Regional Economic Models, Inc.

Economic Impact of Enacting a Feebates Program in Massachusetts

Prepared for

U.S. Environmental Protection Agency and the State of Massachusetts

By

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Using

REMI Policy Insight
Single-Region State Model of Massachusetts

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Executive Summary

The Environmental Protection Agency (EPA) contracted Regional Economic Models (REMI) to assess the economic impact of a feebates program in four states; Connecticut, Rhode Island, Massachusetts, and Maine. The focus of the program was to promote the purchase of more fuel-efficient cars by placing a fee (surcharge) on high fuel-consumption vehicles and a rebate on fuel-efficient cars.

The feebate program is intended to be self-sustaining; the monetary amount of rebates given to fuel-efficient vehicle purchasers would equal the amount of fee received from high fuel-consumption vehicle purchasers. Included in the feebates would be the cost for the four states to implement the program. Consequently, there will not be any government spending to stimulate the economy. All economic stimulation is assumed to be the result of a decrease in the demand for gasoline. As sales of fuel-efficient vehicles increase, the demand for gasoline decreases. An increase in consumer spending on other goods results from consumers having more money from purchasing less gasoline. This decrease in demand for gasoline will cause a loss in revenue for gasoline stations and consequently all four states will lose the revenue from tax on gasoline. This is a simplifying assumption for simulation purposes only. In reality, state governments can offset the loss in revenue using a variety of measures such as increasing tax on gasoline. If the states enacted such measures, they could reduce the loss in state revenue.

REMI performed five separate geographic analyses on the economic impact on each individual state[1] and the combined region. This analysis focuses solely on the economic impact of a feebates program on the State of Massachusetts over a 15-year time horizon from 2006 to 2020. To quantify the indirect and induced effects of the policies, REMI captured all direct effects of the policies, including:

- The increase on consumer spending on other goods
- A loss in revenue for gasoline stations
- A loss in tax revenue for the State of Massachusetts

In examining the economic impact for each geographic region, three different feebate designs were modeled. Each scenario corresponds to levels in a loss of demand for gasoline consumption due to the increase in fuel efficiency. Scenario A assumes that the feebate policy will reduce 2020 gasoline consumption by the difference in consumption between 1990 and 2003. Scenario B assumes that the feebate policy will reduce 2020 gasoline consumption by the difference in consumption between 90% of 1990 and 2003. Scenario C assumes that the feebate policy will reduce 2020 gasoline consumption to 90% of 1990 consumption. Please see 'Feebate Simulation Inputs' in Section 1-3 for greater detail, and Appendix for data calculations.

[1] For the individual state runs, each state was run as a single economy. There was no consideration of the impacts from other states.

This analysis does not quantify other important benefits that would be captured by a feebate program, and the primary impetus for implementing the policy in the first place, including reductions in carbon emissions, a variety of other air pollutants, and decreased dependence on foreign oil.

REMI received data regarding projections of gasoline consumption changes, and total costs and benefits of the feebates program from Meszler Engineering Services and Harold Ward from the University of Brown. Data for this analysis was also provided by Northeast States for Coordinated Air Use Management (NESCAUM).

Major Findings

Table 1 shows the cumulative economic growth in the State of Massachusetts due to the feebates program over a 14-year time period.

Table 1. Economic Growth due to Feebate Policies in Massachusetts (Cumulative 2006 – 2020)

	Scenario A	Scenario B	Scenario C
Employment (Avg Annual Increase)*	1,387	2,130	2,807
Total Output (Bil 96$)	2.374	3.649	4.809
Total GSP (Bil 96$)	1.343	2.064	2.721
Population	3,034	4,654	6,139
Real Disp Inc (Bil 96$)	0.771	1.183	1.563
State Revenues (Bil 96$)	-0.868	-1.333	-1.754

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

All three feebates scenarios in Table 1 show a largely positive effect on the Massachusetts economy. All three scenarios follow similar trends; growth in employment, output, gross state product, population, and real disposable income. All three scenarios also show a loss in the amount of revenues collected by the State of Massachusetts. The loss in state revenue is the direct result of a loss in gasoline-tax collections by Massachusetts. It is important to note that all economic results presented in the report are inclusive of each other. The loss in state revenues is already included in the total output and total gross state product of the economy. Despite Massachusetts' loss in state revenues the total output of the economy still improves by $2.374 billion for scenario A, $3.649 billion for scenario B, and $4.809 billion for scenario C. If the Massachusetts' state government were to offset the loss in state revenue via other measures then the total output of Massachusetts would increase, although not in parallel.

