Employment Impacts of the Surface Transportation Assistance Act of 1982

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ABSTRACT

The Surface Transportation Assistance Act (STAA) of 1982 was primarily a legislative response to growing concern about the condition and performance of the nation's highways. There was also a widely held belief that implementation of the act would generate additional employment. Thus the specific purpose of this study was to estimate the employment consequences of (a) increases in highway and transit expenditures and (b) increases in highway user taxes attributable to the STAA. Because of the large number of economic variables that had to be analyzed and the complex interrelationships among these variables, the research was conducted with the aid of multiequation econometric models. The results of the study indicate that the STAA of 1982 has no significant impact on the gross national product, although sectors linked closely to highway construction benefit from the act and those sensitive to higher gasoline prices, lower disposable income, and higher interest rates suffer. However, the net effect on employment is not zero because of different labor intensities among industries. Thus total employment was predicted to drop slightly in 1983 but to increase from 1984 through 1986 as the stimulus of increased highway spending gradually overtook the inhibitive effects of the tax increase. Regional variations are primarily the result of differences in the number of new construction jobs created, differences in construction wage rates, and geographic concentration of manufacturing and trade in general and motor vehicle manufacturing in particular.

The Surface Transportation Assistance Act (STAA) of 1982 was a legislative response to growing concern about the condition and performance of the nation's highways, the tax structure supporting the Highway Trust Fund, and several other related issues. Increased federal aid to the states was deemed necessary to maintain the highway system. Thus, when financing for the Highway Trust Fund was extended, the level of funding was increased. This was accomplished primarily by raising the tax rate on motor fuels by 5 cents per gallon. Other highway taxes were restructured, but the intent of those changes was to redistribute the burden of highway user taxes, not to increase revenues. In addition, a portion of the increased funding was dedicated to public transportation assistance.

Although the STAA of 1982 was introduced primarily as a transportation infrastructure improvement measure, the commonly held opinion that implementation of the legislation would generate employment provided additional support for enactment. The FHWA has responded to widespread interest in the employment issue by undertaking a study to monitor the employment trends resulting from the act. The study consists of several research efforts, including surveys of actual construction projects, an analysis of effects on transportation projects funded solely by state revenues, and an econometric assessment of the employment impacts of the legislation. In this paper the research of the third phase of the study, the econometric analysis, is summarized.

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The purpose of this research effort is to estimate the employment consequences of (a) increases in highway and transit expenditures and (b) increases in highway user taxes that are attributable to the STAA of 1982. A priori, it was not clear what effect these increases would have on total employment. Obviously, the increased expenditures would tend to create jobs. However, the higher user fees would be expected to dampen employment because consumers and business firms would have less money to spend on nonhighway goods and services. The net effect on employment over time would depend critically on the rate at which the newly created funding would be spent relative to the rate at which the increased user fees would be collected. The net effect would also be a function of the labor intensities of the affected industries.

Because all of these factors had to be considered in a way that captures their interrelationships, the research was conducted with the aid of large, multiequation econometric models. Computer-based models available from Data Resources, Inc. (DRI) were chosen for this project because they permit the national, regional, and industry aspects of the problem to be addressed within a single analytical system. In addition, the DRI macroeconomic model contains spending and tax variables that can be changed in ways that closely reflect the actual implementation of the STAA of 1982. Working within an analytical framework developed by the Transportation Systems Center, the DRI Interindustry Service and the DRI Regional Information Service prepared reports on national and industry employment effects and regional employment effects, respectively. In this paper the methodology is outlined and the results of these reports are summarized. For more technical detail, the reader is referred to the individual DRI reports.

The general approach of the research is to simulate the behavior of the economy in two scenarios, one with the STAA of 1982 in effect and the other without. The differences in the values of economic variables in these two cases are estimates of the impacts of the act. As with other research of this type, it is the changes between scenarios, not the absolute levels predicted for either scenario, that are important.

When the project was initiated in the fall of 1983, the fuel tax and spending provisions of the STAA of 1982 had already been implemented. The FHWA determined that the employment consequences of the act should be estimated for 1983 and also forecast for the years 1984 through 1986. Because the standard DRI macroeconomic forecasts already incorporated the relevant provisions of the STAA of 1982, the November 1983 forecast, with historical information for the prior months of 1983, was used as the baseline scenario. This is the "with-STAA" scenario. A "without-STAA" scenario that models the performance of the economy under the assumption that the act was not passed has also been developed; this includes estimates for early 1983 as well as for the remainder of the study period.

