Appendices

APPENDIX I: DATA CONSTRUCTION

This appendix describes the procedure used to construct my data set, including the method used to construct annual capital stocks and stocks of debt that are not available in the original survey data.

1. Data Construction

The data has been taken from the annual surveys on manufacturing establishments conducted by the Central Bureau of Statistics since 1975. An additional data set, which proves to be very useful because it contains data on capital stocks and exports, is the 1986 Census of Manufacturing Establishments. The number of establishments in the annual survey varies from 8,300 establishments in 1975 to around 14,000 in 1988, and the 1986 census has 5,830 establishments with complete capital stock data.

I select a sample of firms from those two sources as follows. As there is no data available on financial sources prior to 1981, a sample period which runs from 1981 to 1988 is used. The 1981–88 survey data include 4,400 firms with complete data for at least three sequential years of output. The census data include 5,430 firms. Merging the 1981–88 survey with the 1986 census set brings the total number of firms to 3,192. I then construct a capital stock estimate by back-casting and forecasting the capital stocks, using the capital stock from the 1986 census data as a benchmark (see below for details). Leaving out establishments that have negative and zero capital stock and outliers, and keeping firms that have at least one year of positive investments, leaves us with 2,970 establishments (data set I). The frequency of each category of firms is given in Table 1 of this appendix. This data set is used to calculate the tables in Chapter 2 and the summary statistics in Chapter 4, section 4.

A very large number of firms report zero investment for many years. I am unable at this time to determine whether reporting of zero investment is in fact a non-response or represents a real observation of very low investment. I run a logit estimation of investment where it takes a value of 1 if investment is positive, and zero otherwise, the results of which are given in Table 2 of this appendix. The

TABLE 1(a)
Frequency of Data for Descriptive Statistics

Category	Number of Firms	Per Cent
All sizes	2,970	100.0
Number of years with output positive		
3 years	156	5.3
4 years	300	10.1
5 years	140	4.7
6 years	198	6.7
7 years	336	11.3
8 years	1,840	62.0
Firm Size[a]		
Small	777	26.1
Medium	1,336	45.0
Large	857	28.9
Class[b]		
Private enterprise	2,505	84.3
Public enterprise	465	15.7
Status of ownership[c]		
Domestic	2,461	82.9
Foreign/joint venture	509	17.1
Group[d]		
Non-conglomerate	2,696	90.8
Conglomerate	274	9.2
Market[e]		
Domestic market	2,369	79.8
Export market	601	20.2
Sector		
31 Food, beverage, tobacco	689	23.2
32 Textile, yarn, leather	443	14.9
33 Wood, furniture, etc.	106	3.6
34 Paper, printing, etc.	251	8.5
35 Chemicals, rubber, plastic, etc.	666	22.4
36 Non-metallic mineral products	123	4.1
37 Basic metals	33	1.1
38 Machineries, equipment, cars	636	21.4
39 Others — toys, etc.	23	0.8

[a] Small (<100 workers); Medium (100 to <500 workers); Large (>500 workers).
[b] Private refers to firms with 100 per cent private (non-government) equity, while public enterprise refers to firms with any level of central or regional government equity participation.
[c] Domestic ownership refers to firms with 100 per cent domestic equity, foreign/joint venture refers to firms with any level of foreign equity participation.
[d] Non-conglomerate refers to individual establishments.
[e] Export market refers to firms that directly export their products.

TABLE 1(b)
Frequency, by Size and other Categories for Descriptive Statistics

	Size		
Category	Small	Medium	Large
Group[d]			
Non-conglomerate	766	1,203	727
Conglomerate	11	133	130
Market[e]			
Domestic market	742	1,045	582
Export market	35	291	275
Sector			
31 Food, tobacco	211	200	296
32 Wood, furniture	45	192	206
33 Textile, leather	34	53	19
34 Paper, printing	94	150	7
35 Rubber, plastic	173	382	111
36 Non-mineral	59	32	32
37 Basic metals	4	17	12
38 Machines, cars	164	302	170
39 Toys, candies	11	8	4

See notes to Table 1(a) for definitions.

conclusion is that a higher profit rate will increase the probability of firms to invest. Hence, excluding non-positive investment from the sample will bias the coefficient of profit rate downward.

