Economic Impact Analysis Excerpt

What

A report co-written with Taylor Long for an Economic Development Analysis Techniques course at UIC. The work I performed included much of the model creation and execution, and wrote the majority of the “Summary”, “Methodology”, and “Technical Appendix” sections. The analysis examined the direct, indirect, and induced impact of a proposed Bombardier aircraft manufacturing facility moving into Winnebago County, Illinois on associated sectors and the economy overall.

Work Performed

- Conducted economic impact analysis modeling, parameter selection, and execution.
- Wrote “Summary”, “Methodology”, and “Technical Appendix” sections.

Why

- Economic impact analysis
- Report & proposal writing
- Group collaboration & teamwork

Assignment 3:
Economic Impact Analysis of Proposed Bombardier Facility

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Economic Impacts Analysis:
New Bombardier Campus in Rockford, Illinois

Summary

This report quantifies the impact the proposed new Bombardier airplane manufacturing facility is expected to have on Rockford's regional economy, taking into account both Bombardier's up-front investment and the economic impact of successive rounds of local spending. Our analysis shows Bombardier's impact on the local economy will be significant, particularly considering the high-levels of unemployment in the region.[1] Based on our analysis, we estimate the economic impact of the facility in the first four years will be approximately $818 million. Between 1,150 and 1,250 job-years[2] are expected to be created as a result of construction-related activity, generating about $163 million in total output. Operations in the first four years is expected to generate about $533 million in total output and create 1,600 to 1,700 job-years over a four-year period. Capital investment can be expected to generate a total of $122 million in total output and lead to the creation of between 500 and 600 job-years over four years. At the end of the four-year investment period, we forecast approximately 648 jobs will be sustained annually through direct, indirect, and induced impacts in the community.

Methodology

This economic impact analysis was performed using IMPLAN online software[3]. IMPLAN models economic impacts of three types — direct, indirect and induced. Direct effects speak to initial expenditures captured by the local economy as a result of the development, indirect effects

[1] Unemployment in Winnebago county was twice as high as the national average according to the ACS 5-year community estimates from 2017, with an unemployment rate of about 10 percent.
[2] A job-year represents full-time employment for one person for one year.
[3] IMPLAN utilizes data from the Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), Census Bureau and other federal and state sources in its analysis.

assesses how the development impacts spending at local firms and induced effects measures spending of local households as a result of the development. In order to best capture impacts for the entire Rockford Functional Economic Area (FEA), researchers defined the study area to comprise both Winnebago and Boone counties. Our analysis captures four years of investment by Bombardier beginning in 2020.

Direct Impacts

Our assessment of direct impacts is based on data provided by Bombardier concerning the proposed plant's construction, annual operation, and purchase of equipment and machinery. These figures were adjusted based on the anticipated share of local spending by Bombardier and assigned industry sectors in IMPLAN.[4] The direct impacts analysis does not account for expenditures made by local firms or employees — for example, construction of new homes to accomodate Bombardier employees.

Construction

The development of the proposed manufacturing plant requires the construction of a 500,000 square foot facility as well as associated site and infrastructure improvements. This construction will occur over four years, adding approximately 125,000 square feet annually. Bombardier estimates they will spend $120 million in construction over the anticipated four year construction period. This differs is comparable to our estimates, which projects total construction expenditures of approximately $116.6 million in 2019 dollars.[5] Construction is expected to directly create 865 job-years over a four year period, generating roughly $56.8 million in labor

[4] See technical appendix for logic of industry assignment.
[5] Spending deflated to 2019 dollars to be consistent with monetary values in the report year.

income and contributing $72.7 million to the local economy.[6] These direct impacts are largely concentrated in Years 1 and 2, when the majority of construction will take place.

Production

We estimate Bombardier's production expenditures at $431.9 million total for the first four years of operation (discounted to 2019 US $). This estimate is based on estimates of expected yearly expenditures provided by Bombardier. Each year specifies different manufacturing operations, which our model accounts for by assigning different corresponding industry sectors for each year in IMPLAN.[7] For example, while Year 1 will add production line & test operations, in Year 2 Bombardier expects to add fuselage, parts and assemblies operations. Resulting estimates show production gradually increasing (see Table 1), with a four-year ramp up to full employment. As such (assuming no plans for future expansion), Year 4 therefore provides a good sense of what production expenditures might look like in subsequent years.

