New Estimates of Fixed Investment and Capital Stock for Chinese State Industry

Kuan Chen, Gary H. Jefferson, Thomas G. Rawski, Hongchang Wang and Yuxin Zheng*

Measures of society's stock of fixed assets are necessary for describing production technology, evaluating capital-output ratios and analysing multi-factor productivity. Even in advanced industrial economies, existing series of fixed capital incorporate many weaknesses and arbitrary assumptions; in low-income nations, these problems are often severe. China is no exception. While recognizing the inherent difficulty of compiling capital stock estimates for an economy in which prices have long deviated from scarcity values, this article uses currently available materials to derive an improved time series of fixed capital stock for independent accounting units within Chinese state industry.[1] Our objective is to produce new series that adhere as closely as possible to the standard national accounting concepts of gross domestic fixed capital formation and gross reproducible fixed assets. Despite the difficulties mentioned below, we believe that our new series are distinctly superior to existing figures for the analysis of capital deepening, multi-factor productivity and other aspects of Chinese state industry requiring estimates of fixed capital stock.

Improving the quality of data relating to industrial fixed capital is particularly significant for China because evaluation of the progress of recent industrial reform efforts, whether by Chinese or foreign analysts, invariably calls for calculations involving fixed assets. Trends in industrial output or profit per *yuan* of fixed assets or in multi-factor productivity are frequently cited as indicators of the success or failure of industrial reform.[2] Indeed, our results suggest that use of misleading capital stock data may be responsible for the finding, advanced by several authors, that multi-factor productivity in

* The authors gratefully acknowledge research support from the Brandeis University Mazer Fund, the Chinese Academy of Social Sciences, the University of Pittsburgh Contemporary China Program and the Fulbright Program, as well as the invaluable assistance of Robert Michael Field, Nicholas R. Lardy, Dwight H. Perkins and Barry Naughton.

1. China's industrial sector includes mining, manufacturing and utilities. The state sector dominates Chinese industrial activity, accounting for 70·4% of 1985 industrial output value [*Zhongguo tongji nianjian 1986* (*China Statistical Yearbook*; hereafter *TJNJ 1986*); Beijing: Zhongguo tongji chubanshe, 1986), p. 273]. Within the state sector, independent accounting units (i.e. excluding railway repair yards, publishing houses operated by universities and other industrial operations subordinate to non-industrial units) predominate; they contributed 93·2% of 1979 state-sector industrial output [World Bank, *China: Socialist Economic Development* (Washington, D.C.: The World Bank, 1983), Vol. 2, pp. 127–28; see also *TJNJ 1986*, p. 357].

2. Wang Zhiye (ed.), *Jishi jinbu de pingjialilun yu shijian* (*Theory and Practice of Evaluating Technical Progress*) (Beijing: Kexue jishu wenxian chubanshe, 1986), *passim.*

state-sector industry remained roughly constant between the mid 1950s and the mid 1980s.[3]

The following sections of this article analyse the provenance and characteristics of existing time series for industrial fixed capital, describe the derivation of the new series, compare the new and old series, and indicate outstanding issues requiring additional study.

Fixed Capital Stock Data for Chinese Industry: Description and Critique

Chinese statistical publications provide separate series for state sector industrial fixed assets at *original cost* and at *net value.* These are constructed according to formulas (1) and (2) respectively:

$$(1)\ KFO(t)=KFO(t-1)+I(t)$$
$$(2)\ KF(t)=KF(t-1)+I(t)-d(t)KFO(t-1)-S(t)$$

where KFO and KF represent fixed assets valued respectively at original cost and at net value; I indicates the annual value, *in current prices,* of newly-commissioned fixed assets (including the contribution of three separate investment categories recognized in Chinese statistical practice, namely "basic construction" (*jiben jianshe*), "technical renovation" (*gengxingaizao*) and "miscellaneous" (*qita*) projects but excluding work in progress)[4]; d is the average of depreciation rates used in various industries (see Appendix, Table A6)[5]; S indicates the book value of assets decommissioned or scrapped (a small item that we shall omit from our calculation of new capital stock measures) and t indicates time.[6] Time series data from Chinese sources giving the original and net (of depreciation) value of industrial fixed assets calculated according to (1) and (2) are shown in the left-hand columns of Table A1, together with the annual increment to fixed assets (Col. 3) and the breakdown of newly-

3. Thomas G. Rawski, "Strengths, weaknesses and challenges for policy in China's industry today" (unpub., 1980); "Chinese management capabilities: industrial technology" (unpub., 1983); and "Productivity change in Chinese industry: problems of measurement" (unpub., 1986); World Bank, *China: Socialist Economic Development,* Vol. 2, pp. 115–16 and *China, Long-term Development Issues and Options* (Baltimore: Johns Hopkins University Press, 1985), p. 111; Gene Tidrick "Productivity growth and technological change in Chinese industry" (World Bank Staff Working Papers, No. 761, 1986).

4. Recent statistical publications combine the last two categories; state-sector investment outlays are reported in two components: "basic construction" and "renovation and miscellaneous" (see Table A2). Because we seek to obtain a capital stock series suitable for evaluating the efficiency of industrial production, rather than industrial investment, we retain the Chinese practice of excluding work in progress from the capital stock. Barry Naughton, "The economy of the Cultural Revolution: military preparation, decentralization, and leaps forward" (unpub., 1987), discusses recent increases in the volume of work in progress.

5. Note that Chinese statistical practice involves the application of annual depreciation rates to fixed assets valued at original cost.

6. The investment figures for 1981–85 include outlays financed with foreign funds [*TJNJ 1986,* p. 470].

commissioned assets among four categories: non-residential construction, equipment, housing and other expenditures (Cols. 4–7).[7]

Until recently, "basic construction" outlays occupied the bulk of investment spending; this category includes major projects undertaken under China's official economic plans as well as many smaller projects. "Technical renovation," a category designed to accommodate planned outlays intended to upgrade the capability of existing production units, has become increasingly important as enterprises have gained control over larger pools of investable funds. Renovation spending typically focuses on equipment rather than construction. "Miscellaneous" expenditures fall outside the plans for basic construction and renovation.[8]

A key difficulty arises from the Chinese practice of cumulating newly-commissioned fixed assets from successive years, each valued in current prices, to compile estimates of total fixed capital. Unless the prices of investment goods remain stable, this procedure can generate trends that have no relation to the actual growth of real fixed assets; shifts in the relative prices of construction and equipment, the main components in industrial investment, can easily distort any effort to measure changes in the composition of industrial fixed investment. In China, neither the level of investment goods prices nor the relative prices of major investment goods have remained constant over time. Deviations from the required price stability are particularly evident during the past decade, which has brought steep increases in both the absolute and relative price of construction. We therefore anticipate that trends in the size and composition of the capital stock as measured by the unrevised data displayed in Table A1 may deviate widely from actual circumstances, especially during recent years of comparatively rapid price change.

Chinese industrial investment data incorporate several types of expenditure that are not encompassed by the standard national accounting concept of fixed industrial investment. While we cannot remove all of these elements, it is possible to introduce adjustments that offset the largest divergence from international accounting practice, which arises from the inclusion of substantial quantities of residential construction in Chinese data for industrial fixed investment and capital stock. Urban work units (*danwei*) in China's state

7. Certain aspects of formulas (1) and (2) require clarification. It is possible that certain components of I(t), the annual value of newly-commissioned fixed assets, may be valued on the basis of budget figures rather than actual cost. Some sources [*TJNJ 1986*, p. 357; Guan Liansheng *et al.* (eds.), *Jiben jianshe jingji cidian* (*Dictionary of Basic Construction Economics*) (Changchun: Jilin renmin chubanshe, 1986), p. 299], indicate valuation at actual cost, but others [Xu Zhaowen, *Guding zichan touzi tongji* (*Fixed Asset Investment Statistics*) (Beijing: Zhongguo tongji chubanshe, 1986), pp. 23, 26, 27, 99 and *Guding zichan touzi tongji jiaoxue cankaoshu* (*Fixed Asset Investment Statistics—Teaching Reference Book*) (Beijing: Zhongguo tongji chubanshe, 1986), pp. 17, 41] note that budget figures are used to value the construction component of investment spending. Furthermore, published sources [e.g. *TJNJ 1986*, p. 357] do not include the deduction for scrapping shown in equation (2).

