

This Week's Citation Classic

Griliches Z. Distributed lags: a survey. *Econometrica* 35:16-49, 1967.

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The origins of this *Classic* paper are discussed. A connection is made to an earlier, 1957, hybrid corn paper and to the problem of distinguishing between whether it is that people are slow to respond or that the models used are incomplete and the left-out variables change only slowly. [The *SSC*[®] and the *SC*[®] indicate that this paper has been cited in more than 310 publications.]

Distributed Lags

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The 1967 "Distributed Lags" paper grew out of my first major cited paper.¹ A decade earlier, I was trying to explain the spread of hybrid corn across the US using the logistic growth curve as a summary device and focusing on explaining the variability in its three main parameters: origin, slope, and ceiling across states and regions, using a number of economic variables related to the profitability of innovation introduction and adoption. When I turned to the analysis of other major changes in US agriculture, it became clear that I needed a different model, one with shifting "ceilings," where these ceilings were themselves functions changing economic variables. This led me to become, not entirely accidentally, one of the early "adopters" of the partial adjustment distributed lag model.

Marc Nerlove was a student at Chicago at about the same time, Phil Cagan had just finished his dissertation on adaptive expectations models, and I was sharing an office with John Muth for a year, while he was a postdoc there. Moreover, Hans Theil, who was one of my teachers, had brought L.M. Koyck's² model to Chicago. In this model, the "desired" level of use, which I identified with the "ceiling" of the earlier model, is a function of the underlying, more permanent economic variables, while ac-

tual use approaches this level only gradually, both because of the uncertainty about its exact location and because of costs of adjustment and other inertia factors. I used this model rather successfully to analyze the rise in fertilizer use and the growth in the demand for tractors, showing that they could be explained as responses to falling real prices plus a reasonable lag in adjustment to such changes.^{3,4}

Such models are subject, however, to a number of serious econometric difficulties, which accounts for my interest in the methodology of distributed lag estimation. In particular, there was a tendency toward finding rather high lagged dependent variable coefficients, implying implausible slow rates of adjustment. In an earlier paper,⁵ I stressed the fact that simple serial correlation in the residuals of the model, due to some other left-out factors, could produce biases in this direction. The major contribution of the 1967 paper, besides its pedagogical interest in laying out and unifying the treatment of various suggested models in the literature of that time, was in making this point loud and clear and in suggesting a testing procedure which could, in principle, distinguish between the assertion that people are slow to respond to stimuli and the possibility that they are not slow, but that other relevant but unmeasured factors in their environment are changing only slowly.

This problem, and the suggested testing procedure, has been rediscovered a number of times independently in various other areas of applied economic analysis, e.g., in the COFAC test of the London School of Economics "school" of econometrics and in the more recent debates about heterogeneity versus state dependence in labor economics. The topic itself, distributed lags, has gotten somewhat lost in the rise of modern time series analysis and various VAR and ARIMA models, but keeps surfacing from time to time as researchers keep coming back to trying to give their findings some structural (causal) interpretation.

1. Griliches Z. Hybrid corn: an exploration in the economics of technological change. *Econometrica* 25:501-22, 1957. (Cited 260 times.)

2. Koyck L. M. *Distributed lags and investment analysis*. Amsterdam, The Netherlands: North Holland, 1954. (Cited 375 times.)

3. Griliches Z. The demand for fertilizer an econometric interpretation of a technical change. *J. Farm Econ.* 40:591-606, 1958.

4. ----- Distributed lags, disaggregation, and regional demand functions for fertilizer. *J. Farm Econ.* 41:90-102, 1959.

5. ----- A note on serial correlation bias in estimates of distributed lags. *Econometrica* 29:65-73, 1961. (Cited 75 times.)