October 2013

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Kelly Whealan-George
Embry-Riddle Aeronautical University, georged8@erau.edu

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Embry-Riddle Aeronautical University

DAV 735 -- Module 4

October 10, 2013

Abstract

The Space Project Team of the Organization for Economic Cooperation and Development (OECD) International Futures Programme (IFP) determined that the future demand for space applications is likely to be substantial. They present three likely scenarios that have different geopolitical, socio-economic, and energy and environment scenarios. Using the three scenarios for Space 2030 presented by the IFP working group, this paper estimates a potential impact from the change in final demand of the space value chain to the U.S. economy. Because of the interrelations of applications, the space value chain is made up of three broad categories: information services, transport services, and manufacturing. Each scenario gives the most promising applications for the next 30 years, excluding military applications.

The impact on the U.S. economy will be determined by using an Input-Output Analysis model and the most current data on U.S. economic output that is available. The most current Input-Output table is available through the World Input Output Database (WIOD) with data generated for 2009. Just as a reference, the most current published IO database that the Department of Commerce publishes is broken down into more categories than the WIOD, but only represents 2002 economic output. An outlook based on the most aggressive IFP scenario of a 40% growth in the commercial space industry was used to forecast industry-by-industry changes. Industries predicting significant growth as a result of growth in commercial space industry are: basic and fabricated metals; mining and quarrying; rubber and plastics; agriculture; air transport; and inland transport. The industries showing significant negative results from growth in the U.S. commercial space industry were: machinery, electricity, gas and water supply, education, wood products, other transport; other non-metallic minerals, and water transport.

The Projected U.S. Economic Impacts of the Space Industry 2030

Domination by government investment in the space industry may be over in the 21st century as the commercial use of space is emerging as a part of the U.S. economy's future structure. Various bodies forecast significant future growth in commercialization of the space industry and importance for the U.S. economic competitiveness within the global market. The space sector is not solely comprised of launches and satellites but now includes direct consumer applications and personal entertainment (Office of Space Commercialization, 2002). Given that the commercial space industry is forecasted to be at the beginning of significant expansion period, Input Output analysis is useful to predict what industries will benefit from its growth and inform the government that may want to use this information in their policy or public investment decisions.

The Space Project Team of the Organization for Economic Cooperation and Development (OECD) International Futures Programme (IFP) determined that the future demand for commercial space applications is likely to be substantial. They presented three likely scenarios that have different geopolitical, socio-economic, and energy and environment scenarios. Using the three scenarios for Space 2030 presented by the IFP working group and the presented cost of access to space, this research determines a potential impact from the change in final demand of the space value chain to the U.S. economy (OECD, 2004). Economic projections from the Federal Aviation Administration's Office of Commercial Space Transportation (FAA AST) were also incorporated into the future demand scenarios. Because of the interrelations of applications, the space value chain is made up of three broad categories: information services, transport services, and manufacturing.

Definition and Current Status of the Commercial Space Transportation Industry

The space transportation industry comprises activities that refer to the movement of satellites, cargo vehicles, payloads, or passengers to and from space. Commercial space transportation is the orbital and suborbital activities performed by profit pursuing companies in a competitive marketplace (Federal Aviation Administration, 2012). As such, industry activity includes expendable launch vehicles, reusable launch vehicles, commercial spaceports, reentry vehicles, in-space technologies, propulsion and vehicle component technologies, and passenger space flight.

The development of the commercial space transportation industry began in the 1980s with the banning of commercial payloads on the Space Shuttle and the creation of Arianespace, a European commercial launch services organization. Commercial launches account for one-fourth of the total launches worldwide (Federal Aviation Administration, 2012). The first ever commercially operated flights out of the Earth's atmosphere took place in April, 2012 by Spacex, Inc. and there are more expected. Of the 994 operational satellites globally, 68% of them are for commercial, non-military satellites (Satellite Industry Association, 2012). Within the commercial space transportation industry is the relatively new subsector, space tourism. To date, only the Russian Space Agency has commercialized personal space flight in the first decade of the 21st century. There are multiple companies and private space agencies such as XCOR Aerospace and Virgin Galactic offering sales of orbital and suborbital flights and stays in space hotels (McKinley, 2012; Nield, 2012; Stenovac, 2012).

