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STRUCTURAL CHANGES AND SECTORAL INTERDEPENDENCE IN THE CHINESE ECONOMY, 1952–80

KUAN-I CHEN and ROBERT T. TSUCHIGANE

SUMMARY OF CONTENT

This paper examines the structural change of the Chinese economy during 1952–70. Since the Chinese economy has a combination of characteristics not usually found in other economies at the same stage of economic development, this study attempts to demonstrate whether the structural change of the Chinese economy is consistent with the findings of Kuznets and Chenery and Taylor. It also analyzes the factors affecting the shares of each sector in the economy as well as the sectoral interdependence between agriculture and industry in the context of the demand for and supply of selected variables.

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I. INTRODUCTION

As the economy of a nation develops, the shares of the agricultural, modern,

and service sectors in the net domestic product (NDP) would change over time. A review of the literatures on the long-term trends in the sectoral share of NDP for a number of economies, whether developed or less developed, shows that the share of NDP in the agricultural sector first declined and later leveled off at a certain low level. The share of NDP in the modern sector increased at an early stage of development but declined mildly or remained unchanged at a later stage of development. The share of NDP in the service sector reveals a trend of mild increase or stability. China's economy has the characteristics of "underdeveloped", "planned", "near autarky", and "quite invulnerable to fluctuations of world prices of primary commodities", and has experienced substantial economic fluctuations[1] during 1952–65. It is therefore interesting to find out what factors affected the share of Chinese NDP in each of the three sectors. What would be the underlying forces affecting the agricultural and modern sectors of the Chinese economy? What would the performance of the Chinese economy be like in 1980 as its sectoral change follows such trends into the 1980's?

The aims of this paper are, therefore, threefold. First, we shall examine factors affecting the share of NDP in each of the three sectors of the Chinese economy. In so doing, we shall make our own formulation in explaining the share of NDP in each of the three sectors of the economy. Second, we shall examine the factors affecting the agricultural and modern sectors with emphasis on sectoral interdependence. Third, we shall project the sectoral change of the Chinese economy in 1980 as an integral part of this study. The task of evaluation of any economic performance in the past will be incomplete unless the validity of suggested hypothesis is re-examined in the context of up-to-date development and the assumptions underlying the hypothesis are critically appraised. To re-examine the hypothesis we shall compare selected indicators of the economy in the 1969–71 period with those projected on the basis of our estimation in the same period before we project the economy to 1980.

II. CHANGES IN ECONOMIC STRUCTURE

Past studies[2] indicate that at the early stage of economic development as per capita income rose, the share of net domestic product (NDP) in the agricultural sector fell while the proportion of NDP in the manufacturing sector rose. The service sector would make up either a constant or mildly increasing or decreasing proportion of NDP. Main reasons cited for structural change in a three-sector economy are attributed to (1) transformation of the economy from predominantly agricultural to industrial state and (2) transfer of surplus labor from agriculture

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[1] Chen, Kuan-I,, "Economic Fluctuations in a Planned Underdeveloped Economy—A Study of Mainland China, 1952–65," *Asian Survey*, University of California Press, April 1972, pp. 349–62.

[2] Kuznetx, S. "Industrial Distribution of National Product and Labor Force," *Economic Development and Cultural Change*, Vol. 5, July 1957 Supplement.

(low productivity) to industry (high productivity).

In a more recent study, Chenery and Taylor[3] explained the share of NDP in each of the agricultural, industrial, and service sectors in terms of per capita income, size of population, and proportion of gross domestic investment to GNP, the ratio of exports to GNP, and the ratio of imports to GNP.

Previous studies were based on free market economies, whether developed or underdeveloped. It is, therefore, instructive to examine factors affecting the share of NDP in each of the three sectors in the economy of Mainland China. Our study attempts to present an interpretation which would closely represent the economic reality of Mainland China. In common with previous studies our study employs similar analytical concepts, hypotheses and methods developed by other writers. The important exception is, however, the exclusion of domestic investment from the demand equation. The other exclusion is the effect of foreign trade on structural change in the economy of Mainland China.

