

Comparing Employment Multiplier and Economic Migration Responses in Single vs Multi Region Models

(December 2017)

In order to answer an interesting question regarding the consistency of the REMI model's employment multiplier and economic migrant responses to a shock in a single region vs multi region model, sample simulations were run in several different geographic configurations and the results compared. In each test model, a shock of 10,000 jobs was added to the Industry Employment policy variable for the Management of Companies and Enterprises industry in the first forecast year (2016)¹. In addition, the Compensation policy variable was adjusted so that each of the 10,000 direct jobs earned a rate of \$100,000, regardless of the average rate in the region. However, the comparisons did not take into account or adjust for differences in labor productivity between the regions².

A total of nine different models were built for comparison purposes:

1. Three different size regions were chosen in order to illustrate how model responses compare in different economies.
2. Single and Multi Region models were chosen in order to illustrate how model responses compare in the primary region (of impact) versus when combined with a larger surrounding region.
3. Multi Region US models were chosen in order to illustrate how model responses compare with models where the rest of nation is excluded, as well as with the Single Region US model.

Berkshire County, Massachusetts was chosen because it is relatively small and rural (employment is 85,000 jobs in 2015, and population is 128,000 people).

Essex County, Massachusetts was chosen because it is relatively medium sized and suburban/urban (employment is 444,000 jobs in 2015, and population is 776,000 people).

The state of Massachusetts was chosen because it is a large and relatively diverse economy (employment is 4,500,000 jobs in 2015, and population is 6,800,000 people).

Table 1 summarizes the employment and economic migrant responses across the various test models. As expected, the employment multipliers vary somewhat depending on the size of the region(s), but the multiplier is quite constant for the primary region whether it is stand alone, or part of a larger multi region model. The same is true for the economic migration response.

¹ All tests were conducted with REMI PI+ v2.1 70 sector models.

² Adjusting so that the direct 10,000 jobs generated the same level of output in each region would have led to even more consistency between the multipliers. The 2015 output per employee in Essex County and the state of Massachusetts is very similar (\$208,951 and \$214,610 fixed (2009) dollars, respectively), but for Berkshire County it is only \$129,241.

Table 1. Comparison of Test Models: Shock of 10,000 jobs to Management of Companies and Enterprises in 2016, with adjustment for compensation rate to equal \$100,000 per direct job.

REMI PI+ v2.1 70 sector Model	Model Type	Direct Jobs (Primary Region)	Total Jobs (Primary Region)	Dynamic Multiplier (Primary Region)	Economic Migrants (Primary Region)	Economic Migrants as Share of Total Jobs	Total Jobs (All Regions)	Dynamic Multiplier (All Regions)	Economic Migrants (All Regions)	Economic Migrants as Share of Total Jobs
Essex County, MA	SR	10,000	20,420	2.0	6,823	33%	20,420	2.0	6,823	33%
Essex County and Rest of Massachusetts	MR	10,000	20,869	2.1	7,129	34%	30,174	3.0	9,816	33%
Essex County and Rest of US	MRUS	10,000	20,524	2.1	6,857	33%	49,509	5.0	0	0%
Berkshire County, MA	SR	10,000	18,187	1.8	2,995	16%	18,187	1.8	2,995	16%
Berkshire County and Rest of Massachusetts	MR	10,000	18,260	1.8	3,045	17%	20,346	2.0	3,683	18%
Berkshire County and Rest of US	MRUS	10,000	18,281	1.8	3,052	17%	42,249	4.2	0	0%
State of Massachusetts	SR	10,000	29,893	3.0	8,259	28%	29,893	3.0	8,259	28%
State of Massachusetts and Rest of US	MRUS	10,000	30,505	3.1	8,352	27%	50,467	5.0	0	0%
United States	SRUS	10,000	45,909	4.6	0	0%	45,909	4.6	0	0%