Commercial space transportation and enabled industries (CST&EI) includes manufacturing and services of launch vehicles (LVM&SI), satellite manufacturing, ground-equipment manufacturing, satellite services, satellite remote sensing, and distribution industries. These activities can be traced into four major industries of the economy: satellite services, satellite manufacturing, launch industry, and ground equipment manufacturing (Table 1) (Satellite Industry Association, 2012). For purposes of this research and the economic impact, the commercial space transportation final demand was traced within the industry sectors based on the North American Industry Classification System (NAISC) (Federal Aviation Administration, 2012; U.S. Census Bureau, 2012). The industry accounts are: 1) Sector 3364: Aerospace Product and Parts Manufacturing, 2) Sector 4812: Nonscheduled Air Transportation 3) 3342 Communications Equipment Manufacturing, and 4) Sector 5174: Satellite Telecommunications Services. As the industry grows and develops, it is expected that the primary economic activity will be contained within these space industry sectors and spillover into many of the other industries in the U.S. economy.

Table 1. *List of commercial space industry subsectors*

Satellite Services	**Satellite Manufacturing**	**Launch Industry**	**Ground Equipment**
Consumer Services • Satellite TV • Satellite Ration • Satellite Broadband	Satellite Manufacturing	Launch Services	Network Equipment • Gateways • Control Stations • Very Small Aperture Terminals (VSAT)
Fixed Satellite Services • Transponder Agreements • Managed Network Services	Parts, Components & Subsystem Manufacturing	Launch Vehicles Services	Consumer Equipment • Direct Broadcast Satellite (DBS) Dishes • Mobile satellite terminals (including satellite phones • Digital Audio Radio Service (DARS) Equipment • GPS stand-alone Hardware
Mobile Satellite Services • Mobile Data • Mobile Voice			
Remote Sensing			
Space Flight Management Services			

As of 2011, the most recent year that economic data is available by industry details, the commercial space industry accounted for approximately $80 billion or 0.6% of total U.S. GDP. For comparison, the commercial space industry accounted for approximately $61 billion or 0.5% of total U.S. GDP in 1999. In the past decade, the CST&EI economic activity has experienced a 239% increase while LVM&SI decreased by 76%. The growth of the commercial space industry is dominated by growth in satellite services and ground equipment manufacturing. The U.S. LVM&SI industry has contracted due to decreased U.S. launch activity and increased growth and competition from global orbital launch servicers (Federal Aviation Administration, 2012; Satellite Industry Association, 2012; U.S. Department of Commerce, 2011).

As of 2011, the U.S. share of global satellite services industry was approximately 45% at $48 billion dollars. The U.S. share of global satellite manufacturing was 52% at $6.2 billion with two thirds of the manufacturing revenues from U.S. government contracts. The U.S. share of global satellite launch services industry was 39% at $1.9 billion with 70% of the launch services revenue from U.S. government contracts (Satellite Industry Association, 2012). The U.S. share of ground equipment revenue was approximately 45% at $24 billion dollars (Anonymous, 2013). The U.S. commercial space transportation market was broken down as follows: 60% satellite services, 8% satellite manufacturing, 2% launch industry, and 30% ground equipment manufacturing (Figure 1).