Table 1: Projected Production Output, 2020-2023

	Total	Year 1	Year 2	Year 3	Year 4
Production Output (2019 $, mil.)	440	40	90	130	180
Employment, Bombardier-projected	950 - 1,150	100 - 150	200 - 250	300 - 350	350 - 400
Employment, DCEO-projected	911	62	217	277	355

Bombardier also provided ranges for expected staffing each year. While these numbers provide a helpful baseline, our model provided a somewhat different estimate based on expected

[6] For IMPLANs definitions of Output, Value Added, Labor Income and other terminology, please see technical appendix.
[7] See technical appendix for corresponding industries in detail.

production expenditures in Year 1.[8] We estimate 911 total job-years would be created by the manufacturing facility over the course of the four years studied, generating roughly $99.5 million in total labor income. Our estimates show that the Bombardier facility will employ approximately 355 employees when the plant is at full employment. Assuming no future plans for expansion, then this will be the expected annual employment at the plant in the near future. This estimate is approximate to the low estimate provided by Bombardier, which the firm estimated between 350-400 employees in Year 4.

Capital

Manufacture of aviation and aerospace equipment is capital-intensive, requiring a large up-front investmentment. Bombardier's estimated investments reflect this, and the firm expects to invest $455 million total in equipment and machinery, with $320 million of that expected in the first two years. However, since Bombardier contracts with exclusive suppliers for specifically-designed machinery, Rockford can be expected to benefit from only a fraction of that capital investment — less than 20 percent. Correcting for local absorption rates reveals that local industries in Rockport can instead expect approximately $90 million total capital investment over the four year study period.[9]

Impact Estimates

IMPLAN generates a set of Type II multipliers that allow us to estimate ripple effects the construction and ongoing operations of the proposed facility may have on the local economy, including indirect and induced output. We estimate that construction and four years of operation of the proposed facility will result in roughly $818.5 million in total local economic impact. As

[8] We used Bombardier's estimates for expected production output to determine our own ranges for annual jobs added. See technical appendix for more detail on our model's logic.
[9] While Bombardier estimates local 20 percent of capital investment will be spent locally, IMPLAN estimates only 13% of that local investment will actually be absorbed.

Table 2 illustrates, the majority of these are direct outputs. Sectors most affected by this growth (outside of aircraft and equipment manufacturing and construction, of course) include real estate and residential construction, wholesale trade, health care, services and retail. Appendix 5 provides a summary of the Top 10 industries by impact.

Table 2: Total Economic Impact, All Impacts, All Years

Impact	Employment	Labor Income (2019 $, mil.)	Value Added (2019 $, mil.)	Output (2019 $, mil.)
Direct	2,097.8	164.1	211.6	638.8
Indirect	457.7	24.3	36.4	70.1
Induced	844.8	34.5	62.2	109.5
Total	3,400.3	22.8	310.3	818.5

TECHNICAL APPENDIX

The investments by Bombardier were defined as Industry Output events according to relevant industries. Implan groups industries into its own internal classifications from 6-digit NAICS codes. Yearly production was also entered as an Industry Output event. The classifications were as follows:

- Production: industry output, dollar amount, in three relevant industry codes (357 “Aircraft manufacturing,” 358 “Aircraft engine and engine parts manufacturing,” 359 “Other aircraft parts and auxiliary equipment manufacturing.”
- Construction: industry output, dollar amount, industry code 53 “Construction of new manufacturing structures”.
- Capital: industry output, dollar amount, industry code 282 “Rolling mill and other metalworking machinery manufacturing”.

Because Bombardier did not specify which NAICS codes their investments would constitute, these classifications were chosen based on research and judgement of Illinois Department of Commerce and Economic Opportunity (DCEO) staff. Elements of production of the final product, or output, fit into three classifications: 357 “Aircraft manufacturing,” 358 “Aircraft engine and engine parts manufacturing,” or 359 “Other aircraft parts and auxiliary equipment.” Bombardier has relayed that the following operations will occur at the new campus: production line & test facilities; fuselage, parts, & assemblies; and engine fabrication. These manufacturing operations are added individually over four years, and staff divided production into the three industry codes according to the year it was added.

Bombardier’s construction of new facilities fits cleanly into Implan industry code 53 “Construction of new manufacturing structures.” Bombardier is not renovating existing structures - and therefore it is new-build. Specifically, the primary land use is manufacturing.

