REMI

Estimating Trade Flow Parameters (Industry Betas and Sigmas)

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Frederick Treyz, Ph.D.

Nicolas Mata

Sherri Lawrence

Distance Decay (Betas)[1]

In the absence of survey data, trade flows between regions are often estimated by a gravity equation. One form of such an equation specifies that for a given industry, trade flows between two regions is determined by the interaction of the industry's output in the region of origin and of demand in the region of destination. The intensity of interaction is measured by the distance between the two regions and a distance decay parameter beta. Thus, for any given industry,

$$T_{ij} = A_i \, B_j \, Q_i \, D_j \, / \, d_{ij}^{\,beta} \qquad\qquad (1)$$

where T_{ij} is the trade flow between the region of origin i and the region of destination j

Q_i is the output in the region of origin i

D_j is the demand in the region of destination j

d_{ij} is the distance between region i and region j estimated from longitude and latitude data

beta   is the distance decay parameter to be estimated

A_i, B_j are balancing factors to be estimated

$$A_i = (\Sigma B_j D_j d_{ij}^{\,-beta})^{-1} \qquad\qquad (2)$$

$$B_j = (\Sigma A_i Q_i d_{ij}^{\,-beta})^{-1} \qquad\qquad (3)$$

The A_i and B_j ensure the following constraints are satisfied,

$$Q_i = \underset{j=1}{\Sigma} T_{ij}$$

$$D_j = \underset{i=1}{\Sigma} T_{ij}$$

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[1] The following discussion is based on an unpublished paper *Inter- and Intra-State Trade Flow Estimation in the Absence of Trade Flow Data* by George Treyz, Omar F. El-Gayar and Frederick Treyz as well as its implementation in a Fortran computer program.

Data & Methodology

The parameter beta and factors A and B are estimated simultaneously using an iterative procedure where a value of beta is found at the point where the value of the objective function is a minimum. A and B are evaluated at that optimum beta using equations (2) and (3) above.

The objective function is evaluated as the sum of squares of differences between actual changes in output in the region of origin and the estimated changes of that output. The estimated change of output is determined by the change in demand in the demanding regions modified by the distance and the distance decay parameter beta.

This iterative procedure does not require the use of actual trade flows to estimate beta and A and B.

The data set used is a panel data set of output Q and demand D for 3086 counties and years 1990 thru 2007. The Qs and Ds are normalized to the U.S. Qs and Ds. The Qs are adjusted for exports to get domestic output, and the Ds are adjusted for imports to get local demand that is satisfied by local supply.

With a starting value of beta, the optimizing routine is iterated until the beta converges to a value within its lower and upper bounds at the point that the value of the objective function is a minimum.

Results

Several approaches were used in order to generate a set of estimates that were both reasonable and relatively consistent with the previous estimates, which were based on a different time series (1969-1996 instead of 1990-2007), a different level of geographic detail (state data instead of county data), and a different industry definition (Standard Industrial Classification instead of NAICS). Estimates utilizing log in the distance function were made based on county to county as well as state to state data, in addition to those utilizing county data and a power of 0.3 as well as a power of 0.4. From these four sets of estimates, the following set of betas were selected.