8. *TJNJ 1986*, p. 588.

sector typically provide a broad array of social services for their labour force, of which housing is the most costly in investment terms. Chinese industrial investment and capital stock totals include the cost of housing constructed by industrial units. If the share of housing in total investment spending increases, as has occurred in recent years, currently available statistics cannot provide an accurate guide to trends in the availability of capital stock used for industrial production.

Fixed Investment and Capital Stock Data for Chinese Industry: New Estimates

Our new series of industrial investment and fixed assets is intended to rectify the principal shortcomings of currently available data by valuing investments completed in all years according to a consistent price base and by removing residential construction from the totals for investment and capital stock in state-sector industry.

General Procedure

Our general procedure is as follows:

A. Decompose annual figures for newly-added fixed assets into four categories: non-residential construction, equipment, housing and other.

B. Construct price indexes appropriate for deflating each component of industrial investment.

C. Combine the deflated components (excluding residential construction) to form a new time series of industrial investment valued at constant prices.

D. Cumulate the constant-price investment series into a time series of industrial fixed assets valued at constant prices in terms of original cost or net value.

Decomposition of Annual Increments to Fixed Assets

The figures used to decompose annual additions to the fixed assets of independent accounting units within state industry, valued at current prices, into separate categories of non-residential construction, equipment, housing and other appear in Columns (4)–(7) of Table A1. The shares for construction (including housing), equipment and other expenditures come from Chinese data covering the entire state sector (not industry alone). We apply the same proportions to industry, which has long dominated state-sector investment activity.[9]

9. We ignore the minor inconsistency that arises because published expenditure shares relate to annual investment spending (including work in progress), whereas the investment totals in Column (3) of Table A1 are based on the annual value of newly-commissioned fixed assets, which excludes work in progress.

For 1952–77, we use outlay shares for the basic construction component of investment expenditure to represent the overall total. Since the share of this category in state-sector investment spending surpassed 80 per cent prior to 1971 and 75 per cent during 1971–77, detailed information about the composition of renovation and miscellaneous outlays, if available, would have little effect on the figures in Columns (4)–(7) of Table A1. For 1978–85, when the share of renovation and miscellaneous spending increased rapidly, the expenditure shares reported in Columns (4)–(7) of Table A1 are weighted averages of the shares shown in Table A2 for basic construction and for renovation and miscellaneous spending, using the annual shares of investment spending in the two categories as weights.[10] The category of "other expenses" includes research and design work, acquisition of land and miscellaneous outlays, some of which, such as the cost of land, should ideally be excluded from our estimates of gross domestic fixed capital formation for independent accounting units within Chinese state industry.[11]

Price Indexes

As noted above, China has experienced substantial changes in both the level and structure of investment goods prices. Responding to the data requirements of an economy in which, until recently, resources have been allocated primarily through administrative rather than market mechanisms, Chinese statistical organizations have directed only limited effort towards the compilation of price indexes, especially for intermediate and capital goods. Furthermore, available price indexes may reflect official transfer prices, which in recent years have tended to diverge considerably from the market prices at which increasing shares of intermediate and capital goods are now exchanged. Since compilations of price data remain restricted to "internal use" within Chinese organizations, our effort to compile indexes of price change can only hope to produce preliminary results that will require revision as better data become available.[12] Although many observers comment on deficiencies of China's domestic price structure, recent studies focusing on the years 1979 and 1981 indicate that the relative domestic prices of building materials, construction

10. E.g., the 1985 share of equipment spending shown in Table A1 is calculated as:
$$1985\ \text{share} = 0{\cdot}202 \times 0{\cdot}479 + 0{\cdot}422 \times 0{\cdot}521 = 0{\cdot}317.$$

11. On the category of "other expenses," see Xu Zhaowen, *Fixed Asset Investment Statistics—Teaching Reference Book*, p. 43 and *TJNJ 1986*, p. 491.

12. One such source is Guojia wujiaju, *Zhonggong jiaotong jiage shouce* (*Price Handbook for Heavy Industry and Transport*; 3 vols.) (Beijing: Zhongguo jingji chubanshe, 1986), a restricted compilation that tabulates official ex-factory prices for thousands of commodities. Such data, together with similar compilations relating to earlier years, would facilitate analysis of industrial price trends.

and machinery, the sectors most relevant to the present study, were quite similar in China and the United States.[13]

Cost Trends for Non-residential Construction. Chinese sources have recently begun to offer systematic data on long-term trends in construction costs.[14] We find considerable anecdotal evidence of rising construction costs in recent years, but this is partly due to increases in design standards enforced in the wake of the severe 1976 earthquake in North China.[15] There is also evidence of considerable fluctuation in the quality of construction work.

Under these circumstances, there are two plausible methods for deriving an index of construction costs. The first involves the use of time series data for the annual value of overall construction output (including both non-industrial construction and work in progress) in current and in constant prices to obtain an implicit deflator for construction costs. Results for benchmark years are shown below:[16]

1952	100·0
1957	87·3
1965	88·5
1975	97·5
1980	104·8
1985	134·0

These figures, which suggest that construction costs remained relatively stable for nearly three decades before rising moderately after 1980, conflict sharply with a 1980 report complaining of rising construction costs in previous years generated by "price chaos" and "universal" increases in the actual (as opposed to budgeted) cost of construction materials.[17] The cost index shown above also conflicts with official information on construction costs per square metre for various types of structure. These data, summarized in Table 1, show a pattern of steadily rising costs in the state sector, with sharply accelerating inflation during the 1980s.[18] Even a substantial rise in design standards cannot begin to account for the inconsistency between these unit cost data, which show increases ranging from 193

13. Jeffrey R. Taylor, "China's price structure in international perspective" (unpub., 1986).

14. *TJNJ 1986*, p. 461; *Zhongguo jianzhu nianjian (1984–1985)* (*China Construction Yearbook*) (Beijing: Zhongguo jianzhu gongye chubanshe, 1985), *passim.*

15. Barry Naughton kindly provided information on this point: see *Gongye jingji guanli congkan* (*Collected Articles on Industrial Economic Management*), No. 7 (1981), p. 32 and *Jingji yanjiu cankao ziliao* (*Reference Materials on Economic Research*), No. 50 (1982), pp. 8–18.

16. Zheng Yuxin and Chen Kuan, "Woguo gongyeshengchanlü yanjiu yu dangqian jingji xingshi fenxi" (*Research on Chinese Industrial Productivity and Analysis of Present Economic Circumstances*) (unpub., 1987).

17. Jin Minqiu, "Work hard to reduce the cost of new buildings," *Renmin ribao* (*People's Daily*) 24 February 1980, reprinted in *Jianzhu jingji yuanli yu tizhigaige* (*Principles of Construction Economics and System Reform*) (Beijing: Zhongguo jianzhu gongye chubanshe, 1985), p. 117.

18. *TJNJ 1986*, pp. 448, 461.

to 388 per cent during 1957/85, and the figures derived from value data for construction output showing a rise of only 53 per cent during the same period. Construction design personnel in Beijing estimate that construction costs for residential buildings in the capital increased by 150 per cent between 1965 and 1985 exclusive of land costs and design changes [interview material]; this information supports the unit cost data and casts further doubt upon the price indicator derived from value totals in current and constant prices.

