence from China. *Technological Forecasting and Social Change* 146(1): 233–41. https://doi.org/10.1016/j.techfore.2019.05.018.

Chen, Z. Z. Liu, J.C. S. Serrato, and D. Y. Xu. (2018). Notching R&D investment with corporate income tax cuts in China. Working Paper. *National Bureau of Economic Research.*

Congressional Budget Office. (2007). *Federal Support for Research and Development.* United States Congress.

Eathington, L. & D. Swenson. (2010). Selected Measures of Iowa’s Research and Development Performance, *Department of Economics, Iowa State University*.

Fichtner, J. J., & A. N Michel. (2015). Can a Research and Development Tax Credit Be Properly Designed for Economic Efficiency?.

Finley, A., Lusch, S., & K.A., C. (2015). The Effectiveness of the R&D Tax Credit: Evidence From the Alternative Simplified Credit. *Journal of the American Taxation Association, 37*(1), 157-181.

Girardi, A. (2016). Iowa's Research Activities Tax Credit Tax Credits Program Evaluation Study, *Iowa Department of Revenue*.

Guenther, G. (2007). Research Tax Credit: Current Status and Selected Issues for Congress, *CRS Report for Congress*.

Gullickson, A. & A. R. Harris. (2008). Iowa's Research Activities Tax Credit Tax Credits Program Evaluation Study, *Iowa Department of Revenue*.

Gullickson, A., A R. Harris, & Z. Jin. (2011).Iowa's Research Activities Tax Credit Tax Credits Program Evaluation Study, *Iowa Department of Revenue*.

Gupta, S., Hwang, Y., & Schmidt, A. (2011). Structural Change in the Research and Experimentation Tax Credit: Success or Failure? *National Tax Journal, 64*(2), 285-322.

Hall, B. H., & Van Reenen, J. (2000). How Effective Are Fiscal Incentives for R&D? A Review of the Evidence. *Research Policy, 29*, 449-469.

Hall, Bronwyn H. & Marta Wosinska. (1999). The California R&D Tax Credit: Description, History, and Economic Analysis.

Harris, R., Li, Q.C. & Trainor, M. (2009) Is a higher rate of R&D tax credit a panacea for low levels of R&D in disadvantaged regions? *Research Policy* 38: 192–205.

Hemphill, T. A. (2009). The US Research and Experimentation Tax Credit: The Case for an Effective R and D Investment Policy Incentive. *Innovation: Management, Policy, and Practice, 11*(3), 341-356.

Huergo & Moreno (2017). Subsidies or Loans?

Ibele, M. A. & J. D. Vashe, (2004). An Overview of California's Research and Development Tax Credit. *State Tax Notes*: 461-477

Kennedy, Joe, & Robert D Atkinson. 2017. Why Expanding the R&D Tax Credit Is Key to Successful Corporate Tax Reform. *INFORMATION TECHNOLOGY.* 11.

La Croix, S. & J. Mak. (2021). The Hawaii Research Activity Tax Credit: Is it effective and how can it be improved? *UHERO*.

Lokshin, Boris, & Pierre Mohnen. (2012). How Effective Are Level-Based R&D Tax Credits? Evidence from the Netherlands. *Applied Economics* 44(12): 1527–38. https://doi.org/10.1080/00036846.2010.543083.

Lucking, Brian, Nicholas Bloom, & John Van Reenen (2019). Have R&D Spillovers Declined in the Twenty- First Century? *Fiscal Studies* 40(4): 561-590. https://doi.org/10.1111/1475-5890.12195

Miller, Chad R., & B. Richard. (2010). The Policy Diffusion of the State R&D Investment Tax Credit. *State and Local Government Review* 42(1): 22–35. https://doi.org/10.1177/0160323X10364748.

Mulkay, B. & Mairesse, J. (2013). The R&D tax credit in France: Assessment and ex-ante evaluation of the 2008 reform. NBER Working Paper 19073.

OECD. (2002). The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys on Research and Experimental Development. 'Frascati Manual'. Paris: OECD.

Paff, Lolita A. (2005). State-Level R&D Tax Credits: A Firm-Level Analysis, *Topics in Economic Analysis & Policy*, 5(1).

Parisi, M.L. & Sembenelli, A. (2003). Is private R&D spending sensitive to its price? Empirical evidence on panel data for Italy. Empirica 30: 357–377.

Petrin, T. (2018). A Literature Review on the Impact and Effectiveness of Government Support for R&D and Innovation, 57.

Rao, N. (2016). Do Tax Credits Stimulate R&D Spending? The Effect of the R&D Tax Credit in its First Decade. *Journal of Public Economics, 140*, 1-12.

Romer, P.M. (1986). Increasing returns and long-run growth. *Journal of Political Economy* 94: 1002–1037.

Romer, P.M. (1990). Endogenous technological change. *Journal of Political Economy* 98: S71-S102.

Szarowská, I. (2017). "Does Public R&D Expenditure Matter for Economic Growth? GMM Approach." *Journal of International Studies*, 14.

Tax Foundation. (2007). *2008 State Business Tax Climate.*

Thomson, R. (2017). The Effectiveness of R&D Tax Credits. *Review of Economics and Statistics* 99(3): 544–549. https://doi.org/10.1162/REST_a_00559

Wilson, D. (2005). The Rise and Spread of State R&D Tax Credits, *FRBSF Economic Letter*: 1005-26.

Wilson, D. J. (2009). Beggar Thy Neighbor? The In-State, Out-of-State, and Aggregate Effects of R&D Tax Credits. *Review of Economics and Statistics, 91*(2), 431–436.

Yang, C., C. Huang, & T. C. Hou. (2012). Tax Incentives and R&D Activity: Firm-Level Evidence from Taiwan. *Research Policy* 41(9): 1578–88. https://doi.org/10.1016/j.respol.2012.04.006

Tables and Figures

Table 1. Research and Development Tax Credit Programs by State

State	Credit Description	General Tax Credit Basis and Rate	Initial Tax Year	Sunset Date	Limit on Taxpayer Credit	Statewide Program Cap	Refundable	Credit Carry Forward
Alabama	No credit for research activities	NA	NA	NA	NA	NA	NA	NA
Alaska	18% of the amount of research credit determined for federal income tax purposes. Research must be conducted in the United States but does not need to be conducted in Alaska to qualify.	18% of allocated federal credit	1998	No	No	No	No	20 Years
Arizona	For tax years beginning in 2011 through 2030, the credit is equal to 24% of the first $2.5 million of incremental research expenditures conducted in the state and 15% of incremental research expenditures over $2.5 million. Beginning tax year 1999, individuals may also claim the credit. For tax years 2010 and later, if a taxpayer employs fewer than 150 people in the taxpayer's trade or business, the taxpayer may elect to receive a refund of the credit in the amount of 75% of the excess of the credit over tax liability up to $5 million. However, the remaining 25% is forfeited by the taxpayer. Since 2011, there is also a nonrefundable credit for basic research payments to univerisites under the jurisdiction of the Arizona Board of Regents up to 10% of the basic research payments over the base amount. Must apply for certification of payments from the Arizona Commerce Authority (ACA)	15%-24% of incremental research expenditures in-state	1993	2030	No	$5 million for refundable portion	Yes, for qualified small businesses only	15 Years
Arkansas	Prior to 2007, 10% of incremental qualified expenditures. For tax years 2007 or later, credit is equal to 20% of incremental qualified research expenditures (not to exceed $10,000 per year) for up to five years for in-house research conducted in the state. Businesses can be granted a 33% credit per year for five years (not to exceed $50,000 per year) for research in a strategic research area or research through the Arkansas Science and Technology Authority. This credit may be carried forward for nine years. Targeted businesses, which are qualified emerging technology companies, may also be eligible for a 33% credit with a nine-year carry forward or credits can be transferred. Eligible businesses can apply for an additional five years of credits at the higher rate.	20%-33% of incremental research expenditures	2003	No	Yes, $10,000-$50,000 per year	No	No	9 Years
California	24% of basic research costs above a base amount, and 15% of incremental qualified research expenditures conducted in the state.	15% of incremental research expenditures	1988	No	No	No	No	Until Utilized
Colorado	3% of incremental research expenditures over the average of expenditures for the two prior taxable years conducted in an Enterprise Zone. No more than one-fourth of the allowable credit may be taken in any one tax year and the remaining amount is credited in the succeeding three taxable years. Beginning in 2012, must pre-certify to be eligible.	3% of incremental research expenditures	1989	No	25% of credit amount	No	No	Until Utilized
Connecticut	C corporations may claim 20% of the amount spent directly on research expenditures in the state that exceeds the amount spent in the preceding income year. The credit cannot reduce tax liability by more than 70%. A small business with prior year gross receipts less than $70 million with no tax liability may claim a refund equal to 65% of the value of the credit but must be less than $1.5 million for any one year. The state also offers a non-incremental credit equal to 6% of current year's R&D expenses. The credit is 5% for companies employing between 251 and 800 employees.	20% of incremental research expenditures	1993	No	70% of liability	No	Yes, up to 65% of credit for qualified small businesses only	15 Years
Delaware	10% of incremental qualified research expenditures conducted in the state over the average of qualified research expenditures over the immediately preceding four taxable years or 50% of Delaware's apportioned share of the taxpayer's federal research tax credit computed under the alternative incremental credit method. For qualifying small businesses, amounts are doubled.	10% of incremental re-search expenditures or 50% of allocated federal research tax credit com-puted under alternative simplified method	2000	No	No	No	Yes (Effective January 1, 2017)	No
Florida	10% of qualified research expenditures above the average of the four previous years of qualified research conducted in the state. For businesses less than four years old, the credit is reduced by 25% for each taxable year the business did not exist. Limited to 50% of tax liability after all other credits. Limited to C corporations in target industries only: aviation and aerospace, cloud infomration technology, homeland security and defense, information technology, life sciences, manufacturing, marine sciences, materials science, nontechnology.	10% of incremental research expenditures	2012	No	50% of liability. For businesses less than four years old, limits apply.	$9 million in 2015. $23 million in 2016. $9 million in 2017 and after. (First come, first served.)	No	5 Years
Georgia	10% of qualified research expenditures above the computed base conducted in the state. The computed base amount is determined using Georgia gross receipts. The credit taken in any taxable year cannot exceed 50% of the company's remaining tax liability after all other credits have been applied. Can also be used against state payroll withholding. Limited to manufacturing, warehousing and distribution, processing, telecommunications, tourism, and research and development sectors.	10% of incremental research expenditures	1998	No	50% of liability after all other credits have been applied	No	No	10 Years
Hawaii	20% of incremental qualified research expenditures conducted in the state. The credit may only be claimed by a qualified high technology business as defined by Hawaii statute.	20% of incremental research expenditures	2013	2024	No	No	Yes, up to $5 million	No

Sources: TaxCreditResearch.com, www.taxcreditresearch.com; C2ER State Business Incentives Database, www.stateincentives.org; updated September, 2021. Note: Table 1 shows state tax credits for research expenditures. Many states offer additional tax incentives for expenses related to research, such as for construction of research facilities, which are not included in the table.

Table 1 continued. Research and Development Tax Credit Programs by State

State	Credit Description	General Tax Credit Basis and Rate	Initial Tax Year	Sunset Date	Limit on Taxpayer Credit	Statewide Program Cap	Refundable	Credit Carry Forward
Idaho	5% of the incremental qualified research expenditures conducted in the state.	5% of incremental research expenditures	2001	No	No	No	No	14 Years
Illinois	6.5% of the incremental qualified research expenditures conducted in the state. Expenditures include basic reseserach payments defined in IRC section 41(e) .The tax credit lapsed in 2011 but was subsequently extended through 2015 and again through 2027.	6.5% of incremental research expenditures	1990	2027	No	No	No	5 Years
Indiana	15% of the first $1 million of incremental qualified research expenditures in the state. After the first $1 million, the credit is 10% of incremental qualified research expenditures. 100% sales tax exemption for quaalified research and development equipment and property. May be calculated using the alternative method since Dec 31, 2009.	10%-15% of incremental research expenditures	1984	No	No	No	No	10 Years
Iowa	6.5% of the incremental qualified research expenditures conducted in the state or 4.55% under the alternative simplified method. Limited to businesses conducting researchin manufacturing, life sciences, software engineering, aviation and aerospace, and agriscience industry. Also offers a supplemental credit awarded by Economic Development Authority.	4.55% - 6.5% of incremental research expenditures	1985	No	No	No	Yes	No
Kansas	6.5% of the excess of research expenditures in the state over the average of the current and past two years. In a tax year, the credit claimed may not exceed 25% of the credit generated in a given year, forcing the credit claim to be spread over at least four years. Beginning in tax year 2013, this credit is only available to C corporations.	6.5% of incremental research expenditures	2001	No	25% of credit	No	No	Until Utilized
Kentucky	No credit for research activities, but has a credit for research facilities	NA	NA	NA	NA	NA	NA	NA
Louisiana	5% of incremental qualified research expenditures conducted in the state if the taxpayer employs 100 or more Louisiana residents, 10% if the taxpayer employs 50 to 99 residents, or 30% for businesses with less than 50 residents. Taxpayers must pay a $250 fee as part of the pre-application to claim the credit.	5% of incremental research expenditures	2003	No	No	No	Yes	10 Years
Maine	5% of the qualified research expenditures conducted in the state over the average qualified research expenditures for the three prior taxable years, along with 7.5% of basic research payments. The credit may be used against 100% of the first $25,000 in tax liability, plus 75% of any tax in excess of $25,000. All companies receiving $10,000 or more in credits must file an annual report on employment levels and changes. Also includes sales tax exemption for manufacturing, R&D , custom computer programming, fuel and electricity, and biotech.	5% of incremental research expenditures	1996	No	75% of liability beyond $25,000	No	No	15 Years
Maryland	10% of qualified research expenditures conducted in the state that exceed the Maryland base amount where the base amount equals average annual gross receipts of the business for the four preceding tax years multiplied by the Maryland base percentage (usually the ratio of Maryland research expenditures for the preceding four tax years to total gross receipts for those years).	10% of incremental research expenditures	2000	2027	Yes, up to $250,000	$12 million statewide cap (Prorated); $3.5 million for small businesses	Yes, (effective December 15, 2012) for small businesses	7 Years
Massachusetts	10% of incremental qualified research expenditures conducted in the state, plus 15% of incremental qualified basic research payments. The credit may be used against the first $25,000 in tax liability and 75% of any liability over $25,000. Credits that exceed this limitation, but do not exceed 100% of the tax, are converted to unlimited carry forward status. Cannot reduce the tax below the minimum tax of $456. S corporations may claim the credit but cannot pass the credit onto shareholders.	10% of incremental research expenditures	1991	No	75% of liability beyond $25,000	No	Yes, partially refundable	15 Years
Michigan	Expired on Jan 1, 2012. As of June 2021 a bill has been introduced in state legisture to reinstate the credit.	1.9% of in-state research expenditures	2008	2011	65% of liability	NA	NA	NA
Minnesota	10% of qualifying expenses for research conducted in the state up to $2 million, and 4% for expenses above that level. The credit applies against regular corporate franchise tax and the individual income tax, but not the alternative minimum tax.	4% - 10% of incremental research expenditures	1981	No	No	No	No	15 Years
Mississippi	No credit for research activities. Research and development skills tax credit allows a credit of $1,000 for each new full time employee in any new job requiring research and development skills. Academic research investor rebate also exists.	NA	NA	NA	NA	NA	NA	NA
Missouri	Expired in 2005	6.5% of incremental research expenditures	1994	2004	NA	NA	NA	NA
Montana	Expired on December 31, 2010	5% of incremental research expenditures	1987	2010	NA	NA	NA	NA
Nebraska	15% of the allocated federal credit for research done within the state. The credit can also be used to obtain a refund of state sales and use taxes paid. Credit is equal to 35% if research is conducted on campus of a college or university in Nebraska.	15%-35% of allocated federal credit	2006	2022	No	No	Yes	No

Sources: TaxCreditResearch.com, www.taxcreditresearch.com; C2ER State Business Incentives Database, www.stateincentives.org; updated September, 2021. Note: Table 1 shows state tax credits for research expenditures. Many states offer additional tax incentives for expenses related to research, such as for construction of research facilities, which are not included in the table.

Table 1 continued. Research and Development Tax Credit Programs by State

State	Credit Description	General Tax Credit Basis and Rate	Initial Tax Year	Sunset Date	Limit on Taxpayer Credit	Statewide Program Cap	Refundable	Credit Carry Forward
Nevada	None	NA	NA	NA	NA	NA	NA	NA
New Hampshire	10% of manufacturing research expenditures in the state over a base amount, up to a maximum credit of $50,000. Eligible expenditures include only wages paid in New Hampshire for research activities.	10% of incremental research expenditures	2007	No	Yes, up to $50,000	$7 million statewide cap (Prorated)	No	5 Years
New Jersey	10% on incremental qualified research expenditures conducted in the state, plus 10% of basic research payments. The amount of the credits applied cannot reduce tax liability to an amount less than the statutory minimum tax. Limited to C and S corporations. Cannot pass credit onto shareholders	10% of incremental research expenditures	1994	No	No	No	No	7 Years. 25 Years for certain types of research
New Mexico	5% of expenditures for qualified research of up to $5 million conducted at a facility in New Mexico. The taxpayer must employ no more than 50 employees. The tax credit is doubled to 10% for expenditures in facilities located in rural New Mexico. An additional 5% credit is allowed for increasing in-state payroll by $75,000 for every $1 million in qualified expenditures.	5% of incremental research expenditures	2000	No	No	No	No	99 Years
New York	50% of the federal research credit, up to 6% of expenditures, attributed to research expenditures conducted in the state for companies that participate in the Excelsior Jobs Program and operate in New York. The tax credit is available to businesses in specified strategic industries. The program's credits are subject to a state-wide cap. Projects may qualify for 8% rate. There is also a life sciences research and development tax credit for 15% of qualified life sciences company's research and development that employs 10 or more persons. The rate increases to 20% that employs fewer than 10 persons. Up to three consecutive years, but limited to $500,000.	50% of allocated federal credit or 6% of expenditures (8% for qualified projects)	2005	No	No	$250 million statewide (First come, first served.)	Yes	No
North Carolina	Expired on December 31, 2015	1.25% to 20% of incremental research expenditures	1996	2015	NA	NA	NA	NA
North Dakota	25% for the first $100,000 of incremental qualified research expenditures conducted in the state. For expenditures over $100,000, the applicable percentage for tax years 2007 through 2016 differs based on the start date for research. For tax years after 2016, the credit is 8% for all taxpayers on incremental research expenditures over $100,000. Small businesses with gross receipts less than $750,000 may transfer up to $100,000 in credits if they fall in a "primary sector" industry classification and had claimed the credit prior to 2007. As of 2019, can use alternative method equal to 17.5% for first $100,000 plus 5.6 percent in excess of incremental qualified research expenditures.	25% of incremental research up to $100,000. 8% of incremental research beyond $100,000.	1988	No	No	No	No	15 Years or 3 Year Carry Back
Ohio	7% of research expenditures conducted in the state over the average of qualified research expenditures for the three prior tax years.	7% of incremental research expenditures	2001	No	No	No	No	7 Years
Oklahoma	None	NA	NA	NA	NA	NA	NA	NA
Oregon	Expired January 1, 2018	5% of incremental research expenditures	1989	2017	NA	NA	NA	NA
Pennsylvania	10% of the excess of qualified research expenditures conducted in the state over the ratio of the four prior year's research expenditures to gross receipts; 20% for small businesses. The credit is transferable, but purchasers can offset only 75% of liability and cannot carry forward unused credits.	10% of incremental research expenditures	1997	No	75% of liability	Statewide $55 million cap, $11 million for small businesses (Prorated)	No	15 Years
Rhode Island	22.5% of the first $111,111 in incremental qualified research expenditures conducted in the state and 16.9% for any remainder. The credit is applied to 50% of the tax due after all other credits available have been used.	16.9% - 22.5% of incremental research expenditures	1994	No	50% of liability	No	No	7 Years
South Carolina	5% of qualified research expenditures conducted in the state. The annual credit is capped at 50% of a taxpayer's state tax liability net of all other applied credits.	5% of incremental research expenditures	2001	No	50% of liability	No	No	10 Years

Sources: TaxCreditResearch.com, www.taxcreditresearch.com; C2ER State Business Incentives Database, www.stateincentives.org; updated September, 2021. Note: Table 1 shows state tax credits for research expenditures. Many states offer additional tax incentives for expenses related to research, such as for construction of research facilities, which are not included in the table.

Table 1 continued. Research and Development Tax Credit Programs by State

State	Credit Description	General Tax Credit Basis and Rate	Initial Tax Year	Sunset Date	Limit on Taxpayer Credit	Statewide Program Cap	Refundable	Credit Carry Forward
South Dakota	None	NA	NA	NA	NA	NA	NA	NA
Tennessee	None	NA	NA	NA	NA	NA	NA	NA
Texas	Either a franchise tax credit based on qualified research expenses or a sales and use tax exemption on the purchase, lease, rental, storage or use of depreciable tangible personal property directly used in qualified research. 5% of incremental research expenses; 6.25% if the taxpayer contracts with an institution of higher education in the state for the performance of qualified research.	5% of incremental research expenditures	2014	2026	No	No	No	20 Years
Utah	5% of incremental expenditures for research and 7.5% total research expenditures conducted in the state during the tax year.	5% of incremental qualified research expenditures and 7.5% of total qualified research expenditures	2008	No	No	No	No	14 Years for incremental based credits
Vermont	27% of the federal credit for qualified research expenditures conducted in the state.	27% of allocated federal credit	2011	No	No	No	No	10 Years
Virginia	*Standard R&D Expense Credit*. 15% of the first $300,000 in incremental qualified research expenditures conducted in the state or 20% of the first $300,000 in incremental qualified research expenditures if the research was conducted with a Virginia public or private college or university.	15%-20% of first $300,000 of incremental research expenses	2011	2021	No	$7 million statewide cap (Prorated)	Yes	No
Virginia	*Major R&D Expense Credit*. For companies with R&D expenses greater than $5 million. In general, equal to 10% of incremental R&D expenses, or 5% of qualifying expenses for taxpayers that did not incur Virginia R&D expenses in any of the three prior years.	10% of incremental research expenses	2016	2021	75% of liability	$20 million statewide cap (Prorated)	No	10 Years
Washington	Expired December 31, 2014	1.5% of incremental research expenses	1995	2014	NA	NA	NA	NA
West Virginia	Expired 2013	10% of incremental research expenses	2003	2012	NA	NA	NA	NA
Wisconsin	5.75% of incremental qualified research expenditures conducted in the state. 11.5% for research expenditures incurred in qualified research related to internal combustion engines and certain energy efficient products. Credits are only available to corporations. (If the claimant had no qualified research expenses in any of the 3 taxable years immediately preceding the taxable year for which the claimant claims the credit, the claimant may claim an amount equal to 2.875% of the qualified research expenses for the taxable year for which the credit is claimed or 5.75 % for research related to internal combustion engines or certain energy efficient products.)	5.75% - 11.5% of incremental research expenditures	1986	No	No	No	Yes, (effective 2018) up to 10%	15 Years
Wyoming	None	NA	NA	NA	NA	NA	NA	NA

Sources: TaxCreditResearch.com, www.taxcreditresearch.com; C2ER State Business Incentives Database, www.stateincentives.org; updated September, 2021. Note: Table 1 shows state tax credits for research expenditures. Many states offer additional tax incentives for expenses related to research, such as for construction of research facilities, which are not included in the table.