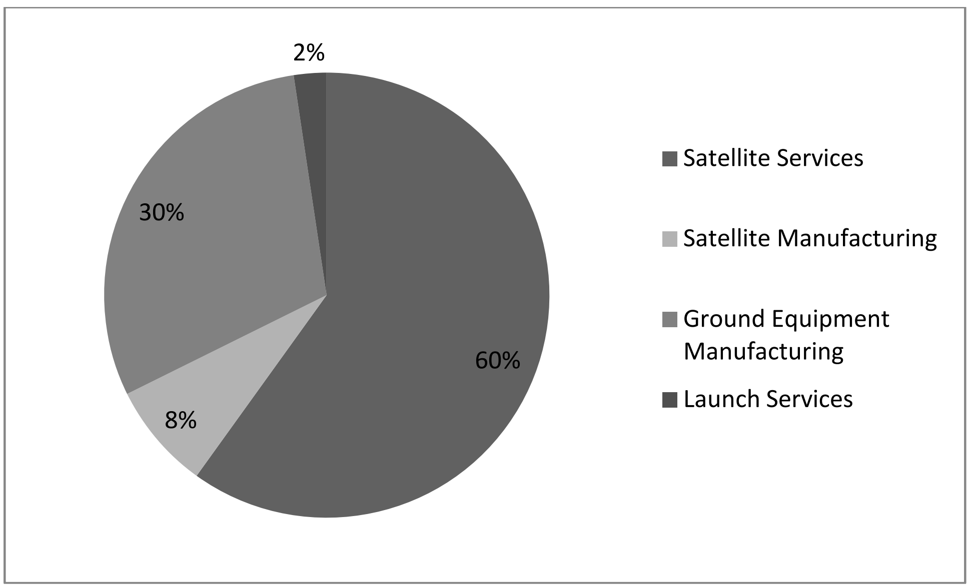

Figure 1. Breakdown of the commercial space industry sub-sectors.

Table 2. *The commercial space industry current economic value.(billions of dollars)*

	Current Economic Value

Satellite Services	48.0
Satellite Manufacturing	6.2
Launch Industry	1.9
Ground Equipment	24.0
Total	80.1

Scenarios of Commercial Space Industry's Growth to 2030

OECD's Space 2030 (2004) was the interim report of the International Futures Programme task force to study emerging economic issues for decision makers in both the public and private sectors. This task force identified the future development of the commercial and civil space sector and the related economic impacts on global economies, national security importance, and environmental concerns as a key future issue. This interim report of the task force includes a brief history of commercial space growth, the current status of the industry, and three broad environmental scenarios under which the commercial space sector will develop. These scenarios will be used as a basis the space sector economic growth forecast in this paper. The three likely scenarios for the next two decades under which the future of the space sector will evolve include variants of geopolitical developments, socio-economic developments, energy and the environment, and technology.

The major drivers defined are geopolitical developments, socio-economic developments, energy, and the environment. Based on these three scenarios, the report identifies the key drivers of the implications for future demand applications and an assessment of the technological feasibility of such applications.

Military space demands and priorities are the drivers of follow-on innovation and advancement in the commercial space sectors. The degree of national economic protectionism and the national security importance drives the development of commercial applications and technology transfer. The demand for types of space applications are categorized into three broad categories: information services such as communications, earth observation, and navigation; transport such as public access to space and space transport; and manufacturing such as solar energy, microgravity, and lunar extraction. The IFP task force concluded that the main contenders for development of space applications are distance learning and telemedicine, e-commerce, entertainment, location-based consumer services, location-based services (traffic management), land dover (precision farming, urban planning, exploration), disaster prevention and management, meteorology and climate change, and monitoring international treaties. Further technological advancements would allow space applications for space tourism, in-orbit servicing, and power relay stations in the next two decades.

Even though military space is expected to be an important part of the space sector throughout the next two decades, commercial space demand is likely to be dominant across a range of uses (OECD, 2005). Commercial space sectors will likely play an important part in solving issues in society that need global solutions. The three forecast scenarios are described below.

The IFP's scenario one is titled 'Smooth Sailing'. The global world is relatively calm, and free markets and democracy are the generally accepted model for institutions. Global trade is growing as well as transportation and communication. To solve world problems, global actors cooperate for resolution. The environment continues to deteriorate as energy demands rapidly expand. Some groups exist that oppose the "westernization" of the world. These groups have access to weapons of mass effect (WME) and work to exploit vulnerable areas and governments. Military space operations are less of a priority than civil applications as an international space consortium emerges to advance the development of civil space infrastructures and an open space environment to support trade and commerce. Companies in the space industry face increasing competition that spawns increased innovation, increased competition, and thus, lower costs and improved quality. The cost of access to space is drastically reduced. Smooth sailing is the most favorable condition for thriving growth of commercial space industry at the global level (OECD 2004; OECD 2005).

