

Benchmark Update of the Regional Input-Output Modeling System

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Introduction

The Bureau of Economic Analysis (BEA) released a benchmark update of the Regional Input-Output Modeling System (RIMS II) multipliers on August 29, 2019. This benchmark update, occurring every 5 years, follows the release of the detailed 5-year estimates from the BEA supply-use tables (also known as input-output tables). All the data sources are updated in the benchmark year, including 2012 supply-use data, 2017 regional data, 2011–2015 commuting patterns, and 2017 personal spending rates.

RIMS II multipliers are a useful tool for estimating the local impact of incremental changes to the local economy. Specifically, RIMS II can be used to analyze how spending will ripple through county, state, or regional economies. The RIMS II multipliers can be used by local planners, investors, and policymakers to help assess the potential economic effects of a new corporate headquarters, a highway project, or a new bakery. For example, a bakery might buy eggs locally and cake boxes from afar. If a new corporate neighbor starts ordering lots of cakes, the bakery will spend more money in the local economy on eggs, but its increased box spending goes outside the region. Bakery workers and egg farmers benefiting from these increased sales and wages will spend more money, perhaps on eating out or entertainment.

As a relatively straightforward linear model, RIMS II complements other more complex models and studies and allows users to identify potential differences in model assumptions. The multipliers are free of licensing restrictions, can be freely shared, and have an open methodology. This facilitates transparency in impact studies.

Highlights

Highlights from the 2017 update of the RIMS II model are as follows:

- Service sector multipliers generally increased relative to manufacturing multipliers, especially in large metropolitan areas
- Household spending rates decreased in all states, putting downward pressure on household spending impacts (Type II multipliers)
- The share of imports increased, putting downward pressure on the multipliers

A previous *Regional Quarterly Report* in the October 2019 issue of the *Survey of Current Business* provided a summary description of the update. This report provides a more detailed description of the changes to the data sources and discusses the effects on the RIMS II multipliers. It concludes with a brief discussion about future work in the RIMS II program.

New National Data

Supply-Use data. The supply-use tables (SUTs), which are at the core of the RIMS II model, have been updated to 2012 data, from the 2007 data. The SUTs use data from the Census Bureau 2012 Economic Census, which is the most detailed and comprehensive data on industry structure available. It is collected every 5 years and provides business data classified by more than 400 North American Industry Classification System (NAICS) codes.

North American Industry Classification System (NAICS). While not directly affecting the multipliers, the benchmark update provides RIMS II the opportunity to incorporate revised NAICS codes. NAICS codes are periodically updated to expand detail and coverage in growing or evolving sectors of the economy. The benchmark updates RIMS II to the 2012 NAICS code definitions used in the SUTs. RIMS II also adjusts its industry definitions to capture the 2017 NAICS codes used in the BLS QCEW.

The SUTs consist of two tables; the supply table shows the primary and secondary production of industries while the use table shows the goods, services, and labor needed for that production. The inter-industry relationships from the SUTs, including information on personal consumption expenditures, industry spending on intermediate inputs, compensation, and the share of imported goods and services, are used to estimate how changes in an industry's production will impact the rest of the economy. For example, the SUTs provide baseline data on how much a fruit cannery spends on fruit, cans, utilities, and labor per dollar of output. It also shows purchases of that canned fruit by other industries and final users, such as restaurants or households. These baseline data are required by the RIMS II model to estimate how goods and services move through the economy to final users.

Intermediate inputs

Intermediate input share in the SUTs is defined as an industry's non-labor costs as a share of total production. In this update, the U.S. share of domestic non-labor costs of production to output for all industries fell by 0.6 percent, from 40.8 percent in the 2007 SUTs to 40.6 percent in

the 2012 SUTs (table 1). The small 0.2 percent decline for all manufacturing industries results from offsetting changes in durable and non-durable manufacturing. The durable goods share decreased 4.7 percent from 51.0 percent to 48.6 percent while the non-durable goods' share increased 3.1 percent from 53.4 to 55.1 percent. Lower intermediate inputs per dollar of output tend to decrease Type I multipliers by decreasing the amount businesses re-spend within the economy through their non-labor business expenses.