Since there are econometric problems associated with estimating zero investment, I have chosen for both the econometric analysis in Chapter 3 and in Chapter 4, section 3, a data set that includes observations *only* if the investment level is positive for at least four sequential years (data set II). By following this practice, I am left with an unbalanced panel of 524 establishments. Table 2 of this appendix shows the structure of the data by different categories of firms.

2. *Capital Stock Construction*

I now discuss the problems of constructing the capital stock variable. I am quite fortunate that the 1986 census data provides a measure of the replacement value of capital stock. I then use the data on annual investment purchases, I_t, obtained from the annual survey, and calculate the estimated capital stock for the rest of the period using the perpetual inventory method. My task is simplified because both sources have the data broken down into five components: land, buildings, machinery, vehicles, and other capital goods. The main advantage of this breakdown is that it

TABLE 2(a)
Frequency of Data for Econometric Estimations

Category	Number of Firms	Per Cent
All sizes	523	100.0
Number of years the firms have been in existence		
4 years	102	19.5
5 years	65	12.4
6 years	81	15.5
7 years	26	5.0
8 years	249	47.6
Firm size[a]		
Small	149	27.4
Medium	233	44.6
Large	141	27.0
Class[b]		
Private enterprise	433	82.8
Public enterprise	90	17.2
Status of ownership[c]		
Domestic	422	84.5
Foreign/joint venture	81	15.5
Group[d]		
Non-conglomerate	479	91.6
Conglomerate	44	8.4
Market[e]		
Domestic market	412	78.8
Export market	111	21.2
Firm age[f]		
Young (<6 years)	126	24.1
Medium (7–16 years)	81	15.5
Old (>17 years)	316	60.4
Sector		
31 Food, beverage, tobacco	113	21.6
32 Textile, yarn, leather	87	16.6
33 Wood, furniture, etc.	29	5.5
34 Paper, printing, etc.	44	8.4
35 Chemicals, rubber, plastic, etc.	111	21.2
36 Non-metallic mineral products	27	5.2
37 Basic metals	6	1.1
38 Machineries, equipment, cars	102	19.5
39 Others — toys, etc.	4	0.8

[f] Age refers to year production starts. Young (>1975); Old (1965–75); Very old (<1965).
See also notes to Table 1(a) for other definitions.

TABLE 2(b)
Frequency, by Size and Other Categories for Econometric Estimations

	Size		
Category	Small	Medium	Large
Group[d]			
Non-conglomerate	147	209	123
Conglomerate	2	24	180
Market[e]			
Domestic market	138	179	95
Export market	11	54	46
Sector			
31 Food, tobacco	31	35	47
32 Wood, furniture	15	37	35
33 Textile, leather	8	12	9
34 Paper, printing	18	24	2
35 Rubber, plastic	29	65	17
36 Non-mineral	15	6	6
37 Basic metals	2	3	1
38 Machine, cars	29	49	24
39 Toys, candies	2	2	0

See notes to Table 1(a) and Table 2(a) for definitions.

enables me to assign different physical depreciation rates to each asset type while constructing the capital stock. The overall capital stock finally used is the summation of those five variables, net of each asset sold during the period, IS_t. For each type of asset, capital stock estimates are constructed by the perpetual inventory method, where

$$K_t = I_{t-1} + (1-\delta)K_{t-1} - IS_t$$

In choosing the depreciation rates to be used (δ), I make use of information from an informal survey I conducted in 1990. On the basis of the information collected, I assume that the value of buildings depreciate by 0.033 per cent annually, machinery by 0.10 per cent, vehicles by 0.20 per cent, and other equipment by 0.20 per cent. Land is assumed to have zero depreciation.