Scenario two is titled ‘Back to the Future’. During the next two decades, economic power is centered in three geographic locations: the US, Europe, and China. Europe’s and the U.S.’s economic powers weaken as China rapidly advances pushing back against western values. The world geopolitical power is bipolar with the US and Europe cooperating and China and Russia cooperating. Bi-polar power rivalries seep into all cross-political issues. Access to natural resources is highly competitive and an issue of national strategy. Social tensions heighten as multiple nation’s budget deficits pit internal groups against each other. Dependence on fossil fuels continues to be high. With high use of fossil fuels and minimal global cooperation to address greenhouse gas emissions, the environment deteriorates further. Technological advancement is restrained due to difficult economic conditions and military inspiration of technology development is given priority over commercial development. The space sector will benefit from national budgets that favor military applications. Commercial applications will expand with pursuit of lowering the cost of space access and dual-use technologies, but at a slower pace due to international tensions. Civil space applications will focus on the creation of “soft national power” or national prestige and those that serve regional economic uses. A national protectionist theme of the space sector is dominant and markets are protected as technology transfers highly regulated. Because of the blocs pursuing their own strategic interests, commercial space industry development and growth is strong but slower than the first scenario (OECD 2004; OECD 2005).

Scenario three is titled “Stormy Weather”. Strong geopolitical disagreements persist and the US acts increasingly unilaterally to primarily protect only its own interests. On the political front, ethnic conflicts and terrorism persist, mostly in Asia and the Middle East. Nations turn their policies increasingly towards protectionism. One the economic front, trade disputes weaken the World Trade Organization (WTO) that in turn, exacerbates economic and financial crises around the world. With lower economic growth, energy demand is not as robust but security of supply is a primary concern. The quest for alternative energy sources becomes a higher priority. On the environmental front, the environment deteriorates with sporadic regional agreements limiting greenhouse gas emissions. Technology innovation is further suppressed as military space takes on a greater vital national interest and dominates over the push to commercialize space. Civil space applications are limited to those delivering immediate benefits. Commercial space applications are the byproducts of military space. Private commercial space investment is restrained due to the high risk and high upfront cost of access to space. Regional political barriers restrain robust development of other segments of commercial space yielding stormy weather scenario, the lowest growth scenario of the commercial space industry (OECD, 2004; OECD, 2005).

Economic Forecasts of Commercial Space Industry’s Growth to 2030

Numerical estimates of commercial space industry are not available and difficult to project due to the commercial space technologies that have not yet been invented. However, one could use the growth of commercial space travel as a proxy for commercial space industry growth and apply it to the three OECD scenarios. Estimates for increased commercial space travel range from $1 to 1.6B over the next decade (McKinley, 2012; Nield, 2012). The Tauri Group (2010) estimated demand for suborbital reusable vehicles for the next decade. Of the eight categories of suborbital reusable vehicles, 80% of the predicted trips are for commercial passenger spaceflight. The second largest area of suborbital reusable vehicles demand is for basic and applied research funded by research non-profits, universities, and commercial firms, representing 10% of future demand. The remaining 10% of demand is predicted to be from satellite deployment, education, aerospace technology test and demonstration, and media and public relations (The Tauri Group, 2010). Using these forecasts and combining them with the scenarios, one could estimate growth in demand on two ends of the spectrum: a low of 18% growth rate for the stormy weather scenario and a high of 40% growth rate for a smooth sailing scenario out to year 2030. A back to the future demand growth would fall somewhere in between 18% and 40%. Using these growth rates as a substitute for the back to the future and smooth sailing scenarios, one can construct the projected composition of the economic value of the space industry in the two extreme scenarios (Table 3). It is this baseline and enhanced growth final demand changes that will be used with Input Output (IO) analysis to project the impact on the industries in the U.S. economy.