		New Beta Estimate	Previous Beta Estimate
1	Forestry et al.	1.02610	1.33420
2	Agriculture	1.48230	2.38000
3	Oil, gas extraction	0.86860	0.65020
4	Mining (except oil, gas)	0.54520	0.65020
5	Support activities for mining	0.83460	0.65020
6	Utilities	1.66990	1.96000
7	Construction	2.49980	2.31000
8	Wood product mfg	1.16690	0.92240
9	Nonmetallic mineral prod mfg	1.14230	1.15260
10	Primary metal mfg	0.81590	1.15000
11	Fabricated metal prod mfg	1.16960	1.26300
12	Machinery mfg	0.83980	1.03360
13	Computer, electronic prod mfg	0.90180	0.98179
14	Electrical equip, appliance mfg	0.99860	0.96880
15	Motor vehicle mfg	1.15230	0.92900
16	Transp equip mfg. exc. motor veh	0.77790	0.82440
17	Furniture, related prod mfg	0.73470	0.91890
18	Miscellaneous mfg	0.89820	1.08490
19	Food mfg	0.56810	1.06610
20	Beverage, tobacco prod mfg	0.93970	1.18630
21	Textile mills	0.38050	0.92230
22	Textile prod mills	0.64340	0.92230
23	Apparel mfg	1.40610	1.23500
24	Leather, allied prod mfg	0.94520	1.31000
25	Paper mfg	1.12920	1.47800
26	Printing, rel supp act	1.47630	1.74900
27	Petroleum, coal prod mfg	0.94880	1.08920
28	Chemical mfg	0.90410	1.24100
29	Plastics, rubber prod mfg	1.11840	1.35000
30	Wholesale trade	2.07530	1.68000
31	Retail trade	2.17710	2.66000
32	Air transportation	0.93830	1.15250
33	Rail transportation	0.39990	1.08060
34	Water transportation	0.29010	0.89820
35	Truck transp; Couriers, msngrs	0.88250	1.17150
36	Transit, ground pass transp	1.15850	1.11010
37	Pipeline transportation	0.35470	0.89820
38	Scenic, sightseeing transp; supp	0.85630	0.89820
39	Warehousing, storage	0.52850	1.17150

40	Publishing, exc Internet	1.17620	1.74900
41	Motion picture, sound rec	0.48150	1.82000
42	Internet serv, data proc, other	1.98230	2.17000
43	Broadcasting, exc Int; Telecomm	1.07240	1.24030
44	Monetary authorities, et al.	1.14910	1.96000
45	Sec, comm contracts, inv	0.92280	1.54000
46	Ins carriers, rel act	0.79950	1.21650
47	Real estate	1.87520	1.87000
48	Rental, leasing services	2.20390	2.25280
49	Prof, tech services	1.45380	1.87760
50	Mgmnt of companies, enterprises	0.90460	1.79000
51	Administrative, support services	1.95730	2.17000
52	Waste mgmnt, remed services	1.87560	1.79000
53	Educational services	1.24320	1.40000
54	Ambulatory health care services	2.28370	2.38000
55	Hospitals	2.16180	2.38000
56	Nursing, residential care facilities	2.40880	2.27120
57	Social assistance	0.87410	1.96000
58	Performing arts, spectator sports	2.22100	1.96000
59	Museums et al.	2.39900	1.96000
60	Amusement, gambling, recreation	1.23400	1.96000
61	Accommodation	1.33740	1.01120
62	Food services, drinking places	2.76070	2.66000
63	Repair, maintenance	2.10820	2.43880
64	Personal, laundry services	2.05390	2.52000
65	Membership assoc, organ	1.45800	1.96000
66	Private households	1.85770	3.60000

Price Elasticity of Demand (Sigmas)[2]

The price elasticity of demand is derived from interregional trade flows. For a given industry, it is hypothesized that the change in output in the supplying region is determined by two factors, (1) the change in demand that results from a shift of the demand curve in the demanding regions, and (2) the change in demand that results from the movement along the demand curve or by a change in price in the supplying region.

Thus,

$$\Delta Q / Q = \Delta EDS / EDS + \Delta EDM / EDM \qquad (1)$$

or $\quad \Delta Q / Q - \Delta EDS / EDS = \Delta EDM / EDM \qquad (2)$

where,

$\Delta Q / Q$ is the rate of change of output in supplying region

$\Delta EDS / EDS$ is the rate of change in demand resulting from a shift of the demand curve in the demanding regions

$$= \quad (\sum S_{ij}(\Delta D_j)) / ((\sum S_{ij}/D_j) \qquad (3)$$

$\Delta EDM / EDM$ is the rate of change in demand resulting from a change in price or from the movement along the demand curve.

$$= \quad (1 - \sigma)[(\Delta \Omega_i / \Omega_i) - (1/Q_i)(\sum S_{ij}D_j(\sum S_{ij}(\Delta \Omega_i / \Omega_i))] \quad (4)$$

and for each industry,

$S_{ij} = A_i B_j Q_i d_{ij}^{-\beta}$ is the share of domestic demand in region j supplied by region I $\qquad (5)$

σ is the demand price elasticity

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[2] The following discussion is based on notes from Omar El-Gayar's binder of computer runs and on the Fortran computer program that implemented the formulas from these notes.