Scenario A estimates: 1,387 new jobs, output increases of $2.374 billion, gross state product increases of $1.343 billion, population increases of 3,043 people, and real disposable income increases of $771 million. The only negative effect on the economy is a loss in Massachusetts state revenues of $868 million due to the loss in revenue from gasoline taxes. Again, the loss in state revenues is already

reflected in all other economic variables. Output increases by $2.374 billion and GSP increase by $1.343 billion despite the loss in state revenues of $868 million.

Scenario B estimates: 2,130 new jobs, output increases of $3.649 billion, gross state product increases of $2.064 billion, population increases of 4,654 people, and real disposable income increases of $1.183 billion. The estimated loss in state revenue is $1.333 billion due to a loss in gasoline taxes. The loss in state revenues is already reflected in all other economic variables. Output increases by $3.649 billion and GSP increase by $2.064 billion despite the loss in state revenues of $1.333 billion.

Scenario C estimates: 2,807 new jobs, output increase of $4.809 billion, gross state product increases of $2.721 billion, population increases of 6,139 people, and real disposable income increases of $1.563 billion. The estimated loss in state revenue is $1.754 billion due to a loss in gasoline taxes. The loss in state revenues is already reflected in all other economic variables. Output increases by $4.809 billion and GSP increase by $2.721 billion despite the loss in state revenues of $1.754 billion.

Tables 2 and 3 show the annual increase of two specific years: 2010 and 2020. These graphs are not an accumulation of preceding years, but instead show how much growth Massachusetts would experience that single year. Both years follow a similar trend; growth in employment, output, gross state product, population, and real disposable income; and a loss in state revenues

Table 2. Economic Growth Due to Feebate Policies in Massachusetts, 2010

	Scenario A	Scenario B	Scenario C
Employment	1,102	1,693	2,231
Total Output (Mil 96$)	123.000	189.100	249.000
Total GSP (Mil 96$)	69.370	106.600	140.400
Population	766	1,175	1,546
Real Disp Inc (Mil 96$)	33.840	51.940	68.590
State Revenues (Mil 96$)	-44.237	-67.910	-89.363

Table 3. Economic Growth Due to Feebate Policies in Massachusetts, 2020

	Scenario A	Scenario B	Scenario C
Employment	1,989	3,054	4,026
Total Output (Mil 96$)	232.900	357.500	471.600
Total GSP (Mil 96$)	131.500	202.000	266.500
Population	3,034	4,654	6,139
Real Disp Inc (Mil 96$)	88.070	135.100	178.600
State Revenues (Mil 96$)	-87.534	-134.392	-176.896

1 Methodology & Assumptions

1-1 REMI Policy Insight

REMI Policy Insight® is the leading regional economic-forecasting and policy-analysis model. For this study, REMI developed Policy Insight for the State of Rhode Island. REMI built this model using the REMI model building system, which consists of hundreds of programs developed over the last two decades. The system assembled the State of Rhode Island model using data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Department of Energy, the Bureau of Census, and other public sources.

REMI Policy Insight is a structural model, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor in the model determines the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in costs would decrease the share of markets supplied by local firms. This market share combined with the demand described above determines the amount of local output. The model has many other feedbacks. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment and population growth impacts government spending.

Figure 1-1 is a pictorial representation of REMI Policy Insight. The Output block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and their relative costs. The Demographic block includes Population and Labor Supply, contributing to demand and wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Wage, Price and Profit block. Production costs determine market shares. Output depends on market shares and the components of demand.