Table 1: **Construction Costs per Square Metre for Various Types of Structure**

Type of Structure	*Cost per Square Metre* 1957	1965	1978	1985	*Cost Index for 1985 (1957=100)*
Factory Buildings	102	140	153	299	293·1
Warehouses	42	71	92	188	447·6
Office Buildings	59	71	98	196	332·2
Residential	47	59	89	177	376·6
Schools	51	70	79	182	356·9
Medical	70	85	103	218	311·4
Other	58	77	100	283	487·9
Average:	56	81	104	205	366·1

These inconsistencies focus attention on the compilation of construction output values in fixed prices as the weakest element in the data relating to trends in construction costs. The value of construction output at current prices is easily understood and readily calculated by accountants or statisticians at the enterprise level from information on current annual expenditure and output volume. Calculation of output at fixed prices, which is apparently conducted at the enterprise level as well, requires detailed analysis of historical price data that may not be readily available to enterprise statisticians. Even if such data are available, the calculation of output value at fixed prices has no bearing on the current business operations of construction units and may be governed by rules of thumb that produce quick but misleading results.[19]

Pending further investigation of statistical practice within China's construction industry, we should base our analysis of cost trends on

19. China has used several sets of fixed prices: 1952 prices for 1949/57, 1957 prices for 1957/71, 1970 prices for 1971/81, and 1980 prices since 1981 [*TJNJ 1986*, p. 86]. Calculation of output value for 1965 at constant 1957 prices, for example, involves the use of quantities for 1965 and price and wage figures for 1957 to construct a Laspeyres quantity index using the 1957 official prices of cement, lumber, steel, hardware, electricity, labour etc. as weights. This procedure is described in Xu, *Guding zichan touzi tongji jiaoxue cankaoshu*, pp. 49ff.

figures cast in terms of current prices and avoid data that rely on construction values calculated at fixed prices. At present, trends in cost per square metre of factory structures seem to offer the best method for deflating the non-residential construction component of industrial investment. We assume that recent improvements in design standards, apparently in response to increased awareness of the danger of earthquakes, have increased the expected lifetime of new structures without altering the annual flow of services per square metre of building space. On this assumption, information on costs per square metre of construction can be used to measure trends in construction costs without further adjustment. Our price index based on these sources is compiled in Column 1 of Table A3.

Trends in Equipment Costs. With most industrial equipment supplied by domestic producers, price trends for industrial machinery depend primarily upon changes in the price level for products of China's large machine-building industry, which employs nearly seven million workers, and in 1985 produced 16·4 billion *yuan* of industrial equipment, equivalent, at that year's official exchange rate of Y2.94=US$1, to more than US$5 billion.[20] Given the wide range of products, rapid introduction of new varieties and continuing change in quality and product mix, derivation of a meaningful price index for machinery is unavoidably complex.

Three previous studies, each using somewhat different methods, have generated similar estimates of price trends for domestic machinery products. Field and Rawski used price quotations for a small number of specific items to estimate price trends; Zheng and Chen computed an implicit deflator from annual output values for the industrial equipment subdivision of the machinery industry calculated in current and in constant prices. Results are as shown in Table 2 (1952=1.00).[21] The similarity in the results derived from independent studies using two completely different methods initially inspires confidence in the general validity of the price trend shown in the (relatively complete) index compiled by Zheng and Chen.

If we assume, however, based on the unit cost figures for factory buildings shown above, that construction costs tripled between 1952 and 1975 (ignoring negligible changes between 1952 and 1957), the enormous relative price change implied by rising construction costs and falling equipment prices generates implausibly low shares for non-residential construction in industrial investment during recent

20. *TJNJ 1986*, pp. 236, 279.

21. Robert Michael Field, "Real capital formation in the People's Republic of China, 1952–73," and Thomas G. Rawski, "China's industrial performance, 1949–1983," in Alexander Eckstein (ed.), *Quantitative Measures of China's Economic Output* (Ann Arbor: University of Michigan Press, 1980); Zheng and Chen, "Research on Chinese industrial productivity."

Table 2: **Price Trends for Domestic Machinery Products Estimated in Three Previous Studies**

Year	*Field**	*Rawski*	*Zheng–Chen*
1952	1·000	1·000	1·000
1957	0·772	0·788	0·709
1965	n.a.	0·695	0·635
1970	n.a.	n.a.	0·561
1972	0·623	0·577	n.a.
1975	n.a.	0·577†	0·546
1980	n.a.	n.a.	0·530
1985	n.a.	n.a.	0·583

Note:
* Field, "Real capital formation," pp. 378–79 presents several similar indexes.
† Assumed equal to 1972.

years.[22] In 1985, for example, the nominal shares of non-residential construction and equipment in total industrial investment (including residential construction) are 0·470 and 0·317 (Table A1). Applying a construction cost index of 3·00 and an equipment price index of 0·583 (both with 1952=1), the ratio of non-residential construction to equipment outlay in terms of 1952 prices becomes $(0{\cdot}470 \times 0{\cdot}583)/(3{\cdot}0 \times {\cdot}317) = 0{\cdot}288$. This would imply a decline in the ratio of non-residential construction to equipment spending from 2·56 to 0·29 between 1953 and 1985. Cross-section data for the early-postwar period as well as time-series data for western industrial nations, the Soviet Union and pre-war Japan lead us to anticipate a gradual increase in the share of equipment spending at the expense of construction outlays during the course of the development process.[23] The precipitous decline in the share of spending on non-residential construction implied by the three studies of machinery prices, however, seems implausibly large, as does the high terminal ratio of equipment spending to construction costs.

This result raises the possibility that, despite the parallel conclusions of previous studies, available materials exaggerate the degree to

22. Data for housing construction indicate average unit cost of 56·9 *yuan* per square metre during 1953–57, the same as the 1957 figure shown above [*Zhongguo shehui tongji ziliao* (*Statistical Materials on Chinese Society*) (Beijing: Zhongguo tongji chubanshe, 1985), pp. 101–102]; we therefore ignore possible changes in construction costs during 1952/57.

23. Simon Kuznets, "Quantitative aspects of the economic growth of nations: v. capital formation proportions: international comparisons for recent years," *Economic Development and Cultural Change*, Vol. 8, No. 4 (1960), Pt 2, p. 33; *Modern Economic Growth: Rate, Structure and Spread* (New Haven: Yale University Press, 1966), pp. 252–54; and "A comparative appraisal," in Abram Bergson and Simon Kuznets (eds.), *Economic Trends in the Soviet Union* (Cambridge, Mass.: Harvard University Press, 1963), p. 353; Koichi Emi, "Capital formation and capital stock," in Kazushi Ohkawa and Miyohei Shinohara (eds.), *Patterns of Japanese Economic Development: A Quantitative Appraisal* (New Haven: Yale University Press, 1979), p. 183.

which prices of industrial machinery have declined over time, particularly during 1952/57. There are several potential sources of error. It is difficult to doubt that foreign inflation and, during the 1980s, devaluation of the Chinese currency have brought substantial increases in prices of imported equipment, which accounted for perhaps 40 per cent of the total value of equipment supplied during 1952/57, 5–10 per cent during the early 1970s, and 20–25 per cent during the 1980s.[24] The relatively large share of imports in new industrial equipment during the 1950s permits the average cost of equipment to diverge considerably from price trends for domestic machinery products which form the exclusive focus of previous studies. In addition, rapid changes in product mix may have led to unusual declines in relative (as well as absolute) prices of the "old," and possibly obsolete items included in the Field and Rawski calculations. Finally, the presence of large numbers of new products raises the question of how fixed prices are assigned to commodities that were not produced and perhaps not even imported during the base year.

If the Zheng–Chen results may exaggerate the degree of price decline for industrial equipment, what is the possible range of price outcomes? Since we expect the share of equipment in industrial investment to rise over time, we may obtain an upper bound to plausible price trends by assuming no change in the share of equipment in the real cost of newly-commissioned fixed assets between 1953 and 1985. In order for the 1985 ratio of non-residential construction outlays to equipment costs, both based on 1952 prices, to match the 1953 figure of 1·72, we require $(0{\cdot}445/3)/(0{\cdot}202/x) = 1{\cdot}72$, where x represents the 1985 machinery price index (1952 = 1) and the remaining figures indicate the nominal shares of construction and equipment in newly-commissioned fixed assets for 1985 and the 1985 price index for construction. Thus, a 1985 equipment price index of 2·34 (1952 = 1) generates no change in the ratio, in real terms, of non-residential construction costs to equipment outlays within state-sector industrial investment.