Capital investments by Bombardier - or the production equipment and machinery purchased the firm - was classified as 282 “Rolling mill and other metalworking machinery manufacturing.” Staff compared aircraft manufacturing machinery on the market currently and utilized best judgement to match to 6-digit NAICS and corresponding Implan industry codes. While Bombardier estimates spending $455 million on capital investments over four years, 80% of their purchasing will come from their own specialized supply chain outside of the region. Thus, only 20% will be bought on the open market and was utilized in the analysis.

Appendix 1: All Impacts by Bombardier, all years

	Total	Year 1	Year 2	Year 3	Year 4
Employment	**3,400.3**	**686.5**	**1,470.3**	**835.1**	**866.7**
Direct	*2097.8*	*454.5*	*632.8*	*507.7*	*502.7*
Indirect	*457.7*	*71.9*	*125.3*	*119.6*	*141.1*
Induced	*844.8*	*160.1*	*253.9*	*207.7*	*223.1*
Labor Income (2019 $, mil.)	**222.8**	**42.4**	**89.9**	**54.8**	**57.8**
Direct	*164.1*	*31.7*	*50.1*	*40.1*	*42.3*
Indirect	*24.3*	*4.0*	*6.6*	*6.3*	*7.3*
Induced	*34.5*	*6.5*	*10.4*	*8.5*	*9.1*
Value-Added (2019 $, mil.)	**310.3**	**60.0**	**125.7**	**75.7**	**81.3**
Direct	*211.6*	*42.0*	*64.5*	*51.1*	*54.6*
Indirect	*36.4*	*6.3*	*10.1*	*9.3*	*10.7*
Induced	*62.2*	*11.7*	*18.8*	*15.3*	*16.4*
Output (2019 $, mil.)	**818.5**	**139.7**	**215.3**	**211.3**	**252.0**
Direct	*638.8*	*107.2*	*163.5*	*166.4*	*201.6*
Indirect	*70.1*	*11.9*	*18.8*	*18.0*	*21.4*
Induced	*109.5*	*20.8*	*32.9*	*26.9*	*28.9*

Appendix 2: Impacts of Production Output by Bombardier, all years

	Total	Year 1	Year 2	Year 3	Year 4
Employment	**1,644.5**	**108.5**	**850.0**	**496.5**	**647.8**
Direct	*910.6*	*62.2*	*216.5*	*276.7*	*355.1*
Indirect	*306.1*	*23.0*	*69.5*	*91.8*	*121.8*
Induced	*427.8*	*23.3*	*105.6*	*128.0*	*170.9*
Labor Income (2019 $, mil.)	**112.6**	**6.2**	**50.7**	**33.7**	**44.0**
Direct	*79.5*	*3.9*	*20.1*	*23.8*	*31.8*
Indirect	*15.6*	*1.3*	*3.5*	*4.7*	*6.2*
Induced	*17.5*	*1.0*	*4.3*	*5.2*	*7.0*
Value-Added (2019 $, mil.)	**153.8**	**8.8**	**69.9**	**45.9**	**61.7**
Direct	*99.5*	*5.2*	*24.6*	*29.6*	*40.1*
Indirect	*22.7*	*1.9*	*5.0*	*6.8*	*9.0*
Induced	*31.5*	*1.7*	*7.8*	*9.4*	*12.6*
Output (2019 $, mil.)	**532.6**	**46.6**	**112.3**	**157.6**	**216.1**
Direct	*431.9*	*39.8*	*88.9*	*127.6*	*175.6*
Indirect	*45.2*	*3.8*	*9.7*	*13.4*	*18.3*
Induced	*55.5*	*3.0*	*13.7*	*16.6*	*22.1*

Appendix 3: Impacts of Construction Investments by Bombardier, all years

	Total	Year 1	Year 2	Year 3	Year 4
Employment	**1,205.7**	**408.0**	**402.6**	**248.2**	**146.9**
Direct	*865.7*	*293.0*	*289.0*	*178.2*	*105.5*
Indirect	*69.3*	*23.5*	*23.2*	*14.3*	*8.5*
Induced	*270.7*	*91.6*	*90.4*	*55.7*	*33.0*
Labor Income (2019 $, mil.)	**71.8**	**24.3**	**24.0**	**14.8**	**8.8**
Direct	*56.8*	*19.2*	*19.0*	*11.7*	*6.9*
Indirect	*4.0*	*1.3*	*1.3*	*0.8*	*0.5*
Induced	*11.0*	*3.7*	*3.7*	*2.3*	*1.3*
Value-Added (2019 $, mil.)	**99.1**	**33.5**	**33.1**	**20.4**	**12.1**
Direct	*72.7*	*24.6*	*24.3*	*15.0*	*8.9*
Indirect	*6.5*	*2.2*	*2.2*	*1.3*	*0.8*
Induced	*19.9*	*6.7*	*6.7*	*4.1*	*2.4*
Output (2019 $, mil.)	**163.4**	**55.3**	**54.5**	**33.6**	**19.9**
Direct	*116.6*	*39.5*	*38.9*	*24.0*	*14.2*
Indirect	*11.7*	*4.0*	*3.9*	*2.4*	*1.4*
Induced	*35.1*	*11.9*	*11.7*	*7.2*	*4.3*

