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Recent Trends in the Chinese Economy

Thomas G. Rawski

The past 15 years have been eventful ones for the Chinese economy. They have seen an ambitious attempt at economic acceleration decline into agricultural crisis, a major reversal of the direction of economic policy, agricultural recovery and resurgent economic momentum. These years have brought major changes to the Chinese economy: whole new industries have appeared; official policy towards such diverse areas as education, income distribution, regional dispersion of industry and economic specialization has shifted repeatedly; the organization of agricultural production has also changed.

Unfortunately for economists, the 1960s were a period during which the Chinese Government saw fit to withhold the statistical information essential to serious analysis of economic trends. Discussion of the Chinese economy of necessity revolved around estimates provided by various foreign academic and government economists. Recently, China's policy towards the publication of economic information has begun to change. Fresh information describing economic performance after the Cultural Revolution has appeared and this new material also sheds light upon developments in earlier years. The purpose of this article is to describe and analyse recent economic trends using information emanating from China.

The usefulness of this approach hinges upon the appraisal of Chinese economic data, an issue which has claimed the attention of economists for over a decade. Detailed investigations by a number of economists have shown that, with the exception of the Great Leap Forward years of 1958–60, published economic data represent the fruit of Peking's increasingly effective efforts to secure accurate information concerning the progress of the Chinese economy. Although the absence of a regular and comprehensive statistical literature and the use of Marxian accounting conventions provide outsiders with endless problems of compilation and conversion, the issue of reliability, either within the Chinese statistical network or at the top level in Peking, creates no greater barrier to a study of the Chinese economy than to research on other developing countries.

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To endorse official economic data is to assert that Peking is capable of collecting and aggregating valid information concerning the operation of production brigades, communes, factories, mines, railroads, stores and other economic units, and to dismiss the possibility that incorrect information is published despite the availability of accurate data.

In 1972, after more than 20 years of administrative experience, the ability of Chinese government agencies to assemble valid economic statistics cannot be questioned. Because of its protean nature, agriculture provides the greatest problems of data gathering; yet no economist has challenged the accuracy of harvest estimates for 1957. Since then, the spread of peasant literacy, the migration of educated persons to the countryside, improved communications and greatly increased official awareness of agriculture's importance all point to a vastly improved apparatus for monitoring the rural sector. Economists have generally accepted official statistics for industry, mining, transport and trade during the first Five-Year Plan period (1953-7). As in agriculture, the passage of time can only have enhanced the capacity to generate accurate information.

Although the possibility of falsification at the central level can never be logically eliminated, demonstrations of consistency among various sets of data enhance confidence in the published materials. There have been many such tests: agricultural and industrial output is consistent with input; industrial output value is consistent with physical output and price data; national industrial output totals check with the sum of provincial aggregates.¹ Under these circumstances, if falsification exists, it must permeate the whole administrative network. Tens of thousands would know if published information were false, an inference which corroborates Perkins' observation that "of all the people who daily go in and out of China, not one has produced evidence of the existence of two sets of books."²

There are other reasons for discarding the hypothesis that recently published data are not correct. First, there is no need to publish false data once a policy of silence is established. Second, as was discovered in the aftermath of the Great Leap, inaccurate but favourable information creates cynicism and hostility among the Chinese public. Hungry peasants and idle workers are not impressed by false reports of bounteous harvests or surging production.

1. Tests showing consistency between input and output data appear in K. Chao, *The Rate and Pattern of Industrial Growth in Communist China* (University of Michigan Press, 1965), pp. 57-75, and *Agricultural Production in Communist China, 1949-1965* (University of Wisconsin Press, 1970), pp. 249-60. Consistency between overall and disaggregated output data and between national and regional totals is shown in T. G. Rawski, "Chinese industrial production, 1952-1971," *Review of Economics and Statistics* (forthcoming), and "Regional distribution of industrial production, 1949-1957" (unpublished paper, 1971).

2. D. H. Perkins, *Market Control and Planning in Communist China* (Cambridge, Mass.: Harvard University Press, 1966), p. 222.

In sum, we should accept Chinese data because of Peking's capacity to marshal accurate information, because published data have withstood repeated tests for consistency, and because there are strong reasons impelling Peking to disseminate only accurate information.

Dimensions of Growth

Agriculture

In assessing the performance of the Chinese economy, no single indicator is more significant than the annual harvest of grain. Chinese sources have recently announced that the 1970 harvest amounted to 240 million metric tons (mmt), with an increase to 246 million tons in 1971. These are the first official production statistics to appear since 1960, and show a substantial gain from the 1957 output of 185 mmt and the 1965 harvest, variously estimated at 180–200 million tons.³

Chinese sources leave little room for doubt that the aftermath of the Cultural Revolution has witnessed an [increase] in both aggregate and *per capita* food supplies which presupposes substantial growth of grain production. National grain reports are buttressed by claims of record harvests in 17 provinces and by detailed and often quantitative descriptions of unprecedented output and yield achievements in hundreds of counties, communes and production units.⁴ A major article in the *People's Daily* of 1 October 1971 assessed the food situation in extremely concrete terms⁵:

The excellent food situation of our country also finds expression in the steadily improving livelihood of urban and rural people and a steadily rising level of consumption of food. . . . Due to food self-sufficiency on a national scale, the national reserve grain stock has surpassed the highest level in history. An unceasing increase is also noticeable in the collective grain stock at the commune and brigade level and the reserve grain stock of individual commune members.

Such statements, which can be verified by any peasant, would hardly appear unless *per capita* grain output and supply during 1970–1 exceeded the levels achieved in 1957 or 1965.

Further support for the 1970 and 1971 harvest claims comes from their consistency with regional output data, some of which present an

3. 1957, 1970 and 1971 data from Table 1; 1965 data from D. H. Perkins, "Economic growth in China and the Cultural Revolution," *CQ* 30 (1967), p. 36.

4. Claims of provincial grain output records have appeared in various issues of *Survey of the China Mainland Press (SCMP)* and of the British Broadcasting *Economic and Technical Supplement* (hence BBC) for Anhwei, Chekiang, Fukien, Honan, Hopei, Hupei, Kansu, Kiangsu, Kirin, Kwangsi, Kwangtung, Kweichow, Liaoning, Shansi, Shantung, Shensi and Yunnan Provinces. A typical local report concerns Lunghai county, Fukien, which produced 245,000 tons of grain in 1970, 32 per cent. above 1966 output, with average yield of 10.2 tons/hectare (*SCMP* 4995, pp. 238–9), and 275,000 tons in 1971, with average yield raised to 10.5 tons/hectare (BBC W664, 15 March 1972, A10).

5. *SCMP* 4994, p. 170.

unflattering picture of recent agricultural progress. These data appear in Table 1. Despite near-stagnation of grain production in the Yellow River area since 1957, the provinces and regions included in Table 1 accounted for a rising proportion of officially claimed grain output during 1957-71.⁶ Achievement of the 240-6 mmt level required below average increases from the regions for which 1971 output data have not appeared: production in the north-east, south (excluding Kwangtung) and south-west regions need have risen only 4.2-13.7 per cent. from 61.6 to 64-70 mmt, between 1957 and 1970-1.

Table 1

National and regional grain output (million metric tons)

	1949	1957	1970-1
Yellow River drainage: Chinghai, Honan, Inner Mongolia, Kansu, Ninghsia, Shansi, Shantung, Shensi	25.180	41.865	44.820 ^(a)
Middle and Lower Yangtze Valley: Anhwei, Chekiang, Hunan, Hupeh, Kiangsi, Kiangsu (including Shang- hai)	30.855	60.095	101.822
Hopei Province	4.550	9.750	13.300
Kwangtung Province	8.000	12.200	16.000 ^(a)
Sum of above regions	68.585	123.910	175.942
National grain output	108.100 ^(b)	185.500 ^(b)	240.000 ^(a) -246.000 ^(c)
Included regions' output as % of national total	63.4%	66.8%	73.3%-71.5%

(a) 1970 data; other figures in this column refer to 1971.

(b) Official national totals from N. R. Chen, *Chinese Economic Statistics* (Aldine, 1967), p. 338.

(c) 1970 output (240mmt) from Edgar Snow, "Ciu En-lai ci parla della potenza Cinese" ("Chou En-lai discusses China's power"), *Epoca* (Milan), 28 February, 1971, p. 21. 1971 output (246 mmt) from *Peking Review*, No. 1 (1972), p. 10.

Source: Unless otherwise noted, Appendix, Table A1.

Fragmentary information shows that such increases were almost certainly attained. In Liaoning, where grain yields averaged 220 catties per *mu* in 1957, one-third of all counties reported 1970 yields in excess of 400 catties. A number of provinces reported substantial harvest gains between 1965 and 1970: Heilungkiang claimed a 33.5 per cent. rise in grain output; Szechwan's 1970 grain output was 16.2 per cent. higher

6. The 1971 data for Honan, Inner Mongolia and Shansi shown in Appendix, Table A1 raise the possibility that Table 1 understates 1970 grain output in the Yellow River drainage or that the 1970 harvest was abnormally low in this region.

than the 1965 figure; for Yunnan, the rise was 20 per cent. Honan's average grain yield rose 35.2 per cent. between 1965 and 1971. Fukien, Kirin, Kwangsi, Kweichow and Liaoning all reported record 1970 harvests, while Sinkiang's grain production during 1966-70 exceeded the 1961-5 total by 32 per cent.⁷

The 1970 and 1971 harvest claims provide further support for the proposition, already advanced by Perkins and others on the basis of evidence concerning *per capita* consumption, that China's 1965 grain output can hardly have fallen short of 200 mmt.⁸ If, as some have argued, 1965 grain output was as low as 180-5 mmt, the implied growth of grain output during 1965-71 becomes approximately 35 per cent., a figure claimed for only a handful of provinces (Hopei, Heilungkiang, Kiangsi), and well beyond the gains of a larger number of more important producers: Szechwan, Shantung, Honan, Inner Mongolia, Kirin and Yunnan.⁹ Unless provinces for which no data are available made extraordinary gains, acceptance of recent harvest claims implies that 1965 grain output was well above 185 mmt.

Output of cotton may be studied either directly or, making use of the close relation between cotton and textile output, indirectly. The recent statement by Prime Minister Chou En-lai, giving 1970 output of cotton textiles at 8,500 million linear metres, 68 per cent. above the 1957 figure of 5,050 million metres, permits us to employ both approaches.¹⁰

Projection of the relation between cotton supplies and cotton cloth production during 1949-57 indicates that the reported 1970 textile output requires an annual cotton supply of 2.55 mmt.¹¹ If cotton imports during 1969-70 continued at the annual rate of 0.1 mmt reported for 1966,

7. For Liaoning grain yields, see *Provincial Agricultural Statistics for Communist China* (Committee on the Economy of China, 1969), p. 166 and *Peking Review* (PR) 2 (1971), p. 7. Percentage gains for Heilungkiang, Szechwan, Yunnan and Sinkiang from the following issues of *SCMP*: 4969, pp. 36 and 33; 4921, p. 15 and 4906, p. 117. For Honan, see PR 40 (1972), p. 27. Claims of record output appear in the following issues of *SCMP*: 4878, p. 152; 4874, p. 135; 4848, p. 70; 4819, p. 84 and 4826, p. 31.