Ω_i is the cost of production in region of origin

$\Delta\Omega_i$ is the change in the cost of production in region of origin

D_j is the total demand in region of destination j

d_{ij} is the distance between regions i and j

β is the distance decay parameter from the gravity model

A_i , B_j are balancing factors from the gravity model

Q_i is the total output in supplying region

Regression

Substituting equations (3) and (4) into equation (2) produces the regression equation with 1-σ as the coefficient of the right-hand side. The data used is a panel data set of output, Q, and demand, D, generated by the REMI model-building system for 3086 counties and for years 1990 thru 2007. The county data is normalized to the U.S. data. The output is adjusted for exports to get domestic output and the demand is adjusted for imports to get local demand satisfied by local supply. A time fixed effects regression model is used to estimate the coefficient 1-σ.

Results

The sigmas estimated here are consistent with the betas shown above, as well as with the As and Bs, as can be seen in equation (5) above.

		New Sigma Estimate	Previous Sigma Estimate
1	Forestry et al.	0.96484	2.74644
2	Agriculture	0.95296	2.54743
3	Oil, gas extraction	0.90697	1.54443
4	Mining (except oil, gas)	1.52664	1.54443
5	Support activities for mining	0.98279	1.54443
6	Utilities	2.93667	1.54443
7	Construction	1.06820	1.54443
8	Wood product mfg	0.93878	2.82481
9	Nonmetallic mineral prod mfg	1.67781	2.82481
10	Primary metal mfg	1.19351	2.82481
11	Fabricated metal prod mfg	0.97932	2.82481

12	Machinery mfg	0.96834	2.82481
13	Computer, electronic prod mfg	2.96924	2.82481
14	Electrical equip, appliance mfg	0.98776	2.82481
15	Motor vehicle mfg	0.97373	2.82481
16	Transp equip mfg. exc. motor veh	2.02781	2.82481
17	Furniture, related prod mfg	0.90809	2.82481
18	Miscellaneous mfg	0.97316	2.82481
19	Food mfg	2.08089	2.82481
20	Beverage, tobacco prod mfg	0.97036	2.82481
21	Textile mills	1.73583	2.82481
22	Textile prod mills	1.17067	2.82481
23	Apparel mfg	1.19561	2.82481
24	Leather, allied prod mfg	1.61753	2.82481
25	Paper mfg	1.30406	2.82481
26	Printing, rel supp act	0.99874	2.82481
27	Petroleum, coal prod mfg	2.21288	2.82481
28	Chemical mfg	2.75107	2.82481
29	Plastics, rubber prod mfg	2.16394	2.82481
30	Wholesale trade	2.04227	2.54743
31	Retail trade	3.61392	4.91705
32	Air transportation	3.25572	1.54443
33	Rail transportation	1.50541	1.54443
34	Water transportation	0.87110	1.54443
35	Truck transp; Couriers, msngrs	1.46324	1.54443
36	Transit, ground pass transp	3.16148	1.54443
37	Pipeline transportation	1.78940	1.54443
38	Scenic, sightseeing transp; supp	1.00042	1.54443
39	Warehousing, storage	1.09415	1.54443
40	Publishing, exc Internet	0.98459	2.82481
41	Motion picture, sound rec	1.00657	2.54743
42	Internet serv, data proc, other	0.99270	2.54743
43	Broadcasting, exc Int; Telecomm	0.99995	1.54443
44	Monetary authorities, et al.	1.72376	4.91705
45	Sec, comm contracts, inv	3.68790	4.91705
46	Ins carriers, rel act	0.98093	4.91705
47	Real estate	6.22500	4.91705
48	Rental, leasing services	3.02730	2.54743
49	Prof, tech services	3.86182	2.54743
50	Mgmnt of companies, enterprises	2.98002	2.54743
51	Administrative, support services	3.43080	2.54743
52	Waste mgmnt, remed services	1.00270	2.54743
53	Educational services	0.99432	2.54743

