Appendix M: Statistical analysis and economic impact modeling

Weldon Cooper Center conducted several statistical and economic impact analyses for this review.

Synthetic control method analysis

Weldon Cooper Center for Public Service staff conducted a synthetic control method analysis of Virginia's customized incentive grants for the semiconductor industry. The method is a quasi-experimental case study method developed by Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). It compares a treatment unit (Virginia) affected by a particular policy (large semiconductor manufacturing grants) to a synthetic control constructed from weighted units (other states) that did not issue such large financial assistance packages for semiconductor attraction or expansion over the 2000–2017 period. The synthetic group is constructed by selecting weights that minimize the mean squared prediction error (MSPE) during the pre-treatment period for predictor variables. The synthetic control group represents the counterfactual of what would have happened to the treated unit without the incentive.

This analysis examined the change in semiconductor and related device manufacturing after the signing of Qimonda and Micron Phase II Memoranda of Understanding in 2005 (Micron) and 2006 (Qimonda). Seven states made up the pool of potential control group states. These states had not made similarly sized awards (i.e., $10 million or more in total value to an individual firm) to semiconductor manufacturers over the 2001–2017 period as found in the Good Jobs First Megadeal and SubsidyTracker databases. According to this source, eight other states did offer such financial assistance, including Arizona, Maine, New Mexico, New York, North Carolina, Oregon, Texas, and Utah. During this period California offered a large grant to a semiconductor design firm but not to any firm with a fabrication facility. Thus, it was eligible for the control pool. Three states were not included in the study population because of missing data on one of the selection variables: Alaska, Hawaii, and Wyoming.

Statistical analysis was conducted to develop the synthetic control group. The analysis used employment in the semiconductor and related device manufacturing industry as the outcome variable. The predictor variables included:

- the average electricity rate charged to state industrial consumers (ELECTRIC_RATE);
- the percentage of the population 25 years and older with a college degree (PCOLLEGE); and
- the average wage (AVEWAGE) in the computer and electronic product manufacturing industry.

These predictor variables are thought to have some influence on semiconductor location and expansion. Two lagged variables for semiconductor and related device manufacturing employment (2001 and 2003) were also included to improve control group fit. The data was input into the Stata analysis software to perform the analysis using the "synth_runner" procedure (Galiani and Quistorff 2017), which is a data-driven procedure for constructing a synthetic control group and conducting diagnostic tests. The pre-treatment period, over which predicator variables are averaged, was 2001–2004. The treatment period, which represents the period when the incentive was in effect, was 2005–2017.

The synth_runner procedure selected a weighted average of California (0.01), Colorado (0.493), Nebraska (0.35), and Pennsylvania (0.146) as the synthetic control group (Table M-1). This group was constructed by selecting weights that minimize the mean squared prediction errors of the predictor variables during the pre-treatment period. The lower the mean squared prediction errors, the closer the "fit" of the synthetic control group to the treated unit (Virginia). The suitability of the synthetic group was evaluated by several diagnostics. Synthetic control predictor values for the pre-treatment period are closer to Virginia values than all untreated states as the method ensures (Table M-2).

TABLE M-1
Four out of 42 states that did not offer large semiconductor incentives were selected for synthetic control group

Control state	Weights for synthetic control
California	0.01
Colorado	0.493
Nebraska	0.35
Pennsylvania	0.146

SOURCE: Weldon Cooper Center.
NOTE: Weight reflects the proportion of the control group that is represented by that state. Thirty-eight of the states without incentives were excluded because they did not improve the fit of the control group or lacked data for one of the selection variables.

TABLE M-2
Predictor variables of synthetic control are closer to Virginia values than all untreated states prior to the semiconductor manufacturing performance grants

Predictor variable	Virginia	Synthetic control	All untreated states
ELECTRIC_RATE	4.20	4.72	5.29
COLLED	31.98	29.41	25.47
AVGWAGE	$56,292	$58,577	$52,964
EMP(2001)	5,311	5,282	4,129
EMP(2003)	3,303	3,280	3,084

SOURCE: Weldon Cooper Center analysis of semiconductor manufacturing performance grants..