The methodology and results of the macroeconomic, interindustry, and regional simulations are summarized in the next three sections. The development of the without-STAA macroeconomic scenario is given prominence because it is the basis of the subsequent interindustry and regional work. The critical assumptions, consequent limitations, and data are noted in the methodological discussions.

MACROECONOMIC ANALYSIS

Two sets of estimates had to be made to develop the without-STAA macroeconomic scenario. These were the changes in spending on highways and transit and the changes in tax receipts that resulted from the STAA of 1982. The legislation sets forth only increases in apportionments to the states and the 5-cent increase in the federal motor fuels tax. Decisions had to be made about how these changes could best be represented in the DRI macroeconomic model.

For the spending changes, both the dollar amounts and their timing had to be estimated. Estimation of the increased highway spending attributable to the act was complicated because the federal government does not pay for highway and transit construction directly. Instead, it provides aid to the states, which in turn let the construction contracts. In addition, the federal-aid program requires the states to provide some percentage of project costs from their own revenues. Thus the increase in spending could be greater than spending from federally provided funds if state matching funds were new state revenues. Alternatively, states could provide matching funds by shifting state funds from other highway or transit projects to federally aided projects. In the current economic climate, it appears unlikely that states would raise taxes solely to match new federal funds; therefore it was assumed that matching funds would come from existing state revenues. [A third possibility is that states would use federal funds for projects that would have been funded entirely from state-only revenues. In this case, which has been judged less likely to occur, the total change in spending would be less than the change in federal aid.] State highway and transit spending from the states' own revenues has been held constant, and the total change in spending is, therefore, equal to the increase in federally provided money. An implication of this assumption is that changes in state motor fuel tax rates that have occurred would have occurred even if the STAA of 1982 had not been passed.

The time pattern of highway spending by the states relative to the apportionment process is determined by two lags and by obligation ceilings. First, there is a lag between the apportionments at the beginning of the fiscal year and the point at which states obligate some part of the apportionment for a specific project. Generally, states are allowed 3 or 4 years in which to obligate a specific year's apportionment. State obligations in any year are constrained not only by the level of apportionments but also by obligation ceilings. There is also a lag between the obligation of funds and payments to contractors. This lag depends on how long it takes to let construction contracts and the pace of the construction or repair project itself.

Because no data on the apportionment-obligation lag are readily available, the changes in obligation levels that result from the STAA of 1982 have been estimated solely from data on obligation ceilings before and after enactment of the act. The aggregate obligation ceiling, which had been binding for the past several years, was raised by the STAA. Preliminary data indicate that the new ceiling was binding for FY 1983. At the suggestion of the FHWA, it was assumed for the purpose of this study that states would continue to obligate funds up to their ceilings, adjusted to include authorizations for programs not covered by the ceilings. Thus the change in obligations is estimated to be the difference between ceilings. It should be noted that, even though an obligation ceiling is reached in a particular year, the obligated funds are not necessarily solely from that year's apportionment; the increases in highway spending that occur as a result of the STAA are due not only to increases in federal aid per se but also, and perhaps especially, to the change in the obligation ceiling. If there is a bias in the impact estimates because of the assumption that the ceiling is reached, it is upward. If the states as a whole obligate less than the ceiling in future years, highway expenditures will be less than predicted, and the spending impacts will be somewhat smaller.

The new funding ceilings provided by the STAA of 1982 are given in the first row of Table 1. It was assumed that, in the absence of the act, the funding ceilings would have been $8 billion. The incremental obligations for highways, the differences between the ceilings, are given in Row 3.

TABLE 1 Estimated Incremental Obligations Under the STAA of 1982 (fiscal year, billions of dollars)

	1983	1984	1985	1986
Highway obligation ceiling under STAA[a]	12.449[b]	13.421	14.427	15.319
Highway obligation ceiling without STAA	8.000	8.000	8.000	8.000
Incremental highway obligations	4.449	5.421	6.427	7.319
Incremental transit obligations[c]	0.572	1.351	1.175	1.106

[a] Adjusted by FHWA to reflect programs not covered by ceiling.
[b] Actual obligations for FY 1983.
[c] Provided by UMTA.