54	Ambulatory health care services	2.86602	2.54743
55	Hospitals	4.40878	2.54743
56	Nursing, residential care facilities	2.90148	2.54743
57	Social assistance	0.97775	2.54743
58	Performing arts, spectator sports	1.21099	2.54743
59	Museums et al.	2.63919	2.54743
60	Amusement, gambling, recreation	0.99175	2.54743
61	Accommodation	4.31839	2.54743
62	Food services, drinking places	4.92963	4.91705
63	Repair, maintenance	3.87010	2.54743
64	Personal, laundry services	3.16046	2.54743
65	Membership assoc, organ	3.17893	2.54743
66	Private households	1.64433	2.54743

Selected Industry and Region Trade Flow Comparisons

Self Supply as Share of Domestic Trade Flows for Counties in Massachusetts:

	Wood product mfg		Retail trade		Construction		Food services	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Barnstable	9%	26%	71%	70%	99%	99%	54%	54%
Berkshire	4%	10%	69%	62%	84%	89%	79%	81%
Bristol	14%	28%	72%	69%	86%	89%	86%	87%
Dukes	0%	0%	64%	59%	96%	98%	36%	36%
Essex	18%	35%	94%	88%	85%	88%	96%	97%
Franklin	2%	4%	86%	69%	83%	89%	90%	92%
Hampden	10%	23%	81%	75%	86%	89%	92%	93%
Hampshire	4%	9%	78%	66%	84%	90%	78%	80%
Middlesex	33%	53%	96%	92%	79%	80%	97%	98%
Nantucket	0%	8%	59%	58%	92%	94%	27%	27%
Norfolk	21%	37%	89%	82%	64%	65%	92%	93%
Plymouth	12%	26%	91%	84%	83%	86%	93%	94%
Suffolk	40%	63%	96%	90%	91%	93%	70%	70%
Worcester	15%	29%	93%	86%	91%	93%	97%	97%

	Hospitals		Motor vehicle mfg		Chemical mfg	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Barnstable	75%	71%	0%	0%	31%	7%
Berkshire	43%	40%	3%	8%	13%	4%
Bristol	64%	60%	14%	30%	36%	13%
Dukes	54%	47%	0%	0%	0%	0%
Essex	69%	64%	22%	31%	36%	17%
Franklin	70%	58%	0%	0%	10%	2%
Hampden	47%	45%	9%	20%	26%	9%
Hampshire	63%	54%	0%	0%	11%	3%
Middlesex	66%	62%	32%	51%	39%	26%
Nantucket	76%	66%	0%	0%	0%	0%
Norfolk	53%	49%	20%	37%	32%	14%
Plymouth	72%	65%	15%	30%	30%	10%
Suffolk	12%	11%	26%	45%	50%	24%
Worcester	53%	51%	15%	29%	32%	14%

Self Supply as Share of Domestic Trade Flows for Counties in Michigan:

	Wood product mfg		Retail trade		Construction		Food services	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Alcona	0%	0%	94%	74%	89%	94%	93%	100%
Alger	2%	6%	97%	82%	93%	97%	95%	95%
Allegan	5%	13%	96%	84%	88%	93%	94%	95%
Alpena	3%	7%	68%	64%	97%	98%	99%	99%
Antrim	1%	3%	95%	84%	94%	97%	90%	91%
Arenac	0%	2%	93%	76%	93%	98%	91%	92%
Baraga	0%	0%	95%	77%	92%	97%	96%	98%
Barry	0%	0%	97%	83%	89%	94%	96%	97%
Bay	2%	7%	77%	70%	90%	94%	78%	79%
Benzie	0%	0%	96%	82%	95%	98%	95%	96%
Berrien	3%	9%	95%	85%	91%	94%	93%	94%
Branch	1%	4%	78%	62%	86%	92%	90%	92%
Calhoun	2%	7%	89%	78%	82%	87%	86%	87%
Cass	1%	3%	95%	79%	77%	85%	95%	96%
Charlevoix	2%	7%	95%	86%	92%	96%	79%	80%
Cheboygan	0%	0%	68%	62%	94%	97%	65%	66%
Chippewa	0%	2%	74%	69%	97%	99%	90%	91%
Clare	0%	2%	85%	68%	93%	97%	93%	95%
Clinton	2%	5%	93%	78%	75%	80%	92%	94%
Crawford	1%	2%	79%	61%	91%	95%	84%	85%
Delta	2%	7%	82%	74%	85%	89%	96%	97%
Dickinson	4%	10%	64%	60%	64%	65%	88%	88%
Eaton	2%	6%	90%	76%	70%	75%	90%	92%
Emmet	2%	8%	58%	56%	94%	96%	75%	75%
Genesee	6%	19%	89%	83%	96%	98%	83%	83%
Gladwin	0%	0%	78%	63%	73%	84%	93%	95%
Gogebic	1%	3%	88%	72%	89%	94%	93%	95%
Grand Traverse	3%	11%	56%	55%	96%	97%	66%	66%
Gratiot	1%	3%	91%	72%	86%	92%	86%	88%
Hillsdale	0%	0%	91%	72%	83%	91%	97%	98%
Houghton	1%	4%	85%	78%	95%	97%	92%	92%
Huron	0%	2%	95%	81%	93%	97%	98%	99%
Ingham	7%	17%	78%	74%	97%	98%	77%	77%
Ionia	1%	4%	90%	73%	84%	90%	98%	98%