Appendix 4: Impacts of Capital Investments by Bombardier, all years

	Total	Year 1	Year 2	Year 3	Year 4
Employment	**550.1**	**170.0**	**217.7**	**90.4**	**72.0**
Direct	*321.5*	*99.3*	*127.3*	*52.8*	*42.1*
Indirect	*82.3*	*25.4*	*32.6*	*13.5*	*10.8*
Induced	*146.3*	*45.2*	*57.9*	*24.0*	*19.2*
Labor Income (2019 $, mil.)	**38.4**	**11.9**	**15.2**	**6.3**	**5.0**
Direct	*27.8*	*8.6*	*11.0*	*4.6*	*3.6*
Indirect	*4.7*	*1.4*	*1.8*	*0.8*	*0.6*
Induced	*6.0*	*1.8*	*2.4*	*1.0*	*0.8*
Value-Added (2019 $, mil.)	**57.4**	**17.7**	**22.7**	**9.4**	**7.5**
Direct	*39.4*	*12.2*	*15.6*	*6.5*	*5.6*
Indirect	*7.2*	*2.2*	*2.9*	*1.2*	*0.9*
Induced	*10.8*	*3.3*	*4.3*	*1.8*	*1.4*
Output (2019 $, mil.)	**122.5**	**37.8**	**48.5**	**20.1**	**16.0**
Direct	*90.3*	*27.9*	*35.7*	*14.8*	*11.8*
Indirect	*13.2*	*4.1*	*5.2*	*2.2*	*1.7*
Induced	*18.9*	*5.9*	*7.5*	*3.1*	*2.5*

Appendix 5: Top 10 Industries by Impact, all years

		Total Output Impact (2019 $, all years)			
Rank	Industry	Direct	Indirect	Induced	Total
1	357 - Aircraft manufacturing	$235,870,287	$54,702	$1,318	$235,926,307
2	359 - Other aircraft parts and auxiliary equipment manufacturing	$147,266,995	$1,188,202	$4,264	$148,459,460
3	53 - Construction of new manufacturing structures	$116,612,102	$-	$-	$116,612,102
4	282 - Rolling mill and other metalworking machinery manufacturing	$90,288,204	$204,499	$46	$90,492,750
5	358 - Aircraft engine and engine parts manufacturing	$48,788,219	$5,742,431	$2,468	$54,533,117
6	395 - Wholesale trade	$-	$12,585,898	$3,159,798	$15,745,696
7	441 - Owner-occupied dwellings	$-	$-	$15,732,620	$15,732,620
8	482 - Hospitals	$-	$-	$10,997,297	$10,997,297
9	440 - Real estate	$-	$1,205,617	$4,952,238	$6,157,855
10	49 - Electric power transmission and distribution	$-	$2,705,109	$2,360,142	$5,065,250
---	*All other industry codes*	*$-*	*$46,440,627*	*$72,288,473*	*$118,729,100*
		$638,825,808	$70,127,085	$109,498,662	$818,451,555

Appendix 6: Information summary provided by Bombardier

Investment and Staffing Forecast

Year	1	2	3	4	Total
Square footage added	125,000	125,000	125,000	125,000	500,000
Manufacturing operation added	production line & test	fuselage, parts, & assemblies	production line & test	engine fabrication	
Non-manufacturing operation added	administration, engineering and design, support	administration, engineering and design, support	engineering and design, support	engineering and design	
Construction* (in millions $)	40	40	25	15	120
Equipment and Machinery* (in millions $)	140	180	75	60	455
Approximate staffing	100 - 150	200 - 250	300 - 350	350 - 400	
Operation	3 shifts – 18 hours/day – 6 days/week				
Production (in millions $)	40	90	130	180	

Note: The sequence of construction may be reversed based on capacity analysis (i.e.,engines first, followed by fuselage, parts, and assemblies).

** Construction and equipment and machinery not-to-exceed figures quoted.*