Because construction on highway projects begins only after funds are obligated, the lag between obligations and expenditures must be estimated. An expenditure, from the federal government's point of view, is a reimbursement from the federal government to a state for payments to contractors. FHWA data on expenditures, therefore, most closely approximate the flow of funds into the economy. FHWA has developed a payout table that reports the rate at which

TABLE 2 Estimated Incremental Expenditures Under the STAA of 1982[a] (fiscal year, billions of dollars)

	1983	1984	1985	1986
Incremental highway expenditures	0.747	3.243	4.597	5.624
Incremental transit expenditures	0.030	0.205	0.507	0.803
Total incremental expenditures	0.777	3.448	5.104	6.427

[a]Payout patterns provided by FHWA and UMTA.

funds obligated in a given year are expended in that year and subsequent years. This table was applied to the estimates of incremental obligations to develop estimates of the incremental highway expenditures attributable to the STAA. These are given in Table 2.

The transit program is characterized by an obligation lag and an expenditure lag analogous to those in the highway program. No published data on the length of the lags are available. Estimates of incremental obligations by the states for transit improvements were provided directly by UMTA to FHWA. These are reported in Row 4 of Table 1. UMTA also provided information on payout rates for transit expenditures. The notable point about the transit payout pattern is that, although payout rates are initially lower than those for highways, the payout period is shorter. The estimates of increased transit expenditures are given in Table 2.

The second major set of issues in the without-STAA macroeconomic scenario involves the estimation of (a) tax revenues that would not have been collected had the STAA not been passed and (b) the incidence of the tax rate increase. The Bureau of Economic Analysis had made forecasts of tax revenues generated by the 5-cent increase in the gas and diesel tax through the end of FY 1984. DRI extrapolated this series to the end of calendar year 1986, using the baseline forecast of refined petroleum production as a proxy for the tax base. The revenue estimates, which are consistent with estimates provided by FHWA, are given in Table 3.

TABLE 3 Estimated Incremental Revenue Under the STAA of 1982[a] (fiscal year, billions of dollars)

1983	1984	1985	1986
2.9	5.5	5.5	5.6

[a]1983 and 1984 estimates from Bureau of Economic Analysis; 1985 and 1986 estimates by DRI.

The federal gasoline tax is levied on gasoline production and is, therefore, paid by refiners or, in some cases, primary distributors. The actual incidence, or burden, of the tax will differ, however, as producers pass the rate increase backward to labor and capital or forward to highway users. It was assumed that producers would pass the entire tax increase along to highway users, thereby raising the retail price of gasoline. This assumption is supported by actual price increases that occurred on or about April 1, 1983. The treatment of gasoline prices in the DRI model reflects this assumption.

These spending and tax changes have been incorporated into the alternative macroeconomic simulation by making changes in several exogenous spending and tax variables. The baseline scenario is the with-STAA case, so construction of the without-STAA case involved reducing the level of spending and taxes. Because highway and transit construction is directly financed by state governments, the levels of the variables for state and local purchases of goods and services and of construction were reduced to reflect spending changes reported in Table 2. The flow of funds from the federal government to the states in the model was altered by reducing the amount of grants-in-aid. The magnitude of the change equaled that of the change in state spending because the federal government reimburses the states for their payments to contractors.

Changes in tax revenue were introduced into the model by reducing the level of the variable for federal government indirect business tax and nontax accruals by the amounts given in Table 3. Because the producer price index for gasoline in the DRI model is estimated net of the federal tax, the change in the tax rate was reflected by reducing the level of the gas tax variable. This adjusts the retail price index and thus implements the assumption that the incidence of the tax is on highway users. Because reductions in tax revenues exceed reductions in federal grants-in-aid in the without-STAA scenario, there will be an increase in the federal deficit. However, it was assumed that the increase would be too small to induce changes in monetary policy and that the Federal Reserve would continue the policies implied in the with-STAA scenario.

The impacts of the STAA on key macroeconomic variables are estimated by comparing the with-STAA and without-STAA simulations. The variables of interest are the real gross national product (GNP) and its components, disposable income, prices, and interest rates. Table 4 gives the percentage differences in these variables.