Table 1. Intermediate Inputs as a Share of Industry Output
[percent]

Industry	2007	2012	Percent change
All industries	40.8	40.6	-0.6
Manufacturing	52.2	52.1	-0.2
Durable	51.0	48.6	-4.7
Non-durable	53.4	55.1	3.1
Services	37.0	36.5	-1.3

Compensation shares

The U.S. share of compensation to output for all industries fell from 27.7 percent in 2007 to 26.8 percent in 2012, a 3.2 percent decline (table 2). The change was largest in the non-durable goods sector where the share of compensation fell 15.7 percent, from 12.1 percent to 10.2 percent. Lower compensation shares decrease the Type II (household spending impact) multipliers as workers receive less of each dollar of extra output and have less to spend. It is important to note that compensation share, roughly payroll expenses, is not a salary or wage rate. The compensation share will be the same whether it is paid to a few highly-paid employees or many low-paid employees. A fall in compensation share simply means that less compensation is required for a given amount of production, whether because of mechanization, productivity gains, or lower wages.

Table 2. Compensation as a Share of Industry Output
[percent]

Industry	2007	2012	Percent change
All industries	27.7	26.8	-3.2
Manufacturing	17.6	15.9	-9.9
Durable	23.0	22.4	-2.5
Non-durable	12.1	10.2	-15.7
Services	31.8	31.0	-2.5

Business profits are what remain after intermediate costs, compensation to employees, and income to proprietors are subtracted. Business profits are a leakage¹ in RIMS II and increased profits tend to decrease multipliers.

$$\text{Business profits} = \text{output} - \text{intermediate inputs} - \text{compensation} - \text{proprietors}$$

RIMS II excludes the impact of business profits since profits cannot generally be assigned to a region or time period. For example, business profits could be retained or saved, distributed to shareholders in other regions, or held by retirement funds that will not pay out in the current period.²

Import matrix

Imports and exports are both accounted for in the SUTs, but the import shares have a greater impact on the RIMS II estimates. Adjusting for imported goods and services is necessary since increased import shares tend to reduce multipliers. Higher import shares mean more imports and fewer domestic goods are used in production. RIMS II is not able to determine if an imported product, such as a car part, is more likely to be used by businesses, households, or other specific sectors of the economy. Therefore, the RIMS II model, like the SUTs, assumes that all purchasers will buy imported car parts and domestic car parts in proportion to their availability in the economy. In the case of car parts, the RIMS II model assumes that businesses use a mixture of domestic and imported parts equivalent to the overall market shares of imported and domestic parts. However, industries that generally use high shares of imported raw materials and supplies will have a smaller impact on other domestic industries because fewer domestic inputs are needed. This means that a coffee roastery, processing typically imported beans, may have less of an impact than a fruit cannery that may purchase local fruit.

Import share is measured as the imported goods and services content share of industry output. For example, table 3 shows that 12.1 percent of the goods and services in a domestically-produced durable good, such as a dishwasher, were imported in 2012, up from 11.4 percent in 2007. Overall, the import share for all industries increased 1.5 percent at the U.S. level, showing that more imports were used in domestic production. The increase was highest in non-durable manufacturing where the import share rose 11 percent, from 15.1 percent in the 2007 SUTs to 16.8 percent in the 2012 SUTs. Services, which generally use fewer goods as inputs to production, had an import share of 2.3 percent, unchanged from the 2007 SUTs. As mentioned above, increased import content in production tends to lower both the Type I and Type II multipliers because spending at local producers is replaced by spending at non-local producers.