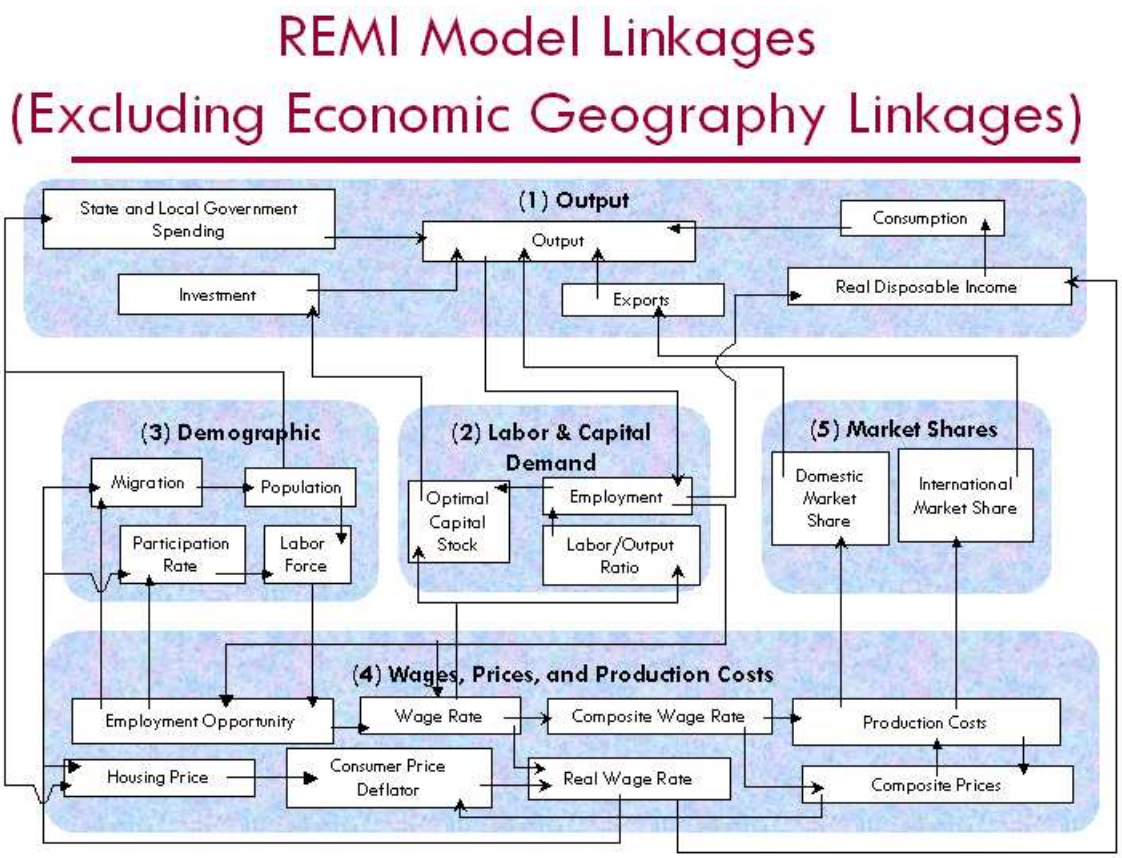

Figure 1. Figure 1-1 REMI Policy Insight overview

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast as well as for simulation purposes. The model includes all the inter-industry interactions that are included in input-output models in the Output block, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in Figure 1-1.

In order to broaden the model in this way, it is necessary to estimate key relationships. This is accomplished by using extensive data sets covering all areas in the country. These large data sets and two decades of research effort enable REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

The model has strong dynamic properties, which means that it forecasts not only what *will* happen but also *when* it will happen. This results in long-term predictions that have year-by-year change. This means that the long-term properties of general equilibrium models are preserved while maintaining accurate annual predictions and using estimates of key equations from primary data sources.

Figure 1-2 shows the policy simulation process for a scenario called Policy X. The effects of a scenario are determined by comparing the baseline REMI forecast with an alternative forecast that incorporates the assumptions for the scenario. The baseline REMI forecast uses recent data and thousands of equations to generate projected economic activity for a particular region. The policy variables in the model are set equal to their baseline value (typically zero for additive variables and

one for multiplicative variables) when solving for the baseline forecast. To show the effects of a given scenario, these policy variables are given values that represent the direct effects of the scenario. The alternative forecast is generated using these policy variable inputs. Figure 1-2 shows how this process would work for a policy change called Policy X.