This leaves us with a very wide range of alternatives, spanning substantial price declines, as portrayed in previous studies, and an

24. Figures for the share of imports in industrial equipment are crude guesses based, for 1952–57 and 1970–73, on the estimated ratio of the *yuan* value of machinery imports to the value of all machinery and equipment delivered to construction sites [Field, "Real capital formation," p. 233] and, for the 1980s, on incomplete information about the dollar value of China's machinery imports (including aircraft and other non-industrial categories) and the *yuan* value of industrial equipment production [*1984 Almanac of China's Foreign Economic Relations and Trade* (Hong Kong: China Resources Trade Consultancy 1984, p. 831 and *TJNJ 1986*, p. 277]. Any attempt to calculate this ratio must confront difficult problems of exchange rate conversion and domestic pricing of imported equipment. The official exchange rate (Chinese *yuan* per U.S. dollar), was approximately 2·36 in 1955, 2·62 in 1965, 1·83 in 1977, 1·97 in 1983 and 2·94 in 1985 [see Alexander Eckstein, *Communist China's Economic Growth and Foreign Trade: Implications for U.S. Policy* (New York: McGraw-Hill, 1966), p. 294; World Bank, *China: Socialist Economic Development*, Vol. 2, p. vi; *1984 Almanac of China's Foreign Economic Relations and Trade*, p. 807 and *TJNJ 1986*, p. 580].

upper bound estimate that admits the possibility of considerable inflation in machinery prices. For machinery, as with construction, satisfactory understanding of price trends must await greater availability of detailed price data as well as careful study of accounting practices within Chinese enterprises. To eliminate flagrant contradictions while preserving what, on the basis of present knowledge, appears to be a reasonable picture of changes in equipment prices after 1957, we resolve the matter as follows: for 1952/57, we assume no change in machinery prices. For 1957/85, we adopt the index constructed by Zheng and Chen from output value for industrial equipment reported in current and constant prices. Our price index appears in Table A3.[25] The results generated with this index are reasonable: the estimated share of equipment in new fixed assets (Table A5) rises over time. Increases in the share of equipment in new fixed assets are bunched during the mid 1950s, when China received large shipments of Soviet machinery, and during the recent reform period, which has brought a rapid shift in the direction of the equipment–intensive "technical renovation" category of capital outlays.

Trends in Housing Costs and Other Expenses. Our price indexes for residential construction and "other expenses" are shown in Table A3. Trends in the cost of residential construction are derived from benchmark figures giving costs per square metre for 1957, 1962, 1965, 1975 and 1978–85, with interpolation for missing years; as before, we ignore the impact of rising design standards, which may have produced cost increases of perhaps 25 per cent, and of quality fluctuations, which we assume to have affected the expected lifetime of new housing rather than the value of annual service flows.[26]

Lacking information about price trends for "other expenses," we assume that changes in the share of this small category in nominal investment outlays arise entirely from price fluctuations. The annual price index for this category then becomes ON(t)/0·074, where ON(t) represents the nominal share in year t of this expenditure category (Col. 6 of Table A1) and 0·074 is the nominal share for 1953/57.

Revised Estimates of Industrial Fixed Investment and Capital Stock

The results of our study appear in Tables A4, A5 and A6 of the Appendix. In Columns (1)–(3) of Table A4, we tabulate the real value, in terms of 1952 prices, of the components of industrial gross fixed capital formation; housing is excluded. In each case, nominal outlays

25. A subsequent finding that equipment prices increased after 1957, rather than experiencing the mild downtrend shown in Column 2 of Table A2, would accentuate our conclusion (Table A7) that the volume of industrial fixed investment and capital stock grew more slowly than the unrevised totals shown in Table A1.

26. The 25% figure is based on citations contained in materials provided by Barry Naughton.

are deflated by the appropriate price index. The total, shown in Column (4) of Table A4, represents the annual value, in terms of 1952 prices, of newly-commissioned fixed assets (excluding work in progress and residential construction) for independent accounting units in Chinese state-sector industry. This series represents our revision of the Chinese industrial investment data shown in Column (3) of Table A1. Whereas the Chinese figures are based on mixed prices and include residential construction, our figures exclude housing and incorporate a consistent price base.

Table A5 describes the changing structure, in real terms, of investment spending within Chinese state sector industry; to facilitate comparison with the nominal shares shown in Table A1, the breakdown in Table A4 includes expenditures on residential construction even though these amounts are excluded from the revised investment total shown in Column (4) of Table A4.

The revised series of newly-commissioned fixed assets, together with the initial 1952 fixed asset totals reported in Chinese sources, is used to construct new series of year-end fixed asset totals in gross and net terms.[27] The new capital stock estimates, reported in Table A6, are derived as follows for 1953–85:

$$(1a)\quad DKFO(t)=DKFO(t-1)+DI(t)$$
$$(1b)\quad DKF(t)=DKF(t-1)+DI(t)-d(t)DKFO(t-1)$$

where DKFO and DKF denote the revised capital stock series at original (gross) and net value respectively, DI represents the revised (deflated and net of housing) series of newly-commissioned fixed assets, and d, also shown in Table A6, is the average rate of depreciation taken from Chinese sources.[28] We also summarize in Table A6 the results of exploratory calculations of time series for fixed assets based on 1980 prices. Although additional assumptions about the composition of the initial stock of fixed assets are necessary to derive these figures, a series based on 1980 prices offers a vehicle for analysing long-term trends in economic structure, productivity and efficiency that avoids the distortions contained in the 1952 price structure.[29]

Results

In Tables A7 and A8 we compare the original and revised time series for the year-end value of gross and net (of depreciation) fixed assets and of the annual value of newly-commissioned fixed assets for

27. Since industrial employers rarely provided housing for their workers prior to 1949, we assume that the 1952 fixed asset totals reported for state-sector industry include few or no residential structures.

28. Note that lack of data prevents us from deducting the value of scrapped assets, which is thought to be small.

29. Dwight H. Perkins, "Issues in the estimation of China's national product," in Eckstein (ed.), *Quantitative Measures.*

independent state industrial enterprises. Both Chinese and foreign observers agree that, over the past several decades, industrial investment and industrial capital stock have expanded rapidly, though erratically. Examination of Tables A7 and A8 shows that our revisions produce no major changes in this picture. Our findings do reveal, however, that the exclusion of residential construction and revaluation of new assets in constant prices affects the composition of new assets, leads to modest reductions in long-term growth rates and produces significant changes in the short-term growth rates of both incremental and total fixed assets.