SR = Single Region

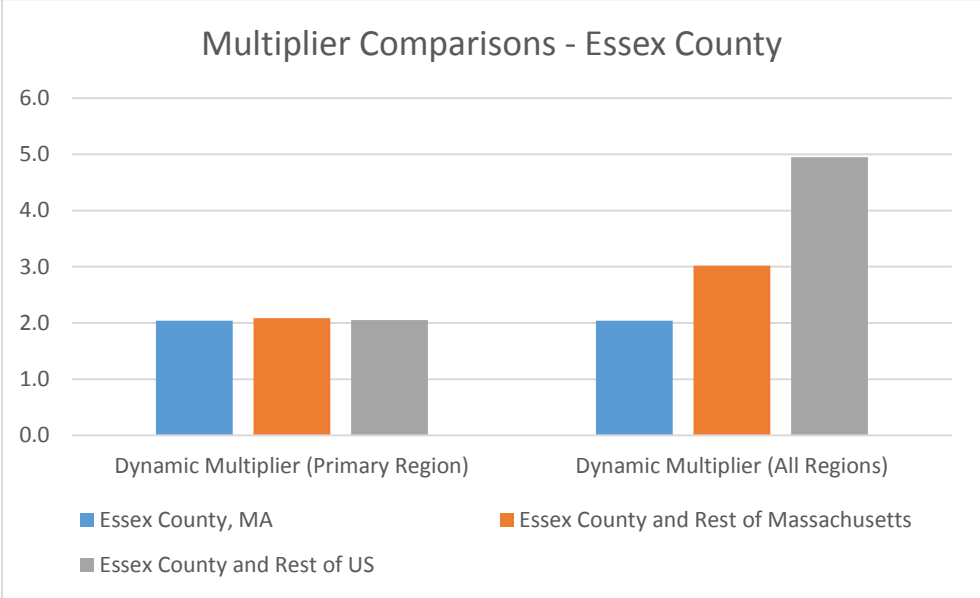
MR = Multi Region

MRUS = Multi Region US

SRUS = Single Region US

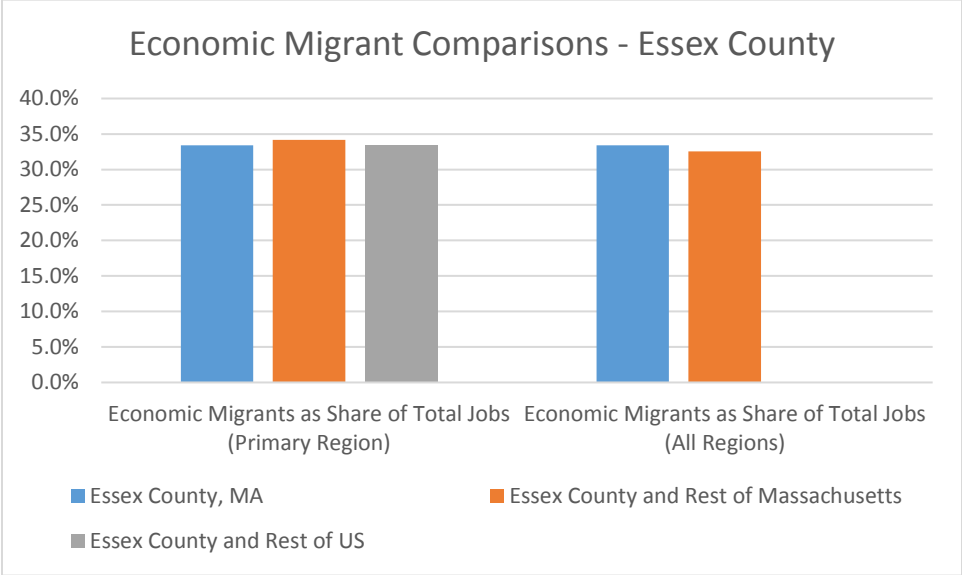
For Essex County, the dynamic employment multiplier is 2.0-2.1 whether stand alone (as a single region), part of a two region state model, or part of a two region national model. The multiplier grows to 3.0 when the entire state is considered, and 5.0 with the entire nation.