China's economy is divided into three sectors, namely, the traditional sector, the modern sector, and the government sector. The traditional sector constitutes agriculture, handicraft, and other economic activities closely related to agriculture. ("Traditional" is used interchangeably with "agricultureal" in this paper.) This sector had experienced a steady decline in its share of NDP from 65 percent in 1952 to 44 percent in 1965 while the modern sector which consists of mining, construction, utilities, and modern factories as well as wholesale and retail trade had shown a steady increase in its share of NDP from 30 percent to 51 percent during the same period.[4] The proportion of government sector which provide services needed for the economy had undergone little change in its sahre of NDP, ranging between 4.6 and 5.6 percent. This decomposition of the Chinese economy into three sectors resembles that employed by other writers while recognizing some differences in classification. Such differences reflect appropriately the reality of an economy undergoing industrialization and modernization with government direction in the past two decades.

Underlying the above structural changes in the economy are the drastic shifts in priority and the subsequent changes in economic policy during the period, 1949–65. This whole period may be divided into three distinctive phases of development. The first phase of development during the period, 1949–57, was characterized by the Soviet model of emphasizing heavy industries, nationalization of industries and socialization of agriculture. The second phase of developmemt, 1958–60, was characterized by the "Great Leap Forward" strategy which would permit and foster the simultaneous development of agriculture and industry. This strategy involved mass mobilization of underemployed rural labor to work on labor-intensive rural investment projects, to increase per acre yield without much

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[3] Chenery, H. B. and Taylor, L. "Development Patterns Among Countries and Over Time," *Review of Economic Statistics*, Vol. 50, November 1968, p. 391.

[4] Based on data in Alexander Eckstein et al., *Economic Trends In Communist China*, Aldine, 1968, pp. 163–4.

modern inputs, such as chemical fertilizers, electric pumps, etc., and to develop small scale industry rapidly. Thus the special features of this strategy are mass mobilization of labor, dualism in technology and the economy, decentralization of economic management and the establishment of communes. This strategy brought great disruptive effects upon the economy and was finally abandoned.

Third phase, 1961–66 was characterized by a policy which considered agriculture as the foundation and industry as the leading factors. Agriculture was accorded highest priority. Consumer goods industries were accorded higher priority than producers goods branches. Within the producers goods branches, emphasis was shifted to those branches that support agricultural development. Private plots were reintroduced and modern agricultural techniques, irrigation and rural electrification were extended.

In an attempt to determine the effect of the demand factors on structural change of the economy we have estimated three equations each of which is linear in the growth rate of population and of the NDP. A summary of the statistically significant results is presented in Table 1. Equation (1) can be interpreted, for example, as follows: an annual increase in the NDP, say, by 6 percent would result in the decreases of the share of the traditional sector, S_a, by six-tenths of one percentage point ($-.10$ times 6 percent) while an annual increase in the rate of population growth (pop), say, by one percent would result in a drop of the share of that secotr by .74 percentage point (.74 times 1 percent). As a result, the traditional sector would decrease its share in the NDP by 1.34 percentage points. In contrast, the modern sector, S_m, would increase it share in the NDP by 1.34 percentage points (.11 times 6 and .68 times 1 give 1.34) and the service sector, S_s, would keep its share unchanged ($-.01$ times 6 and .06 times 1 give zero).

Two independent variables, NDP and POP are statistically significant at the 5 percent level for equations (1) through (3) with the exception for NDP in equation (3). NDP represents aggregate demand while POP is viewed as aggregate physical needs. Thus, both NDP and POP constitute a kind of proxy variable for per capita domestic product. There are, however, two other demand variables that should be included in each of the three equations. They are domestic investment and net balance of imports and exports. Exclusion of domestic investment could be justified because the relationship between the dependent variable, the share of NDP, and investment is not linear. Instead, domestic investment is a function of the lagged investment, the lagged food grain output, and the capital-output ratio. Thus, the inclusion of the ratio of domestic investment to NDP in the equations not only misrepresent reality but also distort the picture of structural change.[5] In the absence of continuous inflow of foreign credit, it was necessary for China to pursue a deliberate policy of balancing import with export. In the meantime import and export each made up about 2 percent of the GNP as a result of a self-reliance policy. Thus the Chinese net balance of export

[5] For an estimate of investment equation, see equation (8) in Table 2.

and import as a percentage of NDP was neglibible.