Growth. Comparison of the original and revised series for newly-commissioned fixed assets confirms the pattern of rapid but somewhat unstable growth described by numerous observers. With housing excluded and other spending converted to 1952 prices, we find that the annual quantity of newly-commissioned assets rose steeply during 1953/57, declined sharply during 1957/65, reflecting the severe cyclical downturn brought about by the Great Leap Forward campaigns of 1958–60, and resumed the earlier pattern of rapid growth during 1965/78. One important finding concerns the period since 1978, which is widely regarded as an interlude of dangerously accelerating investment activity. Our results show that, at least in the state sector of industry, the growth rate of annual additions to the volume of fixed assets, amounting to only 6·4 per cent for 1978/85 (Table A8), is sharply lower than the 13·0 per cent growth rate compiled during 1965/78. With the real share of residential construction rising only modestly above levels of the mid 1960s and remaining well below the peak figures attained in 1953 and 1954 (Table A5), it is clear that inclusion of housing in the total would not substantially alter this result. Rapid growth of state-sector industrial investment expenditure in recent years (11·6 per cent annual rate during 1978/85) is largely a monetary phenomenon, with modest increases in machinery prices and steeply rising construction costs (Table A3) masking significant deceleration in the volume of completed investment activity.[30]

With the growth of newly-commissioned fixed assets largely invariant to our revisions prior to 1978, we find that the trajectory of revised state-sector fixed asset stocks closely mirrors that of the original data. After 1978, however, the growth rate for year-end fixed assets (gross or original cost) declines abruptly to 6·7 per cent, well

30. Industrial investment spending for "basic construction" and "renovation" rose from 38 to 93 billion *yuan* between 1981 and 1985, with the average annual growth of current spending topping 20% [*TJNJ 1986*, pp. 452, 470]. Another reason for the slow growth of completed investments is that the ratio of newly-commissioned fixed assets to annual investment outlay has fallen in recent years [*TJNJ 1986*, p. 461], indicating a gradual rise in the volume of work in progress, both in absolute terms and relative to annual investment spending.

below both the long-term trend and the contemporaneous growth rate for the unrevised fixed asset data (Table A8).

The growth pattern for newly-commissioned and total fixed assets valued in 1980 prices strongly resembles the parallel series valued at 1952 prices; conversion to 1980 prices reduces the annual growth rate of all series by approximately one-half of one per cent in every time period.

Composition. Our results offer a somewhat different view of long-term trends in the composition of industrial investment activity than emerges from the original data, which include no adjustment for price changes. The original data (Table A1), reflecting expenditure shares, show a generally constant share for non-residential construction, with a mild downtrend appearing during the past few years. The share of equipment displays a similar pattern of long-term stability followed by a modest decline after 1976. The unrevised data show a spectacular increase in the expenditure share devoted to housing dating from 1978, and a smaller rise in the importance of "other expenditures."

The revised data (Table A5), reflecting the structure of new asset quantities rather than current expenditures, show a substantial long-term decline in the share of non-residential construction and a gradual increase in the share of equipment. The share of residential construction, after falling to extremely low levels during the late 1960s and early 1970s, increases during the 1980s, but only modestly, remaining below levels attained during the early 1950s.

Efficiency. The significance of our effort to construct a revised series of fixed assets for state-sector industry rests on the possible efficiency implications of the new series. Even though the broad characteristics of our revised series of fixed assets parallel those of the original data, the revisions carry important new implications. Previous studies of multi-factor productivity in state sector industry have agreed that the past several decades have witnessed an increase in output per worker and a decline in output per unit of industrial fixed assets. Under these circumstances, the direction of change in multi-factor productivity depends significantly on input aggregation procedures. With our new data, the basic observation of opposed trends in partial productivity of labour and capital disappears (see Table 3).

Using the revised data, as shown in Table 3, we see that the 1985 level of output per unit of net fixed assets exceeds the figures for both 1952 and 1957. Lingering effects of war-time disruption may have kept the 1952 figure abnormally low. If we focus on the period from 1957, we see that the output/capital ratio declined between 1957 and 1978 but rose rapidly thereafter to a terminal level 7 per cent above the 1957 figure. This result, which suggests a pattern of long-run increases in the partial productivity of *both* labour and fixed capital, indicates that careful re-evaluation of studies indicating long-term

Table 3: **Index Numbers of Output, Capital and Output per Unit of Capital, 1952–85**

Year	Value Added (1952 Prices)	Year-end Net Fixed Assets Mixed Prices Original	Year-end Net Fixed Assets 1952 Prices Revised	Output/Capital Ratio Original	Output/Capital Ratio Revised
1952	100	100	100	100	100
1985	3,052	3,949	2,482	77	123
1957	100	100	100	100	100
1978	637	928	769	69	83
1985	1,165	1,660	1,085	70	107

Source:
Tables A1 and A7; estimated value added for independent accounting units in state industry from Zheng and Chen, "Research on Chinese industrial productivity."

stagnation of multi-factor productivity in state-sector industry is now required.

Summary and Conclusion

This article represents an initial effort to combine Chinese official data with a set of reasonable statistical and economic assumptions to derive long-term measures of industrial fixed assets that are consistent with standard procedures for national income accounting and comparable with international data. Our results include new time series for annual increments and for the cumulated stock of fixed assets for independent accounting units within the state sector of Chinese industry over the period from 1952 to 1985. The revised series differ from the totals appearing in Chinese statistical publications in that we have removed residential construction from the total and converted the remaining elements – non-residential construction, purchase of equipment and "other expenditures" – to a consistent 1952 or 1980 price base. The new series for incremental and total fixed assets embody a higher level of internal consistency and international comparability than data appearing in Chinese statistical publications.

Although our revisions do not alter the long-term trends of investment expansion and fixed asset growth contained in the original data for 1952/85 and reflected in previous studies of China's economy, the new data are not without significant implications. The revised data, based on 1952 prices, show somewhat lower long-term growth rates for both newly-commissioned and year-end fixed assets than the original materials. With no change in the 1952 base, the revised figure for net fixed assets at the end of 1985 is less than two-thirds of the total presented in Chinese sources (Table A7). Aside from our exclusion of residential construction, the reduced growth of fixed assets arises primarily because of a sharp deceleration in the real

(but not in the nominal) growth of year-end fixed assets and especially of annual additions to the fixed asset stock during the recent period of economic reform. Conversion to 1980 prices produces similar, but somewhat stronger results. We also find that the real structure of new assets is somewhat different from the pattern embodied in the original data. Finally, the new series indicate that studies showing long-term stagnation of multi-factor productivity in state-sector industry require re-evaluation; it is possible that the results of previous analyses of multi-factor productivity are severely influenced by errors in measuring fixed assets.

Our own results cannot claim immunity from inadequate measurement. It is possible, for example, that we have overlooked substantial price increases for industrial equipment. If so, the present estimates may exaggerate the rise in the real share of equipment costs in investment outlays (Table A5) and also overstate the growth rate of industrial investment and fixed assets. Our inability to remove outlays on non-industrial assets other than housing from the investment totals builds an upward bias into our estimates of the level and perhaps the growth rate of investment and capital stock. On the other hand, we may have over-estimated the share of residential construction spending in industrial investment, which would bias our results in the opposite direction. Finally, limited information makes our treatment of the category of "other expenditures" unavoidably crude.

Further information and analysis of investment spending, pricing conventions, enterprise record-keeping and other areas will surely enhance our understanding of China's industrial economy. For the present, however, we conclude that our new time series of fixed investment and capital stock for Chinese state industry surely represent a major improvement in an important category of economic data. We anticipate that future revisions will, if anything, strengthen the conclusions derived from the present analysis.

Appendix

Table A1: **Industrial Capital Stock and Investment Data, 1952–85 Unrevised Figures** (billion *yuan* and percentages)

