

## INTERNATIONAL

### Investment in Transportation Infrastructure

International comparisons of particular investment strategies or public infrastructure policies have become common place. Certainly, there are benefits to understanding the investment approaches and their resulting impacts as experienced by other countries. However, in drawing correlations between U.S. policies and those of other countries, one must be cautious. Unqualified assumptions that similar investment policies or percentages across dissimilar countries, especially in regard to transportation infrastructure, will yield like effects on economic vitality and productivity are unfounded. For example, per capita private vehicles and per capita roadway mileage in the U.S. is relatively larger than most European countries and Japan. In contrast, the fatality rates are much lower in the U.S. Simple comparison statistics show that while the U.S. has a relatively small percentage of public capital transportation investment as a portion of Gross Domestic Product (GDP) and a population density much lower than that of most European countries and Japan, the U.S. has a relatively higher rate of population growth, and GDP per capita.

In order to draw meaningful conclusions about transportation investment and economic growth, detailed correlation analysis and related investigation would be necessary on a broad array of policy and capital investment variables across countries. Unfortunately, data are limited and inconsistent due to the variations in collection methodology across countries. In the absence of better data and detailed econometric results, review of the available data offers an initial look at how transportation investment as a percentage of economic output appears to vary across countries.

The following factors should be considered when attempting to make inferences about the international data: population density, population growth rates, aging of the population, income per capita, reliance on international trade, and urbanization.

A few simple demographic characteristics for selected countries are displayed in Table 1.

Table 2 presents a snapshot of public transport investment as a percentage of production output for the countries in our sample. Gross Domestic Product is used as a measure of the output produced by all

labor and property located in a specific country. Inland transportation is defined by the European Community (EC) as including road investment, railways investment, transit investment, and inland waterways investment. All transport investment in most cases includes inland transport as well as pipelines, ports, and airports.

The data on transportation capital investment is drawn from a variety of sources. The data for the different modes exhibits some differences in the level of capital expenditures included. Unfortunately the data definitions due to these variances and the lack of sufficient data collection in some cases may cause the data to be inconsistent across countries. Furthermore, inherent differences exist in countries such as Japan, where there is a heavy reliance on sea-ports and air transport which are not part of inland transport as categorized by the EC. Inferences from this data that a certain percentage of transportation investment in relation to GDP is required for economic vitality should be made cautiously and in a best case scenario would include a variety of other factors.

Tables 3 and 4 offer a sample of international comparison statistics related specifically to highways.

### Summary

The Statistical Abstract of the U.S. notes several reasons for caution in international comparison. Indeed, the quality and comparability of the data can be affected by many factors. Frequently, the data presented is not consistent for each country or for each measure from a country. The methods of estimating, data collection, coverage, precision of definition, and margins of error may vary for different items within a country and for similar items across countries. In many cases the measures presented should be taken as rough indicators of magnitude. Measures can show variation as a result of differing source data, or revisions in the data, differences in the definition of the territory included (i.e. in the U.S. not all States are always included). Further, in some cases comparison requires that investment figures be converted into a common currency. A variety of techniques are available to accomplish this conversion, not all reflect the relative purchasing power of the varying countries.

Historical comparisons over time may be one simple improvement. Others might suggest that comparing European countries with individual States might be more appropriate, while still others would suggest that comparing the European Community with the U.S. would be best. All of these options have limitations as economic entities and in the data. More detailed demographic characteristics such as employment characteristics and historic patterns, might lead us to identify more applicable trends. The necessity of far more detailed analysis prior to drawing any conclusions about causation between these variables cannot be overemphasized.

## SOCIAL AND DEMOGRAPHIC CHARACTERISTICS FOR SELECTED COUNTRIES

TABLE I-1  
OCTOBER 1993

	France	Germany (West)	Spain	Sweden	United Kingdom	United States	Japan
Population Density (persons per sq.mile) 1989	266	635	203	48	606	69	861
Population Growth Rate 1980-1990 (annual percent change)	0.4	-0.1%	0.6	0.1	0.1	0.9	0.6
Percent of Population age 65 and over in 1989	13.7%	15.4%	12.9%	not available	15.6%	12.4%	11.6%
GDP per capita (in dollars using Purchasing Power Parity's for 1987)	12,803	13,323	8,681	13,771	12,340	18,338	13,182
Trade Balances (in millions of dollars for 1988)	-8,732	78,640	-12,980	4,748	-36,514	-126,780	94,990

Source: Prepared from "The Statistical Abstract of the United States", 1990-1992, U.S. Department of Commerce, Bureau of the Census: Washington, D.C.

## CAPITAL INVESTMENT IN TRANSPORTATION AS A PERCENTAGE OF GROSS DOMESTIC PRODUCT 1989 CURRENT FIGURES

TABLE I-2  
OCTOBER 1993

	France	Germany (West)	Spain	Sweden	United Kingdom	United States	Japan
Road Investment as a Percentage of GDP	0.80%	0.66%	0.99%	0.38%	0.61%	0.52%	2.4%
Inland Transport Investment as a Percentage of GDP	1.12%	0.98%	1.28%	0.57%	0.84%	0.67%	2.7%
All Transport Investment as a Percentage of GDP	1.15%	1.10%	1.47%	0.70%	0.92%	0.73%	3.1%
Road Investment as a Percentage of Inland Transport Investment	72%	68%	78%	66%	73%	78%	89%
Road Investment as a Percentage of all Transportation Investment	70%	60%	68%	54%	66%	71%	78%
Gross National Product (annual percent change) 1985 - 1988	2.6%	2.6%	4.6%	1.9%	3.9%	3.6%	4.2%