Table 2. Number and Percent of States with Program Features, 1981-2021

	RAC States		Incremental Basis		Federal Basis		Tiered Credit		Full Refund		Partial Refund		Refund Small Business		Any Refund		Limited Amount		Statewide Limit		Limited Type or Taxpayer		Any Limit		Target Small Business		Target Industry		Target Any	
Tax Year	Count	Percent*	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
1981	1	2%	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1982	1	2%	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1983	1	2%	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1984	2	4%	2	100%	0	0%	2	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1985	3	6%	3	100%	0	0%	2	67%	1	33%	0	0%	0	0%	1	33%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1986	4	8%	4	100%	0	0%	2	50%	1	25%	0	0%	0	0%	1	25%	0	0%	0	0%	1	25%	1	25%	0	0%	1	25%	1	25%
1987	5	10%	5	100%	0	0%	2	40%	1	20%	0	0%	0	0%	1	20%	0	0%	0	0%	1	20%	1	20%	0	0%	1	20%	1	20%
1988	7	14%	7	100%	0	0%	3	43%	1	14%	0	0%	0	0%	1	14%	0	0%	0	0%	1	14%	1	14%	0	0%	1	14%	1	14%
1989	9	18%	9	100%	0	0%	3	33%	1	11%	0	0%	0	0%	1	11%	1	11%	0	0%	1	11%	2	22%	0	0%	2	22%	2	22%
1990	10	20%	10	100%	0	0%	3	30%	1	10%	0	0%	0	0%	1	10%	1	10%	0	0%	1	10%	2	20%	0	0%	2	20%	2	20%
1991	11	22%	11	100%	0	0%	3	27%	1	9%	1	9%	0	0%	2	18%	2	18%	0	0%	2	18%	3	27%	0	0%	2	18%	2	18%
1992	11	22%	11	100%	0	0%	3	27%	1	9%	1	9%	0	0%	2	18%	2	18%	0	0%	2	18%	3	27%	0	0%	2	18%	2	18%
1993	13	26%	13	100%	0	0%	4	31%	1	8%	3	23%	2	15%	4	31%	3	23%	1	8%	4	31%	5	38%	2	15%	3	23%	4	31%
1994	16	32%	16	100%	0	0%	5	31%	1	6%	3	19%	2	13%	4	25%	4	25%	1	6%	5	31%	7	44%	2	13%	3	19%	4	25%
1995	17	34%	17	100%	0	0%	5	29%	1	6%	3	18%	2	12%	4	24%	4	24%	1	6%	5	29%	7	41%	2	12%	3	18%	4	24%
1996	19	38%	19	100%	0	0%	5	26%	1	5%	3	16%	2	11%	4	21%	5	26%	1	5%	5	26%	8	42%	3	16%	5	26%	6	32%
1997	20	40%	20	100%	0	0%	5	25%	1	5%	3	15%	2	10%	4	20%	6	30%	2	10%	5	25%	9	45%	4	20%	6	30%	8	40%
1998	23	46%	21	91%	2	9%	5	22%	1	4%	3	13%	2	9%	4	17%	7	30%	2	9%	5	22%	10	43%	4	17%	7	30%	9	39%
1999	23	46%	21	91%	2	9%	5	22%	1	4%	3	13%	2	9%	4	17%	7	30%	2	9%	4	17%	10	43%	4	17%	7	30%	9	39%
2000	26	52%	24	92%	3	12%	5	19%	1	4%	3	12%	2	8%	4	15%	8	31%	3	12%	5	19%	12	46%	7	27%	7	27%	12	46%
2001	32	64%	30	94%	3	9%	5	16%	2	6%	3	9%	2	6%	5	16%	10	31%	3	9%	5	16%	14	44%	7	22%	7	22%	12	38%
2002	32	64%	30	94%	3	9%	5	16%	2	6%	3	9%	2	6%	5	16%	10	31%	3	9%	5	16%	14	44%	7	22%	7	22%	12	38%
2003	35	70%	33	94%	3	9%	5	14%	3	9%	3	9%	3	9%	7	20%	11	31%	3	9%	5	14%	15	43%	7	20%	8	23%	13	37%
2004	35	70%	33	94%	3	9%	5	14%	3	9%	3	9%	3	9%	7	20%	11	31%	3	9%	5	14%	15	43%	8	23%	8	23%	14	40%
2005	36	72%	33	92%	4	11%	5	14%	4	11%	3	8%	3	8%	8	22%	11	31%	4	11%	5	14%	16	44%	9	25%	9	25%	15	42%
2006	37	74%	32	86%	5	14%	5	14%	5	14%	3	8%	3	8%	9	24%	12	32%	4	11%	5	14%	17	46%	10	27%	9	24%	16	43%
2007	37	74%	32	86%	5	14%	5	14%	5	14%	3	8%	3	8%	9	24%	13	35%	5	14%	5	14%	18	49%	10	27%	9	24%	16	43%
2008	38	76%	33	87%	5	13%	5	13%	5	13%	3	8%	3	8%	9	24%	13	34%	5	13%	5	13%	18	47%	10	26%	9	24%	16	42%
2009	38	76%	33	87%	5	13%	5	13%	5	13%	3	8%	3	8%	9	24%	13	34%	5	13%	5	13%	18	47%	10	26%	9	24%	16	42%
2010	39	78%	33	85%	5	13%	5	13%	6	15%	3	8%	3	8%	10	26%	13	33%	6	15%	5	13%	18	46%	10	26%	9	23%	16	41%
2011	37	74%	32	86%	5	14%	6	16%	6	16%	3	8%	3	8%	9	24%	14	38%	6	16%	5	14%	19	51%	10	27%	9	24%	16	43%
2012	37	74%	33	89%	5	14%	6	16%	6	16%	3	8%	4	11%	10	27%	14	38%	7	19%	6	16%	19	51%	10	27%	10	27%	17	46%
2013	37	74%	33	89%	5	14%	6	16%	6	16%	3	8%	3	8%	10	27%	14	38%	7	19%	7	19%	19	51%	10	27%	10	27%	17	46%
2014	38	76%	34	89%	5	13%	6	16%	6	16%	3	8%	3	8%	10	26%	14	37%	7	18%	6	16%	18	47%	10	26%	10	26%	17	45%
2015	37	74%	33	89%	5	14%	6	16%	6	16%	3	8%	3	8%	10	27%	14	38%	7	19%	6	16%	18	49%	10	27%	10	27%	17	46%
2016	36	72%	32	89%	5	14%	6	17%	6	17%	3	8%	3	8%	10	28%	14	39%	7	19%	6	17%	18	50%	9	25%	9	25%	16	44%
2017	36	72%	32	89%	5	14%	6	17%	7	19%	3	8%	3	8%	11	31%	14	39%	7	19%	6	17%	18	50%	9	25%	9	25%	16	44%
2018	36	72%	32	89%	5	14%	6	17%	7	19%	4	11%	3	8%	12	33%	14	39%	7	19%	6	17%	18	50%	9	25%	9	25%	16	44%
2019	35	70%	31	89%	5	14%	6	17%	7	20%	4	11%	3	9%	12	34%	14	40%	7	20%	6	17%	18	51%	9	26%	9	26%	16	46%
2020	35	70%	31	89%	5	14%	6	17%	7	20%	4	11%	3	9%	12	34%	14	40%	7	20%	6	17%	18	51%	9	26%	9	26%	16	46%
2021	35	70%	31	89%	5	14%	6	17%	7	20%	4	11%	3	9%	12	34%	14	40%	7	20%	6	17%	18	51%	9	26%	9	26%	16	46%

Sources: TaxCreditResearch.com, www.taxcreditresearch.com; C2ER State Business Incentives Database, www.stateincentives.org; updated September, 2021. Note: * percent of U.S. states.

Figure 1. Number of States with Tax Credits for Incremental Research Expenditures by Region, 1981-2021

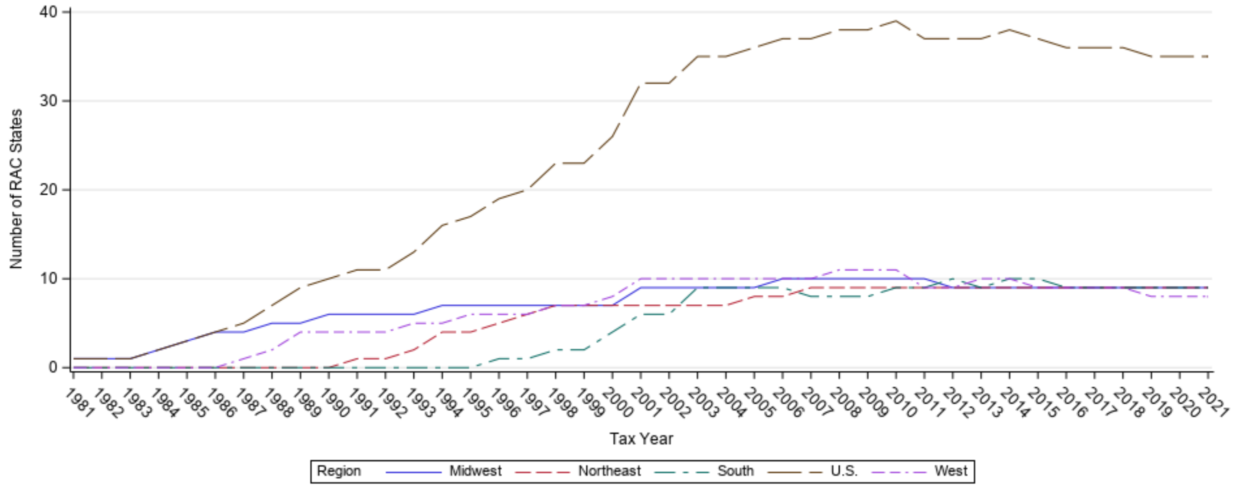
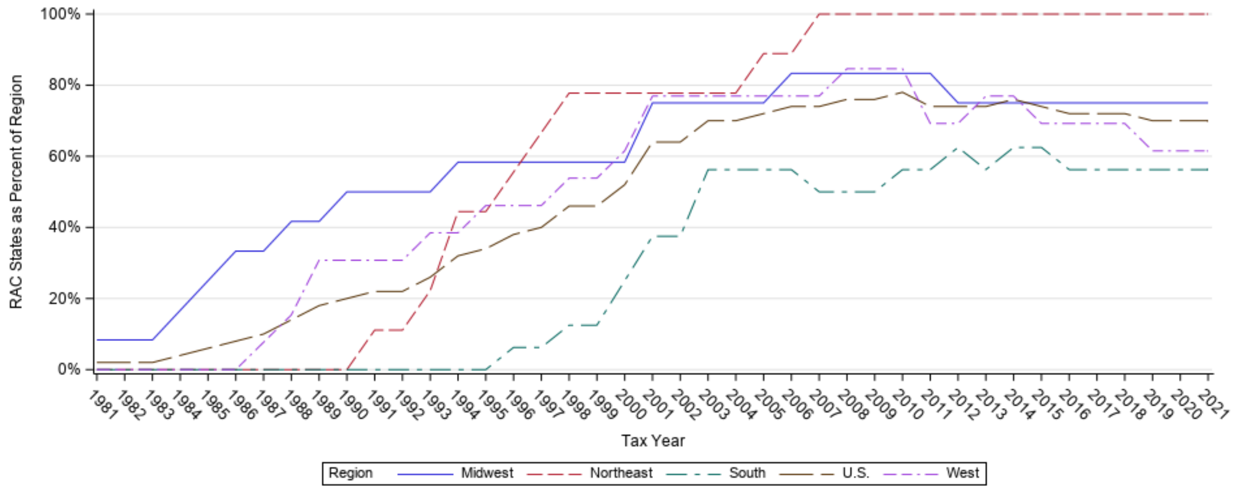
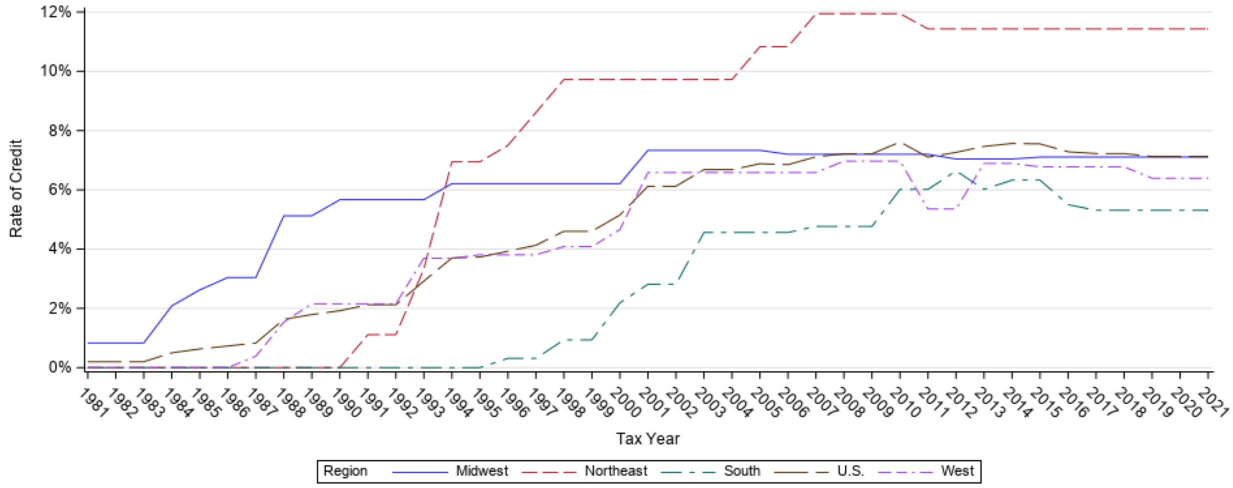


Figure 2. States with Tax Credits for Incremental Research Expenditures as Percentage of States in the Region, 1981-2021



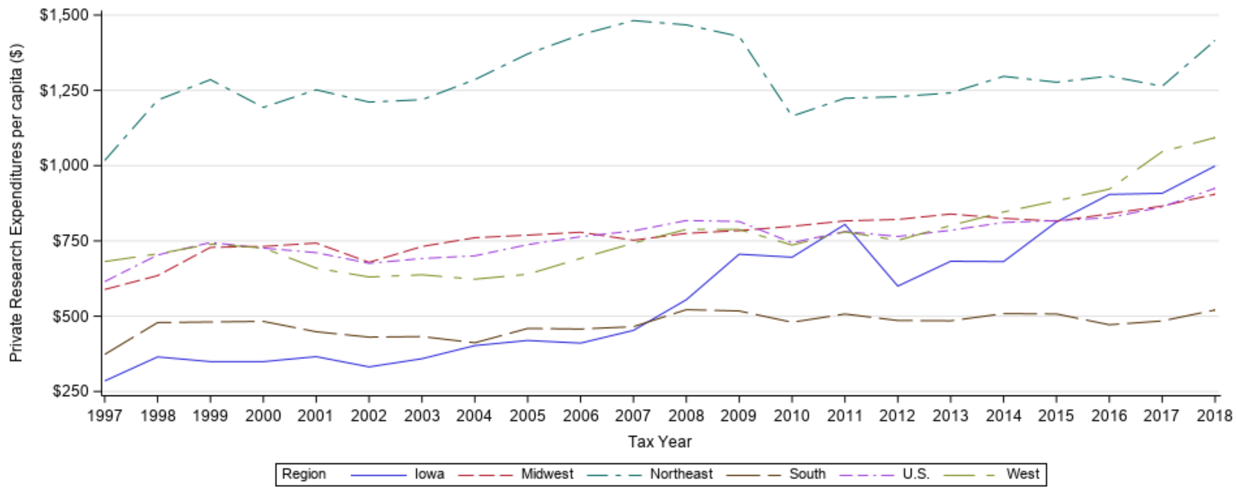
Sources: State government websites, www.stateincentives.org; updated September, 2021.

Figure 3. Average RAC Rate by Region, 1981-2021



Sources: State government websites, www.stateincentives.org; updated September, 2021.

Figure 4. Average Business Research Expenditures per Capita by Region, 1981-2019



Source: National Center for Science and Engineering Statistics, U.S. Bureau of Economic Analysis; updated December, 2020.

Figure 5. Average Business Research Expenditures (percent GDP) by Region, 1981-2019

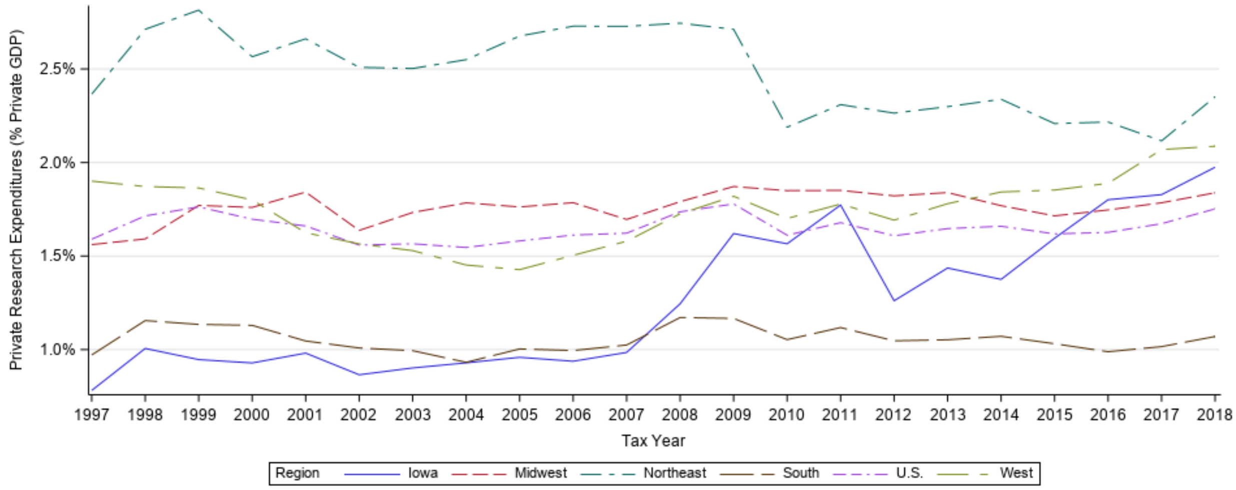
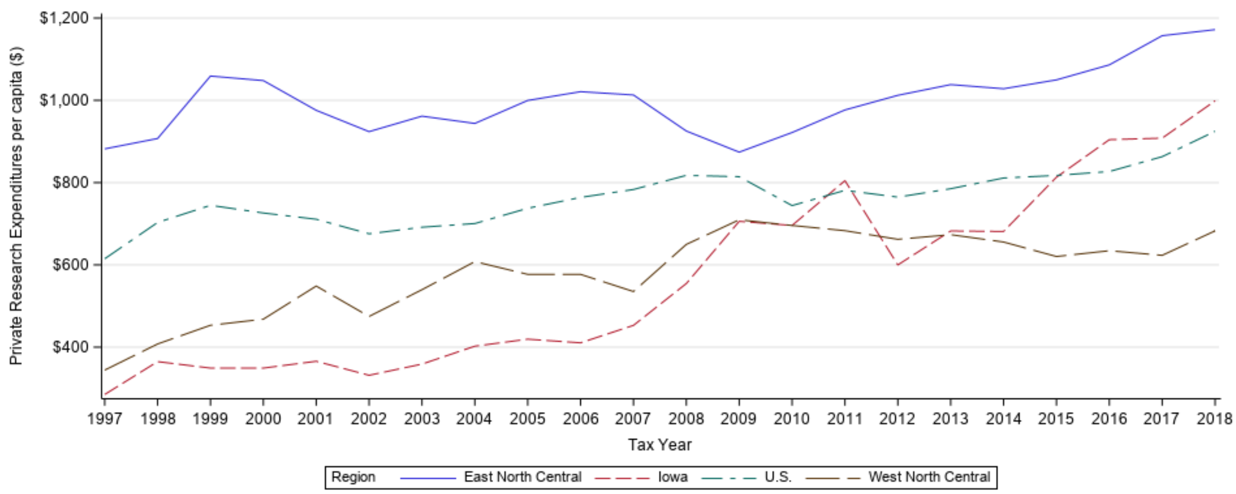
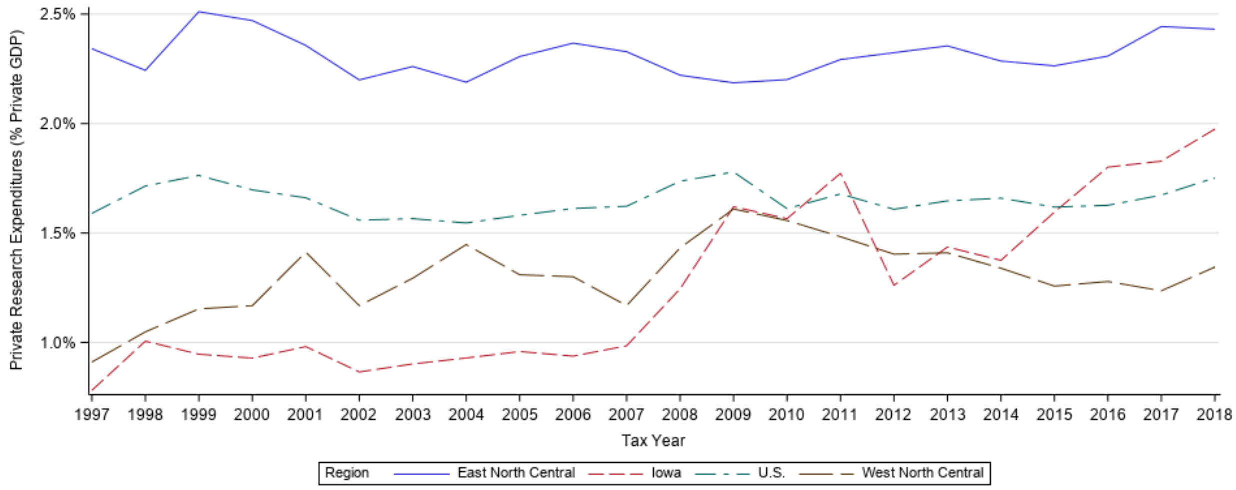


Figure 6. Average Research Expenditures per Capita by Midwest Region, 1997-2019



Source: National Center for Science and Engineering Statistics, U.S. Bureau of Economic Analysis; updated December, 2020.

Figure 7. Average Business Research Expenditures (percent GDP) by Midwest Region, 1981-2019



Source: National Center for Science and Engineering Statistics, U.S. Bureau of Economic Analysis; updated December, 2020.

Table 3. Total Research and Development Expenditures by Type and State, 2017

	Business		Higher		Federal		State		Total R&D	
State	**Millions**	**Rank**	**Millions**	**Rank**	**Millions**	**Rank**	**Millions**	**Rank**	**Millions**	**Rank**
California	$132,473	1	$8,894	1	$15,739	1	$512	1	$150,552	1
Massachusetts	$23,655	2	$3,632	6	$5,238	5	$32	15	$31,299	2
Washington	$21,462	3	$1,601	13	$2,622	12	$44	9	$24,958	4
Michigan	$21,042	4	$2,497	8	$1,491	20	$17	27	$23,855	5
Texas	$21,002	5	$5,225	3	$5,198	6	$294	3	$27,113	3
New Jersey	$16,405	6	$1,082	22	$1,963	18	$37	10	$18,495	8
New York	$15,671	7	$6,020	2	$4,889	7	$434	2	$23,631	6
Illinois	$14,399	8	$2,370	9	$2,542	14	$16	29	$18,120	9
Pennsylvania	$10,986	9	$3,949	5	$3,744	8	$93	6	$15,998	10
North Carolina	$10,246	10	$2,992	7	$2,005	17	$45	8	$13,799	11
Ohio	$9,769	11	$2,164	12	$2,550	13	$109	5	$13,056	12
Connecticut	$8,694	12	$1,210	18	$2,349	16	$54	7	$10,018	14
Oregon	$7,691	13	$732	26	$573	29	$37	11	$8,579	17
Minnesota	$7,146	14	$918	24	$986	24	$18	24	$8,470	18
Florida	$6,463	15	$2,366	10	$2,866	11	$202	4	$10,156	13
Georgia	$6,450	16	$2,177	11	$1,285	21	$14	33	$9,056	15
Arizona	$6,338	17	$1,140	19	$1,199	22	$14	34	$7,826	19
Indiana	$6,283	18	$1,297	17	$690	26	$17	26	$7,814	20
Maryland	$5,595	19	$3,970	4	$15,417	2	$30	18	$20,859	7
Wisconsin	$5,436	20	$1,402	16	$730	25	$13	35	$7,020	22
Missouri	$5,299	21	$1,117	21	$1,604	19	$15	30	$6,518	24
Colorado	$4,703	22	$1,403	15	$3,396	9	$26	20	$7,159	21
Virginia	$4,332	23	$1,436	14	$6,311	4	$30	17	$8,897	16
Iowa	**$2,938**	**24**	**$786**	**25**	**$520**	**30**	**$9**	**40**	**$3,900**	**27**
Utah	$2,846	25	$540	30	$1,058	23	$33	14	$3,664	28
Kansas	$2,212	26	$502	31	$212	39	$7	42	$2,819	29
Delaware	$2,048	27	$196	43	$169	43	$3	48	$2,265	32
Alabama	$1,896	28	$953	23	$8,663	3	$26	19	$5,879	25
Idaho	$1,747	29	$156	46	$675	27	$15	31	$2,442	30
Tennessee	$1,407	30	$1,133	20	$2,476	15	$10	39	$4,521	26
South Carolina	$1,370	31	$618	28	$505	31	$35	12	$2,360	31
New Hampshire	$1,361	32	$413	35	$351	34	$2	49	$1,845	33
Kentucky	$983	33	$561	29	$289	37	$30	16	$1,596	34
Alaska	$912	34	$171	45	$182	41	$9	41	$1,146	38
Oklahoma	$833	35	$441	33	$368	33	$34	13	$1,531	35
New Mexico	$802	36	$362	36	$3,366	10	$4	44	$6,595	23
Rhode Island	$730	37	$301	37	$615	28	$4	46	$1,410	36
Nevada	$624	38	$186	44	$338	35	$11	38	$846	41
Nebraska	$592	39	$478	32	$211	40	$23	23	$1,150	37
Arkansas	$466	40	$289	39	$170	42	$16	28	$812	42
North Dakota	$304	41	$241	40	$75	49	$15	32	$592	43
Louisiana	$297	42	$634	27	$332	36	$25	21	$1,058	39
Maine	$292	43	$120	49	$158	44	$23	22	$520	45
Mississippi	$266	44	$437	34	$449	32	$4	45	$991	40
Vermont	$253	45	$122	47	$81	47	$1	50	$381	48
West Virginia	$212	46	$198	42	$141	46	$11	37	$492	46
South Dakota	$199	47	$108	50	$77	48	$4	47	$343	49
Hawaii	$169	48	$297	38	$275	38	$11	36	$558	44
Montana	$133	49	$216	41	$151	45	$18	25	$414	47
Wyoming	$87	50	$122	47	$46	50	$6	43	$219	50
United States	$398,362		$70,809		$112,272		$2,494		$528,712	

Source: National Center for Science and Engineering Statistics, updated December, 2020.