Informal statistical inference occurs by conducting "placebo" comparisons and MSPE tests. In the former, the units eligible for the synthetic control are regarded as treatment units and synthetic controls constructed. The paths of the differences between the eligible control units and their corresponding synthetic controls are compared with the differences between treatment unit and its synthetic control. If the latter is an outlier during the post-treatment period, this provides evidence that the difference is causal. Placebo test results (not shown) indicated that employment differences were not statistically significant for the pre-test years (2001–2004). They were statistically significant for the initial post-test years 2005–2008 but not thereafter. Secondly, MSPE ratios of post-treatment period to pre-treatment period are calculated. A relatively high ratio for the treatment unit compared to the eligible control units provides another informal test of causal relationship. Virginia had a higher ratio (3.51) compared with its control group (California 0.80; Colorado 2.15, Nebraska 1.72, and Pennsylvania 1.13).

Regression analyses of manufacturing single sales apportionment on employment

The effect of electing to use single sales apportionment on manufacturing employment was examined using information from corporate tax records and Virginia Employment Commission ES202 employment data. The individual units of analysis were firms, with company employment data aggregated to the company level using Federal Employer Identification Numbers (FEIN). Single sales factor electors were compared to other multistate manufacturing companies. The dependent variable in the analysis was employment change over the 2013–17 period (*Empchange13_17*). Firms that elected single sales factor apportionment (*SSF_Elect*) during the first available tax year (2014) were used as treated firms. Other firms that elected in tax year 2015 and tax year 2016 were removed from the sample. Several other independent variables that could potentially explain growth during the period that could be easily constructed from the VEC employment data were also used:

- firm size in the base year (*Employment2013*),
- a dummy variable indicating whether the firm manufactured durable goods (i.e., NAICS codes 321XXX, 327XXX, and 33XXXX) (*Durable_Industry*), and
- prior employment growth (*Empchange11_13*).

A linear regression using ordinary least squares with robust errors indicated that single sales factor election is associated with more employment creation over the period 2013–17 (Table M-3).

TABLE M-3
Linear regression of employment change, 2013–17

	Coef.	Std. Err	z	P>|z|
Employment2013	-0.07231	0.03238	-2.23	0.026
Durable_Industry	-13.36419	5.27253	-2.53	0.012
Empchange11_13	0.12723	0.08684	1.47	0.144
SSF_Elect	26.67423	14.75260	1.81	0.071
Constant	13.56631	4.91109	2.76	0.006
Number of observations	468	F(4,463)	2.58	
R-squared	0.11	Prob>F	0.037	

Complicating assessment of the role of single sale factor election in employment growth is the fact that treatment is not random. Firms select themselves to receive the incentive based on their likelihood of financially benefitting from the policy. Since firms maintain eligibility for the tax incentive during a three-year period by keeping employment above 90 percent of base year employment, firms that are growing or anticipating growth are more likely to elect to use the incentive than firms that are contracting. Second, firms that have tax liability during the election year are more likely to make the election than those that do not. Most importantly, firms that have significant manufacturing operations in the state as indicated by payroll and property value but have proportionally lower sales in the state will realize greater savings from choosing single sales factor apportionment over the standard double sales factor. This variable (*Factor*) is measured as the sum of the proportion of the firm's property factor in Virginia and the proportion of the firm's payroll factor in Virginia divided by two minus the proportion of the sales factor in Virginia. Firms are more likely to benefit from single sales factor apportionment over the standard double weighted sales factor as *Factor* increases in size. A binary outcome model to describe single sales election (*SSF_Elect*) using probit regression with robust standard errors was conducted using these three explanatory variables:

- prior employment growth (*Empchange11_13*),
- a dummy variable indicating whether the firm had tax liability or not (*Tax_liability*), and
- the manufacturing single sales factor apportionment benefit measure (*Factor*).

Results indicate that the manufacturing single sales factor apportionment benefit measure is positively associated with single sales factor apportionment election as expected (Table M-4). Previous employment change and tax liability also have the expected positive signs but fall slightly short of statistical significance at the α=.10 level.

