ECONOMIC GROWTH AND INTEGRATION IN PREWAR CHINA

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CONTENTS

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by

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I. INTRODUCTION

Economists specializing in the study of contemporary China have reached a broad consensus about the dimensions of Chinese economic growth since the Communist takeover in 1949. Despite remaining data gaps and continuing controversy over China's economic prospects, we have now a growing body of increasingly comprehensive and widely accepted estimates showing the level and growth of aggregate and per capita output, the structure of production and employment, the rate and pattern of investment and other important economic variables. There is also wide agreement about the factors responsible for promoting as well as restraining the ongoing development of China's postwar economy.[1]

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Consensus is much narrower for the prewar period, largely because there is little quantitative information on which to base an analysis of trends in the economy. Carefully developed time series are limited to foreign trade and investment statistics, John K. Chang's estimates of industrial output growth, several studies of the textile industry, various indexes of price change, and regional income estimates for Manchuria during benchmark between 1924 and 1941.[2] There is also a mass of quantitative material published during the late 1920s and 1930s that remains largely untapped.[3] Detailed national income accounts exist only for 1933; more tentative estimates are available for 1914-18, 1931-36 and 1946.[4]

With this fragile quantitative backdrop, reliable generalizations about the development of China's prewar economy must remain few in number and narrow in scope. We know that rapid economic change occurred in Manchuria, where per capita output may have risen by one-third between 1924 and 1941; in the Lower Yangtze area, where growth centered on the port, the factories and the money markets of Shanghai; and in the immediate environs of a small number of lesser cities.[5] But regional growth, however dynamic, disappears in China's huge economic and demographic aggregates. Dwight Perkins and K. C. Yeh have found that national output expanded at about one percent annually during the prewar decades, or no faster than the rate of population growth.[6]

How should we interpret this combination of regional progress and national stagnation? One view sees the economic history of prewar China as the first phase of a long-term process of economic growth. In comparing 1936 with 1911, K. C. Yeh explains that[7]

> There had been discernible growth in total output. More significantly, distinct changes in the internal economic structure had taken place, indicating marked shifts from low to high productivity sectors, spread of modern technology in the manufacturing and transportation

sectors, and increasing urbanization. Clearly economic modernization had begun, albeit slowly and restricted to a few sectors and regions.

The view that "economic modernization had begun" in China prior to the Pacific War, with the implied corollary that post-war growth under Communist leadership is an extension of earlier trends rather than a new departure, is not universally shared. Some writers stress the geographic limits of new developments, arguing that the growth of the modern sector in China's urban treaty ports had little impact on the traditional economy. R. H. Tawney's elegant phrase summarizes the views of Rhoads Murphey and Ramon Myers as well: "A modern fringe was stitched along the hem of the ancient garment. . . . the economic frontier between the West and China was moved inland," with cities like Shanghai becoming more and more reminiscent of European commercial centers.[8]

Despite mounting evidence of vigorous development in some regions and sectors, the standard Chinese interpretation continues to present the prewar decades as a period of economic stagnation.[9] The stagnation thesis also draws support from Western scholars. Victor Lippit, for example, refers to factors that "tended to minimize . . . actual saving or investment" in prewar China, and adds that "what investment did take place tended to be of an 'unproductive' kind--e.g. investment in luxury housing or in inventories, in the latter of which the hoarding of food was of outstanding importance."[10] This position, with its implicit denial of structural change, is echoed by Joseph Esherick, who ridicules the suggestion that prewar China offered an environment conducive to private investment.[11] Economic stagnation or decline also appears as a theme in the writings of political historians seeking to explain the roots of Communist victory in China's protracted civil war.

Can we agree with K. C. Yeh that China, like Japan, experienced what Rosovsky has called the "transition to modern economic growth" before the modern sector attained a significant share of national output, employment or fixed capital?[12] Or should we view regional growth poles in Manchuria and the Lower Yangtze area as small, isolated and externally-oriented enclaves that failed to influence the traditional sectors of China's economy? The answers to these questions depend on detailed information about the process of economic modernization. It is essential to study modern-sector developments over time. If Japan's transition to modern economic growth was completed by 1885, when the size of the modern sector was still minute, we cannot dismiss Yeh's assertions merely by pointing to the small share of modern activity in China's economy during the 1930's. Can we detect a cumulative growth process in China's nascent modern sector that represents a gathering of economic forces reminiscent of events in late Tokugawa and early Meiji Japan? Can we determine the extent of mutual interaction between the modern and traditional segments of China's prewar economy?

Existing studies provide neither a comprehensive measure of modern sector growth nor a systematic overview of linkages between the traditional and modern sectors. It is therefore apparent that ignorance is partly or perhaps largely responsible for the diversity of views on these issues. The objective of the present paper is to reduce this diversity by introducing a new measure of modern-sector expansion.

The indicator developed in the following pages is a time series of modern-oriented fixed investment during the years 1903-1936 for China proper, for the northeast or Manchurian region, and for the combined national aggregate. Attention is focused on investment rather than production simply

because of data limitations. Following a methodology introduced in Ingvar Svennilson's study of interwar investment in Europe, data on domestic consumption of cement, iron and steel, and machinery are used to construct annual measures of the level of fixed investment in modern-oriented activities, which are defined in terms of their use of these three investment goods. Data required to develop the investment series are, with minor exceptions, readily available and of reasonable quality. As a result, the new time series of annual outlays on modern-oriented fixed investment offers a long-term and comprehensive measure of the growth of the modern sector of China's economy between 1903 and 1936.

The implications of these estimates are both noteworthy and surprising. The new series reveals the existence of an investment spurt in which modern-oriented fixed investment expanded at rates comparable to those experienced in prewar Japan and in the People's Republic of China. The timing of investment growth differs sharply from the macroeconomic patterns hypothesized by earlier studies. World War I, often described as a "golden age" for Chinese industry, emerges as a period of low investment.[13] Following a sharp acceleration after World War I, modern-oriented fixed investment continued to rise during the 1920s and 1930s, providing a strong contrast with the conventional view of these decades as periods of economic stagnation or decline stemming from political disunity, foreign oppression and the world depression.[14]

The following sections of the paper describe the methodology and the results of our effort to construct measures of modern-oriented fixed investment at the national and regional level. We then consider possible sources of investment growth. Profits from cotton textile manufacture and the volume of

foreign trade are introduced as possible determinants of the level of modern-oriented fixed investment. Readers impatient with the minutiae of quantitative economics may turn immediately to the final sections of the paper dealing with the links between investment performance and domestic economic activity in the areas of surplus accumulation, domestic commerce and banking.

II MEASUREMENT

MEASURING MODERN-ORIENTED FIXED INVESTMENT: METHODOLOGY

The methodology used to estimate trends in fixed capital formation for prewar China is adapted from Ingvar Svennilson's study of the interwar European economy. Desirous of making international investment comparisons involving accounting systems that were both incomplete and methodologically diverse, Svennilson derived new investment estimates by taking the geometric mean of separate quantity indexes measuring apparent consumption of cement and steel. The resulting measures fit closely with more elaborate estimates for the United States and Germany.[15]

The present study applies Svennilson's insights about the close association between aggregate investment and physical consumption of investment goods to China's prewar economy. Our index of modern-oriented gross domestic fixed capital formation (GDFCF) is the geometric mean of separate indexes showing apparent consumption of cement, iron and steel products and machinery. Machinery is included as a separate component because of the predominance of imports in apparent consumption and the relative ease of measuring the value of additions to the stock of machinery rather than following Svennilson's

method of estimating the steel content of machinery supplies.[16] As with Svennilson's European data, available measures of the value of Chinese fixed investment, in this case for the years 1952-1957, correspond reasonably well to the patterns shown by the less complex index derived from apparent consumption of a small number of investment goods (Appendix D, Table D-4).

Our annual series for the value of modern-oriented GDFCF in terms of 1933 yuan is constructed from data compiled in the appendixes to this paper. Time series estimates of apparent consumption of cement, iron and steel, and machinery are derived in Appendixes A, B and C. In each case, apparent consumption at the national level is calculated as the sum of domestic production and net imports (equation 1). Separate regional estimates of apparent consumption for China proper and for Manchuria are developed from data on regional production, regional net imports and, to the extent possible, interregional commodity shipments (equations 2a and 2b). Inventory changes and time lags between commodity production (or importation) and disposition are ignored. The estimates for cement and for iron and steel are in physical units. The machinery series is presented in terms of 1933 yuan.

With the exception of domestic production of machinery, for which the estimates for years prior to 1931 are no more than conjectural, the data base for these calculations is good. The foreign trade data, which relate mainly to imports, are taken from the published records of the foreign-administered Chinese Maritime Customs. Given the long prior experience of the Maritime Customs in compiling trade data, the concentration of trade in investment goods in the largest ports with the best-developed recording systems, the homogeneous nature of two of the commodity categories used in this study (tons of cement or of iron and steel products), and the absence of incentives for

smuggling investment goods either to or from China, there can be little doubt that the Maritime Customs figures provide reasonably accurate data on commodity trade flows.[17] Manufacture of cement and of iron and steel was limited to a small number of plants whose records have been studied in considerable detail. Again, it is difficult to doubt the broad accuracy of available data. The weak links in our estimates of apparent consumption of investment goods lie in the area of domestic machinery manufacture and interregional trade flows. But since machinery supplies are dominated by imports throughout our period of analysis and trade in investment goods between China and Manchuria was minuscule, we may conclude that data problems do not seriously hamper our application of Svennilson's methodology to the problem of estimating a time series of modern-oriented fixed investment in prewar China.[18]

To calculate an annual index of fixed investment, each series of apparent commodity consumption is converted to index-number form with 1933 as the base year.[19] Our national (equation 3) or regional (equations 4a and 4b) index of modern-oriented gross domestic fixed capital formation, with 1933=100, is then derived by calculating the geometric mean of the three indexes of commodity consumption for each year.

(1) $A_{int} = Q_{int} + M_{int} - E_{int} = A_{ict} + A_{imt}$

(2a) $A_{ict} = Q_{ict} + M_{ict} - E_{ict} + H_{imct} - H_{icmt}$

(2b) $A_{imt} = Q_{imt} + M_{imt} - E_{imt} - H_{imct} + H_{icmt}$

(3) $J_{nt} = (I_{1nt} \ I_{2nt} \ I_{3nt})^{1/3}$

(4a) $J_{ct} = (I_{1ct} \ I_{2ct} \ I_{3ct})^{1/3}$

(4b) $J_{mt} = (I_{1mt} \ I_{2mt} \ I_{3mt})^{1/3}$

where i = 1,2,3, represent the three commodities

n,c, and m indicate geographic entities:

national aggregate,

China proper and

Manchuria

t is a time subscript

A, Q, E and M represent apparent consumption, domestic production, exports to and imports from foreign countries

H represents domestic interregional trade flows from China to Manchuria (H_{cm}) or from Manchuria to China (H_{mc})

I_{ijt} is an index of apparent consumption of commodity i in region j during year t (1933=100).

$$I_{ijt} = 100 \, A_{ijt} / A_{ij\,1933}$$

and J_{jt} is an index of modern-oriented gross domestic fixed capital formation in region j during year t (1933=100)

It is also desirable to attach monetary values to index numbers of fixed investment in order to obtain time series estimates of the size as well as the growth rate of modern-oriented GDFCF at the regional and national level. A procedure for monetizing the investment indexes is described in Appendix D. We begin by using the methodology described above to obtain esti-

mates of modern-oriented gross domestic fixed capital formation, J_{nt}, for the years 1952-57. If we assume that all fixed investment during 1952-57 was "modern-oriented," K. C. Yeh's estimates of aggregate fixed capital formation for 1952-57 in terms of 1933 prices may be used to compute a monetary value for modern-oriented fixed investment in 1933. Once this is done, monetary estimates of modern-oriented fixed investment at the national and regional level are easily derived for the entire period 1903-36.

What are the properties of the resulting time series estimates of national and regional fixed investment in modern-oriented activities? In principle, all modern-oriented investment efforts are included, with "modern" defined in terms of the presence of non-traditional investment goods, namely cement, iron and steel and western-style machinery. Projects that absorb these commodities are included in our estimates no matter what sector of the economy they inhabit and without regard to the nationality of the entrepreneurs involved. Thus our estimates include the full range of modern activities--mining, manufacturing, utilities, railways, and others. Investment in semi-traditional activities such as civilian and military construction, partially mechanized handicrafts, water control projects using concrete structures or farm purchases of diesel pumps are included to the extent that they absorb the key investment goods used in this study. Our estimates are therefore designed to produce quantitative indicators of the level and growth of modern-oriented investment at the national or regional level by all economic agents, private or public, Chinese or foreign, and in all sectors of the economy. Given the reasonably close correspondence between the present index of modern-oriented gross fixed investment J_{nt} and K. C. Yeh's estimate of aggregate fixed investment for 1952-57--with the exception of 1956, an unusual year of "high tide" in investment activity, J_{nt} differs from an index

of Yeh's estimates by between 3 and 11 percent--we may conclude that the time series results shown in Table 1 provide a reasonable estimate of the annual level and growth of modern-oriented GDFCF in China between 1903 and 1936.[20]

It must be stressed, however, that our measure does not include all investment activity. Investment in the traditional sectors or in partially modern activities is excluded unless the key commodities of cement, iron and steel or machinery are utilized. There is also the problem of leakage of investment goods into civilian or military consumption. If motor vehicles, bicycles or other investment goods were actually used as consumer durables, our results will overstate the level of capital formation. Although arms and ammunition are not included in machinery imports, diversion of bicycles, trucks, airplanes or other machinery to military uses would lead to a similar overstatement of investment. In addition, our measures incorporate rough and ready adjustments required to bridge gaps in available data, particularly in the estimation of domestic machinery production before 1931. Conversion of the investment index into monetary terms depends on estimates by Liu and Yeh of price shifts between 1933 and 1952; in the case of machinery prices, the empirical foundation of these estimates is weak.

A final problem concerns the identification of modern-oriented fixed investment with the modern sector of China's economy, which is normally taken to include the output of factories, mines, utilities, construction, modern transport and communications and a portion of the services sector.[21] Comparison between modern-oriented fixed investment and modern sector output, as in Tables 4 and 5 below, ignores divergences between the two concepts that arise from the presence of farm tractors, mechanized handicraft equipment and other instances of modern-oriented investment in traditional sectors of the

economy or from the continuation of traditional types of investment activity in mining or other areas of the modern sector.

Although none of these qualifications appears quantitatively significant, their existence reminds us that our estimates must be taken as approximations rather than as precise measures of actual investment levels. Even so, the broad agreement between J_{nt} and Yeh's estimates for 1952-57, the general consistency among the commodity indexes, the quality of the underlying trade statistics for all three investment goods and of the domestic output estimates for cement and for iron and steel, and the successful outcome of Svennilson's European application of his methodology all suggest that the estimates summarized in Table 1 provide a substantially accurate representation of historic trends in the level and growth of modern-oriented GDFCF in China's prewar economy.

MEASURING MODERN-ORIENTED FIXED INVESTMENT: RESULTS

New estimates of modern-oriented gross domestic fixed capital formation for China and its two geographic components, China proper and Manchuria, are compiled in Table 1 and reproduced in semi-logarithmic graphical form in Graph 1.[22] These data show that modern-oriented GDFCF experienced a strong upward trend in China proper, in Manchuria and in the nation as a whole throughout the period of analysis. In addition, inspection of Graph 1 reveals a sharp upward break both in the level and, for China proper, in the growth rate of modern-oriented fixed investment beginning immediately after the conclusion of World War I.

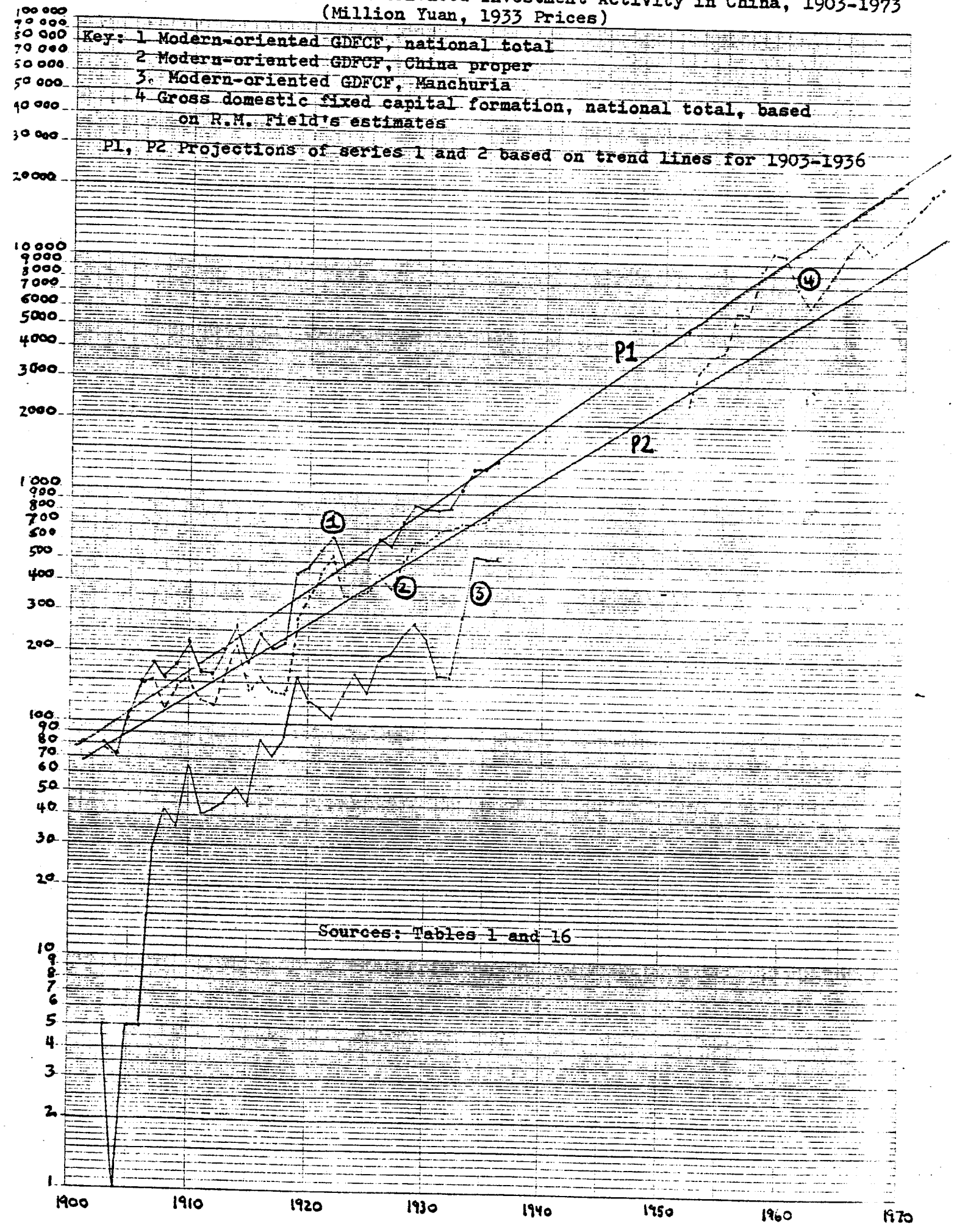
Table 1

National and Regional Estimates of Modern-Oriented GDFCF, 1903-1936

Year	National Index of Apparent Consumption (1933 = 100)				Modern-Oriented GDFCF (Million 1933 Yuan)		
	Cement	Iron-Steel	Machinery	J_{nt}	National	China Proper	Manchuria
1903	1.9	19.5	12.8	7.8	81	76	5
1904	1.4	19.0	12.8	7.0	72	71	1
1905	3.0	21.7	18.3	10.6	110	105	5
1906	4.9	23.6	26.6	14.5	150	145	5
1907	8.6	21.9	27.9	17.4	180	152	28
1908	7.6	23.4	18.6	14.9	154	112	42
1909	9.8	34.1	15.2	17.2	178	142	36
1910	14.1	35.5	20.0	21.6	223	158	65
1911	11.2	25.0	14.9	16.9	166	125	41
1912	13.6	17.9	16.2	15.8	163	120	43
1913	12.2	33.3	19.7	20.0	207	161	46
1914	17.3	34.4	28.9	25.8	267	214	53
1915	16.2	23.0	14.8	17.7	183	139	44
1916	17.4	23.2	32.3	23.5	243	158	85
1917	18.5	18.0	25.0	20.3	210	137	73
1918	19.8	17.5	29.2	21.6	223	134	89
1919	26.7	53.1	55.3	42.8	442	282	160
1920	27.7	52.3	67.4	46.0	476	352	124
1921	34.9	41.9	108.9	54.2	560	442	118
1922	44.5	46.3	114.7	61.8	639	532	107
1923	44.1	32.8	71.6	47.0	486	353	133
1924	39.4	46.8	70.1	50.6	523	358	165
1925	39.9	49.1	62.8	49.7	514	376	138
1926	54.9	59.9	70.2	61.3	634	444	190
1927	52.2	50.8	70.1	57.1	590	388	202
1928	61.1	80.3	76.4	72.1	746	505	241
1929	77.0	89.7	93.3	86.4	893	618	275
1930	72.7	80.6	94.1	82.0	848	613	235
1931	74.9	80.8	89.4	81.5	843	681	162
1932	83.6	84.8	82.7	83.7	865	704	161
1933	100.0	100.0	100.0	100.0	1034	741	293
1934	105.9	137.4	127.5	122.9	1271	741	530
1935	102.0	148.4	127.6	124.5	1287	761	526
1936	133.1	140.1	132.6	135.2	1398	873	525

Source: Appendixes A, B, C and D. J_{nt} is the index of the national total of modern-oriented GDFCF as defined in equation (3).

Graph 1: Estimates of Modern-Oriented Investment Activity in China, 1903-1973
(Million Yuan, 1933 Prices)



Sources: Tables 1 and 16

The upward trend of modern-oriented fixed investment is a strong one. If annual fluctuations are smoothed by constructing five-year moving averages, as in Table 2, we find that the resulting series of smoothed national investment totals declines only twice between 1907 and 1934; a similarly smoothed series of private non-agricultural GDFCF in Japan shows eight annual declines during the same years.[23] The comparison emphasizes the strong momentum of China's modern-sector investment drive during the prewar decades.

The increased volume of investment and, for China proper, the accelerated growth of investment following World War I are equally clear-cut. From Table 1, we can calculate that the average annual level of fixed investment for the entire nation and for each region during 1919-1936 is more than 150% above the maximum level achieved during 1903-1918. And in each case, the lowest annual investment figure for the period 1919-1936 is at least 20% above the pre-1919 peak. The underlying estimates of national and regional apparent consumption of cement, iron and steel, and machinery tell the same story. Despite considerable annual fluctuations, the post-1918 commodity totals remain uniformly above the maximum levels recorded during 1903-1918 with only a few exceptions.[24]

The summary measures of investment growth shown in Table 3 confirm both the rapid growth of modern-oriented GDFCF and its post-World War I acceleration. For China proper, the growth rate of modern-oriented fixed investment rose by about one-half following World War I. Although the high prewar growth rate of Manchurian investment, spurred during 1903-1918 by the tiny initial base and active development of several major projects in the railway and metallurgical sectors, was not maintained during 1919-36, the upward break in investment levels was so large that the growth rate of

Table 2

Five-Year Moving Average of National and Regional Modern-Oriented GDFCF, 1905-1934
(Million 1933 Yuan)

Year	National	China Proper	Manchuria
1905	119	110	9
1906	133	117	16
1907	154	131	23
1908	177	142	35
1909	180	138*	42
1910	177*	131*	45
1911	187	141	46
1912	205	156	50
1913	197*	152*	45*
1914	213	158	54
1915	222	162	60
1916	225	156*	69
1917	260	170	90
1918	319	213	106
1919	382	269	113
1920	468	348	120
1921	521	392	128
1922	537	407	129
1923	544	412	132
1924	559	413	147
1925	549*	384*	166
1926	601	414	187
1927	675	466	209
1928	742	514	229
1929	784	561	223*
1930	839	624	215*
1931	897	671	225
1932	972	696	276
1933	1060	726	334
1934	1171	764	407

Source: Calculated from Table 1.

*indicates instances of annual decline in five-year moving average.

Table 3

Average Growth Rate of Modern-Oriented GDFCF, 1903-1936

Region	1903-1918	1919-1936	1903-1936
National total	6.4%	6.5%	8.1%
China proper	3.6%	5.7%	7.3%
Manchuria	22.7%	8.0%	12.7%

Calculated from linear regressions of the form $\ln Y_t = a + bt$ where the Y variables represents national or regional estimates of modern-oriented GDFCF from the three right-hand columns of Table 1 and t represents time.

modern-oriented GDFCF over the entire period 1903-1936 is substantially larger both for the nation and for China proper than during either of the pre- or post-war sub-periods.

With modern-oriented GDFCF rising much faster than gross domestic product, which, according to K. C. Yeh's estimate, increased at an annual rate of 1.1 percent between 1914-18 and 1931-36, modern-sector activity undoubtedly contributed to an increase in the rate of capital formation in prewar China. The small initial size of modern-oriented fixed investment, however, limited the terminal investment proportion to a modest fraction of total output. This is evident from Table 4, which compares capital formation proportions for 1914-18 and 1931-36. Comparing annual averages for 1914-18 and for 1931-36, we find (Line 3a) that the share of modern-oriented GDFCF in gross domestic product (GDP) quadrupled, rising from 0.9% of GDP during 1914-18 to 3.8% of GDP in 1931-36. The annual figures also show a sharp rise in the output share of modern-oriented fixed investment during the 1930s, with the ratio increasing from less than 3% to above 4% of gross domestic product:

Year	Modern-oriented GDFCF (Billion 1933 Yuan) (1)	GDP (2)	Ratio (1)/(2)
1931	0.84	28.57	0.029
1932	0.86	29.47	0.029
1933	1.03	29.46	0.035
1934	1.27	26.90	0.047
1935	1.29	29.09	0.044
1936	1.40	30.94	0.045

Sources: (1) Table 1

(2) Yeh, "China's National Income, 1931-36," p. 97.