8. Perkins, "Economic growth in China," pp. 36-9.

9. 1970-71 Hopei grain output exceeded the peak prior to the harnessing of the Hai River (1965?) by 30-50 per cent. (*SCMP* 4994, p. 168). Kiangsi grain yields increased 40 per cent between 1965 and 1970 (*SCMP* 4922, p. 73). Shantung grain output rose 19 per cent. between 1965 and 1970 (*SCMP* 4880, p. 24). Inner Mongolia's grain output rose 16.3 per cent. between 1966 and 1970 (*SCMP* 4909, p. 86). 1970 grain output in Kirin exceeded the 1967 peak by 6 per cent. (*SCMP* 4874, p. 135).

10. For Chou's remarks, see Snow, "Ciu En-lai," p. 22; 1957 output from Chen, *Statistics*, p. 189.

11. Calculated from the regression equation $C = 480 + 3.14S$ ($R^2 = 0.73$) where C = cotton cloth output (million metres) from *ibid.* pp. 188-9 and S = sum of domestic cotton output and imports (thousand metric tons) lagged by one-half year (*ibid.* pp. 339 and 408; 1957 cotton imports assumed identical with the 1956 figure), and the regression is calculated from 1950-7 cloth output and 1949-57 cotton production and imports.

cotton output during 1969 and 1970 may be placed at an annual level of 2.45 mmt.¹²

As before, this result may be compared with available information on regional output; this appears in Table 2. Cotton output in the 14 provinces for which summary data were found fell from 82 per cent. of the national total in 1949 to 69 per cent. in 1957. Percentage data for cotton output in these regions during 1970-1 indicate that a national total of 2.45 mmt could have been achieved only if the share of these regions had continued to decline to a level of 56 per cent.¹³ This would imply that cotton output in the regions excluded from Table 2, which grew by 530 per cent. during 1949-57, grew by an additional 111 per cent. between 1957 and 1970-1.

Table 2

National and regional cotton output (thousand metric tons)

	1949	1957	1970-1
Yellow River drainage: Chinghai, Honan, Inner Mongolia, Kansu, Ninghsia, Shansi, Shantung, Shensi ..	247.7	571.4	587.0 ^(b)
Middle and Lower Yangtze Valley: Anhwei, Chekiang, Hunan, Hupeh, Kiangsi, Kiangsu (including Shanghai)	115.8	558.5	787.4 ^(c)
Sum of above regions:	363.5	1129.9	1374.4
National cotton output	444.5 ^(a)	1640 ^(a)	2450 ^(d)
Included regions' output as % of national total	81.8%	68.9%	56.1%

(a) Official national totals from Chen, *Statistics*, pp. 339 and 408.

(b) 1970 figure.

(c) 1971 figure.

(d) My estimate. For derivation, see text.

Source: Unless otherwise stated, Appendix, Table A1.

The meagre reports concerning cotton and textile output in these regions indicate the plausibility of such an increase. Liaoning has succeeded in growing long-staple cotton and has developed a new textile industry serving the three north-eastern provinces.¹⁴ Sinkiang,

12. 1966 imports reported in R. M. Field, "Industrial production in Communist China: 1957-68," *CQ* 42 (1970), pp. 62-63. Since this was written, *PR* 41 (1972), p. 12, has reported that cotton output rose five-fold since 1949, implying recent annual output of 4445×6 or 2.667 mmt (1949 output from Table 2).

13. In the absence of reports of increased cotton or textile output during 1969-71 (in contrast to many specific figures for other industries and crops), I assume no growth of cotton output during 1969-71 or of textile output during 1970-1.

14. T. R. Tregear, *Economic Geography of China* (American Elsevier, 1970), p. 221; *SCMP* 3399, p. 15.

another new cotton growing region, produced 69.9 per cent. more cotton during 1966–70 than during 1961–5.¹⁵ Szechwan's cotton output increased by 20 per cent. during 1969–70 and by 15–25 per cent. during 1970–1.¹⁶

The nearly complete absence of quantitative comparison of pre- and post- Cultural Revolution cotton and textile output suggests that the rate of growth in this sector during 1965–71 may have been low. This in turn implies that the relatively high estimate of 1965 cotton output offered by Chao should be accepted in preference to the lower estimates of cotton and textile output presented elsewhere.¹⁷ These low estimates conflict with reports of substantial investment in the cotton textile industry beginning in 1965, a year in which 37 cotton textile mills were built or expanded and 1.4 million new cotton spindles installed, and continuing into 1966, when nine more mills were opened and spindle output showed further growth.¹⁸

1957, the most recent year for which firm output statistics exist, was a year of substantial idle capacity in the textile industry. If spindles and looms available but not yet installed at the end of 1956 and 1957 output of these items are added to year-end 1956 installed capacity, the utilization ratios for 1956 and textile output data for 1956 and 1957 imply that 1957 output of cotton yarn and cloth occupied only 77 per cent and 70 per cent. respectively of the 1957 year-end capacity of China's cotton textile sector.¹⁹ Officially reported output of spindles (1958–60) and of looms (1958–9) during the Great Leap Forward, if correct, would add 40 per cent. and 19 per cent. respectively to the productive capacity in the yarn and cloth sectors.²⁰ Even with no increase in capacity during 1961–4, China's textile industry could have produced 81 per cent. more yarn and 68 per cent. more cloth than in

15. Tregear, *Economic Geography*, p. 222; *SCMP* 4906, p. 117. However, 1965 output, reported in one source as six times the 1949 level (L. T. C. Kuo, *The Technical Transformation of Agriculture in Communist China* (Praeger, 1972), pp. 46–7), may have been below the 1957 figure of 8.1–10.5 times the 1949 level derived from *Provincial Agricultural Statistics*, pp. 202, 200 and 206.

16. *SCMP* 4814, p. 171; BBC W661, 23 February 1972, A11.

17. Chao, *Agricultural Production*, p. 270; for lower estimates, see W. Klatt, "A review of China's economy in 1970," *CQ* 43 (1970), p. 118; R. M. Field, "Chinese industrial development: 1949–70," U.S. Congress, Joint Economic Committee, *People's Republic of China: An Economic Assessment* (Washington, 1972), p. 83; and A. L. Erisman, "China: agricultural development 1949–71," *ibid.* p. 124.

18. For 1965: new mills from *SCMP* 3472, p. 9; new spindles from *SCMP* 3603, p. 17. For 1966: new mills from C. Y. Cheng, *The Machine-building Industry in Communist China* (Aldine, 1971), p. 261; during the first eight months of 1966, spindle output was 18 per cent. higher than in the corresponding months of 1965 (Lu Yün, "Survey of Communist China's textile industry," *Fei-ch'ing yen-chiu* June 1967, p. 76).

19. Calculated from data appearing in Chen, *Statistics*, pp. 188–9 and 253–4; also Cheng, *Machine-building*, pp. 260–1.

20. Official claims for output of spindles (1958–60) and looms (1958–9) from *ibid.*

1957 without new equipment.²¹ Installation of 1.4 million cotton spindles in 1965 alone (7.3 million were available at the end of 1957) makes it difficult to believe that 1965 cotton yarn output was only 12.5 per cent. above the 1957 level or that cotton cloth output was 4–7 per cent. higher than in 1957.²²

Far more plausible is the Chinese claim that 1964 cotton output exceeded the 1957 level, and that cotton output and yield have attained unprecedented levels in each year since 1965.²³ Since the officially claimed cotton output record (for 1958) of 2.1 mmt is still considered valid by the Chinese press, we may conclude that 1965 cotton production attained this peak level.²⁴ Together with cotton imports of 0.1 mmt and the statistical relation between cotton supply and textile output, these results imply that 1965 production of cotton cloth exceeded 6,666 million linear metres.²⁵

There is little information concerning output of subsidiary agricultural crops, such as edible oils, sugar, tea and vegetables, or China's animal population. Furthermore, existing data sometimes suggest conflicting patterns of growth and are therefore difficult to interpret. However, the dominant role of grain in Chinese agriculture permits me to conclude this section with an estimate of total agricultural output based on trends for grain and for cotton.

The result appears in Table 3. If 1971 grain and cotton production are taken at 246 and 2.45 mmt respectively, overall agricultural output for 1971 is 34 per cent. above the 1957 level, implying an average annual growth rate of 2.1 per cent. If 1965 grain output is placed at 200 mmt and cotton production at 2.1 mmt, agricultural output may be estimated at 10 per cent. above 1957 level, indicating compound growth rates of 1.2 per cent. during 1957–65 and 3.4 per cent. during 1965–71.²⁶

21. This neglects possible scrapping of equipment and presumes Great Leap output claims, which may well be exaggerated, to be accurate. On the other hand, it ignores post-1960 output of textile machinery as well as possible improvements in the quality and capacity of such equipment.

22. 1957 stock of cotton spindles calculated from data in Chen, *Statistics*, p. 253. 1965 estimates for yarn and cloth output from Klatt, "A review," p. 118 and Field, "Chinese industrial development," p. 83.

23. For 1965, see Chao, *Agricultural Production*, p. 270; for 1966–70, see for instance *SCMP* 4871, pp. 235–8.

24. *PR* 17 (1971), p. 17, states that 1958 cotton output was 4.5 times the 1949 figure; this implies that 1958 output was 2.0 mmt. The official claim made in 1959 was for an output of 2.1 mmt (Chen, *Statistics*, p. 339).

25. According to Chinese reports cited in Chao, *Agricultural Production*, p. 270, 1964 output exceeded the 1957 level (1.64 mmt) and 1965 output set a new record. This means that cotton output averaged 1.87 mmt or higher for the two years. Adding imports of 0.1 mmt and applying the regression equation of note 11 leads us to estimate 1965 cotton cloth output at a minimum of 6,666 million linear metres.

26. According to the Liu-Yeh adjusted estimate of gross agricultural output value for 1957 (in 1952 prices), grain and cotton accounted for 63 per cent. of plant and animal output and for 55 per cent. of a total which includes, in addition to these items, forest, fishery and miscellaneous agricultural products. Since we assume

Table 3

Estimated growth of agricultural output, 1957-71, based on output of grain and cotton

	1957	1965	1971
Output: mmt			
Food grains	185.5	200	246
Cotton	1.64	2.1	2.45
Gross output values (billion 1952 <i>yuan</i>) ^(a)			
Food grains	22.816	24.600	30.258
Cotton	2.785	3.566	4.160
Total	25.601	28.166	34.418
Index of output value for grain and cotton, and for all agriculture	100.0	110.0	134.4

(a) Throughout most of the period under review, the official exchange rate (*yuan* per U.S. dollar) was 2.355 (F. H. Mah, *The Foreign Trade of Mainland China* (Aldine, 1971), p. 77). The American billion is used throughout this paper.