TABLE M-4
Probit regression of manufacturing single sales apportionment election

	Coef.	Std. Err	z	P>|z|
Factor	0.45232	0.20192	2.24	0.025
Empchange11_13	0.00204	0.00135	1.51	0.131
Tax_Liability	0.45275	0.28111	1.61	0.107
Constant	-2.33789	0.24802	-9.43	0.000
Number of observations	468	Wald chi2(3)	9.61	
Pseudo R2	0.07	Prob>chi2	0.02	

A linear regression with endogenous treatment was conducted to account for the self-selection using the Stata *etregress* procedure with treatment effect. Results (Table M-5) largely conform to those of the individual linear and probit regressions. Results indicate that single sales election is positively and statistically significantly associated with employment change for the 2014 taxpayer cohort.

TABLE M-5
Linear regression of employment change with endogenous single sales factor treatment

	Coef.	Std. Err	z	P>|z|
Empchange13_17				
Employment2013	-0.07250	0.03233	-2.24	0.025
Durable_Industry	-13.38650	5.24237	-2.55	0.011
Empchange11_13	0.12265	0.08422	1.46	0.015
SSF_Elect	43.11397	17.95646	2.40	0.016

	Coef.	Std. Err	z	P>|z|
Constant	13.12585	4.78121	2.75	0.006
SSF_Elect				
Factor	0.44066	0.20085	2.19	0.028
Empchange11_13	0.00193	0.00133	1.45	0.147
Tax_Liability	0.49338	0.29326	1.68	0.092
Constant	-2.36053	0.2526033	-9.34	0.000
Number of observations	468	Wald chi2(4)	11.81	
Log pseudolikelihood	-2575.74	Prob>chi2	0.019	

Economic impact modeling

Weldon Cooper Center staff conducted economic impact analyses of Virginia economic incentives using REMI PI+ (Policy Insight Plus) software. REMI PI+ is a dynamic, multisector regional economic simulation model used for economic forecasting and measuring the impact of public policy changes on local economies. The model combines different contemporary regional economic modeling methods, such as input-output analysis, econometric forecasting, and computable general equilibrium to characterize the mechanics and path of a regional economy. The model has been extensively peer-reviewed and is widely used by state agencies around the country to model economic and tax revenue impacts of economic development incentive programs, including economic development incentives. The model used for this analysis was customized for the Virginia and includes 70 industry sectors. Outcome variables examined include total employment, state GDP, and personal income. In addition, a state tax revenue impact analysis was conducted based on a methodology described further below.

The modeling of each program was conducted differently depending on the type of economic stimulus provided by the program. Table M-6 describes the REMI modeling inputs by program using information on REMI modeling blocks and policy variables. Two basic approaches were used. When the only information for the program available was the effect of the program on firm costs, program cost savings (state revenue impacts) were modeled as reductions in firm production or capital costs for the industries that were affected. Capital cost reductions were modeled when the programs principally reduced the costs of facilities and equipment. Production cost reductions were generally modeled when the programs reduced costs for labor and other inputs. For example, the biodiesel and green diesel fuel producers credit was modeled as reducing production costs for firms that are classified as Chemical Manufacturers. Biofuel refiners are included in the NAICS industry "All Other Basic Organic Chemical Manufacturing," (i.e., NAICS code 325199) which characterizes firms that convert organic materials into biodiesel fuels among other types of manufacturers.

When information on program employment and capital investment impacts were available from program documents and employment records, firm employment increases and capital investment expenditures were modeled. However, not all of the job creation or capital investment was attributed to the incentive. Instead, the portion that could reasonably be attributed to the incentive based on its share of additional firm operational costs was estimated using a procedure described below. For the Micron semiconductor grant, this portion is assumed to be 8–21 percent, for the Qimonda grant 6–10 percent, for the data centers 90 percent, and for manufacturing single sales factor apportionment 15 percent.