Table 4. Private Research and Development Expenditures by State, 1997 Compared to 2018

	Total R&D ($ Millions)				Per Capita ($)				Share of Private GSP (%)			
State	**Tax Year 1997**	**Tax Year 2018**	**Percent Change**	**Rank Change**	**Tax Year 1997**	**Tax Year 2018**	**Percent Change**	**Rank Change**	**Tax Year 1997**	**Tax Year 2018**	**Change**	**Rank Change**
Alabama	$829	$2,122	60.9%	3	$192	$434	126.1%	6	0.7%	1.2%	0.5%	8
Alaska	$34	$24	-42.4%	0	$55	$32	-41.9%	-2	0.1%	0.1%	0.0%	0
Arizona	$2,609	$5,886	55.7%	-1	$573	$822	43.4%	-1	1.6%	2.0%	0.4%	8
Arkansas	$166	$447	62.9%	2	$66	$148	125.6%	1	0.2%	0.4%	0.2%	1
California	$47,859	$137,148	65.1%	0	$1,485	$3,478	134.1%	3	3.7%	5.5%	1.8%	4
Colorado	$3,163	$4,775	33.8%	-7	$813	$838	3.1%	-11	1.9%	1.5%	-0.4%	-10
Connecticut	$4,241	$7,106	40.3%	1	$1,298	$1,988	53.2%	1	2.4%	3.0%	0.6%	0
Delaware	$1,420	$2,254	37.0%	0	$1,932	$2,331	20.7%	-2	3.5%	3.6%	0.0%	-1
Florida	$4,843	$6,158	21.3%	-5	$330	$290	-12.2%	-7	1.0%	0.7%	-0.3%	-5
Georgia	$1,791	$4,808	62.7%	1	$239	$457	91.0%	7	0.6%	0.9%	0.3%	7
Hawaii	$122	$139	11.6%	-5	$103	$97	-5.4%	-5	0.3%	0.2%	-0.1%	-5
Idaho	$1,662	$2,426	31.5%	-4	$1,373	$1,384	0.9%	-3	4.5%	3.7%	-0.8%	-4
Illinois	$8,792	$12,509	29.7%	1	$732	$983	34.3%	0	1.7%	1.7%	0.0%	-1
Indiana	$3,767	$6,620	43.1%	-1	$641	$988	54.1%	5	1.8%	2.1%	0.3%	5
Iowa	**$813**	**$3,146**	**74.1%**	**10**	**$285**	**$999**	**250.5%**	**19**	**0.8%**	**2.0%**	**1.2%**	**17**
Kansas	$1,599	$2,461	35.0%	-1	$611	$845	38.3%	-1	1.8%	1.7%	0.0%	0
Kentucky	$505	$1,362	62.9%	4	$129	$305	136.0%	5	0.4%	0.8%	0.4%	6
Louisiana	$242	$394	38.5%	0	$56	$84	51.8%	-1	0.2%	0.2%	0.0%	-1
Maine	$117	$270	56.8%	1	$94	$202	115.2%	1	0.3%	0.5%	0.2%	1
Maryland	$2,005	$5,709	64.9%	1	$394	$945	140.0%	9	1.1%	1.8%	0.7%	8
Massachusetts	$11,679	$25,890	54.9%	2	$1,910	$3,760	96.9%	1	4.0%	5.3%	1.3%	2
Michigan	$18,306	$21,268	13.9%	-2	$1,871	$2,130	13.8%	-2	5.1%	4.8%	-0.3%	-3
Minnesota	$4,385	$7,027	37.6%	-1	$935	$1,253	33.9%	0	2.2%	2.2%	0.0%	-2
Mississippi	$103	$262	60.8%	1	$38	$88	133.5%	3	0.1%	0.3%	0.1%	3
Missouri	$1,815	$6,805	73.3%	7	$336	$1,111	230.9%	17	0.9%	2.6%	1.6%	21
Montana	$129	$171	24.2%	-5	$147	$161	9.2%	-4	0.6%	0.4%	-0.2%	-5
Nebraska	$100	$541	81.5%	8	$60	$281	365.6%	8	0.2%	0.5%	0.4%	8
Nevada	$535	$911	41.3%	2	$319	$301	-5.8%	-5	0.7%	0.6%	-0.1%	-1
New Hampshire	$917	$2,435	62.3%	5	$782	$1,797	129.8%	4	1.9%	3.4%	1.5%	6
New Jersey	$15,576	$19,218	18.9%	-3	$1,934	$2,161	11.8%	-4	4.2%	3.7%	-0.5%	-3
New Mexico	$1,843	$663	-177.9%	-16	$1,070	$317	-70.4%	-24	3.3%	0.9%	-2.3%	-24
New York	$13,986	$16,621	15.9%	-3	$771	$850	10.3%	-6	1.7%	1.1%	-0.5%	-7
North Carolina	$5,052	$11,118	54.6%	1	$680	$1,070	57.3%	6	1.9%	2.4%	0.5%	5
North Dakota	$46	$296	84.3%	6	$72	$390	437.7%	12	0.2%	0.6%	0.4%	6
Ohio	$7,891	$9,154	13.8%	-1	$704	$784	11.3%	-8	1.9%	1.6%	-0.3%	-7
Oklahoma	$602	$824	26.9%	0	$182	$209	14.9%	-2	0.6%	0.5%	-0.1%	-2
Oregon	$1,551	$8,304	81.3%	14	$478	$1,985	315.2%	17	1.3%	4.1%	2.9%	21
Pennsylvania	$9,300	$11,486	19.0%	-1	$774	$897	15.9%	-6	2.1%	1.7%	-0.4%	-8
Rhode Island	$991	$667	-48.5%	-5	$1,004	$630	-37.3%	-18	2.8%	1.4%	-1.4%	-16
South Carolina	$1,102	$1,585	30.5%	-1	$291	$311	7.1%	-2	1.0%	0.8%	-0.1%	-2
South Dakota	$37	$191	80.8%	3	$50	$217	333.3%	10	0.2%	0.4%	0.3%	6
Tennessee	$1,532	$1,367	-12.1%	-5	$285	$202	-29.2%	-8	0.8%	0.4%	-0.4%	-8
Texas	$10,223	$19,861	48.5%	1	$528	$694	31.4%	-2	1.4%	1.3%	0.0%	-3
Utah	$1,445	$2,871	49.7%	3	$700	$910	30.0%	-1	2.2%	1.9%	-0.3%	-6
Vermont	$346	$285	-21.6%	-3	$588	$456	-22.5%	-8	1.8%	1.1%	-0.7%	-12
Virginia	$2,486	$5,433	54.2%	-3	$369	$638	72.9%	1	1.0%	1.3%	0.3%	2
Washington	$9,301	$28,758	67.7%	5	$1,660	$3,821	130.2%	4	4.3%	6.0%	1.7%	2
West Virginia	$471	$226	-108.7%	-7	$260	$125	-51.8%	-10	1.0%	0.4%	-0.7%	-16
Wisconsin	$2,402	$5,662	57.6%	-1	$462	$975	111.0%	9	1.3%	2.0%	0.7%	9
Wyoming	$39	$37	-6.5%	-1	$82	$64	-22.1%	-6	0.2%	0.1%	-0.1%	-4

Source: National Center for Science and Engineering Statistics, Survey of Industrial Research and Development, Business R&D and Innovation Survey, and Business Research and Development Survey, U.S. Bureau of Economic Analysis; updated December, 2020.

Table 5. Historical Business R&D Expenditures in Iowa, 1997-2018

Year	Total R&D ($ Millions)	Total R&D (State Rank)	Percent Change since 1997	Per Capita ($)	Per Capita (State Rank)	Percent Change Since 1997	Percent Share of Private GSP	Private GSP (State Rank)	Percent Change Since 1997
1997	$813	34		$285	33		0.78%	34	
1998	$1,044	34	28.31%	$365	31	28.02%	1.01%	30	28.74%
1999	$1,002	35	23.16%	$349	32	22.51%	0.95%	33	21.12%
2000	$1,022	33.5	25.71%	$349	33	22.50%	0.93%	32	18.83%
2001	$1,072	33	31.81%	$366	30	28.32%	0.98%	30	25.55%
2002	$973	33	19.62%	$332	29	16.37%	0.87%	31	10.74%
2003	$1,055	32	29.77%	$359	30	25.90%	0.90%	30	15.41%
2004	$1,188	31	46.10%	$402	30	41.19%	0.93%	31	18.89%
2005	$1,243	32	52.84%	$419	29	47.16%	0.96%	31	22.68%
2006	$1,224	32	50.54%	$411	30	44.07%	0.94%	32	19.98%
2007	$1,358	31	67.01%	$453	28	58.94%	0.98%	31	26.02%
2008	$1,673	30	105.72%	$555	30	94.65%	1.24%	29	59.31%
2009	$2,141	27	163.20%	$706	22	147.71%	1.62%	23	107.34%
2010	$2,123	26	161.01%	$696	20	144.20%	1.57%	23	100.36%
2011	$2,468	25	203.42%	$805	19	182.41%	1.77%	19	126.85%
2012	$1,846	28	126.93%	$600	28	110.52%	1.26%	26	61.38%
2013	$2,111	26	159.58%	$682	24	139.49%	1.44%	25	83.78%
2014	$2,119	26	160.53%	$681	24	139.07%	1.38%	24	75.99%
2015	$2,539	26	212.17%	$813	18	185.36%	1.60%	22	104.17%
2016	$2,834	25	248.39%	$904	19	217.39%	1.80%	20	130.48%
2017	$2,855	24	250.98%	$908	17	218.68%	1.83%	20	133.97%
2018	$3,146	24	286.78%	$999	14	250.49%	1.97%	17	152.69%

Source: National Center for Science and Engineering Statistics, Survey of Industrial Research and Development, Business R&D and Innovation Survey, and Business Research and Development Survey, U.S. Bureau of Economic Analysis; updated December, 2020.

Table 6. Business Research Expenditures and Earned Research Activities Tax Credits Reported on Forms IA 128 and IA 128S, 2006-2019

Research Expenditures and Research Activities Tax Credits Reported on Form IA 128

Distribution of U.S. Research Expenditures Reported on Form IA 128

Wages	Supplies	Computers	Contract
57.51%	21.11%	0.88%	20.50%

Distribution of IA Research Expenditures Reported on Form IA 128

Wages	Supplies	Computers	Contract
61.35%	29.47%	0.48%	8.69%

Tax Year	Firms	Total U.S. Expenditures ($ Millions)	IA Share of U.S. Expenditures	Total IA Expenditures ($ Millions)	Regular Research Activities Credits ($ Millions)	Supplemental Research Activities Credits ($ Millions)	Total Research Activities Credits ($ Millions)	Credits per Research Dollar
2006	336	$13,255.40	5.14%	$681.06	$20.55	$4.35	$24.90	$0.037
2007	377	$12,871.56	6.48%	$833.61	$24.82	$10.24	$35.06	$0.042
2008	307	$12,639.55	5.00%	$631.53	$19.85	$6.39	$26.24	$0.042
2009	269	$10,098.64	6.21%	$626.75	$19.31	$5.94	$25.25	$0.040
2010	267	$9,709.26	6.51%	$631.71	$19.75	$4.18	$23.93	$0.038
2011	247	$9,084.83	6.91%	$628.16	$19.90	$3.62	$23.52	$0.037
2012	243	$10,763.89	6.38%	$686.74	$21.66	$2.21	$23.87	$0.035
2013	247	$9,983.16	9.85%	$983.21	$31.68	$1.59	$33.27	$0.034
2014	235	$11,119.68	7.83%	$871.01	$27.62	$1.65	$29.27	$0.034
2015	214	$8,072.08	11.40%	$920.07	$28.49	$0.73	$29.23	$0.032
2016	225	$11,710.47	8.59%	$1,006.08	$32.02	$0.52	$32.54	$0.032
2017	200	$10,267.84	8.35%	$856.95	$27.47	$0.44	$27.91	$0.033
2018	167	$6,474.81	8.43%	$546.14	$17.57	$0.53	$18.09	$0.033
2019	162	$12,873.04	3.11%	$400.86	$12.67	$0.10	$12.77	$0.032

Research Expenditures and Research Activities Tax Credits Reported on Form IA 128S

Distribution of U.S. Research Expenditures Reported on Form IA 128S

Wages	Supplies	Computers	Contract
65.52%	19.66%	0.20%	14.63%

Distribution of IA Research Expenditures Reported on Form IA 128S for 2010 - 2020

Wages	Supplies	Computers	Contract
56.32%	34.21%	0.45%	9.02%

Tax Year	Firms	Total U.S. Expenditures ($ Millions)	IA Share of U.S. Expenditures	Total IA Expenditures ($ Millions)	Regular Research Activities Credits ($ Millions)	Supplemental Research Activities Credits ($ Millions)	Total Research Activities Credits ($ Millions)	Credits per Research Dollar
2010	147	$2,623.42	28.07%	$736.42	$19.82	$11.97	$31.79	$0.043
2011	219	$9,066.23	9.70%	$879.85	$23.67	$12.71	$36.38	$0.041
2012	278	$11,900.39	8.76%	$1,042.19	$28.61	$6.93	$35.54	$0.034
2013	322	$13,600.06	9.32%	$1,267.70	$34.14	$5.27	$39.40	$0.031
2014	379	$12,490.90	10.03%	$1,252.62	$31.71	$7.15	$38.86	$0.031
2015	445	$15,539.99	9.32%	$1,448.81	$38.87	$4.79	$43.66	$0.030
2016	475	$17,435.59	8.30%	$1,447.70	$33.00	$1.08	$34.08	$0.024
2017	398	$17,233.93	8.67%	$1,494.06	$36.83	$2.55	$39.38	$0.026
2018	350	$17,753.72	9.81%	$1,741.57	$45.00	$2.18	$47.18	$0.027
2019	339	$12,241.75	11.94%	$1,461.83	$36.61	$1.61	$38.22	$0.026

Total Research Expenditures and Research Activities Tax Credits

Distribution of U.S. Research Expenditures

Wages	Supplies	Computers	Contract
60.89%	20.50%	0.59%	18.02%

Distribution of IA Research Expenditures

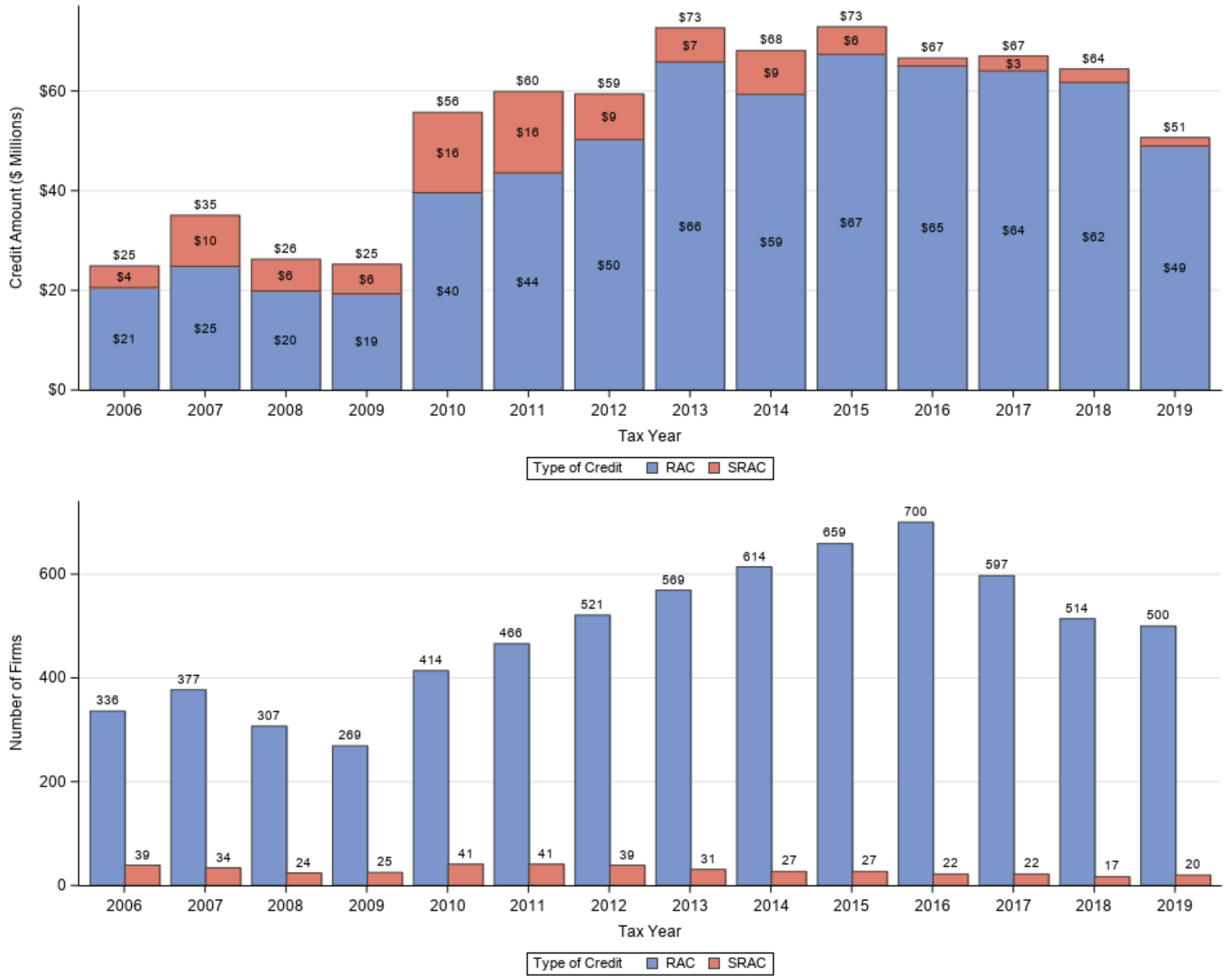
Wages	Supplies	Computers	Contract
58.78%	31.90%	0.47%	8.86%

Tax Year	Firms	Total U.S. Expenditures ($ Millions)	IA Share of U.S. Expenditures	Total IA Expenditures ($ Millions)	Regular Research Activities Credits ($ Millions)	Supplemental Research Activities Credits ($ Millions)	Total Research Activities Credits ($ Millions)	Credits per Research Dollar
2006	336	$13,255.40	5.14%	$681.06	$20.55	$4.35	$24.90	$0.037
2007	377	$12,871.56	6.48%	$833.61	$24.82	$10.24	$35.06	$0.042
2008	307	$12,639.55	5.00%	$631.53	$19.85	$6.39	$26.24	$0.042
2009	269	$10,098.64	6.21%	$626.75	$19.31	$5.94	$25.25	$0.040
2010	414	$12,332.68	11.09%	$1,368.13	$39.57	$16.15	$55.72	$0.041
2011	466	$18,151.06	8.31%	$1,508.01	$43.57	$16.33	$59.90	$0.040
2012	521	$22,664.28	7.63%	$1,728.94	$50.27	$9.14	$59.41	$0.034
2013	569	$23,583.22	9.54%	$2,250.92	$65.82	$6.85	$72.67	$0.032
2014	614	$23,610.59	8.99%	$2,123.63	$59.33	$8.80	$68.13	$0.032
2015	659	$23,612.07	10.03%	$2,368.88	$67.37	$5.52	$72.89	$0.031
2016	700	$29,146.06	8.42%	$2,453.78	$65.03	$1.60	$66.62	$0.027
2017	598	$27,501.77	8.55%	$2,351.01	$64.31	$2.99	$67.29	$0.029
2018	517	$24,228.53	9.44%	$2,287.71	$62.56	$2.70	$65.27	$0.029
2019	501	$25,114.79	7.42%	$1,862.69	$49.28	$1.71	$50.99	$0.027

Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS).

Note: Taxpayers are not required to report total U.S research expenditures on the IA 128S. Data for tax years 2018 and 2019 is incomplete. Calculated based on verified data.

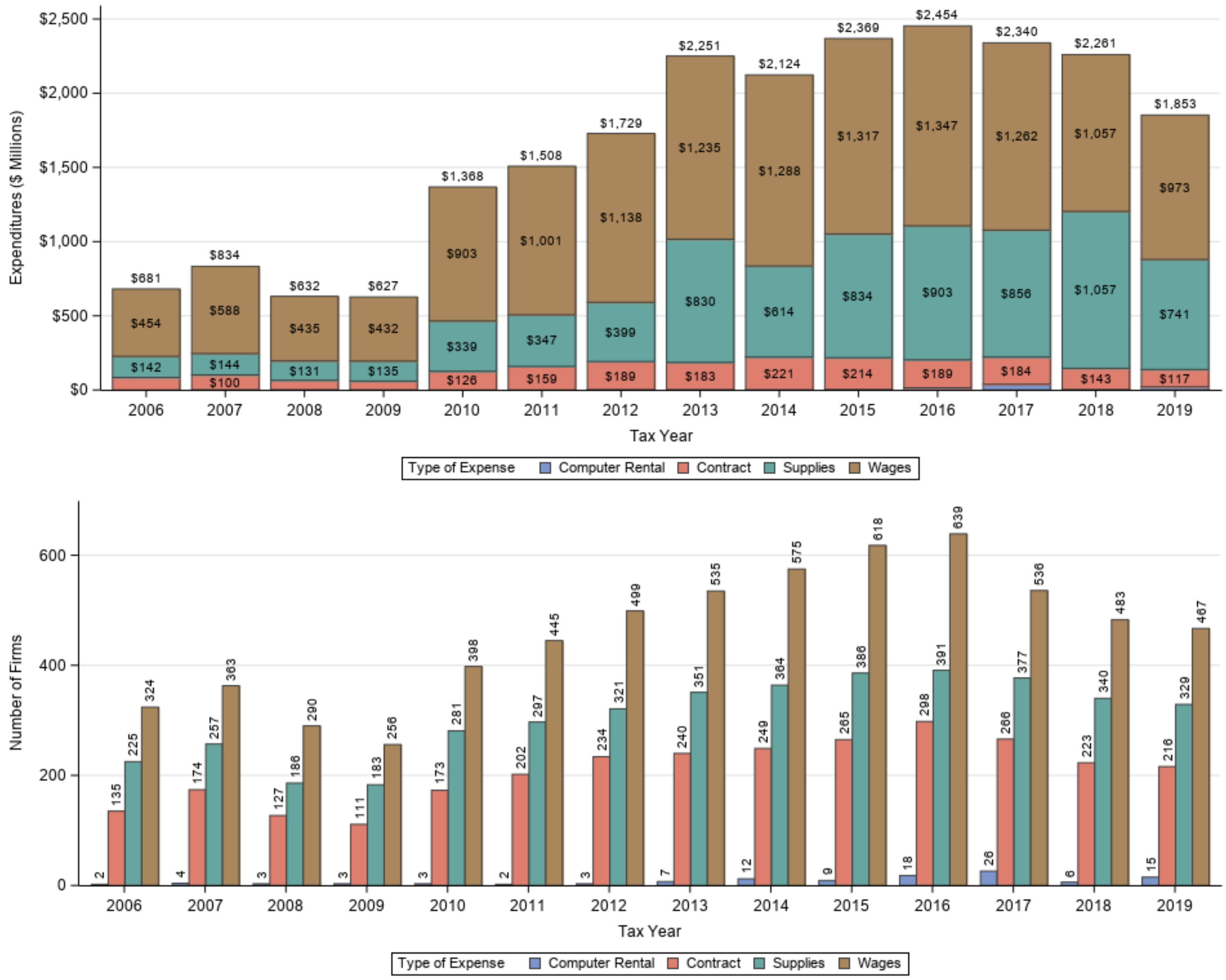
Figure 8. Iowa Research Activities Tax Credits Reported on Forms IA128 and IA 128S by Type of Tax Credit, 2006-2019



Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128s.

Note: Taxpayers are not required to report total U.S research expenditures on the IA 128S. Data from tax year 2018 and 2019 is incomplete.

Figure 9. Iowa Research Expenditures Reported on Forms IA 128 and IA 128S by Expense Type, 2006-2019



Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128s.
Note: Taxpayers are not required to report total U.S research expenditures on the IA 128S. Tax year 2019 is incomplete. Computer rental expenditures are much smaller compared to other expenditures.