TABLE 4 Macroeconomic Impacts of the STAA of 1982 (percentage differences between with-STAA and without-STAA scenarios by calendar year)

	1983	1984	1985	1986
Real GNP	0.0	0.0	0.1	0.0
Real consumption	−0.1	−0.1	−0.1	−0.1
Real nonresidential fixed investment	0.0	−0.1	−0.1	−0.2
Real residential fixed investment	0.0	−0.1	−0.3	−0.4
Implicit price deflator	0.1	0.2	0.3	0.3
Three-month treasury bill rate	0.01	0.05	0.09	0.10
New high-grade corporate bond rate	0.02	0.04	0.06	0.04

The results indicate that the stimulus of increased government spending is largely offset by the negative effects of the tax increase so that there is no significant impact on real GNP (measured in 1972 dollars). This is so even though the time patterns of increased spending and increased tax revenues are markedly different. The increase in spending does result in a 0.1 percent rise in real GNP in 1985 above what it would have been if the STAA had not been enacted, but GNP in other years is unaffected.

More significant changes occur in the primary components of real GNP. Government spending is, of course, up, but both real consumption and real residential and nonresidential investment are lower in the with-STAA simulation. Residential investment is the most adversely affected sector, declining by 0.4 percent in 1986 from the without-STAA level. The decline in personal consumption expenditures is largely the result of a decline in real expenditures on gasoline and oil and on motor vehicles and parts, and the decline in residential investment reflects the decline in housing starts caused by higher interest rates.

These changes are attributable directly and indirectly to the increase in the retail price of gasoline caused by the tax. Most important, the price increase not only affects fuel consumption; it also increases the cost of operating a motor vehicle. Furthermore, it is reflected in an increase of 0.1 percent to 0.3 percent in the general price level as measured by the GNP price deflator, which has a small negative effect on real disposable income and thus on other consumption categories. An increase in interest rates prompted by the general price increase reduces interest-sensitive purchases such as housing starts and consumer durables (e.g., furniture and vehicles).

INTERINDUSTRY ANALYSIS

The purpose of the interindustry analysis is to assess the employment impacts of the STAA in greater detail than would be possible with a macroeconomic analysis alone. Use of the DRI input-output-based industry model permits identification of both the total (net) employment effect and specific industry employment effects. The industry impacts include both direct and indirect effects, where indirect effects are those on suppliers to the directly affected industries.

Both the with-STAA and without-STAA interindustry simulations are derived from their companion macroeconomic simulations. Development of the without case, however, requires additional model manipulation to fully reflect the nature of particular final demand changes. The interindustry model by itself captures the lower level of state and local construction spending, but it is necessary to target these spending changes to specific industries to ensure that sectors such as sewer and water facility construction are not affected.

The necessary adjustments were made in a two-stage process. The first was to identify the types of construction projects that are expected to be undertaken and to estimate the incremental funding for each type. The second was to develop a mapping between project types and the relevant industries in the DRI model. FHWA and UMTA each supplied information on expenditures by project type. DRI developed the mapping between projects and the industries classified in the model; 6 of the 400 industries in the interindustry model were judged to be affected. Table 5 gives expenditures by project type, and Table 6 gives the targeted industries by project type. The outputs of the industries listed in Table 6 were reduced by the amounts in Table 5 in the creation of the without-STAA simulation.

The direct effects are the result of final demand shifts forecast by the macroeconomic model, and the indirect effects are determined by the technological coefficients of the interindustry model. The final demand shifts include both the increase in government spending on construction and the reduction in personal consumption and housing investment. Employment is expected to increase in the six sectors designated as recipients of increased state and local expenditures and to decline in (a) consumption categories that are vulnerable to price and interest rate increases and (b) the housing construction industry. These industries, particularly the six targeted ones, can generally be characterized as having a large number of suppliers, each accounting for a relatively small amount of input costs. The indirect effects are likely, therefore, to be widespread but minor in terms of industry output. The indirect employment impacts will likewise be small, particularly in capital-intensive industries. Although the net effect on GNP is insignificant, the net employment effect need not be zero because of differing labor intensities among industries.