Source: Output data and estimates from Tables 1 and 2. Output values calculated from 1952 prices per ton of 123 *yuan* (grain) and 1698 *yuan* (cotton) given in T. C. Liu and K. C. Yeh, *The Economy of the Chinese Mainland* (Princeton, 1965), pp. 381 and 397 (the former being the average price of 1957 food crop output calculated from physical output and gross output value).

Industry

Existing estimates of industrial growth since 1957 depend heavily on physical output data for various major products provided by foreign governments, notably those appearing in the U.S. Hong Kong Consulate General's publication *Current Scene*.²⁷ Since these sources typically provide no supporting material, it is not possible to determine the extent to which they reflect careful study and evaluation of Chinese materials. Because of this difficulty, I avoid the use of such data, and rely instead on information or inference from Chinese sources; my results thus provide a yardstick against which other foreign views of the Chinese economy may be tested.

that all agricultural output moved in proportion to output of grain and cotton alone, a 10 per cent. error with respect to growth of products other than grain and cotton would imply an error of 3.7 per cent. (or 4.5 per cent.) in our estimate of plant and animal (or the augmented total) output. See Liu and Yeh, *Economy of the Chinese Mainland*, pp. 397-400. Our result may be compared with an estimate by A. G. Ashbrook, "China: economic policy and economic results, 1949-71," *Economic Assessment*, p. 47, which gives average growth rates for agricultural output of 0.1 per cent. for 1957-65, 2.2 per cent. for 1965-71 and 1.0 per cent. for 1957-71.

27. Industry is defined to include the extractive sector, electric power and manufacturing; treatment of other utilities is uncertain. The official Chinese concept of "modern industry" includes "modern factories" and "handicraft factories" but excludes "individual handicrafts" (those establishments employing less than four hired workers). For elaboration, see Chen, *Statistics*, pp. 28-9 and Liu and Yeh, *Economy of the Chinese Mainland*, pp. 489-92.

To analyse the level of output attained prior to the Cultural Revolution, let us begin with machine-building, a key sector which has been studied in closer detail than any other area of Chinese industry. Gross output value for the machinery sector has been separately estimated by C. Y. Cheng and by me; the results of both studies appear in Table 4. Although my figures, which indicate a higher level of output than Cheng's are used below, it should be noted that the two series show broadly similar output trends. The derivation of estimated machinery output is sketched in the Appendix (p. 31) and explained in detail elsewhere.²⁸

Table 4

Estimated gross output value for machine-building, 1957-66 (1952 yuan)

	<i>Cheng estimate</i> ^(a)		<i>Present estimate</i> ^(b)	
	<i>Gross output value (billion yuan)</i>	<i>Index</i>	<i>Gross output value (billion yuan)</i>	<i>Index</i>
1957	6.18	100	6.2	100
1958	11.13	180	-	-
1959	15.59	252	-	-
1960	18.86	305	-	-
1961	9.43	152	-	-
1962	7.54	122	8.1-12.4	131-201
1963	9.05	146	9.7-14.9	157-241
1964	10.42	168	11.2-17.2	181-278
1965	14.58	236	15.1-23.2	244-375
1966	17.49	283	19.6-30.1	318-488

(a) Cheng, *Machine-building*, p. 108. Gross output values were converted from 1957 to 1952 yuan using a deflator derived from 1957 producer goods output totals in 1952 and 1957 yuan appearing in Chen, *Statistics*, p. 210.

(b) Rawski, "Machine-building," pp. 79 and 82.

What do these results imply concerning availability of steel, a major input for machine-building? Although estimates of 1965 ingot steel production range as high as 15 mmt, most outside observers have agreed on a figure of 11 million tons, just over twice the 1957 figure of 5.35 mmt.²⁹ Could 1965 machinery output have increased to 2.44-3.75 times the 1957 level if steel supplies only doubled?

28. See T. G. Rawski, "The economics of Chinese machine-building, 1931-1967" (Ph.D. dissertation, Harvard University, 1972), ch. II and Appendix C.

29. For 1957 ingot steel output and various estimates for 1965, see R. M. Field, "Chinese Communist industrial production," in U.S. Congress, Joint Economic Committee, *An Economic Profile of Mainland China* (Washington, 1967), Vol. I, p. 293 and I. Fan, "Communist China's industries in 1968," in *Communist China 1968* (Union Research Institute, 1969), p. 343.

Table 5

Investment, machinery imports and domestic machinery output, 1957 and 1965 (billion 1952 yuan)

<i>Year</i>	<i>Net domestic investment</i>	<i>Derived demand for producer durables</i>	<i>Imports of machinery</i>	<i>Demand for domestic machinery</i>	<i>Supply of domestic machinery</i>	<i>Demand supply</i>
1957	18.2 ^(a)	5.7 ^(b)	1.0 ^(c)	4.7 ^(d)	6.2 ^(e)	76%
1965	26.9 ^(f)	8.4 ^(b)	0.7 ^(g)	7.7 ^(d)	23.2 ^(e)	33%
1965	34.9 ^(h)	11.0 ^(b)	0.7 ^(g)	10.3 ^(d)	15.1 ^(e)	68%

(a) T. C. Liu, "Quantitative trends in the economy," in A. Eckstein, W. Galenson and T. C. Liu (eds.), *Economic Trends in Communist China* (Aldine, 1968), p. 164.

(b) Assuming a 31.4 per cent. share of producer durables (assumed identical with machinery) in total investment outlay as given for 1957 by K. C. Yeh, "Capital formation," *ibid.* p. 519.

(c) Calculated from R. F. Dernberger, "Prices, the exchange rate and economic efficiency in the foreign trade of Communist China," in A. Brown and E. Neuberger (eds.), *International Trade and Central Planning* (University of California Press, 1968), pp. 237-9, by assuming that the share of machinery, equipment and complete plants in total imports equalled their share in allocable imports, and that $Y2.36 = \$1$.

(d) Derived demand less imports.

(e) Table 4.

(f) Assumed 48 per cent. greater than 1957 figure; see text.

(g) Calculated from R. L. Price, "International trade of Communist China, 1950-1965," in *Economic Profile*, Vol. II, 586, assuming that $Y2.36 = \$1$.

(h) Assumed 92 per cent. greater than 1957 figure; see text.

The answer to this question is affirmative only if 1965 machinery output fell in the lowest part of the range specified in Table 4. Y. L. Wu's calculations indicate that, in 1957, machine-building absorbed 20.8 per cent. of China's finished steel production.³⁰ Assuming unit output coefficients to have been constant during 1957-65, if 1965 machinery output were 3.75 times the 1957 level while steel output rose only 106 per cent., the share of finished steel allotted to machine-building would have to rise to 37.9 per cent. in 1965. This increment could have come from a reduction in the share of finished steel absorbed by construction (including railroads). Wu estimates this share at 60.9 per cent. of 1957 steel output.³¹ A drop to 43.8 per cent. in 1965, releasing 17.1 per cent. of steel output for diversion to machine-building, would leave steel supplies for construction 48 per cent. higher than in 1957. Similar reasoning applied to my lower estimate of 1965 machinery output indicates a 92 per cent. increase in the supply of steel available for construction.

30. Y. L. Wu, *The Steel Industry in Communist China* (Praeger, 1965), p. 173.

31. *Ibid.* p. 179; 60.9 per cent. is the sum of the shares of railroads and other construction.

However, the level of aggregate investment implied by these quantities of steel would not provide sufficient demand to absorb available machinery supplies unless 1965 machinery output fell at the lower end of the range shown in Table 4. This is demonstrated by Table 5, which indicates that with overall investment at 48–92 per cent. above the 1957 level, the share of current machinery production absorbed by investment demand would have fallen from 76 per cent. in 1957 to 33–68 per cent. in 1965.³²

Table 6
Output of cement, 1949–65 (mmt)

1949	0.66 ^(a)	1963	9.08 ^(d)
1957	6.86 ^(a)	1964	10.89 ^(e)
1961	6.36 ^(b)	1965	13.72 ^(f)
1962	7.32 ^(c)		

(a) Chen, *Statistics*, pp. 186–7.

(b) Derived on the basis of a 15 per cent. output increase for large and medium plants during 1961–2 reported in *Nippon tekko renmei, 1962 nen no Chūgoku keizai- Soren bōekisho keiki kenkyūjo chōsa (The Chinese Economy in 1962—A Survey by the Business Research Unit of the Soviet Ministry of Trade)* (Tokyo, 1963), p. 18.

(c) Derived on the basis of a 24 per cent. output increase over the first 10 months of 1962–3 cited in Y. C. Chao, “Industrial development,” in *Communist China 1963* (Union Research Institute, 1965), Vol. I, p. 77.

(d) Derived on the basis of a 20 per cent. output increase for 1963–4 (a minimum figure) reported in *SCMP* 3391, pp. 1–2.

(e) Calculated at 16.5 times the 1949 figure on the basis of reports of a 16-fold (*SCMP* 3431, p. 23) or a 15-fold (C. T. Ma, “Industry,” in *Communist China 1964* (Union Research Institute, 1965), Vol. I, p. 133) output increase over a 15-year period.

(f) Derived on the basis of a 26 per cent. output increase during the first five months of 1964–5 reported in C. MacDougall, “China’s industrial upsurge,” *Far Eastern Economic Review*, 30 September, 1965, p. 610.

To suggest that investment demand absorbed only 33 per cent. of China’s 1965 machinery output seems inconceivable. The hoards of machinery required to make sense of the data associated with my higher output estimate for 1965 would be so enormous that their existence in secret is impossible. Nor can rising output of consumer durables explain this discrepancy: available evidence points to a slight

32. These calculations assume constant requirements of ingot steel per *yuan* of machinery output and of steel and machinery per *yuan* of investment outlay, that all machinery imports go to investment, and that increases in the share of steel consumed in machinery production necessitate equal reductions in the share devoted to construction. China’s small exports of machinery, which amounted to less than 4 per cent. of domestic output during 1962–4 (Cheng, *Machine-building*, p. 48 and Table 4 above), do not affect the analysis.

decline in the share of consumer products in aggregate machinery output between 1957 and 1965.³³

An increase in the share of machinery and equipment outlays in total investment might suffice to eliminate the minor inconsistency between steel output of 11 mmt and 1965 machinery output falling within the lowest portion of the estimated range. It is certainly possible that the share of equipment outlays in investment rose. This might occur, for instance, if a large share of investment were devoted to conversion of existing factories to new product lines, or to replacement of old and unsatisfactory equipment in existing factories.³⁴ On the other hand, we know that Chinese policy in the past decade has emphasized investment in agriculture which, during the 1950s at least, required an extremely low input of machinery per *yuan* of investment outlay.³⁵

A further problem arises from output trends in the cement industry, which are shown in Table 6. Since cement has no significant uses other than construction and cannot be stored, we may assume that current output is put to use with a minimal time lag, and therefore provides a good index of cement consumption in current construction.³⁶ If this is so, my higher machinery output estimate, steel output of 11 mmt and cement output of 13.7 mmt jointly imply that the ratio of cement to steel used in construction during 1965 was 35 per cent. above the comparable 1957 figure. This seems improbable. My lower boundary for machinery output, taken with the same steel and cement data, implies that the ratio of cement to steel for construction in 1965 exceeded the 1957 figure by less than 5 per cent.