Table 4 also draws on previous estimates of aggregate fixed capital formation for the entire nation and for Manchuria to present an integrated set of fixed investment data for 1931-36 broken down both sectorally (modern and traditional) and regionally (China proper and Manchuria). Table 5 provides separate compilations for 1934 and 1936, years for which detailed product estimates are available for the nation and for Manchuria. By combining the results of separate studies by K. C. Yeh, Kang Chao and the present author, these tables overlook elements of inconsistency resulting from different methodologies.[25] There is also the problem, mentioned earlier, of associating modern-oriented fixed investment with modern sector output even though modern-oriented investment was not directed exclusively toward modern-sector activities. Despite these difficulties, the degree of consistency between various authors and concepts seems sufficient to warrant combining the results of several studies to present a broad overview of investment activity in relation to aggregate, sectoral and regional production.

During 1931-36, we see that capital formation proportions are much higher in Manchuria than in China proper. In Manchuria, modern-oriented fixed investment, much of it financed from Japan and undertaken by the South Manchurian Railway and other semi-official Japanese organizations, amounted to over 13% of regional GDP during 1931-36 and reached a peak of more than 16% of GDP in 1936. Modern-oriented fixed investment in China proper, almost entirely contained within the private sector, averaged just under 3% of regional GDP during 1931-36 and reached a 1936 peak of 4.3% of total output.

In considering the sectoral breakdowns in Table 4 and 5, it is important to note that the estimates of modern-sector output include only factories, mining, utilities, construction, and modern transport and communica-

Table 4

Sectoral and Regional Breakdown of Output and Fixed Investment, 1914/18 and 1931/36

(Billion 1933 Yuan)

Category	National	China Proper	Manchuria
A. Annual Averages for 1914/18			
1. Gross domestic product (GDP)	24.26[a]	...	...
1a. Modern sector: GDP_m	0.85[a]	...	...
1b. Traditional sector: GDP_t	23.41[b]	...	...
2. Gross domestic fixed capital formation (GDFCF)	...	...	...
2a. Modern-oriented: $GDFCF_m$	0.23[c]	0.16[c]	0.07[c]
2b. Traditional: $GDFCF_t$	...	...	...
3. Fixed investment ratio: GDFCF/GDP	...	...	...
3a. Modern investment only: $GDFCF_m/GDP$	0.9%	...	...
3b. Trad. investment only: $GDFCF_t/GDP$	...	...	...
4. Sectoral accumulation ratio			
4a. Modern: $GDFCF_m/GDP_m$	25.9%	...	...
4b. Traditional: $GDFCF_t/GDP_t$	...	...	...
B. Annual Averages for 1931/36			
1. Gross domestic product (GDP)	29.13[a]	26.30[b]	2.83[d]
1a. Modern sector: GDP_m	2.18[a]	1.78[b]	0.40[e]
1b. Traditional sector: GDP_t	26.95[b]	24.52[b]	2.43[b]
2. Gross domestic fixed capital formation (GDFCF)	1.44[f]	1.12[b]	0.32[d]
2a. Modern-oriented: $GDFCF_m$	1.12[c]	0.75[c]	0.37[c]
2b. Traditional: $GDFCF_t$	0.32[b]	0.37[b]	-0.05[b]
3. Fixed investment ratio: GDFCF/GDP	4.9%	4.3%	11.3%
3a. Modern investment only: $GDFCF_m/GDP$	3.8%	2.9%	13.1%
3b. Trad. investment only: $GDFCF_t/GDP$	1.1%	1.4%	-1.8%
4. Sectoral accumulation ratio			
4a. Modern: $GDFCF_m/GDP_m$	51.4%	42.1%	92.5%
4b. Traditional: $GDFCF_t/GDP_t$	1.2%	1.5%	-2.0%

... indicates data that are not available

Notes for Table 4:

[a]Yeh, "China's National Income, 1931-36," pp. 104, 107. The modern sector includes factories, mining, utilities, construction and modern transport.

[b]Calculated as a residual from other entries in the Table.

[c]Table 1.

[d]GDP figures are based on the arithmetic average of totals for 1929, 1934 and 1936 given in Chao, "Sources of Economic Growth," p. 258; figures for fixed investment are based on the annual average of data for 1931/36 in ibid., 261. Both sets of data are presented in terms of 1934 Manchukuo yuan. These figures are converted to 1933 prices using the index of Manchurian prices given in Kungtu C. Sun, The Economic Development of Manchuria (Cambridge, 1969), p. 95, and tranformed into Chinese yuan using the 1934 exchange rate given in Liu and Yeh, Economy of the Chinese Mainland, p. 504.

[e]Average output for 1929, 1934 and 1936 from mining, factories, construction and modern transportation and communication given in Chao, "Sources of Economic Growth," p. 258, and converted to 1933 Chinese yuan as described in note d above.

[f]Kung-chia Yeh, "Capital Formation in Mainland China: 1931-36 and 1952-57," (Ph.D. thesis, Columbia University, 1964), p. 76a.

Table 5

Sectoral and Regional Breakdown of Output and Fixed Investment for 1934 and 1936
(Billion 1933 Yuan)

	Category	National	China Proper	Manchuria
A.	Data for 1934			
1.	Gross domestic product (GDP)	26.90[a]	24.38[b]	2.52[c]
1a.	Modern sector: GDP_m	2.16[a]	1.76[b]	0.40[c]
1b.	Traditional sector: GDP_t	24.74[b]	22.62[b]	2.12[b]
2.	Gross domestic fixed capital formation (GDFCF)	1.46[d]	1.02[b]	0.44[c]
2a.	Modern-oriented: $GDFCF_m$	1.27[e]	0.74[e]	0.53[e]
2b.	Traditional: $GDFCF_t$	0.19[b]	0.28[b]	-0.09[b]
3.	Fixed investment ratio: GDFCF/GDP	5.4%	4.2%	17.5%
3a.	Modern investment only: $GDFCF_m/GDP$	4.7%	3.0%	21.0%
3b.	Trad. investment only: $GDFCF_t/GDP$	0.7%	1.1%	-3.6%
4.	Sectoral accumulation ratio			
4a.	Modern: $GDFCF_m/GDP_m$	58.8%	42.0%	132.5%
4b.	Traditional: $GDFCF_t/GDP_t$	0.8%	1.2%	-4.2%
B.	Data for 1936			
1.	Gross domestic product (GDP)	30.94[a]	27.85[b]	3.09[c]
1a.	Modern sector: GDP_m	2.63[a]	1.60[b]	1.03[c]
1b.	Traditional sector: GDP_t	28.31[b]	26.25[b]	2.06[b]
2.	Gross domestic fixed capital formation (GDFCF)	1.69[d]	1.19[b]	0.50[c]
2a.	Modern-oriented: $GDFCF_m$	1.40[e]	0.87[e]	0.52[e]
2b.	Traditional: $GDFCF_t$	0.29[b]	0.32[b]	-0.02[b]
3.	Fixed investment ratio: GDFCF/GDP	5.5%	4.3%	16.2%
3a.	Modern investment only: $GDFCF_m/GDP$	4.5%	3.1%	16.8%
3b.	Trad. investment only: $GDFCF_t/GDP$	0.9%	1.1%	-0.6%
4.	Sectoral accumulation ratio			
4a.	Modern: $GDFCF_m/GDP_m$	53.2%	54.4%	50.5%
4b.	Traditional: $GDFCF_t/GDP_t$	1.0%	1.2%	-1.0%

Notes for Table 5:

[a]Yeh, "China's National Income, 1931-36," p. 97. The modern sector includes factories, mining, utilities, construction and modern transportation and communication.

[b]Calculated as a residual from other entries in the table.

[c]Annual data from Chao, "Sources of Economic Growth," pp. 258, 261. The modern sector includes factories, mining, construction and modern transportation and communication. Figures are converted from 1934 Manchukuo yuan into 1933 Chinese yuan as described in note d to Table 4.

[d]Yeh, "Capital Formation in Mainland China," p. 76a.

[e]Table 1.

tions. All service industries are assigned to the traditional sector. Although this makes modern-sector output (Line 1a) inappropriately small and the accumulation ratio for the modern sector (Line 4a) inappropriately large, it is not easy to decide which services should be included in the modern sector.

In their detailed study of China's national income in 1933, T. C. Liu and K. C. Yeh included trading stores, restaurants and modern financial institutions in the modern sector along with the industries mentioned above. The inclusion of trading stores, restaurants and modern financial institutions raises the modern sector's share of net domestic product in 1933 from 5.8% to 12.1%.[26] If a similar proportional increase is made in the modern-sector contribution to average GDP for 1931-36 shown in Line 1a, Panel B of Table 4, the modern sector's accumulation ratios (Line 4a) decline from 51.5 to 24.4% for the national total, from 42.1 to 20.2% for China proper, and from 92.5 to 44.0% for Manchuria. These calculations show that plausible expansion of the modern sector to include a service component can sharply reduce the ratio of modern-oriented fixed investment to modern sector output by increasing the denominator of this fraction. Even so, the revised accumulation ratios for the modern sector are high enough to suggest that the financing of modern-oriented fixed investment in both China proper and Manchuria may have required substantial injections of savings from foreigners or from domestic sources outside the modern sector. As we shall see, the drying up of foreign sources of investible funds during the depression years of the 1930s points to the traditional sector as a significant source of finance for modern-oriented fixed investment in China proper during the 1930s.

When we turn to the implications of Table 4 for the non-modern sectors of China's economy, there is immediate evidence of inconsistency among the estimates of national and regional output, aggregate fixed investment and modern-oriented fixed investment. The difficulty arises when fixed investment in traditional sectors, which is obtained as a residual by subtracting modern-oriented fixed investment from the national or Manchurian totals estimated by K. C. Yeh and Kang Chao, is compared with traditional sector output. At the national level, the ratio of gross fixed investment to gross domestic product in the traditional sectors barely exceeds one percent; for Manchuria, modern-oriented fixed investment exceeds Chao's estimate of overall fixed investment, leaving no room for investment in the traditional sector. Table 5 shows the same unsatisfactory results for 1934 and 1936: at the national level, gross fixed investment in the traditional sector is less than one percent of sectoral output, while in Manchuria, the data imply a decline in the fixed capital stock of the traditional sector.

Resolution of the inconsistency between these results and the behavior of traditional-sector output--rising during the 1920s and stable during the 1930s--calls for detailed investigation of the possibility that gross domestic capital formation and its traditional-sector component were considerably larger during the 1930s than the levels shown in Lines 2 and 2b of Tables 4 and 5. This issue is beyond the scope of the present study.

Regardless of the precise level of overall fixed investment in prewar China, we must ask whether the estimates relating to modern-oriented fixed investment presented in Tables 1-3 justify the assertion that prewar China experienced an investment spurt comparable to those identified with the early stages of industrialization in other countries. One way of approaching this

issue is to compare Chinese and Japanese investment performance during the prewar decades. Although there can be no doubt that aggregate economic performance in China failed to keep pace with that of Japan, investment performance in prewar China compares quite favorably with Japanese achievements.

Capital formation proportions in prewar China were not high, but they may have been comparable with Japanese figures for the 1880-95 period which Rosovsky identifies as Japan's transition to the era of modern economic growth.[27] Since the existence of an investment spurt is more closely linked to the growth rate than to the level of investment, it is perhaps more appropriate to compare rates of increase of fixed investment in China and Japan during the prewar decades. This is done in Table 6, which leads to the surprising conclusion that modern-oriented fixed investment in China grew at a substantially higher rate than comparable Japanese aggregates, particularly after the end of World War I.

Table 6 compares the growth rates of modern-oriented fixed investment in China and its two major regions with the growth of several Japanese investment aggregates. The results form a fairly consistent pattern: during the early portion of the period up to and including World War I, investment growth tends to be more rapid in Japan than in China. After 1918, however, the pattern is reversed, with Chinese investment outgrowing the Japanese aggregates by a large margin. If the entire period 1903-36 is examined, the Chinese figures retain a substantial advantage. The Manchurian data form an exception to this pattern, with the rate of investment growth falling sharply after World War I. This is not surprising since modern-oriented fixed investment in Manchuria was dominated by Japanese projects, and could indeed be viewed as an extension of Japanese domestic economic activity.

Table 6

Average Annual Growth Rate of Fixed Investment, China and Japan, 1903-1936

	1903-1918	1919-1936	1903-1936
A. China: Modern-Oriented GDFCF			
1. National total	6.4%	6.5%	8.1%
2. China Proper	3.6%	5.7%	7.3%
3. Manchuria	22.7%	8.0%	12.7%
B. Japan: GDFCF			
4. Aggregate	5.8	1.8	4.4
5. Private Sector	5.0	2.5	3.7
6. Private Sector: Non-agriculture	9.9[a]	2.0	4.6[a]
7. Mining, manufacturing, construction and facilitating industries	8.8[a]	2.6	5.0[a]

Sources: Calculated from linear regressions of the form $\ln Y_t = a + bt$ where the Y variables are listed in the rows of the table and t represents time. The values of the Y variables for Lines 1-3 are from Table 1. For lines 4-5, see Kazushi Ohkawa and Miyohei Shinohara eds., Patterns of Japanese Economic Development (New Haven, 1979), pp. 355-56 and 359-61. For lines 6 and 7, see Ohkawa and Rosovsky, Japanese Economic Growth, p. 294.

[a]Series begins in 1905.

These comparisons may overstate the relative investment performance of China. This is because the Chinese data are restricted to modern-oriented fixed investment whereas aggregate fixed investment on the Japanese side includes investment outlays associated with agriculture and other slow-growing traditional industries. This bias in favor of the Chinese side may be reduced by focusing attention on the Japanese aggregates for private nonagricultural investment (Line 6) and for fixed investment in the M+ sector (mining, manufacturing, construction and facilitating industries--utilities, transport and communiction; Line 7 in Table 6). These aggregates contain some slow-growing elements like residential construction and handicraft investments that would fall outside the scope of modern-oriented fixed investment on the Chinese side, but the share of these activities in the total is small. To further sharpen the comparison, it is perhaps appropriate to focus on investment activity in China proper on the grounds that Manchurian investment behavior is linked as much to Japanese as to Chinese economic trends.

Restricting the comparison to Japanese performance in increasing private, nonagricultural fixed investment or fixed investment in the M+ sector and to China's achievements in raising modern-oriented fixed investment in China proper eliminates much of the bias enhancing the relative growth of fixed investment in China. The results of this more balanced comparison, however, are essentially the same as before. Again we find that investment grows more rapidly in Japan before 1919. Thereafter the situation is reversed, and Chinese investment grows much faster than Japanese investment. Over the whole period, the Chinese aggregate outperforms the Japanese series by a considerable margin.

This result parallels the finding of John K. Chang that between 1912 and 1936, modern industrial output (factories, mines and utilities) in China, growing at about 9 pecent per annum, outperformed Japanese industry, which expanded at an annual rate of about 7%.[28] Again, the comparison is biased toward China because of the inclusion of slow-growing handicraft enterprises in the Japanese data. Again, however, the comparison shows impressive evidence of the dynamism of the modern sector in China's prewar economy.

Further insight into the dimensions of China's prewar investment performance emerges from Table 7, which compares the absolute magnitude of Chinese modern-oriented fixed investment with several Japanese investment aggregates which have been expressed in terms of Chinese yuan (1933 prices). Once again, we see the superior growth performance of the Chinese series. If attention is limited to the relatively unbiased comparison between modern-oriented fixed investment in China proper and the Japanese series for private non-agricultural investment and for fixed investment in the M+ sector, we see that the Chinese series starts at a level equivalent to about two-thirds of the Japanese aggregates during 1905-09, lags behind the more rapid growth on the Japanese side for the next decade, and then advances steadily until the two series cross briefly in the mid-1930s, with modern-oriented fixed investment in China proper surpassing Japanese private non-agricultural fixed investment and fixed investment in the M+ sector for a few years until accelerated military outlays propel the Japanese figures ahead once again.

Here we find that another comparison with Japan points to a surprisingly strong investment performance in prewar China, with modern-oriented fixed investment catching and even overtaking comparable Japanese aggregates in terms of the absolute level of investment activity. While this indicates a

Table 7

Quinquennial Averages of Fixed Investment, China and Japan, 1905-1934
(Million Chinese Yuan, 1933 Prices)

	1905/1909	1910/1914	1915/1919	1920/1924	1925/1929	1930/1934	Ratio: 1930/34 to 1905/09
A. China							
1. Modern-Oriented GDFCF: National	154	205	260	537	675	972	6.3
2. Modern-Oriented GDFCF: China Proper only	131	156	170	407	466	696	5.3
B. Japan[a]							
3. Aggregate GDFCF	886	1212	1588	2175	2250	2368	2.7
4. GDFCF: Public Sector	305	433	342	890	982	1135	3.7
5. GDFCF: Private Sector	582	781	1246	1288	1276	1258	2.2
6. GDFCF: Private Non-agricultural	192	294	594	564	526	585	3.0
7. GDFCF: Mining, Manufacturing, Construction, Facilitating Industry	206	299	567	602	596	685	3.3
8. Ratio: Line 2 / Line 6	.68	.53	.29	.72	.88	1.19	
9. Ratio: Line 2 / Line 7	.64	.52	.30	.68	.78	1.02	

Sources: for Lines 1 and 2: Table 1; for Lines 3-5, Ohkawa and Shinohara eds., Patterns of Japanese Economic Development, pp.355-61; for Lines 6 and 7: Ohkawa and Rosovsky, Japanese Economic Growth, pp. 294-95.

Note: Components of the Japanese estimates may not check with the total due to rounding error or to minor elements of double counting noted in the source for Lines 3-5. The figures reported in lines 6 and 7 are earlier estimates and may not agree with the aggregates in Lines 3-5.

[a]The procedure for converting Japanese aggregates in 1934-36 prices to Chinese yuan at 1933 prices is as follows. The Japanese deflator for GDFCF in 1933 is 0.961 (1934-36 = 100; see Ōkawa, Takamatsu and Yamamoto, Kokumin shotoku, p. 232). In 1933, on Chinese yuan was, on average, equivalent to 1.01077 Japanese yen (Hsiao, China's Foreign Trade Statistics, p. 192). One yen of Japanese fixed investment in 1934-36 prices is therefore equivalent to 0.961/1.01077 = 0.951 Chinese yuan at 1933 prices.

substantial level of investment in China's economy, we must remember that with a population roughly eight times that of Japan, Chinese investment per capita remained substantially below Japanese levels throughout the period of analysis.

This serves to emphasize that modern-oriented investment in prewar China was a regional rather than a national phenomenon. This is shown by data compiled in Table 8. Industrial activity clustered around a small number of urban centers: the Shanghai area in southern Kiangsu province which was the center of Chinese private industry and also of private foreign investment; the Fushun-Mukden-Anshan-Dairen area of eastern Liaoning province in Manchuria, where industrial activity was dominated by large-scale Japanese enterprise; and lesser industrial nodes surrounding the cities of Tientsin and T'angshan in the north, Wuhan in the central Yangtze basin and Canton in the south.

The data in Table 8 reveal an extreme concentration of industrial activity in the Shanghai area. Sales of industrial output per person in the great metropolis were over fifteen times the average for Manchuria and over one hundred times the average for other regions of China. Data for Chinese factories located in China proper illustrate the huge gap between the scale of industrial activity in Shanghai and elsewhere. Modern activity in finance and other tertiary sectors was, if anything, still more highly concentrated in Shanghai, which served as China's financial hub as well as the leading center of manufacturing.[29]

If the development of China's modern sector prior to World War II was a regional rather than a national phenomenon, its results will be clearly shown by regional rather than national data pertaining to economic growth and structural shifts. There are few detailed studies of regional economic

Table 8

Regional and National Industrial Indicators for 1933

		Amount	Percent
I.	Gross Value of Factory Output (Million yuan)		
A.	All Factories		
1.	National Total	2646[a]	100.0
2.	Shanghai	1060[b]	40.1
3.	Manchuria	377[a]	14.2
4.	Other	1209	45.7
B.	Chinese-owned Factories in China Proper[c]		
1.	Total	1771	100.0
2.	Shanghai	728	41.1
3.	Canton	102	5.8
4.	Wusih (Kiangsu)	77	4.3
5.	Tientsin	74	4.2
6.	Wuhan (Hankow, Wuch'ang, Hanyang)	73	4.1
7.	Chinan (Shantung)	33	1.9
8.	Ch'ingtao (Shantung)	27	1.5
9.	Nanking	23	1.3
10.	Wuchin (Kiangsu)	22	1.2
11.	Others contributing less than 1% of the total	612	34.6
II.	Population (Millions)		
1.	National Total	503[d]	100.0
2.	Shanghai	3[e]	0.6
3.	Manchuria	38[f]	7.6
4.	Other	462	91.8
III.	Gross Value of Factory Output (All Factories) per capita		
1.	National Total	5	
2.	Shanghai	353	
3.	Manchuria	10	
4.	Other	3	
IV.	Shanghai Figures and Share of National Totals[g]		
1.	Cotton Spindles (million)	2.5	52.2
2.	Flour Output (million bags)	31.8	42.5
3.	Polished Rice Output (1000 shih)	179.6	12.8
4.	Rubber Output (tons)	300	69.1
5.	Silk Cloth (1000 bolts)	1182	77.9
6.	Castings (1000 pounds)	7906	77.1
7.	Glass (1000 yuan)	3513	59.0

Notes for Table 8:

[a]Liu and Yeh, Economy of the Chinese Mainland, pp. 427-28.

[b]Sum of output value from Chinese-owned firms estimated in Liu Ta-chün, Chung-kuo kung-yeh tiao-ch'a pao-kao (Report on a Survey of China's Industries; Shanghai, 1937), 3:11 and output value from foreign-owned firms, which is assumed to be two-thirds of the total for China Proper shown in Liu and Yeh, Economy of the Chinese Mainland, pp. 427-28. The actual share of foreign firms' output produced in Shanghai may have been higher than this: Onoe, Chūgoku no sangyō ritchi, p. 291, indicates that 83% of foreign-owned cotton spindles were located in Shanghai during the early 1930s.

[c]These data are based on the 1933 survey of Chinese-owned factories in China proper. The national total is a revision of the original result produced by Liu and Yeh, Economy of the Chinese Mainland, pp. 427-28. The figures for other areas are the original results from Liu Ta-chün, Chung-kuo kung-yeh 3: 2-328.

[d]Liu and Yeh, Economy of the Chinese Mainland, p. 178.

[e]Average of 1932 and 1934 figures given in Onoe, Chūgoku no sangyō ritchi, p. 269.

[f]Chao, "Sources of Economic Growth," p. 259

[g]Onoe, Chūgoku no sangyō ritchi, p. 293.

developments in prewar China, but the limited evidence that is available leaves little doubt that modern economic growth had begun in some regions of China during the prewar period.

The most clear cut and also the best documented instance of modern economic growth in prewar China occurred in the three northeastern provinces known as Manchuria. Kang Chao's estimates of Manchurian gross domestic product for benchmark years during 1924-41, reproduced in Table 9, show that total and per capita output rose at annual rates of 3.7 and 1.3 percent during these years, resulting in a 33% rise in aggregate output per person for the region's 40 million inhabitants. Structural change of the variety associated with industrializing economies occurred at the same time: between 1924 and 1941 the share of agriculture, fishing and forestry in Manchuria's regional product declined from nearly half to only one-third, while the contribution of the secondary and tertiary sectors to total output rose markedly. Within the M+ sector, mining, factory industry, construction and modern transport and communication grew rapidly, increasing their share of regional product from 10.8% in 1924 to 23.2% in 1941. The estimated share of gross fixed investment in total output also increased from 11 - 11.5% in 1924-26 to 19 - 24% in 1936-41.[30]

Although we have no comparably detailed study of the Lower Yangtze region where modernization developed around the port, the factories and the money markets of Shanghai, there is abundant evidence of similarly rapid changes in the level and structure of regional economic output. The outcome of this growth process emerges from a study by Robert Tomski, who reports the following sectoral output structure for 1952, largely reflecting prewar patterns of investment and production:[31]

Table 9

Gross Domestic Product and Components for Manchuria, 1924-1941

(Million 1934 Yuan)

Sector	1924	1926	1929	1934	1936	1939	1941	Average annual[a] Growth, 1924-41
A+	1143.6 (47.8)	1306.6 (48.6)	1482.7 (48.6)	950.9 (35.8)	1394.3 (42.7)	1382.3 (33.3)	1574.2 (33.5)	1.1%
M+	507.9 (21.2)	547.9 (20.4)	606.7 (19.9)	692.2 (26.0)	764.0 (23.4)	1181.9 (28.5)	1363.9 (29.0)	6.0
S	741.1 (31.0)	833.6 (31.0)	960.5 (31.5)	1015.9 (38.2)	1104.8 (33.8)	1584.9 (38.2)	1766.0 (37.5)	5.1
GDP	2392.6 (100.0)	2688.1 (100.0)	3049.9 (100.0)	2659.0 (100.0)	3263.1 (100.0)	4149.1 (100.0)	4704.1 (100.0)	3.7
Population (million)	31.0	32.5	35.8	38.7	40.0	43.0	45.8	2.4
GDP per capita (yuan)	77.2	82.7	85.2	68.7	81.6	96.5	102.7	1.3

Source: Chao, "Sources of Economic Growth," pp. 258-59. The A+ sector includes agriculture, subsidary production of agriculture, fishing and lumber. The M+ sector consists of mining, factory industry, construction and modern transportation and communication. All other activities are classified as part of the S sector. Figrues in parentheses give sectoral shares in overall GDP.

[a]Trend rates calculated from log-linear regressions.

