percent. These extreme differences in policy do not necessarily imply that the zero interest-rate calculations produce larger highway programs, because the total size of such programs may be determined by receipts from use taxes or other budget constraints. But, if a given investment fund proves to be inadequate at a zero discount rate, then it must be parcelled out among individual projects on the basis of benefit-cost ratios a good deal higher than unity. A combination of a zero discount rate and high benefit-cost ratios is sure to distort both the geographical distribution and the physical characteristics of highway investment. The very word "investment" implies the importance of time. Yet a zero discount rate assumes that time has no importance.

The same general phenomenon occurs in different forms in financing aviation investment. The Federal Aviation Administration, a component of the Department of Transportation, systematically employs discounting to determine the present values of future costs and benefits. Yet most investment in airports is made locally, on the basis of investment criteria which are typically unannounced even if they are known. Local airport finance may enforce some discounting rules in practice: an airport financed by revenue bonds must automatically convert some future benefits into cash flows and effectively discount these future cash flows by applying applicable rates of interest against them. But many airports are not financed by revenue bonds. Also, the very choice between revenue bonds and obligations pledging full faith and credit produces a further option in interest rates which may be used for discounting in addition to the option created by the fact that local obligations, free of Federal taxes, typically involve interest rates lower than those available to the U.S. Treasury.

b. *The ragged edge between public and private investment*

The tax differential mentioned in the preceding paragraph is, of course, even more obvious if public and private investments are compared. A locally-financed transportation investment may disregard both direct and indirect income tax payments. Income of the project itself is not taxable; and interest paid to bondholders is free of Federal income tax. A Federally-financed project involves indirect Federal income tax payments by holders of Federal securities which are the counterparts of the investment expenditure, but the project pays no income taxes directly. Private investment financed by bonds has the same Federal income tax position as Federal investment; but private investment financed by sale of new equity capital involves both direct and indirect income taxation by all relevant levels of government. To complicate matters still further, equity capital created by ploughing back earnings may greatly reduce the indirect tax liabilities of stockholders who take the capital-gains route to keep themselves in funds or who have no need to sell stock.

This description could, of course, be applied to the differences in income tax liabilities of private and of different kinds of public investors anywhere in the economy. Its particular significance for transportation arises from the interrelationships of public and private investment in transport investment. Where the two are complementary, as they are in aviation, the practical results may be just the reverse of the over-extension of airports relative to airplane investment which pure discount theory would lead one to expect. Hard-pressed local governments may refuse to incur further debt even if it is incurred to finance an investment which seems almost sure to be profitable. And revenue bonds may not be saleable in one big lump for a huge new airport. But the most difficult cases are not those of investment complementarity between the private and public sectors. These most difficult cases involve investment competition, in the sense of investment in facilities to provide competitive services. The outstanding example of this competition is that of highways and railroads. But the rail investment problem has so many other aspects that it requires special treatment of its own.

3. The special case of railroad investment

The Department of Transportation operates the Alaska Railroad. The City of Cincinnati owns, but does not operate, the Cincinnati Southern. Otherwise the railroad map of the United States is dominated by private ownership. Therefore it may seem paradoxical to single out railroad investment policy in a statement devoted to Federal Government standards for discounting future costs and benefits. Moreover, most important present-day problems of railroad investment cannot be attributed simply to public investment in highway facilities for the specific purpose of facilitating freight movement. The contrasting attitudes of the American Trucking Association and the American Automobile Association on truck size and weight limits are enough to indicate that truck and passenger car uses of