Results shown in Table 1 are consistent with those of Kuznets, Chenery, and Taylor. We have found two variables, NDP and POP, provide a far better explanation of long-term structural changes in the economy of Mainland China than any other variables such as per capita domestic product, domestic investment, and net foreign exports. The negative effects of NDP and POP on the traditional sector indicates transfer of labor from the traditional sector to the modern sector. In contrast, the positive effects of NDP and POP on the modern sector shows increases in production and employment in this sector while in the service sector NDP and POP have the opposing effects on the share of NDP.

III. SECTORAL INTERDEPENDENCE BETWEEN AGRICULTURE AND INDUSTRY

We have examined demand factors affecting each sector of the economy in aggregate terms. We shall not analyze the relationship between agriculture and industry. In the process of economic development, both agriculture and industry play a vital role. Agriculture provides food and other raw materials to industry for processing while industry supplies fertilizers, agricultural equipment and machinery, and various consumer products to the agricultural sector. General services provided by government is also important in facilitating the process of economic development. In the absence of a finer breakdown of data for the service sector we focus attention to the relationship between the two other sectors, namely, agriculture and industry.

The development policy of industry in Mainland China has been shifted during the period, 1952-71. The first phase, 1952-57, was characterized as one of rapidly developing the heavy industry sector. Substantial gains were made in basic producers goods such as iron and steel, nonferrous metals, cement, metal processing, machinery and equipments, and chemicals. However, only limited supports were given by this key sector in the form of modern inputs to the agricultural sector, although the latter played an important role in financing such industrialization. Thus the interdependence between agriculture and industry did not work in full force during this first phase.

During the second phase, 1958-60, a change in the policy of industrial development was made. A simultaneous development of two distinct industrial sectors was pursued—a modern large-scale capital-intensive sector and a more or less traditional, small-scale labor-intensive sector. The strategy of developing the former sector resembled the one pursued during 1952-57. The development of the latter sector, however, represented a new stragegy which encourages the growth of small-scale industry in branches such as coal extraction, iron and steel, fertilizer, machine shops, power generation as well as the traditional food processing and textile industries.

Much of the inputs for such small-scale industry would not be supplied from the

TABLE I. SIGNIFICANT VARIABLES (DEMAND FACTORS) ASSOCIATED WITH THE
STRUCTURAL CHANGE IN THE NET DOMESTIC PRODUCT OF CHINA FOR THE
AGRICULTURAL, (TRADITIONAL), MODERN, AND SERVICE SECTORS,
1952-1970
(t values in parentheses)

Dependent Variable	Independent Variable			R^2
	NDP	POP	Const.	
(1) S_a	−.10	−.74	140.6	.95
	(1.97)	(5.18)	(13.79)	
(2) S_m	.11	.68	−40.4	.95
	(2.11)	(4.89)	(4.04)	
(3) S_s	−.01	.06	.6	.70
	(.63)	(3.03)	(.55)	

Estimated Shares of NDP by the sectors: $S_a = 32\%$; $S =_m 62\%$; $S_s = 6\%$.
1970

Sources: Population (POP) data from Leo Orleans "Propheteering: The Population of
Communist China: Current Science, December 15, 1969, p. 15.

Sectoral percentage shares of NDP for 1952-65 were compiled from statistics pre-
sented in Alexander Eckstein et al. Economic Trends in Communist China, Aldine,
1968, pp. 163-4.

Sectoral percentage shares of NDP for 1970 were based on the information given in
(1) Edgar Snow "Talks with Chou En-lai" New Republic, March 27, 1971, p. 23
and Leo Goodstadt "China Looking Past Mere Survival" Far Eastern Economic
Review, January 8, 1972, p. 27. The ratio of agricultural output to industrial
output referred to by Leo Goodstadt is 1: 3. However the ratio as defined in
our analysis refers to that of traditional sector (including agriculture) to modern
sector. It is obvious that the output of the traditional sector is larger than that of
agriculture sector. Based on data in Table I, the ratio of traditional sector to
modern sector is most likely to be 1: 2 in 1970. If the service sector continues to
make up 6 percent of the NDP, then the percentage share of NDP for 1970 will
be as follows: $S_a = 32\%$; $S_m = 62\%$; and $S_s = 6\%$.

