Appendix L: Economic impact modeling

Weldon Cooper Center staff conducted economic and tax revenue impact analyses of Virginia economic incentives using REMI PI+ (Policy Insight Plus) software. REMI PI+ is a dynamic, multi-sector 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 and econometric modeling to characterize the mechanics and path of a regional economy. The model has been extensively peer-reviewed and is widely used by state agencies elsewhere in the nation 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 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. 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.

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. The REMI modeling of economic impact was conducted by increasing export base employment using agency and Virginia Employment Commission data on actual and projected project employment for the relevant industry sectors (Table L-1). This utilized the REMI PI+ "Industry Employment" policy variable in the Labor and Capital Demand model block. For two shortened custom grant projects that had sizable capital investment/employment ratios, the capital investment associated with the employment increase was nullified in REMI, the default endogenous effect of industry employment on investment capital investment was nullified, and project capital investment was introduced via the investment spending policy variable with construction investment modeled as investment spending for nonresidential structures and machinery and tools capital investment introduced as investment spending for equipment. Estimates of custom grant economic and tax revenue impacts were scaled by the "but for" computations described in the next section.

TABLE L-1
Industry sectors by custom project sectors, including REMI sectors

Custom grant project	NAICS Industry	Industry cluster (Subcluster)	REMI industry (Sector Number)
Morgan Olson	336211 (Motor Vehicle Body Manufacturing)	Automotive (Motor Vehicles)	15 (Motor vehicles, bodies and trailers, and parts manufacturing)
Huntington Ingalls-Production	334511 (Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing)	Aerospace Vehicles and Defense (Search and Navigation Equipment)	13 (Computer and electronic product manufacturing)
Huntington Ingalls-Training	334511 (Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing)	Aerospace Vehicles and Defense (Search and Navigation Equipment)	13 (Computer and electronic product manufacturing)
Rolls-Royce	336412 (Aircraft Engine and Engine Parts Manufacturing)	Aerospace Vehicles and Defense (Aircraft)	16 (Other transportation equipment manufacturing)
Amazon HQ2	551114 (Corporate, Subsidiary, and Regional Managing Offices)	Business Services (Corporate Headquarters)	15 (Management of companies and enterprises)
Blue Star	339113 (Surgical Appliance and Supplies Manufacturing)	Medical Devices (Surgical and Dental Instruments and Supplies)	18 (Miscellaneous manufacturing)
Siemens Gamesa	333611 (Turbine and Turbine Generator Set Units Manufacturing)	Production Technology and Heavy Machinery (Agricultural and Construction Machinery and Components)	Not Modeled
Merck	325412 (Pharmaceutical Preparation Manufacturing)	Biopharmaceuticals (Biological Products)	26 (Chemical manufacturing)
LEGO Group	326199 (All Other Plastics Product Manufacturing)	Plastics (Plastic Products)	27 (Plastics and rubber products manufacturing)
CoStar	531390 (Other Activities Related to Real Estate)	Local Real Estate, Construction, and Development (Real Estate Services)	47 (Other real estate)

Custom grant project	NAICS Industry	Industry cluster (Subcluster)	REMI industry (Sector Number)
Micron	334413 (Semiconductor and Related Device Manufacturing)	Information Technology and Analytical Instruments (Semiconductors)	13 (Computer and electronic product manufacturing)
CMA CGM	551114 (Corporate, Subsidiary, and Regional Managing Offices)	Business Services (Corporate Headquarters)	15 (Management of companies and enterprises)
Rocket Lab	336419 (Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing)	Aerospace Vehicles and Defense (Missiles and Space Vehicles)	16 (Other transportation equipment manufacturing)
Amazon Web Services	551114 (Corporate, Subsidiary, and Regional Managing Offices)	Business Services (Corporate Headquarters)	15 (Management of companies and enterprises)
SRI International	541690 (Other Scientific and Technical Consulting Services)	Business Services (Consulting Services)	49 (Professional, scientific, and technical services)
Microsoft	511210 (Software Publishers)	Information Technology and Analytical Instruments (Software Publishers)	39 (Publishing industries, except Internet)
Volvo	336120 (Heavy duty truck manufacturing)	Automotive (Motor Vehicles)	15 (Motor vehicles, bodies and trailers, and parts manufacturing)

SOURCE: Weldon Cooper Center.