	Population (Millions)	Share of Output Originating in Agriculture	Industry	Services
National total	569.3	52%	16%	32%
Kiangsu province (includes Shanghai)	46.1	27	38	24
Liaoning province	21.5	31	36	33
National total excluding Kiangsu and Liaoning	501.7	57	11	32

Here we see that Kiangsu (including Shanghai) and Liaoning, the most industrial province of the northeast, with combined populations of approximately 56 million persons in 1933 and 68 million in 1952, share the familiar pattern of output structure (exaggerated here by the high relative weights attached by 1952 prices to industrial commodities) associated with economies that have embarked on a path of industrialization.[32] These figures show that economic growth in Kiangsu and Liaoning advanced well ahead of nationwide trends during the decades preceding 1952, with the result that the share of agricultural output in the two advanced provinces was only about half and the share of industrial output more than thre times the corresponding shares in total output for the remainder of the nation. Presentation of similar data for regions defined by economic rather than political boundaries would heighten the contrast between the structure of output in areas that benefited substantially from modern-oriented investments and those that did not.[33]

The long-run significance of regional growth spurts built on modern-oriented fixed investment in the prewar decades is clearly recognizable in the case of Shanghai. Although post-1949 investment policy in the People's Republic of China has systematically discriminated against the great metropolis, extremely low incremental capital-output ratios have limited the decline in Shanghai's share of national industrial output. Despite low investment, recent data show that per capita GNP in Shanghai is more than seven times the

national average and that the per capita value of Shanghai's commodity output (in terms of gross or sales value) is 8.5 times the national average. The superiority of Shanghai's enterprises over better equipped rivals in other regions in raising productivity, adopting new technology, lowering costs, creating new products, overcoming technical difficulties, and penetrating foreign markets is a staple theme of Chinese press reports that reflects the continuing impact of prewar development on China's present-day economy.[34]

Our examination of the estimates of modern-oriented gross domestic fixed capital formation in China during the period 1903-36 provides a new overview of developments in the modern sector of China's economy during the prewar decades. Our findings are considerably different from those of economic and political historians who, in the absence of long-term quantitative indicators, have portrayed China's modern sector in terms of weakness, stagnation and decline. Growth of modern-oriented fixed investment in prewar China was both rapid and sustained. In China proper, political and economic instability failed to prevent an acceleration of modern-oriented fixed investment during the 1920s and 1930s. The significance of China's investment performance may be judged by comparisons showing that modern-oriented fixed investment in prewar China grew faster and more consistently than comparable Japanese aggregates. Although the industrialization process stimulated by the growth of modern-oriented fixed investment was regional rather than national in scope, important structural transformations occurred in regional economies whose population matched that of Japan and comprised a significant fraction of China's enormous demographic mass. The long-run impact of these changes on the rate and pattern of China's economic growth is clearly visible today, particularly in the strong economic and technological leadership of Shanghai.

III. PROBLEMS OF INTERPRETATION

INTRODUCTION

The previous section shows that China's economy experienced a significant and sustained burst of investment activity in the small but growing modern sector duing the first four decades of the twentieth century. These results raise questions concerning the forces affecting the level and growth of modern-oriented fixed investment as well as the links between the modern sector and China's traditional economy. Consideration of these questions leads inevitably to two complex issues: the impact of foreign trade and investment on China's prewar economy and the growth or collapse of socioeconomic integration between the modernizing port cities and the less dynamic hinterlands, or more generally between city and countryside in prewar China.

Given the well-known history of imperialist encroachment upon China's polity and the resulting privileges awarded to foreign traders and investors under the unequal treaty system, it is not surprising to find an extensive literature supporting the view that China's industrial development was stifled by uncontrolled competition from foreign imports, which paid only small tariffs, and from manufactures produced in foreign plants established in the Chinese treaty ports. This position is a standard feature of most Chinese accounts. It also appears in Western works, most recently in a book by Frances Moulder which explains China's failure to match Japan's economic progress in terms of China's "incorporation" into the world economy "as a dependent satellite" of "the Western capitalist nations" prior to World War I.[35] Historians who view the modern period in terms of "China's response to the

West" implicitly assume that foreign contacts exercised a decisive influence over Chinese affairs, although this influence need not be for the worse.

Economists who have studied the impact of foreign influence tend to conclude that China's economy benefited from foreign participation, but that the positive impact of foreign trade and investment was too small to overcome other obstacles to development, most notably governmental weakness and China's vast size.[36]

Discussion of socioeconomic integration and disintegration is more muted and lacks the sharp disagreements surrounding the topic of foreign participation. Extreme views do exist: Sheridan speaks of "an urban elite . . . who had little contact with life in the countryside," while Rhoads Murphey describes the treaty ports as suffering economic as well as "political and cultural isolation from the rest of China."[37] At the same time, the growth of modern transport and the resulting shrinkage of economic distance, the expansion of urban processing industries based on cotton, wheat, tobacco and other farm products, and the gradual development of modern communication technologies, including advertising and propaganda methods as well as the telegraph and telephone, represent formidable changes in the direction of integration.

What can the present study contribute to the analysis of these issues? Our finding that modern-oriented investment grew in a rapid and sustained fashion into a large annual flow adds importance to the task of determining the sources and linkages of modern-sector activity. At the same time, the availability of quantitative investment data may open new avenues of inquiry into these issues.

We begin by using regression analysis to identify economic variables that are correlated with, and may therefore be considered as possible causal influences on modern-oriented fixed investment. We first test the performance of profits, long seen by economists as influencing investment behavior, as determinants of modern-oriented fixed investment. The statistical results improve if the volume of foreign trade, another measurable quantity, is included as a second determinant of investment behavior. Still better results are obtained by discarding profit and using foreign trade volume alone as a predictor of investment growth.

What is the meaning of statistical results indicating that increased foreign trade is strongly associated with current and future increases in modern-oriented investment flows? These results are precisely opposite to the expectations of the foreign dominance school which postulates a negative relation between foreign activity and domestic economic growth. But can we conclude that rising foreign trade promoted higher domestic investment?

There is no justification in economic theory for expecting investment flows in a large nation to be determined by its small foreign trade sector. We may suspect, therefore, that the close statistical correlation between foreign trade volume and modern-oriented fixed investment masks links between these variables and a common determining element that is excluded from the statistical analysis. Our hypothesis is that statistical association between modern-oriented investment and foreign trade volume arises not because one determines the other, but because both are decisively influenced by a third variable--the level of domestic economic activity.

This approach emphasizes the impact of investments in modern forms of transport, communication and financial institutions on the traditional as well as the modern sectors of China's economy. By lowering the costs of producing and delivering traditional products to central markets, these investments stimulate domestic as well as international commerce. As the banking system expands through the complementary development of modern and traditional financial agents, funds available for modern investments are swelled by a partial transfer of incremental surplus created in the growing traditional sector of the economy.

These changes lead to a cumulative and mutually supportive expansion of investment, production, trade and financial flows radiating outward from regional growth centers in Manchuria, in the Shanghai area and, to a lesser extent, in other major cities. The modern sector of China's prewar economy may be viewed not as a few isolated clusters of innovation, but as a small and dynamic element drawing successively larger segments of the traditional economy into its expanding orbit.

The following sections pursue these issues in detail, beginning with the statistical analysis of investment determinants and moving on to a preliminary investigation of possible links between the modern and traditional sectors in three areas: surplus accumulation; domestic commerce and banking.

DETERMINANTS OF MODERN-ORIENTED FIXED INVESTMENT

In discussing the sources of growth, it is important to distinguish between developments in Manchuria and in China proper. In Manchuria, Japanese interests controlled the bulk of modern-sector assets. The South Manchurian Railway and other agencies, financed in part by the Japanese government and responsive to Japanese policy objectives, embarked upon a variety of large-scale projects centered on the mineral resources of south-eastern Liaoning province. These included the coal and oil-shale mines at Fushun, the iron mines and smelting installation at Anshan and Penhsi, the engineering complex at Shenyang (Mukden) and Talien (Dairen) and the railway and port facilities that linked these enterprises to one another and to the Japanese home islands.[38] Chinese participation in the modern sector included numerous small-scale private ventures concentrated in the processing of soybeans and other agricultural products and a handful of public enterprises such as the Chinese Eastern Railway and the arsenal established by Chang Tso-lin at Shenyang (Mukden).[39] The dominance of Japanese-controlled enterprises in Manchuria's modern sector can be seen from the large share of Japanese firms and of the Japanese-controlled mining, engineering and metallurgy industries in modern-sector output.[40]

Under these circumstances, we should expect that the pattern and timing of modern-oriented fixed investment in Manchuria responded primarily to decisions taken by the leaders of semi-public Japanese organizations prior to 1932 and by the Japanese rulers of the newly created colonial state of Manchoukuo thereafter, and that market forces exercised relatively little influence over investment behavior in the modern sector. Events following the Japanese annexation of Manchuria illustrate this outcome: implementation of a

five-year plan for the development of Manchoukuo in 1932, in which leading industries were reserved for Japanese enterprises, led to the sharp increase in investment recorded in Table 1.

In China proper, by contrast, both the decision to invest and the financing of investment projects rested almost exclusively with the private sector. The weakness of succesive Chinese governments--the waning Ch'ing empire that expired in 1911, the parade of militarist governments that followed the overthrow of the Ch'ing, and the Nanking government of 1927-37--meant that revenue remained low while expenditure aimed at preserving order and security rather than encouraging economic expansion.

The Nanking government of 1927-37, which was certainly more committed to economic growth than its predecessors, illustrates the inability of the state to participate effectively in capital formation. Despite vigorous efforts to increase revenues through both tax collection and borrowing, central government expenditures never reached 4% of gross domestic product.[41] If the share of investment outlay in central government expenditures is generously taken to be 5%, the share of central government investment in gross domestic product may have reached a peak of 0.2% by 1935 or 1936.[42] Although government investments in highways, telephone networks and other social overhead projects undoubtedly enlarged business opportunities for the private sector, the overall impact of public investment amounting to hardly more than one-fifteenth of the total for China proper alone (Table 1) must have been modest indeed.[43] With most revenues earmarked for military outlays, debt service and administration, the Nanking government, like its predecessors, lacked funds to implement plans for stimulating the economy.

Domestic capital markets in prewar China were both unstable and thin. Government bonds dominated the market for securities. Organized exchanges for commercial and industrial shares appeared only in the late 1920s, and trading was restricted to a small list of well-known textile, financial, real estate and utility firms, many dominated by expatriate management.

Investment in modern activities could also draw support from indirect financing provided by foreign and Chinese institutions in the modern banking sector and by Chinese ch'ien-chuang (native banks), all of which made loans to industrial and other modern-sector enterprises. Although research by Terry Sicular has shown that Chinese banks alone provided substantial loans to industrial firms, it is clear that intermediaries concentrated on the finance of current production and commerce rather than investment and that available bank credit went mainly to leading firms in cotton textiles, flour milling and other well-developed sectors of industry.[44]

The poverty of the state and the limited contribution of organized capital markets leads to the hypothesis that modern-sector investment, particularly in China proper, may have drawn its financial resources mainly from retained earnings. What statistical evidence exists to support this view?

Unfortunately, we have no measure of modern-sector profit for any time period. We can, however, construct crude time series estimates of annual profit flows for cotton textile manufacturing during 1913-36. Cotton textiles were the largest single block of modern-sector activity, accounting for 26% of value added by factories and for 10% of value added by the modern sector of China's economy in 1933.[45] Three alternative estimates of annual profits (in terms of 1933 prices) in the factory sector of China's cotton textile industry during 1913-36 are developed in Appendix E.

If modern-oriented fixed investment is financed from retained earnings, can we find a positive association between profit and investment in the textile industry? To investigate this issue, we use Kang Chao's time series of year-end stocks of spindles and looms in the factory sector of the cotton textile industry to construct a series of annual net investment estimates for this industry. If we assume, based on Ueno's Japanese data for 1941 and for the 1950s, that one loom is equivalent to 15 spindles,[46] then annual investment in the factory textile sector in year t in terms of thousands of spindle-equivalents may be calculated as follows:

$$(5) \quad INVTEX_t = [S_t - S_{t-1} + 15\ (L_t - L_{t-1})] \times 10^{-3}$$

where S_t = year-end number of spindles in year t

L_t = year-end number of looms in year t

If the resulting series of textile investment is regressed against estimated textile profits (in constant prices), the resulting equations show poor fit and at best, only a weak positive association between lagged textile profit and current textile investment:

$$(6a) \quad INVTEX_t = 158.34 + 0.52\ PROFA_{t-1} \qquad R^2 = 0.01$$
$$(207.86) \quad (1.20)$$

$$(6b) \quad \ln INVTEX_t = -2.38 + 1.28\ \ln PROFA_{t-1} \qquad R^2 = 0.05$$
$$(6.00) \quad (1.20)$$

$$(6c) \quad \ln INVTEX_t = -4.00 + 1.90\ \ln PROFB_{t-1} \qquad R^2 = 0.17$$
$$(3.93) \quad (0.90)$$

$$(6d) \quad \ln INVTEX_t = 1.06 + 0.78\ \ln PROFC_{t-1} \qquad R^2 = 0.15$$
$$(0.16) \quad (0.40)$$

where t ranges from 1914-36; PROFA, PROFB and PROFC are the alternative profit estimates derived in Appendix E; and non-

positive values of investment or profit have been arbitrarily raised to 0.1 in calculating equations 6b, 6c and 6d; values in parentheses are standard errors for the corresponding estimated coefficients.

These findings, which do not improve if lagged profit is replaced by current profit, indicate that textile profits have only limited explanatory power as determinants of investment in the textile industry. Determinants other than past profit might include:

--supply of investible funds from elsewhere (textiles was one of the favored sectors receiving substantial bank loans; foreign investment was also important in this sector)

--international economic trends (textiles were both import substitutes and exportables)

--domestic business trends and domestic political stability

--relative profit prospects in textiles and other sectors, given the intersectoral mobility of capital

Even if the relationship between textile profits and textile investment is weak, the link between textile profit and modern-oriented fixed investment in the aggregate may be more significant. This could arise for several reasons:

--textile profits provided the largest pool of retained earnings in the modern sector. If modern-oriented fixed investment is largely self-financed, textile profit is an important determinant of the overall supply of investible funds

--In view of numerous examples of interindustry mobility of capital of capital (machinery and textiles for the Yen family; textiles and food processing for the Jung family; salt and chemicals for Fan Hsu-tung;retailing and manufacture for Sincere department store; agriculture, manufacturing and retailing for the British-American Tobacco Co. etc.), the link between textile profits and aggregate investment may be more significant than the relation between profit and investment in textiles[47]

--as the bellwether component of the modern sector, textile performance, which was well reported in the domestic and international press, could have provided market signals to potential investors, including foreign investors, in a variety of industries.

Table 10 presents the results of regression analysis designed to investigate the link between profit in textile manufacturing and modern-oriented fixed investment. These results, along with the findings reported in Table 11, were obtained using the maximum-likelihood estimation method with adjustments for autoregressive (first and/or second order) residuals. Appendix F, prepared by C. W. Kenneth Keng, describes the econometric methodology adopted in this paper. The results shown in Table 10 come from two of the alternative textile profit series, PROFA and PROFC. A third profit series, PROFB, generated consistently weak results.

The results in Table 10 confirm some, but not all of the expectations described in the foregoing analysis. The correlation coefficient $\bar{R}^2$ which, unlike the usual least-squares correlation coefficient, may decline if spurious independent variables are introduced into an estimating equation, is uniformly high, indicating that the hypothesis of a causal link between current or lagged textile profit and modern-oriented fixed investment is consistent with the data. There is considerable evidence of a statistically significant relation between textile profit and modern-oriented investment. In Panel A, based on PROFA, we find a significant link between the current value of textile profit and current investment; lagged profit is insignificant as a determinant of investment. In Panel B, based on PROFC, we find the opposite: lagged profit appears significant while current profit carries no significance as a determinant of current investment.

Table 10

Regressions I: Modern-Oriented GDFCF vs. Textile Profits, 1913-36

1	2	3	4	5	6	7	8	9
ln INV	Constant	ln PROF	ln PROF$_{-1}$	D	$\bar{R}^2$	ρ_1	ρ_2	DW
Regressions based on PROFA								
N	4.34	0.40	--	--	0.88	0.92	--	2.18
	(0.83)	(0.15)				(0.08)		
CP	3.53	0.49	--	--	0.87	0.85	--	1.81
	(0.82)	(0.16)				(0.11)		
N	3.54	0.43	0.15	--	0.87	0.86	--	1.79
	(1.08)	(0.15)	(0.17)			(0.11)		
CP	2.86	0.48	0.16	--	0.86	0.81	--	1.53
	(1.07)	(0.16)	(0.16)			(0.13)		
CP	2.74	0.52	0.14	--	0.87	1.13	-0.39	2.30
	(1.05)	(0.14)	(0.14)			(0.22)	(0.23)	
N	5.59	0.17	0.03	-0.61	0.91	0.90	--	2.07
	(1.15)	(0.15)	(0.14)	(0.22)		(0.10)		
CP	5.01	0.22	0.03	-0.64	0.90	0.85	--	1.78
	(1.20)	(0.16)	(0.14)	(0.24)		(0.12)		
Regressions based on PROFC								
N	6.32	-0.01	--	--	0.86	0.96	--	2.21
	(0.75)	(0.05)				(0.05)		
N	6.43	-0.04	--	-0.27	0.86	0.97	--	2.46
	(0.82)	(0.05)		(0.18)		(0.04)		
CP	6.05	-0.03	--	-0.27	0.83	0.95	--	2.29
	(0.64)	(0.06)		(-.20)		(0.06)		
N	6.02	0.03	0.08	--	0.86	0.93	--	1.64
	(0.54)	(0.05)	(0.05)			(0.07)		
CP	5.35	0.09	0.10	--	0.84	1.25	-0.41	2.21
	(0.42)	(0.06)	(0.05)			(0.21)	(0.23)	
N	6.42	--	0.06	-0.70	0.92	0.93	--	1.95
	(0.38)		(0.04)	(0.17)		(0.08)		
CP	6.08	--	0.05	-0.77	0.90	0.88	--	1.76
	(0.31)		(0.04)	(0.19)		(0.11)		
N	6.45	-0.01	0.06	-0.70	0.92	0.93	--	1.97
	(0.41)	(0.04)	(0.04)	(0.13)		(0.08)		
CP	6.09	-0.002	0.05	-0.77	0.90	0.88	--	1.76
	(0.37)	(0.04)	(0.04)	(0.20)		(0.11)		

-- variable omitted or incidator not relevant
figures in parentheses are standard deviations of parameter estimates

Table 10 con'td

Column 1. Dependent variable. Log of modern-oriented GDFCF for the nation (N) or China Proper (CP).

2-5. Independent variables: constant term (2)
log of current (3) or previous year's (4) profit
dummy for World War I: equals 1 for 1914-18, zero for other years (5)

6. Adjusted coefficient of determination

7-8. Estimated coefficients of first (7) and second (8) order autocorrelation

9. Durbin-Watson statistic

Introduction of a dummy variable to capture the effect of World War I produces consistently significant results: the coefficient of D is uniformly negative with high levels of significance, indicating that wartime conditions reduced investment below the levels predicted from the normal relationship between textile profits and fixed investment.[48] The negative impact of World War I on investment, however is small. Taking the coefficient of D, the dummy variable, to be -0.6 or -0.7, we can suggest that the effects of war lowered the 1914-18 average level of modern-oriented fixed investment by about 2 million yuan.

The finding that World War I exercised a negative effect on modern-oriented fixed investment, together with the earlier observation of a sharp investment upturn starting in 1919 is important because of the widespread belief that 1914-18 witnessed a "Golden Age" of industrial development in China. In fact, the war period was an interlude of retarded rather than surging investment in the modern sector.

An unexpected outcome shown in Table 10 is the failure of the regression results to improve when investment in China proper rather than national investment is taken as the dependent variable. This is puzzling because the concentration of textile manufacture in China proper and the importance of Japanese government policy in Manchurian investment decisions point to a stronger profit-investment link in China Proper than in Manchuria.[49] Do the results suggest that Japanese investment policy in Manchuria responded to economic conditions in China Proper?

I have argued in the past that "domestic rather than external economic forces are basically responsible for the state and evolution" of China's prewar economy and that "the specific influence of foreign activity . . . on the level of capital formation . . . and on other important economic magnitudes was generally small . . ."[50] The present analysis offers an opportunity to test this view by inserting a foreign trade variable into the textile profit-investment regressions. The results of this operation appear in Table 11 where F is an index of foreign trade volume derived in Appendix G and displayed in Table 12.

Examination of Table 11 reveals a strong positive link between the volume of foreign trade and the level of modern-oriented fixed investment. The adjusted coefficients of determination $\bar{R}^2$ are consistently higher than in Table 10.[51] The regression coefficients attached to the trade variable are both significant and, with one exception, much larger than the regression coefficients attached to current or lagged textile profit. Comparison of equations 6 and 7 (Table 10) with equations 3 and 4 (Table 11) shows that introducing the trade variable lowers both the size and the statistical significance of the World War I dummy variable; equations 15 and 16 (Table 10) and equations 8 and 9 (Table 11) show similar results using PROFC rather than PROFA. Since both the trade and dummy variables capture the impact of external economic forces, this is not surprising.

What is surprising is the apparent conflict between the hypothesized dominance of domestic investment determinants and the strong performance of foreign trade volume as a predictor of investment behavior. The foreign trade-modern investment link emerges most clearly from the following regression:

Table 11

Regressions II: Modern-Oriented GDFCF vs. Textile Profit and Foreign Trade, 1913-36

1	2	3	4	5	6	7	8	9	10	11
ln INV	Constant	ln PROF	ln $PROF_{-1}$	D	F	ln F	$\bar{R}^2$	P_1	P_2	DW
Regressions based on PROFA										
N	-4.02	0.22	0.08	--	--	1.86	0.94	0.73	--	1.71
	(1.52)	(0.12)	(0.11)			(0.38)		(0.17)		
CP	-3.07	0.34	--	--	--	1.55	0.95	1.24	-0.68	2.17
	(1.15)	(0.09)				(0.27)		(0.13)	(0.17)	
N	--	0.12	0.02	-0.37	--	1.22	0.95	0.86	--	2.12
		(0.12)	(0.10)	(0.15)		(0.17)		(0.12)		
CP	-4.88	0.42	0.09	0.21	--	1.74	0.95	1.21	-0.77	2.25
	(1.70)	(0.10)	(0.08)	(0.19)		(0.33)		(0.17)	(0.15)	
CP	--	0.69	--	--	3.56	--	0.94	1.32	-0.42	1.63
		(0.23)			(0.73)			(0.22)	(0.23)	
Regressions based on PROFC										
N	-3.78	0.02	0.05	--	--	2.07	0.94	0.77	--	1.69
	(1.66)	(0.03)	(0.04)			(0.35)		(0.16)		
CP	-2.73	0.07	0.07	--	--	1.73	0.93	1.22	-0.61	2.34
	(1.49)	(0.04)	(0.04)			(0.33)		(0.20)	(0.20)	
N	4.83	-0.001	0.05	-0.44	0.01	--	0.95	0.85	--	2.17
	(0.48)	(0.03)	(0.03)	(0.16)	(0.003)			(0.13)		
N	-0.54	0.003	0.05	-0.38	--	1.44	0.95	0.86	--	2.12
	(1.97)	(0.03)	(0.03)	(0.18)		(0.40)		(0.12)		
CP	-1.48	0.05	0.06	-0.16	--	1.49	0.92	1.19	-0.53	2.29
	(2.34)	(0.04)	(0.04)	(0.23)		(0.48)		(0.22)	(0.22)	
CP	--	0.05	0.06	-0.27	--	1.19	0.93	1.22	-0.48	2.25
		(0.04)	(0.04)	(0.16)		(0.06)		(0.21)	(0.22)	

-- variable omitted or indicator not relevant
figures in parentheses are standard deviations of parameter estimates

Column 1. Dependent variable. Log of modern-oriented GDFCF for the nation (N) or for China Proper (CP)

2-7. Independent variables: constant term (2); log of current (3) or previous year's (4) textile profit; dummy for World War I (5): 1 for 1914-18; zero for other years; index of volume of foreign trade (1913=100) (6); log of index of volume of foreign trade (7)

8. Adjusted coefficient of determination

9-10. Estimated coefficients of first (9) and second (10) order autocorrelation

11. Durbin-Watson statistic

Table 12

China's Foreign Trade Volume, 1913-1936

1913=100

1913	100.0
1914	88.3
1915	81.2
1916	85.6
1917	88.0
1918	82.6
1919	102.4
1920	94.0
1921	108.2
1922	120.1
1923	120.5
1924	126.7
1925	119.5
1926	134.9
1927	128.3
1928	141.8
1929	143.8
1930	131.0
1931	132.6
1932	122.7
1933	139.1
1934	147.2
1935	149.6
1936	151.3

Source: Appendix G.

$$INVN = -924 + \underset{(1.60)}{9.76\ F} + \underset{(1.58)}{3.92\ F_{-1}} \qquad R^2 = 0.96 \qquad DW = 1.89$$

$$p_1 = 1.26 \qquad p_2 = -0.38$$

in which the current and lagged index of foreign trade volume alone provides an excellent statistical explanation of the observed pattern of modern-oriented fixed investment during 1913-1936.

What is the significance of these results showing strong positive correlation between current or lagged foreign trade volume and the level of modern-oriented fixed investment? The positive association between foreign trade and domestic investment is the opposite of the negative relation postulated by writers who stress the deleterious economic impact of unrestricted foreign participation in China's economy. The regression results also appear to conflict with my own assertions about the primacy of domestic forces in determining the course of China's economy.

One way of resolving these difficulties is to suggest that the strong statistical assoication between foreign trade volume and the level of modern-oriented fixed investment arises because both these variables respond to changes in the overall level of domestic economic activity, changes which are not presently amenable to quantitative study. Can we establish a plausible case for this hypothesis?