Iosco	0%	0%	79%	68%	91%	95%	69%	69%
Iron	1%	3%	90%	71%	85%	91%	96%	97%
Isabella	2%	6%	65%	59%	92%	95%	71%	72%
Jackson	3%	5%	88%	77%	89%	93%	87%	88%
Kalamazoo	6%	18%	91%	83%	87%	90%	79%	79%
Kalkaska	0%	0%	87%	68%	68%	73%	94%	96%
Kent	21%	40%	80%	78%	85%	87%	88%	88%
Keweenaw	0%	0%	93%	71%	67%	83%	73%	73%
Lake	0%	0%	93%	67%	82%	90%	89%	91%
Lapeer	1%	4%	94%	81%	90%	94%	95%	96%
Leelanau	0%	0%	94%	85%	85%	90%	78%	79%
Lenawee	3%	8%	91%	75%	84%	90%	93%	94%
Livingston	4%	10%	96%	86%	83%	88%	98%	98%
Luce	0%	0%	86%	66%	90%	97%	90%	93%
Mackinac	0%	3%	84%	69%	90%	94%	38%	38%
Macomb	17%	36%	96%	91%	80%	82%	97%	98%
Manistee	1%	4%	92%	75%	93%	96%	95%	96%
Marquette	2%	5%	76%	72%	94%	97%	77%	77%
Mason	2%	5%	80%	68%	89%	94%	92%	93%
Mecosta	0%	2%	75%	63%	94%	96%	92%	93%
Menominee	2%	4%	94%	78%	85%	91%	92%	93%
Midland	0%	14%	98%	89%	77%	80%	99%	99%
Missaukee	1%	3%	94%	75%	84%	92%	95%	98%
Monroe	3%	9%	94%	83%	71%	76%	79%	80%
Montcalm	0%	3%	79%	65%	82%	90%	94%	96%
Montmorency	0%	1%	94%	77%	80%	91%	97%	97%
Muskegon	0%	17%	61%	59%	93%	96%	84%	84%
Newaygo	1%	2%	90%	72%	85%	92%	97%	98%
Oakland	26%	50%	92%	88%	79%	81%	98%	98%
Oceana	0%	4%	96%	81%	82%	89%	89%	90%
Ogemaw	0%	0%	50%	45%	93%	98%	73%	75%
Ontonagon	0%	0%	84%	65%	81%	90%	96%	96%
Osceola	0%	3%	95%	77%	46%	48%	99%	99%
Oscoda	0%	1%	91%	71%	72%	82%	92%	97%
Otsego	0%	6%	41%	39%	88%	94%	67%	68%
Ottawa	15%	32%	97%	90%	91%	94%	98%	99%
Presque Isle	1%	2%	91%	75%	88%	93%	88%	89%
Roscommon	0%	0%	61%	54%	88%	93%	82%	83%
Saginaw	4%	12%	76%	71%	78%	82%	72%	72%