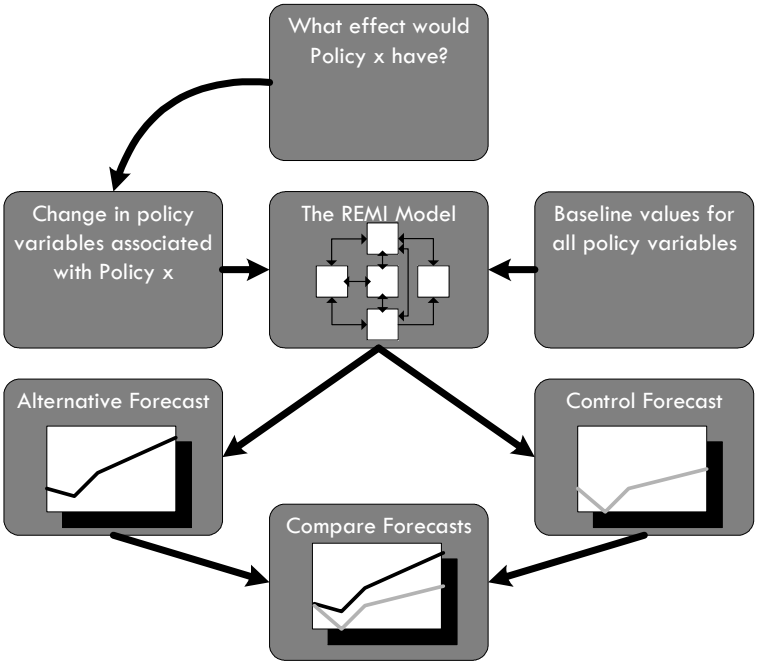

Figure 1-2 Policy X scenario

1-2 Assumptions

For this project, REMI examined the economic effects of feebate policies in the State of Massachusetts. REMI made the following simplifying assumptions:

1. As fuel-efficient vehicles become more prevalent, there is a decrease in the amount of gas purchased.
2. Any consumer spending saved due to buying less gasoline is reallocated onto other goods and services.
3. All high fuel-consumption vehicles sold in Massachusetts are manufactured outside of Massachusetts. Consequently, any loss in motor vehicles sales will not reduce revenue for Massachusetts' motor vehicle industry.
4. The feebates program is self-sufficient; the fees collected for high fuel-consumption vehicles will equal the rebates given for fuel-efficient vehicles, plus the cost of program implementation.
5. All growth in vehicle fleet size is constant
6. There will not be any change in vehicle-miles-traveled or vehicle-hours-traveled due to a decrease in the cost of driving.
7. All gasoline prices and tax rates are constant across the time-horizon.

1-3 Simulation Inputs

Consumer Spending on Gasoline

As the ratio of fuel-efficient vehicles to high fuel-consumption vehicles increases, the total quantity of gasoline demanded by consumers decreases. REMI captured the decrease in demand by decreasing consumer spending for gasoline. Shown in 'Consumer Spending on Gasoline' on Tables 1-1, 1-2, 1-3.

Consumption Reallocation

Consumption reallocation transfers the money saved from purchasing less gas to purchasing other goods. The input is based on the assumption 2, all money saved from gas purchases will be spent on other goods. Shown in 'Consumption Reallocation' on Tables 1-1, 1-2, 1-3.

Government Spending

The feebates program is intended to be self-sufficient. There will not be any change in government spending due to the implementation of the program, feebate collection, or rebate distribution. However, there will be a loss in government spending due to a loss in state tax revenue on gas collections. The government-spending variable does assume the government will offset the loss in state tax revenue by decreasing the amount of government employees. Shown in 'Government Spending' on Tables 1-1, 1-2, 1-3. (See section 2-3)

Feebates Simulation Inputs

In examining the economic impact for each geographic region, three different feebate designs were modeled. Each scenario corresponds to levels in a loss of demand for gasoline consumption[2] due to the increase in fuel efficiency. Scenario A assumes that the feebate policy will reduce 2020 gasoline consumption by the difference in consumption between 1990 and 2003. Scenario B assumes that the feebate policy will reduce 2020 gasoline consumption by the difference in consumption between 90% of 1990 and 2003. Scenario C assumes that the feebate policy will reduce 2020 gasoline consumption to 90% of 1990 consumption. The difference in gasoline consumption directly affects the simulation inputs for all three scenarios. Although each scenario has different target consumption rates, the annual growth rates are similar.