Foreign trade arises from the interplay between supply and demand conditions in internal and external markets. Since China's foreign transactions in most trade goods contributed only a small fraction to trade volume in both domestic and world markets, ouput, domestic consumption and trade volume were typically determined primarily by domestic market forces. Under these conditions, trends in the volume of China's international trade may appear as

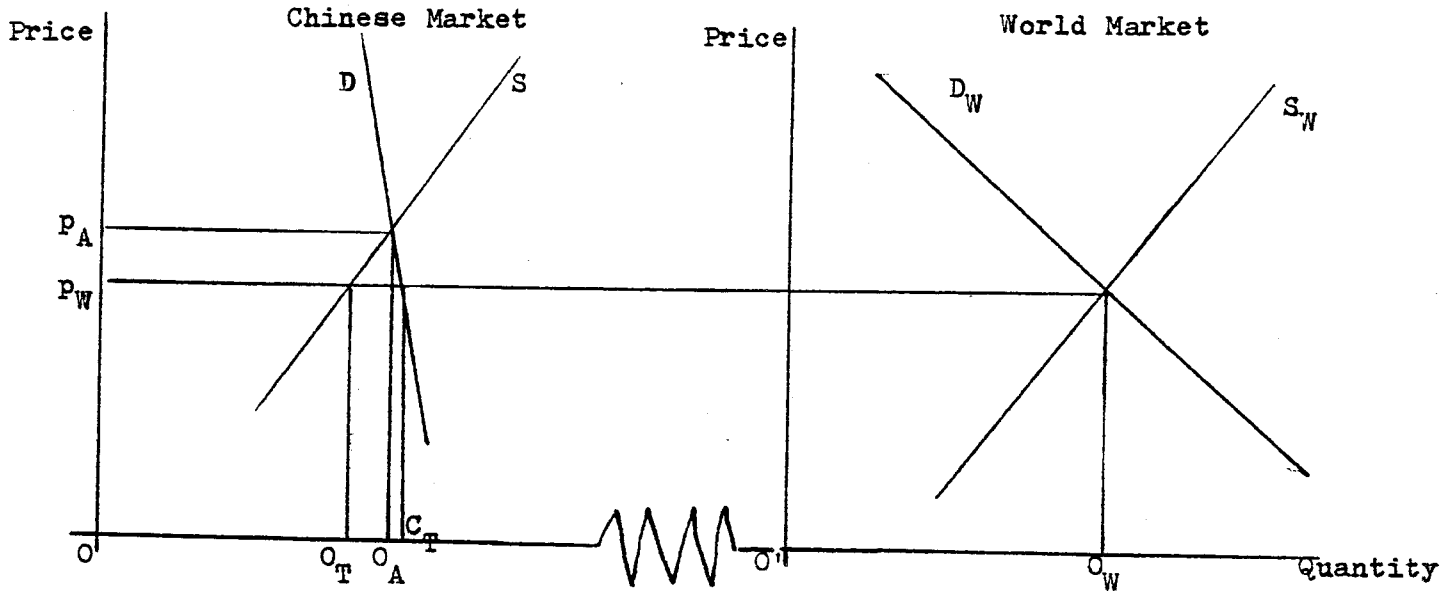
responses to, rather than determinants of changes in the level of domestic economic activity. Thus our regression results linking higher foreign trade with higher investment may actually reflect an investment response to rising levels of domestic economic activity, with foreign trade growth serving as a statistical proxy for internal economic expansion.

This situation is illustrated in Graph 2, which shows the determination of price, output and consumption for an importable commodity under autarchy and with trade. Since world output (O_W) is a large multiple of Chinese output before (O_A) or after (O_T) trade commences, the entry of China into the world market has little impact on world demand, supply, price or output. The diagram is constructed to reflect the assumption that the existence of trade opportunities does not lead to large shifts in domestic output, consumption or price of the imported product. Under these conditions, rising Chinese demand caused by domestic economic expansion will lead to an increase in the level of imports. A similar set of diagrams could illustrate the case of an exportable commodity in which the volume of exports will rise with increases in the domestic supply schedule.

This analysis, showing how domestic economic expansion could raise the level of both imports and exports, is consistent with the hypothesis of strong linkage between domestic economic activity and foreign trade volume. It also fits well with information about the composition of China's external trade. The share of combined exports and imports in total Chinese output is small, averaging 10.2% of gross domestic product during 1931-36 and 7.4% during 1914-18.[52] This means that the role of internationally traded goods in typical domestic markets was necessarily small. This conclusion is reinforced by the broad dispersion of Chinese trade among various commodity groups shown in

Graph 2

Price and Output Determination for an Importable Commodity



P_A	Chinese domestic price under autarchy
O_A	Chinese domestic output and consumption under autarchy
O_T, C_T	Chinese output (O_T) and consumption (C_T) with trade
P_W, O_W	World price (p_W) and output (O_W)
S, D	Supply and demand in the Chinese market
S_W, D_W	World supply and demand

Chinese imports under trade are equal to the horizontal distance between C_T and O_T

Table 13.

On the import side, there are a number of categories dominated by non-competing goods; these include kerosene, petroleum, transportation materials, chemicals, metals and machinery, accounting for 25.9% of total imports or 35.7% of identified imports in 1931. From a world perspective, China's purchases in these categories were small. As a result, import volume was almost entirely dependent on the level of domestic demand, which was in turn related to domestic output and disposable income. Imports of raw cotton and cotton yarn, amounting to 12.9% of identified imports in 1931, reflected the level of domestic activity in the textile industry; in the case of raw cotton, there was an element of complementarity between long-staple imports and short-staple domestic fibers. Imports of grain, flour, sugar and tobacco resulted from urban growth and changing tastes on the demand side coupled with limited internal transport capacity and weather-induced harvest fluctuations on the supply side; these imports, amounting to 23.0% of total or 32.1% of identified imports in 1931, in part represented the demand implications of domestic economic expansion.

Leaving aside the unidentified category, we see that with the exception of cotton goods, for which imports declined with the expansion of domestic factory industry, commodity imports are dominated by categories whose annual flow appears to move together with trends in domestic economic activity.

The situation is less clear-cut on the export side, but here again we have a broad commodity mix in which small quantities of a large variety of products are supplied to world markets. Surely China's exports of foodstuffs, animal products, minerals, cotton, cotton textile goods and a host of other

Table 13

Composition of China's Foreign Trade
(Percentage of Current Value)

Imports:	1913	1916	1920	1925	1928	1931	1936[a]
Cotton goods	19.3	14.1	21.8	16.3	14.2	7.6	1.5
Cotton yarn	12.7	12.4	10.6	4.4	1.6	0.3	0.2
Raw cotton	0.5	1.6	2.4	7.4	5.7	12.6	3.8
Rice and wheat	3.3	6.6	0.8	6.8	5.7	10.6	4.1
Wheat flour	1.8	0.2	0.3	1.6	2.6	2.0	0.5
Sugar	6.4	7.1	5.2	9.5	8.3	6.0	2.2
Tobacco	2.9	5.8	4.7	4.1	5.1	4.4	1.8
Paper	1.3	1.8	1.9	2.0	2.4	3.2	4.1
Kerosene	4.5	6.2	7.1	7.0	5.2	4.5	4.2
Petroleum	---	0.2	0.4	0.9	1.4	1.8	4.1
Transportation materials	0.8	4.0	2.6	1.9	2.3	2.3	5.6
Chemicals, dyes, pigments	5.6	4.1	6.4	5.6	7.5	8.0	10.8
Iron, steel, other metals	5.3	5.1	8.3	4.7	5.4	6.2	13.2
Machinery	1.4	1.3	3.2	1.8	1.8	3.1	6.4
All others	34.2	29.5	24.3	26.0	30.8	27.4	37.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Exports:							
Silk and silk goods	25.3	22.3	18.6	22.5	18.4	13.3	7.8
Tea	8.4	9.0	1.6	2.9	3.7	3.6	4.3
Beans and bean cake	12.0	9.3	13.0	15.9	20.5	21.4	1.3
Seeds and oil	7.8	8.4	9.1	7.9	5.8	8.4	18.7
Eggs and egg products	1.4	2.6	4.0	4.3	4.4	4.1	5.7
Hides, leather, skins	6.0	6.0	4.3	4.0	5.4	4.1	5.7
Ores and metals	3.3	6.3	3.2	2.9	2.1	1.6	7.7
Coal	1.6	1.2	2.3	2.6	2.9	3.0	1.6
Cotton yarn and cotton goods	0.6	0.8	1.4	2.0	3.8	4.9	3.0
Raw cotton	4.0	3.6	1.7	3.8	3.4	2.9	4.0
All others	29.6	30.5	40.8	31.2	29.6	32.7	40.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Albert Feuerwerker, Economic Trends in the Republic of China, 1921-1949 (Ann Arbor, 1977), pp. 104-105

[a] excludes Manchuria

products can be explained by a "vent for surplus" approach in which foreign sales are determined by the difference between output and domestic demand, neither of which is significantly affected by external forces. Even in the case of tea and silk, products in which China commanded a major share of world markets in the late nineteenth century, but suffered declining export volume thereafter, the inability to match Japanese progress in product quality, rather than erosion of foreign demand, was the major source of difficulty. So here again, we may expect export volume to be determined largely, though not entirely, by domestic developments (or, in the case of tea and silk, by their absence).

Even if trade is small and its volume is determined largely by domestic economic conditions, the external sector may exercise great influence if the international terms of trade are widely at variance with pre-trade domestic relative prices. Although there has been little research on China's price history, we have no indication that the growth of international trade produced massive shifts in relative prices parallel to those observed in Meiji Japan, where Huber's comparison of 1846-55 and 1871-79 shows an increase of 240% in the commodity terms of trade (index of export prices divided by index of import prices).[53]

We thus see that the strong performance of foreign trade volume as a statistical determinant of modern-oriented fixed investment, which seems to support the view that foreign influence dominated events in China's modern sector, is also consistent with an alternative view that ties modern-sector growth to the expansion of China's domestic economy, including sectors and regions that did not participate directly or extensively in the investment spurt centered in Manchuria and in the Lower Yangtze area. The experience of

the 1930's, which saw increases in both foreign trade volume (Table 12) and in modern-oriented fixed investment (Table 1) that cannot possibly be attributed to buoyant external market conditions, lends further credence to the view that the sources of investment growth must be sought within China's domestic economy.

In seeking to connect modern-sector investment with trends in the domestic economy, we come into conflict with the views of Murphey, who states that the coastal port cities[54]

> grew very rapidly, but not primarily because of any close integration with the rest of the Chinese economy. Their commercial innovations and their rapid growth as overseas trade centers . . . remained an artificial graft which never grew into an organic union with the late traditional economy.

and of Lippit, who observes that[55]

> the question of the exact extent to which saving in the agricultural sector financed investment in the industrial sector before 1949 remains open; but . . . any such flow of funds cannot have been significant.

On the other hand, David Buck's study of the city of Tsinan, in Shantung province, leads him to conclude that "commercial growth owes more to shifts and increases in the level of Chinese domestic commerce than to the expansion of foreign trade," a finding that "undermines . . . critics . . . who relate . . . 'underdevelopment' . . . to the control of finance and commerce in coastal entrepot cities by foreigners."[56] Can we link the rapid expansion of modern-oriented fixed investment in prewar China with developments in the traditional economy? The following section briefly explores possible linkage in three areas: accumulation and disposition of economic surplus, domestic commerce, and banking.

MODERN-ORIENTED FIXED INVESTMENT AND THE DOMESTIC ECONOMY

Economic Surplus in Prewar China

Previous studies of economic surplus in prewar China by Victor Lippit and Carl Riskin have emphasized the large size of the surplus relative to investment.[57] Their results are reproduced in Table 14. Riskin contrasts net domestic investment of "less than 2 percent of net domestic expenditures" in 1933 with surplus above essential consumption estimated at 27.2% or, adding potential output from underutilized resources, 36.8% of 1933 net domestic product. The reader is left with a picture of an economy incapable of mobilizing the domestic surplus: "only with victory of Chinese communism" do we find "a closer alignment of investment and surplus."[58]

We have already seen that the investment estimate underlying Riskin's calculations may require upward revision. It also appears that the Lippit-Riskin estimates of produced surplus shown in Table 14 are considerably overstated even though Riskin describes the results as "conservative and incomplete."[59] Even without changing the estimates of investment or surplus, the characterization of prewar China as incapable of mobilizing its domestic surplus is only partially valid.

This conclusion follows from recognizing that modern-oriented fixed investment, while modest in relation to the national economic aggregates, was a regional and sectoral rather than a national phenomenon. Taking 1934 as an example, if we assume that half of the modern oriented fixed investment in China proper occurred in Kiangsu province (including Shanghai), then the share of Kiangsu and Manchuria in modern-oriented fixed investment for that year becomes $(0.5 \times 0.74 + 0.53)/1.27$ or 71%.[60] If we assume that Kiangsu and

Table 14

Estimated Size and Sectoral Division of Produced Surplus, 1933

Sector	Net value-added / NDP	Surplus / NDP	Surplus / Net value-added
Traditional sector	.844	.226	.27
Agriculture	.650	.190	
Handicrafts	.071	.018	
Transport & communications	.042	.005	
Peddlers	.033	.004	
Personal services	.012	---	
Residential rents	.036	.009	
Modern sector	.129	.046	.36
Factories, mines, utilities	.034	.012	
Trading stores & restaurants	.061	.022	
Finance	.007	.005	
Transport and communications	.015	.007	
Construction	.012	---	

Source: Riskin, "Surplus and Stagnation," p.75.

Manchuria, which accounted for approximately 15% of China's population in the early 1930s, produced 50% more than this share, or 22.5% of aggregate output and generated a comparable percentage of estimated economic surplus, then the ratio of regional modern-oriented fixed investment to regional economic surplus for Manchuria and Kiangsu becomes:

$$\frac{.71}{.225 \times .272} \times \frac{\text{modern-oriented GDFCF}}{\text{GDP}}$$

or 0.54.[61] When we consider that regional expansion of traditional types of fixed assets (e.g. in Manchurian agriculture) and of working capital in both modern and non-modern sectors undoubtedly occurred, it is evident that the ratio of investment to economic surplus in China's dynamic regions was quite large. Even though some investment was financed by foreign capitial, particularly in Manchuria, these results make it difficult to doubt that systematic mobilization of surplus did occur in the expanding regions of China's economy prior to World War II. If the data in Table 14 exaggerate the level of available surplus, the ratio of investment to surplus would rise, thus reinforcing the conclusion that sytematic transfer of resources into new capital was a regular feature of economic activity in some regions of prewar China.

Furthermore, it appears that modern-oriented fixed investment was partially financed by a transfer of resources from the traditional sector of China's economy, at least during the 1930s. Neither modern sector incomes nor foreign funds could have supplied enough savings to finance the observed volume of modern- oriented fixed investments. Riskin's estimates show that non-wage incomes absorbed only 36% of net value added in the modern sector in 1933 (Table 14). A substantial portion of these incomes went to support the comfortable and sometimes luxurious consumption standard of China's urban

bourgeoisie. Even if the modern sector accumulation ratios of 40-55% in Tables 4 and 5 are overstated by a considerable margin, it seems clear that savings from non-wage incomes in the modern sector could hardly have financed half of modern-oriented fixed investment. Savings from modern-sector wage incomes can safely be ignored as significant sources of investment finance in this period.

What of foreign savers, including overseas Chinese as well as Westerners, Japanese and the businesses they controlled in China? Information about foreign sources of funds is shown in Table 15, which reproduces data from Yu-kwei Cheng's compilation of various balance of payments estimates for 1903-36 in Haikwan taels (the Maritime Customs' unit of account) and in current U.S. dollars. These data come from a number of sources and may not be consistent from year to year; furthermore, Manchurian data are missing from the figures beginning in mid-1932.

Despite these inconsistencies, it is obvious that foreign savings cannot have financed the bulk of modern-oriented fixed investment. In 1931-36, for example, modern-oriented fixed investment averaged 1.12 billion yuan (1933 prices), of which 0.75 billion yuan occurred in China proper; at the 1933 rate of exchange, these investment figures are equivalent to US $295 million for the national total and $198 million for China proper. During the same five years, the annual net inflow of foreign funds in the categories shown in Table 15 was never more than US $82 million and averaged only $44 million, or less than one-fourth of average investment for China proper.[62] Furthermore, line 8 of Table 15 shows that overseas Chinese remittances dominated the inflow of funds. Since these remittances were received primarily in South China and were often used to support consumption spending by families of emigrants or to

Table 15

Foreign Sources of Investable Funds, 1903-1936 (Million Haikwan Taels)

	1903	1912	1913	1920-3[a]	1928	1929	1930	1931	1932[b]	1933[b]	1934[b]	1935[b]	1936[b]
1 Overseas Chinese Remittances	73.0	40.0	77.0	100.0	167.1	187.1	210.9	232.2	209.9	192.6	160.5	166.9	205
2 New Foreign Business Investment	27.0	100.0	100.0	106.7	64.0	113.3	134.7	28.5	38.5	19[c]	45[c]	...	38
3 Remittances by Foreigners From China	16.0	20.0	20.0	30.0	0.3	0.3	0.7	...	0.6	...	...	...	...
4 Profit Remitted by Foreign businesses	...	....	...	...	119.3	132.3	132.0	57.0	35.9	12.8	9.6	6.4	44[d]
5 Capital Flight	...	...	...	...	...	...	...	...	...	...	128.4	160.5	273
6 Investable Funds 1+2-(3+4+5) Mill. Haikwan Taels	84.0	120.0	157.0	176.7	111.5	167.8	212.9	203.7	211.9	198.8	67.5	0	-38
7 US$ equivalent of 1 Haikwan Tael	0.64	0.74	0.73	0.91	0.71	0.64	0.46	0.34	0.34	0.41	0.53	0.56	0.46
8 Investable Funds Mill. US Dollars	53.8	88.8	114.6	160.8	79.2	107.4	97.9	69.2	72.0	81.5	35.8	0	-17.5
9 Ratio: Line 1 / Line 8	0.87	0.45	0.67	0.56	1.49	1.12	0.99	1.14	0.99	0.97	2.38	--	--

Source: Cheng, Foreign Trade and Industrial Development, p. 260.

... no data shown in source
-- ratio cannot be calculated

[a] Annual averages for 1920-23.

[b] China Proper only.

[c] Includes foreign loans to the Chinese government.

[d] Includes payments for freight and insurance.

purchase land, only a fraction of these funds were available for investment purposes. The net inflow of foreign business funds, most of which were intended to support modern-oriented fixed investments, was small.

This leads to the conclusion that, in contrast to the claims of writers who share Rhoads Murphey's view that China's dynamic cities were economically "extraneous and tiny outposts of a system which remained foreign to China and made little impact on it," the traditional sector of China's economy did in fact play an important role in accumulating funds for the modern-oriented investments that were concentrated in Shanghai and other coastal cities.[63] Where did this accumulation come from, and how was it transferred to the cities? Possible answers to these questions can be seen from a brief survey of developments in domestic trade and banking.

Internal Trade in Prewar China

If surplus generated in the traditional sectors of China's prewar economy contributed to the financing of investment in the modern sector, it is natural to inquire where this surplus originated and whether its transfer into the modern sector represented a diversion from previous uses within the traditional economy or whether the transferred surplus resulted from a process of economic expansion. We know that the gradual spread of steamship services on coastal and riverine transport routes and the expansion of the railways, particularly on the North China plain and in Manchuria, attracted growing volumes of freight and passenger traffic. But did these new services merely replace traditional carriers? Or did steamships and railways initiate a process of trade creation that might explain the availability of new surpluses within the

traditional economy?

To answer these questions requires an investigation of domestic trade that would extend far beyond the scope of this paper. The measurement of domestic trade is complicated both by conceptual (how does one measure trade volume if the same ton of grain may pass through numerous markets?) and empirical problems. Although Perkins has investigated traditional interprovincial trade and Skinner and Rozman have studied the structure of marketing systems, we have no estimates of the overall volume or growth of internal trade.[64]

In a separate study, I have attempted to survey the size and growth of internal trade by estimating the volume of freight traffic, in terms of ton-kilometers, for various modes of transportation between 1890 and 1935. Preliminary calculations show that the volume of freight traffic expanded at approximately 15% per decade between 1890 and 1935. This is substantially higher than traditional growth rates of population, aggregate output and, presumably, domestic trade volume. The growth of freight traffic closely parallels estimated output between 1914-18 and 1931-36, suggesting that output and freight traffic probably moved together between 1895 and 1914-18 as well.

The expansion of freight traffic occurred because of the growth of modern transport systems--steamships and railways. There appears to be no sign of decline in aggregate freight volume for traditional transport modes. It is possible that traffic of traditional carriers increased; my calculations, however, assume static freight volume for traditional carriers.

If the volume of freight traffic is related to aggregate commodity output or to gross domestic product for 1933, the resulting ratios of freight traffic (in ton-kilometers) per unit of commodity output or GDP are smaller

than, but in some cases very close to similar measures for the United States economy in 1849, 1860 and 1870. This comparison adds an international dimension to statements about the degree of commercialization in China's traditional economy: according to some measures, the volume of freight traffic per dollar of output in China during the 1930s was nearly as large as in the United States in 1860.

These findings, which are corroborated by what we know about the growth of commodity flows in domestic markets for rice, wheat, cotton, soybeans, tea, silk, coal, cement and other major trade goods, indicate that expanded specialization, division of labor and commercialization following the spread of modern transport systems may well have generated a growing surplus within the traditional economy that could be transferred into the small but dynamic modern sector of China's economy.

Banking and Finance in Prewar China

The first four decades of the twentieth century witnessed the rapid development of modern commercial banking in China, first by foreign, and then by Chinese-operated institutions. Parallel to the rise of modern banks, we find the appearance and expansion of other new financial institutions: insurance companies, trust firms, stock and bond markets. Existing literature on this subject suggests that the expansion of modern financial institutions occurred partially or wholly at the expense of older intermediaries, especially the ch'ien-chuang or native banks, which are said to have been in a state of "collapse," "dying a natural death," or in "gradual decline" by the 1930s.[65] Examination of available evidence, however points to the opposite view that strong complementaries between new and old financial institutions

allowed the latter to prosper and even expand during the prewar decades.

This is evident from developments at Shanghai, the center of commercial banking, and the city in which older institutions faced the most severe rivalry from modern banks. Although both the number of native banks and their profit rate declined during the 1920s and 1930s, paid-up native bank capital in the Shanghai area expanded at an average annual rate of 8% during 1921-34, while Shanghai native bank deposits grew at about 9% annually over the same period.[66] These growth rates, which are similar to those for modern-oriented fixed capital formation and industrial production, show that the native bank sector in Shanghai was far from dead. Indeed, with national income expanding at an annual rate of perhaps 1% between 1914-18 and 1931-36, these results point strongly toward the participation of native banks in fast-growing modern-sector activities as well as less dynamic traditional segments of China's economy.

A brief survey of native bank activities in Shanghai and Tientsin shows that native banks in these urban centers were deeply involved in financing modern-sector activities. Links between native banks and the modern sector can be seen from data on industrial loans and from ownership ties linking native banks and a variety of modern-sector activities. Native banks dominated the financing of internal commerce outside the largest urban centers. Their participation was essential to the maintenance and expansion of commodity flows linked to the growth of foreign trade and of modern-sector commodity production: cotton, wheat, yarn, cloth etc. Native banks maintained strong ties to modern-sector financial institutions, both Chinese and foreign. These ties included large exchanges of deposits and loans among various types of institutions; provision by native banks of clearing facilities for modern

and foreign banks (before 1933) and vice versa (after 1933); interlocking ownership; joint financing of commodity flows, particularly with regard to foreign trade commodities; and strong personal links which saw native bank personnel and their sons migrate into the modern bank sector.

In Shanghai, Tientsin and other dynamic urban centers, native banking prospered and expanded because the ch'ien-chuang could provide valuable services needed by modern banks, and also because the native institutions managed to adapt their operations sufficently to earn for themselves a role in the financing of modern industry, foreign trade, government debt and other expanding elements of the urban economy.

If the native banks managed to maintain themselves and even expand in Shanghai and Tientsin, there can be little doubt the the ch'ien-chuang continued to flourish in smaller centers less affected by new financial institutions. The emergence of modern commercial banking in the leading urban centers benefited the wider economy of the surrounding regions or hinterlands, and many of these benefits were diffused through the native banking network. Financial development meant a general increase in liquidity resulting from credit injections originating from foreign and Chinese modern banks in the urban centers. This loosened credit constraints on the expansion of production and trade both within and outside these cities. There was also a general increase in the strength and resilience of the entire financial system. Although foreign bankers sought to increase their own profits rather than to ensure the prosperity of Chinese financial intermediaries, extensive interdependence between the commercial and financial activities of foreigners and Chinese and of urban and rural economic agents obliged the foreigners, acting in their own interest, to provide financial support for Chinese institutions

in times of crisis. Just as the native banks performed certain central banking functions for foreign institutions, the foreign banks often acted as lenders of last resort for Chinese firms, thus enhancing the stability of China's financial network and reducing the risk attached to trade and its financing. The foreign banks led the way in using new technologies-- steamships, telegraph, telephone--to speed the pace of monetary transfers, thus increasing the turnover of funds and further relaxing financial constraints on commodity flows.

The changes initiated by the growth of banks and the spread of foreign financial practice may be credited with a general loosening of liquidity constraints on business activity in both the traditional and modern sectors of China's economy. These benefits were not evenly distributed, but were concentrated in major trading centers and their economic hinterlands. However, the strong economic ties between distant regions of China, ties that can be seen in the quick response of grain prices in urban centers of the middle and upper Yangtze regions to developments on the Shanghai grain market, or in the marked stability of rates of tael exchange between distant cities, suggest that economic changes originating in Shanghai or Tientsin may have influenced events throughout the commercially active areas of the country.

Summary

This discussion has sought to demonstrate the plausibility of several interrelated hypotheses. First, I have argued that the size and growth of modern-oriented fixed investment reported in Table 1 is linked with domestic developments. The traditional sectors of China's twentieth-century economy bore a considerable share of the financing of these investments. The growth of the modern sector was not, as some have argued, an isolated phenomenon that developed with little or no linkage to China's traditional economy. Linkage surely existed, and was by no means limited to the substantial spread effects and uninvestigated, but perhaps equally substantial backwash effects of regional economic growth. Mobilization of traditional financial resources seems to have been an important component of China's modern-sector development before World War II.

How large was the contribution of the traditional economy to the financing of modern-oriented fixed investment? Where did the surplus originate, and how was it transferred to the cities? While none of these questions can be answered with precision, the mechanism of accumulation and transfer may be explicable in terms of a development sequence beginning with the introduction of new technologies for transportation, communication and finance into China's economy in the late nineteenth century. The steamship, the railroad, the telegraph and, equally important, the modern commercial bank contributed to an accleration of specialization, division of labor and internal as well as overseas trade. This was done by relaxing the constraints of distance and liquidity. The growth of specialization and trade may have quickened the pace of traditional output growth in regions affected by technological change as early as the 1890s. By the early twentieth century, the

traditional segments of dynamic regional economies were deeply involved in an unprecedented process of economic growth. The surplus arising from the traditional sector's participation in regional processes of modern economic growth, created by growing specialization and trade and amalgamated within the newly strengthened financial network, appears to have been responsible for financing the considerable fraction of modern-oriented investment that was not supported by modern-sector retained earnings, urban savings or capital inflows from abroad.

IV. CONCLUSION

This essay has focused on the growth of the modern sector of China's economy during the prewar decades of the twentieth century. Its principal result, a time series of modern-oriented gross domestic fixed capital formation at the national and regional levels, supports the proposition that regional investment spurts in Manchuria and in the lower Yangtze area of China proper generated regional processes of modern economic growth in the decades leading up to the Pacific War.