Comparison of the two simulations indicates that the net employment effect is in fact not zero. Table 7 gives the net employment changes. Total employment declined slightly in 1983 below what it would have been without the STAA but is expected to increase in

TABLE 5 Incremental Expenditures by Project Type (billions of 1972 dollars)

Project Type	1983	1984	1985	1986
Highway				
Repair	0.472	1.485	2.019	1.812
New construction	0.052	0.65	0.224	0.201
Bus facility construction	0.002	0.008	0.020	0.023
Railroad				
Repair	0.007	0.037	0.088	0.102
New construction	0.007	0.034	0.080	0.093
Buses	0.002	0.008	0.020	0.023
Railroad vehicles				
Existing systems	0.002	0.009	0.022	0.026
New systems	0.000	0.000	0.001	0.001

TABLE 6 Industries Affected by Incremental Expenditures in the 400-Sector Interindustry Model

Project Type	No.	Industry
Highway		
Repair	44	Maintenance and repair, other
New construction	37	New highways and streets
Bus facility construction	42	New construction, NEC
Railroad		
Repair	44	Maintenance and repair, other
New construction	31	New railroads
Buses	333	Motor vehicles
Railroad vehicles		
Existing systems	340	Railroad equipment
New systems	340	Railroad equipment

TABLE 7 Employment Impacts of the STAA of 1982 (thousand employees)

No.	Industry	1983	1984	1985	1986
Change in Total Employment		−9	29	98	43
Change in Industries Directly Affected by Increased Construction					
31	New railroads	0	1	2	2
37	New highways and streets	2	7	9	8
42	New construction, NEC	0	0	1	1
44	Maintenance and repair, other	23	75	103	91
333	Motor vehicles	−1	−1	−1	−1
340	Railroad equipment	0	0	0	0
Change in Selected Industries Directly Affected by Decreased Consumption Expenditures and Investment					
21	New residential single-family housing	0	−1	−2	−3
376	Retail trade	−12	−16	−7	−6
389	Automobile repair	−1	−1	−1	−1
Change in Selected Supplier Industries (indirect effects)					
19	Stone and clay mining	0	1	1	1
181	Petroleum refining and related products	−1	−1	0	−1
202	Concrete products, NEC	0	1	1	1
248	Metal stampings	0	−1	0	−1
264	Construction machinery	0	1	1	0
334	Motor vehicle parts and accessories	−1	−1	−1	−1
375	Wholesale trade	−4	−6	−3	−6
385	Miscellaneous business services	−1	−1	1	−2
386	Advertisting	−1	−1	0	−1

1984 through 1986. This is because the government spending stimulus increases gradually over the period but the inhibitive effects of tax increases occur immediately.

Table 7 also gives employment effects for selected industries. Of the six industries designated as recipients of incremental construction funds, only one, maintenance and repair, experiences a major increase in employment over the entire period. Much smaller increases occur in the other three construction categories. The pattern of increases over time reflects the pattern of the anticipated spending changes. Interestingly, employment in the motor vehicle industry actually declines slightly. This is due to the reduction in automobile sales occasioned by the fuel tax increase, which outweighs increases in bus purchases. The additional expenditures for rail equipment are not sufficient to cause an increase in employment in that industry. The most significant decline in employment occurs in the retail trade industry, primarily as a result of the drop in consumption expenditures but also as a result of indirect impacts. The decline in automobile repair employment is also representative of the adjustments that follow from the reduction in consumption. The employment reduction in housing construction employment is directly linked to lower levels of residential investment.

The indirect employment effects fall into two categories: changes for construction industry suppliers and changes for consumption-related industries. These groups are not mutually exclusive, and the results given in Table 7 are net. The indirect construction impacts show up in industries such as stone and clay mining, concrete products, and construction machinery. The negative indirect effects are experienced by industries supporting fuel and motor vehicle sales sectors, such as petroleum refining and related products and motor vehicle parts and accessories, and by those providing general business services, such as wholesale trade, miscellaneous business services, and advertising. Industries in this latter category also support the construction sector, so the net negative effect is due to the dominance of the shifts in consumption expenditure industries.

REGIONAL ANALYSIS

The employment impacts of the STAA for the nation as a whole were presented in the preceding section. In this section, these national impacts are disaggregated by census region.