Table 3. Import Content of Industry Output

[percent]

Industry	2007	2012	Percent change
All industries	4.9	5.0	1.5
Manufacturing	13.2	14.6	10.4
Durable	11.4	12.1	6.1
Non-durable	15.1	16.8	11.0
Services	2.3	2.3	0.0

Personal (household) consumption expenditures

Personal consumption expenditures (PCE) in the SUTs are national-level estimates of the goods and services bought by households. The RIMS II model uses the SUTs' national pattern of household spending as its baseline pattern of household spending. Separate from changes in the share of imports purchased by households and businesses, changes in the mix of products and

services purchased by household will impact the regional Type II multipliers. For example, if the new PCE data show a nation-wide increase in household spending on oranges and a decrease in potatoes, multipliers for Idaho would decrease as Idaho households switched to buying Florida oranges instead of local Idaho potatoes. In this case, consumer spending patterns have shifted away from what the local economy can produce.

Table 4 shows the import-adjusted share of household spending on goods and services. Domestically manufactured goods, as a share of household spending, fell 4.1 percent from 16.6 percent in 2007 to 16.0 percent in 2012. This change was largest in durable goods where the share of domestic durable goods in PCE decreased 17.1 percent from 5.2 percent to 4.3 percent. Household spending on services, a growing part of PCE overall, increased 1.6 percent from 80.9 percent in 2007 to 82.2 percent in 2012.

Table 4. Import Adjusted Personal Consumption Expenditures Shares by Commodity
[percent]

Commodity	2007	2012	Percent change
All commodities	100.0	100.0	0.0
Manufactured goods	16.6	16.0	-4.1
Durable goods	5.2	4.3	-17.1
Non-durable goods	11.4	11.6	1.9
Services	80.9	82.2	1.6

New Regional Data

The national-level SUTs data are complemented by county-level data from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW). QCEW data are used to regionalize the RIMS II model by determining which industries exist in a region and the ability of those industries to supply additional goods and services to local firms. Five-year data on commuting patterns from the American Community Survey (ACS) regionalize labor by determining which industries have high rates of employees commuting into the region for work. Together, the QCEW and ACS data allow RIMS II to better measure how a project will impact the local economy and local employees.

Employment and Wage Data

While the SUTs data provide national-level industry relationships, data from the QCEW provide RIMS II with a regional dimension. The RIMS II model uses 2017 QCEW data to estimate how self-sufficient a region is; that is, whether increased demand for goods and services can be satisfied locally or if the goods and services must be imported. The RIMS II model assumes that if an industry's share of the region's economy is at least as large as the industry's share of the U.S. economy, then all increased demand can be supplied locally. Otherwise, the local share of the increased demand is scaled back proportionally. This measure of regional self-sufficiency is known as a location quotient and drives much of the differences in multipliers between regions. Updated state-level wage rates by industry are also used to regionalize national-level data and reflect regional variation in the number of employees used to produce a given amount of output.

Commuting data

In the same way QCEW data are used to estimate regional self-sufficiency for industries, ACS commuting data from the Census Bureau are used to estimate regional self-sufficiency for workers. The ACS provides RIMS II with county-level worker commuting patterns by industry. While the RIMS II model always assumes that workers will be freely available for any increased demand, it also assumes that if a large share of existing workers commute into a region, additional workers will be commuters in the same proportion as existing workers. Workers who commute into a region for work, then return home, reduce the induced, or household spending effect, in the multipliers. This is because the RIMS II model assumes that workers spend most of their earnings in the region where they live.³ The commuting adjustment in RIMS II is the reason that RIMS II recommends the use of an entire commuter shed for estimating regional impacts. The new 5-year commuting data show that the county average share of workers who live and work in the same county fell 2.2 percent (table 5). The average for the period 2006–2010 was 78.7 percent, falling to 77.0 percent for the period 2011–2015.