Table 7. Gross Receipts, Qualified Research Expenditures, and Research Intensity, 2006-2019

	Firms		Reported Four-Year Moving Average of Annual Gross Receipts ($ millions)*				Qualified Research Expenditures ($ millions)				Research Intensity**
Tax Year	Count	Percent of Total	Amount	Percent of Total	Mean	Median	Amount	Percent of Total	Mean	Median	Total
IA 128 - Regular Method											
2006	336	100%	$305,511.17	100%	$863.65	$49.29	$681.06	100%	$2.36	$0.64	0.22%
2007	377	100%	$237,973.71	100%	$706.73	$44.50	$833.61	100%	$2.18	$0.51	0.35%
2008	307	100%	$299,009.78	100%	$1,231.27	$24.48	$631.53	100%	$2.30	$0.53	0.21%
2009	269	100%	$286,676.39	100%	$812.43	$19.40	$626.75	100%	$2.03	$0.48	0.22%
2010	267	64%	$319,783.89	82%	$963.76	$13.43	$631.71	46%	$2.03	$0.43	0.20%
2011	247	53%	$242,753.11	57%	$689.78	$19.36	$628.16	42%	$2.21	$0.48	0.26%
2012	243	47%	$197,817.61	43%	$1,087.31	$16.38	$686.74	40%	$2.06	$0.37	0.35%
2013	247	43%	$209,963.86	52%	$1,160.63	$15.51	$983.21	44%	$2.35	$0.41	0.47%
2014	235	38%	$242,178.07	61%	$1,299.93	$14.87	$871.01	41%	$2.38	$0.43	0.36%
2015	214	32%	$300,112.18	66%	$1,098.43	$12.86	$920.07	39%	$2.55	$0.43	0.31%
2016	226	32%	$325,040.39	54%	$887.07	$14.93	$1,006.08	41%	$2.83	$0.46	0.31%
2017	200	33%	$456,229.54	57%	$945.78	$10.76	$856.95	36%	$4.03	$0.42	0.19%
2018	167	32%	$247,923.24	40%	$1,187.15	$12.06	$546.14	24%	$3.74	$0.42	0.22%
2019	162	32%	$497,856.61	78%	$1,613.51	$12.51	$400.86	22%	$4.34	$0.42	0.08%
IA 128S - Alternative Simplified Method											
2010	147	36%	$69,972.00	18%	$804.28	$5.01	$736.42	54%	$16.72	$0.42	1.05%
2011	219	47%	$183,311.70	43%	$1,454.85	$4.02	$879.85	58%	$14.74	$0.56	0.48%
2012	278	53%	$260,316.26	57%	$1,712.61	$3.75	$1,042.19	60%	$20.28	$0.51	0.40%
2013	322	57%	$196,066.92	48%	$1,181.13	$3.94	$1,267.70	56%	$22.43	$0.58	0.65%
2014	379	62%	$153,458.64	39%	$755.95	$3.31	$1,252.62	59%	$33.78	$0.48	0.82%
2015	445	68%	$156,692.23	34%	$693.33	$3.26	$1,448.81	61%	$39.65	$0.56	0.92%
2016	475	68%	$273,085.99	46%	$1,192.52	$3.07	$1,447.70	59%	$35.69	$0.51	0.53%
2017	398	67%	$337,652.61	43%	$1,918.48	$3.75	$1,494.06	64%	$28.08	$0.56	0.44%
2018	350	68%	$365,533.32	60%	$2,298.95	$4.98	$1,741.57	76%	$36.12	$0.63	0.48%
2019	339	68%	$138,243.28	22%	$897.68	$4.32	$1,461.83	78%	$28.61	$0.64	1.06%
Total											
2006	336	100%	$305,511.17	100%	$863.65	$49.29	$681.06	100%	$2.36	$0.64	0.22%
2007	377	100%	$237,973.71	100%	$706.73	$44.50	$833.61	100%	$2.18	$0.51	0.35%
2008	307	100%	$299,009.78	100%	$1,231.27	$24.48	$631.53	100%	$2.30	$0.53	0.21%
2009	269	100%	$286,676.39	100%	$812.43	$19.40	$626.75	100%	$2.03	$0.48	0.22%
2010	414	100%	$389,755.90	100%	$963.76	$13.43	$1,368.13	100%	$2.03	$0.43	0.35%
2011	466	100%	$426,064.81	100%	$689.78	$19.36	$1,508.01	100%	$2.21	$0.48	0.35%
2012	521	100%	$458,133.87	100%	$1,087.31	$16.38	$1,728.94	100%	$2.06	$0.37	0.38%
2013	569	100%	$406,030.78	100%	$1,160.63	$15.51	$2,250.92	100%	$2.35	$0.41	0.55%
2014	614	100%	$395,636.71	100%	$1,170.44	$15.10	$2,123.63	100%	$3.32	$0.43	0.54%
2015	659	100%	$456,804.42	100%	$1,227.85	$13.75	$2,368.88	100%	$3.24	$0.47	0.52%
2016	701	100%	$598,126.39	100%	$1,221.69	$15.75	$2,453.78	100%	$3.32	$0.50	0.41%
2017	598	100%	$793,882.15	100%	$1,046.47	$16.06	$2,351.01	100%	$3.98	$0.51	0.30%
2018	517	100%	$613,456.56	100%	$972.08	$20.29	$2,287.71	100%	$3.47	$0.46	0.37%
2019	501	100%	$636,099.88	100%	$1,108.75	$25.53	$1,862.69	100%	$3.61	$0.50	0.29%

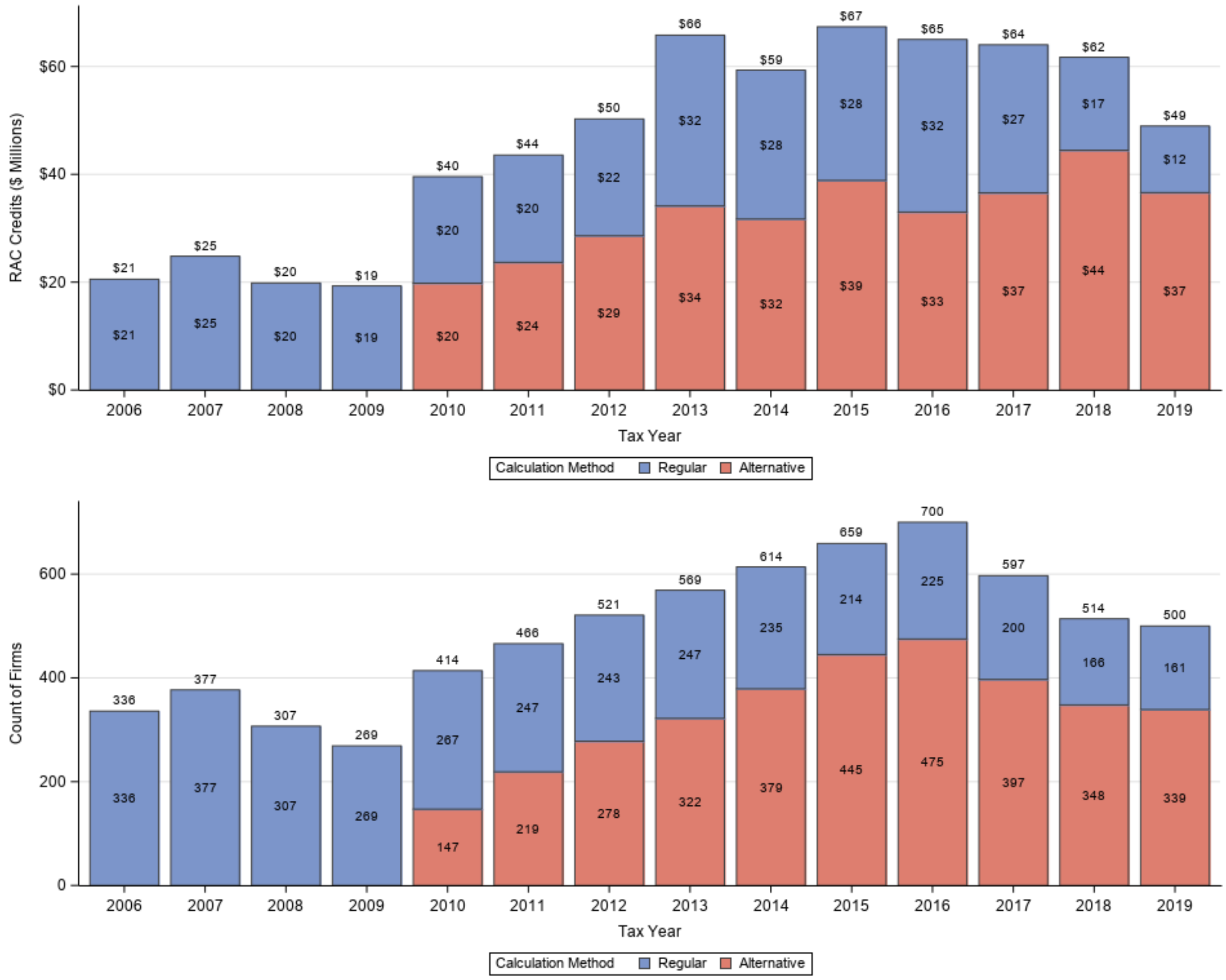
Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128S.

Note: Data for tax years 2018 and 2019 is incomplete.

*Taxpayers report the four-year moving average of annual gross receipts. Taxpayers using the IA 128S are not required to supply data for annual gross receipts. The amount of annual gross receipts reflects the totals among taxpayers that supplied this information, calculated based on verified data.

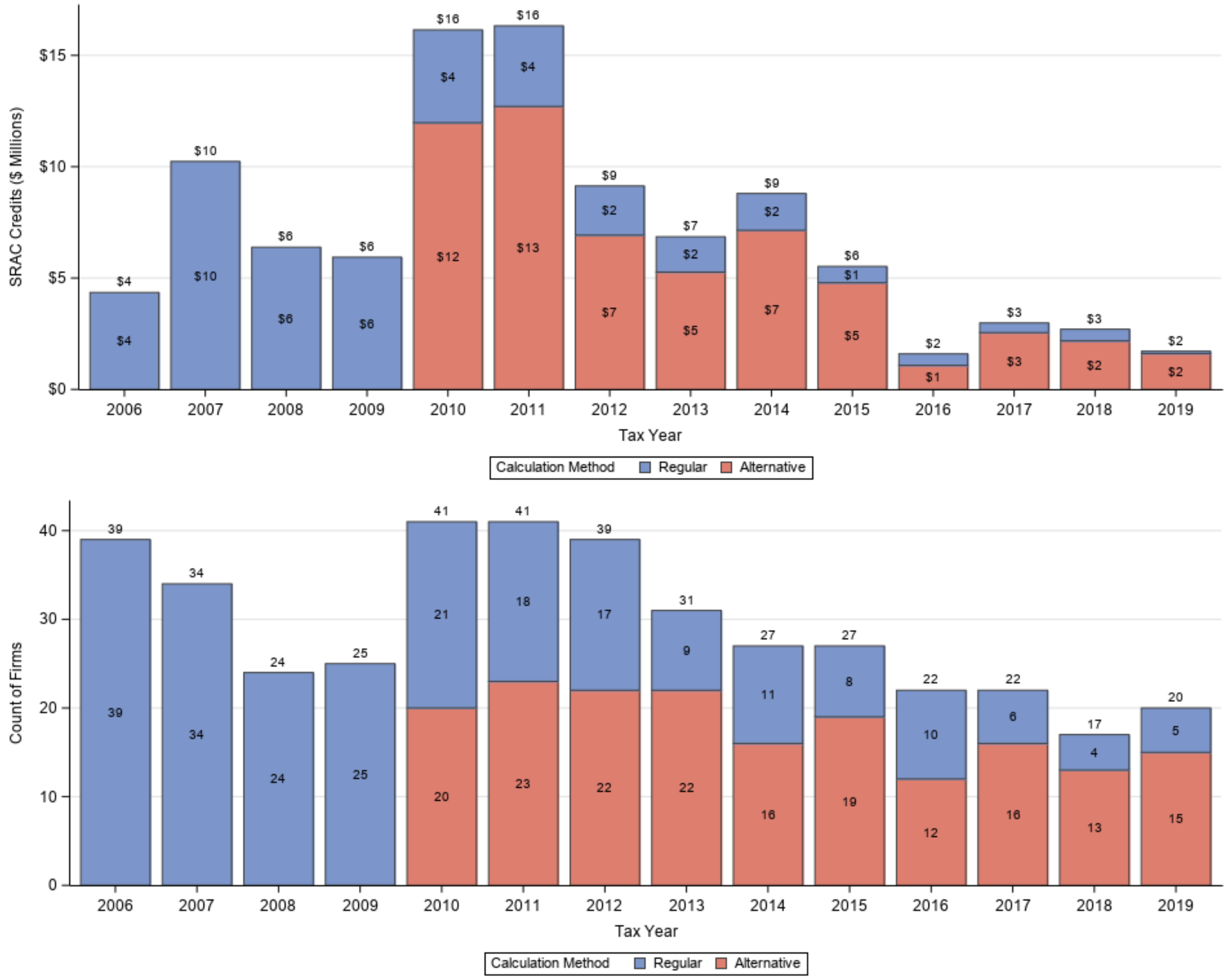
**Research intensity is the percentage of annual gross receipts represented by qualified research expenditures, calculated based on verified data.

Figure 10. RAC Credits and Counts of Firms by Calculation Method



Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128s.
Note: Data for tax years 2018 and 2019 is incomplete.

Figure 11. SRAC Credits and Counts of Firms by Calculation Method



Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128s.
Note: Data for tax years 2018 and 2019 is incomplete.

Table 8. Supplemental Research Activities Tax Credit by Firm Size

Tax Year	Supplemental RAC					
	Firms Reporting SRAC	Firms per Year	Percent of Total	Total Credits Reported	Average Credits per Firm	Percent of Total
2006-2019						
Firm's Average Annual Gross Receipts						
Less than $20 Million	158	11.3	38%	$29,158,578	$184,548	30%
Greater than $20 Million	253	18.1	62%	$69,557,677	$274,932	70%
Total	411	29.4	100%	$98,716,255	$240,186	100%

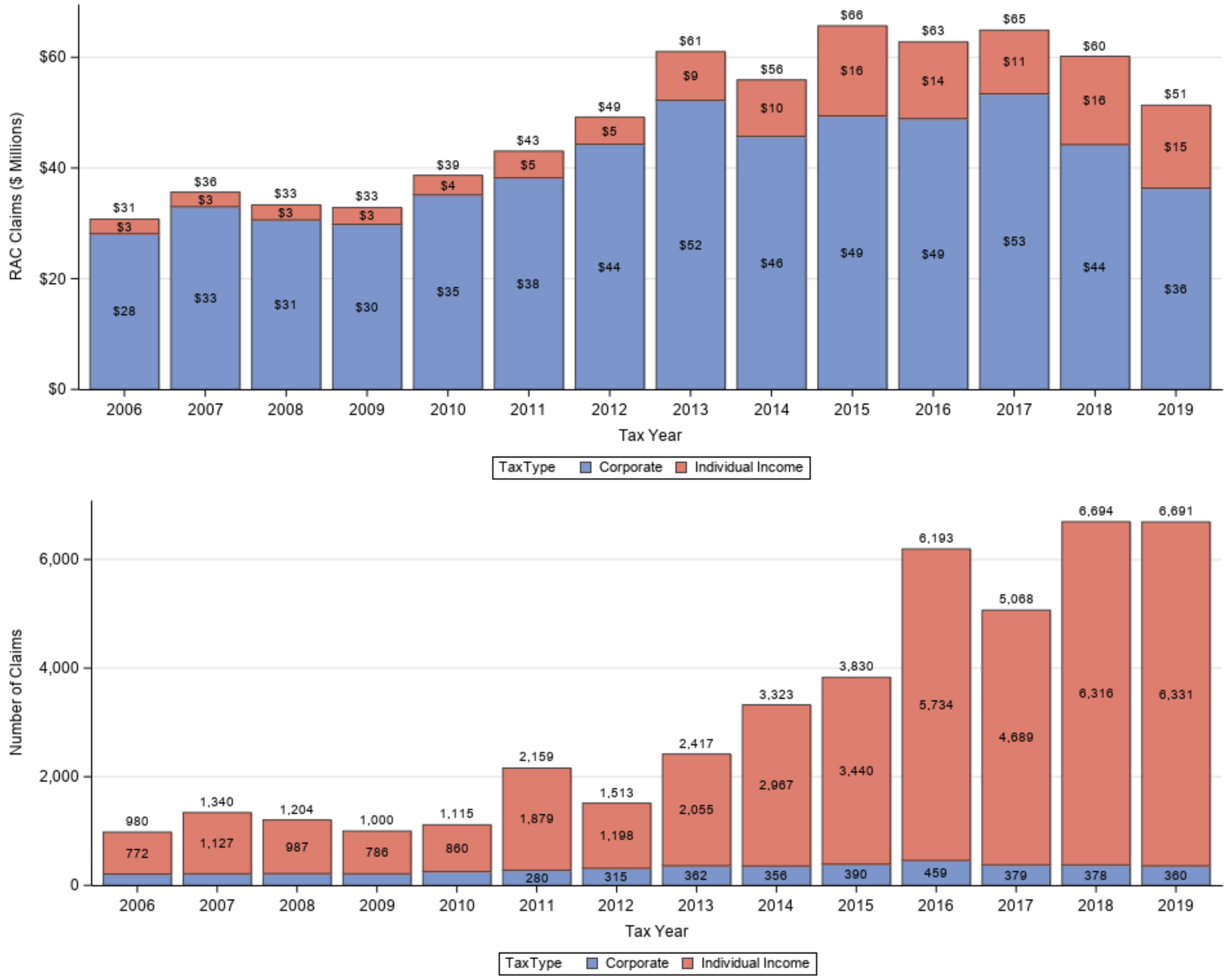
Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 128 and 128s.
Note: Data for tax years 2018 and 2019 is incomplete.

Table 9. Number and Value of Automatic Research Activities Tax Credit Claims Reported on IA 148 by Tax Type, 2006-2019

	Corporate			Individual			Total		Corporate Claims Share	
Tax Year	Number of Claims	Amount of RAC Claims	Average RAC Claim	Number of Claims	Amount of RAC Claims	Average RAC Claim	Number of Claims	Amount of RAC Claims	Percent of Claims	Percent of Claimed Amount
2006	208	$28,138,929	$135,283	772	$2,625,294	$3,401	980	$30,764,223	21.2%	91.5%
2007	213	$33,007,576	$154,965	1,127	$2,624,681	$2,329	1,340	$35,632,257	15.9%	92.6%
2008	217	$30,632,223	$141,162	987	$2,698,125	$2,734	1,204	$33,330,348	18.0%	91.9%
2009	214	$29,821,616	$139,353	786	$3,041,171	$3,869	1,000	$32,862,787	21.4%	90.7%
2010	255	$35,147,102	$137,832	860	$3,527,757	$4,102	1,115	$38,674,859	22.9%	90.9%
2011	280	$38,218,842	$136,496	1,879	$4,834,147	$2,573	2,159	$43,052,989	13.0%	88.8%
2012	315	$44,289,221	$140,601	1,198	$4,893,094	$4,084	1,513	$49,182,315	20.8%	90.1%
2013	362	$52,234,395	$144,294	2,055	$8,793,611	$4,279	2,417	$61,028,006	15.0%	85.6%
2014	356	$45,721,279	$128,431	2,967	$10,203,188	$3,439	3,323	$55,924,467	10.7%	81.8%
2015	390	$49,420,396	$126,719	3,440	$16,265,146	$4,728	3,830	$65,685,542	10.2%	75.2%
2016	459	$48,925,850	$106,592	5,734	$13,869,747	$2,419	6,193	$62,795,597	7.4%	77.9%
2017	379	$53,409,361	$140,922	4,689	$11,491,994	$2,451	5,068	$64,901,355	7.5%	82.3%
2018	378	$44,226,160	$117,000	6,316	$15,954,199	$2,526	6,694	$60,180,359	5.6%	73.5%
2019	360	$36,359,757	$100,999	6,331	$14,980,191	$2,366	6,691	$51,339,948	5.4%	70.8%
Total	4,386	$569,552,707	$129,857	39,141	$115,802,345	$2,959	43,527	$685,355,052	13.9%	84.5%

Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148
Note: Data for tax years 2018 and 2019 is incomplete. Data includes owners of passthrough entities.

Figure 12. Research Activities Tax Credit Claims by Tax Type, 2006-2019



Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148

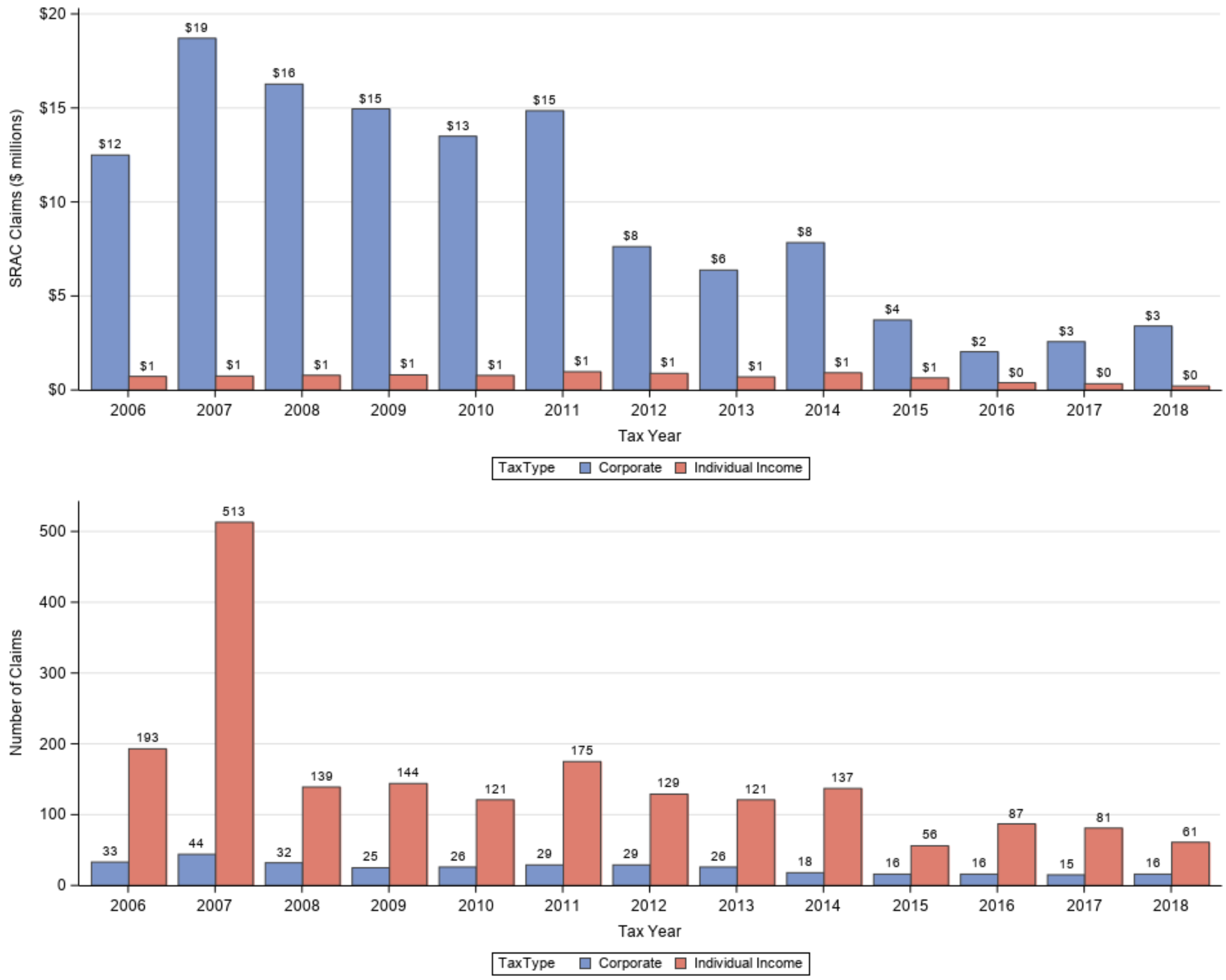
Note: Data for tax years 2018 and 2019 is incomplete.