Chart 1. Essex County Employment Multipliers



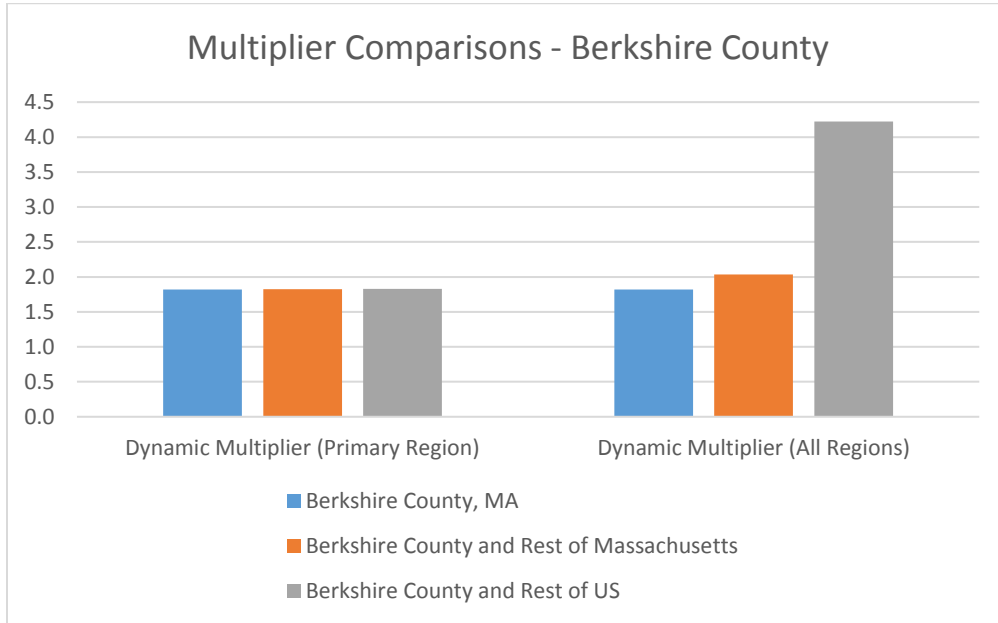
The economic migrant response, at 33-34% as a share of total jobs, is quite similar across applicable models (multi region US models do not have an economic migration response because only international migration, which is restricted by law and policy, is allowed).

Chart 2. Essex County Economic Migrants as a Share of Total Jobs



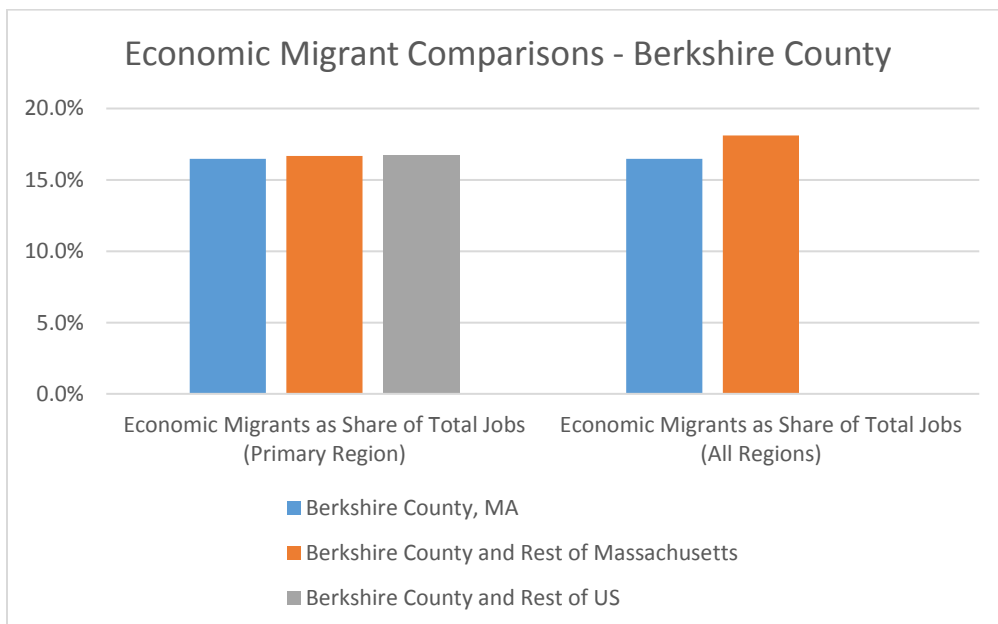
For Berkshire County, the dynamic employment multiplier is 1.8 whether stand alone (as a single region), part of a two region state model, or part of a two region national model. The multiplier grows to 2.0 when the entire state is considered, and 4.2 with the entire nation.