	Fixed Assets Year-end Totals		*Annual Addition to Industrial Fixed Assets*				
	Gross	*Net*	*Total*	*% Composition*			
Year	*KFO (1)*	*KF (2)*	*KFO (3)*	*NRESCN (4)*	*Equip. (5)*	*Other (6)*	*Housing (7)*
1952	14·88	10·08	n.a.	0·549	0·254	0·094	0·103
1953	17·57	12·04	2·690	0·569	0·222	0·084	0·125
1954	21·95	15·19	4·380	0·526	0·268	0·113	0·093
1955	24·95	17·13	3·000	0·528	0·332	0·074	0·066
1956	28·25	19·77	3·300	0·525	0·326	0·063	0·086
1957	33·46	23·98	5·210	0·522	0·332	0·053	0·093
1958	43·56	33·06	10·100	0·522	0·383	0·065	0·030
1959	57·19	44·71	13·630	0·533	0·375	0·053	0·039
1960	72·18	57·08	14·990	0·525	0·384	0·050	0·041
1961	80·08	62·49	7·900	0·535	0·353	0·052	0·060
1962	85·54	65·73	5·460	0·583	0·293	0·065	0·059
1963	88·96	67·07	3·420	0·582	0·274	0·067	0·077
1964	95·17	70·97	6·210	0·561	0·292	0·067	0·080
1965	104·00	77·72	8·830	0·553	0·322	0·070	0·055
1966	112·00	82·89	8·000	0·526	0·331	0·099	0·044
1967	117·60	85·41	5·600	0·580	0·266	0·116	0·038
1968	122·90	88·44	5·300	0·514	0·330	0·106	0·050
1969	129·40	91·91	6·500	0·516	0·332	0·097	0·055
1970	146·20	103·33	16·800	0·514	0·359	0·101	0·026
1971	161·00	115·69	14·800	0·543	0·338	0·076	0·043
1972	180·69	130·11	19·690	0·535	0·344	0·064	0·057
1973	203·36	145·90	22·670	0·510	0·367	0·061	0·062
1974	219·61	156·12	16·250	0·503	0·368	0·064	0·065
1975	242·83	171·63	23·220	0·500	0·369	0·072	0·059
1976	262·18	184·64	19·350	0·505	0·362	0·072	0·061
1977	288·22	201·13	26·040	0·525	0·334	0·072	0·069
1978	319·34	222·57	31·120	0·511	0·348	0·059	0·082
1979	346·67	237·86	27·330	0·502	0·311	0·059	0·128
1980	373·01	252·80	26·340	0·485	0·292	0·062	0·161
1981	403·23	270·93	30·220	0·476	0·273	0·065	0·186
1982	437·50	291·40	34·270	0·474	0·268	0·072	0·186
1983	476·78	316·10	39·280	0·474	0·287	0·074	0·166
1984	517·00	339·55	40·220	0·497	0·290	0·081	0·132
1985	595·62	398·08	78·615	0·470	0·317	0·088	0·125

Notes and Sources

Columns (1) and (2). KFO denotes fixed assets of independent accounting units within state-sector industry, valued at original cost. KF denotes fixed assets of independent accounting units within state-sector industry, net of depreciation and scrapping. Sources: for 1952, 1957, 1962, 1965, 1970 and 1975–84, *TJNJ 1985*, p. 374; for 1985, *TJNJ 1986*, p. 243; for other years, data provided by the Institute of Quantitative and Technical Economics [IQATE].

Column (3). Calculated from Column (1).

Columns (4)–(7). For 1952–77, *TJNJ 1983*, pp. 339, 342 gives annual shares (of investment *outlay* for the *entire* state sector) for construction (including residential), housing and equipment. The shares of non-residential construction (NRESCN) and "other" expenditures are derived as residuals. For 1978–85, calculation of shares, using data compiled in Table A2, is described in the text.

Table A2: **Composition of Investment Outlays, 1978–85** (current prices)

	1978	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*
1. Shares in Investment Outlay								
A. Basic Construction	0·649	0·648	0·649	0·568	0·558	0·516	0·523	0·479
B. Renovation and Miscellaneous	0·351	0·352	0·351	0·432	0·442	0·484	0·477	0·521
2. Composition of Outlays								
A. Basic Construction								
1. NRESCN	0·522	0·509	0·482	0·465	0·461	0·487	0·502	0·476
2. Equip.	0·331	0·274	0·244	0·190	0·183	0·197	0·204	0·202
3. Other	0·069	0·069	0·074	0·094	0·102	0·105	0·113	0·122
4. Housing	0·078	0·148	0·200	0·251	0·254	0·211	0·181	0·200
B. Renovation and Misc.								
1. NRESCN	0·490	0·490	0·490	0·492	0·490	0·460	0·491	0·464
2. Equip.	0·380	0·380	0·380	0·382	0·376	0·382	0·385	0·422
3. Other	0·040	0·040	0·040	0·027	0·034	0·041	0·046	0·057
4. Housing	0·090	0·090	0·090	0·091	0·100	0·117	0·078	0·057

Sources:

Lines 1-A and 1-B. For 1978–80, see notes to Table A2. For 1981–85, calculated from annual industrial investment outlays reported for "basic construction" in *TJNJ 1986*, p. 452, and for a combined category of "renovation" and "miscellaneous" spending reported for 1981–82 in *TJNJ 1983*, p.363 and for 1982–85 in *TJNJ 1985*, p. 451. The same 1982 figure is given in both sources, but only the latter specifies the inclusion of "miscellaneous" spending. Inclusion of "miscellaneous" spending in the former source is confirmed because the 1981 total noted above exceeds the figure for 1981 industrial "renovation" investment outlay reported in *TJNJ 1986*, p. 470, by 8·2 billion *yuan*. For 1985, we estimate the combined total of "renovation" and "miscellaneous" industrial investment by assuming that the ratio between the combined total and "renovation" spending alone remained constant at the level reported for 1984. Figures for industrial "renovation" spending in 1984 and 1985 appear in *TJNJ 1986*, p. 471.

Lines 2A-1 to 2A-4. Taken or derived from *TJNJ 1986*, p. 441.

Lines 2B-1 to 2B-4. For 1981, *TJNJ 1984*, pp. 335–336; for 1982–84, *TJNJ 1985*, pp. 452–53. For 1985, we have data on the shares of construction (including residential), equipment and housing in "renovation" expenditures [*TJNJ 1986*, p. 471]. For 1984, we have data on the shares of the same categories in "renovation" alone [*ibid.*] and for the combined total of "renovation" and "miscellaneous" investment [*TJNJ 1985*, pp. 452–53]. We estimate expenditure shares for 1985 by assuming that the ratio between the shares for "renovation" alone and for the combined total of "renovation" and "miscellaneous" did not change between 1984 and 1985.

Notes:

In addition to sources described above, we have used the following assumptions: for 1978–80, we assume that the share of renovation and miscellaneous outlays in total investment spending for industry (Line 1-B) is 10 percentage points above the share derived from data for the entire state sector (*TJNJ 1986*, pp. 452, 470). During 1981–1984 this difference was 9·6, 9·9, 10·8 and 10·4 percentage points, respectively [*ibid.*]. We have no data on the composition of outlays for renovation and miscellaneous investment during 1978–80. The figures for those years shown in lines B-1 to B-4 above are assumed.

Table A3: **Price Indexes for Components of Industrial Investment 1952–85**

Year	*Price Indexes for Investment Components (1952=100)* NRESCN (1)	Equip. (2)	Other (3)	Housing (4)
1952	1·000	1·000	1·000	1·000
1953	1·000	1·000	1·000	1·000
1954	1·000	1·000	1·000	1·000
1955	1·000	1·000	1·000	1·000
1956	1·000	1·000	1·000	1·000
1957	1·000	1·000	1·000	1·000
1958	1·028	0·983	0·757	1·043
1959	1·056	0·967	0·757	1·085
1960	1·084	0·951	0·757	1·128
1961	1·112	0·935	0·757	1·170
1962	1·140	0·919	0·757	1·191
1963	1·210	0·903	0·919	1·213
1964	1·280	0·887	0·919	1·234
1965	1·370	0·871	0·919	1·255
1966	1·380	0·855	1·378	1·285
1967	1·390	0·839	1·378	1·315
1968	1·400	0·823	1·378	1·345
1969	1·410	0·807	1·378	1·374
1970	1·420	0·791	1·378	1·404
1971	1·430	0·785	0·919	1·434
1972	1·440	0·779	0·919	1·464
1973	1·450	0·773	0·919	1·494
1974	1·460	0·767	0·919	1·523
1975	1·470	0·761	0·919	1·553
1976	1·480	0·755	0·959	1·667
1977	1·490	0·749	0·959	1·780
1978	1·500	0·747	0·959	1·894
1979	1·580	0·744	0·959	2·128
1980	1·690	0·747	0·959	2·404
1981	1·970	0·741	1·270	2·723
1982	2·010	0·720	1·378	2·872
1983	2·410	0·739	1·419	3·213
1984	2·760	0·754	1·527	3·404
1985	2·930	0·822	1·649	3·766

Notes and Sources

Column (1). Price index for industrial construction is based on unit cost per square metre of factory structures in 1957, 1962, 1965 and 1978–85 shown in *TJNJ 1986*, p. 461. We assume no change in construction costs during 1952–57 and use arithmetic interpolation to provide missing data.

