Calculating Multipliers with the REMI Model

Traditional Multipliers

Three different types of multipliers (Type I, Type II, and Dynamic) may be calculated by running a series of simulations based on specific policy variable shocks and alternative model settings. Employment and Output Multipliers may be calculated when using Industry Employment (Exogenous Production), Industry Sales (Exogenous Production) or Exogenous Final Demand policy variables.

For **Type I multipliers** (summation of direct and indirect effects), you will first need to run and save an alternative regional control forecast based on the alternative model setting 'Input-Output Processing Sector'. Then run a regional simulation based on this alternative control, and enter the desired policy variable change. To calculate the Type I employment multiplier, take the difference in Total Employment for the region and divide it by the Exogenous Industry Sales Employment or the Exogenous Industry Demand Employment (depending on which policy variable was used) for the industry and region that was shocked. To calculate the Type I output multiplier, take the difference in Total Output and divide it by the Exogenous Industry Sales or the Exogenous Industry Demand.

For **Type II multipliers** (direct, indirect, and induced effects), you will first need to run and save an alternative regional control forecast based on the alternative model setting 'Input-Output Including Endogenous Consumption'. Then run a regional simulation based on this alternative control, and enter the desired policy variable change. To calculate the Type II employment multiplier, take the difference in Total Employment for the region and divide it by the Exogenous Industry Sales Employment or the Exogenous Industry Demand Employment (depending on which policy variable was used) for the industry and region that was shocked. To calculate the Type II output multiplier, take the difference in Total Output and divide it by the Exogenous Industry Sales or the Exogenous Industry Demand.

Dynamic multipliers (full economic and demographic effects) are calculated based on the Standard Regional Control forecast, so there is no need to run and save an alternative as a first step. Run a regional simulation based on the standard control, and enter the desired policy variable change. To calculate the Dynamic employment multiplier, take the difference in Total Employment for the region and divide it by the Exogenous Industry Sales Employment or the Exogenous Industry Demand Employment (depending on which policy variable was used) for the industry and region that was shocked. To calculate the Dynamic output multiplier, take the difference in Total Output for the region and divide it by the Exogenous Industry Sales or the Exogenous Industry Demand.

Table 1 illustrates a comparison of employment multipliers by type from a single region state model of Massachusetts where 1000 employees were added to the Food Manufacturing industry (based on the traditional methodology of isolating the model responses by removing the appropriate equations). Since the Type I multipliers only include the direct and indirect effects, they are the smallest. The Type II multipliers are somewhat larger because the spending induced by the additional jobs is applied. The Dynamic multipliers are the largest because they include the investment, government spending, price, and labor supply responses.

	2018	2019	2020	2021	2022
Type I	1.5	1.5	1.5	1.5	1.5
Type II	2.0	1.9	1.9	1.9	1.9
Dynamic	2.8	2.9	3.1	3.0	3.0

Table 1. Traditional Employment multipliers from v2.3 PI+ model of Massachusetts (70 sectors) – **Three run approach**

Shortcut Multipliers

There is an alternative "shortcut" method to calculating the employment multiplier if time does not permit three separate model runs, and "approximate" values are acceptable. To calculate the three types of multipliers from a single dynamic (standard) REMI model run:

1. For Type I, use Intermediate Demand Employment plus the Exogenous Industry Sales Employment (or Exogenous Industry Demand Employment, as appropriate) in the numerator, and Exogenous Industry Sales Employment (or Exogenous Industry Demand Employment) in the denominator.
2. For Type II, use Intermediate Demand Employment plus Local Consumption Demand Employment plus Exogenous Industry Sales Employment… in the numerator, and Exogenous Industry Sales Employment… in the denominator.
3. For Dynamic, use Total Employment (including government) in the numerator, and Exogenous Industry Sales Employment… in the denominator.

Table 2 illustrates a comparison of multipliers by type based on this alternative "shortcut" methodology.

	2018	2019	2020	2021	2022
Type I	1.7	1.8	1.8	1.8	1.7
Type II	2.4	2.4	2.4	2.4	2.4
Dynamic	2.8	2.9	3.1	3.0	3.0

Table 2. Shortcut Employment multipliers from v2.3 PI+ model of Massachusetts (70 sectors) – **Single run approach**

The Type I and Type II multipliers shown here are higher than those calculated based on the proper method because the Intermediate Demand Employment and Local Consumption Demand Employment values from the standard REMI model results are not isolated to the just the response to the direct (exogenous) employment change. They also include, for example, intermediate demand responses to the consumer, investment, and government spending. Likewise, the consumption demand employment is not just a result of spending from the wages of the direct employees, but also includes spending from all of the indirect, induced, government, etc. employees.