St. Clair	5%	11%	97%	88%	94%	97%	98%	99%
St. Joseph	2%	3%	89%	73%	83%	91%	95%	96%
Sanilac	0%	0%	80%	67%	90%	95%	96%	97%
Schoolcraft	0%	0%	84%	66%	87%	94%	95%	96%
Shiawassee	1%	3%	84%	69%	80%	86%	93%	95%
Tuscola	1%	2%	90%	73%	82%	89%	97%	98%
Van Buren	0%	0%	89%	74%	83%	90%	95%	96%
Washtenaw	7%	18%	96%	88%	97%	99%	96%	97%
Wayne	26%	50%	99%	95%	92%	94%	91%	91%
Wexford	0%	2%	58%	52%	90%	94%	68%	68%

	Hospitals		Motor vehicle mfg		Chemical mfg	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Alcona	0%	0%	0%	0%	0%	0%
Alger	58%	48%	0%	0%	0%	0%
Allegan	85%	76%	2%	3%	13%	5%
Alpena	96%	89%	1%	2%	0%	0%
Antrim	0%	0%	1%	3%	4%	1%
Arenac	67%	56%	0%	1%	0%	0%
Baraga	0%	0%	0%	0%	0%	0%
Barry	80%	69%	1%	2%	0%	0%
Bay	60%	55%	2%	4%	15%	4%
Benzie	89%	77%	0%	1%	3%	1%
Berrien	73%	68%	2%	4%	18%	4%
Branch	0%	0%	0%	1%	4%	1%
Calhoun	72%	65%	4%	7%	12%	3%
Cass	83%	71%	1%	1%	5%	0%
Charlevoix	83%	76%	1%	2%	0%	0%
Cheboygan	59%	54%	0%	0%	0%	0%
Chippewa	0%	0%	1%	2%	5%	0%
Clare	86%	74%	0%	1%	4%	1%
Clinton	78%	67%	1%	2%	6%	1%
Crawford	29%	27%	0%	1%	4%	1%
Delta	84%	74%	1%	2%	9%	2%
Dickinson	0%	0%	2%	4%	7%	1%
Eaton	84%	75%	1%	3%	8%	1%

Emmet	35%	34%	1%	4%	9%	2%
Genesee	71%	68%	9%	14%	30%	8%
Gladwin	81%	69%	0%	1%	0%	0%
Gogebic	69%	58%	0%	0%	0%	0%
Grand Traverse	39%	39%	3%	8%	18%	3%
Gratiot	53%	46%	0%	1%	5%	1%
Hillsdale	0%	0%	1%	3%	5%	1%
Houghton	55%	52%	1%	3%	6%	2%
Huron	59%	52%	1%	2%	7%	2%
Ingham	42%	41%	8%	13%	25%	8%
Ionia	85%	73%	2%	4%	6%	1%
Iosco	73%	63%	1%	2%	0%	0%
Iron	50%	43%	0%	1%	0%	0%
Isabella	78%	68%	1%	2%	0%	0%
Jackson	59%	55%	2%	5%	12%	3%
Kalamazoo	64%	61%	5%	9%	20%	9%
Kalkaska	0%	0%	1%	1%	0%	0%
Kent	55%	55%	11%	17%	36%	16%
Keweenaw	0%	0%	0%	0%	0%	0%
Lake	0%	0%	0%	0%	0%	0%
Lapeer	0%	0%	1%	2%	9%	2%
Leelanau	100%	75%	0%	0%	0%	0%
Lenawee	82%	71%	1%	2%	9%	3%
Livingston	91%	85%	3%	5%	13%	3%
Luce	0%	0%	0%	0%	0%	0%
Mackinac	0%	0%	0%	0%	0%	0%
Macomb	90%	86%	15%	18%	50%	19%
Manistee	0%	0%	0%	1%	4%	0%
Marquette	29%	28%	1%	4%	10%	1%
Mason	62%	56%	0%	0%	5%	1%
Mecosta	0%	0%	1%	2%	0%	0%
Menominee	0%	0%	0%	1%	4%	1%
Midland	67%	62%	2%	5%	17%	7%
Missaukee	0%	0%	0%	1%	0%	0%
Monroe	77%	69%	3%	5%	12%	2%
Montcalm	42%	38%	1%	2%	5%	0%
Montmorency	0%	0%	0%	0%	0%	0%
Muskegon	57%	55%	2%	6%	16%	4%
Newaygo	66%	56%	1%	2%	5%	1%