This method of back-casting and forecasting the capital stock has one important weakness, that is, some back-casted negative capital stock value might appear whenever investment in that particular year is much larger than the capital stock. I have eliminated all firms in which the capital stock becomes negative in any year.

3. Stock of Debt Variable

My first step to get a reasonable sample is to check for outliers. I find that some firms have extremely low or high capital–to–value added ratio. I tend to believe that a *K/VA* ratio of less than 0.30 or more than 6.00 could well be a sign of mis-reported or mis-measured capital or value added. I therefore retain only firms with *K/VA* of 0.30 to 6.00 in the sample.

In the construction of the debt variable I again use the information collected in my 1990 informal survey. This information suggests that most of the firms replied to the question concerning the flow of new debt for a certain year by giving the figure for the stock of debt outstanding, which is in fact easier to find in their balance sheet. Moreover, by checking the debt-to-capital ratio, interest-to-debt ratio, interest–to–value added ratio, and capital–to–value added ratio, I conclude that indeed it is highly likely that most of the establishments have provided stock of debt instead of flow of debt data. Moreover, on the basis of these ratios it is possible to identify firms that in fact have provided data on flow of debt in any year. For these observations I convert the flow data to stock of debt by cumulating the flows.

Finally, many establishments do not provide the debt figures, although they almost always provide the figures for interest payments. Again, from the informal survey conducted, I find that some multi-plant establishments do not have the debt figures in their bookkeeping, although they do record interest payments. This is mainly because all loans are handled by the head office and yet interest payments are charged to the establishment. To obtain an estimate of the stock of debt for these establishments, I must first decide which interest rate to use to impute the debt figure. Considering that the average annual interest rate ranges from 5 per cent for priority sectors to as high as 45 per cent in the informal credit market, I decide to work out the median interest rate for firms having interest rates within that range, calculating yearly for different sizes of firms. I then use this median rate to impute debt figures for those years for which the debt figure is missing, but for which interest payments have been reported. Finally, for firms that have an interest-to-debt ratio outside the 0.050 to 0.450 range, I also use interest payments and the median rates in their year-size class to impute the debt figure.

4. Number of Firms in Data Set I and Data Set II

Tables 1(a), 1(b), 2(a), and 2(b) are presented to show the distribution of the two data sets I created. Data set I, consisting of parts (a) and (b) of Table 1, will be used to calculate the descriptive statistics of Chapter 2 and the last part of Chapter 4. Data set II, consisting of parts (a) and (b) of Table 2, will be used to run the econometric estimates of the investment equation in Chapter 3 and the new debt equation in Chapter 4.

APPENDIX II: GENERALIZED METHOD OF MOMENTS ESTIMATOR

The Generalized Method of Moments (GMM) estimator is a version of the Instrumental Variables method of estimation that minimizes the distance between population and sample moments, which then forms the basis of the GMM estimator that efficiently exploits all the information in the data. In essence, this method can be used to pool information from the $T-1$ first-difference equations (based on periods 1 and 2, periods 2 and 3, and so forth, the $T-2$ second-difference equations (based on periods 1 and 3, periods 2 and 4, and so forth), and so on. The set of valid instruments depends on the process that the errors follow. If the model has pre-determined or lag-endogenous (dated $t-1$) variables and the v_{it} is serially uncorrelated, then all variables dated $t-2$ and further lags are valid instruments for the first-difference equation for firm i in period t.

To see how this is done, the exposition in Tybout and Westbrook (1991) is followed here.

Imagine that the data is organized into blocks of n observations, one block corresponding to each of these $H = T(T-1)/2$ equations. We may then define the explanatory variable matrix to be

$$X = (X_1', X_2', . X_h', . , X_H')(nH \times 2)$$

where if the h^{th} block corresponds to the j^{th} difference ending in period t, its representative row is (d^jL_{it}, d^jK_{it}).