Table 3. *Forecasts for the commercial space industry economic value based on the International Futures Programme.(billions of current dollars)*

	Smooth Sailing (40% growth)	Stormy Weather (18% growth)
Satellite Services	67.2	56.6
Satellite Manufacturing	8.7	7.3
Launch Industry	2.7	2.2
Ground Equipment	33.4	28.3
Total	112.0	94.4

Methodology

Input Output Table Basics

The methodology to determine the economic impact was used and published by Whealan-George (2012).

> “Input-Output (IO) analysis was developed by Wassily Leontief in the 1930s was a new method of analyzing the interdependence of industries within an economy for which he was awarded the Nobel Peace Prize in 1973 (Miller & Blair, 2009). “Input-Output analysis is a practical extension of the classical theory of general interdependence which views the whole economy of a region, a country, and even of the entire world as a single system and sets out to describe and to interpret its operation in terms of directly observable basic structural relationships” (Leontief, 1966, Leontief, 1987 p. 860). Leontief’s (1936) applied paper on input-output relations in the US is recognized as the beginning of a major branch of quantitative economics (Rose & Miernyk, 1989).
>
> Because the inputs of one industry come from the outputs of another, IO tables enable users to trace where each industry uses the product of another industry and how a change in final demand in as little as one industry can impact the each other industry’s output. Economic interdependencies can be described though the industry accounting and relationships between industries can be determined through analyzing an economy’s IO accounts. In short the IO model can be referred to as an impact model, tracing specified changes in final demand through the economy.
>
> To recognize the inter-industry demand relationships, IO transactions tables are created by rows and columns of data that create a matrix of linear equations. Each row or equation in the matrix generally represents one industry or sector of the economy. The equation for each row describes the total value of that industry’s output as the sum of all the value of that industry’s output sold as final demand, the value of the industry’s output used in its own production process, and the value of the industry’s output that is sold as an input to other industries. If x is the total output from industry i, z is the intermediate output used as inputs required from industry for that industry in all other industries 1 through n, and f is the final demand of i’s output, each row’s equation can be represented as Equation 1 below. Final demand columns are included in the matrix that detail which sectors of final demand the industry output terminates. These final demand sectors are the major GDP accounts: personal consumption, gross private domestic investment, government purchases, and net exports (exports minus imports).
>
> $$x_i = z_{i1} + \ldots + z_{in} + f_i \qquad (1)$$
>
> Each column of the matrix represents what inputs are required from all the other industries in the economy to produce each industries output. The equation for each column describes the total value of an industry’s required inputs as the sum of all the inputs that are needed from each industry, inputs needed from its own industry, and value added inputs to total production. If x is the total value of inputs needed from industries 1 through n for that industry plus value-added for that industry, each column’s equation can be represented as Equation 2 below. Value added includes labor wages and profits, depreciation of capital, and taxes (George & Taylor, 1995, Miller & Blair, 2009.
>
> $$x_i = z_{1i} + \ldots + z_{ni} + va_i \qquad (2)$$
>
> Using national income and product accounting rules, the value of gross national income (va_i) less the final demand (f_i) is equal to the intermediate consumption or production (x_i) which is considered the is the core of the mathematical depiction of the

interrelatedness of the industries in the economy. This matrix of simultaneous equations represents the total accounting for production in the economy for one year.

The IO table can be manipulated by simulating a change in one or more industries, typically represented as a change to final industry demand(s), to trace its expected effects in all the other industries (George & Taylor, 1995). This manipulation is essentially solving a matrix algebraic problem of the number of industries or sectors by 1 vector representing the changed final demand(s) using numerical analysis software and noting the resulting vector representing the change in output for each industry. Changes in one industry affect other industries and are allowed to feed back on the original industry until the disequilibrium from the shock significantly dampens (Min Tam, 2008; Polenske, Robinson, Hong, Moore, & Stedman, 1992; Pereira & Polenske, 1996).