Oakland	72%	70%	12%	16%	50%	23%
Oceana	0%	0%	1%	2%	4%	0%
Ogemaw	0%	0%	0%	1%	0%	0%
Ontonagon	0%	0%	0%	0%	0%	0%
Osceola	61%	51%	1%	2%	0%	0%
Oscoda	0%	0%	0%	1%	0%	0%
Otsego	73%	64%	1%	2%	5%	0%
Ottawa	97%	94%	7%	12%	26%	8%
Presque Isle	84%	71%	0%	0%	0%	0%
Roscommon	88%	86%	0%	1%	0%	0%
Saginaw	40%	38%	5%	9%	17%	4%
St. Clair	80%	73%	2%	4%	19%	5%
St. Joseph	94%	82%	2%	5%	12%	3%
Sanilac	68%	57%	0%	1%	7%	1%
Schoolcraft	0%	0%	0%	0%	3%	1%
Shiawassee	66%	56%	1%	1%	5%	1%
Tuscola	78%	65%	1%	1%	4%	1%
Van Buren	0%	0%	1%	2%	6%	2%
Washtenaw	73%	68%	7%	11%	27%	9%
Wayne	54%	53%	16%	20%	55%	26%
Wexford	62%	54%	1%	1%	11%	2%

Self Supply as Share of Domestic Trade Flows for U.S. States and DC:

	Wood product mfg		Retail trade		Construction		Food services	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Alabama	11%	19%	86%	81%	94%	96%	91%	92%
Alaska	64%	91%	100%	100%	79%	79%	100%	100%
Arizona	52%	72%	93%	92%	82%	82%	98%	98%
Arkansas	8%	14%	92%	84%	95%	97%	94%	95%
California	69%	82%	100%	100%	89%	90%	100%	100%
Colorado	39%	60%	99%	98%	91%	92%	96%	97%
Connecticut	23%	39%	95%	90%	91%	93%	98%	98%
Delaware	7%	15%	80%	74%	75%	77%	76%	77%
District of Columbia	26%	49%	94%	87%	91%	94%	61%	61%
Florida	43%	62%	85%	84%	92%	92%	79%	79%
Georgia	20%	30%	87%	84%	96%	97%	82%	83%
Hawaii	77%	96%	100%	100%	71%	71%	66%	66%
Idaho	13%	22%	92%	88%	93%	95%	98%	98%
Illinois	30%	44%	97%	94%	80%	80%	96%	96%
Indiana	17%	26%	94%	88%	85%	87%	87%	87%
Iowa	10%	17%	87%	81%	90%	92%	95%	95%
Kansas	12%	25%	92%	86%	88%	91%	94%	95%
Kentucky	9%	16%	86%	78%	88%	91%	81%	82%
Louisiana	12%	21%	94%	90%	86%	87%	88%	89%
Maine	12%	22%	74%	72%	98%	99%	90%	90%
Maryland	20%	32%	91%	86%	77%	78%	90%	91%
Massachusetts	38%	56%	96%	93%	91%	92%	95%	96%
Michigan	20%	33%	96%	93%	96%	97%	97%	97%
Minnesota	22%	32%	96%	93%	92%	93%	99%	99%
Mississippi	9%	15%	86%	79%	94%	96%	91%	92%
Missouri	13%	23%	89%	84%	84%	85%	82%	82%
Montana	10%	18%	92%	86%	92%	93%	94%	94%
Nebraska	7%	16%	89%	84%	93%	95%	95%	96%
Nevada	31%	50%	99%	96%	60%	61%	76%	77%
New Hampshire	10%	19%	71%	68%	93%	96%	91%	92%
New Jersey	27%	39%	89%	84%	75%	78%	94%	94%
New Mexico	19%	38%	97%	92%	91%	93%	92%	93%
New York	37%	51%	96%	93%	97%	98%	96%	97%