These calculations show that, taken with the cement output shown in Table 6, the lower range of my 1965 machinery estimate is consistent with ingot steel output of 11 mmt. The upper range of my machinery estimate, however, conforms to a steel output of 11 mmt only if the level of 1965 investment is assumed to be so low that large quantities of new machinery and substantial amounts of cement could not be absorbed. If steel requirements for both machine-building and construction were identical in 1957 and 1965, the upper limit of my machinery output estimate requires 1965 steel output to have been slightly above 13 million tons.

33. Output of bicycles, sewing machines and radios, the products in our ten-item machinery sample which might be classed as consumer goods, grew less rapidly during 1957-65 than the entire sample (Appendix, Table A2).

34. For reports of conversion, see Cheng, *Machine-building*, p. 305. *SCMP* 3443, pp. 18-19 includes a report describing replacement of equipment at small paper mills in Shantung.

35. During the first Five-Year Plan period, 38 per cent. of total investment was to be spent on machinery and equipment. For different types of investment, the shares of machinery in total outlay were: industry 40 per cent.; agriculture 17 per cent.; culture and education 10 per cent. (Cheng, *Machine-building*, p. 43).

36. Available trade statistics suggest that cement exports grew less rapidly than domestic production; elimination of exports from the total would enhance the argument in the text.

Output trends in two other capital goods industries, chemicals and petroleum, may also be sketched from Chinese sources. Table 7 presents an estimate of the growth of the chemical industry derived on the

Table 7

Output of chemical fertilizers and of the chemical industry, 1949–71

	<i>Chemical industry gross output value (billion 1952 yuan)</i>	<i>Chemical fertilizer output (mmt)</i>
1949	0.162 ^(a)	0.027 ^(c)
1957	4.291 ^(a)	0.871 ^(c)
1962	4.628 ^(b)	3.000 ^(c)
1963	6.480 ^(d)	4.200 ^(c)
1964	9.072 ^(b)	5.900 ^(c)
1965	13.699 ^(b)	8.900 ^(c)
1966	17.808 ^(b)	11.600 ^(c)
1970	21.492 ^(b)	14.000 ^(e)
1971	25.790 ^(b)	16.828 ^(f)

(a) S. Ishikawa, *National Income and Capital Formation in Mainland China* (Tokyo: Institute of Developing Economies, 1965), p. 60.

(b) Calculated from the 1963 figure on the basis of annual percentage changes in fertilizer production.

(c) Chao, *Agricultural Production*, p. 315.

(d) *Jen-min jih-pao*, 25 September, 1964, p. 1 reported that 1963 output value was over 40 times the 1949 level (cited in R. Kojima, "Kōgyō seisan to kagaku kōgyō," in S. Kambara, ed., *Chūgoku no kagaku kōgyō (China's Chemical Industry)* (Ajia keizai kenkyūjo, 1970), p. 35); I use the figure 40 times the 1949 level.

(e) Snow, "Ciu En-lai," p. 21.

(f) BBC, W654, p. A-1 reports a 20.2 per cent. increase in output for 1970–71.

assumption that the entire sector grew during 1962–71 in proportion to output of chemical fertilizer. Although fertilizer output data are given by a number of sources, I use Chao's estimates, which are derived from Chinese materials.³⁷

1965 crude oil output of 5.4 mmt, a lower figure than is given in other studies, is derived from Chou En-lai's statement that 1970 output was 20 mmt and from a report that the average annual growth rate during 1966–70 was 30 per cent.³⁸ Total output of the petroleum industry is assumed to have risen in proportion to crude oil production.

Table 8 summarizes my output estimates for producer goods.³⁹

37. Chao, *Agricultural Production*, pp. 315–17.

38. Snow, "Ciu En-lai," p. 22 and *PR* 3 (1972), p. 3. Field, "Chinese industrial development," p. 83, estimates 1965 crude oil output at 8 mmt.

39. Capital or producer goods or heavy industry is defined by the Chinese to include mining, metallurgy, power, metal-processing (including machine-building), basic chemicals and building materials (Chen, *Statistics*, p. 28).

Growth of ferrous metallurgy, building materials, chemicals and petroleum is assumed proportional to increases in the principal

Table 8

Gross output value of producer goods, 1957 and 1965 (billion 1952 yuan)

	1957	1965
Building materials	1.6	3.2
Chemicals	4.3	13.7
Ferrous metals	5.2	10.7-12.6
Machine-building	6.2	15.1-23.2
Petroleum	0.6	2.3
Total	17.9	45.0-55.0
Index	100.0	251.4-307.3

Source: 1957 data from (Tables 4, 6 and 7 and from Ishikawa, *National Income*, p. 60. 1965 output for building materials, ferrous metals and petroleum is assumed to have increased in proportion to output of the major commodities: cement (table 6), ingot steel (5.35 mmt in 1957, 11-13 mmt in 1965) and crude oil (1.5 mmt in 1957 (Chen, *Statistics*, p. 187), 5.4 mmt in 1965). Other 1965 data from tables 4 and 7.

products: ingot steel, cement, fertilizer and crude oil. Such assumptions are not foolproof. Because of its high priority, for instance, chemical fertilizer may have grown faster than the entire chemical industry; on the other hand, improvements in refining technique probably caused output of petroleum and steel products to expand more rapidly than production of crude oil and steel ingot.

Table 8 includes industries which accounted for approximately 55 per cent. of the 1957 output of producer goods. The excluded sectors are either very small (non-ferrous metallurgy) or closely linked to the overall pace of industrial advance (electric power and coal). The sample represented in Table 8 may therefore be used as an indicator of overall performance in the capital goods sector of industry. 1965 output for this sample exceeded the 1957 total by 150-200 per cent., implying that capital goods production during 1965 considerably exceeded the range suggested by previous studies.⁴⁰

Output trends for the consumer goods sector of industry (excluding

40. Perkins, "Economic growth in China," p. 41, concludes that output of industrial producer goods rose by 90-100 per cent. between 1957 and 1965. The major difference between my calculation and his arises from my inclusion of machine-building, which by 1965 had become the largest industrial sector. I omit the coal and electric power sectors because there are no Chinese materials which permit us to estimate their output levels; their inclusion in Table 8 with the 1965 output estimates used by Perkins would not change my conclusion: with 1957 = 100, 1965 producer goods output would become 238-87, well above Perkins' result (using 1957 data from Ishikawa, *National Income*, p. 60, lines B3 and B4).

handicrafts) are shown in Table 9.⁴¹ Textile production is assumed to have grown in proportion to output of cotton cloth for which, as noted above, I have offered a 1965 estimate considerably in excess of those provided elsewhere. An estimate for paper output is also shown. In addition, I include total industrial output for Shantung and Kwangtung Provinces, whose industry is dominated by consumer manufactures, and Shanghai's light industrial output.⁴² Although this procedure leads to double counting of textile production for Shanghai, Kwangtung and Shantung, the relatively slow growth of textiles serves only to emphasize my finding that output of consumer manufactures increased between 1957 and 1965, and certainly did not stagnate.⁴³

Table 9

**Gross output trends for segments of "Light Industry," 1957-65
(billion 1952 yuan)**

	1957	1965
Shanghai light industry	7·296 ^(a)	13·643 ^(a)
Shantung provincial industrial output	4·068 ^(a)	5·150 ^(a)
Kwantung provincial industrial output	3·202 ^(a)	4·512 ^(a)
Textile output	12·419 ^(b)	16·393 ^(c)
Paper output	1·691 ^(b)	2·473 ^(d)
Total	28·676	42·171
Index	100·0	147·1

(a) See the Appendix, below, p. 33.

(b) Ishikawa, *National Income*, p. 60.

(c) Assumed to have increased in proportion to output of cotton cloth, which rose from 5,050 million metres in 1957 to an estimated 6,666 million metres in 1965 (note 25).

(d) Output of paper was 1·2 mmt in 1957 and an estimated 1·5 mmt in 1964 (Field, "Industrial Production," pp. 56 and 62); output of paper and paperboard rose 17 per cent. during the first four months of 1965 compared with the same period of 1964, a percentage which we apply to the entire year (see *SCMP* 3478, p. 10). Gross output value is assumed to have grown in proportion to physical output of paper.

We are now in a position to appraise overall industrial growth between 1957 and the Cultural Revolution. If we attach equal weight to the producer and consumer goods sectors, Tables 8 and 9 imply that with 1957 taken as 100, 1965 industrial output falls within the range of

41. The Chinese include paper, textiles, food processing, drugs, leather, printing and daily necessities in light or consumer industry (Chen, *Statistics*, p. 28).

42. Textiles and food processing accounted for 75 per cent. of Shantung's 1952 and for 58 per cent. of Kwangtung's 1957 industrial production (*ibid.* pp. 229-30).

43. Perkins, "Economic growth in China," p. 41, assumes that combined output of handicrafts and consumer industry stagnated or declined slightly between 1957 and 1965.

199–227, indicating an average growth rate for 1957–65 of 9.0–10.8 per cent., far short of the 19.2 per cent. rate achieved during the first Five-Year Plan period, but considerably above the 5 per cent. level suggested by previous estimates.⁴⁴

Table 10

Level of industrial production, 1957–71 (billion 1952 yuan)

<i>Year</i>	<i>Present Estimate</i> <i>Gross Output Value</i> <i>(billion yuan)</i>	<i>Index</i>	<i>Per cent. increase</i> <i>over previous</i> <i>year</i>	<i>Official Gross</i> <i>Output Data</i> <i>(billion yuan)</i>
1957	65.0 ^(a)	100		
1963	101.4–115.7 ^(b)	156–178		116.5 ^(c)
1964	116.4–133.2 ^(b)	179–205	15 ^(d)	
1965	129.4–147.6 ^(e)	199–227	11 ^(f)	
1966	155.4–177.4 ^(b)	239–273	20 ^(g)	
1970	207.4–236.6 ^(h)	319–364		216 ⁽ⁱ⁾
1971	228.1–260.3 ⁽ⁱ⁾	351–400		226 ^(k)

(a) Chen, *Statistics*, p. 210.