Table 10. Supplemental Research Activities Tax Credit Claims Reported on IA 148 by Tax Type, 2006-2019

	Corporate			Individual			Total		Corporate Claims Share	
Tax Year	Number of Claims	Amount of SRAC Claims	Average SRAC Claim	Number of Claims	Amount of SRAC Claims	Average SRAC Claim	Number of Claims	Amount of SRAC Claims	Percent of Claims	Percent of Claimed Amount
2006	33	$12,493,644	$378,595	193	$724,874	$3,756	226	$13,218,518	14.6%	94.5%
2007	44	$18,705,207	$425,118	513	$743,462	$1,449	557	$19,448,669	7.9%	96.2%
2008	32	$16,267,248	$508,352	139	$782,508	$5,630	171	$17,049,756	18.7%	95.4%
2009	25	$14,949,782	$597,991	144	$803,562	$5,580	169	$15,753,344	14.8%	94.9%
2010	26	$13,496,561	$519,099	121	$775,632	$6,410	147	$14,272,193	17.7%	94.6%
2011	29	$14,850,818	$512,097	175	$972,599	$5,558	204	$15,823,417	14.2%	93.9%
2012	29	$7,624,342	$262,908	129	$885,768	$6,866	158	$8,510,110	18.4%	89.6%
2013	26	$6,378,523	$245,328	121	$698,016	$5,769	147	$7,076,539	17.7%	90.1%
2014	18	$7,837,797	$435,433	137	$918,128	$6,702	155	$8,755,925	11.6%	89.5%
2015	16	$3,724,524	$232,783	56	$642,787	$11,478	72	$4,367,311	22.2%	85.3%
2016	16	$2,035,569	$127,223	87	$389,376	$4,476	103	$2,424,945	15.5%	83.9%
2017	15	$2,569,388	$171,293	81	$333,100	$4,112	96	$2,902,488	15.6%	88.5%
2018 & 2019*	16	$3,401,976	$212,624	61	$210,199	$3,446	77	$3,612,175	20.8%	94.2%
Total	325	$124,335,379	$382,570	1,957	$8,880,011	$4,538	2,282	$133,215,390	16.1%	91.6%

Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148
Note: Data for tax years 2018 and 2019 is incomplete. Data includes owners of passthrough entities.
*TY 2018 and 2019 data is combined out concern for taxpayer confidentiality.

Figure 13 Supplemental Research Activities Tax Credit Claims by Tax Type, 2006-2019



Source: Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148

Note: TY 2018 data includes TY 2019 data out of concern for taxpayer confidentiality.

Table 11. Research Activities Tax Credit Claims Paid as Refunds, 2006-2019

	Corporation Income Tax			Individual Income Tax			Both Corporate and Individual		
Tax Year	Total RAC Claims	RAC Claims Paid as Refunds	Refunds Percentage of Total RAC Claims	Total RAC Claims	RAC Claims Paid as Refunds	Refunds Percentage of Total RAC Claims	Total RAC Claims	RAC Claims Paid as Refunds	Refunds Percentage of Total RAC Claims
2006	$28,138,929	$26,069,123	92.6%	$2,641,558	$2,641,558	100.0%	$30,780,487	$28,710,681	93.28%
2007	$33,007,576	$30,493,940	92.4%	$2,650,343	$2,650,343	100.0%	$35,657,919	$33,144,283	92.95%
2008	$30,632,223	$27,750,112	90.6%	$2,714,092	$2,714,092	100.0%	$33,346,315	$30,464,204	91.36%
2009	$29,821,616	$27,114,142	90.9%	$3,175,334	$3,080,786	97.0%	$32,996,950	$30,194,928	91.51%
2010	$35,147,102	$25,730,411	73.2%	$3,808,934	$3,785,787	99.4%	$38,956,036	$29,516,198	75.77%
2011	$38,218,842	$26,199,097	68.6%	$5,206,371	$5,163,203	99.2%	$43,425,213	$31,362,300	72.22%
2012	$44,289,221	$29,466,669	66.5%	$5,100,342	$4,876,578	95.6%	$49,389,563	$34,343,247	69.54%
2013	$52,187,963	$43,021,730	82.4%	$9,238,571	$3,556,010	38.5%	$61,426,534	$46,577,740	75.83%
2014	$45,698,612	$38,676,284	84.6%	$10,870,018	$4,412,884	40.6%	$56,568,630	$43,089,168	76.17%
2015	$48,770,807	$40,749,104	83.6%	$16,818,538	$10,191,209	60.6%	$65,589,345	$50,940,313	77.67%
2016	$48,846,065	$42,860,922	87.7%	$14,348,000	$4,970,988	34.6%	$63,194,065	$47,831,910	75.69%
2017	$54,100,956	$46,368,523	85.7%	$12,032,569	$4,872,693	40.5%	$66,133,525	$51,241,216	77.48%
2018	$42,421,189	$28,262,932	66.6%	$16,801,043	$6,935,920	41.3%	$59,222,232	$35,198,852	59.44%
2019	$36,771,893	$29,941,433	81.4%	$15,308,289	$7,063,686	46.1%	$52,080,182	$37,005,119	71.05%
Total	$576,100,332	$468,392,221	81.3%	$130,705,160	$72,186,508	55.2%	$706,805,492	$540,578,729	76.48%

Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148
Note: Data for tax years 2018 and 2019 is incomplete. Data includes owners of passthrough entities.

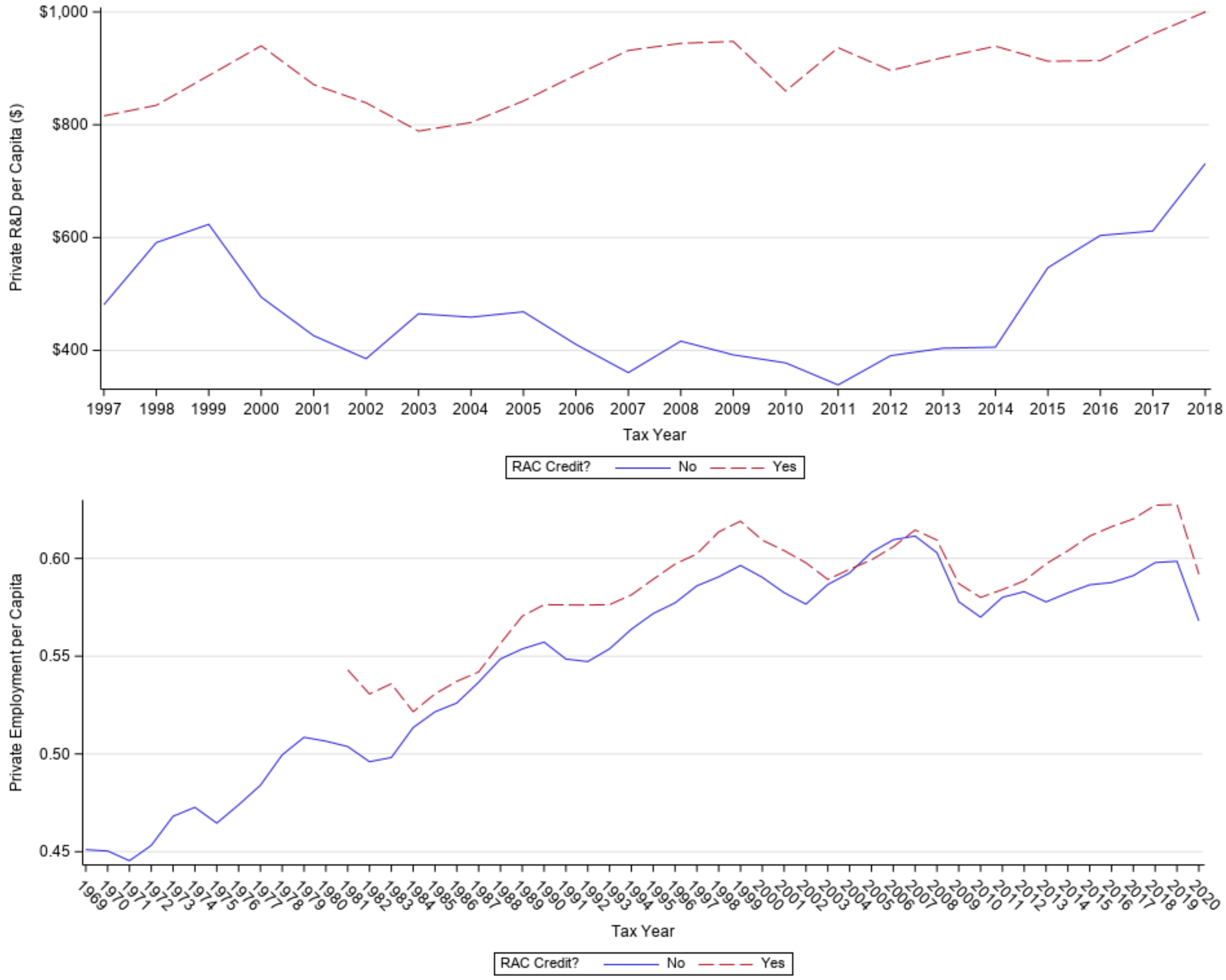
Table 12. RAC and SRAC by Fiscal Year

	RAC		SRAC		Total	
Fiscal Year	Number	Millions ($)	Number	Millions ($)	Number	Millions ($)
2007	654	$2.33	151	$0.72	805	$3.05
2008	1,269	$15.65	512	$7.24	1,781	$22.88
2009	1,168	$51.65	226	$27.96	1,394	$79.62
2010	1,030	$14.23	174	$3.80	1,204	$18.03
2011	993	$41.55	157	$20.24	1,150	$61.79
2012	2,054	$38.44	200	$14.59	2,254	$53.04
2013	1,505	$29.33	151	$12.36	1,656	$41.69
2014	1,598	$48.16	159	$16.18	1,757	$64.34
2015	1,885	$39.60	170	$6.66	2,055	$46.25
2016	2,401	$48.67	98	$5.13	2,499	$53.80
2017	5,612	$67.18	120	$7.50	5,732	$74.68
2018	5,428	$69.29	110	$3.36	5,538	$72.64
2019	8,039	$82.16	56	$2.58	8,095	$84.74
2020	7,785	$79.39	52	$2.34	7,837	$81.73
2021	7,284	$67.75	35	$2.88	7,319	$70.63
Total	48,705	$695.38	2,371	$133.52	51,076	$828.90

Source: Iowa Department of Revenue Credit Award, Claim, and Transfer Administration System (CACTAS), IA Form 148

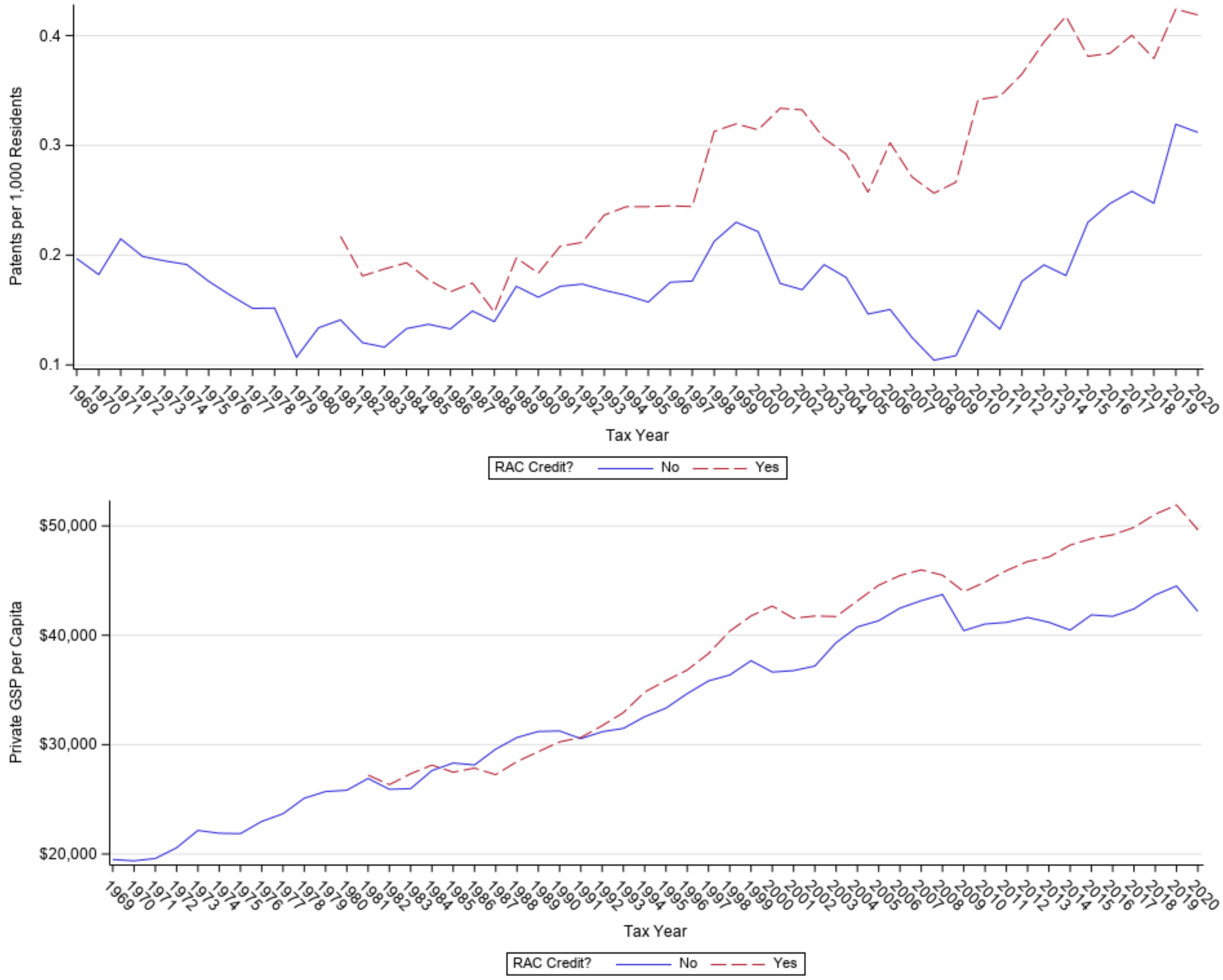
Note: Number of claims are preliminary.

Figure 14. Research Inputs in RAC States vs Non-RAC States



Source: National Center for Science and Engineering Statistics, Survey of Industrial Research and Development, Business R&D and Innovation Survey, and Business Research and Development Survey (various years), data available as of December 2020; U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020. United States Patent and Trademark Office, Last updated May 2021.

Figure 15. Research Outputs in RAC States vs Non-RAC States.



Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Table 13. Average Research Inputs, RAC vs Non-RAC States

Year	Average Private R&D Expenditures per capita ($)				Average Private Employment per Capita			
	RAC	Non-RAC	Difference	Percent Difference	RAC	Non-RAC	Difference	Percent Difference
1981	.	.	.	.	0.54	0.50	0.04	8%
1982	.	.	.	.	0.53	0.50	0.03	7%
1983	.	.	.	.	0.54	0.50	0.04	8%
1984	.	.	.	.	0.52	0.51	0.01	2%
1985	.	.	.	.	0.53	0.52	0.01	2%
1986	.	.	.	.	0.54	0.53	0.01	2%
1987	.	.	.	.	0.54	0.54	0.01	1%
1988	.	.	.	.	0.56	0.55	0.01	1%
1989	.	.	.	.	0.57	0.55	0.02	3%
1990	.	.	.	.	0.58	0.56	0.02	3%
1991	.	.	.	.	0.58	0.55	0.03	5%
1992	.	.	.	.	0.58	0.55	0.03	5%
1993	.	.	.	.	0.58	0.55	0.02	4%
1994	.	.	.	.	0.58	0.56	0.02	3%
1995	.	.	.	.	0.59	0.57	0.02	3%
1996	.	.	.	.	0.60	0.58	0.02	3%
1997	$816	$481	$335	70%	0.60	0.59	0.02	3%
1998	$834	$591	$243	41%	0.61	0.59	0.02	4%
1999	$887	$623	$264	42%	0.62	0.60	0.02	4%
2000	$940	$494	$446	90%	0.61	0.59	0.02	3%
2001	$871	$426	$445	105%	0.60	0.58	0.02	4%
2002	$839	$385	$454	118%	0.60	0.58	0.02	4%
2003	$789	$465	$324	70%	0.59	0.59	0.00	0%
2004	$804	$459	$345	75%	0.59	0.59	0.00	0%
2005	$842	$468	$374	80%	0.60	0.60	0.00	-1%
2006	$888	$411	$478	116%	0.61	0.61	0.00	-1%
2007	$932	$361	$571	158%	0.61	0.61	0.00	1%
2008	$944	$416	$528	127%	0.61	0.60	0.01	1%
2009	$948	$392	$556	142%	0.59	0.58	0.01	2%
2010	$860	$378	$482	128%	0.58	0.57	0.01	2%
2011	$937	$339	$598	177%	0.58	0.58	0.00	1%
2012	$896	$391	$506	129%	0.59	0.58	0.01	1%
2013	$919	$404	$515	128%	0.60	0.58	0.02	3%
2014	$939	$406	$534	132%	0.60	0.58	0.02	4%
2015	$913	$547	$366	67%	0.61	0.59	0.02	4%
2016	$914	$604	$310	51%	0.62	0.59	0.03	5%
2017	$961	$612	$349	57%	0.62	0.59	0.03	5%
2018	$1,000	$731	$269	37%	0.63	0.60	0.03	5%
2019	.	.	.	.	0.63	0.60	0.03	5%
2020	.	.	.	.	0.59	0.57	0.02	4%
Pooled	$898	$484	$414***	85%	0.60	0.53	0.07***	14%

Note: *** denotes statistically significant difference of means, T-value of 9.61 for research expenditures and 29.95 for employment.

Table 14. Average Research Outputs, RAC vs Non-RAC States

	Average Utility Patents per Thousand Residents				Average Private GSP per Capita ($)			
Year	RAC	Non-RAC	Difference	Percent Difference	RAC	Non-RAC	Difference	Percent Difference
1981	0.22	0.14	0.08	54%	$27,216	$26,905	$310	1%
1982	0.18	0.12	0.06	51%	$26,343	$25,919	$424	2%
1983	0.19	0.12	0.07	61%	$27,336	$25,976	$1,359	5%
1984	0.19	0.13	0.06	45%	$28,132	$27,631	$501	2%
1985	0.18	0.14	0.04	30%	$27,480	$28,320	-$840	-3%
1986	0.17	0.13	0.03	26%	$27,853	$28,140	-$287	-1%
1987	0.17	0.15	0.03	17%	$27,259	$29,592	-$2,333	-8%
1988	0.15	0.14	0.01	6%	$28,450	$30,653	-$2,203	-7%
1989	0.20	0.17	0.03	15%	$29,358	$31,204	-$1,846	-6%
1990	0.18	0.16	0.02	14%	$30,252	$31,251	-$998	-3%
1991	0.21	0.17	0.04	21%	$30,653	$30,547	$106	0%
1992	0.21	0.17	0.04	22%	$31,729	$31,179	$549	2%
1993	0.24	0.17	0.07	41%	$32,933	$31,486	$1,447	5%
1994	0.24	0.16	0.08	49%	$34,807	$32,558	$2,249	7%
1995	0.24	0.16	0.09	55%	$35,850	$33,338	$2,512	8%
1996	0.24	0.18	0.07	40%	$36,822	$34,667	$2,155	6%
1997	0.24	0.18	0.07	38%	$38,330	$35,828	$2,502	7%
1998	0.31	0.21	0.10	47%	$40,378	$36,369	$4,009	11%
1999	0.32	0.23	0.09	39%	$41,768	$37,675	$4,092	11%
2000	0.31	0.22	0.09	42%	$42,674	$36,639	$6,036	16%
2001	0.33	0.17	0.16	92%	$41,555	$36,770	$4,785	13%
2002	0.33	0.17	0.16	97%	$41,763	$37,187	$4,576	12%
2003	0.31	0.19	0.11	60%	$41,714	$39,331	$2,384	6%
2004	0.29	0.18	0.11	63%	$43,151	$40,767	$2,384	6%
2005	0.26	0.15	0.11	76%	$44,581	$41,331	$3,250	8%
2006	0.30	0.15	0.15	101%	$45,462	$42,482	$2,980	7%
2007	0.27	0.12	0.15	117%	$45,982	$43,166	$2,816	7%
2008	0.26	0.10	0.15	146%	$45,491	$43,730	$1,761	4%
2009	0.27	0.11	0.16	146%	$43,988	$40,424	$3,565	9%
2010	0.34	0.15	0.19	128%	$44,861	$41,031	$3,830	9%
2011	0.34	0.13	0.21	160%	$45,908	$41,178	$4,730	11%
2012	0.37	0.18	0.19	107%	$46,742	$41,629	$5,113	12%
2013	0.39	0.19	0.20	106%	$47,153	$41,188	$5,965	14%
2014	0.42	0.18	0.24	130%	$48,250	$40,473	$7,777	19%
2015	0.38	0.23	0.15	66%	$48,837	$41,863	$6,973	17%
2016	0.38	0.25	0.14	55%	$49,183	$41,728	$7,455	18%
2017	0.40	0.26	0.14	55%	$49,858	$42,407	$7,451	18%
2018	0.38	0.25	0.13	53%	$51,074	$43,689	$7,385	17%
2019	0.42	0.32	0.10	33%	$51,912	$44,507	$7,406	17%
2020	0.42	0.31	0.11	34%	$49,651	$42,184	$7,467	18%
Pooled	0.32	0.17	0.15***	89%	$43,941	$29,391	$14,550***	50%

Note: *** denotes statistically significant difference of means, T-value of 21.44 for patents and 33.23 for gross domestic product.

Table 15. Descriptive Statistics of Variables for Analysis

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Private R&D per capita ($)	1,100	$764	$695	$32	$3,821
Private Employment per capita	2,600	0.55	0.07	0.37	0.82
Patents per Thousand Residents (count)	2,600	0.22	0.19	0.02	1.36
Private GSP per capita ($)	2,600	$34,674	$12,307	$13,164	$104,803
RAC Credit (0=No, 1=Yes)	2,600	0.36	0.48	0.00	1.00
Highest Rate of RAC Credit (Percent	2,600	3.59	6.03	0.00	25.00
Partially or Fully Refundable Credit (0=No, 1=Yes)	2,600	0.09	0.28	0.00	1.00
Income Tax (0 = "No", 1 = "Yes")	2,600	0.81	0.39	0.00	1.00
Sales Tax Rate (Percent)	2,600	4.37	1.86	0.00	8.25
Top Corporate Tax Rate (Percent)	2,600	6.30	2.87	0.00	12.25
State Support for Higher Education per student ($)	2,050	$8,089	$2,695	$2,214	$22,611
Population (Logged)	2,600	14.99	1.03	12.60	17.49
Population Density (Residents per Sq. Mi.)	2,600	174.39	241.97	0.52	1,209.10
Agriculture (Proportion of Private GDP)	2,600	0.04	0.04	0.00	0.43
Construction (Proportion of Private GDP)	2,600	0.06	0.02	0.03	0.37
Finance (Proportion of Private GDP)	2,600	0.21	0.09	0.06	0.65
Manufacturing (Proportion of Private GDP)	2,600	0.22	0.10	0.02	0.53
Mining (Proportion of Private GDP)	2,600	0.04	0.08	0.00	0.56
Retail (Proportion of Private GDP)	2,600	0.11	0.02	0.04	0.17
Services (Proportion of Private GDP)	2,600	0.15	0.05	0.04	0.43

Table 16. OLS Analysis of Research Activities Tax Credits and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
RAC State (0 = "No", 1 = "Yes")	*204.65****	*0.04****	*0.07****	*5,270.54****
	36.77	0.00	0.01	307.00
Income Tax (0= "No", 1 = "Yes")	*-249.74****	*-0.03****	*-0.05****	*-4979.06****
	50.23	0.00	0.01	355.82
Sales Tax Rate (Percent)	*-22.70***	*0.01****	*-0.01***	*429.58****
	9.90	0.00	0.00	74.74
Corporate Tax Rate (Percent)	*-16.35***	*-0.000*	*0.01***	*27.58*
	6.86	0.00	0.00	50.03
Population (Logged Thousands)	*60.25****	*-0.02****	*0.01****	*70.45*
	22.22	0.00	0.00	156.89
Population Density (Residents per Sq. Mi.)	*0.79****	*-0.000****	*0.00****	*-2.99****
	0.09	0.00	0.00	0.62
Agriculture (Percent Private GDP)	*2,471.15***	*-0.25****	*1.12****	*-12,230.14**
	1,185.64	0.05	0.18	6,903.71
Construction (Percent Private GDP)	*-2,629.52***	*-0.28****	*0.98****	*76,856.30****
	1,244.63	0.06	0.21	8,160.03
Finance (Percent Private GDP)	*4,681.70****	*0.14****	*1.43****	*67,484.37****
	585.41	0.03	0.11	4,362.84
Manufacturing (Percent Private GDP)	*3,822.97****	*-0.25****	*1.23****	*-11,153.55***
	638.56	0.04	0.12	4,666.09
Mining (Percent Private GDP)	*1,601.65***	*-0.32****	*0.82****	*6096.51*
	728.54	0.04	0.14	5,445.30
Retail (Percent Private GDP)	*-2,679.48***	*-1.66****	*-0.54**	*-319,654.34****
	1,364.63	0.09	0.28	10,798.53
Services (Percent Private GDP)	*3,442.23****	*0.07*	*1.30****	*16,052.78****
	835.18	0.05	0.15	5,964.99
Intercept	*-2,206.60****	*1.11****	*-0.82****	*50,174.64***
	770.59	0.04	0.14	5,519.49
Number of Observations	1,100	2,600	2,600	2,600
R^2	0.49	0.57	0.37	0.77

Note: R&D data covers 1997-2018 whereas the other models use data from 1969-2020. Italicized denotes coefficient estimate. Standard errors are provided below coefficient estimates. *probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01.