Similarly, the dependent variable may be organized into the vector

$$Y = (Y_1', Y_2', . Y_h', . , Y_H')$$

with a representative row for the h^{th} block (d^jY_{it}).

Finally, the associated disturbance vector is

$$V = (V_1', V_2', . V_h', . , V_H')(nH \times 1)$$

where $V_h = d^j\epsilon_t - \beta d^j v_t$ has representative element $(d^j\epsilon_t - \beta d^j v_{it})$.

Suppose Z_h is the $(n \times r_h)$ matrix of Instrumental Variables available for the h^{th} difference equation, Z_h has representative row z_{ih} and each column of z_h is orthogonal to V_h. Then, defining $m = r_h$ and $Z_{(nH\times m)} = \text{diag } [Z_h]$, $(h = 1, \ldots, H)$, the m orthogonality conditions $E(Z'V) = 0$ form the basis of the GMM estimator that efficiently exploits all the information in the data.

In the presence of general heteroskedasticity across both firms and time, to construct the GMM estimator, $U_{(m\times m)}$ is defined thus:

$$U_{(m\times m)} = (1/n) {}_{i=1}^{n} z_i \hat{v}_i \hat{v}_i' z_i$$

where $z_{i(H\times m)} = \text{diag } (z_{i1}, z_{i2}, \ldots, z_{iH})$ and $\hat{v}_{i(H\times 1)}$

is a vector of residuals from the H equations for the I^{th} firm obtained, with some consistent initial estimator (for example, two-stage Least Squares) or an iterative procedure.

Then the coefficient of the GMM estimator is

$$(\hat{\alpha}, \hat{\beta})' = [X'ZU^{-1}Z'X]^{-1}X'ZU^{-1}Z'Y$$

and its covariance matrix is estimated by $n[X'ZU^{-1}Z'X]^{-1}$.

APPENDIX III

TABLE 1
Production Function Estimates

	CRES	NCRES	CRES	NCRDS	IVCR	IVNCR	IVTL
C	0.273	0.317			0.441	0.179	0.042
	(8.470)	(16.766)			(3.128)	(1.957)	(0.392)
L		0.764				0.665	0.450
		(3.667)				(3.078)	(2.078)
K2							–0.053
							–(1.466)
L2							–0.110
							–(6.146)
KL							0.163
							(5.480)
Sector 31K			0.393	0.395			
			(4.289)	(7.497)			
Sector 31EL				0.673			
				(2.111)			
Sector 32K			0.376	0.351			
			(3.651)	(6.392)			
Sector 32EL				0.716			
				(2.273)			
Sector 33K			0.044	0.364			
			(0.239)	(2.983)			
Sector 33EL				0.722			
				(5.173)			
Sector 34K			0.351	0.314			
			(3.165)	(4.715)			
Sector 34EL				0.760			
				(9.896)			
Sector 35K			0.282	0.279			
			(5.746)	(9.375)			
Sector 35EL				0.797			
				(3.761)			
Sector 38K			0.175	0.336			
			(2.555)	(8.864)			
Sector 38EL				0.750			
				(1.323)			
Other sectorK			0.124	0.101			
			(0.782)	(1.058)			
Other sectorEL				0.937			
				(2.293)			
R^2	0.522	0.893	0.525	0.895	0.262	0.288	0.268
Sargan test					12.7	32.9	60.9
Degree of freedom					(10)	(20)	(50)

NOTE: EFCRES = Cobb-Douglas function, fixed effect, constant returns to scale, imposing equal slope for all sectors; EFNCRS = Cobb-Douglas, fixed effect, non-constant returns to scale, imposing equal slope for all sectors; EFCRDS = Cobb-Douglas function, fixed effect, constant returns to scale, allowing different slopes for each industrial sector; EFNRDS = Cobb-Douglas function, fixed effect, non-constant returns to scale, allowing different slopes for each industrial sector; EFIVCR = Cobb-Douglas function, constant returns to scale, Instrumental Variable; EFIVNCR = Cobb-Douglas function, non-constant returns to scale, Instrumental Variable; EFIVTL = translog function, Instrumental Variable. Coefficient of year dummies are not reported.