TABLE M-6
REMI policy variables and modeling description by incentive

Name of incentives	REMI industry	REMI model policy variables	Modeling description
Semiconductor Manufacturers Exemption	REMI industry "computer and electronic product manufacturing."	Compensation and Prices->Production Costs->Capital Costs	Model economic impact based on reduced capital cost equal to tax credit or estimated exemption tax revenue impact. Assign REMI industry based on industry(ies) affected or other sources
Recyclable Materials Processing Equipment Tax Credit	Distributed to REMI industries based on corporate tax credit use by industry: chemical manufacturing (36%), primary metal manufacturing (29%), wholesale trade (16%), paper manufacturing (6%), and various other industries (12%).		
Pollution Control Equipment & Facilities Exemption	Distributed to REMI industries based on Weldon Cooper Center survey results: REMI industries "construction" 82%, "utilities" 8%, "machinery manufacturing" (6%), and various other REMI industries (4%).		
Semiconductor Wafers Exemption	REMI industry "computer and electronic product manufacturing."	Compensation and Prices->Production Costs->Production Costs	Model economic impact estimate based on reduced production cost. Assign REMI industry based on industry(ies) affected.
Biodiesel and Green Diesel Fuels Producers Tax Credit	REMI industry "chemical manufacturing"		
Green Job Creation Tax Credit	REMI industry "construction"		

Name of incentives	REMI industry	REMI model policy variables	Modeling description
Data Centers Exemption	REMI industry "data processing, hosting, and related services; Other information services" and 43 "Telecommunications"	(1) Labor and Capital Demand>-Employment>-Firm >-Industry (Exogenous Production, Nullify Investment); (2) Output and Demand>-Industry Sales (Exogenous Production)>-Power and Communication Structures; (3) Output and Demand>-Industry Sales (Exogenous Production)>-Wholesale Trade	Model economic impact estimate based on 90% "but for" assumption. Employment assigned to industry. Tangible personal property capital investment assigned to wholesale trade sales using margin of 28.7%. Real property investment assigned to industry sales..
Semiconductor Custom Grant (Micron)--Semiconductor Memory or Logic Wafer Manufacturing Performance Grant	REMI industry "computer and electronic product manufacturing."	(1) Labor and Capital Demand>-Employment>-Firm >-Industry (Exogenous Production, Nullify Investment); (3) Output and Demand>-Real Disposable Income>-Compensation (Adjust compensation by difference from industry average compensation), (3) Output and Demand>-Industry Sales (Exogenous Production)>-Manufacturing Structures; (4) Output and Demand>-Industry Sales (Exogenous Production)>-Wholesale Trade	Model economic impact estimate based on 8%-21% "but for" assumption for Micron and 6%-10% for Qimonda. Employment assigned to industry. Tangible personal property capital investment assigned to wholesale trade sales using margin of 18.3% Real property investment assigned to industry sales.
Semiconductor Custom Grant (Qimonda)--Semiconductor Memory or Logic Wafer Manufacturing Performance Grant			

Name of incentives	REMI industry	REMI model policy variables	Modeling description
Manufacturing Single Sales Factor Apportionment	REMI industries for 2013 cohort: nonmetallic mineral product manufacturing, fabricated metal product manufacturing, machinery manufacturing, miscellaneous manufacturing, food manufacturing, and plastics and rubber products manufacturing	(1) Labor and Capital Demand>-Employment>-Firm >-Industry (Competes locally)	Model economic impact estimate based on 15% "but for" assumption. Employment assigned to industry.

SOURCE: Weldon Cooper Center.
NOTE: Data processing, hosting, and related services is the REMI sector for Internet publishing and broadcasting; ISPs, search portals, and data processing; other information services.

Data centers employment was modeled as equally split between the telecommunications sector and the internet publishing and broadcasting; ISPs, search portals, and data processing; other information services sectors. The employment and capital investment figures were estimated using information from VEDP MOU data. For capital investment, it was assumed that 22.3 percent was spent on building and construction and the other 77.7 percent was spent on equipment eligible for the sales and use tax exemption based on the expenditure pattern of a standard data center (Day and Pham 2017). These expenditures are represented as sales to the construction and wholesale trade sectors (wholesale margins only for the latter). Full-build out of data center employment and investment was assumed to occur over a three-year period. Also, allowance is made for an equipment refresh cycle every five years, which is modeled as generating sales for the wholesale trade sector (again, only wholesale margin spending occurs in the state).

For each economic impact analysis, the opportunity cost of state funds was accounted for by raising personal income taxes. Personal income taxes are the largest source of tax revenue for the general fund, and thus seemed appropriate as a source for offsetting the cost of the incentive programs.

