Alwin D F & Hauser R M. The decomposition of effects in path analysis.
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This paper was written to clarify the terminology of causal modeling and to demonstrate a simple algebraic method for computing and interpreting direct and indirect effects of variables in recursive path models The paper shows how to compute indirect effects as differences between coefficients in successive reduced-form equations, estimated via multiple regression techniques [The *Science Citation Index®* (*SCI®*) and the *Social Sciences Citation Index®* (*SSCI®*) indicate that this paper has been cited in over 265 publications since 1975 ]

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Path analysis was invented before 1920 by the great geneticist Sewall Wright. It is based upon an isomorphism between path or flow diagrams and the coefficients of systems of linear equations.[1] It was used primarily as a deductive method for predicting correlation of genetic traits among relatives of stated degree, but Wright also used it inductively to model complex economic and social processes using observed correlations. Related statistical modeling tools were developed in other fields but rarely by persons acquainted with Wright's work.[2]

By the mid-1960s, there was already a long tradition of causal modeling in sociology and a language for interpreting statistical relationships in causal terms. Lazarsfeld's methods for elaborating cross-tabulations[3] and Blalock's methods of causal analysis using partial correlation were well known.[4] Path analysis became widely known and was used in several social scientific disciplines following the appearance of Duncan's introductory paper for sociologists,[5] Blau and Duncan's national study of social mobility,[6] and other widely cited applications.

Our paper was intended to clarify some of the terminology of causal modeling and to demonstrate a simple method for computing and interpreting direct and indirect effects of variables in recursive path models, models where the flow of causation is unidirectional. Our paper stimulated a number of other papers on the calculation of indirect effects in nonlinear or nonadditive structural equations models and in nonrecursive models. This has been followed by work on the standard errors of the components of direct and indirect effects.

Our paper made no claim of originality, and our work was heavily indebted to others, especially Finney[7] and Duncan, Featherman, and Duncan.[8] Rather, our goal was primarily didactic: the paper began as a handout to students in a graduate course on causal models that Alwin was teaching at Washington State University. It relied heavily on similar material developed by Hauser for his courses in multivariate data analysis, which Alwin had been exposed to as a graduate student at Wisconsin. Moreover, similar expositions were accessible in other publications that appeared at about the same time.[9,10]

Our paper was published at a time when the popularity of causal modeling via path analysis was at its peak in sociology. Many research questions required the decomposition of effects into direct and indirect components. Our paper was useful to researchers because it clarified the meaning of the several components of correlation/covariation and because it showed how to compute those components in a class of models that was in wide use. Because of its placement in a prominent sociological journal, it was cited frequently. Our contribution was scarcely original, but it appeared at the proverbial "right time and place."

1 **Wright S.** The method of path coefficients *Ann Math Stat* 5 161-215, 1934 (Cited 190 times since 1955 )
2 **Goldberger A S.** Structural equation methods in the social sciences *Econometrica* 40 979-1001, 1972 (Cited 40 times )
3 **Lazarsfeld P F.** The interpretation of statistical relations as a research operation (Lazarsfeld P F & Rosenberg M, eds ) *The language of social research* Glencoe. IL Free Press, 1962 p 115-25.
4 **Blalock H M, Jr.** *Causal inferences in nonexperimental research* Chapel Hill University of North Carolina Press, 1964 200 p
5 **Duncan O D.** Path analysis. sociological examples *Amer. J Sociol* 72 1-16, 1966 (Cited 540 times )
6 **Blau P M & Duncan O D.** *The American occupational structure* New York Wiley 1967 520 p
7 **Finney J M.** Indirect effects in path analysis *Sociol Meth Res* 1 175-86, 1972 (Cited 60 times.)
8 **Duncan O D, Featherman D L & Duncan B.** *Socioeconomic background and achievement* New York Seminar Press, 1972 284 p
9 **Duncan O D.** *Introduction to structural equation models* New York Academic Press, 1975. 180 p
10 **Lewis-Beck M S.** Determining the importance of an independent variable a path analytic solution *Soc Sci Res* 3 95-107, 1974 (Cited 25 times )