Table 5. American Community Survey 5-year Commuting Patterns
[percent]

	2006 - 2010	2011 - 2015	Percent change
Percent of workers who live and work in the same county, mean of counties	78.7	77.0	-2.2

Personal spending rates

Regional personal spending rates adjust how much of additional household wages are spent in the local economy. The RIMS II model uses the BEA 2017 state-level tax rates and 2017 national-level savings rates to calculate a state specific spending rate, which modifies the Type II induced impacts from household spending. This adjustment recognizes that state taxes and personal saving change the amount of earnings that households can spend. Decreases or increases in the personal spending rate decrease or increase Type II induced impacts in the model. It is important to recognize that the spending rate is not a spending level; it is the share of additional income that is spent. Household spending can increase even while the spending rate decreases if household income increases enough.

The update shows that spending rates decreased in each of the fifty states and the District of Columbia. At the U.S. level, spending rates decreased 1.9 percent from 83.4 cents of every additional dollar of income spent to 81.8 cents (table 6). An increase in the national savings rate from 4.9 percent in 2016 to 7.0 percent in 2017 is the primary factor in the lower spending rates. Additional variation between states occurs due to differences in effective federal, state, and local tax rates. Looking at states, the largest change in spending rates is in North Dakota where the rate fell 2.4 percentage points to 83.7 percent. The smallest change was in New York where the rate fell 0.6 percentage points to 78.4. Mississippi had the highest spending rate at 85.3 percentage points while New York had the lowest spending rate at 78.4 percentage points.

Table 6. Spending Rates, U.S. and States

State	2016	2017	Difference	Percent change
	[percent]			
United States	83.4	81.8	-1.6	-1.9
Alabama	86.0	84.0	-2.0	-2.3
Alaska	86.8	85.2	-1.5	-1.7
Arizona	85.5	83.6	-1.9	-2.2
Arkansas	85.8	83.8	-2.0	-2.3
California	81.4	79.8	-1.6	-2.0
Colorado	83.1	81.0	-2.0	-2.5
Connecticut	80.2	79.1	-1.2	-1.5
Delaware	84.5	82.3	-2.1	-2.5
District of Columbia	80.7	79.1	-1.6	-2.0
Florida	84.6	83.6	-0.9	-1.1
Georgia	84.4	82.7	-1.6	-1.9
Hawaii	84.9	83.0	-1.8	-2.2
Idaho	85.5	83.5	-2.1	-2.4
Illinois	82.9	81.5	-1.4	-1.7
Indiana	85.2	83.3	-2.0	-2.3
Iowa	84.9	83.0	-1.9	-2.2
Kansas	85.4	83.5	-1.9	-2.2
Kentucky	84.8	83.0	-1.8	-2.1
Louisiana	86.6	84.4	-2.1	-2.5
Maine	85.2	83.2	-2.0	-2.4
Maryland	82.3	80.6	-1.7	-2.0
Massachusetts	80.3	78.8	-1.5	-1.8
Michigan	84.2	82.1	-2.1	-2.5
Minnesota	81.8	80.2	-1.6	-2.0
Mississippi	87.2	85.3	-2.0	-2.2
Missouri	84.4	82.6	-1.8	-2.1
Montana	84.6	83.1	-1.4	-1.7
Nebraska	85.2	83.4	-1.8	-2.2
Nevada	85.2	82.8	-2.4	-2.8
New Hampshire	85.1	83.2	-2.0	-2.3
New Jersey	82.0	80.3	-1.7	-2.0
New Mexico	86.6	84.8	-1.8	-2.1
New York	79.0	78.4	-0.6	-0.8
North Carolina	84.3	82.4	-1.8	-2.2
North Dakota	86.0	83.7	-2.4	-2.8
Ohio	84.6	82.8	-1.9	-2.2
Oklahoma	86.0	84.5	-1.5	-1.8
Oregon	82.6	80.7	-2.0	-2.4
Pennsylvania	83.8	82.1	-1.7	-2.0
Rhode Island	84.3	82.4	-1.9	-2.2
South Carolina	85.5	83.4	-2.1	-2.4
South Dakota	86.3	84.5	-1.9	-2.2
Tennessee	87.0	84.9	-2.1	-2.4
Texas	85.5	84.3	-1.2	-1.4
Utah	84.5	82.4	-2.1	-2.4
Vermont	85.3	83.4	-1.9	-2.3
Virginia	83.0	81.1	-1.9	-2.3
Washington	84.8	82.5	-2.2	-2.6
West Virginia	85.9	84.3	-1.7	-1.9
Wisconsin	83.9	82.0	-1.9	-2.3
Wyoming	85.5	84.2	-1.3	-1.5