REMI PI+ discontinued tax revenue estimation as part of its base package beginning with the 2.0 version and moved improved revenue modeling capabilities into its new REMI Tax PI model. In order to conduct tax revenue analysis, this study scaled revenues to economic outputs using the procedure described in Regional Economic Models Inc. (2012). State tax revenues were derived from the Census of Government's *State and Local Government Finance* and *Annual Survey of State Tax Collections*. Revenue estimates are calculated by multiplying state revenue rates by the corresponding base quantity, which included state-level demand for selected industries (general sales tax, selective sales tax, license taxes), state-level personal income less transfer payments (individual income tax), corporate income tax (gross domestic product), and personal income (other taxes). The tax revenue impact analysis does not include the effect of economic development incentives on other revenues, including non-general revenues. Nor does it estimate the effect on local tax revenues. Lastly, it does not estimate the effect of economic development incentives on government expenditures at the state or local level.

Estimation of "but for" effect of selected incentives

The "but for" effect of an incentive is the percentage of firm activity or growth that can be attributed to the incentive. Trying to determine this effect with precision is difficult. Site selection decisions are based on a variety of factors that affect businesses' operations and employees. While the importance of individual factors varies based on the requirements of each business and project, factors affecting long-term costs—such as transportation infrastructure and labor availability and costs—are typically most important. Incentives, if considered, often become more important toward the end of the site selection process, after a few sites meeting the fundamental business requirements have been selected. However, some businesses may rule out sites early on if incentives are not available. Site selection decisions are ultimately made by business executives whose motivations are hard to anticipate and impossible to verify after the fact. (See *Review of State Economic Development Incentive Grants*, JLARC 2012).

Weldon Cooper Center estimated the "but for" effect of four Virginia incentives in this report: the Micron and Qimonda custom grants, data center sales and use tax exemption, and manufacturers single sales apportionment. The analysis relies on a cost sensitivity analysis from recent research by Bartik (2018b) that assesses the intensity or size of incentives relative to the locating or expanding firm's cost of operations and uses a tax-elasticity-based formula to determine how it influences company site selection decisions. The intuition behind the formula is that smaller incentives relative to the firm's expanded or newly relocated operations are less likely to "tip the balance" in a firm's location decision than larger incentives. For instance, Bartik estimates that the recent Wisconsin Foxconn incentive deal (approximately $230,000 per job) would reduce operating costs for the firm on a discounted basis over time by 30 percent. This 30 percent cost reduction would influence the location and expansion decision 97 percent of the time, on average. In contrast, an incentive that constitutes just 0.1 percent of the amount would affect only 1 percent of the location/expansion decisions.

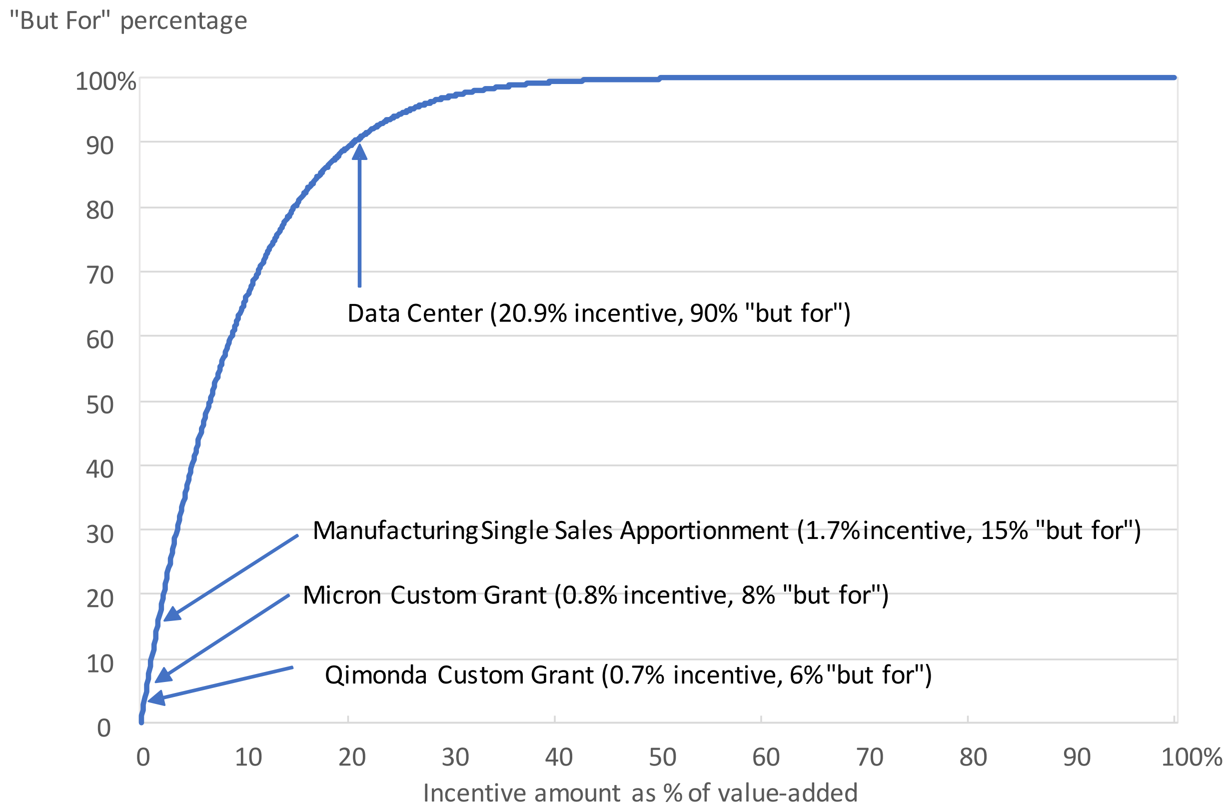
The formula, which is further explained in Appendix D of Bartik (2018b), is as follows:

$$(E_a-E_b)/E_a=(1-(1-s)(-R)$$

Where E_a is the employment before the incentive, E_b is the employment after the incentive, R is the elasticity of long-run business activity for business costs (and assumed to be equivalent to -10 in line with business activity tax elasticities of -0.5 and the finding that business taxes represent about 5 percent of value-added or R=-.5/.05=-10), and s is the relative incentive size (i.e., present value of incentives as a proportion of present value of stream of company value-added over a 20-year period).

Production costs are proxied by value-added, which are payments made to capital and labor. The stream of value-added and incentives are discounted over time to determine the present value of costs and cost savings. Bartik recommends using a discount rate of 12 percent as best representing the time value of money for private companies. Figure M-1 illustrates the effect of the incentive subsidy as percentage of value-added on estimated "but for" percentage.

FIGURE M-1
The "but for" percentage increases with relative size of the incentive



Source: Based on Bartik (2018b) Who Benefits from Economic Development Incentives, using state economic activity tax elasticity of -0.5.

Historical nominal sectoral value-added per employee are derived from REMI for the affected industries. Computations for each of the four programs are presented in Table M-7 and discussed briefly below.

The incentive share of production costs for the semiconductor manufacturing grants was estimated using actual (from company data for 1998–2010) and estimated employment (from Virginia Employment Commission records 2011–2017) over a 20-year time horizon for Dominion Semiconductor/Micron and White Oak Semiconductor/Infineon/Qimonda. Value-added per employee over the period is estimated using information from REMI for the computer and electronic product manufacturing industry. Using this information, we compute that the customized Micron and Qimonda grants (both Phase I and Phase II grants for each company) represented 0.7 percent and 0.9% of value-added total output over a 20-year time period (1998–2017). These figures translate into "but for" estimates of 6 percent and 8 percent respectively. However, when leveraged local incentives are added, these "but for" estimates expand. Each host locality adopted lower machinery and tools tax rates for semiconductor firms than other manufacturing firms under on a 1996 Virginia statute (§ 58.1-3508.1. Separate classification of machinery and tools used in semiconductor manufacturing). When the estimated value of the Manassas City ($92.6 million) and Henrico County ($27.3 million) machinery and tools tax abatements (based on computations using information from Weldon Cooper Center Local Tax

Rates on machinery and tool tax rates, information from press reports, and an interview with the City of Manassas economic development director) over the period are added, the estimated incentive portion of value added rises to 2.3 percent for Micron and 1.0 percent for Qimonda which translates into "but for" effects of 21 percent and 10 percent respectively.