Table 17. FE Analysis of Research Activities Tax Credit and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
RAC State (0 = "No", 1 = "Yes")	*-171.94****	*-0.01*	*0.03****	*37.637*
	22.88	0.00	0.01	265.78
Income Tax (0= "No", 1 = "Yes")	*-288.10**	*-0.03*	*0.02*	*539.30*
	158.95	0.00	0.02	682.20
Sales Tax Rate (Percent)	*45.61***	*-0.04****	*0.02****	*-744.06****
	23.17	0.00	0.00	151.35
Corporate Tax Rate (Percent)	*2.51*	*-0.01****	*-0.04***	*-366.54****
	6.74	0.00	0.00	70.30
Population (Logged Thousands)	*147.65*	*-0.05****	*0.16****	*-2,527.78****
	195.46	0.00	0.02	889.84
Population Density (Residents per Sq. Mi.)	*3.41****	*0.00*	*0.00*	*37.16****
	0.67	0.00	0.00	4.51
Agriculture (Percent Private GDP)	*2316.22**	*-0.25****	*0.19*	*17,248.31***
	1,230.35	0.04	0.21	7,806.34
Construction (Percent Private GDP)	*-2,571.92***	*-0.01*	*0.58****	*76,153.29****
	1,107.35	0.04	0.21	7,965.98
Finance (Percent Private GDP)	*672.24*	*0.02*	*-0.02*	*26,612.25****
	827.66	0.03	0.17	6,650.60
Manufacturing (Percent Private GDP)	*1,825.08***	*0.14****	*0.43***	*4,682.02*
	760.17	0.03	0.17	6,457.77
Mining (Percent Private GDP)	*394.86*	*-0.09****	*0.30**	*-7,432.20*
	737.73	0.03	0.18	6,893.70
Retail (Percent Private GDP)	*3,424.20***	*-0.03*	*0.63**	*-127,615.59****
	1,514.70	0.07	0.37	14,005.15
Services (Percent Private GDP)	*359.35*	*0.14****	*0.54****	*12,201.21**
	811.80	0.03	0.19	7,055.10
Intercept	*-2,608.80*	*1.31****	*-2.49****	*84,458.76****
	3,048.18	0.07	-0.37	14,061.14
Observations	1,100	2,600	2,600	2,600
R^2	0.92	0.93	0.72	0.90

Note: R&D data covers 1997-2018 whereas the other models use data from 1969-2020. Iowa data is not used to identify effect of rate or refundability in R&D model. * probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01. Standard errors are provided immediately below the coefficient. Coefficient estimates for state and year are omitted for presentation.

Table 18. Iowa's Observed Values in 2015.

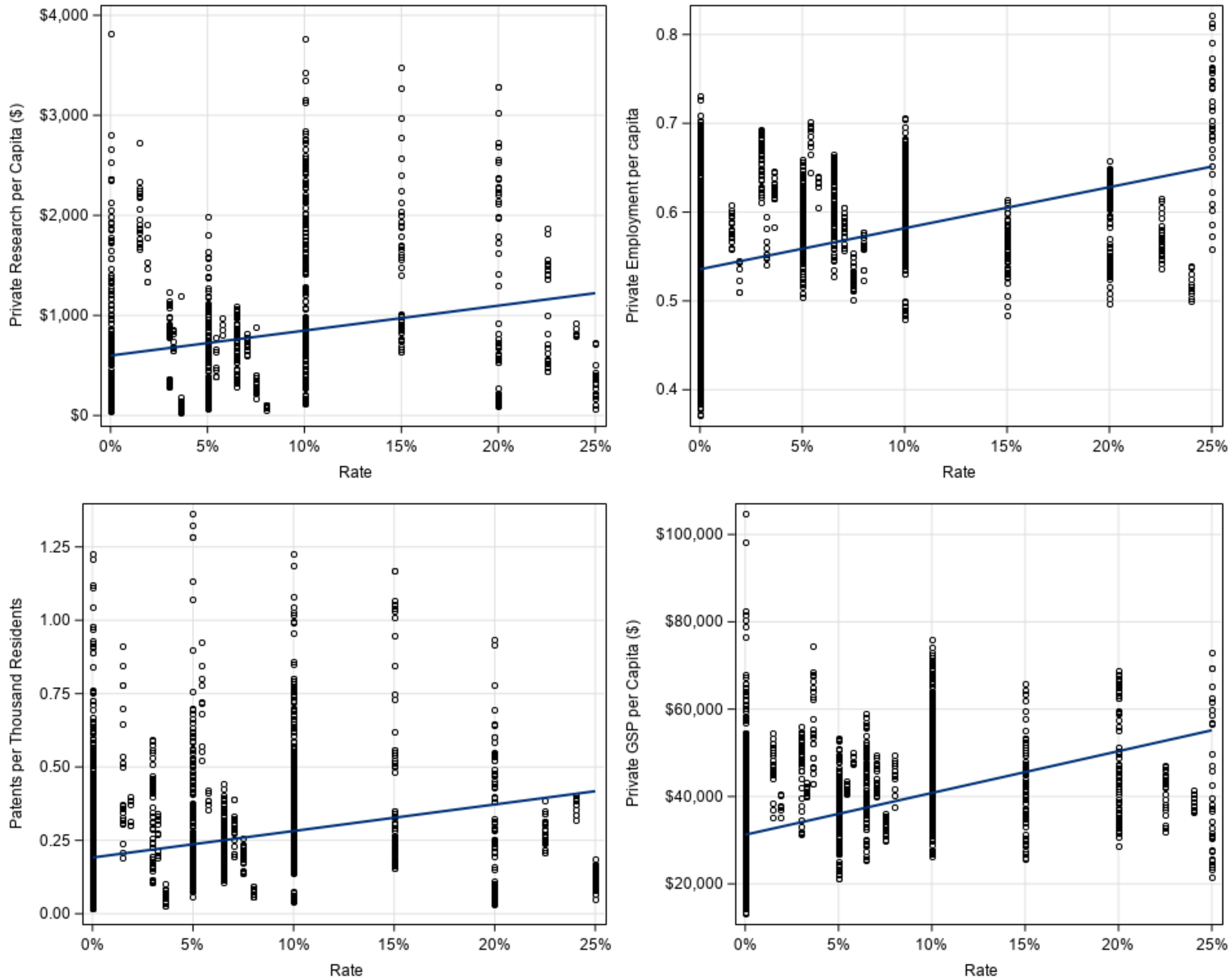
Variable	Value
Private R&D per capita ($)	$813
Private Employment per capita	0.66
Patents per Thousand Residents (count)	0.32
Private GSP per capita ($)	$50,968
RAC Credit (0=No, 1=Yes)	Yes
Highest Rate of RAC Credit (Percent	6.50
Partially or Fully Refundable Credit (0=No, 1=Yes)	Yes
Income Tax (0 = "No", 1 = "Yes")	Yes
Sales Tax Rate (Percent)	6.00
Top Corporate Tax Rate (Percent)	12.00
State Support for Higher Education per student ($)	$6,788
Population (Logged)	14.95
Population Density (Residents per Sq. Mi.)	55.90
Agriculture (Proportion of Private GDP)	0.06
Construction (Proportion of Private GDP)	0.06
Finance (Proportion of Private GDP)	0.28
Manufacturing (Proportion of Private GDP)	0.26
Mining (Proportion of Private GDP)	0.00
Retail (Proportion of Private GDP)	0.08
Services (Proportion of Private GDP)	0.11

Table 19. Predicted Value with and without RAC Program

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value with RAC	Predicted Value without RAC	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	Yes	$879.37	$674.73	-$204.65	-23.27%
Ordinary Least Squares	Private Employment per Capita	Yes	0.64	0.60	-0.04	-6.54%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.37	0.30	-0.07	-18.95%
Ordinary Least Squares	Private GSP per Capita ($)	Yes	$49,683.05	$44,412.51	-$5,270.54	-10.61%
Twoway Fixed Effects	Private R&D per Capita ($)	Yes	$615.72	$787.66	$171.94	27.92%
Twoway Fixed Effects	Private Employment per Capita	No	0.65	0.65	0.00	0.08%
Twoway Fixed Effects	Utility Patents per Thousand Residents	Yes	0.30	0.27	-0.03	-9.68%
Twoway Fixed Effects	Private GSP per Capita ($)	No	$45,287.92	$45,250.28	-$37.64	-0.08%

Note: Predicted value is calculated using the estimated equations in Tables 18 and 19 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with RAC compared to without RAC.

Figure 16. Scatter plots of Rate and Research Inputs/Outputs



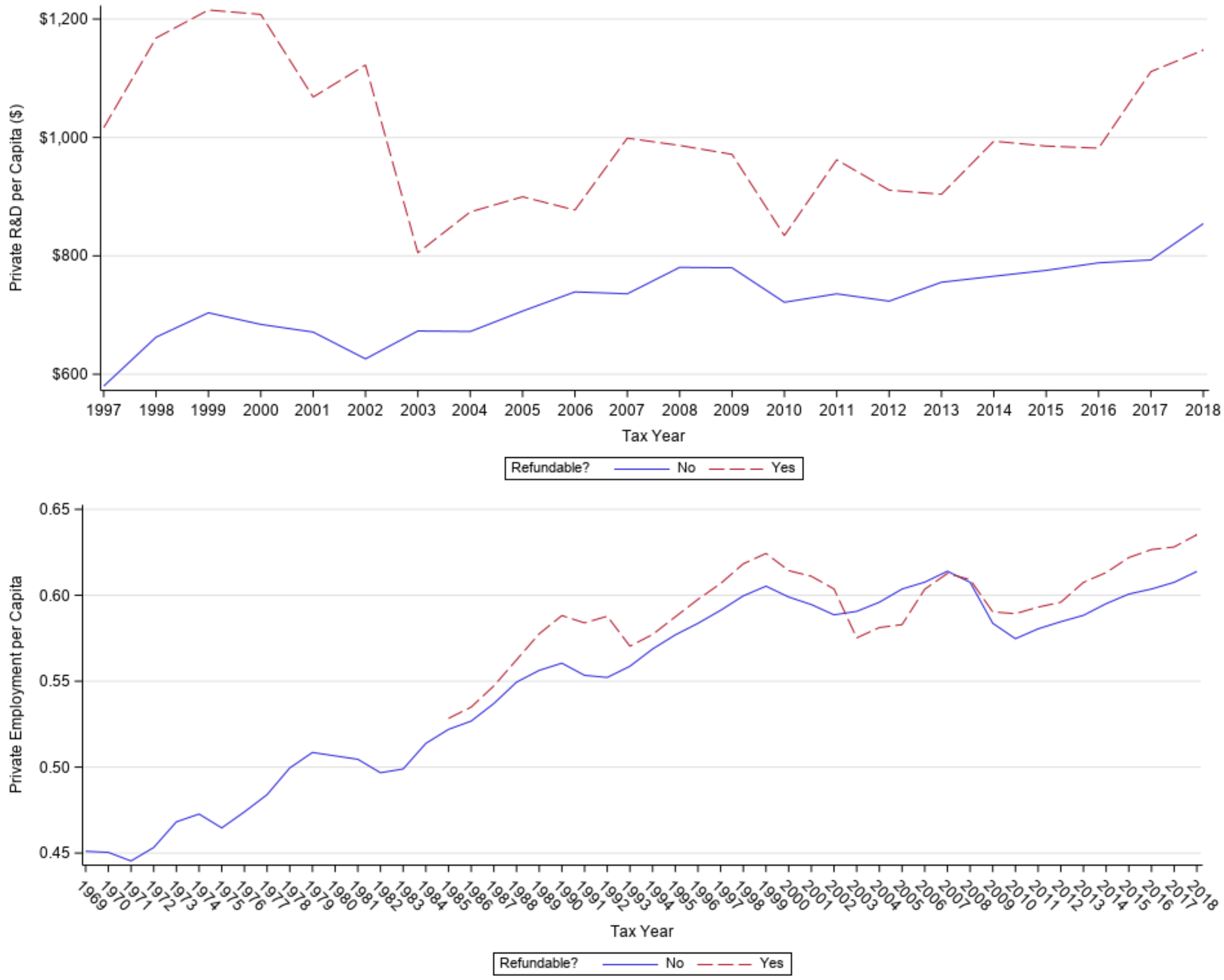
Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Table 20. Correlation Coefficients of Credit Rate, Corporate Rate, and State Support on Research Inputs/Outputs

	Private R&D per Capita	Private Employment per Capita	Patents per Thousand Residents	Private GSP per Capita
Rate of Credit	0.24**	0.40**	0.29**	0.47**
Top Corporate Rate	0.14**	0.05*	0.18**	0.09**
State Support per Student	-0.07*	0.23**	-0.11**	0.40**

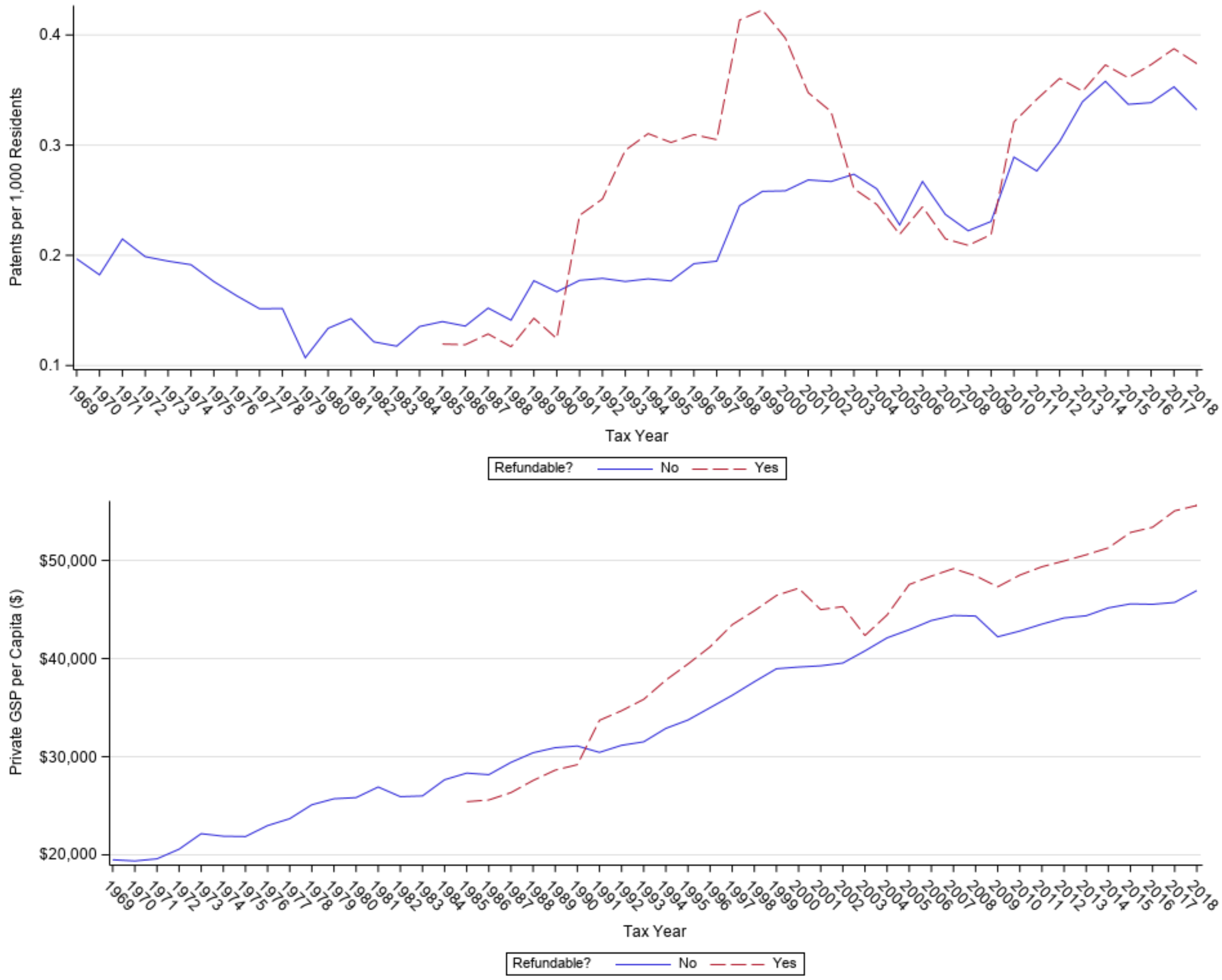
Note: Pearson's correlation coefficients. ** denotes probability less than 0.01. * denotes probability less than 0.05

Figure 17. Research Inputs in States with Refundable Credits vs States without Refundable Credits.



Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Figure 18. Research Outputs in States with Refundable Credits vs States without Refundable Credits.



Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Table 21. Research Inputs, States With vs Without Refundable RAC Credit

	Average Private R&D Expenditures per capita ($)				Average Private Employment per Capita			
Year	Refundable	Non-Refundable	Difference	Percent Difference	Refundable	Non-Refundable	Difference	Percent Difference
1985	.	.	.	.	0.53	0.52	0.01	1%
1986	.	.	.	.	0.53	0.53	0.01	2%
1987	.	.	.	.	0.55	0.54	0.01	2%
1988	.	.	.	.	0.56	0.55	0.01	2%
1989	.	.	.	.	0.58	0.56	0.02	4%
1990	.	.	.	.	0.59	0.56	0.03	5%
1991	.	.	.	.	0.58	0.55	0.03	6%
1992	.	.	.	.	0.59	0.55	0.04	6%
1993	.	.	.	.	0.57	0.56	0.01	2%
1994	.	.	.	.	0.58	0.57	0.01	1%
1995	.	.	.	.	0.59	0.58	0.01	2%
1996	.	.	.	.	0.60	0.58	0.01	2%
1997	$1,016	$580	$436	75%	0.61	0.59	0.02	3%
1998	$1,168	$663	$505	76%	0.62	0.60	0.02	3%
1999	$1,215	$704	$511	73%	0.62	0.61	0.02	3%
2000	$1,208	$684	$524	77%	0.61	0.60	0.02	3%
2001	$1,068	$671	$397	59%	0.61	0.59	0.02	3%
2002	$1,122	$626	$496	79%	0.60	0.59	0.02	3%
2003	$805	$673	$132	20%	0.58	0.59	-0.02	-3%
2004	$874	$672	$202	30%	0.58	0.60	-0.01	-2%
2005	$900	$707	$193	27%	0.58	0.60	-0.02	-3%
2006	$877	$739	$138	19%	0.60	0.61	0.00	-1%
2007	$999	$736	$263	36%	0.61	0.61	0.00	0%
2008	$987	$781	$206	26%	0.61	0.61	0.00	0%
2009	$971	$780	$192	25%	0.59	0.58	0.01	1%
2010	$834	$722	$113	16%	0.59	0.57	0.01	3%
2011	$962	$736	$227	31%	0.59	0.58	0.01	2%
2012	$911	$723	$188	26%	0.60	0.58	0.01	2%
2013	$904	$755	$149	20%	0.61	0.59	0.02	3%
2014	$994	$766	$228	30%	0.61	0.60	0.02	3%
2015	$985	$775	$210	27%	0.62	0.60	0.02	4%
2016	$982	$788	$194	25%	0.63	0.60	0.02	4%
2017	$1,111	$793	$318	40%	0.63	0.61	0.02	3%
2018	$1,147	$854	$293	34%	0.64	0.61	0.02	3%
2019	.	.	.	.	0.63	0.61	0.02	3%
2020	.	.	.	.	0.60	0.58	0.01	2%
Pooled	$986	$721	265***	37%	0.60	0.55	0.06***	10%

Note: *** denotes statistically significant difference of means, T-value of 4.70 for expenditures and 12.03 for private employment.

Table 22. Research Outputs, States With vs Without Refundable RAC Credit

	Average Utility Patents per Thousand Residents				Average Private GSP per Capita ($)			
Year	Refundable	Non-Refundable	Difference	Percent Difference	Refundable	Non-Refundable	Difference	Percent Difference
1985	0.12	0.14	-0.02	-15%	$25,412	$28,328	-$2,916	-10%
1986	0.12	0.14	-0.02	-12%	$25,589	$28,169	-$2,579	-9%
1987	0.13	0.15	-0.02	-15%	$26,341	$29,421	-$3,080	-10%
1988	0.12	0.14	-0.02	-17%	$27,575	$30,401	-$2,826	-9%
1989	0.14	0.18	-0.03	-19%	$28,630	$30,917	-$2,287	-7%
1990	0.12	0.17	-0.04	-25%	$29,188	$31,089	-$1,901	-6%
1991	0.24	0.18	0.06	33%	$33,706	$30,440	$3,266	11%
1992	0.25	0.18	0.07	40%	$34,682	$31,159	$3,523	11%
1993	0.30	0.18	0.12	68%	$35,844	$31,516	$4,328	14%
1994	0.31	0.18	0.13	74%	$37,802	$32,884	$4,918	15%
1995	0.30	0.18	0.13	71%	$39,441	$33,736	$5,706	17%
1996	0.31	0.19	0.12	61%	$41,194	$34,990	$6,205	18%
1997	0.30	0.19	0.11	57%	$43,448	$36,253	$7,195	20%
1998	0.41	0.25	0.17	69%	$44,865	$37,635	$7,230	19%
1999	0.42	0.26	0.16	64%	$46,426	$38,961	$7,465	19%
2000	0.40	0.26	0.14	54%	$47,162	$39,135	$8,028	21%
2001	0.35	0.27	0.08	30%	$44,986	$39,260	$5,727	15%
2002	0.33	0.27	0.06	24%	$45,290	$39,541	$5,749	15%
2003	0.26	0.27	-0.01	-5%	$42,347	$40,780	$1,567	4%
2004	0.25	0.26	-0.01	-5%	$44,439	$42,109	$2,330	6%
2005	0.22	0.23	-0.01	-4%	$47,537	$42,935	$4,603	11%
2006	0.24	0.27	-0.02	-9%	$48,396	$43,873	$4,522	10%
2007	0.22	0.24	-0.02	-9%	$49,162	$44,391	$4,771	11%
2008	0.21	0.22	-0.01	-6%	$48,431	$44,330	$4,101	9%
2009	0.22	0.23	-0.01	-5%	$47,308	$42,217	$5,091	12%
2010	0.32	0.29	0.03	11%	$48,503	$42,802	$5,701	13%
2011	0.34	0.28	0.07	24%	$49,354	$43,509	$5,844	13%
2012	0.36	0.30	0.06	19%	$49,942	$44,135	$5,807	13%
2013	0.35	0.34	0.01	3%	$50,573	$44,359	$6,215	14%
2014	0.37	0.36	0.01	4%	$51,276	$45,160	$6,116	14%
2015	0.36	0.34	0.02	7%	$52,844	$45,569	$7,275	16%
2016	0.37	0.34	0.03	10%	$53,378	$45,526	$7,853	17%
2017	0.39	0.35	0.03	10%	$55,050	$45,719	$9,330	20%
2018	0.37	0.33	0.04	13%	$55,596	$46,925	$8,671	18%
2019	0.43	0.38	0.05	14%	$56,494	$47,542	$8,952	19%
2020	0.43	0.37	0.06	16%	$54,178	$45,274	$8,904	20%
Pooled	0.32	0.21	0.11***	51%	$48,388	$33,356	$15,032***	45%

Note: *** denotes statistically significant difference of means, T-value of 8.38 for patents and 18.77 for gross domestic product.