IO analysis is useful for descriptive analysis, forecasting, and assessment of policy impact scenarios. IO models usefulness is the ability to estimate the indirect impacts of a final demand change by detailing the interdependency of the economy's industry. Isard et al. (1998) maintains that because of IO's interdependency of industry capabilities, it is an indispensable part of impact research. IO models produce a multiplier index that is useful in measuring the total impact of a change in final demand on inter-industry demand that can be used for forecasting, and by extended application, employment impacts (Stimson, Stough, & Roberts, 2002).

IO accommodates or accounts for three types of effects or impacts in the economy: direct, indirect, and induced. Direct impacts are those affects from business activity. Indirect impacts are those caused by inter-industry changes in business. Induced effects are those impacts created by the household sector spending of those employed by the direct and indirect altered industries (Miller & Blair, 2009). Since the IO approach accounts for changes of inputs to industries based on changing outputs of industries, it is possible to achieve a more precise calculation of the impacts of a given or potential change in the economy. "Input output analysis can be thought of as documenting and exploring the precise systems of inter-industry exchange through which different components of regional product become different components of regional income" (Bendavid-Val, 1972, pp. 87-88). From IO analysis, one can get a comprehensive description of the inter-industry structure of an economy where strategic industries and opportunities for income and/or employment impacts can be analyzed."

Input Output Analysis Tables

The FAA AST developed and published an economic report based on the impact of commercial space transportation in 2010 (Federal Aviation Administration, 2012). However, this FAA AST report uses impact measures that are a decade old. The industry has grown and with new technology, the inter-industry relationships reflected in an updated input output table is appropriate to use.

World Input Output Database (WIOD)

Country-by-country IO tables are the inputs to the WIOD. Typically, each country releases a complete IO table every five years and rarely revises the table. Comparing results from analysis from one IO release to IO another release is statistically unwise as industry classification schemes, methodologies, and accounting rules change over time and between countries. However, in the construction of the WIOD, each country's supply and use tables (SUT) and the national accounting system (NAS) was benchmarked in order to make the accounts internationally consistent and appropriate for time series comparisons (Timmer, 2012a). The WIOD industry classification has 59 products within 35 industries. Industry classifications were defined according to the definitions used in the EU KLEMS database that incorporates the International Standard Industrial Classification (ISCS) definitions (Timmer, 2012b). EU KLEMS stands for European Union capital (K), labor (L), energy (E), materials (M), and service (S) (European commission, 2012a). The ISCS codes also correspond with the Statistical Classification of Economic activities in the European Community most commonly referred to as NACE (Nomenclature des Activites Economiques dans la Communaute Europeenne) (European commission, 2012a; European commission, 2012b).

The ISCS is published by the United Nations to classify economic data and facilitate statistical analysis of output and productivity across countries. It quantifies commercial space manufacturing as the manufacture of spacecraft and launch vehicles, satellites, planetary probes, orbital stations, and shuttles. The manufacture of telecommunication equipment for satellites is also included in the manufacturing account. It quantifies the commercial space services as the transport of passengers or freight by air or via space whether by regular services or private charter while excluding the repair of aircraft or aircraft engines and their support activities, the operation of airports, and activities that make use of the aircraft for other than transportation (crop dusting, aerial advertising, or aerial photography) (United Nations, 2008). ISCS definitions for ATS is consistent with the North American Industry Classification Strategy (NAICS) published by the United Nations that also classifies economic data and facilitate statistical analysis of output and productivity across countries (U.S. Census Bureau, 2012).

The data from the forecast will be used as the change in final demand vector for the IO analysis. The change in satellite manufacturing, launch industry, and ground equipment are reflected in the change in the final demand of U.S. transport equipment manufacturing industry. The change in satellite services is reflected in the change in the final demand of U.S. air transportation services industry.

Results Extracted from WIOD

The commercial space sector currently represents approximately 0.6 % of total U.S. economic output. A smooth sailing outlook of a 40% growth in the commercial space industry was used to predict industry-by-industry changes. Table 4 shows the industries affect by most affected to least affected as measured by percentage gain/loss of output within that industry. The scenario using a slower growth rate of 18% predicted less economic impact but the same industry rankings.