The search for causal factors underlying this investment surge has touched a wide range of subjects, including modern-sector profits, the size, composition and growth of foreign and internal commerce, and the development of financial institutions. Although our knowledge of each of these areas will undoubtedly improve with further research, a number of conclusions have emerged from the preliminary reconnaissance reported in the preceding pages.

First and foremost, this study shows that there was an investment spurt in prewar China of the type identified with the early phase of industrialization in many other nations. The estimates of modern-oriented fixed investment, although not without weak points, rest on a firm statistical base. Comparison with prewar Japanese investment performance reveals that the level and growth rate of modern-oriented investment during 1903-36 were quite substantial. Further insight into the dimensions of China's prewar economic performance arises from projecting the time trend of prewar modern-oriented fixed investment into the post-1949 era of high and rising capital formation under Communist-led central planning. This is done in Graph 1, where the trend lines for aggregate modern-oriented gross domestic fixed capital formation throughout China and in China proper have been extended to 1973 to facilitate

comparison with Field's estimates of gross domestic fixed capital formation for the period 1952-73 shown in Table 16. The projections in Graph 1 lead to the quite remarkable observation that despite the low capital formation proportions of the 1930s, the powerful and effective intervention of China's post-1949 central planning apparatus has failed to push investment performance beyond the trend lines established in the largely free-enterprise environment of the prewar decades.

This does not overshadow the achievements of China's present regime in raising investment rates and building industrialization into a national rather than a regional phenomenon. It does, however, show that China's recent economic expansion can be seen as part of a long-term process whose origins lie in the prewar decades. The conclusion that investment in the People's Republic has followed long-term trends established before the Pacific War shows that the prewar growth experience reviewed in this study should be seen as the first phase in a longer process of economic expansion and structural change in China's economy.

Modern-oriented fixed investment in the prewar decades clustered in two regions: the northeastern provinces, which were strongly influenced by the economic and political forces of Japanese imperialism, and the lower Yangtze region centered on Shanghai, where development rested almost exclusively in the hands of Chinese and foreign private enterprise. Modern economic growth in the lower Yangtze region has not received the scholarly attention that it deserves. Output expansion, resource mobilization, structural and technological changes all evolved swiftly despite a high degree of economic and political instability, frequent and disruptive external shocks and a virtual absence of governmental initiative. The regional spread effects

Table 16

Gross Domestic Fixed Capital Formation in China, 1952-1973

(Million Yuan)

Year	1957 Prices	1933 Prices
1952	7697	2417
1953	11140	3498
1954	12883	4045
1955	13758	4320
1956	20045	6294
1957	19522	6130
1958	30378	9539
1959	35422	11122
1960	34877	10951
1961	24846	7802
1962	20918	6568
1963	25110	7884
1964	29123	9145
1965	35461	11135
1966	40346	12669
1967	35514	11151
1968	38808	12186
1969	44407	13944
1970	50112	15735
1971	56729	17813
1972	63356	19894
1973	68013	21356

Sources: data in 1957 prices are from Robert M. Field, "Real Capital Formation in the People's Republic of China, 1952-73," in Eckstein ed., Quantitative Measures of China's Economic Output, p. 233.

1933 prices: Liu and Yeh, Economy of the Chinese Mainland, p. 235, estimate that with 1952=100, a 1957 price index for basic construction outlays is 90.4. To link 1952 with 1933 prices, we use K. C. Yeh's finding ("Capital Formation in Mainland China," p. 76a) that the average level of GDFCF during 1952-57 was 4.27 billion yuan (1933 prices) and 15.03 billion yuan (1952 prices). To convert data from 1957 to 1933 prices, we therefore multiply by 4.26/(.904x15.03) or 0.314.

of modern-sector growth can easily be documented with reference to growing flows of non-traditional commodities, expansion of factory industry, movement of rural workers to the cities, development of transport, communication and financial networks, and a host of other indicators.

The experience of the lower Yangtze region during the prewar decades strongly contradicts the popular view that radical social change was a prerequisite for developing China's stagnant economy. Regional economic expansion did occur before World War II, and without the benefit of land reform, socialization of industry, expropriation of private capital, government leadership or other features of China's postwar political economy. If we investigate the limits of prewar regional growth, geography and instability rather than imperialism or elite resistance to change appear to have constrained the spread of economic dynamism. And if we consider the contributions of China's present Communist regime to the long-run growth of China's economy, it is not revolutionary change but rather political stability and the injection of new growth poles into formerly stagnant or declining regions that seem most important. Indeed, growing numbers of Chinese as well as foreign observers anticipate that China's economy may now benefit from a partial reversal of the very social reforms whose absence is said to have constrained China's prewar economic growth.

China's experience of regional growth spurts is not unlike that of the United States, Russia, India and other large nations in which industrialization began as a regional, rather than a national phenomenon. Alexander Gerschenkron's influential essay on "Economic Backwardness in Historical Perspective" provides a convenient benchmark for a comparative appraisal of China's prewar development. Surprisingly, we find that Gerschenkron's frame-

work, which is built around the history of France, Germany and Russia and has been applied to Japan, Italy, Austria and numerous other countries, has very little relevance to the Chinese case.

Few of the distinctive ingredients of a Gerschenkronian spurt are present in China, especially in the lower Yangtze region. Unless one looks back to the Opium Wars of 1840-1860, there is no sharp departure from the past. There is no leader comparable to Witte in Russia, Koerber in Austria or the Meiji oligarchs in Japan. The role of the state, so prominent in Russia and Japan, is present in Manchuria but absent in China proper. Although I have emphasized the contribution of new and old financial institutions to economic expansion, commercial banks in China are merely one link in a growing economy; they do not provide the driving force of the Credit Mobilier in France or the investment banks in Germany. Nor is there a distinctive ideology associated with China's prewar economic growth.

In short, we find in China a combination of economic backwardness and rapid regional growth with limited government participation and without massive institutional change or a powerful new ideology. In contrast to Gerschenkron's insistence that[67]

> to break through the barriers of stagnation in a backward country, to ignite the imaginations of men, and to place their energies in the service of economic development. . . . even the businessman, even the classical daring entrepreneur, needs a more powerful stimulus than the prospect of high profits. What is needed to move the mountains of routine and prejudice is faith,

Chinese reality is dull and prosaic. Economic growth in China comes from precisely those sources that Gerschenkron sees as insufficient: the uncoordinated effort of thousands of entrepreneurs, both foreign and Chinese, and of millions of households to improve their material well-being.

APPENDIX A

APPARENT CONSUMPTION OF CEMENT, 1909-1936

Domestic Production

Cement manufacture in China began with the opening of the Japanese-owned Onoda plant in Manchuria in 1909; production in China proper dates from the following year. Available estimates of cement production for China proper, for Manchuria and for the combined national total appear in Table A-1; the figures arise from the following sources and methods:

National Total

For 1909: national total is equal to the Manchurian figure.

For 1910-1921: Chang, Industrial Development in Pre-Communist China, p. 126, assumes that the national total is limited to the combined output of two plants: the Onoda plant in Dairen and the Chinese-owned Ch'i-hsin plant at T'ang-shan. This understates actual output by omitting the production of other plants for which only capacity data appear to exist. I employ the following procedure to arrive at a more realistic estimate of output: (i) calculate the production capacity of all domestic cement plants in each year; (ii) use the output and capacity figures for Onoda and Ch'i-hsin to calculate a combined utilization rate (output divided by capacity) for these two plants alone; (iii) apply this utilization rate to overall capacity to derive an estimated output total for each year. These calculations are performed in Table A-2.

For 1922-1930: Shen-pao nien-chien (Shen-pao Yearbook; Shanghai, 1936), p. 716. Another comprehensive estimate ("Cement Industry in China," Chinese Economic Journal 10 (1932): 32) is rejected because it excludes output from foreign-owned plants.

For 1931-1936: Yeh, "Capital Formation," pp. 247-248. The 1936 figure is calculated from the 1935 total and the growth of output value during 1935/36.

Manchuria

For 1909-1931: output of one plant only, the Onoda facility, as shown in Tung-san-sheng wu-ch'an tzu-yuan yü hua-hsueh kung-yeh (Resource Deposits and the Chemical Industry of the Northeast Provinces), comp. Nihon kōgyō kagaku kai Manshū shibu and translated by Shen Hsueh-yuan (Shanghai, 1933), 2: 334-335.

For 1932-1936: Yeh, "Capital Formation," p. 247.

Table A-1

Domestic Production of Cement, 1903-1936
(Thousand Metric Tons)

Year	China Proper Q_{ct}	Manchuria Q_{mt}	National Total Q_{nt}
1903	0	0	0
1904	0	0	0
1905	0	0	0
1906	0	0	0
1907	0	0	0
1908	0	0	0
1909	0	10	10
1910	29	26	55
1911	54	24	78
1912	104	31	135
1913	90	33	123
1914	132	35	167
1915	132	38	170
1916	120	38	158
1917	150	38	188
1918	162	38	200
1919	179	38	217
1920	182	32	214
1921	202	40	242
1922	266	40	306
1923	298	51	349
1924	256	100	356
1925	278	86	364
1926	385	111	496
1927	386	112	498
1928	457	151	608
1929	548	206	754
1930	496	194	690
1931	503	162	665
1932	542	189	731
1933	595	185	780
1934	547	233	780
1935	555	378	933
1936	799	580	1379

Note: the following conversion factors have been used to compile the tables in Appendixes A, B and C:

1 barrel (for cement) = 375 pounds or approximately 0.17 metric ton

1 picul (for cement and for iron-steel) = 0.06046 metric ton

Table A-2

Capacity of Chinese Cement Plants, 1910-1921
(Thousand Metric Tons)

Year	Plant Capacity					Utilization[e] Rate	Estimated[f] Output
	Onoda[a]	Ch'i-hsin[b]	Hua-chi[c]	Hsi-ts'un[d]	Total		
1910	30	0	0	34	64	.859	55
1911	30	0	34	34	98	.796	78
1912	30	105	34	34	203	.670	135
1913	30	105	34	34	203	.606	123
1914	30	105	34	34	203	.822	167
1915	30	105	34	34	203	.836	170
1916	30	105	34	34	203	.778	158
1917	30	105	34	34	203	.928	188
1918	30	105	34	34	203	.986	200
1919	30	105	34	34	203	1.067	217
1920	30	105	34	34	203	1.054	214
1921	30	105	34	34	203	1.193	242

[a] Tung-san-sheng, 2: 333.

[b] Ch'i-hsin, pp. 151-152.

[c] Yang Ta-chin, Hsien-tai Chung-kuo shih-yeh chih (Gazetteer of China's Industries; Shanghai, 1935), 1: 995-996, gives a constant annual "output" -- apparently meaning capacity rather than production -- of 200,000 barrels or 34,000 tons for 1912-1933. "Cement Industry in China," p. 27, states that this plant was erected in 1910.

[d] Ch'en Chen, ed., Chung-kuo chin-tai kung-yeh-shih tzu-liao (Historical Materials on China's Modern Industries, collection 4; Peking, 1961), part 2, p. 729, indicates that this plant was similar in size to the Hua-chi plant but was built one year earlier.

[e] Ratio of combined output to combined capacity for two plants, Onoda and Ch'i-hsin, calculated from Tung-san-sheng, 2: 333-335 and Ch'i-hsin, pp. 151-152.

[f] Product of figures in previous two columns.

China Proper

For 1910-1936: output is calculated as the residual difference between national and Manchurian production.

Imports

Available data for net cement imports (total imports less re-exports) into China proper, Manchuria and the combined national total are shown in Table A-3. These data come from the following sources:

National Total

For 1903-1928: Tuan-liu Yang and Hou-pei Hou, Statistics of China's Foreign Trade During the Last Sixty-five Years (Peking, 1931), p. 48. These data are generally identical with the net import figures shown in the annual trade returns published by the Maritime Customs. There are, however, occasional discrepancies: the customs figures for 1910, for example, show net imports 16% above the figure reported by Yang and Hou.

For 1929-1931: Ch'i-hsin yang-hui kung-ssu shih-liao (Historical Materials on the Ch'i-hsin Cement Company), comp. Nankai University Economic Research Center and Department of Economics (Peking, 1963), pp. 49-50.

For 1932-1936: sum of components.

Manchuria

For 1903: China, Maritime Customs, Returns of Trade and Trade Reports, 1903 (Shanghai, 1904), part 2, p. 15.

For 1904: China, Maritime Customs, Returns of Trade and Trade Reports, 1904 (Shanghai, 1905), part 2, p. 29 shows no imports into Manchurian ports.

For 1905-1908: China, Maritime Customs, Returns of Trade and Trade Reports, 1908 (Shanghai, 1909), 1: 132.

For 1909-1911: China, Maritime Customs, Returns of Trade and Trade Reports, 1911 (Shanghai, 1912), part 3, 1: 151.

For 1912-1914: China, Maritime Customs, Returns of Trade and Trade Reports, 1914 (Shanghai, 1915), part 3, 1: 254

For 1915-1917: China, Maritime Customs, Returns of Trade and Trade Reports, 1917 (Shanghai, 1918), part 3, 1: 250.

For 1918-1920: China, Maritime Customs, Foreign Trade of China, 1920 (Shanghai, 1921), p. 232.

Table A-3

Imports and Exports of Cement, 1903-1936
(Thousand Metric Tons)

Year	Annual Imports of Cement			Annual Exports of Cement		
	China Proper	Manchuria	National Total	China Proper	Manchuria	National Total
	M_{ct}	M_{mt}	M_{nt}	E_{ct}	E_{mt}	E_{nt}
1903	20	1	21	0	0	0
1904	16	0	16	0	0	0
1905	33	0	33	0	0	0
1906	55	0	55	0	0	0
1907	78	18	96	0	0	0
1908	64	21	85	0	0	0
1909	76	24	100	0	0	0
1910	57	46	103	0	0	0
1911	29	18	47	0	0	0
1912	20	10	30	11	2	13
1913	17	20	37	17	7	24
1914	33	21	54	22	6	28
1915	34	8	42	23	8	31
1916	33	17	50	12	2	14
1917	26	17	43	22	2	24
1918	21	31	52	27	3	30
1919	32	60	92	9	1	10
1920	66	40	106	9	1	10
1921	119	34	153	5	0	5
1922	156	36	192	0	0	0
1923	124	36	160	15	1	16
1924	93	15	108	18	6	24
1925	87	19	106	16	8	24
1926	106	40	146	14	14	28
1927	90	26	116	22	8	30
1928	118	20	138	37	26	63
1929	139	32	171	45	19	64
1930	171	13	184	38	23	61
1931	190	9	199	21	6	27
1932	212	22	234	4	26	30
1933	138	204	342	1	3	4
1934	79	325	404	0	0	0
1935	68	150	218	0	11	11
1936	35	169	204	2	93	95

For 1921-1923: China, Maritime Customs, Foreign Trade of China, 1923 (Shanghai, 1924), part 2, 1: 241.

For 1924-1926: China, Maritime Customs, Foreign Trade of China, 1926 (Shanghai, 1927), part 2, 1: 526.

For 1927-1929: China, Maritime Customs, Foreign Trade of China, 1929 (Shanghai, 1930), part 2, 1: 504.

For 1930-1931: China, Maritime Customs, Foreign Trade of China, 1931 (Shanghai, 1932), part 2, 1: 528.

For 1932-1936: Annual Returns of the Foreign Trade of Manchoukuo (Dairen, annual), 1932 edition, pp. 282-283; 1934 edition, pp. 284-285; 1936 edition, part 1, pp. 332-333. These totals exclude imports from the Republic of China.

China Proper

For 1903-1931: national total less imports into Manchurian ports

For 1932: total net imports less imports into Manchurian ports from China, Maritime Customs, The Trade of China, 1932 (Shanghai, 1933), 2: 67 and 3: 353.

For 1933: China, Maritime Customs, The Trade of China, 1933 (Shanghai, 1934), 3: 401.

For 1934-1936: China, Maritime Customs, The Trade of China, 1936 (Shanghai, 1937), 2: 555.

Exports

Exports of cement apparently began in 1912; we assume that no cement was exported before that year.

National Total

For 1912-1914: Returns of Trade, 1914, part 3, 2: 649.

For 1915-1917: Returns of Trade, 1917, part 3, 2: 651-652.

For 1918-1920: Foreign Trade of China, 1920, part 2, 2: 618-619.

For 1921-1923: Foreign Trade of China, 1923, part 2, 2: 643-644.

For 1924-1926: Foreign Trade of China, 1926, part 2, 1: 526.

For 1927-1929: Foreign Trade of China, 1929, part 2, 2: 492.

For 1930-1931: Foreign Trade of China, 1931, part 2, 2: 533.

For 1932-1936: sum of regional components.

Manchuria

For 1912-1931: calculated from the national export totals as follows:

$$E_m = E_n \times \frac{\text{original export of cement from Manchurian ports}}{\text{original export of cement from all ports}}$$

We assume that Manchuria's share in exports of cement is identical with its share in original exports of cement, a category that includes overseas shipments plus those domestic shipments cleared through the Maritime Customs. Data for national exports (E_n) and for original export of cement by port are taken from the sources for national cement exports cited above.

For 1932-1936: Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, pp. 100-101; 1934 edition, pp. 108-109; 1936 edition, pp. 120-121. The totals exclude exports to the Republic of China.

China Proper

For 1912-1931: national exports minus exports from Manchurian ports.

For 1932: exports abroad less shipments from the Manchurian ports of Antung and Dairen as shown in The Trade of China, 1932, 4: 161.

For 1933: The Trade of China, 1933, 2: 148-149.

For 1934-1936: The Trade of China, 1936, 3: 245, excluding shipments to Manchuria.

Apparent Consumption

Our estimates of apparent consumption (or domestic disappearance) of cement are based on current flows of production and trade. Time lags between production or import and consumption are not considered, and the impact of inventory changes, about which little information exists, is ignored. In view of the perishable nature of cement, however, the resulting errors are probably minor. Estimates of apparent consumption of cement for China Proper, Manchuria and the combined national total are shown in Table A-4.

National Total

Apparent consumption of cement at the national level is calculated from the equation $A_{nt} = Q_{nt} + M_{nt} - E_{nt}$ using annual data for output (Q), imports (M) and exports (E) derived in Tables A-1 and A-3. Prior to 1909, Q and E are zero, making apparent consumption equal to annual imports. Results appear in Table A-4.

Table A-4

Apparent Consumption of Cement, 1903-1936
(Thousand Metric Tons)

Year	Physical Quantity			Index With 1933=100		
	China Proper	Manchuria	National Total	China Proper	Manchuria	National Total
	A_{ct}	A_{mt}	A_{at}	I_{ct}	I_{mt}	I_{at}
1903	20	1	21	2.7	0.2	1.9
1904	16	0	16	2.2	0.0	1.4
1905	33	0	33	4.4	0.0	3.0
1906	55	0	55	7.4	0.0	4.9
1907	78	18	96	10.5	4.3	8.6
1908	64	21	85	8.6	5.6	7.6
1909	76	24	110	10.2	6.4	9.8
1910	86	72	158	11.6	19.9	14.1
1911	83	42	125	11.2	11.2	11.2
1912	113	39	152	15.2	10.4	13.6
1913	90	46	136	12.1	12.2	12.2
1914	143	50	193	19.3	13.3	17.3
1915	143	38	181	19.3	10.1	16.2
1916	141	53	194	19.0	14.1	17.4
1917	154	53	207	20.8	14.1	18.5
1918	156	66	222	21.0	17.6	19.8
1919	202	97	299	27.2	25.8	26.7
1920	247	63	310	33.3	16.8	27.7
1921	318	72	390	42.8	19.1	34.9
1922	422	76	498	56.9	20.2	44.5
1923	400	93	493	53.9	24.7	44.1
1924	334	106	440	45.0	28.2	39.4
1925	369	77	446	49.7	20.5	39.9
1926	488	126	614	65.8	33.5	54.9
1927	408	176	584	55.0	46.8	52.2
1928	508	175	683	68.5	46.5	61.1
1929	648	213	861	87.3	56.6	77.0
1930	655	158	813	88.3	42.0	72.7
1931	696	141	837	93.8	37.5	74.9
1932	757	178	935	102.0	47.3	83.6
1933	742	376	1118	100.0	100.0	100.0
1934	631	553	1184	85.0	147.1	105.9
1935	627	513	1140	84.5	136.4	102.0
1936	832	656	1488	112.1	174.5	133.1

Manchuria

Apparent consumption of cement in Manchuria is calculated from the equation $A_{mt} = Q_{mt} - M_{mt} - E_{mt} - E_{mct} + E_{cmt}$ where t is a time subscript, Q, M and E (representing regional production, imports and exports) are tabulated in Tables A-1 and A-3 and the interregional trade flows E_{mct} (shipments of cement from Manchuria to China Proper in year t) and E_{cmt} (shipments from China Proper to Manchuria in year t) are compiled in Table A-5. In the absence of relevant data, we assume that interregional cement flows were negligible prior to 1920.

China Proper

Apparent consumption of cement in China Proper is dervied in Table A-4 as the difference between the national and Manchurian totals.

Table A-5

Interregional Shipments of Cement, 1920-1936
(Thousand Metric Tons)

Year	From China Proper To Manchuria E_{cmt}	From Manchuria To China Proper E_{mct}
1920	0[a]	8[b]
1921	1[b]	3[b]
1922	4[b]	4[b]
1923	11[b]	4[b]
1924	7[b]	10[b]
1925	8[b]	28[b]
1926	25[b]	36[b]
1927	66[b]	20[b]
1928	43[b]	13[b]
1929	28[c]	34[d]
1930	52[c]	78[d]
1931	43[c]	67[d]
1932	3[e]	10[e]
1933	2[e]	12[e]
1934	3[e]	8[e]
1935	0[e]	4[e]
1936	0[e]	0[e]

[a] assumed.

[b] Mantetsu chōsaka, Manshū ni okeru sementō kōgyō to sono jukyū jōkyō (The Manchurian Cement Industry and its Supply and Demand Conditions; Dairen, 1930), pp. 32-33 and 47-49.

[c] In 1926-1928, the Ch'i-hsin works shipped 90,000 tons of cement to Manchuria (Tung-san-sheng 2: 351) or 67% of total shipments from China to Manchuria of 134,000 tons. Total shipments from China to Manchuria during 1929-1931 are estimated by assuming that annual shipments from Ch'i-hsin to Manchuria given in ibid. amounted to 67% of the total in each year.

[d] Shipments from the Onoda works to China proper shown in ibid., 352.

[e] Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, pp. 100-101 and 282-283; 1934 edition, pp. 108-109 and 284-285; 1936 edition, pp. 120-121 and 332-333.

APPENDIX B

APPARENT CONSUMPTION OF IRON AND STEEL PRODUCTS, 1903-1936

Domestic Production

Modern ferrous metallurgy in China dates from 1900, when the Han-yeh-p'ing works began operations in Hupei province. Throughout the prewar period, the main product of the iron-steel sector in both China proper and Manchuria was pig iron. Domestic production estimates in this appendix are based on pig iron alone. If incomplete statistics on steel output were included (they show average output of about 37,000 tons during 1912-1931, with a peak of 77,000 tons in 1921 -- see Ch'en, Chung-kuo chin-tai kung-yeh-shih tzu-liao, coll. 4, part 2, p. 754), the same metal would be counted twice.

Estimated output of pig iron is shown in Table B-1. The figures exclude production of native iron in traditional furnaces in order to limit the estimate to products of "modern" industrial activity.

Imports

Estimated imports of iron and steel products are shown in Table B-2. Where the estimates are compiled directly from the Maritime Customs reports, they include all forms of iron and steel products. Iron ore is excluded, but scrap metal is included because the wide geographic dispersion of scrap imports shows that scrap was used in small-scale foundries and machine shops whose metallurgical output is not covered by Table B-1. Except as noted, import data are net of reexports.

National Total

For 1903 and 1904: Returns of Trade, 1904, part 1, pp. 6-7.

For 1905-1908: Returns of Trade, 1908, 1: 83-99, including classes 73-89.

For 1909-1911: Returns of Trade, 1911, part 1, pp. 22-23 and part 3, 1: 88-104, including classes beginning with anchors and ending with galvanized iron wire.

For 1912-1931: Ch'en, Chung-kuo chin-tai kung-yeh-shih tzu-liao, collection 4, part 2, p. 754.

For 1932-1936: sum of components.

Manchuria

For 1903: Returns of Trade, 1903, part 2, p. 14.

For 1904: Returns of Trade, 1904, part 2, pp. 10-11.

For 1905-1908: Returns of Trade, 1908, 1: 83-99, including classes 73-89.

Table B-1

Domestic Production of Pig Iron, 1903-1936
(Thousand Metric Tons)

Year	China Proper Q_{ct}	Manchuria Q_{mt}	National Total Q_{nt}
1903	39	0	39
1904	39	0	39
1905	32	0	32
1906	51	0	51
1907	62	0	62
1908	66	0	66
1909	74	0	74
1910	119	0	119
1911	83	0	83
1912	8	0	8
1913	98	0	98
1914	130	0	130
1915	136	30	166
1916	150	49	199
1917	150	38	188
1918	139	45	184
1919	166	110	276
1920	134	124	258
1921	140	93	233
1922	164	60	224
1923	73	100	173
1924	27	133	160
1925	54	146	200
1926	12	214	226
1927	4	228	232
1928	11	244	255
1929	14	294	308
1930	3	348	351
1931	10	342	352
1932	45	368	413
1933	36	434	470
1934	45	476	521
1935	40	608	648
1936	37	633	670

Table 3-2

Imports and Exports of Iron and Steel Products, 1903-1936
(Thousand Metric Tons)

Year	Annual Import Volume			Annual Export Volume		
	China Proper	Manchuria	National Total	China Proper	Manchuria	National Total
	M_{ct}	M_{mt}	M_{nt}	E_{ct}	E_{mt}	E_{nt}
1903	109	11	120	0	0	0
1904	118	10	128	12	0	12
1905	152	18	170	23	0	25
1906	159	17	176	34	0	34
1907	142	8	150	33	0	33
1908	135	21	156	31	0	31
1909	209	34	243	39	0	39
1910	174	62	236	65	0	65
1911	153	39	192	71	0	71
1912	121	30	151	13	0	13
1913	208	37	245	71	0	71
1914	187	43	230	79	0	79
1915	103	23	126	85	19	104
1916	106	40	146	114	42	156
1917	77	46	123	134	30	164
1918	87	62	149	154	36	190
1919	219	106	325	99	69	168
1920	308	59	367	163	35	198
1921	198	75	273	99	65	164
1922	279	86	365	144	67	211
1923	236	74	310	144	71	215
1924	385	109	494	182	90	272
1925	282	123	405	75	129	204
1926	309	125	434	1	170	171
1927	250	139	389	0	206	206
1928	407	218	625	0	225	225
1929	438	196	634	0	210	210
1930	409	118	527	30	190	220
1931	499	59	558	0	251	251
1932	520	128	648	0	369	369
1933	581	256	837	0	491	491
1934	615	432	1047	7	440	447
1935	594	402	996	0	433	433
1936	646	274	920	1	446	447

For 1909-1911: Returns of Trade, 1911, part 3, 1: 88-104.