Sectoral percentage shares of NDP for 1966-69 are extrapolated from the percentage
share figures of 1965 and 1970.

modern large-scale sector located normally in cities, but they were to be composed
mainly of the locally manufactured equipments, local labor, and local raw materi-
als. The outputs of such small-scale industry would solely be used to provide rural
areas with manufactured consumer goods, agricultural implements and tools
and other inputs for farm production. Thus the rural sector bore the burden of
providing export surplus for the modern sector, the urban population, as well
as the earnings of needed foreign exchanges. In the meantime the chief task of
the modern sector was to further its own expansion. Most of the output of this
sector would be employed to support new plant construction for the further
growth of this sector; the foreign exchange earnings from any export of such out-
puts would be used to finance imports of capital goods.

As a result, the modern sector's growth would depend on its own output and
reinvestment plus the surplus derived from the agricultural sector while the growth

of the rural sector would depend heavily on its own output and reinvestment with only minimum support from the modern sector. Thus, the national economy would be composed of two almost separate economic systems with only loose link through limited rural-urban trade and interregional trade. The interdependence between agriculture and small industry appeared to operate only within the rural sector, but the interdependence between agriculture and modern industry (including that between small industry and modern industry) was prevented to operate for the national economy as a whole. This was one of the main reasons why the economy was in a state of chaos toward the end of the phase, 1958–60.

The third phase, 1961–71, saw a great shift in the policy of industrial development. The new policy recognized the close interdependence of agriculture and industry and of consumption and investment. Priority was given to agriculture and consumer goods. Modern heavy industry was geared to support agriculture and consumer goods industry. The development of the small industry would now receive support from the modern industrial sector. Thus the interdependence among agricutlure, modern sector and small industry sector was allowed to work with full force in the overall national economy. As a result, a more balanced growth in agriculture and industry and in consumption and investment were realized during this third phase.

Did any pattern of intercependence of agriculture and industry emerge from the period 1952–71 as a whole? If so, what would be the factors affecting such relationship? We shall attempt to answer these questions in the rest of this section.

To obtain an overall view of the relationship between industry and agriculture, it is necessary to have a comparable series of figures for both sectors over time. Furthermore, it is convenient to have a series of data free from any physical units because this will facilitate the comparison of one period with another, expecially for the task of projection.

In order to meet these requirements we have devised a series of comparable indexes for selected variables in both sectors. The base year of 1956 was selected to adjust other variables with industrial index.[6]

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[6] The Laspeyres (or Paasche) index is the fixed weight type index and both indexes are different when weights are different. Irving Fisher thought he had solved the index problem, in particular the weighting problem, when he constructed his "ideal index" which is the geometric mean of the Laspeyres and Paasche indexes. But Fisher actually concealed the weighting problem, instead of solving it. Thus, the index problem cannot be free from the weighting problem in any sense of the word.

Nevertheless, the Laspeyres and Paasche indexes are two time-honored indexes from a practical point of view, as N. Lititan and D. Patinkin comment on both indexes: "What has been well recognized is that the Laspeyres and Paasche indexes provide limits for two different true indexes." (*Economic Development and Cultural Change*, April 1961, p. 520.) This leads to a consideration that the configuration of results are more meaningful than one index alone. In the absence of Paasche index, however, we must make use of the Laspeyres index while recognizing its limitations. These limitations generally reflect built-in downward bias when indexes rise rapidly.

The least squares method is based on the strong assumption that the disturbance term is uncorrelated with each of the independent variables. The validity of this assumption is untenable because agriculture and industry are interdependent. Thus, the two stage least squares method would be used here to provide unbiased estimates of regression coefficients in an interdependent model.