Column (2). Price index for industrial equipment. For 1952–57, we assume no change (see text). The index for 1957–85 is the implicit deflator derived from separate time series of output value for industrial equipment (*gongye shebei*) valued in current and constant prices. Zheng and Chen, "Research on Chinese industrial productivity," derive annual values of this implicit deflator for 1957, 1962, 1965, 1970 and 1975–85. Figures for other years are supplied by arithmetic interpolation. Output data at 1980 fixed prices for 1981/85 are from *TJNJ 1983*, p. 223; *TJNJ 1984*, p. 202; *TJNJ 1985*, p. 316; and *TJNJ 1986*, p. 277. Output for 1980 (at 1970 fixed prices) is from *TJNJ 1986*, p. 277. Output data for 1980/85 in current prices and for 1957–79 in both fixed and current prices is provided by IQATE.

Column (3). Price index for "other expenditures" is assumed equal to ON(t)/0·074, where ON(t) represents the nominal share in year t of this expenditure category (Col. 6 of Table A1) and 0·074 is the nominal share for 1953/57. See text.

Column (4). Price index for housing is based on unit cost figures for housing construction in 1957, 1962, 1965, 1975 and 1978–85 [*TJNJ 1986*, p. 461; *Jiben jianshe gongzuo shouce* (*Handbook of Basic Construction Work*) (Beijing: Zhongguo jianzhugongye chubanshe 1983), p. 377] and an assumed absence of cost change prior to 1957 (see text), with missing data supplied by arithmetic interpolation.

Table A4: **Deflated Value of New Industrial Fixed Assets and Residential Buildings** (billion *yuan*, 1952 prices)

Year	*New Industrial Fixed Assets (excludes residential construction)*				*New Housing*	*Total New Fixed Assets (includes housing)*
	Constr.	*Equip.*	*Other*	*Total DI(t)*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1952	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1953	1·531	0·597	0·199	2·327	0·336	2·663
1954	2·304	1·174	0·324	3·802	0·407	4·209
1955	1·584	0·996	0·222	2·802	0·198	3·000
1956	1·732	1·076	0·244	3·052	0·284	3·336
1957	2·720	1·730	0·386	4·835	0·485	5·319
1958	5·129	3·935	0·747	9·811	0·291	10·102
1959	6·880	5·286	1·009	13·174	0·490	13·664
1960	7·260	6·053	1·109	14·422	0·545	14·967
1961	3·801	2·983	0·585	7·368	0·405	7·773
1962	2·792	1·741	0·404	4·937	0·270	5·207
1963	1·645	1·038	0·253	2·936	0·217	3·153
1964	2·722	2·044	0·460	5·226	0·403	5·628
1965	3·564	3·264	0·653	7·482	0·387	7·869
1966	3·049	3·097	0·592	6·738	0·274	7·012
1967	2·337	1·775	0·414	4·527	0·162	4·688
1968	1·946	2·125	0·392	4·463	0·197	4·660
1969	2·379	2·674	0·481	5·534	0·260	5·794
1970	6·081	7·625	1·243	14·949	0·311	15·260
1971	5·620	6·372	1·095	13·088	0·444	13·531
1972	7·315	8·695	1·457	17·467	0·767	18·234
1973	7·974	10·763	1·678	20·414	0·941	21·355
1974	5·598	7·797	1·203	14·598	0·693	15·291
1975	7·898	11·259	1·718	20·875	0·882	21·757
1976	6·603	9·278	1·432	17·312	0·708	18·020
1977	9·175	11·612	1·927	22·714	1·009	23·723
1978	10·597	14·506	1·963	27·066	1·351	28·417
1979	8·689	11·436	1·723	21·848	1·639	23·486
1980	7·556	10·287	1·635	19·478	1·768	21·246
1981	7·305	11·131	1·548	19·985	2·061	22·046
1982	8·078	12·771	1·789	22·638	2·218	24·856
1983	7·725	15·230	2·049	25·004	2·023	27·028
1984	7·239	15·487	2·135	24·861	1·558	26·419
1985	12·604	30·281	4·203	47·088	2·620	49·707

Notes and Sources:

Annual totals may not check due to rounding error.

Columns (1)–(3) and (5). Calculated from data in Table A1, Columns (4)–(7) and Table A3.

Column (4). Each entry is sum of figures in corresponding rows of Columns (1)–(3).

Column (6). Each entry is sum of figures in corresponding rows of Columns (4) and (5).

Table A5: **Composition of Annual Addition to Fixed Assets of State Sector Industry, 1953–85, Based on Data Converted to 1952 Prices, Including Housing**

Year	*Non-Residential Construction (1)*	*Equipment (2)*	*Other Industrial Assets (3)*	*Total New Industrial Assets DI(t) (4)*	*New Housing (5)*	*Total New Assets (6)*
1953	0·575	0·224	0·075	0·874	0·103	1·000
1954	0·547	0·279	0·077	0·903	0·123	1·000
1955	0·528	0·332	0·074	0·934	0·090	1·000
1956	0·519	0·322	0·073	0·915	0·063	1·000
1957	0·511	0·325	0·072	0·909	0·083	1·000
1958	0·508	0·390	0·074	0·971	0·084	1·000
1959	0·503	0·387	0·074	0·964	0·027	1·000
1960	0·485	0·404	0·074	0·964	0·033	1·000
1961	0·489	0·384	0·075	0·948	0·033	1·000
1962	0·536	0·334	0·078	0·948	0·042	1·000
1963	0·522	0·329	0·080	0·931	0·042	1·000
1964	0·484	0·363	0·082	0·928	0·058	1·000
1965	0·453	0·415	0·083	0·951	0·063	1·000
1966	0·435	0·442	0·084	0·961	0·040	1·000
1967	0·498	0·379	0·088	0·965	0·030	1·000
1968	0·418	0·456	0·084	0·958	0·023	1·000
1969	0·411	0·462	0·083	0·955	0·029	1·000
1970	0·398	0·500	0·081	0·980	0·033	1·000
1971	0·415	0·471	0·081	0·967	0·015	1·000
1972	0·401	0·477	0·080	0·958	0·023	1·000
1973	0·373	0·504	0·079	0·956	0·030	1·000
1974	0·366	0·510	0·079	0·955	0·030	1·000
1975	0·363	0·517	0·079	0·959	0·030	1·000
1976	0·366	0·515	0·079	0·961	0·027	1·000
1977	0·387	0·489	0·081	0·957	0·026	1·000
1978	0·373	0·510	0·069	0·952	0·028	1·000
1979	0·370	0·487	0·073	0·930	0·032	1·000
1980	0·356	0·484	0·077	0·917	0·059	1·000
1981	0·331	0·505	0·070	0·906	0·082	1·000
1982	0·325	0·514	0·072	0·911	0·088	1·000
1983	0·286	0·564	0·076	0·925	0·085	1·000
1984	0·274	0·586	0·081	0·941	0·066	1·000
1985	0·254	0·609	0·085	0·947	0·056	1·000

Source:
Calculated from Tables A1 and A3.