For 1912-1931: calculated from the national total and from the share of Manchurian ports in overall imports of iron and steel products derived from Statistics of Commodity Flow of Chinese Maritime Customs and Railways (1912-1936) (Shanghai, 1937), p. 145.

For 1932-1936: Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, pp. 178-187; 1934 edition, pp. 158-171; 1936 edition, pp. 172-185. In each case, categories included are those numbered 109-139 for which data on physical quantities of imports are presented. Imports from China proper are excluded.

China Proper

For 1903-1931: calculated as residual from national and Manchurian figures.

For 1932: calculated by subtracting imports into Manchurian ports from the totals shown in The Trade of China 1933, 3: 100-130. Categories 109-139 are included in the total. Quantity of scrap imports for 1932 (class 134, p. 124) and of iron and steel n.o.r. for 1932 (class 136, p. 126) are estimated from the corresponding value totals by assuming that average unit values in each class were identical in 1932 and 1933.

For 1933: ibid., 3: 100-130, including returns 109-139.

For 1934-1936: The Trade of China, 1936, 2: 139-175, including classes 109-139.

Exports

China began to export ferrous metal products in 1904. National and regional export figures appear in Table B-2. Sources are as follows:

National Total

For 1904: Returns of Trade, 1904, part 1, p. 10.

For 1905-1907: export of iron (pig and manufactured) to foreign countries, including reexports. Returns of Trade, 1908, part 3, 2: 339.

For 1908-1911: export of articles 79-80, iron and steel, manufactured and unmanufactured, to foreign countries, including reexports. Returns of Trade, 1911, part 3, 2: 411-412.

For 1912-1931: Ch'en, Chung-kuo chin-tai kung-yeh-shih tzu-liao, collection 4, part 2, p. 754. Note that for 1927-29, Ch'en's figures fall below the Manchurian export data cited below by 2, 5 and 5 thousand tons respectively. The national totals for these three years have been increased to match the Manchurian export estimates.

For 1932-1936: sum of components.

Manchuria

For 1903-1904: there were no exports from Manchuria. Returns of Trade, 1904, part 1, p. 10.

For 1905-1924: exports from Manchuria are estimated from the following equation:

$$E_m = E_n \times \frac{\text{original export from Manchurian ports}}{\text{original export from all ports}}$$

where the original export figures include shipments to domestic as well as foreign destinations. Thus Manchuria's share in exports abroad is assumed to be equal to its share in total tonnage shipped to domestic and foreign destinations as recorded by the Maritime Customs. Data for national exports abroad (E_n) are compiled in Table B-2. Data on original exports from Manchurian ports and from all ports come from the following sources:

for 1905-1907: Returns of Trade, 1908, part 3, 2: 339, including article 64.

for 1908-1911: Returns of Trade, 1911, part 3, 2: 411-412, including articles 79-80.

for 1912-1914: Returns of Trade, 1914, part 3, 2: 575-581, including articles 11-13, 15-16 (no exports abroad are shown for item 14).

for 1915-1917: Returns of Trade, 1917, part 3, 2: 565-574, including items 11-16.

for 1918-1920: Foreign Trade of China, 1920, part 2, 2: 536-544, items 11-16.

for 1921-1923: Foreign Trade of China, 1923, part 2, 2: 555-564, items 11-16.

for 1924-1925: Foreign Trade of China, 1926, part 2, 2: 500-501, item 314. Items 311 and 312 are omitted because the export data are in value terms only, but Manchurian exports of these items are only a tiny fraction of export value for item 314, so the resulting error is trivial.

For 1926-1931: Manchuria Yearbook, 1932-33 edition (Tokyo, 1932), p. 161 and Manchoukuo Yearbook, 1934 edition (Tokyo, 1934), p. 333. Data include exports of pig iron to Japan and to all other countries except the Republic of China.

For 1932-1936: exports of pig iron and, for 1936 only, of ingots, billets, slabs, blooms and sheet-bars, given in Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, p. 99; 1934 edition, p. 109; 1936 edition, p. 117.

China Proper

For 1904: identical with national total.

For 1905-1931: difference between national total and estimated exports from Manchurian ports.

For 1932: The Trade of China, 1932, 4: 157, including article 285 (pig iron and kentledge) shipped from Chinese ports. Items 284 and 286 are omitted because there are no physical quantity data in the source.

For 1933: The Trade of China, 1933, 2: 146-147, items 284-285.

For 1934-1936: The Trade of China, 1936, 3: 231-234, including items 284-286 except for those subdivisions for which no quantity data appear in the source. Exports to the Kwantung leased tarritory (part of Manchuria) are excluded.

Apparent Consumption

As with cement, our estimates of apparent consumption of iron and steel products are based on current production and trade flows with no allowance for time lags or inventory changes. Estimates of apparent consumption of iron and steel products are shown in Table B-3.

National Total

Apparent consumption of iron and steel products at the national level is calculated from $A_{nt} = Q_{nt} + M_{nt} - E_{nt}$ using annual data for output (Q), imports (M) and exports (E) shown in Tables B-1 and B-2.

Manchuria

Apparent consumption of iron and steel products in Manchuria is calculated from $A_{mt} = Q_{mt} + M_{mt} - E_{mt} - H_{mct} + H_{cmt}$ where t is a time subscript, Q, M and E (representing regional output, imports and exports) are compiled in Tables B-1 and B-2, and the interregional trade flows H_{mct} (shipments of iron-steel products from Manchuria to China proper in year t) and H_{cmt} (shipments from China proper to Manchuria in year t) shown in Table B-4. Annual flows from Manchuria to China proper are assumed to be negligible prior to 1920. Data for reverse shipments from China proper to Manchuria could be found only from 1932. Since the annual maximum for 1932-1936 is only 2,000 tons, we have assumed that H_{cmt} was zero prior to 1932.

Table B-3

Apparent Consumption of Iron and Steel Products, 1903-1936
(Thousand Metric Tons)

Year	Physical Quantity			Index With 1933=100		
	China Proper	Manchuria	National Total	China Proper	Manchuria	National Total
	A_{ct}	A_{mt}	A_{nt}	I_{ct}	I_{mt}	I_{nt}
1903	148	11	159	23.2	6.1	19.5
1904	145	10	155	23.1	5.6	19.2
1905	159	18	177	25.0	10.0	21.7
1906	176	17	193	27.6	9.5	23.6
1907	171	8	179	26.8	4.5	21.9
1908	170	21	191	26.7	11.7	23.4
1909	244	34	278	38.3	19.0	34.1
1910	228	62	290	35.8	34.6	35.5
1911	165	39	204	25.9	21.8	25.0
1912	116	30	146	18.2	16.8	17.9
1913	235	37	272	36.9	20.7	33.3
1914	238	43	281	37.4	24.0	34.4
1915	154	34	188	24.2	19.0	23.0
1916	142	47	189	22.3	26.2	23.2
1917	93	54	147	14.6	30.2	18.0
1918	72	71	143	11.3	39.7	17.5
1919	286	147	433	44.9	82.1	53.1
1920	279	148	427	43.8	82.7	52.3
1921	240	102	342	37.7	57.0	41.9
1922	301	77	378	47.2	43.0	46.3
1923	169	99	268	26.5	55.3	32.8
1924	238	144	382	37.4	80.4	46.8
1925	272	129	401	42.7	72.1	49.1
1926	330	159	489	51.8	88.8	59.9
1927	272	143	415	42.7	79.9	50.8
1928	440	215	655	69.1	120.1	80.3
1929	474	258	732	74.4	144.1	89.7
1930	422	236	658	66.2	131.8	80.6
1931	548	111	659	86.0	62.0	80.8
1932	595	97	692	93.4	54.2	84.8
1933	637	179	816	100.0	100.0	100.0
1934	671	450	1121	105.3	251.4	137.4
1935	659	552	1211	103.4	308.4	148.4
1936	705	438	1143	110.7	244.7	140.1

Table B-4

International Shipments of Iron-Steel Products, 1920-1936

Year	From China Proper To Manchuria E_{cmt}	From Manchuria To China Proper E_{mct}
1920	0[a]	0[b]
1921	0[a]	1[a]
1922	0[a]	2[a]
1923	0[a]	4[b]
1924	0[a]	8[a]
1925	0[a]	11[b]
1926	0[a]	10[c]
1927	0[a]	18[c]
1928	0[a]	22[c]
1929	0[a]	22[c]
1930	0[a]	40[d]
1931	0[a]	39[e]
1932	1[f]	31[f]
1933	1[f]	21[f]
1934	2[f]	20[f]
1935	0[f]	25[f]
1936	1[f]	24[f]

[a] Assumed.

[b] Shipments of Anshan pig iron to China proper reported in Manshū kaihatsu yonjū nenshi (Forty-Year History of Manchuria's Development; Tokyo, 1964-65), 2: 456.

[c] Midpoint of range given by two separate citations: ibid. and Manchuria Yearbook, 1932-33 edition, p. 161; the latter gives figures for pig iron exports to China.

[d] ibid., 161.

[e] Manchoukuo Yearbook, 1934 edition, p. 333, which gives pig iron exports to China.

[f] Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, pp. 99, 178-187; 1934 edition, pp. 105, 158-171; 1936 edition, pp. 117, 172-185. Data for shipments from China proper include items 109-139 for which quantity data are presented. Data for shipments from Manchuria include pig iron and, for 1936 only, ingots, billets, slabs, blooms and sheet-bars.

APPENDIX C

APPARENT CONSUMPTION OF MACHINERY, 1903-1936

The purpose of this appendix is to derive time series estimates of apparent consumption (or domestic disappearance) of machinery during 1903-1936 for China proper, Manchuria and for the combined national total. Since the estimates are in terms of values, it is essential to use a common price base. In this case, the year 1933 is used as a base. Our result, therefore, will be regional and national time series estimates of apparent consumption of machinery in terms of 1933 yuan.

Domestic Production

National Total

For 1903-1930:

The growth of domestic machinery manufacture prior to 1931 is a topic for which systematic data are not presently available. Although quantitative and qualitative materials convey an impression of rapid growth, it is not possible to avoid arbitrary assumptions in constructing output estimates for this period.

What can be said about the size of the engineering industry on the eve of World War I? We may begin with the results of a 1933 survey which sought to include results for all factories in China proper using mechanical power and employing over thirty workers:

Category	Employment (1000s)	Capital (1000 yuan)	1932 Sales (1000 yuan)
Machinery & metal processing	19.9	16550	32876
Transport equipment	16.6	19004	22352
Combined total	36.5	35554	55228

Source: Liu Ta-chün, Chung-kuo kung-yeh tiao-ch'a, 2: 40-41; 253-255; 387-389.

Since prices of metals in Shanghai rose by less than 3% between 1932 and 1933 (see Shang-hai chieh-fang ch'ien-hou wu-chia tzu-liao hui-pien (1921-1957) (Collected Materials on Shanghai Prices Before and After Liberation - 1921-1957; Shanghai, 1958), p. 126, the sales/employment ratio of 1513 yuan and the sales/capital ratio of 1.55 derived from the totals given above for machinery, metal processing and transport equipment may be taken as approximations to figures in 1933 prices.

Railway shops, arsenals, dockyards and other public-sector firms dominated China's engineering industry on the eve of World War I. Information on these firms is available from the Nung-shang t'ung-chi piao (Statistical Tables of Agriculture and Commerce; Peip'ing, annual), which give the following national totals:

	1914	1915
Transport equipment	1861	1849
Tools	8373	2505
Total	19513	9529
Number of firms		
Machinery	60	111
Transport equipment	152	141
Tools	577	175
Total	789	427

Source: Nung-shang t'ung-chi piao 3 (1914): 134-135 and 4 (1915): 332-336.

These series, like many others in this source, include large annual fluctuations that point to the unreliability of all the data. Despite this problem, we may speculate that if output per man-year, in terms of 1933 yuan, were between 500 and 1000 yuan, total output might have been 10-20 million 1933 yuan in 1914 or 5-10 million yuan in 1915, depending on the accuracy of the employment totals from the Nung-shang t'ung-chi piao.

Since engineering activity at the time of World War I was dominated by repair work, it is evident that production of investment goods was extremely small in comparison to the estimated output of 76-134 million yuan (at 1933 prices) shown for 1931-1936 in Table C-1. Indeed, this survey of available, although admittedly unreliable evidence suggests that there was very little domestic production of engineering goods on the eve of the First World War.

These sketchy observations form the basis for arbitrarily constructing an output series for domestic manufacture of machinery. For years prior to 1913, output is assumed to be negligible. For 1913, we assume a national output total of one million 1933 yuan. For the years 1914-1930, annual output is filled in by arithmetic interpolation between the 1913 figure and K.C. Yeh's 1931 estimate of 76 million 1933 yuan shown in Table C-1.

The resulting series of output figures appears in Table C-1. Although these figures represent arbitrary assumptions, it is hoped that their pattern of rapid growth from a tiny base, a pattern that conforms with the impression given by available information, is not wildly at variance with the actual, but unknown development path.

For 1931-1936: we use K.C. Yeh's estimates for domestic supply of factory capital goods ("Capital Formation," p. 303).

for 1908-1911: Returns of Trade, 1911, part 3, 1: 177, 191, 236-244, 277, 296, 304, 310-316.

for 1912-1914: Returns of Trade, 1914, part 3, 1: 297, 320, 397-405, 449-450, 463, 498, 513, 524-532.

for 1915-1917: Returns of Trade, 1917, part 3, 1: 288, 309, 386-393, 449, 483, 507-514.

for 1918-1920: Foreign Trade of China, 1920, part 2, 1: 267, 289, 364-372, 410-411, 423, 455, 469, 479-486.

for 1921-1923: Foreign Trade of China, 1923, part 2, 1: 278, 300, 375-382, 421-422, 435, 465, 489-497.

for 1924-1926: Foreign Trade of China, 1926, part 2, 1: 596, 630-639, 648, 653, 664, 668, 676-683.

For 1927-1928: Foreign Trade of China, 1928 (Shanghai, 1929), part 2, 1: 508-509, 523, 532, 559, 588, 591-601, 611, 615, 626, 630, 635-644, including articles 741-744, 766, 776, 794-803a, 824, 826-834a, 841, 844, 851-851a, 853, 856-862b.

For 1929-1931: Foreign Trade of China, 1931, part 2, 1: 542, 556, 565, 592, 627-639, 648, 652, 663, 667, 673-681, including the same articles as for 1927-1928.

For 1932-1936: sum of regional components.

The results of these compilations appear in Table C-2.

Manchuria

For 1903-1931: Manchurian machinery imports are compiled from the sources used to calculate national machinery imports, but the totals are limited to imports into Manchurian ports.

For 1932-1936: machinery imports are compiled from Annual Returns of the Foreign Trade of Manchoukuo, 1932 edition, pp. 188-199, 204-209; 1934 edition, pp. 172-185, 188-191, 194-195; 1936 edition, pp. 188-203, 210-215, 218-219, including returns 145-174, 186-189, 193 and 200-201. Imports from the Republic of China are excluded from the totals. Data for 1932 are reported in terms of "Customs Gold Units," which are converted into Haikwan taels at the 1932 Dairen rate of 1.1332 taels per gold unit shown in ibid., 1932 edition, p. 1 (Dairen accounted for nearly three-fourths of Manchuria's foreign trade in 1932). For 1933-1936, data are reported in terms of Manchoukuo yuan and have been

Table C-2

Imports of Machinery, 1903-1936

Year	Import Total At Current Prices (Million Haikwan Taels (1903-32) or Yuan (1933-36)) China M^{c}_{ct}	Manchuria M^{c}_{mt}	National M^{c}_{nt}	Exchange Rate e_t	Price Index P_t	Import Total At 1933 Prices (Million Yuan) M_{nt}
1903	10.629	0.532	11.161	0.132	0.820	29.111
1904	9.955	0.360	10.316	0.143	0.820	29.147
1905	13.991	0.040	14.031	0.150	0.820	41.586
1906	19.104	0.164	19.268	0.164	0.848	60.376
1907	16.359	4.803	21.162	0.162	0.876	63.409
1908	9.496	7.135	16.631	0.133	0.848	42.262
1909	11.788	2.058	13.846	0.130	0.848	34.392
1910	14.747	2.825	17.572	0.135	0.848	45.325
1911	10.796	2.809	13.605	0.134	0.876	33.720
1912	9.029	4.514	13.543	0.153	0.913	36.772
1913	14.212	2.764	16.976	0.151	0.950	43.719
1914	21.009	3.348	24.857	0.136	0.903	60.657
1915	9.611	3.393	13.504	0.130	1.153	24.669
1916	14.823	15.971	30.794	0.166	1.374	60.279
1917	11.437	8.101	19.538	0.216	1.770	38.632
1918	12.283	7.890	20.173	0.264	1.946	44.342
1919	25.601	18.547	44.148	0.317	2.277	99.584
1920	41.999	9.186	51.185	0.340	2.292	123.024
1921	96.457	10.929	107.386	0.198	1.617	213.052
1922	80.057	9.096	89.153	0.188	1.322	222.231
1923	39.676	9.532	49.208	0.174	1.161	119.491
1924	31.954	12.749	44.703	0.183	1.183	112.043
1925	28.750	9.522	38.272	0.174	1.179	91.516
1926	31.393	16.326	47.719	0.156	1.156	104.337
1927	32.673	18.393	51.566	0.141	1.177	100.089
1928	35.410	20.201	55.611	0.146	1.193	110.269
1929	59.305	23.577	82.882	0.132	1.225	144.704
1930	32.956	20.784	103.740	0.094	1.117	141.450
1931	91.313	14.269	106.082	0.077	1.044	126.769
1932	59.647	3.385	68.032	0.907	1.041	102.711
1933	95.301	38.005	133.306	0.062	1.000	133.913
1934	110.828	69.430	180.258	0.067	1.062	184.258
1935	111.763	51.045	162.308	0.074	1.087	179.581
1936	127.125	59.951	187.076	0.060	1.160	156.781

Sources and methodology are explained in the text of this Appendix.

converted to Chinese yuan using the following annual exchange rates (Dairen exchange on Shanghai):

	Chinese yuan per 100 Manchoukuo yuan
1933	98.13
1934	97.19
1935	102.812
1936	103.864

Source: Manshū keizai nempō 1937 (Manchuria Economic Yearbook, 1937; Tokyo, 1937), 1: 354

Results of these compilations appear in Table C-2.

China Proper

For 1903-1931: imports to China proper are the difference between the national total and imports into Manchurian ports.

For 1932: The Trade of China, 1932, 3: 120-145, 156-160, 162-163, 168-170, including items 145-174, 186-189, 193 and 200-201. Imports into Manchurian ports are excluded. The data are reported in terms of "Customs Gold Units," which are converted to Haikwan taels at the average 1932 exchange for Shanghai, 1.184 taels per gold unit, reported in ibid., prefatory matter.

For 1933-1936: The Trade of China, 1933, 3: 135-164, 176-180, 183, 190-191; The Trade of China, 1936, 2: 210, 224-225, 237-242, 245-246, 254-257, including the same items listed for 1932. Import totals are net of reexports and exclude shipments from the Kwantung Leased Territories (in Manchuria). Data are reported in "Customs Gold Units," which are converted to Chinese yuan at the following rates given in ibid, 2: prefatory matter: for 1934, 1.952 yuan per gold unit; for 1935, 1.866 yuan per gold unit; for 1936, 2.260 yuan per gold unit.

Results of these compilations appear in Table C-2.

Imports - Constant Price Series

National Total

The value of machinery imports in terms of 1933 prices is calculated from the following relation:

$$M_{nt} = \frac{M^{*}_{nt} \; e_t \; k}{P_t}$$ where

M_{nt} = imports of machinery in year t, valued in 1933 prices

M^{*}_{nt} = imports of machinery in year t, valued in current prices: Haikwan taels (1903-1932) or Chinese yuan (1933-1936)

e_t = average value in year t in terms of British pounds of one Haikwan tael (for 1903-1932) or one Chinese yuan (for 1933-1936) given in Hsiao, China's Foreign Trade Statistics, pp. 191-192

k = average exchange rate: 16.2025 yuan per British pound for 1933 given in ibid., 192.

P_t = index of British prices of "plant and machinery" with 1933=1 calculated from C.H. Feinstein, National Income, Expenditure and Output of the United Kingdom, 1855-1965 (Cambridge, 1972), pp. T136-137.

In effect, this calculation begins by transforming the current value of machinery imports (M^*_{nt}) into British pounds using the current year's exchange rate (e_t). The resulting figure is then expressed in 1933 values using the machinery price index (P_t) and converted into Chinese yuan at the 1933 exchange rate (k). British machinery prices are used because Britain was the leading supplier of engineering goods imported by China throughout much of the period covered by the present study.

It is important to recognize that both the initial conversion from taels or yuan to pounds (using e_t) and the reconversion to yuan (using k) are needed to correctly estimate the real value of machinery imports. Suppose we were to adopt the methodology of K.C. Yeh ("Capital Formation," p. 308) and calculate a constant price series as follows:

$$\bar{M}_{nt} = M^*_{nt}/P_t.$$

Calculating $\bar{M}_{nt}$ merely deflates the current value of imports by an index of foreign machinery prices. If the tael or yuan value of imports and the level of foreign machinery prices do not change, then the estimated real value of imports must remain constant, even though the international value of the tael or yuan, and hence the real value of machinery imports, may move in either direction. Thus $\bar{M}$ is a satisfactory measure of real import values only if the international value of the tael or yuan remains constant, in which case $ke_t=1$ for all t and M becomes identical with $\bar{M}$. Since e_t, as shown in Table C-2, fluctuates widely, M must be preferred to $\bar{M}$ as a measure of the real value of machinery imports.

Time series for M^*, e and P and the resulting values of M_{nt} are all shown in Table C-2.

Manchuria

The real value of machinery imports into Manchuria, expressed in 1933 prices, is calculated by applying Manchuria's share of the import total in current prices to the national total evaluated at constant prices. This procedure is repeated for each year. Thus

$$M_{mt} = M_{nt} \times M^{*}_{mt}/M^{*}_{nt}$$

Data needed to calculate M_{mt} appear in Table C-2, but the results have been omitted to save space.

China Proper

Machinery imports into China proper at constant 1933 prices are the difference between the constant-price import totals for the nation and for Manchuria. This series may be calculated from data shown in Table C-2; results have been omitted to save space.

Exports

Exports of machinery are extremely small and are therefore ignored in this study. Exports at the national level fell short of one million yuan during 1933-35, but reached what was probably a peak level of two million yuan in 1936 (Foreign Trade of China, 1936, 3: 236-237, 239, 290 and Annual Returns of the Foreign Trade of Manchoukuo, 1934 edition, pp. 116-117; 1936 edition, pp. 116-117). During 1933-1935, machinery exports amount to less than 1% of annual imports. In earlier years, exports were undoubtedly even less significant.

Apparent Consumption

As with cement and iron-steel products, our estimates of apparent consumption (or domestic disappearance) of machinery are based on current flows of production and trade.

National Total

Apparent consumption of machinery at the national level is calculated from the relation $A_{nt} = Q_{nt} + M_{nt}$ using annual data for output (Q) and imports (M) presented in Tables C-1 and C-2. Results appear in Table C-3.

Table C-3

Apparent Consumption of Machinery, 1903-1936
(Million Yuan, 1933 Prices)

Year	Apparent Consumption of Machinery			Index With 1933=100		
	China Proper	Manchuria	National Total	China Proper	Manchuria	National Total
	A_{ct}	A_{mt}	A_{nt}	I_{ct}	I_{mt}	I_{nt}
1903	27.723	1.388	29.111	17.2	2.1	12.8
1904	28.129	1.018	29.147	17.4	1.6	12.8
1905	41.468	0.118	41.586	25.7	0.2	18.3
1906	59.362	0.514	60.376	37.1	0.8	26.6
1907	49.017	14.392	63.409	30.4	22.0	27.9
1908	24.131	18.131	42.262	15.0	27.7	18.6
1909	29.280	5.112	34.392	18.1	7.8	15.2
1910	38.038	7.287	45.325	23.6	11.1	20.0
1911	26.758	6.962	33.720	16.6	10.6	14.9
1912	24.516	12.256	36.772	15.2	18.7	16.2
1913	37.201	7.518	44.719	23.0	11.5	19.7
1914	54.267	11.390	65.657	33.6	17.4	28.9
1915	22.957	10.712	33.669	14.2	16.3	14.8
1916	36.816	36.463	73.279	22.8	55.6	32.3
1917	33.414	23.218	56.632	20.7	35.4	25.0
1918	40.199	26.143	66.342	24.9	39.9	29.2
1919	73.348	52.236	125.584	45.4	79.7	55.3
1920	118.945	34.079	153.024	73.7	52.0	67.4
1921	211.769	35.283	247.052	131.2	53.8	108.9
1922	222.357	37.874	260.231	137.8	57.8	114.7
1923	122.145	40.346	162.491	75.7	61.6	71.6
1924	108.289	50.754	159.043	67.1	77.5	70.1
1925	99.347	43.169	142.516	61.6	65.9	62.8
1926	101.641	57.696	159.337	63.0	88.0	70.2
1927	98.818	60.271	159.089	61.2	92.0	70.1
1928	108.013	65.256	173.269	66.9	99.6	76.4
1929	143.741	67.963	211.704	89.1	103.8	93.3
1930	156.311	57.139	213.450	96.8	87.2	94.1
1931	155.165	47.604	202.769	96.1	72.6	89.4
1932	145.557	42.154	187.711	90.2	64.3	82.7
1933	161.393	65.520	226.913	100.0	100.0	100.0
1934	180.487	108.770	289.258	111.8	166.0	127.5
1935	200.167	89.414	289.581	124.0	136.5	127.6
1936	212.384	87.896	300.781	131.9	134.2	132.6

Manchuria

Apparent consumption of machinery in Manchuria is calculated from the relation $A_{mt} = Q_{mt} + M_{mt}$. Annual data for regional output (Q) appear in Table C-1; annual data for regional imports (M) are obtained using the relation described in the explanation of Manchurian machinery imports. Interregional flows of machinery, which can be measured only from 1932, are ignored because of their tiny size. Results appear in Table C-3.