Chart 3. Berkshire County Employment Multipliers



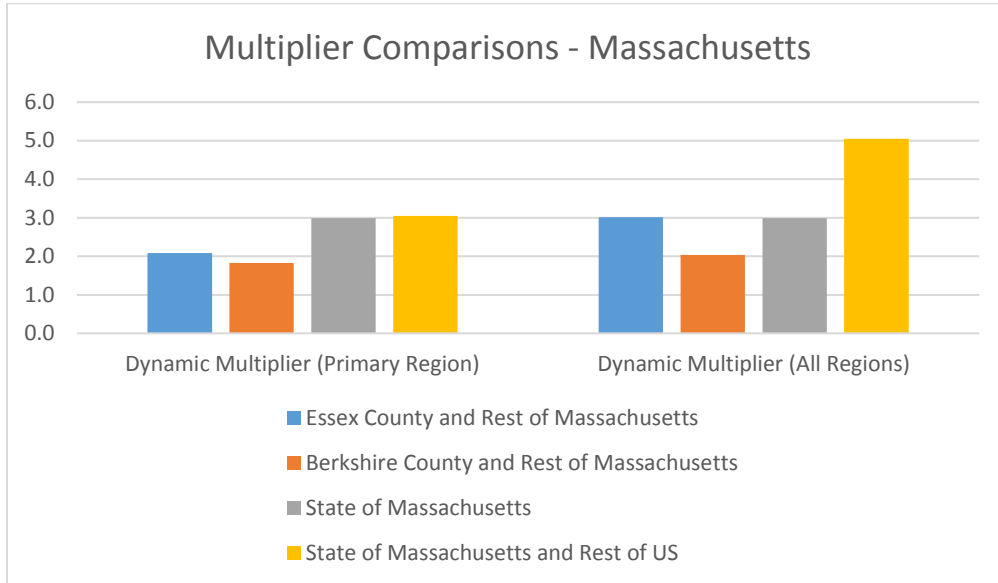
The economic migrant response, at 16-18% as a share of total jobs, is quite similar across applicable models (multi region US models do not have an economic migration response because only international migration, which is restricted by law and policy, is allowed).

Chart 4. Berkshire County Economic Migrants as a Share of Total Jobs



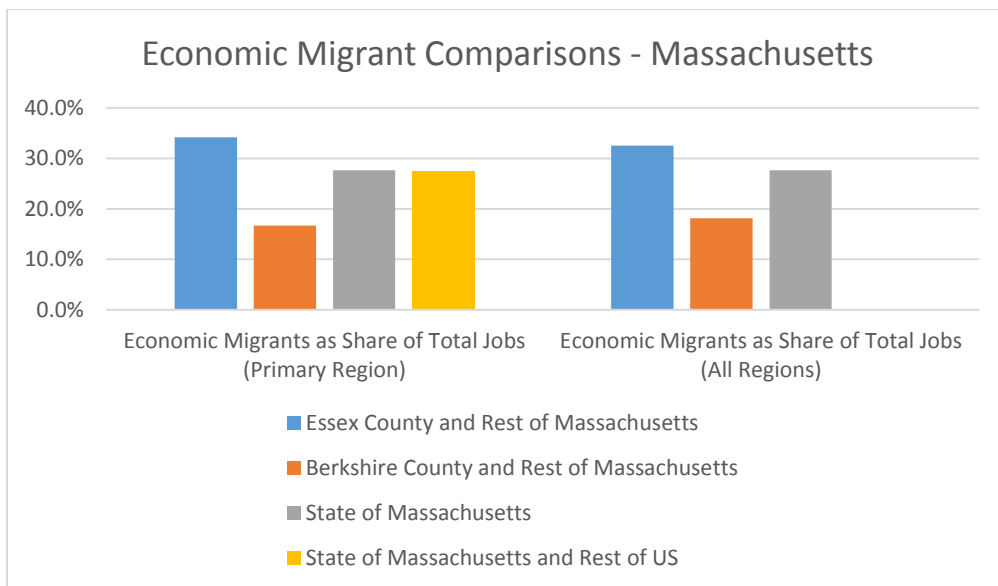
For Massachusetts, the dynamic employment multiplier is 2.0-3.1 whether stand alone (as a single region), part of a two region state model, or part of a two region national model. The multiplier grows to 5.0 with the entire nation.