(b) Calculated from the 1965 figures and from annual percentage changes in output.

(c) Field, "Chinese Communist industrial production," *Economic Profile*, Vol. I, p. 273, cites Chinese sources describing 1963 handicraft output as over four times the 1949 level (given as 3.237 billion 1952 yuan in Chen, *Statistics*, p. 210) and about 10 per cent. of combined 1963 output of industry and handicrafts. $116.5 = 3.237 \times 4 \times (10 - 1)$.

(d) *News from Chinese Provincial Radio Stations*, Supplement to No. 94, 9–16 February, 1965, p. 1.

(e) Calculated from the 1965 index, which is derived in the text, and from the 1957 figure.

(f) A planned increase which I assume to have been attained (Field, "Chinese Communist industrial production," *Economic Profile*, Vol. I, p. 273).

(g) T. Lin, "China's industry in 1966," *Communist China 1966*, Vol. I, p. 117.

(h) 60 per cent. above the 1965 figures; see text.

(i) 10 per cent. above the 1970 figures; see text.

(j) Snow, "Ciu En-lai," p. 22, reporting the Premier's statements, gives 1970 gross output value for industry and transport at \$90 billion or, using Snow's exchange rate of \$1 = Y2.40, Y216 billion. I assume that industry accounted for 90.4 per cent. of this total (based on 1956 data from Chen, *Statistics*, pp. 139, 210) and that the unspecified price base is 1957, and calculate 1970 industrial output at 1952 prices with a price index derived from *ibid.* p. 210, col. 1. If Snow's data include handicrafts (or are based on post-1957 prices), my result is too high (low).

(k) Calculated from 1949 gross output value for factory industry of 10.781 billion 1952 yuan (*ibid.* p. 210) and from the statement in *PR 39* (1972), p. 11, that 1971 total industrial output value rose by about 20 times as compared with 1949. $10.781 \times 21 = 226$ billion yuan. If the total referred to in this statement includes handicrafts, which grew more slowly than factory industry, my derived figure is too low.

44. Gross value of producer and consumer goods (both excluding individual handicrafts) for 1956 were virtually identical (Ishikawa, *National Income*, p. 60). Although the share of producer goods probably rose above 50 per cent. in 1957

In Table 10, Chinese statements concerning annual changes in the level of industrial production are used to extend the estimate to 1963, 1964 and 1966. Table 10 also includes output figures for three years, 1963, 1970 and 1971, derived from Chinese sources. Close agreement between these totals and my summation of diverse estimates for several industrial branches, each based on different materials, supports my initial hypothesis concerning the validity of Chinese sources and provides confidence in the estimating procedures underlying Table 10.

These results indirectly illuminate the industrial situation during 1961 and 1962. Available data on annual output increases during 1961–2 and 1962–3 show only modest growth: output of cement rose by 15 per cent. and 24 per cent. during the two years; two of the fastest growing sectors, chemical fertilizer and machine-building, increased by 40 per cent. and 20 per cent. respectively during 1962–3; provincial industrial output rose during 1962–3 by only 8 per cent. in Kwangtung and 6.2 per cent. in Shensi.⁴⁵ The paucity of such reports, coupled with the certainty that output in some sectors, such as steel, increased slowly, if at all, during these years, makes it unlikely that aggregate industrial output rose by more than 10 per cent. during either 1961–2 or 1962–3. Since 1963 industrial output exceeded the 1957 level by a minimum of 50 per cent., even at the nadir of China's economic fortunes, 1961 industrial output must have exceeded the 1957 level by at least 25 per cent.

To complete this survey of industrial growth, Table 11 estimates the increase in production between 1965 and 1970–71. Data for chemicals, ferrous metals, petroleum and textiles are presented, once again on the assumption that sectoral output grew in proportion to production of major commodities; to these are added gross output data for Shanghai and Shantung province. These data indicate that 1970 industrial production was 58–62 per cent. above 1965 output, a result confirmed by reports from 10 other provinces indicating average increases of 62 per cent. during the same period.⁴⁶ For 1970–71, data in Table 11 indicate an increase of 12 per cent., which agrees with a published statement describing 1971 industrial production as 10 per cent. above the 1970 level.⁴⁷ As shown in Table 10, I have calculated industrial

(no data are available), we allot a 50 per cent. weight to each sector. Field, "Chinese industrial development," p. 63, estimates industrial output (including handicrafts) to have grown at an average annual pace of 5.0–6.1 per cent. during 1957–65 and 5.4–6.6 per cent. during 1957–70.

45. For Kwangtung, see Y. C. Chao, "Industrial development," in *Communist China 1963*, Vol. I, p. 84. For Shensi, see *News From Chinese Provincial Radio Stations* 39 (3 January 1964), p. 3.

46. 62 per cent. is an average of percentage increases reported in various issues of *SCMP* for Anhwei, Honan, Inner Mongolia, Kirin, Kwangsi, Peking, Shansi, Shensi, Szechwan and Yunnan, weighted by 1957 provincial gross output value for industry from Rawski, "Regional distribution of industrial production."

47. *PR* 34 (1972), p. 7.

output for 1970 and 1971 by assuming growth of 60 per cent. during 1965–70 and 10 per cent. for 1970–71.

Table 11

**Growth of several segments of industrial production, 1965–71
(billion 1952 yuan)**

<i>Sector</i>	<i>1965</i>	<i>1970</i>	<i>1971</i>
Ferrous metals	10.7–12.6	17.3 ^(a)	20.4 ^(a)
Chemicals	13.7	21.5 ^(b)	25.8 ^(b)
Petroleum	2.3	8.7 ^(c)	11.0 ^(c)
Textiles	16.4	20.9 ^(d)	20.9 ^(d)
Shanghai industrial output	27.3	43.6	47.5
Shantung industrial output	5.2	10.3	11.8 ^(e)
Total	75.6–77.5	122.3	137.4
Index	100.0	157.8– 161.8	177.3– 181.7

(a) Assumed to have grown in proportion to ingot steel output, which rose from an estimated 11–13 mmt in 1965 (see text) to 21 mmt in 1971 (BBC W654, 5 January, 1972, A1). 1971 output was 18 per cent. above the 1970 level (BBC W655, 12 January, 1972, A12) which is calculated at 17.8 mmt.

(b) Table 7.

(c) Assumed to have grown in proportion to crude oil output, which rose from an estimated 5.4 mmt in 1965 to 20 mmt in 1970 (see text) and increased by 27.2 per cent. during 1970–1 (BBC W654, A1).

(d) Assumed to have grown in proportion to output of cotton cloth, which rose from an estimated 6,666 million linear metres in 1965 to 8,500 million metres in 1970 (see text). We assume no increase during 1970–1.

(e) Shantung's 1971 industrial output was 14 per cent. above the 1970 level (BBC, W657, 26 January, 1972, A8).

Source: Unless otherwise noted, data come from tables 8 and 9 and the notes to Table 9 in the Appendix.

My output series indicates that China's industrial sector advanced at an annual average pace of 9.0–10.8 per cent. during 1957–65, and at 9.9 per cent. during 1965–71. Although these figures fall short of the 19.2 per cent. achieved during 1952–7, they indicate the need for a major upward revision in existing estimates of recent industrial performance.⁴⁸ Industrial expansion has also resulted in an important shift in the

48. Part of the difference between Field's previously cited estimate and mine arises because Field's index includes slow-growing individual handicrafts, while mine does not. Even if handicrafts did not grow at all after 1957, however, my data for factory industry (excluding individual handicrafts) indicate an average growth rate for 1957–70 more than 40 per cent. greater than that implied by Field's results. Since I base my estimate on the official 1957 industrial output figure, which Field regards as an overestimate, the gap between the *level* of output as estimated by Field and as shown in Table 10 is greater than differing estimates of post-1957 growth rates alone would imply. A defence of the official 1957 figure is offered in Rawski, "Chinese industrial production, 1952–1971."

balance between producer and consumer goods output, with the former now providing the bulk of incremental output and increasing its share in the total from 50 per cent. in 1957 to 63–68 per cent. in 1965, with a further increase thereafter. Although producer goods are divided between investment and military uses, the growth of capital goods output between 1957 and 1965 almost certainly implies that both the volume of investment and its share in aggregate output were considerably higher in 1965 than in 1957.⁴⁹

What are the causes of industrial growth since 1957? Although a full analysis cannot be attempted here, two factors stand out among possible explanations of recent progress. The first is the enormous increase in the quantity and quality of China's industrial capital stock since 1957 resulting from the completion of projects begun under the first Five-Year Plan and from the rapid growth of domestic output of industrial capital goods.⁵⁰ Industrial workers are now provided with more and better equipment than they were 15 years ago. Another important development has been a steady improvement in the quality of China's industrial labour force. Formal and spare-time education, training received on the factory floor and the accumulation of industrial experience, especially important in realizing the full potential of new types of machinery and equipment, have all contributed to the growing technical ability of industrial workers. Planned transfer of skilled workers to relatively small and backward enterprises may also have raised overall productivity.

National Product

To obtain a picture of overall development for the entire economy, I make use of a statistical model of the Chinese economy constructed by Ta-chung Liu on the basis of information pertaining to 1952–7.⁵¹ Although the assumption that underlying patterns of intersectoral relations have not changed fundamentally since the mid-1950s cannot be verified, I follow Professor Liu in expecting such extrapolation to provide a broadly accurate view of national economic trends.

The result of applying the findings of the previous sections to Liu's statistical framework appears in Table 12. Estimated net domestic product nearly doubled between 1957 and 1971, showing an annual increase of 4.7 per cent., somewhat below the 5.1 per cent. annual average recor-

49. Military procurement, estimated for 1953–61 by Cheng, *Machine-building*, p. 208, never exceeded three billion *yuan* prior to 1958. Even a large increase would leave civilian supplies growing ahead of national product, suggesting a rising rate of capital formation.

50. Rawski, "Machine-building," p. 409, concludes that even in the absence of positive net investment after 1960, the 1965 stock of industrial fixed capital would have been over 3.5 times the 1957 level. Rising output of capital goods implies that this figure is a substantial underestimate of the actual increase.

51. Liu, "Quantitative trends," pp. 155–67.

ded for the longer period 1952–71.⁵² Despite the temporary disruption associated with the Cultural Revolution, economic growth accelerated during the course of the 1960s, with net domestic product increasing at an estimated 5.7–6.4 per cent. per year after 1965.

Table 12

Net domestic product estimated according to Liu's model (billion 1952 yuan)

	V_o	V_m	G	$V_o + V_m + G$ <i>Net domestic product</i>	<i>Index</i>
1952 ^(a)	46.49 (65)	21.65 (30)	3.27 (4)	71.41	100.0
1957 ^(a)	49.66 (52)	40.65 (43)	5.03 (5)	95.34	133.5
1965	53.64 (43–41)	65.97–71.20 ^(b) (52–54)	5.85 (5–4)	125.46–130.69 ^(b)	175.7–183.0 ^(b)
1971	63.62 (35)	112.24 (62)	6.60 (4)	182.46	255.5

(a) Taken or calculated from estimates provided in Liu, "Quantitative trends," pp. 162–3. 1965 and 1971 estimates are derived as shown in the Appendix.