China Proper

Apparent consumption of machinery in China proper is derived for each year as the difference between the national and Manchurian figures for that year. Results appear in Table C-2.

APPENDIX D

MONETIZING THE INVESTMENT INDEX

The purpose of this appendix is to explain the conversion of the modern-sector fixed investment totals compiled from estimates of apparent consumption of cement, iron and steel, and machinery from an index J_{nt} with 1933=100 to a time series in terms of 1933 yuan. To make this conversion, we begin by applying the Svennilson methodology to data for the years 1952-1957 to construct an index of modern-oriented fixed investment for those years; this is simply an extension of the series for J_{nt} compiled in Table 1. If we assume that all investment during 1952-57 is "modern-oriented," then K.C. Yeh's estimates of gross domestic fixed capital formation for 1952-57 and for 1933 may be used to derive a monetary value for the national total of modern-oriented GDFCF in 1933. Once this figure is available, a time series estimate of D_{nt}, the value, in 1933 prices, of national modern-oriented GDFCF is readily computed from the index J_{nt} compiled in Table 1.

National Total

Estimates for apparent consumption of cement, iron and steel products, and machinery for the years 1952-1957 are compiled in Tables D-1, D-2 and D-3, both as physical or value totals and in index number form with 1933=100. For cement, apparent consumption is the difference between domestic production and exports; there appear to have been no significant imports during this period. For iron and steel, apparent consumption is defined as domestic output of pig iron plus imports of finished steel products less exports of pig iron and finished steel. As in Appendix B, domestic production of ingot and finished steel is excluded to avoid double counting.

Calculation of apparent consumption of machinery is more complex. Reported output totals are converted into 1957 yuan to attain comparability with estimates of net machinery imports. The trade data come in two versions based on different rates of exchange between the (inconvertible) Chinese yuan and foreign currencies: a "trade rate" and a "purchasing power parity" or PPP rate. In Table D-3, apparent consumption is calculated separately as the sum of domestic output and net imports using the two alternative sets of trade figures. The annual average of the two resulting estimates is then taken as our estimate of apparent consumption of machinery in terms of 1957 prices. This estimate is then converted to 1933 prices to attain comparability with the figures compiled in Table C-3.

Table D-1

Apparent Consumption of Cement, 1952-1957
(Million Metric Tons)

Year	Production[a]	Export[b]	Apparent Consumption[c]	
			Million Tons	Index, 1933=100
1933			1.118	100.0
1952	2.9	0	2.9	259.4
1953	3.9	0.3	3.6	322.0
1954	4.6	0.3	4.3	384.6
1955	4.5	0.4	4.1	366.7
1956	6.4	0.8	5.6	500.9
1957	6.9	1.3	5.6	500.9

[a]Chen, Chinese Economic Statistics, pp. 186-187

[b]Ian H. MacFarlane, "Construction Trends in China, 1949-74," in U.S. Congress, Joint Economic Committee, China: A Reassessment of the Economy (Washington, 1975), p. 315.

[c]Production less export equals apparent consumption. The figure for 1933 is from Table A-4.

Table D-2

Apparent Consumption of Iron and Steel Products, 1952-1957
(Thousand Metric Tons)

Year	Pig Iron		Finished Steel		Apparent Consumption[a]	
	Output	Exports	Imports	Exports	Thousand Tons	Index, 1933=100
	1	2	3	4	5	6
1933					816	100.0
1952	1929	150	530	0	2309	283.0
1953	2234	170	930	0	2994	366.9
1954	3114	250	650	30	3484	427.0
1955	3872	650	870	50	4042	495.3
1956	4826	600	760	200	4786	586.5
1957	5936	200	530	90	6176	756.9

Sources: pig iron output from Chen, Chinese Economic Statistics, pp. 186-187; trade data from Alfred H. Usack Jr. and James D. Egan, "China's Iron and Steel Industry," in China: A Reassessment, p. 279.

[a]Apparent consumption (5) is calculated from (5) = (1) - (2) + (3) - (4). The figure for 1933 is from Table B-3.

Table D-3

Apparent Consumption of Machinery, 1952-1957
(Million Yuan)

Year	Output 1957 Prices	Net Imports 1957 Prices		Apparent Consumption Million Yuan		Index
		Trade Rate	PPP Rate	1957 Prices	1933 Prices	1933=100
	(1)	(2A)	(2B)	(3)	(4A)	(4B)
1933					226.913	100.0
1952	1106	760	557	1764	373	164.4
1953	1700	1146	803	2674	566	249.4
1954	2083	1436	988	3295	697	307.2
1955	2388	1510	1041	3664	775	341.5
1956	4542	2061	1453	6299	1332	587.0
1957	4867	2197	1553	6742	1426	628.4

Sources and methodology:

(1) Annual output in 1952 prices from Shigeru Ishikawa, National Income and Capital Formation in Mainland China (Tokyo, 1965), p. 60 converted to 1957 prices using the price index (with 1952=1, 1957=0.788) for machinery derived in Thomas G. Rawski, "China's Industrial Performance, 1949-73," in Alexander Eckstein ed., Quantitative Measures of China's Economic Output (Ann Arbor, 1980), p. 342.

(2A, 2B) U.S. Central Intelligence Agency, People's Republic of China: Estimated Yuan Value of Foreign Trade in Machinery and Equipment, 1951-73 (Washington, 1976), pp. 15, 16, 20.

(3) Arithmetic average for each year of alternate calculations of output plus net imports using the two versions of net imports given in (2A) and (2B).

(4A) Converted from 1957 to 1933 prices using the machinery price index for 1952-57 noted above and the 1952 machinery price index of 600 (1933=100) estimated by Liu and Yeh, Economy of the Chinese Mainland, p. 449. The figure for 1933 is from Table C-3.

(4B) Reproduces (4A) in index-number form, with 1933=100.

Table D-4

Alternative Indexes of Fixed Investment, 1952-1957

Year	Modern-Oriented GDFCF J_{nt}		Aggregate GDFCF Yeh's Estimates		$\frac{J_{nt}\ 1952=100}{\text{Yeh Index, 1933 prices}}$
	1933=100	1952=100	1933 prices	1952 prices	
1952	229.4	100.0	100.0	100.0	1.000
1953	308.9	134.6	151.4	150.7	0.889
1954	369.5	161.1	165.9	165.4	0.971
1955	395.8	172.5	188.6	191.2	0.915
1956	556.6	242.6	307.3	313.1	0.789
1957	619.9	270.2	252.7	258.4	1.069

J_{nt} is calculated from apparent consumption indexes shown in the right-hand columns of Tables D-1, D-2 and D-3 following the definition in equation (3) of the text of this paper. J_{nt} is the geometric mean of annual indexes of apparent consumption of the three key investment goods.

Yeh's estimates of gross domestic fixed capital formation are taken from Yeh, "Capital Formation," p. 76a.

These compilations permit us to extend our index J_{nt} of modern-oriented gross domestic fixed capital formation to the years 1952-1957. Values of J_{nt} for these years are shown in Table D-4.

To attach monetary values to the investment index J_{nt}, we refer to K.C. Yeh's estimates of aggregate GDFCF which also appear, in index number form, in Table D-4. With the exception of 1956, a year of economic "high tide" in which investment outlays may have been unusually large in relation to the physical volume of investment goods available, the figures in the final column of Table D-4 show that Yeh's index of aggregate GDFCF is very close to our own index J_{nt} of modern-oriented GDFCF. This similarity justifies the assumption that all fixed investment included in Yeh's estimates for 1952-1957 was devoted to modern-oriented activities.

Under this assumption, a monetary value D_{nt} can be attached to our index J_{nt} of modern-oriented GDFCF using the following relations:

$$\sum_{1952}^{1957} D_{nt} = 24.801\ D_{n,1933} = \sum_{1952}^{1957} \text{GDFCF at 1933 prices} = 25.65 \times 10^9 \text{ 1933 yuan}$$

where the first equality comes from the first column of Table D-4; the final equality is from Yeh, "Capital Formation," p. 76a, and the central equality comes from the assumed identity of D_{nt} and Yeh's estimate of aggregate gross domestic fixed capital formation for 1952-1957.

From the above relations, we may calculate $D_{n,1933}$ as follows:

$$D_{n,1933} = 25.65 \times 10^9 / 24.801 = 1.034 \times 10^9 \text{ yuan (1933 prices).}$$

With this figure of 1.034 billion 1933 yuan as our estimate of modern-oriented GDFCF in 1933, comparable monetary values for D_{nt} in other years are derived by applying the index of J_{nt} to this base figure. The results of these calculations appear as the estimated national totals of modern-oriented GDFCF shown in Table 1.

China Proper

To determine the monetary value of modern-oriented GDFCF in China proper, we first examine the estimates of apparent consumption of cement, iron and steel, and machinery to find the year in which the shares of China proper in apparent consumption of each of the three commodity groups are closest together. Data needed for this procedure appear in Tables A-4, B-3 and C-3. The desired year turns out to be 1922, during which the shares of China proper in national

apparent consumption (measured by A_{ct}/A_{nt}) of cement, iron-steel and machinery are 0.847, 0.796 and 0.854 respectively. It is assumed that the monetary value of modern-oriented GDFCF for China proper in 1922 is equal to 83.2% of the national value total for that year (.832 being both the arithmetic and geometric mean of the three consumption shares for 1922). For all other years, the monetary value of modern-oriented GDFCF in China proper is calculated from J_{ct}, the regional index of modern-oriented GDFCF in China proper, and the value of regional investment derived for 1922. J_{ct} is in turn calculated from Tables A-4, B-3 and C-3 using the definition given in equation (4a) in the text of this paper; J_{ct} is the geometric mean of indexes of apparent consumption of the three key investment goods in China proper during year t, with all indexes based on 1933=100. D_{ct}, the monetary value of regional modern-oriented GDFCF for China proper in year t, is tabulated in Table 1.

Manchuria

Annual estimates of the monetary value of regional modern-oriented GDFCF for Manchuria are shown in Table 1. For each year, the Manchurian total is obtained by subtracting the figure for China proper from the national total of modern-oriented GDFCF.

APPENDIX E

PROFIT ESTIMATES FOR COTTON TEXTILE MANUFACTURE, 1913-1936

The purpose of this appendix is to obtain estimates of the annual level of profit in China's cotton textile manufacturing sector between 1913 and 1936. Our estimates include profits of foreign as well as Chinese-owned enterprises. In the absence of complete information on annual variations in production costs, three separate profit series are calculated from alternative assumptions about the behavior of production costs. Although annual data for factory output of yarn and cloth extend back to 1890, our series begins only in 1913 because systematic compilation of price data begins in that year. The prices used come from Tientsin because systematic price data for Shanghai, the largest center of textile manufacture, are not available before 1921.

Profit estimates are based on the following time series presented in Table E-1:

p_{ct} = price of cotton in year t. This is the wholesale price per picul (of 60.5 kg.) of Hsi-ho cotton at Tientsin compiled in Nan-k'ai chih-shu tzu-liao hui-pien (Compendium of Nankai Index Number Materials; Peking, 1958), p. 74. This source states that the price data are in "yuan." Fong, Cotton Industry and Trade in China, 1: 76 presents the same price quotations and identifies them as "Tientsin $ per picul" for 1913-31. It therefore appears that these cotton prices (and also the yarn and cloth price data cited below) refer to values in terms of standard silver dollars.

p_{yt} = price of cotton yarn in year t. This is the wholesale price per bale (of 400 lbs. - see Chao, Cotton Textile Production in China, p. 310) of 16-count Sung-hao yarn (made by a Chinese firm) at Tientsin compiled in Nan-k'ai chih-shu tzu-liao hui-pien, p. 74. Bruce L. Reynolds, "The Impact of Trade and Foreign Investment on Industrialization: Chinese Textiles, 1875-1931" (Ph.D. diss., University of Michigan, 1974), p. 152, gives the average factory yarn count as 16.5 for 1922 and 22.5 for 1931. The 1936 price is for 17-count Chinese-made Pa-ma yarn; the 1935 prices of Pa-ma and Sung-hao yarn differ by less than 1%. For 1913-31, identical price quotations appear in Fong, Cotton Industry and Trade in China 1: 107.

Table E-1

Price and Output Data for Textile Profit Calculations, 1913-1936

Year	Data for Prices			Data for Output	
	Cotton P_{ct}	Yarn P_{yt}	Fabric P_{ft}	Yarn Y_t	Fabric Y_t
	yuan/ picul	yuan/ bale	yuan/ bolt	1000 bales	1000 bolts
1913	25.76	122.83	9.08	541	1948
1914	19.91	103.77	6.77	645	2267
1915	20.34	122.83	7.76	645	2299
1916	21.04	169.84	7.83	726	2906
1917	30.54	191.27	8.57	795	2983
1918	35.17	216.96	10.21	928	3083
1919	33.70	268.40	10.98	918	3534
1920	35.04	240.92	11.37	927	4816
1921	35.54	210.28	11.53	1011	4599
1922	36.20	204.19	10.26	1905	7417
1923	49.36	228.12	10.91	1898	8136
1924	57.26	245.06	10.78	1891	8854
1925	50.18	235.75	10.35	1909	10974
1926	43.35	199.15	9.70	1979	11465
1927	45.99	195.78	9.48	2049	11955
1928	45.05	218.99	10.26	2234	16399
1929	48.09	242.60	10.74	2329	16423
1930	46.70	225.92	10.48	2422	16975
1931	48.02	235.52	11.26	2322	22205
1932	38.28	213.65	10.32	2355	24441
1933	38.23	185.72	8.81	2358	25260
1934	39.38	177.66	8.09	2326	28215
1935	36.63	176.42	7.98	2054	29462
1936	44.06	213.73	9.15	2187	35978

P_{ft} = price of fabric in year t. This is the wholesale price per bolt (of 11 lbs. or 40 square yards - see Chao, Cotton Textile Production in China, p. 234) of Shuang-lung brand cloth at Tientsin compiled in Nan-k'ai chih-shu tzu-liao hui-pien, p. 76.

Y_t = factory output of cotton yarn in year t, in thousands of bales, as estimated by Chao, Cotton Textile Production in China, p. 308.

K_t = factory output of cotton fabric in year t, in thousands of bolts, as estimated in ibid., 312. For 1934-1936, output figures are converted from square yards to bolts at the rate of 40 square yards per bolt.

These series for the prices of cotton, carn and cloth and for factory output of yarn and cloth are used to construct three measures of annual textile profits for the years 1913-1936. Since revenue in the textile industry may be approximated using price and output data for yarn and cloth, measurement of annual profit flows depends mainly on our ability to estimate production costs in the manufacture of cotton yarn and cloth.

Survey data presented in Fong, Cotton Industry and Trade in China, 1: 88, show that raw materials accounted for the bulk of these costs. Cost data for manufacturing 10, 14 and 16 count yarn at Tientsin in 1929 show that raw materials occupied 88, 85 and 83% respectively of total costs including overhead and interest. In the case of cloth manufacture, another Tientsin example for 1929 shows that 78-79% of total costs, again including overhead and interest as well as labor, power and materials, consisted of raw materials. The predominance of cotton in the cost of yarn manufacture and of yarn in the cost of cloth production simplifies the task of estimating total costs in the manufacture of cotton yarn and cloth.

Our three profit estimates A, B and C are described below. In each case, total profit is calculated as the product of unit profit and annual output for yarn and cloth.

Estimate A: unit profit is assumed to equal the difference between unit price and unit cost for the main material input. All costs other than those for cotton (in yarn manufacture) and yarn (in cloth production) are ignored. The weakness of this measure is its neglect of non-material costs and consequent overstatement of profit levels.

Estimate B: this measure makes use of the observation that roughly 80% of total cost for both yarn and cloth manufacture is attributable to the main material input. Unit cost is assumed equal to 1.25 times the main material input cost in each year. The weakness of this measure is its volatility. Since the prices of labor, electricity, borrowed funds and other non-material inputs are more stable than the prices of cotton and yarn, this measure introduces excessive fluctuation into the estimated profit levels.

Estimate C: this measure assumes that all costs other than those for the main material input remained constant throughout 1913-1936 at their 1929 level of approximately 25% of cost for the main material input or 20% of total manufacturing costs. In contrast to the previous measures, this version imparts excessive stability to our annual profit series.

Calculation of annual profit estimates proceeds as follows:

Version A: $R_{At} = (p_{yt} - p_{ct}a_{cy})Y_t + (p_{nt} - p_{yt}a_{yn})N_t$

Version B: $R_{Bt} = (p_{yt} - 1.25\, p_{ct}a_{cy})Y_t + (p_{nt} - 1.25p_{yt}a_{yn})N_t$

Version C: $R_{Ct} = (p_{yt}-p_{ct}a_{cy}-.25a_{cy}p_{c,1929})Y_t + (p_{nt}-p_{yt}a_{yn}-.25a_{yn}p_{y,1929})N_t$

where t is a time subscript

a_{cy} = cotton consumption per bale of yarn, assumed equal to 3.5 piculs (Fong, Cotton Industry and Trade in China, 1: 90)

a_{yn} = yarn consumption per bolt of cloth, assumed equal to 11 pounds per bolt or, at 400 pounds per bale, 11/400 = 0.0275 bales per bolt of cloth (Chao, Cotton Textile Production in China, p. 234)

and the remaining symbols are defined above and presented in in Table E-1.

The resulting estimates of annual profit in cotton textile manufacture are compiled in Table E-2.

These results, however, are cast in terms of current prices. To achieve comparability with the estimates of modern-oriented GDFCF based on 1933 prices, the profit estimates R_A, R_B and R_C must be deflated from current to 1933 values. Lacking a more suitable index, I have used the arithmetic average of wholesale Tientsin prices for metal products and construction materials to deflate the three profit series. The deflator is calculated from the Nan-kai

Table E-2

Alternative Estimates of Annual Profits in Textile Manufacturing, 1913-1936
(Million Yuan)

	Current Prices			Deflator	Constant 1933 Prices		
	R_A	R_B	R_C	1933=1	PROFA	PROFB	PROFC
1913	28.78	14.35	2.76	0.670	42.96	22.31	4.12
1914	30.87	18.00	-0.53	0.700	44.10	25.71	-0.76
1915	43.38	29.96	12.40	0.738	58.78	40.60	16.80
1916	79.02	62.26	43.62	0.885	89.29	70.35	49.29
1917	76.96	51.30	38.52	0.977	78.77	53.02	39.43
1918	100.17	67.02	56.02	1.093	91.65	61.32	51.25
1919	150.84	117.22	106.30	0.880	171.41	133.20	120.80
1920	132.47	96.10	85.47	0.958	138.28	100.31	89.22
1921	113.05	75.00	62.89	0.949	119.12	79.03	66.27
1922	182.03	111.32	89.56	0.832	218.79	133.80	107.64
1923	142.82	48.08	49.37	0.847	168.62	56.76	58.29
1924	120.20	10.59	25.84	0.852	141.08	12.43	30.33
1925	162.72	61.12	64.07	0.857	189.87	71.32	74.76
1926	142.23	51.46	39.94	0.889	159.99	57.88	44.93
1927	120.36	21.75	14.17	0.877	137.24	24.80	16.16
1928	206.52	93.69	85.13	0.904	228.45	103.64	94.17
1929	239.34	114.43	114.43	0.943	254.34	121.35	121.35
1930	223.78	98.34	93.32	1.050	213.12	93.66	89.07
1931	262.76	129.22	128.19	1.166	225.35	110.82	109.94
1932	308.56	193.81	168.69	1.075	286.35	180.29	156.92
1933	215.89	104.66	74.48	1.000	215.89	104.66	74.48
1934	182.93	68.36	38.22	0.942	194.19	72.57	40.57
1935	191.26	89.76	55.63	0.897	213.22	100.07	62.02
1936	247.32	110.62	95.70	1.010	245.37	109.52	94.75

chih-shu tzu-liao hui-pien, p. 11, and is compiled in Table E-2 along with the deflated series PROFA, PROFB and PROFC giving estimated annual profits of China's cotton textile manufacturing industry for 1913-1936 in terms of 1933 yuan.

APPENDIX F

COMMENTS ON STATISTICAL METHODOLOGY

By C.W. Kenneth Keng

The criteria of econometric modelling adopted in this paper are rather standard. They are the explanatory power of the model, the levels of significance of the estimated parameters, and the absence of serial (or auto-) correlation of residuals.

$\bar{R}^2$ Criterion for Model Discrimination

Measures of the explanatory power of regression models are currently in dispute. The coefficient of determination (R^2), a classical yet robust measure of the explanatory power of a regression, is widely recognized as a common indicator of the proportion of total variance that is explained or accounted for by the regression model. The higher the R^2, the lower the proportion of unexplained residuals. In the limit where there are no unexplained residuals, $R^2 = 1$ and all of the variance is explained by the regression model. At the other extreme when all of the regression coefficients are zero, none of the variance is explained by the regression model and $R^2 = 0$. Thus R^2 measures the explanatory power of a regression. In particular, R^2 measures how well the model, as estimated, fits the available data. If $R^2 = 0.95$, for example, then 95% of the variance of the dependent (left-hand) variable is explained or accounted for by the regression model, with the remaining 5% left unexplained.

The R^2 rule of model examination must be used carefully in comparing regression models. The value of R^2 can never decrease as more explanatory (right-hand side) variables are added to the model. Thus it is not appropriate to compare R^2 for two regression models with different numbers of explanatory variables.

A related measure, the adjusted coefficient of determination ($\bar{R}^2$), is defined as the multiple correlation coefficient adjusted for the degrees of freedom, i.e.

$$\bar{R}^2 = R^2 - \frac{k-1}{n-k} (1-R^2)$$

where k is the number of parameters in the model and n is the sample size. In general, $\bar{R}^2$ is less than R^2 (unless k or R^2 equals one, in which case $\bar{R}^2 = R^2$), and it is possible for $\bar{R}^2$ to be negative. Hence $\bar{R}^2$ measures both the explanatory power of the (estimated) model and the efficiency of estimation because it takes the model's degree of freedom into account.

Significance of Estimated Individual Parameters

If the estimated standard error of an individual parameter estimate is relatively small so that the estimated value of this parameter is statistically different from zero (i.e. the t-statistic of the estimate is larger than the critical value at a pre-selected level of significance), we accept the underlying hypothesis that the associated variable has a significant cause-effect relationship with the dependent variable. This independent variable should therefore be included in the model. On the other hand, if the standard error of an estimated parameter is too large to provide a significant t-statistic, the corresponding variable should be excluded from the model.

The Problem of Autocorrelation

The usual assumption that errors corresponding to different observations are uncorrelated often breaks down in time-series studies. The case of serially correlated errors is usually referred to as the problem of auto-correlation. Severe autocorrelation of the error terms will directly affect the efficiency of estimation. This will in turn produce spurious regression results.

First order (second order) autocorrelation means that errors in period t are correlated directly with errors in period t-1 (and period t-2 as well). Autocorrelation frequently occurs in time-series modelling either because of correlation in the measurement error component of the error term, or more likely because of the high degrees of correlation over time present in the cumulative effects of variables omitted from the regression model.

Various methods have been suggested for correcting errors arising from the presence of autocorrelation. The method adopted in this paper is described below.

Let the model be $$Y_t = a + \sum_{i=1}^{k} B_i X_{it} + e_t$$

where $i=1,2,\ldots,k$ and $t=1,2,\ldots,n$.

The error term e_t displays second order autocorrelation if p_2 in the following equation is different from zero. If $p_1 \neq 0$ but $p_2 = 0$, we say that first order autocorrelation is present in e_t

$$e_t = p_1 e_{t-1} + p_2 e_{t-2} + u_t$$

where u_t is a serially-uncorrelated random variable with constant variance.

Autocorrelation correction or autoregressive adjustment refers to the process of accounting for autocorrelated errors by estimating values for p_1 and/or p_2. The basic technique is to substitute the above expression for the error term into the original model and to minimize the sum of squares of u_t which is the error term consistent with the postulates of the normal linear regression model. To calculate p_1 and p_2, we have adopted an iterative maximum likelihood estimation method. The first iteration is equivalent to the popular Cochrane-Orcutt method. An appealing feature of our method is that it is equivalent to performing a series of Cochrane-Orcutt adjustments and stops only if the pre-set convergence criterion is met. The computer package used to estimate all the models in this paper is the EPS package provided by Data Resources Inc.

References:

G.S. Maddala, Econometrics (N.Y., 1977)

Robert S. Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts (N.Y., 1976)

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APPENDIX G

INDEX OF FOREIGN TRADE VOLUME, 1913-1936

The purpose of this appendix is to explain the derivation of the volume index for Chinese foreign trade shown in Table 12 and used in the statistical analysis reported in Table 11.

The index used in the present study is based on the Nankai indexes of import and export volume reported in Hsiao, China's Foreign Trade Statistics, pp. 274-275. If I_{mt} is the Nankai index of annual import volume in year t and I_{et} is the Nankai index of annual export volume in year t, with $I_{1913}=100$ in both cases, then our index of overall trade volume for the years 1913-1931 is calculated from the relation:

$$I_t = .582I_{mt} + .418I_{et}$$

where I_t is the index of trade volume in year t and the weights reflect the shares of imports and exports in China's commodity trade value in the base year of 1913 (weights calculated from ibid., 269).