Chart 5. Massachusetts Employment Multipliers



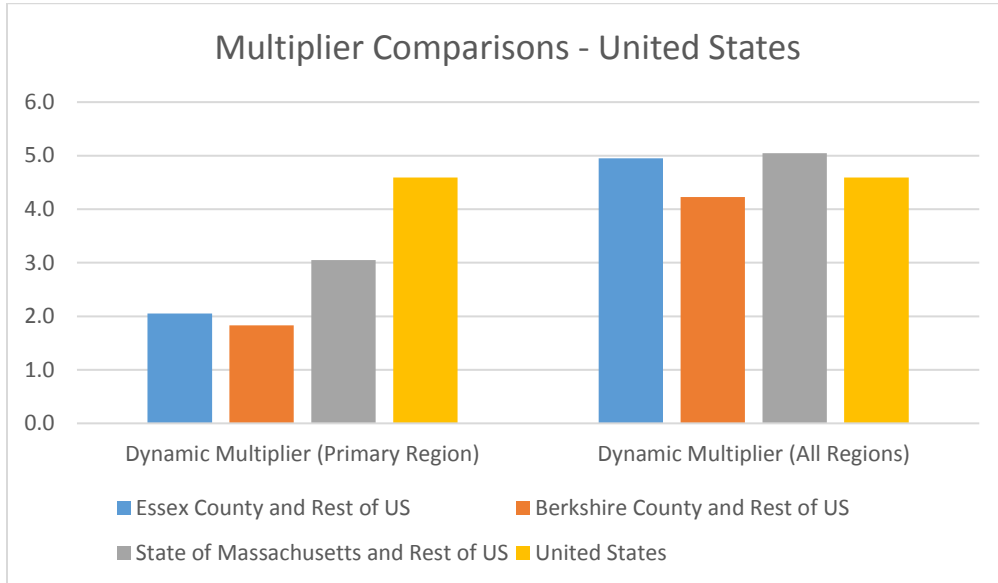
The economic migrant response, at 18-33% as a share of total jobs, varies across models and is determined by the labor demand and supply factors in addition to income and cost of living.

Chart 6. Massachusetts Economic Migrants as a Share of Total Jobs



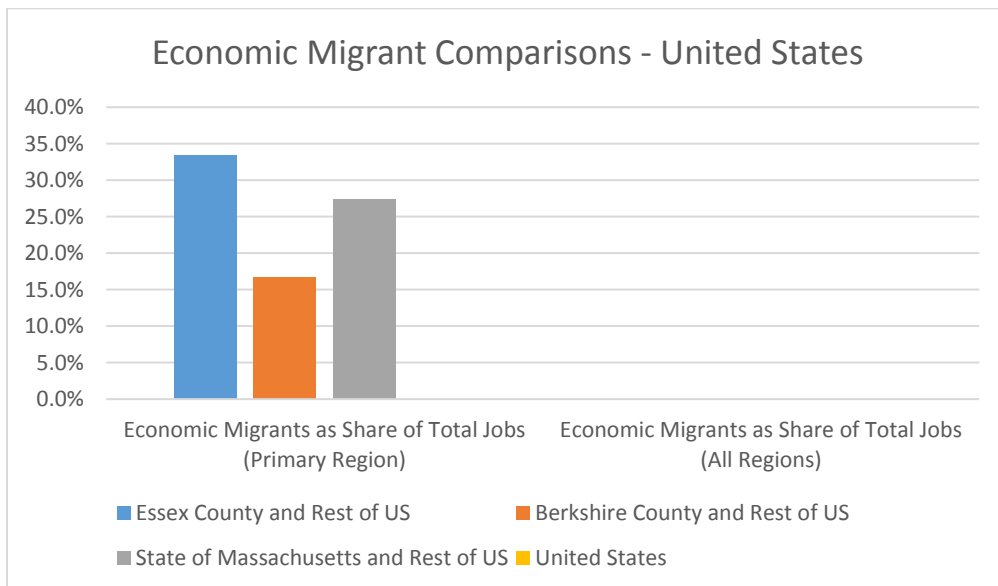
For the United States as a whole, the dynamic employment multiplier is 4.2-4.6 whether stand alone (as a single region) or part of a two region national model. The multiplier grows to 5.0 when the entire nation is considered.

Chart 7. United States Employment Multipliers



The economic migrant response is 0 for single and multi region US models.

Chart 8. United States Economic Migrants as a Share of Total Jobs



In summary, although the model responds differently to identical shocks in different geographic regions (as it should), the responses are quite similar for the same region when included in different model configurations. This holds true for both employment and economic migrants.