Sources: Prepared from "Investment in Transportation Infrastructure in the 1980s," 1992, ECMT; Japan Transport Economic Research Center; "Railroad Facts," 1992, AAR; "Net Fixed Reproducible Tangible Wealth," 1987, U.S.D.O.C., B.E.A.; "The Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance: Report of the Secretary of Transportation to the U.S. Congress, 1993; "National Strategic Planning Study," 1990; and the "Statistical Abstract of the U.S."<sup>1</sup>

<sup>1</sup>The data for France is 1988 rather than 1989, and does not include pipelines which received minor investment. Spain has not included data for inland waterways. Sweden included investment in inland waterways as part of ports. The United Kingdom transport investment figure does not include air transport. The Japanese figure does not have a figure for inland waterways; figures for transit and pipelines are not included. Figures are intended to reflect public capital investment, but in some cases private investment projects may be included.

Data for the United States includes several transportation investment categories. Highway Investment figures are refer to public capital investment in federal state and local highways and streets. Data on Railroad Investment in the U.S. is taken from the capital expenditures figures. U.S. Transit figures reflect capital revenues as published in the "needs" report. Data on inland waterways includes U.S. Army Corps of Engineers Civil Works Expenditures for construction of all navigation systems as well as commercial construction. Airport data for the U.S. includes facilities, equipment and grants. Port data is for corps expenditures on harbor improvement and deep draft project construction. Investment in pipelines is private capital investment.

## ROAD SYSTEM MEASURES FOR SELECTED COUNTRIES

TABLE I-3  
OCTOBER 1993

	France	Germany (West)	Spain	United Kingdom	United States
Road System Extent per Capita for Motorways, Main & National Roads (kilometers per thousand people)	0.63	0.65	0.53	0.27	2.67
Road System Extent per Capita for Secondary and Other Roads (kilometers per thousand people)	13.84	7.41	7.66	5.92	22.89
Fatality Rate (deaths per 100 million vehicle kilometers traveled)	3	2.3	6.9	1.6	1.5
Road System Extent as a Percentage of Non-forest Land (kilometers per sq.km of non-forest land)	2.83	2.03	0.84	1.59	0.92
Vehicles per thousand people	394	463	263.1	318	561

Sources: Prepared from "Europe in Figures," 1992, Eurostat; "World Road Statistics," International Road Federation, 1991; "Highway Statistics," 1987-1990, FHWA; and "The Statistical Abstract of the U.S.," 1990.

## TRANSPORTATION INDICATORS FOR SELECTED COUNTRIES

TABLE I-4  
OCTOBER 1993

ITEM	ASIA	EUROPE					NORTH AMERICA	
	JAPAN	FRANCE	ITALY	SWEDEN	UNITED KINGDOM	WEST GERMANY	CANADA	UNITED STATES
1990--Auto Registrations (thousands)	34,924	23,550	27,300	3,601	22,528	27,218	12,622	143,550
1990--Truck and Bus Registrations (thousands)	21,567	4,910	2,427	324	3,774	5,453	3,931	45,106
1990--Automobiles Per Capita	0.283	0.417	0.478	0.421	0.394	0.430	0.476	0.574
1990--Trucks Per Capita	0.175	0.087	0.043	0.035	0.066	0.086	0.148	0.180
1991--Gasoline Prices (Current \$ per gallon) 2/	3.90	3.86	5.10	4.45	2.55	2.87	2.06	1.43
1991--Gasoline Prices (Constant \$ per gallon) 2/	3.74	3.70	4.89	4.27	2.45	2.75	1.98	1.37
1991--Diesel Fuel Prices (Current \$ per gallon) 3/	2.40	4/	3.77	3.58	4/	2.69	1.98	0.91
1991--Diesel Fuel Prices (Constant \$ per gallon) 3/	2.30	4/	3.62	3.43	4/	2.58	1.90	0.87
1989--New Gasoline Fuel Economy (mpg)	4/	36.3	4/	28.5	4/	25.6		
1989--Fuel Economy of Gasoline Automobile Population (mpg)	4/	27.0	30.7	23.2	25.5	22.5	19.0	
1990--Annual Miles Drive per Vehicle (miles)								
Cars	4/	8,451	4/	4/	10,377	9,010		10,556
Trucks	4/	13,671	4/	4/	35,349	19,139		13,868
Buses	4/	31,070	4/	4/	23,439	36,041		9,136
Inland Surface Transport of Goods (million ton-miles)								
Road	127,992	69,608	89,576	13,162	63,455	83,343		609,691
Water	127,915	5,221	125	5,594	25,917	29,956		382,223
Rail	13,623	33,561	11,718	10,930	9,509	39,776		894,960
1989--Passenger Travel by Personal Vehicles (billion passenger miles)	454	689	4/	54	343	348		2,920
1989--Energy Use by Personal Vehicles (trillion Btu)	1,414	811	4/	159	997	1,214		12,046
Passenger Travel by Bus (billion passenger miles)	68	24	4/	6	25	33		125
Energy Use by Bus (trillion Btu)	59	29	4/	9	44	39		163
Passenger Travel by Rail (billion passenger miles)	228	46	4/	4	24	31		25
Energy Use by Rail (trillion Btu)	70	23	4/	5	4/	28		81

SOURCE: Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 13*.

1/ Automobile registrations for all other countries were calculated by subtracting listed countries' registrations from the world total.

2/ Prices represent the retail prices (including taxes) for premium leaded gasoline on January 1, 1991.

3/ Prices represent the retail prices (including taxes) diesel fuel on January 1, 1991.

4/ Data not available.