In order to explain the sectoral interdependence a simultaneous equations model consisting of five equations—two demand and two supply equations as well as an investment equation—was constructed for the purpose. Both industrial output and food grains output are explained by two demand variables, net domestic product (NDP) and Population (POP). Industrial output is also explained by two supply variables, food grains output (F), the expected value of investment $(\widehat{\text{Inv}})$, the latter is derived from investment equation (8), Table 2. The food grains output has two explanatory variables, chemical fertilizer (FL) supplied by industry and the expected value of investment $(\widehat{\text{Inv}})$. Investment equation (8) has three explanatory variables, the percentage change in net domestic product (ΔNDP), as measured by $(\text{NDP}_2 - \text{NDP}_1 / \text{NDP}_1)$ times 100, net domestic investment lagged one year (Inv_{-1}), and food grains output lagged one year (F_{-1}).

In the simultaneous equation model all variables are divided into endogenous and exogeneous variables. Endogenous variables are IND, F, NDP, ΔNDP, INV and FL while exogenous variables are POP, $\widehat{\text{Inv}}$, F_{-1}, Inv_{-1}. Each of the five equations satisfied order condition for identification. A summary of the results is presented in Table 2.

Equation (4) shows that an increase in NDP by 6 percent would require an increase in industrial output by 11.22 percentage points and that a two percent increase in population would bring an additional increase in the demand for industrial output by 0.80 percentage point (a total of 12.02 percentage points in industrial putput). In contrast, food grains demand would increase by 3.54 percentage points with a 6 percent increase in NDP and increase by 0.12 percentage point with a 2 percent increase in population (a total of 3.66 percentage points in food grains output) (Equation 5). However, the variable of population is not statistically significant at the 5 percent level. Equation (6) shows that an increase in food grains ouput by 2.5 percentage points and an increase of invesment by 5 percentage points would result in an increase of 11.95 percentage points (the sum of 1.45 and 10.5) in industrial output while a five percent increase in fertilizer and a 7.3 percent increase in investment would result in food grains output by 2.5 percentage points (Equation 7).

The relationship between industry and agriculture may be viewed from two different directions. One way is to look at the relationship as the influence of agriculture on industry. A 2.5 percent change in food grains output, for example, would cause industrial output to change by 1.45 percentage points (Equation 6). This, in itself, accounts for interdependence between industry and agriculture. The other way of looking at the relationship is industry's influence on agriculture.

TABLE II. DEMAND AND SUPPLY EQUATIONS IN INDUSTRY AND
AGRICULTURE, MAINLAND CHINA
(t values in parentheses)

Equation	Endogenous variable	Exogenous Variables	R^2
		Demand (1952–70)	
(4)	Ind	$1.87NDP + .40POP - 20.9$ $(2.72) \quad\quad (.21) \quad\quad (1.41)$	.90
(5)	F	$.59NDP + .06POP + 25.3$ $(2.54) \quad\quad (.74) \quad\quad (1.76)$	.88
		Supply (1952–65)	
(6)	Ind	$.58F + 2.10\widehat{Inv} - .52$ $(1.50) \quad\quad (3.50) \quad\quad (1.66)$	.65
(7)	F	$.20FL + .21\widehat{Inv} + 78.4$ $(2.21) \quad\quad (2.12) \quad\quad (6.78)$	.66
		Investment (1952–65)	
(8)	Inv	$.80\Delta NDP + .49Inv_{-1} + .83F_{-1} - 120.2$ $(2.03) \quad\quad (2.06) \quad\quad (2.00) \quad\quad (2.10)$	.90

Sources: Liu, Ta-Chung "The Tempo of Economic Development of the Chinese Mainland, 1949–65," *An Economic Profile of Mainland China*, Joint Economic Committee, U.S. Congress, February 1967, p. 50; Field, R. M. "Chinese Communist Industrial Production," *An Economic Profile of Mainland China*, pp. 271–295; O. L. Dawson's estimate of food grains output taken from E.F. Jones' "The Emeriging Pattern of China's Economic Revolution," *An Economic Profile of Mainland China*, pp. 79–96; A. Eckstein, *Economic Trends in Communist China*, Chicago: Aldine, 1968, p. 172 and p. 164; Liu, T. C. and Yeh, K. C. *The Economy of the Chinese Mainland: National Income and Economic Development, 1933–59*, Princeton University Press, 1965, p. 66.