The DRI Regional Information Service (RIS) model was used in carrying out this analysis. The RIS model is directly linked to the macroeconomic and interindustry models used in the analyses described previously. This linkage made it possible to run the macroeconomic and interindustry with-STAA and without-STAA results through the RIS model in a simple, straightforward way. The regional model then allocated the national impacts to the nine census regions on the basis of the extent to which each region's economy is dependent on motor vehicle sales, oil refining, construction, and other major sectors affected by the act. In addition, as discussed later, the regional distribution of highway spending had to be taken into account.

The RIS model uses employment as the principal indicator of economic activity in each sector. For this reason, the direct impact of increased highway spending was introduced into the model in the form of a change in construction employment. Because the national macroeconomic analysis had already estimated the total direct impact on construction employment nationwide, all that was needed was the regional shares of this total impact. These regional shares are not precisely the same as the shares of the increased federal funds because construction wages vary from region to region. Thus the same dollar expenditure will create more jobs in lower-wage regions than in higher-wage regions.

The regional shares of national highway spending were estimated from data on each state's share of total obligation limitations for the nation as a whole. These shares were then divided by average construction wages by state. In this way, each state's share of the new highway construction employment created by the STAA was estimated. The results, aggregated by census region, are given in Table 8. These results show that the South Atlantic region ranks first in gains in highway construction employment created by the act, with almost twice as many new highway construction jobs as the second-ranking Pacific region.

TABLE 8 Estimated Census Region Shares of Highway Construction Employment Generated by the STAA of 1982 from 1983 to 1986

Rank	Census Region	Average Annual No. of New Highway Construction Jobs (000s)	Share of New Construction Employment (%)
1	South Atlantic	17.0	22.0
2	Pacific	9.1	11.8
3	East North Central	8.8	11.4
4	Middle Atlantic	8.3	10.8
5	West South Central	8.3	10.8
6	West North Central	7.4	9.6
7	East South Central	7.1	9.2
8	Mountain	6.9	8.9
9	New England	4.3	5.5
	U.S. total	77.2	100.0

However, the ranking of regions by gains in highway construction employment differs markedly from the ranking by total employment impacts, given in Table 9. For example, the South Atlantic region, which ranks first in highway construction gains, ranks only third in total employment gains. This might reflect, among other factors, relatively low construction (and other) wages and incomes in this region.

More generally, the data in Table 9 indicate that implementation of the STAA will create more jobs than it destroys in each of the nine census regions. The largest net average annual increases will be realized in the West North Central and West South Central regions, with gains of 7,700 and 7,600, respectively. The East North Central and New England regions, with gains of only 700 and 1,300 jobs, respectively, show the smallest increases. Consistent with the macroeconomic and interindustry analyses, in all nine regions the largest gains occur in construction. This, of course, reflects the increases in highway construction employment. All of the regions also show employment declines in manufacturing, transportation, and trade. For other sectors, the results are mixed across census regions.

The most adversely affected sectors nationwide are manufacturing, trade, and, to a lesser extent, services. The combined impacts of the STAA on these three sectors offset 45 percent of the increase in construction employment. After all impacts are considered, there is a net increase in total nonagricultural employment of 38,100 jobs.

The impacts on manufacturing employment, given in

TABLE 9 Average Annual Number of Jobs Created (net) by the STAA of 1982 from 1983 to 1986 Ranked by Census Region (000s)

Rank	Census Region	Construction	Manufacturing	Transportation	Trade	Finance	Services	Federal Government	State and Local Government	Mining	Total
1	West North Central	8.8	-0.8	-0.1	-0.3	-0.1	-0.3	0.0	0.4	0.1	7.7
2	West South Central	9.5	-0.3	-0.1	-1.5	-0.1	-0.2	0.0	0.2	0.1	7.6
3	South Atlantic	12.2	-2.6	-0.4	-2.6	-0.3	-0.8	-0.1	0.4	0.4	6.2
4	East South Central	7.8	-1.9	0.0	-0.6	0.0	0.1	0.1	0.4	0.3	6.2
5	Mountain	6.3	-0.4	-0.1	-1.0	-0.1	-0.3	0.1	0.2	0.2	4.9
6	Pacific	7.6	-1.3	-0.3	-2.5	-0.3	-0.9	-0.1	-0.3	0.0	1.9
7	Middle Atlantic	8.4	-1.3	-0.3	-2.9	-0.4	-1.2	-0.1	-0.7	0.1	1.6
8	New England	4.0	-0.7	-0.1	-1.1	-0.2	-0.5	0.0	-0.1	0.0	1.3
9	East North Central	9.5	-3.1	-0.4	-3.2	-0.4	-1.4	-0.1	-0.4	0.2	0.7
	U.S total	74.1	-12.4	-1.8	-15.7	-1.9	-5.5	-0.2	0.1	1.4	38.1