North Carolina	20%	30%	88%	84%	95%	97%	85%	85%
North Dakota	7%	15%	79%	73%	87%	90%	88%	89%
Ohio	19%	30%	93%	89%	96%	97%	88%	89%
Oklahoma	10%	20%	97%	91%	97%	98%	95%	96%
Oregon	21%	26%	94%	91%	87%	88%	92%	92%
Pennsylvania	21%	30%	93%	88%	86%	87%	96%	97%
Rhode Island	16%	31%	92%	86%	88%	90%	83%	84%
South Carolina	11%	18%	79%	75%	93%	95%	71%	71%
South Dakota	6%	15%	83%	77%	92%	95%	91%	91%
Tennessee	11%	19%	81%	77%	95%	96%	81%	81%
Texas	44%	60%	95%	94%	91%	91%	92%	92%
Utah	36%	57%	88%	86%	92%	93%	98%	98%
Vermont	6%	12%	74%	70%	93%	96%	91%	92%
Virginia	16%	25%	92%	87%	89%	91%	91%	91%
Washington	33%	43%	99%	97%	80%	80%	99%	99%
West Virginia	5%	8%	83%	73%	79%	83%	84%	85%
Wisconsin	16%	25%	91%	87%	87%	88%	97%	98%
Wyoming	3%	8%	97%	89%	72%	75%	97%	98%

	Hospitals		Motor vehicle mfg		Chemical mfg	
	Previous Estimate	New Estimate	Previous Estimate	New Estimate	Previous Estimate	New Estimate
Alabama	91%	87%	12%	19%	31%	14%
Alaska	100%	100%	88%	97%	98%	72%
Arizona	97%	96%	66%	83%	82%	54%
Arkansas	75%	71%	8%	15%	27%	10%
California	100%	100%	89%	95%	89%	76%
Colorado	98%	97%	56%	76%	70%	40%
Connecticut	78%	75%	27%	41%	33%	20%
Delaware	56%	53%	14%	24%	21%	9%
District of Columbia	45%	44%	0%	0%	50%	22%
Florida	97%	96%	47%	67%	75%	47%
Georgia	88%	85%	19%	30%	52%	28%
Hawaii	100%	100%	91%	99%	98%	78%
Idaho	96%	93%	25%	45%	30%	10%
Illinois	85%	84%	25%	34%	51%	37%
Indiana	78%	74%	15%	20%	33%	22%

Iowa	84%	79%	9%	17%	27%	11%
Kansas	87%	83%	18%	25%	39%	17%
Kentucky	65%	61%	11%	16%	28%	13%
Louisiana	86%	83%	23%	38%	34%	20%
Maine	50%	48%	10%	22%	38%	14%
Maryland	73%	70%	30%	47%	47%	27%
Massachusetts	50%	50%	42%	59%	55%	37%
Michigan	75%	73%	23%	25%	46%	26%
Minnesota	85%	83%	24%	39%	66%	38%
Mississippi	78%	73%	8%	15%	21%	8%
Missouri	74%	71%	22%	30%	45%	25%
Montana	73%	70%	11%	24%	29%	8%
Nebraska	80%	77%	8%	16%	38%	15%
Nevada	99%	98%	33%	51%	63%	30%
New Hampshire	58%	53%	11%	23%	31%	12%
New Jersey	73%	69%	30%	43%	31%	25%
New Mexico	94%	90%	18%	33%	56%	23%
New York	71%	70%	28%	39%	43%	28%
North Carolina	84%	80%	19%	29%	41%	25%
North Dakota	56%	53%	6%	13%	14%	4%
Ohio	73%	71%	16%	21%	44%	26%
Oklahoma	88%	85%	17%	30%	43%	18%
Oregon	93%	90%	41%	56%	68%	40%
Pennsylvania	60%	58%	22%	33%	37%	24%
Rhode Island	52%	50%	11%	23%	32%	15%
South Carolina	92%	88%	13%	22%	34%	16%
South Dakota	61%	58%	7%	15%	20%	6%
Tennessee	74%	71%	12%	18%	33%	16%
Texas	97%	95%	50%	65%	61%	47%
Utah	96%	95%	29%	46%	62%	33%
Vermont	57%	52%	4%	9%	20%	5%
Virginia	87%	83%	23%	35%	38%	19%
Washington	98%	97%	68%	84%	81%	57%
West Virginia	48%	44%	3%	6%	16%	7%
Wisconsin	76%	73%	14%	23%	40%	20%
Wyoming	91%	84%	6%	14%	18%	6%