S. Ishikawa estimated NDP in 1952 Yuan to be 131 billion yuan (S. Ishikawa, "A Hypothetical Projection of the Chinese Economy, 1966 to 1981," *The Developing Economies*, September 1970, p. 272.) It was estimated that NDP in 1967 dropped by 5.9 percent from that of 1966. This 5.9 percent was derived from (a) reported drop of industrial output by 15 percent between 1966 and 1967 (*Far Eastern Economic Review*, January 29, 1972, p. 23), (b) the share of industrial sector in the 1966 NDP was 53 percent, (c) estimated increase of agricultural output (food grains) in 1967 over that in 1966 was about 4 percent, (d) the share of agricultural sector in the 1966 NDP was 42 percent, and (e) the service sector output fluctuated with NDP and the share of service sector in the NDP was 5.3 percent in 1966. The shares of the three sectors in the 1966 NDP was derived by extrapolation between the sectoral shares for 1965 and 1970. An estimate of the NDP in 1970 was 154 billion yuan based on extrapolation.

The degree of influence of chemical fertilizer on good grains, measured by regression coefficients, is 0.20, i.e., a 5.0 percent change in chemical fertilizers supply would cause food grains output to change by 1.0 percentage points. This reflects that good grains output depends on the fertilizer supply to an important degree (Equation 7).

The close interrelationship *between* industry—particularly light industry and industry that provide essential inputs for the agriculture—*and* agriculture have been given recognition by the Chinese planners since the early 1960's. The branches of industry which produce chemical fertilizers, insecticide, irrigation equipments, electric pumps and agricultural implements have shown continued growth during 1961–71. The latest reports[7] on China also indicate that these branches of industries will continue to receive priority from the planners. Thus, it is expected that the degree of influence of industry on agriculture must have been increased since mid-1960's and will continue to grow in the near future. In consequence, the interdependence of agriculture and industry will be strengthened further. There has been steady growth in food grains output for the past 10 years. Factors such as better seeds, favorable weather, river control systems, etc., no doubt, would contribute to the growth, but the supports from the industrial sector, in the form of pumps, irrigation equipments, agricultural implements, chemical fertilizers, etc., have become more and more indispensable, when combined with the above mentioned factors, in making such growth possible.

It is reported that the Chinese NDP has increased at an annual rate of 10 percent for 1970[8] and 1971[9]. With steady gains in both industrial and farm output in recent years the Chinese economy should achiere further expansion in the next few years if stable political conditions continue. This will enable us to project the structural change and growth in the Chinese economy to 1980 under a number of assumptions in the next section.

In industry and agriculture, investment plays an important role in providing productive facilities needed for success of industrial and agricultural production. Investment, Inv, is itself an endogenous variable and hence it is not legitimate to use investment as an independent variable in a regression equation. The problem is how to use the variable, investment, in a legitimate way. In handling this type of problem, the expected value of investment, $\widehat{Inv}$, will be computed in equation (8). Then the expected value of investment becomes a valid exogenous variable seeking to explain the dependent variable (equations 6 and 7 in Table 2). All these explanatory variables were found significant in Equation (8).

Net domestic investment has an important bearing upon the percentage change in net domestic product, ΔNDP. Since the average change in NDP is 4 percentage points, index of investment would tend to increase by 3.2 percentage points, *ceteris paribus*. The magnitude of this figure appears to be in line with the incremental capital-output ratios obtained in the past. A gross fixed incremental

[7] *Far Eastern Economic Review* Yearbook 1972, pp. 143–151 and *New York Limes*, January 14, 1972, p. 44C.

[8] *Study of China's Economy*, 1971 (in Japanese Lanuage), a report prepared by the Ministry of Foreign Affairs, Japan, 1971, pp. 4 & 84.

[9] Leo Goodstadt "China: Looking Past Mere Survival," *Far Eastern Economic Review*, January 8, 1972, p. 27.