While the savings rate in RIMS II is a national rate, the RIMS II tax rate is state specific. It is also an effective tax rate rather than a nominal rate. It is calculated as total taxes paid as a share of state personal income. In Mississippi, a relatively low-income state, additional earnings are taxed at a lower effective rate than in New York, a high-income state. The model captures that New York's more highly paid employees lose more of their additional earning to taxes than Mississippi's employees, whether that is through higher tax rates or other factors. This results in Mississippi employees having more of any additional earnings to spend, that is, a higher spending rate.

Intra-industry relationships

The benchmark update to the RIMS II model also shows shifts in regionalized intra-industry relationships. Historically, RIMS II multipliers have tended to be larger for manufacturing industries where intermediate goods (mostly raw materials) were a large share of production costs. This contrasts with service industries where labor was the largest expense and there were fewer potential rounds of spending in the local economy. However, this relationship has weakened in the 2017 benchmark update. Results from the update show that in areas with large diverse service sectors, such as a metropolitan statistical areas (MSA), service industries may have larger multipliers than manufacturing industries. Relatively smaller and specialized manufacturing sectors also mean more manufactured goods are likely to come from outside a region. The reverse is true for services. Manufacturing industries in smaller regions, where the service sector may be less developed, still have larger multipliers than service sector industries. Table 7 shows this as the miscellaneous manufacturing multiplier is smaller in the District of Columbia MSA (1.1958) than it is in Butler county, OH (1.3616). Conversely, the multiplier for management of companies, a service sector industry, is smaller in Butler (1.1810) than in the District of Columbia. (1.3584). The Albany MSA, a smaller MSA than the District of Columbia, has multipliers that are in-between.

Table 7. Final-Demand Multipliers (Type I)

Region	[2007 national data and 2016 regional data]		[2012 national data and 2017 regional data]		Multiplier difference 2007/2016	Multiplier difference 2012/2017
	Miscellaneous manufacturing	Management of companies	Miscellaneous manufacturing	Management of companies		
Washington-Arlington- Alexandria, DC-VA-MD-WV Metropolitan Statistical Area	1.2482	1.3930	1.1958	1.3584	-0.1448	-0.1626
Albany-Schenectady-Troy, NY Metropolitan Statistical Area	1.3331	1.2962	1.2974	1.2612	0.0369	0.0362
Butler county, OH	1.3838	1.2043	1.3616	1.1810	0.1795	0.1806

Directions for Future Work

As part of its commitment to improving the RIMS II model and multipliers, RIMS staff have identified areas for further research. Three areas are of importance. The first is research into developing state-specific estimates of personal consumption using BEA regional PCE estimates. This would incorporate valuable regional variation into household spending patterns. The second area is the possible expansion of construction detail beyond the four construction sectors currently published in the model. Finally, RIMS staff will evaluate the feasibility of re-introducing the annual RIMS II multipliers based on the annual supply-use tables produced by BEA.

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1. A leakage in the RIMS II model is spending that is removed from the local economy by being taxed, by being saved, or by being spent outside the region, for example, when spent on imported goods.
 2. Users who wish to measure the impacts of changes in business profits should estimate the change to their region's household incomes and apply those changes to the RIMS II household multiplier.
 3. Final-demand employment estimates are also affected by commuting patterns since job impacts in RIMS II are calculated as local jobs, not local and commuter jobs, per million dollars of increased sales to final demand.