(b) Two estimates correspond to ingot steel output for 1965 of 11 and 13 mmt respectively.

Note: V_o = Net value added by the traditional sectors (handicrafts, traditional transportation, peddlers, rural rental incomes, work brigades, and personal services, including agriculture.)

V_m = Net value added by all the modern sectors except government. (Modern factories, mining, utilities, construction, modern transportation and communications, trading stores, restaurant, finance, and urban rental incomes.)

G = Value added by government. (Liu, "Quantitative trends," pp. 156–7.)

For fuller notes on these calculations, see the Appendix, p. 33.

Figures in parentheses indicate the percentage shares of the three sectors in estimated net domestic product. They may not add to 100 per cent. because of rounding.

Derivation of estimates for 1965 and 1971 is explained in the Appendix.

If we assume mid-year population figures for 1952, 1957 and 1971 of 569, 637 and 850 million respectively, *per capita* income is seen to

52. Domestic product is an aggregate output measure which, in China's case, is virtually identical with national product (Liu and Yeh, *Economic Development of the Chinese Mainland*, pp. 18–19). The reader should note that the use of 1952 prices results in a higher estimate of industrial growth, the share of industry (as opposed to agriculture) in aggregate product, and therefore of the growth of the economy than would be obtained from estimates based on prices of other years, such as 1933, 1957 or 1971. Limited data prevent me from offering alternative estimates at the present time.

have increased from 125 *yuan* in 1952 to 150 *yuan* in 1957 and 215 *yuan* in 1971, an increase of 71 per cent., implying average annual growth rates of *per capita* income of 2.9 per cent. for 1952–71 and 2.6 per cent. for 1957–71.⁵³

Viewed against the background of overall performance by non-Communist developing countries which, according to one measure, achieved growth rates of 4.6–4.7 per cent. for total and 2.2 per cent for *per capita* product during the period 1950–68, China's economic advance appears substantial, although the rate of growth was not outstandingly high.⁵⁴

The Chinese Economy Since 1957: An Analysis

We have seen that the period 1957–71 was one of substantial growth. Table 12 shows that important structural change also occurred within the Chinese economy. The wide gap between the post-1957 growth rates of agriculture and industry greatly enlarged the weight of the latter in the economy. By 1965, the modern sector, including industry, construction, trade and finance, had grown to encompass over half of China's aggregate product. By 1971, agriculture's share in the total had fallen from 48 per cent. in 1952 and 39 per cent. in 1957 to a low of only 27 per cent.⁵⁵

The steady gain of the modern sector, led by industry, and the simultaneous relative decline of agriculture represent a fundamental economic shift. Although agriculture remains large in the overall picture, particularly because it continues to employ the vast majority of the labour force, there are now large segments of the economy which are not strongly affected by the vagaries of the annual grain harvest. The link between short-term harvest fluctuations and the general level of economic activity is therefore already much weaker now than it was in the 1950s, and it should continue to diminish in the future.

Economic growth during the past one-and-a-half decades, although substantial, has been notably erratic, with a major cyclical setback during 1959–62 and a lesser pause during the Cultural Revolution years of 1967 and 1968. The economic crisis of 1959–62 was, at least in part, a result of faulty economic analysis underlying the first Five-Year Plan. This programme allotted far more resources – capital, manpower and

53. 1952 and 1957 figures are mid-year totals derived from data in Chinese publications (Liu and Yeh, *Economy of the Chinese Mainland*, p. 102). 850 million is a high estimate of 1971 population. A lower figure would raise the estimated level and growth of *per capita* income. However, the 1970 figure of 697 million recently published in a Chinese atlas (*New York Times*, 6 August 1972), appears unrealistically low.

54. Simon Kuznets, "Problems in comparing recent growth rates for developed and less developed countries," *Economic Development and Cultural Change*, January 1972, pp. 185–209.

55. Calculated from Tables 12 and A3.

foreign exchange – to enterprises and sectors producing industrial capital goods than were actually needed to meet the targets specified by the national economic plan. Had China avoided this error, agricultural prospects in 1957 might have improved sufficiently to have affected the decision to seek agricultural transformation through organizational means.⁵⁶

In the absence of such a policy, the Great Leap was attempted, leading to a serious economic setback. To assess the magnitude of this decline, however, is not easy. The difficulty lies not with agriculture, in which grain output, which expanded beyond the 1957 level of 185 mmt during 1958 but then fell perhaps as low as 150 mmt in 1960, serves as a yardstick, but with industry in which neither the extent of the 1958–60 boom nor the 1960–2 downswing can be readily determined.

While the sheer physical volume of industrial output increased sharply after 1957, the forced pace of production and addition of thousands of unskilled persons to the work force led to a simultaneous decline in product quality. Output of machine tools, for instance, rose from 28,000 in 1957 to 50,000 in 1958; but since the latter total included 35,000 “simplified” machine tools, actual output of standard equipment may have declined rather than risen.⁵⁷ To apply 1952 or 1957 prices to physical output data heavily weighted with inferior products inevitably exaggerates the pace of industrial advance. But in the absence of new and detailed information concerning the quality composition of various categories of industrial output, it is difficult or impossible to overcome this problem. As a result, it seems quite likely that existing estimates showing peak Great Leap industrial output values of 57–198 per cent. above the 1957 level generally err in the upward direction.⁵⁸

Similarly, the undoubted decline in industrial output after 1960 was accompanied by sharp improvement in quality as substandard enterprises were dissolved and the focus of economic policy shifted away from output maximization. Here again, absence of satisfactory descriptive and statistical materials leads the outside observer to overstate the magnitude of cyclical fluctuation.⁵⁹

To argue that foreign observers have probably exaggerated China’s industrial setback of 1960–2 as well as the preceding upswing, is not to minimize the significance of the economic

56. This question is more fully treated in Rawski, “Machine-building,” ch. V.

57. *Ta-kung pao* (Peking), 27 September 1959; Chen, *Statistics*, p. 187.

58. Various estimates of peak Great Leap industrial output exceed 1957 output by 198 per cent. (C. Y. Cheng, *The Economy of Communist China 1949–1969* (Michigan Papers in Chinese Studies, 1971), p. 15); 66 per cent. (Field, “Industrial production,” p. 47); 90 per cent. (Chao, *Rate and Pattern*, p. 88); and 57 per cent. (for factories, mining and utilities – Liu and Yeh, *Economy of the Chinese Mainland*, p. 66).

59. Cheng, *Economy of Communist China*, p. 15, estimates that industrial output fell by 50 per cent. in 1960–1 and by a further 10 per cent. the following year. Field, “Industrial production,” p. 47, indicates that output reached its low point in 1961, falling about 36 per cent. below the 1960 level.

crisis which China faced in the years after 1959. On the contrary, the possibility of a downward economic spiral was by no means remote. Prompt reversal of a dangerous economic situation underlines the very real abilities of China's economic planners, and provides a hopeful example of the capacity of an untutored but energetic elite to grasp economic fundamentals within a short period of administrative experience.

To appreciate the gravity of China's economic position once Great Leap hopes began to fade, it is only necessary to review the circumstances of the major economic sectors: agricultural production was falling, and rural economic organization interfered with successful operation of either central control or individual incentive; morale and discipline were low, as was the prestige of central and local leaders. Industry had devoted long years to producing commodities now seen to be redundant; factories and workers were equally unprepared to turn out the agricultural capital goods needed to restore economic balance. Agricultural stagnation and the widening Sino-Soviet rift limited the extent to which the foreign sector could contribute to redirecting industrial activity. At the same time, the break with the Soviet Union called for extraordinary effort to develop the petroleum industry and added to the urgency of defence production, especially in the nuclear sector.

As in 1949, successful resolution of the economic problems facing China in 1961 demanded flexible and pragmatic policies. In the countryside, retreat from Great Leap initiatives posed issues which required administrative consolidation rather than organizational or technical advance. Once the centre had recaptured control over cadre objectives at the local level, the task of focusing rural energies on expansion of food output presented few unfamiliar difficulties.⁶⁰ In industry, by contrast, the shift in priority from balanced growth of the capital goods sector – the chief objective of the preceding decade – to meeting requirements arising from weakness in existing economic sectors, chiefly agriculture and petroleum, called for major technical change. This was nowhere more evident than in machine-building.

China's machinery plants were faced with the unforeseen task of providing for vastly expanded petroleum and chemical fertilizer industries. The sudden transition to near self-sufficiency in machinery, forced after 1960 by declining exports and major grain imports, meant that the agricultural producer goods now seen as essential for further economic growth could come only from domestically equipped factories.⁶¹ The same was true for petroleum.

Only one enterprise created during the first Five-Year Plan was intended to specialize in producing machinery for the petroleum and chemical sectors. This was the Lanchow Petroleum and Chemical

60. Perkins, *Market Control*, pp. 90–5, succinctly describes the process of agricultural recovery.

61. Data on grain imports and aggregate trade flows appear in A. H. Usack and R. E. Batsavage, "The international trade of the People's Republic of China," *Economic Assessment*, pp. 348 and 343.

Machinery Plant, built with Soviet aid during the 1950s, which was apparently designed to equip the oil fields of the north-west and the refinery and fertilizer plant at Lanchow.⁶² Despite reported imports of refineries and even a petroleum machinery plant, most of the equipment needed to raise petroleum output to the 1971 level of 25.4 mmt came from domestic sources.⁶³ To equip the new Ta-ch'ing field, for instance, factories in Shanghai seem to have been converted into producers of drilling and refining equipment.⁶⁴

A similar situation prevailed in the fertilizer sector. Although fertilizer and ammonia plants were purchased in Japan and western Europe, their capacity accounts for only a small fraction of the reported output increase.⁶⁵ Boilers, compressors and other equipment, needed to increase fertilizer output during the 1960s, came primarily from domestic machinery factories designed to manufacture other types of equipment.

Although planning for self-sufficiency in defence production may have begun before 1957, the sudden withdrawal of Soviet co-operation and growing international tensions probably posed the same problems for military industries as for the civilian sector.

