

**Adjusting the New Eighty-Four-Region, Seventy-Sector REMI Model
to Reflect the MDOT Long-Run Forecast**

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Introduction

The Center for Labor Market Research at the Institute for Research on Labor, Employment, and the Economy (IRLEE), University of Michigan, has generated four long-run forecasts for the eighty-three counties in Michigan over the past fifteen years, with the most recent forecast completed in early 2008 [1]. The Michigan Department of Transportation (MDOT) has since acquired a much more comprehensive REMI model for the state of Michigan [2]. This version of the model includes eighty-four regions (eighty-two counties, the city of Detroit, and the balance of Wayne County) and much greater industry detail than the model used to generate the latest long-run forecasts. MDOT requested that the University of Michigan attempt to calibrate the new model to approximate, as well as possible, the latest long-run forecast. This report documents the steps taken to adjust the new model.

Improving the Industry Estimation Procedure

The first step taken in this adjustment procedure was to provide the REMI staff with some better information on industry and wage employment to construct the new model. One of the significant challenges in the construction of any local economic model is that federal government data are subject to limits on what information can be published, in order to avoid divulging information about specific firms. In practice this means that published data on employment and wages by industry simply are not available for many industries and areas and must be estimated by the model builder. This problem is particularly acute for smaller counties, where the requirement that there be three or more business establishments present for each published industry is frequently not met. Over the past several years, ILREE researchers have been working on a methodology to estimate these missing data cells for the Quarterly Census of Employment and Wages (QCEW) data series. As part of the effort to improve the new REMI model provided to MDOT, we generated revised data estimates and delivered them to the REMI staff who then rebuilt the REMI model to incorporate these data.

An example of the effect of using the U-M data can be seen in table 1, which shows the original REMI employment estimates for the chemical manufacturing industry by county in 2001,¹ and the new estimates after the incorporation of the U-M data. In many cases the employment count

¹ The REMI employment data are based on the Bureau of Economic Analysis measure [3], which includes the self-employed as well as wage and salary workers.

is very close, but in a few cases the data are significantly different. For example, the original REMI data showed 622 employees in chemical manufacturing in Delta County, while the new REMI model shows only 62. We judge that not only does the new model include a better estimate of the historical data, but also that the model will generate better forecasts and simulation results because the new data estimates will improve the operation of the model.

Improving the National Industry Employment Forecasts

The REMI model incorporates a long-run employment forecast by industry for the entire U.S. economy. Since the performance of an industry at the national level is a critical component of the generation of local employment forecasts, it is extremely important that the U.S. employment forecast be as accurate a reflection of future reality as possible. Consequently, we decided to reevaluate the national forecast as well, and generate our own national industry employment forecasts. As shown in table 2, our total U.S. employment forecast for 2035 is very similar to the original REMI forecast, but there are large differences in the outlook for individual industries. For instance, for the utility sector, the original REMI model projects substantial U.S. employment growth over the next twenty-nine years, from 572,700 in 2006 to 700,100 in 2035, while we project that employment will instead decline to 407,500. Obviously, no one can be certain what will happen twenty-nine years into the future, but our forecast is more consistent with the historical performance in this industry, which has seen steady declines in U.S. employment since 1990.

The most important industry for Michigan, of course, is motor vehicle manufacturing, and in this case we again have a meaningful disagreement with the original national REMI forecast. This forecast shows an increase in national motor vehicle manufacturing employment, from 1,067,800 in 2006 to 1,166,300 in 2035. We do not believe this is a reasonable scenario for auto industry employment. Instead, we are projecting—conservatively, in our view—that U.S. employment will decline to 814,400 in 2035.

Different national employment forecasts will have different impacts on local economies depending upon the areas' industrial composition. A more optimistic national forecast for the furniture industry would tend to boost employment growth in Kent County, and a more pessimistic forecast for auto manufacturing would hurt employment prospects in Wayne County.