Scenario A estimates a decrease in consumption of gasoline by 449.589 million gallons in 2020 due to more fuel-efficient cars sold, a decrease from the baseline of 15%.

Table 1-1 Data Inputs for Scenario A (Mil 96$)

	2006	2007	2008	2009	2010	2011
Consumer Spending on Gasoline	-50.449	-143.157	-229.530	-309.568	-383.271	-450.639
Consumption Reallocation	50.449	143.157	229.530	309.568	383.271	450.639
Figure 2. Government Spending	-5.271	-14.956	-23.980	-32.342	-40.042	-47.080

	2012	2013	2014	2015	2016	2017
Consumer Spending on Gasoline	-511.672	-566.370	-614.732	-656.760	-692.453	-721.810
Consumption Reallocation	511.672	566.370	614.732	656.760	692.453	721.810
Government Spending	-53.457	-59.171	-64.224	-68.615	-72.344	-75.411

	2018	2019	2020	Total
Consumer Spending on Gasoline	-744.833	-761.520	-772.568	-7,609.333
Consumption Reallocation	744.833	761.520	772.568	7,609.333
Government Spending	-77.816	-79.560	-80.714	-794.983

[2] Gasoline consumption estimates were provided by Meszler Engineering Services

Scenario B estimates a decrease in consumption of gasoline by 690.249 million gallons in 2020, a decrease in consumption from the baseline by 22%.

Table 1-2 Data Inputs for Scenario B (Mil 96$)

	2006	2007	2008	2009	2010	2011
Consumer Spending on Gasoline	-77.453	-219.787	-352.395	-475.276	-588.432	-691.861
Consumption Reallocation	77.453	219.787	352.395	475.276	588.432	691.861
Figure 3. Government Spending	-8.092	-22.962	-36.816	-49.654	-61.476	-72.282

	2012	2013	2014	2015	2016	2017
Consumer Spending on Gasoline	-785.564	-869.541	-943.792	-1,008.317	-1,063.115	-1,108.188
Consumption Reallocation	785.564	869.541	943.792	1,008.317	1,063.115	1,108.188
Government Spending	-82.071	-90.845	-98.602	-105.343	-111.068	-115.777

	2018	2019	2020	Total
Consumer Spending on Gasoline	-1,143.534	-1,169.154	-1,186.115	-11,682.524
Consumption Reallocation	1,143.534	1,169.154	1,186.115	11,682.524
Government Spending	-119.470	-122.146	-123.918	-1,220.521

Scenario C estimates a decrease in consumption of gasoline by 908.798 million gallons in 2020, a decrease in consumption from the baseline by 29%.

Table 1-3 Data Inputs for Scenario C (Mil 96$)

	2006	2007	2008	2009	2010	2011
Consumer Spending on Gasoline	-101.977	-289.377	-463.971	-625.760	-774.743	-910.920
Consumption Reallocation	101.977	289.377	463.971	625.760	774.743	910.920
Figure 4. Government Spending	-10.654	-30.232	-48.473	-65.376	-80.941	-95.168

	2012	2013	2014	2015	2016	2017
Consumer Spending on Gasoline	-1,034.292	-1,144.858	-1,242.618	-1,327.573	-1,399.722	-1,459.065
Consumption Reallocation	1,034.292	1,144.858	1,242.618	1,327.573	1,399.722	1,459.065
Government Spending	-108.057	-119.608	-129.821	-138.697	-146.235	-152.434

	2018	2019	2020	Total
Consumer Spending on Gasoline	-1,505.603	-1,539.335	-1,561.666	-15,381.477
Consumption Reallocation	1,505.603	1,539.335	1,561.666	15,381.477
Government Spending	-157.296	-160.821	-163.154	-1,606.965

2 Results and Analysis

Tables 2-1, 2-2, and 2-3 display the major economic effects for enacting a feebates program in Massachusetts, including changes in employment, output, gross state product (GSP), population, real disposable income, and state revenue collected. For a detailed explanation of all of the economic variables please see the corresponding section below. As shown in Tables 2-1, 2-2, and 2-3, enacting a feebates program in Massachusetts stimulates overall positive economic growth.