For 1932-1936, we encounter difficulties because the Nankai materials exclude the trade of Manchurian ports with foreign countries and include trade between Chinese and Manchurian ports as part of China's foreign trade; they are therefore not comparable with data for earlier years which include the former but exclude the latter in measuring China's foreign trade. To enhance the consistency of our trade index, I_t for the years 1932-1936 is calculated as follows:

$$I_t = m_t^* (.582I_{mt} + .418I_{et})$$

where I_{mt} and I_{et} are from the source cited above and

$$m_t^* = \frac{a_t \left[T_{mt} - 2(E_{cmt} + E_{mct}) \right] + T_{ct}}{T_{ct}}, \text{ with}$$

a_t = annual average exchange rate: Shanghai yuan per Manchurian yuan

T_{mt} = annual combined value of Manchurian imports and exports (including trade with China proper) reported in terms of current Manchurian yuan by the Manchoukuo government

E_{cmt}, E_{mct} = annual flows of goods from China to Manchuria (E_{cmt}) and from Manchuria to China (E_{mct}) reported in terms of current Manchurian yuan by the Manchoukuo government

T_{ct} = annual combined value of imports and exports for China proper (including trade with Manchuria) reported in terms of current Chinese yuan by the Maritime Customs

The adjustment coefficient m_t^* measures the ratio of the combined overseas trade of China proper and Manchuria to the trade of China proper alone, netting out the internal trade between China proper and Manchuria which, on account of the political circumstances of the 1930s, was recorded as international trade.

The data needed to calculate m_t^* and I_t for 1932-1936 appear in Table G-1. For 1932, trade data for China proper were reported in terms of Haikwan taels, an accounting unit employed by the Maritime Customs prior to 1933. To convert $T_{c,1932}$ from taels to yuan, we use a ratio derived from reports giving the 1932 revenue of the Maritime Customs at 311.976 million standard dollars (or yuan) (The China Year Book 17 (1935) (Tientsin, 1935), p. 180) and 200.241 million Haikwan taels (Hsiao, China's Foreign Trade Statistics, p. 133); the resulting conversion factor is 1.56 yuan per Haikwan tael.

Table G-1

Adjustment of Trade Data for Comparable Coverage, 1932-1936

ar	Exchange Rate	Million Manchoukuo Yuan			Million Chinese Yuan		
	a_t	T_{mt}	E_{cmt}	E_{mct}	T_{ct}	m_t^*	I_t
32	.9848	956	61	183	2532	1.182	122.7
33	.9841	966	80	72	1987	1.277	139.1
34	.9750	1042	58	65	1599	1.485	147.2
35	.8691	1025	32	65	1524	1.473	149.6
36	.9803	695	48	129	1684	1.548	151.3

Sources: for a_t, T_{mt}, E_{cmt}, E_{mct}: Manshū kaihatsu yonjū nenshi, 2: 796, 850

for T_{ct} Hsiao, China's Foreign Trade Statistics, p. 269, with adjustments for 1932 described in the text of this appendix.

Notes

1. See Dwight H. Perkins, "Growth and Changing Structure of China's Twentieth-Century Economy," in Perkins ed., China's Modern Economy in Historical Perspective (Stanford, 1975); Alexander Eckstein, China's Economic Revolution (Cambridge, 1977); Nicholas R. Lardy, Economic Growth and Distribution in China (Cambridge, 1978); Christopher Howe, China's Economy: A Basic Guide (N.Y., 1978); Thomas G. Rawski, Economic Growth and Employment in China (N.Y., 1979) and China's Transition to Industrialism (Ann Arbor, 1980); Alexander Eckstein ed., Quantitative Measures of China's Economic Output (Ann Arbor, 1980); and Robert F. Dernberger ed., China's Development Experience in Comparative Perspective (Cambridge, 1980).

2. Trade statistics compiled by China's Maritime Customs are summarized in Liang-lin Hsiao, China's Foreign Trade Statistics, 1864-1949 (Cambridge, 1974). On foreign investment, see C. F. Remer, Foreign Investments in China (N.Y., 1933); Tōa kenkyūjo, Shogaikoku no tai-Shi tōshi (Foreign Investment in China; 3 vols., 1942-43) and Rekkoku tai-Shi tōshi to Shina kokusai shūshi (Foreign Investments in China and China's International Balance of Payments; Tokyo, 1944). On industrial growth, see John K. Chang, Industrial Development in Pre-Communist China (Chicago, 1969). The cotton textile industry is studied by H. D. Fong, Cotton Industry and Trade in China (2 vols., Tientsin, 1932); Albert Feuerwerker, "Handicraft and Manufactured Cotton Textiles in China, 1871-1910," Journal of Economic History 30.2 (1970): 338-378; Yen Chung-p'ing, Chung-kuo mien-fang-chih shih-kao (Draft History of Cotton Textiles in China, Peking, 1963); Richard A. Kraus, "Cotton and Cotton goods in China, 1918-1936" (Ph.D. diss., Harvard University, 1968); Kiyokawa Yukio, "Chūgoku menkōgyō gijutsu no hatten katei ni okeru zaikabō no igi" (The Signi-

ficance of Foreign Spinning Establishments in the Technical Development of China's Cotton Industry), Keizai kenkyū 25.3 (1974): 238-263; Bruce L. Reynolds, "Weft: The Technological Sanctuary of Chinese Handspun Yarn," Ch'ing-shih wen-ti 3.2 (1974): 1-19; and Kang Chao, The Development of Cotton Textile Production in China (Cambridge, 1977). Manchurian regional income estimates appear in Alexander Eckstein, Kang Chao and John K. Chang, "The Economic Development of Manchuria: The Rise of a Frontier Economy," Journal of Economic History 34.1 (1974): 239-264 and Kang Chao, "The Sources of Economic Growth in Manchuria, 1920-1941," in Chi-ming Hou and Tzong-shian Yu eds., Modern Chinese Economic History (Taipei, 1979), pp. 255-263.

3. These materials, which include many works of high quality, may be approached through Albert Feuerwerker, "Materials for the Study of the Economic History of Modern China," Journal of Economic History 21.1 (1961): 41-60; Andrew J. Nathan, Modern China, 1840-1972: An Introduction to Sources and Research Aids (Ann Arbor, 1973); G. William Skinner et al, eds., Modern Chinese Society: An Analytic Bibliography (3 vols.; Stanford, 1973); and Shinabun zasshi naiyō sakuin mokuruku (Indexes to Contents of Chinese Journals; 2 vols., Shanghai, 1940-42). Charles R. Roll, The Distribution of Rural Incomes in China (N.Y., 1980), illustrates the value of prewar materials.

4. Wu Pao-san, 1933 Chung-kuo kuo-min so-te (China's National Income in 1933; 2 vols., Shanghai, 1947) and "Chung-kuo kuo-min so-te, 1933, 1936 chi 1946" (China's National Income in 1933, 1936 and 1946), She-hui k'o-hsueh tsa-chih 9.2 (1947): 12-30; Ta-chung Liu, China's National Income, 1931-36: An Exploratory Study (Washington, 1946); Ta-chung Liu and Kung-chia Yeh, The Economy of the Chinese Mainland (Princeton, 1965); Kung-chia Yeh, "Capital Formation in Mainland China: 1931-1936 and 1952-1957" (Ph.D. diss., Columbia

University, 1964) and "China's National Income, 1931-36," in Hou and Yu eds., Modern Chinese Economic History, pp. 95-128; and Perkins, "Growth and Changing Structure."

5. Eckstein, Chao and Chang, "Economic Development of Manchuria"; Chao, "The Sources of Economic Growth in Manchuria, 1920-1941"; Rhoads Murphey, Shanghai: Key to Modern China (Cambridge, 1953); Onoe Etsuzō, Chūgoku no sangyō ritchi ni kansuru kenkyū (Studies in the location of Chinese industry: Tokyo, 1971), chap. 7; Rawski, China's Transition to Industrialism, chap. 1.

6. Perkins, "Growth and Changing Structure," pp. 116-25 and Yeh, "China's National Income, 1931-36," pp. 102-05.

7. Ibid., 120, with emphasis added.

8. R. H. Tawney, Land and Labor in China (Boston, 1966), p. 13.

9. Examples of recent publications indicating vigorous development include Shang-hai min-tsu chi-ch'i kung-yeh (Shanghai's Private-Sector Engineering Industry; 2 vols., Peking 1979) and Shang-hai min-tsu hsiang-chiao kung-yeh (China's Private-Sector Rubber Industry; Peking, 1979). General statements, however, present China's prewar economic history as a grim story improved only by occasional bright spots. This standard view appears in Department of Political Economy, Hupei University ed., Chung-kuo chin-tai kuo-min ching-chi-shih chiang-i (Lectures on the Economic History of Modern China; Peking, 1958), chaps. 6-9, and is echoed by Tseng Chi-hsien, "The Problem of Employment in the Economic Development of China," (paper delivered to the U.S.-China Conference on Alternative Strategies for Economic Development, Racine, Wisconsin, November 1980), who states that "before liberation (i.e.

before 1949), China had hardly any modern industry, especially heavy industry" (p. 14).

10. Victor D. Lippit, Land Reform and Economic Development in China (White Plains, N.Y., 1974), p. 27. Lippit, however, offers no quantitative or even anecdotal evidence to support these assertions.

11. Joseph Esherick, "Harvard on China: The Apologetics of Imperialism," Bulletin of Concerned Asian Scholars, December 1972, pp. 13-14.

12. Henry Rosovsky, "Japan's Transition to Modern Economic Growth," in Henry Rosovsky ed., Industrialization in Two Systems (N.Y., 1966), pp. 91-139.

13. The term "golden age" refers to industrial expansion stimulated by the temporary absence of commodity flows and investment initiatives from nations preoccupied with the European war. Kung Chun, Chung-kuo hsin kung-yeh fa-chan-shih ta-kang (Historical Outline of the Development of China's New Industry; Shanghai, 1933), p. 113, dates the "golden age" from 1914 to 1920 or 1921. Chou Hsiu-luan, Ti-i-tz'u shih-chieh ta-chan shih-ch'i Chung-kuo min-tsu kung-yeh ti fa-chan (Private-Sector Industrial Development in China During World War I; Shanghai, 1958), p. 115 extends the period to the end of 1922.

14. Kung Chun, Chung-kuo hsin-kung-yeh, p. 118; Chou Hsiu-luan, Ti-i tz'u shih-chieh ta-chan, chap 4 and p. 155. Ramon H. Myers, The Chinese Economy Past and Present (Belmont, Calif., 1980), pp. 173-82, argues that an agrarian crisis beginning in the early 1920s exacerbated existing problems of poverty, inequality and unemployment.

15. Ingvar Svennilson, Growth and Stagnation in the European Economy (Geneva, 1954), pp. 227-30. Apparent consumption or domestic disappearance refers to the quantity of a commodity absorbed by an economy during a specified period of time. Apparent consumption is calculated by subtracting exports from the sum of domestic production and imports.

16. Including machinery as a separate component introduces an element of double counting in instances when imported iron and steel products are fabricated into machinery. If we assume that 56% of the value of machinery output consists of materials costs (Liu and Yeh, Economy of the Chinese Mainland, p. 516), and that half of these costs are attributable to imported iron and steel products, then the share of machinery output that is counted twice may be calculated from Appendix C, Table C-2 for each year. The results range from zero for 1903-1912 to 5% for 1916, 10% for 1926 and 12% for 1936. In view of the broad parallels between the three commodity indexes evident from Table 1, this double counting cannot have a significant effect on our results.

17. Hsiao, China's Foreign Trade Statistics, pp. 3-16, provides a brief survey of prewar trade data as well as references to more detailed evaluations. Rhoads Murphey's argument that the trade figures exaggerate the growth of commodity flows because of expanding geographic coverage and the diversion of goods from unrecorded carriers does not apply to the time period and commodities used in the present study; see The Outsiders (Ann Arbor, 1977), chap. 11.

18. The share of domestic production in apparent consumption of machinery at the national level may be calculated from Table C-2 as follows: 1905, zero; for 1915, 26.7%; for 1925, 35.8%; for 1935, 38.0%. Interregional flows of machinery and equipment can be measured only for 1932-36. Shipments

of machinery and equipment from China proper reach a peak of 1.6% of Manchurian imports of these goods in 1936.

19. The availability of detailed national income studies for 1933 makes it an obvious choice as a base period. See Wu Pao-san, 1933 Chung-kuo kuo-min so-te and Liu and Yeh, The Economy of the Chinese Mainland.

20. Calculations in Table D-4 show that our index J_{nt} amounts to only 78.9% of Yeh's estimate of aggregate fixed investment for 1956. However 1956 was a year of economic "high tide" that foreshadowed the excesses of the "Great Leap" of 1958-60. With great pressure to raise investment achievments, it is entirely possible that the ratio of investment outlays to physical consumption of investment goods was higher in 1956 than in other years prior to the Great Leap. Thus the discrepancy between J_{nt} and Yeh's investment estimate for 1956 may indicate weaknesses in the expenditure data underlying Yeh's estimate.

21. Liu and Yeh, Economy of the Chinese Mainland, pp. 87-90.

22. The semi-logarithmic arrangement in Graph 1 combines the time variable on the horizontal axis with the natural logarithm of the investment variable on the vertical axis. The growth rate of investment appears graphically as the slope of the investment curve.

23. Calculated from Kazushi Ohkawa and Henry Rosovsky, Japanese Economic Growth (Stanford, 1973), p. 294.

24. The exceptions (based on Tables A-4, B-3 and C-2) are as follows: apparent consumption of cement in Manchuria was 13% below the pre-1919 peak in 1920 and matched the peak in 1921; Manchurian machinery consumption fell 2-6%

below the previous peak in 1920 and 1921; consumption of iron and steel in Manchuria fell 2-3% below the pre-1919 peak in 1921 and 1924 and dropped 31% below this peak in 1923, pulling national consumption in that year to 8% below the pre-1919 peak.

25. Examples of probable errors in Table 5 stemming from such inconsistency include the decline of modern sector output in China proper (Line 1a) and of traditional sector output in Manchuria (Line 1b) between 1934 and 1936.

26. Liu and Yeh, Economy of the Chinese Mainland, pp. 68-69, 89, 604.

27. Japanese gross capital formation proportions of 9.1% for 1885-89 and 9.9% for 1890-94 are calculated from quinquennial averages of GDFCF and GDP, both at 1934-36 prices, shown on pp. 220-221 and 227 of Ōkawa Kazushi, Takamatsu Nobukiyo and Yamamoto Yūzō, Kokumin shotoku (National Income), vol. 1 of the series Chōki keizai tōkei (Estimates of Long-Term Economic Statistics of Japan Since 1868; Tokyo, 1974). These figures are considerably larger than the Chinese data shown in Line 2 of Tables 4 and 5. As indicated in the text, however, upward revision of the Chinese data may be desirable.

28. For China, see Chang, Industrial Development in Pre-Communist China, p. 71. Japanese data for net domestic product originating in mining and manufacturing (at 1934-36 prices) are from Ohkawa and Rosovsky, Japanese Economic Growth, p. 284.

29. A national survey of 1935 found a total of 1,296 ch'ien-chuang or native banks in China, of which 80 firms located in Shanghai accounted for 30.2% of the paid-up captial for all firms included in the survey; see F. Y. Chang, "Banking and Currency," in The Chinese Year Book, 1936-37 (Shanghai, 1936), pp. 795-96. Shanghai's share of financial activity in the modern

sector was, of course, far larger.

30. Chao, "Sources of Economic Growth," pp. 258, 266.

31. Robert M. E. Tomski, "Regional Economic Variation in China: An Historical Analysis" (unpublished draft, 1979), Tables X and A-1.

32. Population data are from ibid., Table A-1, except for the prewar Liaoning figure, which is a 1930 estimate reproduced in China Handbook, 1937-1943 (N.Y., 1943), p. 2.

33. This is particularly true in the Lower Yangtze area where the region involved in modern economic growth prior to World War II coincides with Skinner's Lower Yangtze regional core, an area that includes parts of Anhwei, Chekiang and Kiangsu provinces but excludes large areas of northern Kiangsu. See G. William Skinner, "Regional Urbanization in Nineteenth-Century China," in G. William Skinner ed., The City in Late Imperial China (Stanford, 1977), p. 215.

34. The China Business Review for March-April 1981 gives Shanghai's per capita GNP as US$1,800, or 7.1 times the national average of US$253. For commodity output, see Sun Huai-jen, "Kuan-yu Shang-hai fa-chan ti fang-hsiang" (On Shanghai's Development Path), She-hui k'o-hsueh 4 (1980): 9. The position of Shanghai in China's postwar economy is discussed in Thomas G. Rawski, "Problems of Technology Absorption in Chinese Industry," American Economic Review 65.2 (1975): 324-328; China's Transition to Industrialism, chap. 3; and "Strengths, Weaknesses and Challenges for Policy in China's Industry Today" (unpublished, 1980), pp. 211-243.

35. Frances V. Moulder, Japan, China and the Modern World Economy (Cambridge, 1977), pp. 199-200.

36. Chi-ming Hou, Foreign Investment and Economic Development in China 1840-1937 (Cambridge, 1965); Dwight H. Perkins, "The Economic Performance of China and Japan, 1842-1969," (unpublished, 1971); Robert F. Dernberger, "The Role of the Foreigner in China's Economic Development," in Perkins ed., China's Modern Economy in Historical Perspective, pp. 19-47; Victor D. Lippit, "The Development of Underdevelopment in China," Modern China 4.3 (1978), especially pp. 273-284; and Thomas G. Rawski, "China's Republican Economy: An Introduction" (Discussion paper, 1978).

37. James E. Sheridan, China in Disintegration (N.Y., 1975), p. 23 and Rhoads Murphey, The Treaty Ports and China's Modernization: What Went Wrong?" (Ann Arbor, 1970), p. 65.

38. Manshū kaihatsu yonjū nenshi (Forty-Year History of Manchuria's Development; 3 vols., Tokyo, 1964-65) provides a detailed description of Japanese activities in China's northeastern provinces.

39. Bank of Chosen, Economic History of Manchuria (Seoul, 1920), pp. 178-203; Tung-sheng t'ieh-lu kai-lun (Discussion of the Chinese Eastern Railway; n.p., 1928); Gavan McCormack, Chang Tso-lin in Northeast China, 1911-1928 (Stanford, 1977), pp. 106-08.

40. A 1932 survey of industrial enterprises using machinery and employing more than five workers reported that 63.7% of industrial capital was held by Japanese firms; see Manshū sangyō tōkei, 1932 (Manchurian Industrial Statistics for 1932; Dairen, 1934), pp. 55-57. For information on the composition of industrial output, see Liu and Yeh, Economy of the Chinese Mainland,

pp. 426-28.

41. Rawski, "China's Republican Economy: An Introduction," p. 16.

42. Central government investment outlays should appear primarily in the following budget items: industrial, communications, reconstruction, and capital for government enterprises other than banks. During the period from July 1, 1928 to June 30, 1937, expenditure in these categories amounted to 3.7% of total reported expenditures of 7,629 million yuan. Expenditure data are from Authur N. Young, China's Nation-Building Effort (Stanford, 1971), pp. 437-439.

43. Modern-oriented gross fixed investment in China proper is estimated at 2.9% of regional GDP during 1931-36 (Table 4).

44. Terry Sicular, "Industry and Finance in Republican China" (unpublished, 1979).

45. Liu and Yeh, Economy of the Chinese Mainland, pp. 141, 146. In this calculation, the modern sector is taken to include factories, mining, utilities, construction and modern transport.

46. Hiroya Ueno. "Investment Behavior in the Japanese Cotton Spinning Industry, 1916-1934," Econometrica 29.1 (1961): 45. Estimates of year-end stocks of spindles and looms are from Chao, Cotton Textile Production, pp. 301-07.

47. On the Yen family and Fan Hsu-tung, see Rawski, China's Transition to Industrialism, pp. 10, 16; for the activities of the Jung family and other prewar textile magnates, see Richard C. Bush, "Industry and Politics in Kuomintang China," (Ph.D. diss., Columbia University, 1978), pp. 43-66;

information on the Sincere Department Store group is based on unpublished research by Wellington K. K. Chan; on the British-American Tobacco Company, see Sherman Cochran, Big Business in China (Cambridge, 1980), pp. 129-45. For a general statement on the inflow of commercial capital into the textile and other industries, see Chou Hsiu-luan, Ti-i-tz'u shih-chieh ta-chan pp. 18-21.

48. A dummy variable is an artificial construct used to test the impact of a particular event or condition on the dependent variable (in this case, modern-oriented fixed investment) being investigated. The dummy variable has only two possible values, zero and one; in the present case, the value one is assigned to the wartime years 1914-18, with the dummy value fixed at zero for all other years. If the regression coefficient attached to the dummy variable is significantly different from zero, we conclude that the event or condition associated with the value of one in the dummy variable may exercise a distinct influence on the dependent variable. In our equations, a significant negative value of the dummy coefficient indicates that the level of modern-oriented fixed investment during World War I falls significantly below what would be expected on the basis of the relevant profit figures and the overall profit-investment relationship.

49. Data for 1933 compiled by Liu and Yeh, Economy of the Chinese Mainland, pp. 426-28, show that cotton spinning and weaving accounted for 31.1% of factory employment and 32.0% of gross output value of factories in China proper. For Manchuria, the corresponding shares are 17.2% for factory employment and 14.7% for factory output value.

50. Rawski, "China's Republican Economy: An Introduction," pp. 1, 3.

51. The increase in $\bar{R}^2$ arising from the addition of trade volume as an independent variable in the regressions cannot be attributed to the inclusion of imports of investment goods in both trade volume and modern-oriented fixed investment. Although net imports of investment goods occupy a large share of fixed investment, their share in foreign trade is small. In 1933, for example, gross imports of investment goods amounted to only nine percent of combined imports and exports. Net imports of investment goods would occupy a smaller share of total trade volume. Since investment outgrew trade volume by a wide margin in the decades preceeding 1933, earlier years would show a smaller overlap between foreign trade and modern-oriented fixed investment.

52. These figures are calculated from the index of trade volume derived in Appendix G, from GDP estimates in Yeh, "China's National Income, 1931-36," pp. 97, 126 and from the result, derived in Appendix G, that the combined foreign trade of China and Manchuria in 1933 was 48.5% above the Maritime Customs estimate of 1,987 million yuan for China proper only. It is often forgotten that the Maritime Customs figures from the middle of 1932 to the end of the Pacific War exclude Manchuria's foreign trade. The commonly used Nankai index numbers of foreign trade volume suffer from this defect.

53. J. Richard Huber, "Effect on Prices of Japan's Entry into World Commerce After 1858," Journal of Political Economy (1971): 614-28.

54. Murphey, The Outsiders. p. 104.

55. Lippit, Land Reform, p. 78.

56. David D. Buck, Urban Change in China (Madison, 1978), p. 211.

57. Lippit, Land Reform; Carl Riskin, "Surplus and Stagnation in Modern China," in Perkins ed., China's Modern Economy in Historical Perspective, pp.49-84.

58. Ibid., 74, 79, 84.

59. Ibid., 72. A critical evaluation of these results would begin by listing assumptions that build an upward bias into the calculations. In estimating the agricultural surplus, for example, Lippit assumes that the rural populace is divisible into mutually exclusive groups of peasants (including owner-farmers) and property owners, and that payments of rent and interest flowed exclusively from the first group to the second. He also assumes that all contractual obligations to pay rent or interest were met and that the industrial, managerial, commercial and financial activities of rural property owners made no contribution to farm production (Lippit, Land Reform, chaps. 1-2, esp. pp. 16-18, 50, 70). In a similar spirit, Riskin calculates surplus in non-farm sectors of the economy as the difference between net value added and wages ("Surplus and Stagnation," p. 72), apparently assuming that compensation received by landowners, managers, shareholders and lenders represents pure rent that could be transferred to alternative uses without reducing current production. To illustrate the unreality of assumptions we may cite C. K. Yang, A Chinese Village in Early Communist Transition, reproduced in Yang's Chinese Communist Society: The Family and the Village (Cambridge, 1965), a work praised by Lippit as providing insight into "the actual process of the land reform." In the village studied by Yang, cultivated

acreage amounted to about 1200 mou, of which 840 mou were rented out (p. 46). However only 540 mou were seized and redistributed in the land reform (p. 147), indicating that the percentage of rented land owned by persons or agents identified as rentiers was no more than 540/840 or 64% as opposed to the 100% figure assumed by Lippit (see his Land Reform, pp. 105-106). Roll, The Distribution of Rural Incomes in China, pp. 80, 87, cities national survey data showing that 10% of rent owed was not paid and that 21% of rent payments were received by working farmers.

60. Calculated from Line 2a, Panel A of Table 5.

61. Population data are from Liu and Yeh, National Income, p. 178. I have increased the total for Kiangsu by five million to allow for Shanghai and Nanking, which were classified as "special municipalities and districts." Manchuria's population share was 7.0% (ibid.) but its output share in 1934 was 9.4% (Line 1, Panel A, Table 5) or 34% higher. The 27.2% share of surplus in total output is Riskin's estimate from Table 14. The share of modern-oriented fixed investment in GDP, .047, is the 1936 estimate from Line 3a, Panel A, Table 5.

62. Inflow of foreign funds is compared with investment for China proper because Manchurian data are omitted from the former series beginning in mid-1932.

63. Quoted in Riskin, "Surplus and Stagnation," p. 83.

64. Dwight H. Perkins, Agricultural Development in China, 1368-1968 (Chicago, 1969), esp. ch. 6, 7 and Appendix I; G. William Skinner, "Marketing and Social Structure in Rural China," Parts I-III, Journal of Asian Studies 24.1-24.3 (1964/65) and "Regional Urbanization in Nineteenth-Century China"

and "Cities and the Hierarchy of Local Systems" in The City in Late Imperial China, ed. Skinner, pp. 211-249, 275-351; Gilbert Rozman, Urban Networks in Ch'ing China and Tokugawa Japan (Princeton, 1973). Minami shina nenkan (South China yearbook; Taipei, 1939), pp. 87, 89, 147, 192, gives monetary totals for the [illegible] but neither the derivation nor the significance of these figures is discussed.

65. Frank M. Tamagna, Banking and Finace in China (N.Y., 1942), p. 94; Andrea L. McElderry, Shanghai Old-Style Banks (Ch'ien-Chuang) 1800-1935 (Ann Arbor, 1976), p. 191; F. Y. Chang, "Banking and Currency," p. 794.

66. Data on native bank capital are from Shang-hai ch'ien-chuang shih tzu-liao (Materials on the History of Shanghai Native Banks; Shanghai, 1960), p. 18. Data on native bank deposits are approximations based on estimates of native bank capital and on a 9:1 ratio between deposits and paid-up capital reported in surveys of native banks.

67. Alexander Gerschenkron, Economic Backwardness in Historical Perspective (N.Y., 1965) p. 24.