[10] Liu, Ta-Chung "The Tempo of Economic Development of the Chinese Mainland 1949–65," *Economic Profile of Mainland China*, Joint Economic Committee, U.S. Congress, Government Printing Office, February 1967, p. 62.

mate for the incremental capital-output ratio was 3.1 for 1961–65.   Thus, Equation (8) provides a reasonable estimate for the incremental capital-ouptut ratio for the period 1952–65.

Estimates of the demand for and supply of industrial output and food grain output for 1980 are shown below:

	Demand[11]	Supply[12]	Average percentage error[13]
Ind	598.10	588.08	1.7
F	165.00	160.00	3.0

The average percentage error attributable to the difference in the demand for and supply of industrial output is only 1.7 percentage points while comparable error attributable to the difference in the demand for and supply of food grain output is 3 percentage points.

Such small percentage errors attributable to the difference between demand and supply for 1980 demonstrate that demand and supply equations are highly consistent with each other.   Estimates of regression coefficients in equations (4) through (7) are fairly reliable in terms of projection for 1980, thereby supporting the hypothesis of sectoral interdependence.

IV.   PROJECTION OF SECTORAL SHARES

Estimates of regression coefficients provide one side of the picture concerning reliability of each of regression estimates.   Projection of sectoral shares based on estimates of regression coefficients provides the other side of the picture in terms of the reliability of each of regression coefficients.   To show evidence that regression coefficients obtained from equation (1) through (3) of Table 1 are consistent with each other, we attempt to project sectoral shares for 1980, thereby supporting the hypothesis that the economy of Mainland China will be subject to structural change for 1980 as it has been in the past.

Estimates of S_a, S_m and S_s for 1980 are obtained from Equations (1) through (3) in Table 1 by substituting the 1980 values of NDP and POP for those 1970 values in these equations.   The 1980 values of these two explanatory variables are obtained by extrapolating their 1970 values on the basis of the compound annual rate of growth of 6% and 1% respectively.   (See Table 3 for explanation of the 6% growth rate.)   A summary of these sectoral shares for 1980 is presented in the first three columns of Table 4.   The estimated share of the traditional sector

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[11] Based on equations (4) and (5), provided that indexes of NDP and POP for 1980 are 292.0 and 135.0 respectively.

[12] Based on equations (6) and (7), provided that indexes of F, $\hat{Inv}$, and FL for 1980 are 160.0, 238.0 and 162.1 respectively.

[13] Is defined as the difference in value between demand and supply in Table 2 divided by the adverage of demand and supply estimates.   In symbols $\left[\dfrac{D - S}{(1/2)\,(D+S)]}\right] \times 100$ where D and S are demand and supply estimates.

TABLE III.   EXTRAPOLATION OF SELECTED VARIABLES

	POP	NDP*	F	IND	FL	$\widehat{INV}$
Base Year	1956	1952	1956	1956	1970	1956
Annual Growth Rate (in percent) 1970–80	1.0	6.0	2.5	10.0	5.0	6.4
1970	122.4	154.0	133.3	216.0	100.0	93.8**
1980	135.1	275.7	170.6	561.0	162.8	237.9

* Is expressed in terms of billions of 1952 Yuan.
** Indicates the year 1965.

Note 1.   Each of the variables (POP, F, IND, and $\widehat{INV}$) are expressed in terms of index number, the year 1956 being 100.0 while the variable FL is 100.0 in 1970.

Note 2.   Each of the variables is extrapolated on the basis of a given annual rate of growth during a period between 1970 and 1980. The only exception is the variable $\widehat{INV}$ which is extrapolated on the basis of a given annual rate of growth (6.4 percent) during a period between 1965 and 1980.

Note 3.   The assumed growth rate of NDP for 1970–80, which is 6 percent, is consistent with the structure of the economy because this is the weighted average of the three sectors. S_a which constituted 32 percent of NDP in 1970 is assumed to grow at 2 percent, S_m which was 62 percent of NDP is assumed to grow at 8.5 percent (heavy industry consists of 50 percent with 12 percent growth rate, light industry consisting of the remaining 50 percent with 5 percent growth rate), and S_s which was 6 percent of NDP is assumed to grow at 2 percent. The weighted average is then 5.99 percent. For convenience it is assumed to be 6 percent.