Table 23. OLS Analysis of Program Features and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
Highest Rate of RAC Credit	*10.22****	*0.01****	*0.01****	*288.288****
	2.81	0.00	0.00	25.41
Partially or Fully Refundable (0 = "No"', 1 = "Yes")	*-84.45**	*-0.01***	*-0.05****	*473.72*
	46.856	0.004	0.012	488.813
Income Tax (0= "No", 1 = "Yes")	*-243.54****	*-0.03****	*-0.04****	*-4,990.60****
	51.22	0.00	0.01	367.37
Sales Tax Rate (Percent)	*-28.67****	*0.01***	*-0.01***	*396.82****
	10.20	0.00	0.00	78.22
Corporate Tax Rate (Percent)	*-9.54*	*0.01*	*0.01****	*78.61*
	6.88	0.00	0.00	51.32
Population (Logged Thousands)	*73.29****	*-0.02****	*0.02****	*270.07**
	22.49	0.00	0.00	161.64
Population Density (Residents per Sq. Mi.)	*0.75****	*-0.01****	*0.01****	*-4.88****
	0.09	0.00	0.00	0.63
Agriculture (Percent Private GDP)	*2,587.84***	*-0.20****	*1.26****	*-8,664.69*
	1,198.15	0.06	0.18	7,103.09
Construction (Percent Private GDP)	*-2190.73**	*-0.24****	*1.07****	*80,840.06****
	1,252.49	0.07	0.21	8,376.72
Finance (Percent Private GDP)	*4,885.61****	*0.25****	*1.69****	*77,023.27****
	596.45	0.04	0.11	4,436.28
Manufacturing (Percent Private GDP)	*3,980.21****	*-0.20****	*1.31****	*-6,570.95*
	645.24	0.04	0.12	4,787.86
Mining (Percent Private GDP)	*1,685.64***	*-0.27****	*0.94****	*10,272.00**
	737.27	0.04	0.14	5,590.77
Retail (Percent Private GDP)	*-3,251.51***	*-1.75****	*-0.75****	*-329,288.05****
	1,373.05	0.09	0.28	11,061.40
Services (Percent Private GDP)	*3,487.74****	*0.12***	*1.43****	*21,181.54****
	843.92	0.05	0.16	6,119.00
Intercept	*-2,398.16****	*1.06****	*-0.94****	*44,883.29****
	779.82	0.05	0.14	5,665.43
Number of Observations	1,100	2,600	2,600	2,600
R^2	0.48	0.54	0.35	0.76

Note: R&D data covers 1997-2018 whereas the other models use data from 1969-2020. *probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01. Standard errors are provided immediately below the coefficient and are italicized.

Table 24. FE Analysis of Program Features and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
Highest Rate of RAC Credit	*-9.00****	*0.00*	*0.001*	*-10.26*
	2.83	0.00	0.00	23.42
Partially or Fully Refundable (0 = "No"', 1 = "Yes")	*-41.30*	*-0.01*	*-0.01*	*1,937.15****
	42.53	0.00	0.01	429.35
Income Tax (0= "No", 1 = "Yes")	*-287.13**	*-0.01*	*0.02*	*218.52*
	162.05	0.00	0.02	686.05
Sales Tax Rate (Percent)	*34.86*	*-0.01****	*0.02****	*-730.81****
	23.64	0.00	0.00	151.03
Corporate Tax Rate (Percent)	*3.23*	*-0.01****	*-0.01***	*-347.59****
	6.87	0.00	0.00	70.37
Population (Logged Thousands)	*117.91*	*-0.05****	*0.16****	*-1,899.91***
	201.95	0.00	0.02	895.73
Population Density (Residents per Sq. Mi.)	*3.50****	*0.00*	*0.00*	*35.71****
	0.68	0.00	0.00	4.54
Agriculture (Percent Private GDP)	*2,439.65**	*-0.25****	*0.22*	*13,559.87**
	1,256.91	0.04	0.21	7,859.09
Construction (Percent Private GDP)	*-2395.68***	*-0.01*	*0.54***	*76,366.93****
	1,128.62	0.04	0.21	7,931.36
Finance (Percent Private GDP)	*819.12*	*0.02*	*0.01*	*22,551.86****
	850.24	0.03	0.18	6,678.35
Manufacturing (Percent Private GDP)	*1,905.56***	*0.15****	*0.43***	*812.67*
	783.68	0.03	0.17	6,490.89
Mining (Percent Private GDP)	*489.04*	*-0.09****	*0.30*	*-8,560.79*
	752.88	0.03	0.18	6,868.26
Retail (Percent Private GDP)	*32,95.81***	*-0.03*	*0.60*	*-128,792.11****
	1,548.28	0.07	0.37	13,950.57
Services (Percent Private GDP)	*406.72*	*0.14****	*0.57****	*11,524.97*
	827.86	0.03	0.19	7,020.40
Intercept	*-2,208.81*	*1.33****	*-2.46****	*76,228.58****
	3,143.12	0.07	0.37	14,107.50
Observations	1,100	2,600	2,600	2,600
R^2	0.91	0.93	0.72	0.90

Note: R&D data covers 1997-2018 whereas the other models use data from 1969-2020. Iowa data is not used to identify effect of rate or refundability in R&D model. * probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01. Standard errors are provided immediately below the coefficient. Coefficient estimates for state and year are omitted for presentation.

Table 25. Predicted Value 6.5 Percent Rate compared to 10 Percent Rate

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value at 6.5 Percent	Predicted Value at 10 Percent	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	Yes	$799.33	$835.10	$35.77	4.48%
Ordinary Least Squares	Private Employment per Capita	Yes	0.63	0.64	0.01	1.14%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.32	0.33	0.01	3.02%
Ordinary Least Squares	Private GSP per Capita ($)	Yes	$48,920.34	$49,929.34	$1,009.00	2.06%
Twoway Fixed Effects	Private R&D per Capita ($)	Yes	$610.53	$579.02	-$31.51	-5.16%
Twoway Fixed Effects	Private Employment per Capita	No	0.65	0.65	0.00	-0.09%
Twoway Fixed Effects	Utility Patents per Thousand Residents	No	0.30	0.30	0.00	0.86%
Twoway Fixed Effects	Private GSP per Capita ($)	No	$45,696.57	$45,660.66	-$35.91	-0.08%

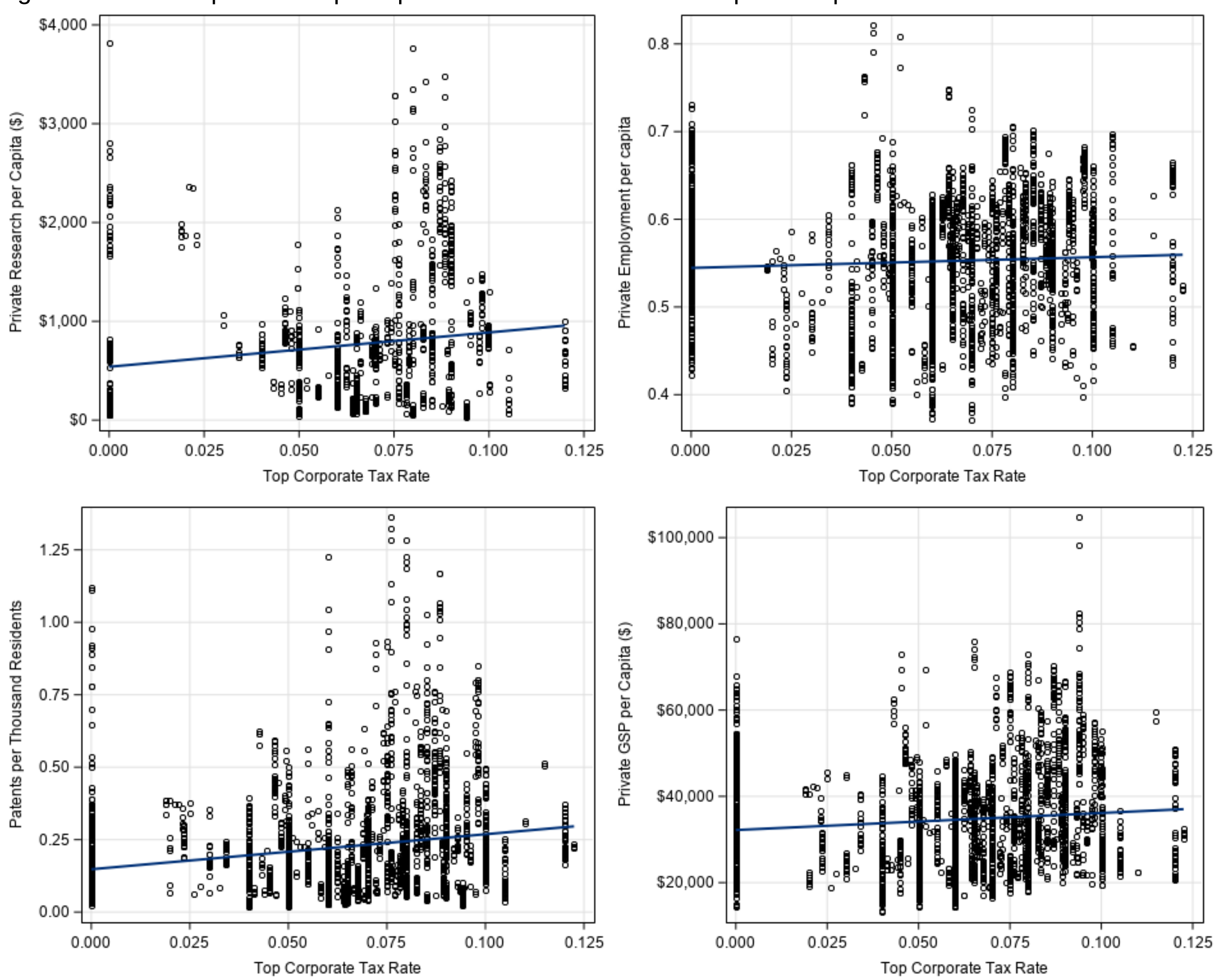
Note: Predicted value is calculated using the estimated equations in Tables 25 and 26 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with Iowa's rate of 6.5 compared to a rate of 10 percent, the median rate of RAC programs.

Table 26. Predicted Value for Refundable Credit Compared to Predicted Value for Non-Refundable Credit

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value Refund	Predicted Value No Refund	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	Yes	$799.33	$883.78	$84.45	10.57%
Ordinary Least Squares	Private Employment per Capita	Yes	0.63	0.64	0.01	1.42%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.32	0.37	0.05	15.66%
Ordinary Least Squares	Private GSP per Capita ($)	No	$48,920.34	$48,446.62	-$473.72	-0.97%
Twoway Fixed Effects	Private R&D per Capita ($)	No	$609.60	$650.90	$41.30	6.77%
Twoway Fixed Effects	Private Employment per Capita	No	0.65	0.66	0.00	0.47%
Twoway Fixed Effects	Utility Patents per Thousand Residents	No	0.30	0.30	0.01	2.87%
Twoway Fixed Effects	Private GSP per Capita ($)	Yes	$45,726.43	$43,789.28	-$1,937.15	-4.24%

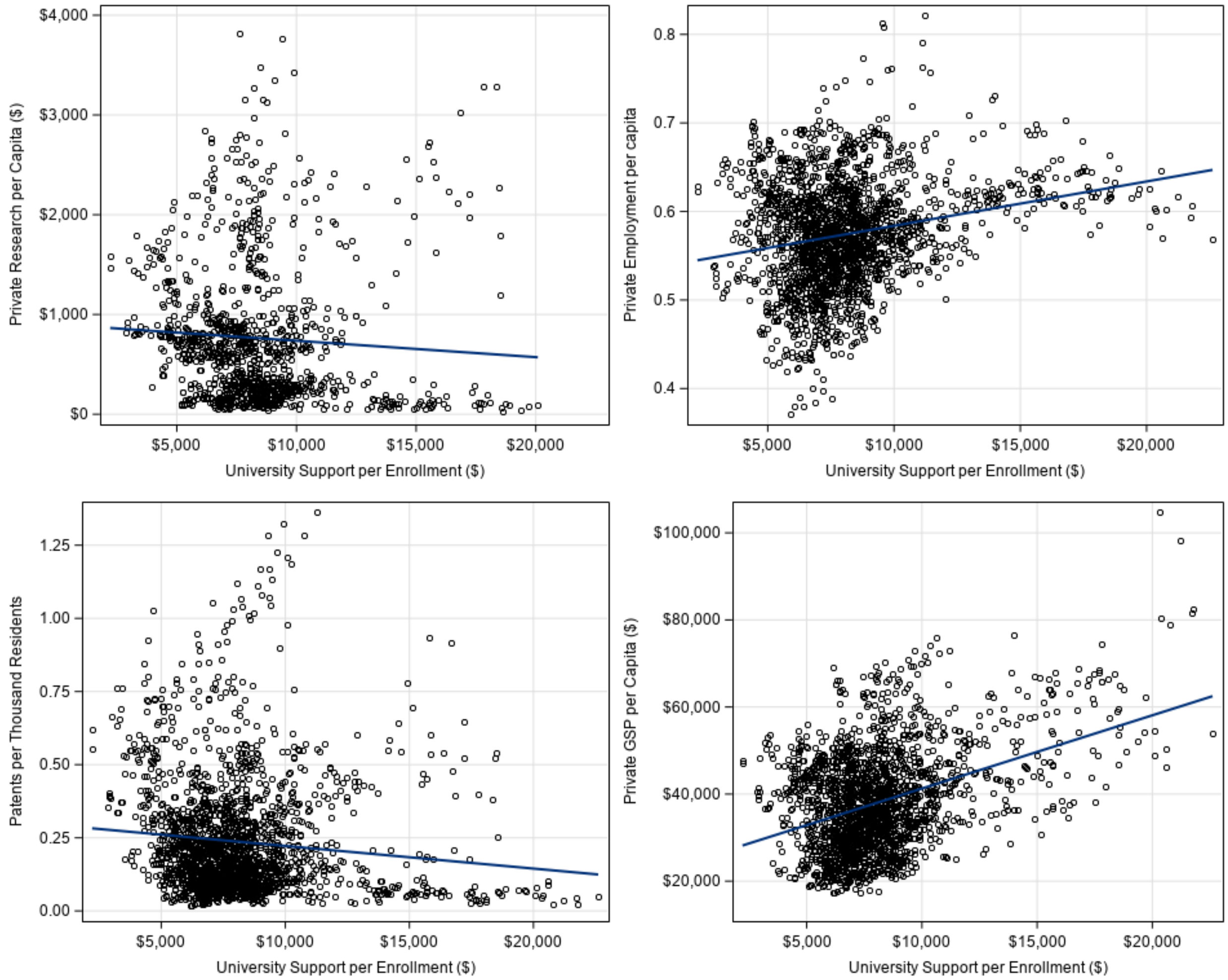
Note: Predicted value is calculated using the estimated equations in Tables 25 and 26 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with refundable equal to one compared to refundable equal to zero.

Figure 19. Scatter plots of Top Corporate Rate and Research Inputs/Outputs



Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Figure 20. Scatter plots of University Support and Research Inputs/Outputs



Source: U.S. Bureau of Economic Analysis, Gross State Product (various years), data available as of May 2020.

Table 27. OLS Analysis of RAC, Corporate Income Tax Rate, University Support, and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
RAC State (0 = "No", 1 = "Yes")	*204.51****	*0.04****	*0.08****	*4.532.06****
	36.77	0.00	0.01	287.56
Top Corproate Income Tax	*-16.00***	*-0.01****	*0.01****	*-75.76*
	6.87	0.00	0.00	51.66
University Support ($)	*-0.06*	*0.00****	*-0.01****	*1.01****
	0.01	0.00	0.00	0.05
Income Tax (0= "No", 1 = "Yes")	-250.95**	-0.03***	-0.06***	-5,860.13***
	50.26	0.00	0.01	375.04
Sales Tax Rate (Percent)	-20.99**	0.01***	0.01	3.63
	10.08	0.00	0.00	77.69
Population (Logged Thousands)	*57.04***	*-0.02****	*0.01**	*228.76*
	22.50	0.00	0.01	-167.65
Population Density (Residents per Sq. Mi.)	*0.80****	*-0.00****	*0.00***	*-2.34****
	0.09	0.00	0.00	0.66
Agriculture (Percent Private GDP)	*2,222.07**	*-0.08*	*0.84****	*-5,084.57*
	1,217.38	0.06	0.23	8,061.63
Construction (Percent Private GDP)	*-2,891.71***	*-0.22****	*0.94****	*92,327.30****
	1,278.13	0.07	0.24	8,184.17
Finance (Percent Private GDP)	*4536.34****	*0.13****	*1.42****	*72,551.15****
	607.16	0.04	0.13	4,519.66
Manufacturing (Percent Private GDP)	*3,630.98****	*-0.13****	*1.05****	*12,352.75***
	673.05	0.04	0.15	5,061.28
Mining (Percent Private GDP)	*1,504.12***	*-0.29****	*0.74****	*8,546.22*
	736.56	0.04	0.16	5,617.03
Retail (Percent Private GDP)	*-2,881.69***	*-1.21****	*-1.37****	*-277,501.63****
	1,382.98	0.09	0.33	11,266.80
Services (Percent Private GDP)	*3,223.10****	*0.09**	*1.34****	*29,146.21****
	869.76	0.05	0.18	6,323.56
Intercept	*-1962.58***	*1.04****	*-0.57****	*29,934.04****
	816.63	0.05	0.18	6,059.36
Number of Observations	1,100	2,050	2,050	2,050
R^2	0.49	0.50	0.38	0.78

Note: * probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01. Standard errors are provided immediately below the coefficient. Coefficient estimates for state and year are omitted for presentation.

Table 28. FE Analysis of RAC, Corporate Income Tax Rate, University Support, and Research Inputs/Outputs

Variable	Model 1: R&D	Model 2: Employment	Model 3: Patents	Model 4: Private GDP
RAC State (0 = "No", 1 = "Yes")	*-174.88****	*-0.01****	*0.01*	*-389.91*
	-22.90	0.00	-0.01	-260.61
Top Corproate Income Tax	*2.68*	*-0.01****	*0.00*	*-407.77****
	-6.73	0.00	0.00	-76.83
University Support ($)	*0.01***	*0.01****	*-0.01***	*1.18****
	-0.01	0.00	0.00	-0.07
Income Tax (0= "No", 1 = "Yes")	-297.61*	-0.02***	0.08***	1,725.56*
	-158.79	0.00	-0.03	-959.39
Sales Tax Rate (Percent)	52.25**	-0.01***	0.02***	6.78
	-23.37	0.00	-0.01	-187.92
Population (Logged Thousands)	*136.44*	*-0.08****	*0.14****	*-3,391.05****
	-195.25	-0.01	-0.03	-1,191.02
Population Density (Residents per Sq. Mi.)	*3.42****	*0.00*	*0.01**	*29.66****
	-0.66	0.00	0.00	-5.33
Agriculture (Percent Private GDP)	*2,132.15**	*-0.23****	*0.15*	*6,510.41*
	-1,231.95	-0.04	-0.26	-9,171.24
Construction (Percent Private GDP)	*-2,694.34***	*0.07**	*0.53****	*97,850.55****
	-1,107.39	-0.04	-0.24	-8,287.36
Finance (Percent Private GDP)	*607.08*	*0.10****	*-0.04*	*41,654.03****
	-827.07	-0.03	-0.21	-7,323.26
Manufacturing (Percent Private GDP)	*1,639.83***	*0.24****	*0.36**	*16,598.94***
	-764.65	-0.03	-0.21	-7,326.31
Mining (Percent Private GDP)	*156.26*	*0.01*	*0.42***	*-2616.25*
	-746.20	-0.03	-0.21	-7,431.32
Retail (Percent Private GDP)	*3,294.17***	*0.40****	*1.28****	*-83,154.47****
	-1,513.85	-0.07	-0.45	-15,812.65
Services (Percent Private GDP)	*311.32*	*0.19****	*0.24*	*35,177.83****
	-810.95	-0.04	0.22	-7,675.61
Intercept	*-2,415.74*	*1.68****	*-2.21****	*69,756.14****
	-3,049.46	-0.09	-0.54	-18,874.36
Observations	1,100	2,050	2,050	2,050
R^2	0.92	0.93	0.75	0.91

Note: * probability of observing the coefficient is less than 0.10. **probability is less than 0.05. ***probability is less than 0.01. Standard errors are provided immediately below the coefficient. Coefficient estimates for state and year are omitted for presentation.

Table 29. Predicted Value for RAC Compared to Predicted Value for No RAC

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value RAC	Predicted Value No RAC	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	Yes	$885.64	$681.13	-$204.51	-23.09%
Ordinary Least Squares	Private Employment per Capita	Yes	0.63	0.59	-0.04	-5.80%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.41	0.33	-0.08	-19.03%
Ordinary Least Squares	Private GSP per Capita ($)	Yes	$47,190.87	$42,658.81	-$4,532.06	-9.60%
Twoway Fixed Effects	Private R&D per Capita ($)	Yes	$611.04	$785.92	$174.88	28.62%
Twoway Fixed Effects	Private Employment per Capita	Yes	0.65	0.66	0.00	0.58%
Twoway Fixed Effects	Utility Patents per Thousand Residents	No	0.31	0.30	-0.01	-2.62%
Twoway Fixed Effects	Private GSP per Capita ($)	No	$44,897.06	$45,286.97	$389.91	0.87%

Note: Predicted value is calculated using the estimated equations in Tables 26 and 27 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with refundable equal to one compared to refundable equal to zero.

Table 30. Predicted Value for 12 Percent Corporate Rate Compared to 9.8 Percent Corporate Rate

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value 12 Percent Corporate Rate	Predicted Value 9.8 Percent Corporate Rate	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	Yes	$885.64	$920.85	$35.21	3.98%
Ordinary Least Squares	Private Employment per Capita	Yes	0.63	0.63	0.00	0.53%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.41	0.40	-0.01	-2.60%
Ordinary Least Squares	Private GSP per Capita ($)	No	$47,190.87	$47,357.54	$166.67	0.35%
Twoway Fixed Effects	Private R&D per Capita ($)	No	$611.04	$605.14	-$5.90	-0.97%
Twoway Fixed Effects	Private Employment per Capita	Yes	0.65	0.66	0.00	0.63%
Twoway Fixed Effects	Utility Patents per Thousand Residents	No	0.31	0.31	0.00	0.34%
Twoway Fixed Effects	Private GSP per Capita ($)	Yes	$44,897.06	$45,794.15	$897.09	2.00%

Note: Predicted value is calculated using the estimated equations in Tables 26 and 27 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with corporate rate equal to 12 compared to 9.8.

Table 31. Predicted Value for $6,788 State Support per Enrollment Compared to $7,467 per Enrollment

Estimation Method	Dependent Variable	Statistically Significant?	Predicted Value Support per Enrollment at $6,788	Predicted Value Support per Enrollment at $7,467	Change	Percent Change
Ordinary Least Squares	Private R&D per Capita ($)	No	$885.64	$881.69	-$3.95	-0.45%
Ordinary Least Squares	Private Employment per Capita	Yes	0.63	0.63	0.00	0.39%
Ordinary Least Squares	Utility Patents per Thousand Residents	Yes	0.41	0.40	-0.01	-1.59%
Ordinary Least Squares	Private GSP per Capita ($)	Yes	$47,190.87	$47,878.32	$687.45	1.46%
Twoway Fixed Effects	Private R&D per Capita ($)	Yes	$611.04	$620.49	$9.45	1.55%
Twoway Fixed Effects	Private Employment per Capita	Yes	0.65	0.65	0.00	0.31%
Twoway Fixed Effects	Utility Patents per Thousand Residents	Yes	0.31	0.31	0.00	-0.98%
Twoway Fixed Effects	Private GSP per Capita ($)	Yes	$44,897.06	$45,701.10	$804.04	1.79%

Note: Predicted value is calculated using the estimated equations in Tables 26 and 27 by inputting Iowa's observed values in 2015 into the equation and comparing predicted value for Iowa with observed program features compared to the counterfactual, in this case with support equal to $7,467.

Appendix

Appendix 1. Time line of Major Program Changes by Tax Year

Year	Program Changes
1985	The RAC is first available.
1997	The Supplemental RAC is first available as a component of the Enterprise Zone Program.
2000 - 2009	The Alternative Incremental RAC is available.
2005	The Renewable Energy Components RAC is first available, capped at $1 million.
2009	The Supplemental RAC as a component of the High Quality Jobs Program becomes available. The Supplemental RAC is made subject to an annual tax credit award cap for all EDA tax credit incentives. This cap is set at $185 million per fiscal year. The cap on the Renewable Energy Components Research Activities Credit is increased to $2 million Taxpayers making Research Activities Tax Credit claims exceeding $500,000 filed after July 1, 2009 must be reported annually to the Iowa Legislature.
2010	The Alternative Simplified RAC is first available. Calculation of the Supplemental RAC is made conditional on the gross revenues of the eligible business. The EDA tax incentive award cap including the Supplemental RAC is reduced to $120 million.
2012	The EDA tax incentive award cap including the Supplemental RAC is increased to $170 million.
2014	The Enterprise Zone Program is repealed.
2017-2021	The EDA tax incentive award cap including the Supplemental RAC is reduced to $105 million. RAC limited to businesses conducting qualified research in manufacturing, life sciences, software engineering, or the aviation and aerospace industry.
2019	Agriscience is added as a qualifying industry.