Table 10, are important because of their relatively large multiplier effects on other sectors. This is caused by the relatively high average wages in this sector. The most significant impacts of the act on manufacturing are felt by the transportation equipment industry, which is adversely affected by the increased cost of automobile ownership. A smaller, opposite impact occurs in the stone, clay, and glass sector as a result of increased highway construction activity. The regional distribution of these changes is primarily a matter of where these industries are concentrated. The largest reduction in manufacturing employment thus occurs in the region in which transportation equipment is most heavily concentrated, the East North Central region. The South Atlantic region shows the second largest decline in manufacturing employment. As is the case in the East North Central region, a significant part of this is explained by negative impacts on transportation equipment. Even more important are the negative impacts, caused by reductions in gasoline demand, of the act on chemicals, which affect the price and production of petrochemical feedstocks.

Reductions in employment in nonmanufacturing sectors of the economy--trade, services, communications, utilities, and so forth--are brought about primarily by reductions in real disposable personal income caused by the 5-cent tax increase. The impact on services is relatively large (see Table 9) because the service sector itself is large. Here, unsurprisingly, the geographic distribution of impacts is fairly even. The employment losses in trade are larger than those in services because this sector includes the retail sale of gasoline by service stations. Like those in services, the employment losses in trade are fairly evenly distributed across census regions, except in the West North Central region. In this region, a relatively large proportion of gasoline is purchased for agriculture, which is largely exempt from fuel taxes, and long-distance trucking, whose demand for gasoline is less responsive to price changes than is the demand by most other sectors of the economy.

The regional employment impacts of the STAA discussed thus far have been measured in absolute numbers of jobs gained or lost. Additional insights into the employment consequences of the act can be obtained by measuring these gains and losses as percentage changes from employment in the without-STAA scenario. When the absolute changes presented in Table 9 are converted to percentage changes, the results are those given in Table 11.

Perhaps the most forceful point indicated by the data in Table 11 is that all of the regional sector employment impacts are quite small relative to the without-STAA employment levels. The largest absolute change in regional sector employment shown in Table 9 is the 12,200 gains in construction jobs in the South Atlantic region; in Table 11, this translates into an increase of 1.4 percent.

Another point brought out by the data in Table 11 is that the percentage gains are largest for the three smallest regions in terms of population: East South Central, West North Central, and Mountain. It is no coincidence that the East South Central and West North Central regions rank first and second, respectively, in percentage gains in construction and that the Mountain region ranks fourth. An excep-

TABLE 10 Average Number of Jobs Created in the Manufacturing Sector by the STAA of 1982 from 1983 to 1986

	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Mountain	Pacific	U.S. Total
Food processing	160	195	140	-103	-75	-359	-31	3	37	-35
Textiles	30	50	-398	41	-177	-41	21	0	46	-429
Apparel	-23	-65	-129	-92	-108	-10	-3	-1	15	-417
Lumber	59	88	-53	28	-127	62	-6	-108	-455	-511
Furniture	-18	-64	-158	-86	-34	-34	-20	-2	12	-403
Paper	-47	-83	-66	-90	-24	-17	-35	-4	-39	-405
Publishing	-75	-125	21	-98	121	2	-24	-11	-39	-228
Chemicals	42	-246	-804	178	-756	161	154	153	839	-277
Petroleum	1	-10	2	-9	-1	0	-25	-4	-14	-59
Rubber and plastics	-64	-92	-34	-237	-40	-16	-36	-8	-85	-611
Leather	-82	-54	-11	-4	-4	-8	1	3	33	-126
Stone, clay, and glass	19	292	199	302	107	136	172	0	81	1,308
Primary metals	5	36	88	-395	-33	-144	-118	-97	-225	-883
Fabricated metals	168	252	-258	26	-277	29	194	-21	-128	-15
Nonelectrical machinery	-105	-367	-342	-418	-279	-111	-300	-52	-194	-2,169
Electrical machinery	-401	-689	-175	-746	147	-122	-72	-172	-343	-2,573
Transportation equipment	-170	-262	-355	-1,302	-113	-253	-172	-68	-609	-3,302
Instruments	-100	-171	-31	-74	-9	-37	-20	-23	-145	-610
Miscellaneous	-36	-64	-17	-71	-6	-34	-16	-11	-57	-312
Total	-663	-1,342	-2,598	-3,148	-1,880	-827	-335	-434	-1,263	-12,487