Local Area Adjustments

The local area adjustment procedure was the most complicated in-depth analysis undertaken when we generated the long-run forecasts subsequently adopted by MDOT, and we could not hope to duplicate that effort in attempting to adjust the new model. Instead, we attempted to adjust the counties using twelve selected variables for each of the eighty-four areas. The twelve variables are:

1. Number of economic migrants
2. Number of retired migrants
3. Percentage change in total compensation in all private-sector industries
4. Federal military employment
5. Federal civilian employment
6. State government employment
7. Local government employment
8. Farm employment
9. Percentage change in production costs in all private industries
10. Percentage change in production costs in auto manufacturing
11. Percentage change in production costs in electrical equipment manufacturing
12. Percentage change in production costs of machinery manufacturing

The county forecasts were adjusted using some or all of these variables, as appropriate.

Conclusion

In recalibrating the new REMI model to be compatible with the forecasts generated using the previous model, several major obstacles presented themselves, including the non-trivial differences between the two versions of the model and the fact that the new model contained seventy sectors whereas the previous model had only twenty-three. Myriad other issues had to be dealt with due to the high level of complexity of the REMI model. Obviously, matching model outputs between the two models was an impossible task. Instead, the goal was to coordinate the models so that they were as compatible as was reasonably possible for future applications, and to include a forecast for the city of Detroit that was consistent with the county forecasts. We judge the forecasts to be qualitatively similar, but the effect of the differences is beneficial: the new results are an improvement over the previous ones.

Table 1. Comparison of Original and New REMI Employment Estimates for Chemical Manufacturing by County, 2001

County	Original REMI	REMI with U-M data	County	Original REMI	REMI with U-M data
Alcona	0	0	Lake	0	0
Alger	0	0	Lapeer	393	10
Allegan	2,629	3,223	Leelanau	0	0
Alpena	0	0	Lenawee	771	814
Antrim	0	0	Livingston	232	243
Arenac	0	0	Luce	0	0
Baraga	0	0	Mackinac	0	0
Barry	0	0	Macomb	882	927
Bay	239	249	Manistee	130	141
Benzie	0	0	Marquette	43	32
Berrien	72	72	Mason	417	11
Branch	167	59	Mecosta	0	0
Calhoun	144	153	Menominee	278	17
Cass	195	70	Midland	595	471
Charlevoix	0	0	Missaukee	0	0
Cheboygan	0	0	Monroe	1,475	57
Chippewa	0	0	Montcalm	856	63
Clare	91	55	Montmorency	0	0
Clinton	132	125	Muskegon	674	699
Crawford	41	36	Newaygo	0	0
Delta	622	62	Oakland	3,287	3,453
Dickinson	49	50	Oceana	0	0
Eaton	56	57	Ogemaw	0	0
Emmet	276	2	Ontonagon	0	0
Genesee	7	7	Osceola	0	0
Gladwin	20	0	Oscoda	0	0
Gogebic	42	47	Otsego	0	0
Grand Traverse	389	147	Ottawa	1,120	1,166
Gratiot	0	0	Presque Isle	0	0
Hillsdale	180	355	Roscommon	24	2
Houghton	44	34	Saginaw	29	30
Huron	511	19	St. Clair	485	508
Ingham	522	544	St. Joseph	12	12
Ionia	553	91	Sanilac	143	10
Iosco	0	0	Schoolcraft	34	11
Iron	0	0	Shiawassee	156	21
Isabella	0	0	Tuscola	338	13
Jackson	920	102	Van Buren	321	339
Kalamazoo	3,196	9,083	Washtenaw	443	485
Kalkaska	0	0	Wayne	2,860	3,003
Kent	4,900	5,095	Wexford	343	64
Keweenaw	0	0			

Table 2. Comparison of National Employment Forecasts by Industry, Original REMI vs. U-M