The "but for" effect for the data center exemption was estimated by simulating the effect of the exemption on a typical data center project benefitting from the program. The typical project employs 64 workers and involves a capital investment of $406 million. Over a 20-year period, value-added per employee is estimated as an average of the value-added per employee for the telecommunications and internet publishing and broadcasting; ISPs, search portals, and data processing; other information services industry. Using this information, the average data center incentive represents an estimated 20.9 percent of operations center value added, which equates to a "but for" estimate of 90.4 percent.

For the manufacturing single sales apportionment factor, actual estimated savings from selecting single sales factor versus the standard double sales factor apportionment was estimated for each firm in the tax year 2014 cohort. These savings were divided by estimated value added for the composite industries and job creation observed from 2013–2017 for the participating firms. The employment increase for this period was projected to be level over the subsequent 16 years (2018–2032) as were the real tax savings. Using this information, we compute that the manufacturing single sales factor apportionment incentive discounted value over a 20-year period will represent 1.7 percent of discounted value-added over the current and projected period for an estimated "but for" effect of 15.5 percent.

Since the formula for the "but for" effect is based on firm reactions to business cost changes due to tax changes, it typifies the likely firm response to a by-right tax cut rather than discretionary incentive. Ordinarily, greater discretion and agency due diligence might be expected to improve the likelihood of an incentive of a given size to move the needle by selecting only those projects most at risk of moving or expanding elsewhere, rather than providing the incentive across the board. Allowance for this could be made for the two semiconductor grants because they were discretionary and the awards were determined after extensive negotiation and firm consideration of alternative sites. However, this was not done for the estimates—thus, they represent conservative "but for" assumptions. In contrast, the data center sales and use exemption and manufacturing single sales factor apportionment program more closely resemble a by-right process, where firms that meet the job creation and capital investment eligibility requirements receive the tax break. Thus the "but for" percentages may more accurately represent the effects in this respect, though it still does not account for other factors that may influence the decision.

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TABLE M-7
Size of Qimonda and Micron grants relative to project costs varies

	Qimonda Grant				Micron Grant			
	Value-added		Incentive amount		Value-added		Incentive amount	
Year	Actual estimated	Discounted	Actual estimated	Discounted	Actual, estimated	Discounted	Actual, estimated	Discounted
1	$126,953,303	$126,953,303	$0	$0	$123,745,473	$123,745,473	$0	$0
2	244,576,098	218,371,516	0	0	139,416,804	124,479,290	0	0
3	239,246,530	190,725,869	0	0	158,222,402	126,133,930	0	0
4	220,082,442	156,650,335	0	0	195,137,092	138,894,728	0	0
5	254,361,019	161,651,026	0	0	130,508,199	82,940,320	0	0
6	324,435,915	184,093,651	0	0	163,776,073	92,930,942	0	0
7	332,720,248	168,566,433	3,000,000	1,519,893	221,314,127	112,124,624	3,720,000	1,884,668
8	370,442,111	167,569,198	3,000,000	1,357,048	203,032,618	91,841,645	3,720,000	1,682,739
9	429,662,492	173,533,474	3,000,000	1,211,650	258,024,808	104,211,892	3,720,000	1,502,446
10	491,442,295	177,219,018	19,250,000	6,941,743	246,650,989	88,944,819	3,720,000	1,341,469
11	400,096,239	128,820,281	19,250,000	6,197,985	219,165,788	70,565,518	3,720,000	1,197,740
12	377,738,671	108,590,842	0	0	226,199,104	65,026,837	0	0
13	394,170,140	101,173,657	0	0	268,782,940	68,989,886	1,600,000	410,680
14	412,370,366	94,504,645	0	0	243,783,781	55,868,950	5,400,000	1,237,541
15	433,980,602	88,801,030	0	0	282,398,569	57,784,342	5,400,000	1,104,947
16	459,338,725	83,919,468	0	0	316,998,688	57,914,475	5,400,000	986,560
17	485,632,533	79,217,186	0	0	405,145,542	66,088,014	5,400,000	880,857
18	513,268,034	74,754,585	0	0	315,890,256	46,007,628	3,800,000	553,448
19	543,001,572	70,611,702	0	0	285,246,133	37,093,290	0	0
20	573,462,082	66,582,834	0	0	262,739,855	30,505,878	0	0