TABLE 2
Determinants of Borrowings of Firms

Independent Variable	Dependent Variable, Firm's Effects from Table 4.9*					
	Pre	Post	Pre	Post	Pre	Post
Constant	–0.359	0.434	–0.500	0.305	–0.623	0.424
	–(0.32)	(0.30)	–(0.45)	(0.21)	–(0.57)	(0.30)
Conglo-merate	–0.005	–0.382	0.042	–0.336	0.043	–0.333
	–(1.25)	–(0.80)	(0.12)	–(0.71)	(0.12)	–(0.71)
Size 2	0.273	–0.479	0.374	–0.388	0.419	–0.428
	(0.81)	–(1.10)	(1.23)	–(0.98)	(1.41)	–(1.11)
Size 3	–0.052	–0.536	0.079	–0.357	0.073	–0.341
	–(0.12)	–(0.93)	(0.21)	–(0.74)	(0.21)	–(0.74)
Age 2	–0.256	0.546	–0.302	0.558	–0.304	0.558
	–(1.03)	(1.71)	–(1.21)	(1.74)	–(1.25)	(1.76)
Age 3	–0.324	0.325	–0.405	0.377	–0.430	0.397
	–(0.89)	(0.69)	–(1.09)	(0.79)	–(1.18)	(0.84)
Public enterprise	0.064	–0.567	0.095	–0.518	0.036	–0.453
	(0.17)	–(1.19)	(0.26)	–(1.11)	(0.10)	–(0.98)
Export	0.483	0.040	0.501	0.057	0.520	0.038
	(1.73)	(0.11)	(1.80)	(0.16)	(1.88)	(0.11)
Sector 31	0.303	0.929	–0.169	1.028	–0.364	1.200
	(0.26)	(0.61)	–(0.14)	(0.66)	–(0.31)	(0.79)
Sector 32	–0.253	0.254	–0.464	0.201	–0.602	0.332
	–(0.22)	(0.17)	–(0.40)	(0.13)	–(0.53)	(0.22)
Sector 33	–0.633	1.039	–0.751	0.998	–0.718	0.954
	–(0.50)	(0.64)	–(0.60)	(0.62)	–(0.58)	(0.59)
Sector 34	–0.429	0.169	–0.537	0.121	–0.176	0.197
	–(0.37)	(0.11)	–(0.47)	(0.08)	–(0.54)	(0.13)
Sector 35	–0.292	0.784	–0.470	0.497	–0.667	0.692
	–(0.25)	(0.52)	–(0.42)	(0.34)	–(0.60)	(0.48)
Sectors 6, 7	0.191	0.361	0.128	0.293	0.109	0.308
	(0.16)	(0.23)	(0.11)	(0.19)	(0.09)	(0.20)
Sector 38	0.001	0.898	–0.195	0.893	–0.259	0.945
	(0.01)	(0.62)	–(0.17)	(0.62)	–(0.23)	(0.66)
EFIVCR	–0.005	0.113				
	–(1.25)	(1.57)				
EFIVNCR			–0.205	0.232		
			–(1.10)	(1.97)		
EFIVTL					–0.419	0.448
					–(2.01)	(1.64)
CVPK	–0.000	–0.000	–0.000	–0.000	–0.000	–0.000
	–(0.14)	–(0.16)	–(0.21)	–(0.15)	–(0.30)	–(0.07)

NOTE: This table is similar to Table 4.10, except that the efficiency indices are derived using Instrumental Variables for Cobb-Douglas constant returns to scale (IVCR), Cobb-Douglas non-constant returns to scale (IVNCR), and the translog function (IVTL).
Pre = Before liberalization, 1981–84.
Post = After liberalization, 1985–88.
* The dependent variable is the firm's specific residual obtained from the equation pre- and post-liberalization in Table 4.9.