"But for" calculations for job creation

Estimation of the "but for" effect for 16 of the 17 custom grants relies on recent research by Bartik (2018) on the role of the relative intensity or size of incentive relative to locating or expanding firm cost of operations in influencing company site decisions. The "but for" effect is the percentage of firm growth during the period that can be attributed to the incentive and is determined by a tax-elasticity-based formula. 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) reduces 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 (derivation, which is explained in Appendix D of Bartik [2018]) 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 the 20-year period).

For each of the grants, information on job creation was available from VEDP records or from examining Virginia Employment Commission's confidential Quarterly Census of Employment (QCEW) establishment-level employment data. To compute "but for" values, it was necessary to translate job creation into production cost for comparison to the incentive. Production costs are proxied by value-added, which are capital and labor payments. "Value-added per employee by industry" was obtained from REMI and merged with incentive records on job creation using a REMI-to-NAICS bridge to compute value-added equivalents. The incentive costs-production cost ratios was computed as the discounted incentive award value as a percentage of the discounted stream of production costs for a 20-year project lifespan, using a 12 percent discount rate as outlined by Bartik (2018). The stream of value-added and incentives are discounted over time to determine the present value of costs and cost savings. Bartik recommends using 12 percent as the discount rate because it best represents the time value of money for private companies.

"But for" computations are made on the basis of MOU performance agreements rather than actual performance data. The MOU reflects the financial parameters of corporate decision-making at the time that the location and expansion decisions were made. These "but for" factors are combined with actual performance data to compute economic and tax revenue impacts.

In addition, local and other state incentive program fund matches were not included in the analysis, mainly because it was difficult—if not impossible—in many situations to determine when the incentive was disbursed or would be disbursed in the future, unlike the custom grant cash grant payments, which are triggered by attaining targets described in the respective MOUs. This imparts a negative bias to the "but for" calculations.

"But for" percentages vary widely by project, largely in line with the average incentive amount per job offered by the custom grant (Table L-2). For example, the lowest "but for" was obtained for the CoStar (2.8 percent) custom grant, which also had the second lowest custom grant value-per-job ratio at $7,560, while the highest "but for" was observed for the SRI International custom grant (90 percent), which had the largest custom grant value per job ratio at $157,143.

TABLE L-2
Incentive per job and "but for" percentages by custom grant

Custom grants project	Incentive amount per job	But for
SRI International	$157,143	90.0%
Rocket Lab	60,976	42.7
Micron	63,291	36.8
Rolls-Royce	54,517	27.5
LEGO Group	42,589	20.1
Merck	49,342	18.0
Huntington Ingalls-Training	32,778	17.0
Huntington Ingalls-Production	46,000	15.1
Volvo	21,236	9.3
CMA CGM	22,892	8.1
Amazon HQ2	22,000	7.3
Blue Star	5,317	5.9
Microsoft	15,000	4.3
Amazon Web Services	7,000	3.3
CoStar	7,560	2.8
Morgan Olson	$9,957	3.3%
Siemens Gamesa	55,161	n.a.
Total custom grants	**$23,697**	**14.1%**

SOURCE: Weldon Cooper Center analysis of economic development incentive grants.
NOTE: Total "but for" is weighted by award sizes for all but Siemens Gamesa, which was canceled.

Since the "but for" effect formula is based on companies' reactions to business cost changes due to tax changes, it typifies the likely company response to a typical by-right tax cut rather than discretionary incentive. Ordinarily, greater discretion and agency due diligence might be expected to improve the likelihood that an incentive would affect business location and expansion decisions, because only projects considering other locations would receive the incentive. No adjustments were made for programs that had these elements and thus, they may sometimes represent conservative "but for" assumptions.