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Productivity Increases in the U.S. Airline Industry: Comments

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There seem to be errors of two types in the paper "Sources of Productivity Increases in the U. S. Passenger Airline Industry," by NEIL B. MURPHY *Trans. Sci.*, 3, 233-238. (1969)

The errors of the first type are numerical. Table I gives the estimate 0.0311 for the parameter h , associated with the *common* logarithm of the time shift variable Y , and -0.0511 for the parameter g_1 . These imply (respectively) an estimated cost increase of 7.4 per cent (rather than the stated 3 per cent) from 1965 to 1966, and a cost change of -11.1 per cent (rather than the -6.9 per cent cited in Table II) for the shift from piston to turbo-prop aircraft.

The second type of error is much more fundamental. In the model equation

$$C = aM^bL^cF^dP^fT_1^{g_1}T_2^{g_2}T_3^{g_3}Y^h, \quad (1)$$

where $C, M, L, \dots, Y$ are observables, the constant a was assumed equal to 1; I can see no justification for that assumption, nor does the paper offer any. In fact, a is not dimensionless; its value therefore must depend on the units in which we express the costs, distances, etc.; it is fantastic to think that we might happen to have $a = 1$ for the specific units employed. (The paper does not quote the units.)

Not only is the assumption that $a = 1$ wrong in principle, but it may have influenced the major conclusion of the paper, which concerns economies of scale. If M and C (total seat-miles and total direct operating cost, respectively) were the largest of the empirical numbers (as would result from the most natural choice of units), then choosing $a = 1$ might tend to force the exponent b to be nearer 1. Only by a recalculation, using the same data in the same model without demanding that $a = 1$, can one confirm or deny this surmise, but the paper's numerical results already suggest the existence of diseconomies of scale; that suggestion would be strengthened, and perhaps made statistically significant, if my surmise is correct.