Chinese publications rarely describe the difficulties encountered in switching old plants to new product lines. We do, however, have an eye-witness account of B. Richman, who visited a small Wuhan plant soon after its conversion to producing diesel engines. Richman observed operations at the plant to be chaotic: management and organization were among the worst encountered in his extended tour of Chinese factories in 1966.⁶⁶ Such direct evidence of the high cost of conversion is corroborated by the experience of other countries. More generally, it seems likely that the decline in output per unit of capital and stagnation of total factor productivity observed in Chinese machine-building between 1957 and 1965 stemmed primarily from the problems of redirecting factory output to meet agricultural requirements.⁶⁷

62. 1967 *Fei-ch'ing nien-pao* (1967 *Yearbook of Chinese Communism*) (Fei-ch'ing yen-chiu tsa-chih she, 1967), p. 852 and *Chūgoku kōgyō kōjō sōran* (*Handbook of China's Industrial Plants*) (2nd ed. Ajia kenkyū-jo, 1970), Vol. II, p. 372.

63. Data on imports of petroleum plants appear in Price, "International trade," *Economic Profile*, Vol. II, p. 603.

64. K. P. Wang, "The mineral resource base of Communist China," *ibid.* Vol. I, pp. 171 and 187.

65. Data on imports of fertilizer plants appear in Price, "International trade," *ibid.* Vol. II, p. 603.

66. B. M. Richman, *A Firsthand Study of Industrial Management in Communist China* (UCLA Graduate School of Business Administration, 1967), pp. 57-8, lists the Wuhan Diesel Engine Plant as among the worst equipped and managed enterprises he encountered in 1966. This seems to be the same plant, which, according to *SCMP* 3626, p. 26 (January 1966), had recently converted its facilities to produce diesel engines.

67. On conversion costs in the Soviet Union, see D. Granick, *Soviet Metal-fabricating and Economic Development* (University of Wisconsin Press, 1967), ch. 2. Rawski, "Machine-building," ch. IV, discusses capital-output ratios and factor productivity.

Despite these costs, the newly evident capacity of machinery plants to provide the equipment needed to support unplanned changes in economic structure shows that Chinese industry has entered a new stage of development since 1957. The successful shift of industrial priorities which lies behind recent expansion of the chemical and petroleum industries indicates a new ability to apply "technical knowledge, skills and facilities for producing machinery to accommodate the changing requirements of productive activity" which Rosenberg identifies as a central characteristic of industrialized, as opposed to backward economies.⁶⁸

This does not, of course, mean that no technical problems remain unsolved. Although domestic producers are now active in all areas of capital goods manufacture, including aerospace, electronics and computers, there are many areas in which China must rely on imports or lag far behind world technological trends. Continued imports of heavy trucks, speciality steel, ocean freighters and chemical, metallurgical and oil refining equipment suggest that domestic producers cannot provide needed equipment of the appropriate specifications and quantity. Significant dependence on small and medium-scale factories in the metallurgy, chemical and cement industries, while often justified in political terms, may reflect continuing inability to manufacture sufficient equipment for larger plants in these sectors. Slow development of the Wuhan and Paot'ou steel complexes, left unfinished by the departure of Soviet technicians in 1960, supports this view: why operate and expand small steel mills in such areas as Ocheng (Hupeh) if it were possible to complete the facilities at the giant Wuhan Steel Company in the same province?⁶⁹

Successful reorientation of economic policy and the consequent economic recovery created a new domestic economic balance and set the stage for a fresh growth spurt which, as shown in Table 12, persisted in spite of the disruption associated with the Cultural Revolution. One factor restricting both the extent and duration of economic disruption was the realization by the left that despite their wish to place "politics in command," repetition of the economic anarchy of 1958 would be intolerable.

Even during early 1967, a period in which Red Guard penetration of factories seems to have reached a peak, a steady flow of directives and exhortations attempted to limit departure from normal economic procedure. "Grasping the revolution and stimulating production" became a leading slogan.⁷⁰ Newspapers extolled such revolutionary virtues

68. N. Rosenberg, "Neglected dimensions in the analysis of economic change," *Bulletin of the Oxford University Institute of Economics and Statistics*, February 1964, p. 71.

69. *SCMP* 3269, p. 17, describes the growth of the Ocheng works. B. M. Richman, *Industrial Society in Communist China* (Random House, 1969), p. 470, mentions unfinished facilities at Wuhan.

70. *Current Background (CB)*, 818, pp. 3, 6.

as “persisting in the eight-hour workday,” “promptly deal[ing] with all letters and telegrams from other countries,” fulfilling production quotas and maintaining strict financial discipline.⁷¹ Central Committee directives listed defence industries, financial institutions and economic planning organs as off-limits to outsiders, prohibited interference with spring planting and proscribed unauthorized use of transport equipment.⁷²

Conclusion

With the Cultural Revolution now history, what can we make of China's economic prospects? Although economic forecasting is particularly hazardous for a nation with as brief an industrial history and so volatile a policy as China's, it now appears quite likely that China stands on the verge of a major forward thrust. The chief cause for optimism is the mounting evidence of quantitative and qualitative transformation in agriculture.

In appraising China's agricultural sector, a most important point is our interpretation of the finding that after growing at an average annual pace of only 1·2 per cent. during 1957–65 and hardly faster during 1952–65, agricultural output increased by 3·4 per cent. per annum during 1965–71. Does the latter rate, which certainly exceeds the rate of population growth, represent only a temporary advance, or does it signify a new trend which is likely to continue? In my opinion, recent agricultural performance is a result of the post-1960 policy of combining adequate individual incentives with massive increases in the supply of agricultural producer goods.

Spectacular growth of manufactured inputs for farming shows no sign of tapering off. Chemical fertilizer output continues to rise, and is supplemented with imports. Estimated annual output of farm machinery and equipment more than tripled between 1957 and 1965.⁷³ Anhwei Province alone now possesses 1·2 million horsepower of drainage and irrigation equipment, over twice the national total for 1957.⁷⁴ Kiangsu added 400,000 hp. of such equipment in 1971, an amount nearly equal to yearly output for the entire nation prior to the Cultural Revolution.⁷⁵ Output of tractors, first manufactured in 1958, had by 1966 reached nearly 20,000 annual units at the leading plant alone; since then, production has spread rapidly to many regions.⁷⁶

71. *Ibid.* pp. 6, 7 and 25; *CB* 852, p. 29.

72. *Ibid.* pp. 91, 92 and 102. 1967 production targets and state plans are mentioned in *CB* 818, pp. 6 and 35 and *CB* 852, p. 107.

73. Appendix, Table A2.

74. BBC W664, 15 March 1972, A4 and Cheng, *Machine-building*, p. 204.

75. Kiangsu data from BBC W654, 5 January 1972, A7. An estimate of 1965 output is given in Rawski, “Machine-building,” pp. 368–72.

76. *Ibid.* p. 357; Cheng, *Machine-building*, pp. 258–9.

The effect upon farm output of additional fertilizer, insecticide, irrigation, mechanical equipment, new seed strains and other improvements depends not only on their quantity, but on their simultaneous and balanced application. Fertilizer without water or new seed strains may reduce rather than increase yield. Determination of the proper balance among soil, seed, fertilizer and water conditions requires time and sustained application of scientific methodology. As the infrastructure of agricultural services expands and rural educational levels rise, we may expect the returns to past and future additions to the supply of modern agricultural inputs to accelerate rather than decline.

Furthermore, the organization of agriculture seems to have achieved a balance between the needs of both private incentive and central control. If maintained, this may permit China to avoid many of the social and political problems which pessimistic observers expect to accompany the "Green Revolution" in India and elsewhere. While the link between personal effort and income currently seems sufficiently close to encourage peasants to raise output, collective management of labour and of income distribution enables the rural population to move into such non-farm occupations as small-scale industrial activity without migration or loss of claim upon foodstuffs.

Although events of the Cultural Revolution revealed that China has not eliminated the problem of excessive urban population growth, her record in this area is certainly outstanding among the large and populous nations of the Third World. Energetic efforts to raise the rural share of such amenities as medicine, education and new housing and to improve the terms of trade between agriculture and the rest of the economy should further alleviate this problem.

In the absence of disruptive organizational change, continuing increases in the supply of physical and human resources should permit agricultural progress to match or exceed the performance of 1965-71.

The case for optimism is much stronger for industry than for agriculture. Industry has shown an ability to expand under both favourable and unfavourable conditions. Growing capacity for prompt response to shifting patterns of final demand represents a new stage in China's development which bodes well for the future.

In contrast to the ignorant and often illiterate personnel who predominated in Chinese industry during the early 1950s, factories and mines are now staffed by a seasoned labour force including many operatives with up to two decades of factory experience. Planners, engineers and managers are increasingly well educated, forced by the political system to acquire practical experience, and trained in problem-solving by the difficult tasks of the past 20 years.

Despite these strengths, industry is not without its problems. In many areas, the technological base remains weak, and the ranks of thoroughly trained personnel thin. If my optimistic prognosis for agriculture proves correct, these deficiencies can increasingly be offset by imports of sophisticated commodities and perhaps even services. Judicious development

of local industry offers another alternative to which the Chinese have already devoted considerable effort.

There are also difficulties embedded in the institutions of Chinese central planning.⁷⁷ These may be broadly described as departmentalism. Ministries, bureaux, factories, mines, workshops and other economic units place fulfilment of their own plan targets ahead of the common good. Anticipating possible supply problems, for example, factories maintain secret hoards of materials, particularly those in short supply, which can be bartered (illegally) in time of need. As a result, shortages are exacerbated or even created by hoarding and by deliberate exaggeration of requirements. Resistance to innovation, which arises from its potential conflict with current performance, is another common aspect of departmentalism.

Although insertion of military cadres or civilian leftists into key managerial roles may be undertaken in part to curb departmentalism, past experience justifies a pessimistic view of the likely outcome. Fulfilment of plans without deviation from standard operating procedure is possible only when targets are easily met. With ambitious goals and a taut balance between ends and means, managers often find it possible to fulfil their tasks only by abandoning strict adherence to the laws and regulations governing economic activity.

Departmentalism is a serious problem which undoubtedly imposes high costs upon the Chinese economy. However, industry has grown rapidly despite such costs in the past, and will continue to do so in the future. With steady improvement in the quality and quantity of fixed capital and trained labour, China's industrial sector should be able to surpass the performance record of the past 15 years.

The conclusion of this survey is that the potential growth rate of the Chinese economy in the immediate future is high. Agriculture appears near to a significant breakthrough to new levels of output and yield. If this occurs, China's foreign trade position will be excellent. Industry seems destined to extend its impressive record. The supply of savings, which has presented no obstacle in the past, should expand rapidly, both because the growth of sales to local industry and agriculture raises the profits of state industry, the main source of government revenue, and because the prospect of regional industrialization seems to encourage voluntary savings at the local level.

Only the possibility of political disruption qualifies this optimistic assessment of China's short-term economic prospects. If the existing potential for growth is to be realized, China's leaders must be willing to assign a high priority to economic expansion. Current policies clearly point in this direction. Reduced prices for fertilizer, petroleum and farm machinery, price increases for subsidiary crops and support for individual incentives on the farm all indicate a relaxed and confident

77. These problems are discussed in D. H. Perkins, "Industrial planning and management," in Eckstein *et al.* (eds), *Economic Trends in Communist China*, pp. 597-635 and in Rawski, "Machine-building," ch. VI and VII.

agricultural policy.⁷⁸ In industry, continuing debate over the merits of investment in mining, metallurgy or electronics betokens a lively interest in rapid growth.⁷⁹ As long as these attitudes prevail, we should expect a continuation of the growth and structural change which have occurred in China's economy over the past 15 years.