Mathematically, the resulting change vector (x) is calculated as $(I-A)^{-1} f = x$. (I-A)-1 is known as the Leontief inverse or the total requirements matrix in IO analysis (Blair & Miller, 2009). The total requirements matrix creates a series of equations that detail the dependence of each of the gross industry outputs in the values of each of the industry final demands. F is the change vector that indicates the additional growth in the services and manufacturing industries as a result of 40% growth in the commercial space sector and 0% for each other industry, thus isolating the resulting changes to industry demand attributed to the U.S. commercial space industry growth. X is the resulting vector that indicates the change in output from each industry as a result of the U.S. commercial space industry growth.

The results show a breakdown of the resulting change in industries' output, some positive and some negative. Table 4 details the IO analysis prediction in output changes to U.S. industries as a percentage of the each industry's output, ranked from most positively affected to most negatively affected.

Some logical expectations result. Industries predicting significant growth as a result of growth in commercial space industry are: basic and fabricated metals; mining and quarrying; rubber and plastics; agriculture; air transport; and inland transport. The industries showing significant negative results from growth in the U.S. commercial space industry were: machinery, electricity, gas and water supply, education, wood products, other transport; other non-metallic minerals, and water transport. Leather industry predicted a huge decrease which may be a corruption in the data for that industry as it is not logical.

Table 4. *Rankings of industries most affected by a change in U.S. Commercial Space Industry (CSI) output.*

Industry	Change in Industry output as a result of CSI growth (millions of $$)	Change in Industry output as a percentage of total industry output from
Basic Metals and Fabricated Metal	0.9068	0.1436
Mining and Quarrying	84.0745	0.0879
Rubber and Plastics	8.3559	0.0455
Agriculture, Hunting, Forestry and Fishing	24.2107	0.0363
Air Transport	17.4188	0.0235
Inland Transport	24.7325	0.0227
Hotels and Restaurants	23.5881	0.0040
Electrical and Optical Equipment	5.4054	0.0039
Pulp, Paper, Paper , Printing and Publishing	3.5538	0.0028
Coke, Refined Petroleum and Nuclear Fuel	3.9586	0.0026
Retail Trade	19.6026	0.0019
Transport Equipment	3.8726	0.0017
Other Community, Social and Personal Services	2.4773	0.0005
Renting of M&Eq and Other Business Activities	1.3793	0.0002
Health and Social Work	1.7483	0.0001
Construction	-0.7917	-0.0001
Public Admin and Defense; Compulsory Social Security	-4.7961	-0.0002
Post and Telecommunications	-0.5914	-0.0002
Real Estate Activities	-4.4356	-0.0003
Financial Intermediation	-2.4711	-0.0003
Food, Beverages and Tobacco	-9.1468	-0.0021
Textiles and Textile Products	-0.4473	-0.0033
Manufacturing, Nec; Recycling	-2.3758	-0.0035
Chemicals and Chemical Products	-6.1627	-0.0039
Wholesale Trade and Commission Trade	-19.4615	-0.0042
Private Households with Employed Persons	-0.9814	-0.0067
Sale, Maintenance and Repair of Motor Vehicles & Motorcycles; Retail Sale of Fuel	-11.4962	-0.0067
Machinery, Nec	-19.9147	-0.0198
Electricity, Gas and Water Supply	-40.8843	-0.0206
Education	-44.5307	-0.0221
Wood and Products of Wood and Cork	-3.5777	-0.0919
Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	-36.9526	-0.2320
Other Non-Metallic Mineral	-14.8256	-0.2496
Water Transport	-158.5771	-1.3007
Leather, Leather and Footwear	-997.5198	-302.8195

Conclusion

Given that the commercial space industry is at the beginning of significant growth and maturing, IO analysis is useful to predict what industries will benefit from its growth and inform the government that may want to use this information in their policy or public investment decisions. Future research would be beneficial to identify cluster industries to the commercial space industry. Further, input output satellite accounts can be linked to the output tables to describe changes in energy use, pollution affects, and income inequality. Full use of the WIOD could expand analysis to incorporate imports and exports to 40 countries.

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