	Qimonda Grant				Micron Grant			
	Value-added		Incentive amount		Value-added		Incentive amount	
Year	Actual estimated	Discounted	Actual estimated	Discounted	Actual, estimated	Discounted	Actual, estimated	Discounted
Total	**$7,626,981,417**	**$2,622,310,051**	**$47,500,000**	**$17,228,318**	**$4,666,179,241**	**$1,642,092,483**	**$45,600,000**	**$12,783,095**
Incentive value as percentage of value-added				**0.66%**				**0.78%**
"But For" percentage				**6.38%**				**7.52%**

TABLE M-8
Size of incentive from Data Center Exemption and Manufacturers Single Sales Apportionment relative to project costs varies

	Data Center Exemption				Manufacturers Single Sales Apportionment			
	Value-added		Incentive amount		Value-added		Incentive amount	
Year	Actual estimated	Discounted	Actual estimated	Discounted	Actual, estimated	Discounted	Actual, estimated	Discounted
1	$5,420,195	$5,420,195	$4,505,203	$4,505,203	$63,741,540	$63,741,540	$1,514,286	$1,514,286
2	10,840,391	9,678,920	4,505,203	4,022,503	96,220,653	85,911,298	1,132,723	1,011,359
3	16,260,586	12,962,840	4,505,203	3,591,521	85,373,901	68,059,551	1,601,216	1,276,479
4	16,260,586	11,573,964	0	0	85,364,611	60,760,844	1,416,075	1,007,934
5	16,260,586	10,333,897	0	0	86,810,481	55,169,630	1,416,075	899,941
6	16,260,586	9,226,693	4,505,203	2,556,373	86,810,481	49,258,598	1,416,075	803,519
7	16,260,586	8,238,119	4,505,203	2,282,476	86,810,481	43,980,891	1,416,075	717,428
8	16,260,586	7,355,463	4,505,203	2,037,925	86,810,481	39,268,653	1,416,075	640,560
9	16,260,586	6,567,378	0	0	86,810,481	35,061,297	1,416,075	571,929
10	16,260,586	5,863,730	0	0	86,810,481	31,304,730	1,416,075	510,651
11	16,260,586	5,235,474	4,505,203	1,450,555	86,810,481	27,950,651	1,416,075	455,938
12	16,260,586	4,674,530	4,505,203	1,295,138	86,810,481	24,955,939	1,416,075	407,088
13	16,260,586	4,173,687	4,505,203	1,156,373	86,810,481	22,282,088	1,416,075	363,471
14	16,260,586	3,726,507	0	0	86,810,481	19,894,722	1,416,075	324,528

	Data Center Exemption				Manufacturers Single Sales Apportionment			
	Value-added		Incentive amount		Value-added		Incentive amount	
Year	Actual estimated	Discounted	Actual estimated	Discounted	Actual, estimated	Discounted	Actual, estimated	Discounted
15	16,260,586	3,327,238	0	0	86,810,481	17,763,144	1,416,075	289,757
16	16,260,586	2,970,748	4,505,203	823,084	86,810,481	15,859,950	1,416,075	258,712
17	16,260,586	2,652,454	4,505,203	734,896	86,810,481	14,160,670	1,416,075	230,992
18	16,260,586	2,368,262	4,505,203	656,157	86,810,481	12,643,455	1,416,075	206,243
19	16,260,586	2,114,520	0	0	86,810,481	11,288,799	1,416,075	184,146
20	16,260,586	1,887,964	0	0	86,810,481	10,079,285	1,416,075	164,416
Total	**$308,951,139**	**$120,352,585**	**$54,062,440**	**$25,112,206**	**$1,719,668,395**	**$709,395,735**	**$28,321,497**	**$11,839,378**
Incentive value as percentage of value-added				**20.87%**				**1.637%**
"But For" percentage				**90.37%**				**15.49%**

Source: Weldon Cooper Center analysis based on actual and estimated employment and industry value-added per employee from REMI; actual and estimated incentive amounts.
Note: Data center flows are based on constant (real) values (2017–2036); manufacturing single sales apportionment is based on nominal historical (2014–2017) and constant (real) values 2018–2033. Semiconductor flow values are based on nominal (historical) values (1998–2017). Assumes discount rate of 12 percent.