Table A6: **Industrial Capital Stock, 1952–85 Revised Figures, Constant Prices** (billion *yuan*)

Year	*Fixed Assets Year-end Totals 1952 Prices* Gross DKFO (1)	Net DKF (2)	*Fixed Assets Year-end Totals 1980 Prices* Gross DKFO (3)	Net DKF (4)	*Annual Rate of Depreciation d(t)* (5)
1952	14·880	10·080	19·677	13·235	0·037
1953	17·207	11·856	22·901	15·731	0·037
1954	21·009	15·021	27·982	19·965	0·037
1955	23·811	17·046	31·616	22·563	0·037
1956	26·863	19·218	35·582	25·359	0·037
1957	31·698	23·059	41·840	30·301	0·037
1958	41·509	31·697	54·163	41·076	0·037
1959	54·683	43·335	70·705	55·614	0·037
1960	69·105	55·734	88·560	70·853	0·037
1961	76·473	60·545	97·772	76·788	0·037
1962	81·410	62·729	104·179	79·675	0·036
1963	84·346	62·734	107·976	79·722	0·036
1964	89·571	64·923	114·544	82·403	0·036
1965	97·054	69·001	123·633	87·139	0·038
1966	103·792	72·052	131·667	90·475	0·038
1967	108·318	72·634	137·340	91·144	0·038
1968	112·782	72·981	142·592	91·178	0·038
1969	118·315	74·229	149·071	92·238	0·038
1970	133·265	84·682	166·236	103·738	0·038
1971	146·352	92·706	181·544	112·730	0·038
1972	163·819	104·612	201·799	126·086	0·038
1973	184·234	118·801	224·924	141·542	0·038
1974	198·831	126·398	241·362	149·434	0·038
1975	219·707	139·320	264·768	163·185	0·040
1976	237·019	147·844	284·230	172·056	0·040
1977	259·733	160·840	310·258	186·431	0·041
1978	286·799	177·257	340·885	204·338	0·041
1979	308·646	187·059	365·764	214·899	0·042
1980	328·124	193·574	387·786	221·559	0·042
1981	348·109	199·449	409·932	227·030	0·043
1982	370·747	207·118	434·840	234·311	0·043
1983	395·751	215·809	461·236	241·574	0·044
1984	420·611	222·465	487·086	246·207	0·046
1985	467·699	250·205	535·037	271·752	0·046

Notes and Sources

Column (1). DKFO represents the revised series of gross fixed assets for independent accounting units within state-sector industry, valued at original cost in terms of 1952 prices. The series is calculated from the 1952 figure of 14·880 billion *yuan* (Table A1) and the series DI(t) (Table A4) according to text formula (1a).

Column (2). DKF represents the revised series of fixed assets for independent accounting units within state-sector industry, net of depreciation (we ignore scrapping), valued in terms of 1952 prices. The series is calculated from the 1952 figure of 10·080 billion *yuan* (Table A1) and the series DI(t) (Table A4) and d(t) (Table A6) according to text formula (1b).

Columns (3) and (4). Time series based on 1980 prices are derived in the same way as the estimates based on 1952 prices except that (a) price indexes shown in Table A3 are converted to a common 1980 base and (b) year-end 1952 figures for the stock of gross and net fixed assets are converted to 1980 prices. To make this conversion, we assume that the 1952 stock of industrial fixed assets included no housing, and that non-residential structures, equipment and other industrial assets accounted respectively for 59·2, 32·7 and 8·1 per cent of total fixed assets at the end of 1952. This percentage breakdown is based on the annual averages of shares in newly-commissioned fixed assets during 1953/57 shown in Columns (1)–(3) of Table A5.

Column (5). Annual depreciation rates for state-sector industry during 1952, 1957, 1962, 1965, 1970 and 1975–84 appear in *TJNJ 1986*, p. 34. We assume no change in 1984–85 and supply missing data through arbitrary interpolation.

Table A7: **Growth of Fixed Asset Stock and of Annual Additions to Fixed Assets, 1952–85: Comparison of Original and Revised Series** (index numbers)

	Year-end Gross Fixed Assets		*Year-End Net Fixed Assets*		*New Industrial Fixed Assets*	
	Original	*Revised*	*Original*	*Revised*	*Original*	*Revised*
	1952=100		*1952=100*		*1953=100*	
Year	*KFO* (1)	*DKFO* (2)	*KF* (3)	*DKF* (4)	*KFO* (5)	*DKFO* (6)
1952	100·0	100·0	100·0	100·0	n.a.	n.a.
1953	118·1	115·6	119·4	117·6	100·0	100·0
1954	147·5	141·2	150·7	149·0	162·8	163·4
1955	167·7	160·0	169·9	169·1	111·5	120·4
1956	189·9	180·5	196·1	190·7	122·7	131·2
1957	224·9	213·0	237·9	228·8	193·7	207·8
1958	292·7	279·0	328·0	314·5	375·5	421·6
1959	384·3	367·5	443·6	429·9	506·7	566·1
1960	485·1	464·4	566·3	552·9	557·2	619·8
1961	538·2	513·9	619·9	600·6	293·7	316·6
1962	574·9	547·1	652·1	622·3	203·0	212·2
1963	597·8	566·8	665·4	622·4	127·1	126·2
1964	639·6	602·0	704·1	644·1	230·9	224·6
1965	698·9	652·2	771·0	684·5	328·3	321·5
1966	752·7	697·5	822·3	714·8	297·4	289·6
1967	790·3	727·9	847·3	720·6	208·2	194·5
1968	825·9	757·9	877·4	724·0	197·0	191·8
1969	869·6	795·1	911·8	736·4	241·6	237·8
1970	982·5	895·6	1,025·1	840·1	624·5	642·4
1971	1,082·0	983·5	1,147·7	919·7	550·2	562·4
1972	1,214·3	1,100·9	1,290·8	1,037·8	732·0	750·6
1973	1,366·7	1,238·1	1,447·4	1,178·6	842·8	877·3
1974	1,475·9	1,336·2	1,548·8	1,253·9	604·1	627·3
1975	1,631·9	1,476·5	1,702·7	1,382·1	863·2	897·1
1976	1,762·0	1,592·9	1,831·7	1,466·7	719·3	744·0
1977	1,937·0	1,745·5	1,995·3	1,595·6	968·0	976·1
1978	2,146·1	1,927·4	2,208·0	1,758·5	1,156·9	1,163·1
1979	2,329·8	2,074·2	2,359·7	1,855·7	1,016·0	938·9
1980	2,506·8	2,205·1	2,507·9	1,920·4	979·2	837·0
1981	2,709·9	2,339·4	2,687·8	1,978·7	1,123·4	858·8
1982	2,940·2	2,491·6	2,890·9	2,054·7	1,274·0	972·8
1983	3,204·2	2,659·6	3,135·9	2,141·0	1,460·2	1,074·5
1984	3,474·5	2,826·7	3,368·6	2,207·0	1,495·2	1,068·4
1985	4,002·8	3,143·1	3,949·2	2,482·2	2,922·5	2,023·5

Source:
Calculated from Tables A1 and A6. Revised series based on 1952 prices.

Table A8: **Annual Growth Rates of Capital Stock and Newly-commissioned Fixed Assets in Chinese State Sector Industry, 1952–85** (per cent)

Period	*Year-end Gross Fixed Assets*		*Year-end Net Fixed Assets*		*Newly-commissioned Fixed Assets*	
	Unrevised KFO(t) (1)	*Revised DKFO(t)* (2)	*Unrevised KF(t)* (3)	*Revised DKF(t)* (4)	*Unrevised I(t)* (5)	*Revised DI(t)* (6)
1952–57	16·0	15·0	17·0	16·3	10·4*	12·4*
		(14·9)		(16·3)		(10·8*)
1957–65	13·2	13·0	13·2	12·3	−5·2	−7·0
		(12·6)		(11·9)		(−7·3)
1965–78	8·9	8·7	8·5	7·9	12·4	13·0
		(8·1)		(7·1)		(12·3)
1978–85	8·5	6·7	7·8	4·3	11·6	6·4
		(6·2)		(3·5)		(4·8)
1952–85	10·2	9·7	10·0	8·7	8·1*	7·1*
		(9·3)		(8·2)		(6·4*)

Note:
* Period begins from 1953.
Source:
Except as noted, exponential growth rates estimated from log-linear regressions using data in Tables A1, A4 and A6. Figures in parentheses are growth rates of series of incremental and total fixed assets valued in 1980 prices.