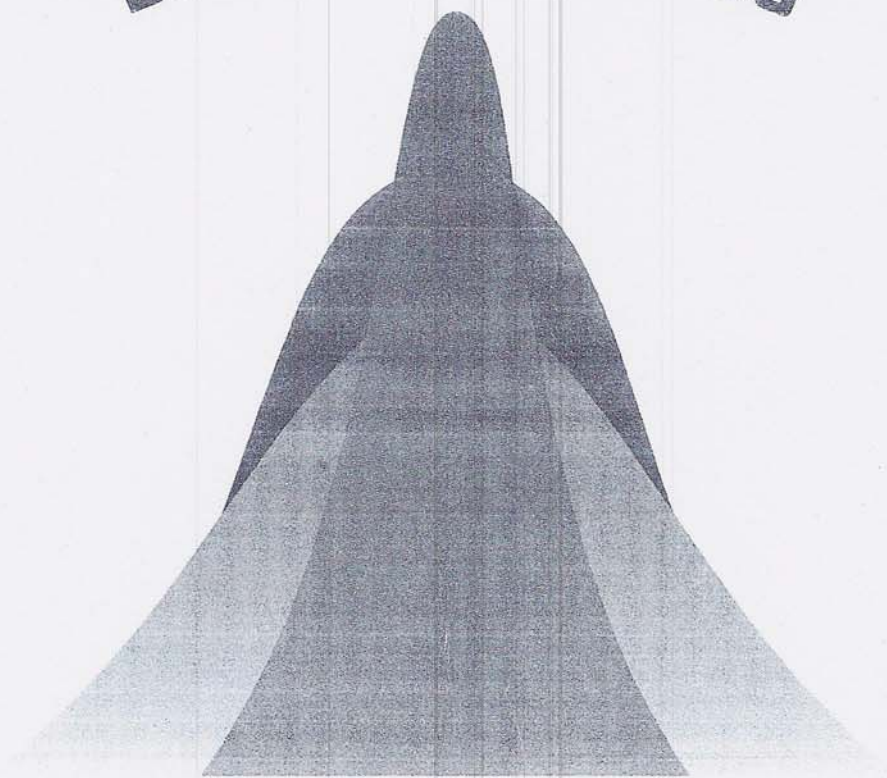


# **EXHIBIT 1**

# BASIC ECONOMETRICS



**Damodar N. Gujarati**

Third Edition



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**Damodar N. Gujarati**

*United States Military Academy, West Point*

**McGraw-Hill, Inc.**

New York St. Louis San Francisco Auckland Bogotá Caracas  
Lisbon London Madrid Mexico City Milan Montreal New Delhi  
San Juan Singapore Sydney Tokyo Toronto



This book was set in New Aster by Publication Services, Inc.  
The editors were Scott D. Stratford and Lucille H. Sutton;  
the production supervisor was Friederich W. Schulte.  
The cover was designed by Tana Kamine.  
Project supervision was done by Publication Services, Inc.  
R. R. Donnelley & Sons Company was printer and binder.

### **BASIC ECONOMETRICS**

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This book is printed on recycled, acid-free paper containing 10% postconsumer waste.

1 2 3 4 5 6 7 8 9 0 DOC DOC 9 0 9 8 7 6 5 4

ISBN 0-07-025214-9

### **Library of Congress Cataloging-in-Publication Data**

Gujarati, Damodar N.

Basic econometrics / Damodar N. Gujarati. —3rd ed.  
p. cm.

Includes bibliographical references (p. ) and index.

ISBN 0-07-025214-9

1. Econometrics. I. Title.

HB139.G84 1995

330'.01'5118—dc20

94-35295

### **INTERNATIONAL EDITION**

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When ordering this title, use ISBN 0-07-113963-X.



### $r^2$ for Regression-through-Origin Model

As just noted, and as further discussed in Appendix 6A, Section 6A.1, the conventional  $r^2$  given in Chapter 3 is not appropriate for regressions that do not contain the intercept. But one can compute what is known as the **raw  $r^2$**  for such models, which is defined as

$$\text{raw } r^2 = \frac{(\sum X_i Y_i)^2}{\sum X_i^2 \sum Y_i^2} \quad (6.1.9)$$

*Note:* These are raw (i.e., not mean-corrected) sums of squares and cross products.

Although this raw  $r^2$  satisfies the relation  $0 < r^2 < 1$ , it is not directly comparable to the conventional  $r^2$  value. For this reason some authors do not report the  $r^2$  value for zero intercept regression models.

Because of these special features of this model, one needs to exercise great caution in using the zero intercept regression model. Unless there is very strong *a priori* expectation, one would be well advised to stick to the conventional, intercept-present model. This has a dual advantage. First, if the intercept term is included in the model but it turns out to be statistically insignificant (i.e., statistically equal to zero), for all practical purposes we have a regression through the origin.<sup>4</sup> Second, and more important, if in fact there is an intercept in the model but we insist on fitting a regression through the origin, we would be committing a **specification error**, thus violating Assumption 9 of the classical linear regression model.

### An Illustrative Example: The Characteristic Line of Portfolio Theory

Table 6.1 gives data on the annual rates of return (%) on Afuture Fund, a mutual fund whose primary investment objective is maximum capital gain, and on the market portfolio, as measured by the Fisher Index, for the period 1971–1980.

In exercise 5.5 we introduced the *characteristic line* of investment analysis, which can be written as

$$Y_i = \alpha_i + \beta_i X_i + u_i \quad (6.1.10)$$

where  $Y_i$  = annual rate of return (%) on Afuture Fund

$X_i$  = annual rate of return (%) on the market portfolio

$\beta_i$  = slope coefficient, also known as the **Beta** coefficient in portfolio theory, and

$\alpha_i$  = the intercept

In the literature there is no consensus about the prior value of  $\alpha_i$ . Some empirical results have shown it to be positive and statistically significant and some

<sup>4</sup>Henri Theil points out that if the intercept is in fact absent, the slope coefficient may be estimated with far greater precision than with the intercept term left in. See his *Introduction to Econometrics*, Prentice-Hall, Englewood Cliffs, N.J., 1978, p. 76. See also the numerical example given next.