Employment (Thousands)	2006	Original REMI Forecast 2035	U-M Forecast 2035	Employment (Thousands)	2006	Original REMI Forecast 2035	U-M Forecast 2035
Forestry et al.	288.3	195.9	292.1	Scenic, sightseeing			
Agriculture	725.3	1,087.1	630.6	trans; supp	658.2	526.6	768.2
Oil, gas extraction	366.5	260.4	426.8	Warehousing, storage	685.4	752.9	1,125.4
Mining (except oil, gas)	238.6	232.1	206.2	Publishing, exc			
Support for mining	282.1	309.6	333.3	Internet	1,058.6	1,154.9	908.8
Utilities	572.7	700.1	407.5	Motion picture, sound rec	465.0	610.2	450.5
Construction	11,580.0	11,394.4	11,812.7	Internet serv, data			
Wood product	636.3	822.5	493.3	proc, other	574.1	358.6	586.2
Nonmetallic mineral prod	529.1	707.0	443.8	Broadcasting, exc Int; telecomm	1,512.6	1,042.1	1,441.6
Primary metal	469.8	465.7	351.4	Monetary auth et al.	3,463.7	2,833.4	4,459.6
Fabricated metal prod	1,610.5	1,648.5	1,403.8	Sec, comm contracts, inv	2,097.4	1,146.0	2,285.2
Machinery	1,216.8	1,438.1	997.7	Ins carriers, rel act	2,906.2	3,901.7	3,312.1
Computer, electronic prod	1,323.0	770.4	1,132.5	Real estate	6,864.4	7,455.9	7,553.8
Electrical equip, appliance	450.7	329.5	393.0	Rental, leasing svcs	841.6	928.8	776.8
Motor vehicle	1,067.8	1,166.3	814.4	Prof, tech services	11,701.0	14,805.7	16,834.1
Trans equip exc. motor veh	703.9	507.3	648.2	Mgmt of companies, enterprises	1,890.7	1,281.2	2,262.4
Furniture, related prod	592.5	765.1	485.7	Admin, support svcs	10,320.6	14,961.8	14,112.8
Miscellaneous	753.7	604.2	690.7	Waste mgmnt, remed	381.3	637.3	415.9
Food	1,531.8	1,581.4	1,398.2	Educational svcs	3,700.3	6,852.5	5,012.1
Beverage, tobacco prod	206.5	238.6	191.8	Ambulatory health care	6,603.1	12,978.9	9,997.1
Textile mills	198.4	110.6	62.0	Hospitals	4,428.4	5,639.2	5,382.2
Textile prod mills	166.8	117.6	72.8	Nursing, residential care facilities	2,973.6	6,379.9	4,152.4
Apparel	278.5	103.9	66.5	Social assistance	3,611.4	6,317.7	4,775.0
Leather, allied prod	46.2	53.5	22.6	Performing arts, spectator sports	1,689.3	2,099.2	2,258.9
Paper	471.0	643.4	345.9	Museums et al.	128.5	161.1	155.5
Printing, rel supp act	699.1	727.2	543.6	Amusement, gambling, recreation	1,800.6	2,245.9	2,750.4
Petroleum, coal prod	113.0	86.7	109.8	Accommodation	1,999.1	2,614.5	2,247.1
Chemical	887.9	951.8	815.8	Food svcs, drinking places	9,961.1	13,197.7	14,445.0
Plastics, rubber prod	813.1	522.1	653.3	Repair, maintenance	2,340.8	3,194.9	3,101.8
Wholesale trade	6,545.3	3,817.4	7,073.9	Personal, laundry svcs	2,247.1	2,036.1	2,648.0
Retail trade	19,199.4	15,373.1	19,599.1	Membership assoc, organ	3,196.9	4,198.0	3,405.9
Air transportation	502.3	371.6	571.0	Private households	2,370.7	2,474.8	3,176.3
Rail transportation	198.1	130.2	149.6	State gov	5,149.0	6,755.0	5,791.0
Water transportation	68.7	78.0	72.2	Local gov	14,035.0	18,304.4	15,925.9
Truck trans; couriers, msgngs	2,977.8	2,680.1	3,649.2	Federal civilian	2,783.0	2,919.0	2,664.6
Transit, ground pass trans	637.5	983.2	789.3	Federal military	2,040.0	2,868.7	1,729.1
Pipeline transportation	39.2	56.2	36.4	Farm employment	2,876.0	2,304.0	2,022.4
				Total employment	178,342.9	207,969.6	207,120.9

References

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