Appendix

Table A1

Output of Grain and Cotton by Province and Region 1949-71 (thousand metric tons)

	Output of Foodgrains			Output of Cotton		
	1949	1957	1970-71	1949	1957	1970-71
Yellow River drainage						
Chinghai	25,180 ^(e)	41,865 ^(e)	44,820 ^(a)	247.7 ^(e)	571.4 ^(e)	587.0 ^(a)
Honan	290 ^(b)	640 ^(b)	—	—	—	—
Inner Mongolia	6,500	12,250	14,950 ⁽ⁱ⁾	83.4	180	—
Kansu	1,995	2,810	8,379 ^(k)	—	—	—
Ningshia	2,300	5,150	—	1.3 ^(e)	8.4	—
Shansi	—	—	—	—	—	—
Shantung	2,595	3,565	5,800 ^(f)	20.2	98.5	—
Shensi	7,900	12,950	—	98.8 ^(d)	181	—
	3,600	4,500	—	44	103.5	—
Middle and Lower Yangtze						
Anhui	30,855 ^(e)	60,095 ^(e)	101,822 ^(g)	115.8 ^(e)	558.5 ^(e)	787.4 ^(g)
Chekiang	4,550	11,500	13,500 ^(f)	12.2	49	—
Hunan	4,200	7,800	—	6.8	44.2	—
Hupei	6,380	11,200	—	7	22	—
Kiangsi	5,200	10,695	—	47.5 ^(h)	227	—
Kiangsu	3,875	6,830	—	1.6	25.8	—
	6,650	11,800	—	40.7	190.5	—
Other provinces						
Hopei	4,550	9,750	13,300 ^(f)			
Kwangtung	8,000	12,200	16,000 ⁽ⁱ⁾			

(a) 1970 output of grain and cotton calculated from the 1949 totals and from the statement in *PR* 42 (1971), p. 9, that 1970 output of grain and cotton in this region (included provinces are those listed in the source) was 79 per cent. and 137 per cent. respectively above the 1949 level.

(b) Chen, *Statistics*, p. 348.

(c) 1949 output estimated from the 1952 figure by assuming that Kansu cotton production increased in proportion to the national total during 1949-52. National output from *ibid.* p. 408.

78. Indications of current farm policies appear in "Pre-Cultural Revolution Policies to the Fore," *Current Scene*, Vol. X, No. 8 (1972), pp. 21-3; *PR* 1 (1972), p. 17; 39 (1972), p. 19; 40 (1972), p. 21; *SCMP* 5012, p. 180, and 5040, p. 134; and T. Durdin, "China links pay to productivity," *New York Times*, 7 May 1972.

79. Elements of this debate can be seen in *CQ* 48 (1971), pp. 797-9 and in *SCMP* 4866, pp. 194-5, and 4895, pp. 78-9.

(d) 1949 output estimated from the 1950 figure by assuming that Shantung cotton production increased in proportion to the national total during 1949–50.

(e) Sum of data for provinces in the region.

(f) Durdin, "China discloses farming statistics," *New York Times*, 2 April, 1972. These figures refer to 1971 output.

(g) 1971 output of grain and cotton calculated from the 1949 totals and from the statement in *PR* 9 (1972), pp. 14–15, that 1971 output of grain and cotton in this region (included provinces are those listed in the source) was 230 per cent. and 580 per cent. respectively above the 1949 level.

(h) Chen, *Statistics*, p. 356.

(i) R. Terrill, "The 800,000,000: report from China," *Atlantic*, November 1971, p. 111, reported that grain output (presumably for 1970) was just double the 1949 level.

(j) Calculated from 1949 output and from the statement in *Peking Review* 40 (1972) p. 25, that 1971 grain output was 2.3 times that of the early post-liberation period.

(k) Calculated from 1949 output and the statement in *ibid.* 18 (1972), p. 8, that 1971 grain output was 3.2 times greater than that of the early post-liberation period.

– indicates that no data could be located.

Source: Unless otherwise noted, data for 1949–57 are from *Provincial Agricultural Statistics for Communist China*.

Table A2

Estimated output for a 10-product sample of machinery in 1957 and 1965 (million 1957 yuan)

	1957	1965
Cotton spindles	176	638
Heavy machinery	99	613
Diesel engines	24	210
Tractors	0	312
Trucks	180	648
Sewing machines	51	346
Bicycles	115	191
Radios	32	173
Agricultural machinery and equipment	430	1540
Machine tools	286	569
Total	1393	5240
Index	100	375

Source: Rawski, "Machine-building," p. 55.

Note: The estimate of 1965 machinery output shown in Table 4 (above, p. 10) is derived in the following way: gross output value for a sample of 10 products could be estimated from information provided in Chinese sources. The result, shown in Table A2, indicated output growth of 275 per cent. between 1957 and 1965. The sample items accounted for approximately one-fourth of 1957 machinery output. To estimate total machinery production for 1965, it is necessary to consider output trends for the sectors of machine-building excluded from the sample of 10 products. Since it is improbable that the Chinese would have released detailed information only for products which tended to expand relatively slowly, I assume that my sample index provides an upper limit to 1965 machinery output. The lower limit to

my estimate of 1965 output is based on the finding that output in the sectors of machine-building excluded from the sample appears to have risen by at least 100 per cent. between 1957 and 1965. If the excluded sectors, with a weight of 0.75, are assigned a 1965 index of 200 and averaged with the sample index of 375, with a weight of 0.25, the lower boundary of my estimate for 1965 machinery output becomes 244 (1957=100), as shown in table 4.

Figures for machinery output for 1962-4 and for 1966 were derived from the 1965 values and from fragmentary information on annual output changes for various products which was used to formulate estimates of annual percentage changes in machinery production during 1962-6.

Table A3

**Basic data for estimating net domestic product with Liu's model
(mmt and billion 1952 yuan)**

	1964	1965	1970	1971
Physical output (mmt)				
Grain	200 ^(a)	200	240	246
Cotton	1.7 ^(b)	2.1 ^(b)	2.45 ^(b)	2.45 ^(b)
Ingot steel	—	11-13	17.8	21
Values				
Cotton output ^(c)	2.887	3.566	4.160	4.160
Grain output ^(c)	24.600	24.600	29.520	30.258
Sum of cotton and grain	27.487	28.166	33.680	34.418
Net value added by agriculture: A	39.911 ^(d)	40.897 ^(d)	48.903 ^(d)	49.975 ^(d)
Liu's variable A' - ₁	—	15.187 ^(e)	—	18.920 ^(e)
Gross value of ingot steel ^(f) output	—	6.600-7.800	10.700	12.600
Liu's variable M'	—	3.400-3.800 ^(g)	5.100 ^(g)	5.900 ^(g)

(a) Estimate based on Chinese official statements given in Perkins, "Economic growth in China," p. 36.

(b) 1964 and 1965 output reportedly exceeded the 1957 and 1958 levels of 1.64 and 2.1 mmt respectively (see text); above data are based on these reports. 1970 and 1971 data from Table 2 and the text.

(c) Table 3.

(d) Estimated by multiplying the sum of cotton and grain output value by 1.452 as proposed by Liu, "Quantitative trends," p. 179.

(e) "Value of cotton production and one half of the value of crop [*i.e.*, grain] production during the preceding year" (*ibid.* p. 156).

(f) Output times price of 600 yuan/ton (*ibid.* p. 180).

(g) "[Gross] Value of coal and iron ore produced by modern mines." (*ibid.* p. 156). Following Liu (*ibid.* p. 181), I estimate gross value of iron ore output at 0.1215 times gross value of ingot steel output. Rather than using questionable Great Leap Forward data, I estimate gross output value for coal from the following regression equation for 1952-7, where S_t indicates ingot steel output in thousands of metric tons:

$$\text{Gross output value for coal} = 576 + 0.180S_t \quad (R^2 = 0.92)$$

(excluding native mines)

data for the regression come from Liu and Yeh, *Economy of the Chinese Mainland*, p. 573 and from Chen, *Statistics*, pp. 186-7.

Notes to Table 9 (p. 16)

Shanghai: 1957 industrial output was 12·800 billion 1952 *yuan* (*Jen-min jih-pao*, 16 February, 1958), of which 57 per cent. or 7·296 billion came from light industry (*Wen-hui pao* (Shanghai), 6 June, 1958). 1956 output was 11·960 billion *yuan*, 3·7 times the 1949 figure, which becomes 3·232 billion *yuan* (*Ta-kung pao* (Peking), 8 August, 1957). Industrial output rose at an average annual pace of 13 per cent. during 1949–71 (BBC, W661, 23 February, 1972, A14), and by 60 per cent. between 1965 and 1970 (SCMP 4828, p. 17). These data allow us to calculate 1965 industrial output at 27·286 billion 1952 *yuan*. The share of light industry, which declined to 50 per cent. in 1963 (SCMP 3133, pp. 18–19) and was below 50 per cent. by 1971 (BBC, W663, A6), is assumed to have been 50 per cent. in 1965.

Shantung: 1949 industrial output of 945 million *yuan* from U.S. Central Intelligence Agency, *Weekly Report on Communist China* No. 15, p. 28. 1969 output was 987 per cent. above that of 1949 (BBC, W542, 22 October, 1969, A7) or 10·272 billion *yuan*. 1970 output was above the 1969 level (SCMP 4833, p. 31) and double the 1965 figure (SCMP 4880, p. 24). We assume 1970 output to have been 10·300 billion and derive 1965 output accordingly.

Kwangtung: 1949 industrial output was 470 million *yuan* (*Nan-fang jih-pao*, 10 August, 1957). 1965 output was over 20 per cent. above 1964 (*Wen-hui pao* (Hong Kong), 21 December, 1965), which in turn was eight times the 1949 figure (*Nan-fang jih-pao*, 28 December, 1964). I use the 20 per cent. figure to calculate the 1949–65 increase.

Notes to Table 12 (p. 21)

V_o is calculated from data in table A3 and Liu's equation 7:

$$(7) V_o = 8.65 + 1.10 A$$

V_m is calculated from data in table A3 and Liu's equation (17):

$$(17) V_m = -37.87 + 0.81 A + 1.68 A'_{-1} + 13.06 M'$$

G, value added by government, is assumed by Liu to have grown in proportion to population; I adopt this assumption, but apply a rate of 2·0 per cent. per annum (rather than Liu's 1·5 per cent.) to Liu's 1957 estimate of this item.

Net domestic product is the sum of V_o , V_m and G.