The majority of the growth in the Massachusetts economy is due to growth from consumption. As stated in Assumption 2 in section 1-2, money saved by consumer spending on gasoline will be reallocated to spending on other goods and services. As the sale of consumer goods increases, industries selling consumer goods increase output and hire more workers, who in turn can boost the economy by buying more goods. However, there are some negative impacts on the economy. The petroleum products industry and wholesale industry both experience losses due to decreased gasoline sales.

Table 2-1 Scenario A: Annual Growth Due to Feebates Program

	2006	2007	2008	2009	2010	2011
Employment	143	400	649	882	1,102	1,297
Total Output (Mil 96$)	14.530	41.690	69.520	96.620	123.000	147.000
Total GSP (Mil 96$)	8.209	23.800	39.460	54.630	69.370	82.700
Population	43	156	321	530	766	1,020
Real Disp Inc (Mil 96$)	3.754	10.940	18.430	26.030	33.840	41.630
State Revenues (Mil 96$)	-5.979	-16.888	-26.887	-35.998	-44.237	-51.658

	2012	2013	2014	2015	2016	2017
Employment	1,483	1,607	1,740	1,803	1,855	1,915
Total Output (Mil 96$)	171.000	186.800	202.900	206.100	210.200	218.200
Total GSP (Mil 96$)	96.010	104.900	113.900	116.800	120.100	124.500
Population	1,287	1,553	1,816	2,063	2,291	2,504
Real Disp Inc (Mil 96$)	49.320	55.660	62.440	67.200	71.660	76.480
State Revenues (Mil 96$)	-58.234	-64.435	-69.774	-74.643	-78.789	-82.046

	2018	2019	2020	Total
Employment	1,958	1,978	1,989	1387
Total Output (Mil 96$)	225.000	229.000	232.900	2,374.460
Total GSP (Mil 96$)	127.700	129.900	131.500	1,343.479
Population	2,703	2,878	3,034	3,034
Real Disp Inc (Mil 96$)	80.810	84.720	88.070	770.984
State Revenues (Mil 96$)	-84.590	-86.401	-87.534	-868.094

Table 2-2 Scenario B: Annual Growth Due to Feebates Program

	2006	2007	2008	2009	2010	2011
Employment	218	614	997	1,356	1,693	1,993
Total Output (Mil 96$)	22.280	64.150	106.800	148.500	189.100	226.000
Total GSP (Mil 96$)	12.760	36.590	60.610	83.920	106.600	127.100
Population	67	239	494	813	1,175	1,566
Real Disp Inc (Mil 96$)	5.722	16.540	28.150	40.080	51.940	63.810
State Revenues (Mil 96$)	-9.189	-25.964	-41.293	-55.255	-67.910	-79.312

	2012	2013	2014	2015	2016	2017
Employment	2,277	2,467	2,672	2,767	2,850	2,942
Total Output (Mil 96$)	262.600	286.800	311.800	316.500	323.100	335.400
Total GSP (Mil 96$)	147.500	161.000	174.900	179.300	184.500	191.200
Population	1,974	2,382	2,786	3,163	3,515	3,843
Real Disp Inc (Mil 96$)	75.470	85.360	95.640	103.100	110.000	117.500
State Revenues (Mil 96$)	-89.450	-98.943	-107.131	-114.621	-120.979	-125.944

	2018	2019	2020	Total
Employment	3,008	3,040	3,054	2,130
Total Output (Mil 96$)	345.700	352.300	357.500	3,648.530
Total GSP (Mil 96$)	196.600	199.400	202.000	2,063.980
Population	4,146	4,417	4,654	4,654
Real Disp Inc (Mil 96$)	124.100	130.000	135.100	1,182.512
State Revenues (Mil 96$)	-129.863	-132.650	-134.392	-1,332.898