Note: Columns do not add to totals because changes in "other" (unclassified) manufacturing employment are not shown.

TABLE 11 Average Annual Percentage Changes in Employment Caused by the STAA of 1982 from 1983 to 1986 Ranked by Census Region

Rank	Census Region	Construction	Manufacturing	Transportation	Trade	Finance	Services	Federal Government	State and Local Government	Mining	Total
1	East South Central	3.11	−0.14	−0.01	−0.06	0.00	0.01	0.05	0.05	0.29	0.12
2	West North Central	3.07	−0.06	−0.03	−0.02	−0.03	−0.02	−0.01	0.04	0.20	0.11
3	Mountain	1.92	−0.07	−0.04	−0.08	−0.04	−0.03	0.03	0.02	0.15	0.10
4	West South Central	1.63	−0.02	−0.02	−0.06	−0.02	−0.01	−0.01	0.02	0.02	0.07
5	South Atlantic	1.41	−0.08	−0.05	−0.07	−0.04	−0.02	−0.01	0.02	0.36	0.04
6	New England	1.96	−0.04	−0.05	−0.09	−0.04	−0.04	−0.01	−0.02	0.19	0.02
7	Middle Atlantic	1.59	−0.04	−0.03	−0.09	−0.03	−0.03	−0.02	−0.03	0.19	0.01
8	Pacific	1.28	−0.05	−0.04	−0.08	−0.04	−0.03	−0.03	−0.01	−0.03	0.01
9	East North Central	1.61	−0.07	−0.05	−0.09	−0.04	−0.04	−0.02	−0.02	0.19	0.00
	U.S. total	1.75	−0.06	−0.04	−0.07	−0.03	−0.03	−0.01	0.00	0.12	0.04

tion to the correlation between percentage increases in construction and total employment is New England, which experienced greater than average losses in trade and services and did not make up for them in mining.

The East North Central region experiences the lowest gain in employment, in both absolute and percentage terms. Although this region ties for second place in the number of new construction jobs, these gains were offset to an unusual extent by losses in the manufacturing sector, which is heavily concentrated in motor vehicles, and by the relatively large multiplier effects of the manufacturing losses on the trade and service sectors. This is in contrast to the neighboring West North Central region, whose manufacturing sector is relatively small and not especially dependent on motor vehicles. In this region, even though it gained only an average number of construction jobs, the negative impact on trade is quite small.

SUMMARY

Although the Surface Transportation Assistance Act of 1982 was passed primarily in response to concern about the nation's transportation infrastructure, the act was also expected to generate increased employment. The results of this analysis indicate that, with respect to aggregate GNP, the stimulus of increased government spending is largely offset by the negative effects of the tax increase. Thus there is no significant impact on real GNP. However, there are changes in the components of the GNP. As would be expected, those sectors linked closely to highway construction benefit from the act and those sectors sensitive to higher gasoline prices, lower disposable income, and higher interest rates suffer.

Although the aggregate GNP impacts are not significant, the net effect on employment is not zero because of differing labor intensities among industries. Thus total employment was predicted to drop slightly in 1983 but to increase in 1984 through 1986 as the spending stimulus gradually overtook the inhibitive effect of the tax increase.

Finally, the regional effects of the act were found not to be borne uniformly. This is also as expected. Regional variations are primarily a result of differences in the number of new construction jobs, differences in construction wage rates, and the geographic concentration of motor vehicle manufacturing in particular and manufacturing and trade in general.

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