Appendix 2. 2020 Iowa Research Activities Credit Form IA 128

Iowa Department of
REVENUE

2020 IA 128
Iowa Research Activities Tax Credit
tax.iowa.gov

Name(s): ______________________ **SSN or FEIN:** ______________________

Industry in which researching business is engaged (see instructions): ______________________

Pass-through entity (if applicable): ______________________

Pass-through FEIN: ______________________ Tax period ending date: ______________________

PART I – Calculation of U.S. Qualified Research Expenses

1. Did the researching business claim the federal research credit for this same tax year?
   Yes ☐...... Continue to Part I, line 2 (if pass-through only, continue to Part II, line 32).
   No ☐...... Taxpayer is not eligible for the Iowa Research Activities Tax Credit. Stop.
2. Certain amounts paid or incurred to energy consortia .... 2. ________
3. Basic research payments to qualified organizations .... 3. ________
4. Qualified organization base period amount .... 4. ________
5. Wages for qualified research services .... 5. ________
6. Cost of supplies used in conducting qualified research .... 6. ________
7. Rental or lease costs of computers used in conducting qualified research .... 7. ________
8. Applicable portion of contract research expenses .... 8. ________
9. Total qualified research expenses. Add lines 5 through 8 .... 9. ________
10. Fixed-base percentage to four decimals, but not more than 16.00% .... 10. ________%
11. Average U.S. annual gross receipts for tax years 2016 through 2019 .... 11. ________
12. Multiply line 11 by the percentage on line 10 .... 12. ________
13. Subtract line 12 from line 9. If zero or less, enter zero .... 13. ________
14. Multiply line 9 by 50% (0.5) .... 14. ________
15. Enter the smaller of line 13 or line 14 .... 15. ________
16. Total allowable U.S. qualified research expenses. Add lines 2 and 15 .... 16. ________

PART II – Calculation of Tax Credit Based on Percentage of Research Occurring within Iowa

17. Basic research payments to qualified organizations in Iowa .... 17. ________
18. Iowa apportioned qualified organization base period amount .... 18. ________
19. Subtract line 18 from line 17. If zero or less, enter zero .... 19. ________
20. Multiply line 19 by 6.5% (0.065) .... 20. ________
21. Wages for qualified research services performed in Iowa .... 21. ________
22. Cost of supplies used in conducting qualified research in Iowa .... 22. ________
23. Rental or lease costs of computers used in conducting qualified research in Iowa .... 23. ________
24. Applicable portion of contract research expenses incurred in Iowa .... 24. ________
25. Total Iowa qualified research expenses. Add lines 21 through 24 .... 25. ________
26. Total U.S. qualified research expenses. Add lines 2 and 9 .... 26. ________
27. Iowa share of research. Divide line 25 by line 26, enter percentage to four decimals (ex. 72.18%) .... 27. ________%
28. Expenses allocable to Iowa. Multiply line 16 by the percentage on line 27 .... 28. ________
29. Multiply line 28 by 6.5% (0.065) .... 29. ________
30. Iowa Research Activities Tax Credit. Add lines 20 and 29.Enter in column K of Part II on the IA 148 Tax Credits Schedule .... 30. ________
31. Supplemental Research Activities Tax Credit. See instructions. Enter in column K of Part II on the IA 148 and include the tax credit certificate number in column J .... 31. ________
32. Pass-through Iowa Research Activities Tax Credit received from partnership, LLC, S corporation, estate, or trust. Enter on Part II and Part IV of the IA 148. .... 32. ________
33. Pass-through Supplemental Research Activities Tax Credit received from partnership, LLC, S corporation, estate, or trust. Enter on Part II and Part IV of the IA 148 and include the tax credit certificate number .... 33. ________

IA 148 Tax Credits Schedule must be completed.

2041128019999

41-128a (09/29/2020)

The IA 128 is used if the taxpayer elects to claim the regular Research Activities Tax Credit. The IA 128S is used only if the taxpayer elects to claim the Alternative Simplified Research Activities Tax Credit. The taxpayer may elect to use this method regardless of the method used in computing the federal research tax credit. The taxpayer is not required to use this method in computing the Research Activities Tax Credit for subsequent years.

Research expenses qualified for the Iowa Research Activities Tax Credit are based on the rules governing the federal research tax credit, see Section 41 of the Internal Revenue Code (IRC). A taxpayer may only claim the Iowa tax credit if the business conducting the research also claims and is allowed the federal research credit for the same taxable year and is engaged in an eligible industry in Iowa.

The Iowa credit equals 6.5% of increased research expenses plus 6.5% of increased basic research expenses in Iowa. Any tax credit in excess of tax liability can be refunded or credited to tax liability for the following year.

Industry in Which the Researching Business is Engaged

You must report the industry in which the business conducting the research is engaged. A taxpayer may only claim the Iowa tax credit if the business conducting the qualified research is engaged in manufacturing, life sciences, agriscience, software engineering, or the aviation and aerospace industry. For definitions of these industries, please see Iowa Admin. Code r. 701—42.11.

Ineligible businesses include, but are not limited to, those engaged in agricultural production, an agricultural cooperative, a finance or investment company, a retailer, a wholesaler, a publisher, a transportation company, a real estate company, a collection agency, an accountant, an architect, a contractor, a subcontractor, or a builder, or a business that engages in commercial and residential repair and installation including but not limited to heating or cooling installation and repair, plumbing and pipe fitting, security system installation, and electrical installation and repair.

Innovative Renewable Energy Generation

Under the High Quality Jobs Program, taxpayers may be awarded a Research Activities Tax Credit for the development and deployment costs of innovative renewable energy generation components manufactured or assembled in Iowa. This cannot include components with more than 200 megawatts of installed effective nameplate capacity. These costs are not eligible for the federal research tax credit. A separate IA 128 must be completed to account for these costs, which can be included on lines 5 and 21 of the separate form. The amount of the additional tax credit relating to these costs is not eligible for the Supplemental Research Activities Tax Credit.

Example: An eligible business with gross receipts of $20 million or less earns an Iowa Research Activities Tax Credit of $50,000, excluding any costs relating to innovative renewable energy generation components. The business is allowed a supplemental credit of $76,923, which would result in an Iowa tax credit of $126,923. The Iowa tax credit relating to innovative renewable energy generation components is $25,000. This can be added to the regular and supplemental tax credit, resulting in a total Iowa Research Activities Tax Credit of $151,923.

Trades or Businesses under Common Control

For a group of trades or businesses under common control (whether or not incorporated), the Iowa Research Activities Tax Credit is calculated as if all the organizations are one trade or business. The tax credit calculated for the group must be shared among the members on the basis of each member's proportionate contribution to the increase in research expenses.

Adjustments for Certain Acquisitions and Dispositions

If a major portion of a trade or business is acquired or disposed of, adjustments must be made to research expenses for the period before or after the acquisition or disposition.

Short Tax Year

For any short tax year, qualified research expenses are annualized.

Pass-Through Entities - Apportionment of Tax Credit

The tax credit calculated on lines 2 through 30 by a partnership, LLC, S corporation, estate, or trust is apportioned to the members. The pass through entity must file the IA 128 and the Federal 6765 with its return. Report the tax credit for each member on Schedule K-1 or on an attachment to Schedule K-1. Instruct the members to complete line 1, report the apportioned tax credit on line 32 of from IA 128, and include it with their tax returns.

If the taxpayer earns a tax credit by conducting research and is a member of a business that has passed through a tax credit to the taxpayer, calculate the tax credit on IA 128, lines 2 through 30. Also enter the pass-through tax credit on line 32. Report each separately on the IA 148 Tax Credits Schedule.

Supplemental Research Activities Tax Credit

Businesses with tax incentive contracts under the High Quality Jobs Program or the Enterprise Zone Program can be awarded a Supplemental Research Activities Tax Credit by the Iowa Economic Development Authority (IEDA). The total eligible supplemental tax credit claim is provided in the contract along with the tax credit certificate number. The maximum supplemental tax credit cannot exceed 10% of the sum of lines 19 and 28 for businesses with annual gross receipts of $20 million or less (as reported on line 11). The maximum supplemental tax credit cannot exceed 3% of the sum of lines 19 and 28 for businesses with annual gross receipts exceeding $20 million.

If the Supplemental Research Activities Tax Credit is earned by a pass-through entity, report the supplemental tax credit separately on Schedule K-1 and provide the tax credit certificate number. Instruct members to report their tax credit on line 33 of the IA 128 and include it with their tax returns.

2020 IA 128 Line Instructions

Provide your name, Social Security Number (SSN) or Federal Employer Identification Number (FEIN), tax period ending date, and industry.

Line 1: Claim to federal research credit

Iowa law requires that the researching business must claim and be allowed the Federal Credit for Increasing Research Activities under IRC section 41 for the same taxable year in order for the business to be eligible to claim the Iowa credit. Even if this is true, the researching business must also meet the industry requirements under Iowa law noted above (see Industry in Which Researching Business is Engaged).

Lines 2 through 8: U.S. qualified research expenses

Enter amounts from the Federal Credit for Increasing Research Activities, federal form 6765. Lines 2-4 are the same as federal lines 1-3; lines 5-8 equal federal lines 5-8.

Line 10: Fixed-base percentage

Use the same fixed-base percentage calculated for the federal research tax credit, rounding to four decimal places (1/100th of 1%), not to exceed 16.00%.

Line 11: U.S. annual gross receipts

Enter the average U.S. annual gross receipts for the four tax years preceding the tax year for which the tax credit is being determined. For any short year you may be required to annualize gross receipts. See IRC sections 41(c)(1)(B) and 41(f)(4) and Treas. Reg. § 1.41-3 for details. Use this value to determine the calculation of the Supplemental Research Activities Tax Credit, if applicable.

Line 17: Iowa basic research payments

Corporations other than S corporations, personal holding companies, service organizations, LLCs, and partnerships, enter cash payments, pursuant to a written contract, made to a qualified university or scientific research organization in Iowa for basic research. See IRC section 41(e) for details.

Line 18: Iowa base period amount

Enter the qualified organization base period amount based on minimum basic research amounts for the preceding three years, see IRC section 41(e) for details. For purposes of apportionment, multiply the amount on line 4 by the quotient of amount on line 17 divided by the amount on line 3 [i.e. line 4 x (line 17 / line 3)].

Line 21: Iowa expenses on research wages

Enter any wages paid to an employee for qualified research services performed in Iowa.

Line 22: Iowa expenses on research supplies

Enter the amounts paid or incurred for supplies used to conduct qualified research in Iowa.

Line 23: Iowa research expenses on computers

Enter the amount paid or incurred to another person for the right to use computers to conduct qualified research in Iowa. This entry must be reduced by any amount received or accrued from any other person for the right to use substantially identical personal property.

Line 24: Iowa contract research expenses

Include 65% of qualified research performed on your behalf in Iowa. Use 75% for payments made to a qualified research consortium and 100% for payments made for qualified energy research performed by an eligible small business, university, or federal laboratory. Include payments to those same entities to the extent they are included as basic research payments on line 17, not to exceed the base period amount on line 18, subject to the 65% or 75% limitation.

Line 30: Research Activities Tax Credit

Individuals and C corporations must enter this amount on the IA 148 Tax Credits Schedule in column K of Part II; use tax credit code 58 in column I and leave column J blank.

Line 31: Supplemental Research Activities Tax Credit

Individuals and C corporations must enter this amount on the IA 148 Tax Credits Schedule in column K of Part II; use tax credit code 59 in column I and report in column J the tax credit certificate number from the tax credit certificate issued by IEDA.

Line 32: Pass-through Research Activities Tax Credit

If the taxpayer has received any pass-through Research Activities Tax Credit from a partnership, LLC, S corporation, estate, or trust, indicate that amount on this line. Also enter this amount in column K of Part II on the IA 148 Tax Credits Schedule; use tax credit code 58 in column I and leave column J blank. Provide the pass-through name in column M and FEIN in column N of Part IV on the IA 148 as well as on the top of this form. File a separate IA 128 for each pass-through Research Activities Tax Credit received. Also list the claims separately on Part II of the IA 148 Tax Credits Schedule, providing each pass-through name and FEIN in Part IV.

Line 33: Pass-through Supplemental Research Activities Tax Credit

If the taxpayer has received any pass-through Supplemental Research Activities Credit from a partnership, LLC, S corporation, estate, or trust, indicate that amount on this line. Also enter this amount in column K of Part II on the IA 148 Tax Credits Schedule; use tax credit code 59 in column I. Include the tax credit certificate number reported on Schedule K-1 in column J, and provide the pass-through name in column M and FEIN in column N of Part IV on the IA 148. File a separate IA 128 for each pass-through Supplemental Research Activities Tax Credit received. Also list the claims separately on Part II of the IA 148 Tax Credits Schedule, providing each pass-through name and FEIN in Part IV.

Include this form, the Federal 6765, and the IA 148 with your IA 1040, IA 1041, or IA 1120.

Include this form and the Federal 6765 with your IA 1065 or IA 1120S.

Appendix 3. 2021 Iowa Research Activities Credit Form IA 128S

Iowa Department of REVENUE

2020 IA 128S

Iowa Alternative Simplified Research Activities Tax Credit

tax.iowa.gov

Name(s): ______________________ SSN or FEIN: ______________

Industry in which researching business is engaged (see instructions): ______________

Pass-through entity (if applicable): ______________

Pass-through FEIN: ______________ Tax period ending date: ______________

PART I - Background Information – U.S. Qualified Research Expenses

1. Did the researching business claim the federal research credit for this same tax year?
   Yes ☐........ Continue to Part I, line 2 (if pass-through only, continue to Part II, line 25).
   No ☐........ Taxpayer is not eligible for the Iowa Research Activities Tax Credit. Stop.
2. Certain amounts paid or incurred to energy consortia .... 2. ______________
3. Basic research payments to qualified organizations .... 3. ______________
4. Qualified organization base period amount .... 4. ______________
5. Wages for qualified research services .... 5. ______________
6. Cost of supplies used in conducting qualified research .... 6. ______________
7. Rental or lease costs of computers used in conducting qualified research .... 7. ______________
8. Applicable portion of contract research expenses .... 8. ______________
9. Average U.S. annual gross receipts for tax years 2016 through 2019 .... 9. ______________

PART II – Calculation of Tax Credit Based on Iowa Qualified Research Expenses

10. Basic research payments to qualified organizations in Iowa .... 10. ______________
11. Iowa apportioned qualified organization base period amount .... 11. ______________
12. Subtract line 11 from line 10. If zero or less, enter zero .... 12. ______________
13. Multiply line 12 by 6.5% (0.065) .... 13. ______________
14. Wages for qualified research services performed in Iowa .... 14. ______________
15. Cost of supplies used in conducting qualified research in Iowa .... 15. ______________
16. Rental or lease costs of computers used in conducting qualified research in Iowa ...... 16. ______________
17. Applicable portion of contract research expenses incurred in Iowa .... 17. ______________
18. Total Iowa qualified research expenses. Add lines 14 through 17 .... 18. ______________
19. Total qualified research expenses in Iowa for the prior three years. If you had no qualified research expenses in Iowa during any one of those years, enter zero and skip lines 20 and 21 .... 19. ______________
20. Divide line 19 by six (6.0) .... 20. ______________
21. Subtract line 20 from line 18. If zero or less, enter zero .... 21. ______________
22. Multiply line 21 by 4.55% (0.0455). If you skipped lines 20 and 21, multiply line 18 by 1.95% (0.0195) .... 22. ______________
23. Iowa Alternative Simplified Research Activities Tax Credit. Add lines 13 and 22. Enter in column K of Part II on the IA 148 Tax Credits Schedule .... 23. ______________
24. Supplemental Research Activities Tax Credit. See instructions. Enter in column K of Part II on the IA 148 and include the tax credit certificate number in column J .... 24. ______________
25. Pass-through Alternative Simplified Research Activities Tax Credit received from partnership, LLC, S corporation, estate, or trust. Enter on Part II and Part IV of the IA 148 Tax Credits Schedule .... 25. ______________
26. Pass-through Supplemental Research Activities Tax Credit received from partnership, LLC, S corporation, estate, or trust. Enter on Part II and Part IV of the IA 148 and include the tax credit certificate number .... 26. ______________

IA 148 Tax Credits Schedule must be completed.

2041124019999

41-124a (09/29/2020)

The IA 128S is used only if the taxpayer elects to claim the Alternative Simplified Research Activities Tax Credit. The IA 128 should be used if the regular Research Activities Tax Credit is claimed. The taxpayer may elect to use this alternative method regardless of the method used in computing the federal research credit. The taxpayer is not required to use this alternative method in computing the Research Activities Tax Credit for subsequent years.

Research expenses qualified for the Iowa Research Activities Tax Credit are based on the rules governing the federal research tax credit, see Section 41 of the Internal Revenue Code (IRC). A taxpayer may only claim the Iowa tax credit if the business conducting the research also claims and is allowed the federal research credit for the same taxable year and is engaged in an eligible industry in Iowa.

The Iowa credit equals 4.55% of increased research expenses plus 6.5% of increased basic research expenses in Iowa. Any tax credit in excess of tax liability can be refunded or credited to tax liability for the following year.

Industry in Which the Researching Business is Engaged

You must report the industry in which the business conducting the research is engaged. A taxpayer may only claim the Iowa tax credit if the business conducting the qualified research is engaged in manufacturing, life sciences, agriscience, software engineering, or the aviation and aerospace industry. For definitions of these industries, please see Iowa Admin. Code r. 701—42.11.

Ineligible businesses include, but are not limited to, those engaged in agricultural production, an agricultural cooperative, a finance or investment company, a retailer, a wholesaler, a publisher, a transportation company, a real estate company, a collection agency, an accountant, an architect, a contractor, a subcontractor, or a builder, or a business that engages in commercial and residential repair and installation including but not limited to heating or cooling installation and repair, plumbing and pipe fitting, security system installation, and electrical installation and repair.

Innovative Renewable Energy Generation

Under the High Quality Jobs Program, taxpayers may be awarded a Research Activities Tax Credit for the development and deployment costs of innovative renewable energy generation components manufactured or assembled in Iowa. This cannot include components with more than 200 megawatts of installed effective nameplate capacity. These costs are not eligible for the federal research tax credit. A separate IA 128S must be completed to account for these costs, which can be included on line 14 of the separate form. The amount of the additional tax credit relating to these costs is not eligible for the Supplemental Alternative Simplified Research Activities Tax Credit.

Example: An eligible business with annual gross receipts of $20 million or less earns an Iowa Alternative Simplified Research Activities Tax Credit of $50,000, excluding any costs relating to innovative renewable energy generation components. The business is allowed a supplemental tax credit of $76,923, which would result in an Iowa tax credit of $126,923. The Iowa tax credit related to innovative renewable energy generation components is $25,000. This can be added to the regular and supplemental tax credit, resulting in a total Iowa Alternative Simplified Research Activities Tax Credit of $151,923.

Trades or Businesses under Common Control

For a group of trades or businesses under common control (whether or not incorporated), the Iowa Alternative Simplified Research Activities Tax Credit is calculated as if all the organizations are one trade or business. The tax credit calculated for the group must be shared among the members of the group on the basis of each member's proportionate contribution to the increase in research expenses.

Adjustments for Certain Acquisitions and Dispositions

If a major portion of a trade or business is acquired or disposed of, adjustments must be made to research expenses for the period before or after the acquisition or disposition.

Short Tax Year

For any short tax year, qualified research expenses are annualized.

Pass-Through Entities - Apportionment of Tax Credit

The tax credit calculated on lines 2 through 23 by a partnership, LLC, S corporation, estate, or trust is apportioned to the members. The pass-through entity must file the IA 128S and the Federal 6765 with its return. Report the tax credit for each member on Schedule K-1 or on an attachment to Schedule K-1. Instruct the members to complete line 1, report the apportioned tax credit on line 32 of from IA 128, and include it with their tax returns. If the taxpayer earns a tax credit by conducting research and is a member of a business that has passed-through a tax credit to the taxpayer, calculate the tax credit on the IA 128S, lines 2 through 23. Also enter the pass-through tax credit on line 25. Report each separately on the IA 148 Tax Credits Schedule.

Supplemental Research Activities Tax Credit

Businesses with tax incentive contracts under the High Quality Jobs Program or the Enterprise Zone Program can be awarded a Supplemental Research Activities Tax Credit by the Iowa Economic Development Authority (IEDA). The maximum eligible supplemental tax credit is provided in the contract along with the tax credit certificate number. The maximum supplemental tax credit is calculated by multiplying line 21 by 7% or line 18 by 3% for businesses with annual gross receipts of $20 million or less (as reported on line 9) plus 10% of line 12. For businesses with annual gross receipts exceeding $20 million, the maximum supplemental tax credit is calculated by multiplying line 21 by 2.1% or line 18 by 0.9%, plus 3% of line 12.

If the Supplemental Research Activities Tax Credit is earned by a pass-through entity, report the supplemental tax credit separately on Schedule K-1, including the tax credit certificate number. Instruct members to report the apportioned supplemental tax credit on line 26 of the IA 128S and include it with their tax returns.

2020 IA 128S Line Instructions

Provide your name, Social Security Number (SSN) or Federal Employer Identification Number (FEIN), tax period ending date, and industry.

Line 1: Claim to federal research credit

Iowa law requires that the researching business must claim and be allowed the Federal Credit for Increasing Research Activities under IRC section 41 for the same taxable year in order for the business to be eligible to claim the Iowa credit. Even if this is true, the researching business must also meet the industry requirements under Iowa law noted above (see Industry in Which Researching Business is Engaged).

Lines 2 through 8: U.S. qualified research expenses

Enter amounts from the Federal Credit for Increasing Research Activities, federal form 6765. Lines 2-4 are the same as federal lines 1-3; lines 5-8 equal federal lines 5-8.

Line 9: Average U.S. annual gross receipts

Enter the average U.S. annual gross receipts for the four tax years preceding the tax year for which the tax credit is being determined. For any short year you may be required to annualize gross receipts. See IRC sections 41(c)(1)(B) and 41(f)(4) and Treas. Reg. § 1.41-3 for details. Use this value to determine the calculation of the Supplemental Research Activities Tax Credit if applicable.

Line 10: Iowa basic research payments

Corporations other than S corporations, personal holding companies, service organizations, LLCs, and partnerships, enter cash payments, pursuant to a written contract, made to a qualified university or scientific research organization in Iowa for basic research. See IRC section 41(e) for details.

Line 11: Iowa base period amount

Enter the qualified organization base period amount based on minimum basic research amounts for the preceding three years, see IRC section 41(e) for details. For purposes of apportionment, multiply the amount on line 4 by the quotient of the amount on line 10 divided by the amount on line 3 [i.e. line 4 x (line 10 / line 3)].

Line 14: Iowa expenses on research wages

Enter any wages paid to an employee for qualified research services performed in Iowa.

Line 15: Iowa expenses on research supplies

Enter the amounts paid or incurred for supplies used to conduct qualified research in Iowa.

Line 16: Iowa research expenses on computers

Enter the amount paid or incurred to another person for the right to use computers to conduct qualified research in Iowa. This entry must be reduced by any amount received or accrued from any other person for the right to use substantially identical personal property.

Line 17: Iowa contract research expenses

Include 65% of qualified research performed on your behalf in Iowa. Use 75% for payments made to a qualified research consortium and 100% for payments made for qualified energy research performed by an eligible small business, university, or federal laboratory. Include payments to those same entities to the extent they are included as basic research payments on line 10, not to exceed the base period amount on line 11, subject to the 65% or 75% limitation.

Line 19: Prior research

Enter the total qualified research expenses in Iowa for the three years before the year in which the tax credit is being determined. If you had no qualified research expenses in Iowa during any one of the prior three years, enter zero. For example, if you had qualified research expenses in Iowa during 2017 and 2019 but did not do research in Iowa during tax year 2018, enter zero. For any short year, see Treas. Reg. 1.41-9(c)(3)(i).

Line 23: Alternative Simplified Research Activities Tax Credit

Individuals and C corporations must enter this amount in column K of Part II on the IA 148 Tax Credits Schedule; use tax credit code 58 in column I and leave column J blank.

Line 24: Supplemental Research Activities Tax Credit

Individuals and C corporations must enter this amount in column K of Part II on the IA 148; use tax credit code 59 in column I and report in column J the tax credit certificate number from the tax credit certificate issued by IEDA.

Line 25: **Pass-through Alternative Simplified Research Activities Tax Credit**

If the taxpayer has received any pass-through Alternative Simplified Research Activities Credit from a partnership, LLC, S corporation, estate, or trust, indicate that amount on this line. Also enter this amount in column K of Part II on the IA 148 Tax Credits Schedule; use tax credit code 58 in column I and leave column J blank. Provide the pass-through name in column M and FEIN in column N of Part IV on the IA 148 as well as on the top of this form. File a separate IA 128S for each pass-through Alternative Simplified Research Activities Tax Credit received. Also list the claims separately on Part II of the IA 148, providing each pass-through name and FEIN in Part IV.

Line 26: Pass-through Supplemental Research Activities Tax Credit

If the taxpayer has received any pass-through Supplemental Alternative Simplified Research Activities Credit from a partnership, LLC, S corporation, estate, or trust, indicate that amount on this line. Also enter this amount in column K of Part II on the IA 148; use tax credit code 59 in column I. Include the tax credit certificate number reported on Schedule K-1 in column J and provide the pass-through name in column M and FEIN in column N of Part IV on the IA 148. File a separate IA 128S for each pass-through Supplemental Research Activities Tax Credit received. Also list the claims separately on Part II of the IA 148, providing each pass-through name and FEIN in Part IV.

Include this form, the Federal 6765 and the IA 148 with your IA 1040, IA 1041, or IA 1120.
Include this form and the Federal 6765 with your IA 1065 or IA 1120S.