Sources: See Tables I and II.

TABLE IV.   ESTIMATES OF SELECTED ENDOGENOUS
VARIABLES FOR 1980

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Demand		Supply		
Year	S_a	S_m	S_s	IND	F	IND	F	INV
1980	13.3%	81.0%	5.6%	598.1	165.1	588.1	160.0	200.4

Note 1.   IND, F and INV are expressed in terms of index numbers while, S_a, S_m, and S_s are expressed by percentage terms.

Note 2. S_a, S_m, and S_s are obtained from Equations (1) through (3) in Table I by substituting the 1980 values of NDP and POP for those 1970 values. Figures in columns (4) and (5) are derived from Equations (4) and (5) in Table II by substituting the 1980 values of NDP and POP for those 1970 values. Figures in columns (6) and (7) are derived from Equations (6) and (7) in Table II by substituting the 1980 values of F, $\widehat{INV}$, and FL for those 1970 values. Figures in column (8) is derived from Equation (8) by substituting the 1980 values of NDP, INV-1, and F-1 for those 1970 values. Table 3 presents the 1980 values of POP, NDP, F, IND, FL and $\widehat{INV}$.

in the NDP by 1980 would only be 13.3% while the estimated share of the modern sector would be as high as 81.0%. It is possible that the share of modern sector is overestimated while the shares of agricultural sector is underestimated in view

capital-output ratio of 2.8 was obtained by Liu and Yeh[10] for 1952–57. Our esti-
of the fact that over 70% of the population is still living in the communes. How-
ever under the Chinese system, a commune, a widespread form of agricultural
production unit, is more than agriculture in the ordinary sense of the word. It
embraces such activities as agricultural, industrial, services, administration,
cultural, etc. The population in the communes have generally been viewed in the
West as farm population or population engaged in agriculture. Actually a
substantial proportion of them have engaged in various non-farming activities or
have devoted a part of their time to non-farming activities. The proportion of
population in communes falling into such category should grow larger in the
future as small and medium-sized industries and other professional services are
being expanded rapidly. Thus whenever we refer to the percentage shares of
the three sectors in the Chinese economy, in 1980, we should always bear in mind
the kind of labor force distribution peculiar to the Chinese economic organiza-
tion.

V. PROJECTION OF INDUSTRIAL OUTPUT, FOOD GRAINS
OUTPUT, AND INVESTMENT

Estimates of IND, F. and INV are obtained from equations (4) through (9),
by substituting the 1980 values of NDP, POP, $\widehat{INV}$, and FL for those 1970 values.
Table 3 persents the estimates of the 1980 values for these explanatory variables.
A summary of the results is presented in Table 4.

As can be seen from the above summary the differences in values of demand and
supply are relatively small for industrial output and food grains ouptut. This
appears to indicate that equations in Table 2 are consistent with aggregate ex-
planatory variables such as NDP, POP, INV, F, and FL.[14]

As for investment equation, the predicted value derived from equation (8) in
Table 2 (200.4) is not close to the projected value drived from the compound rate
of growth of 6.4 percent (237.9). The average percentage error is about 17 per-
centage points.[15]

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[14] The percentage share of the three sectors in 1980 is already indicated in Table IV. If we
assume that growth rates are 2 percent for the traditional sector, 8 percent for the modern sector,
and 6 percent for the service sector, then the weighted average of the rate of growth becomes
6.86 percent. This might turn out to be a conservative estimate in view of the new emerging
economic relation between China and capitalist industrialized nations. Such development
might very well boost the annual growth rate to 7 percent or higher during 1972–80. Should
this be the case, the traditional sector becomes 11 percent, the modern sector 83 percent, and
the service sector 6 percent respectively.

[15] One way of indicating the percentage error due to the difference in value between supply
and demand in Table IV is to compute the average percentage error on the basis of the following
formula:

$$\left[\frac{y_1 - y_2}{(y_1 + y_2)/2}\right] \times 100, \text{ where } y_1 = \text{the value}$$

obtained from regression and y_2 = the value obtained from extrapolation.

This difference is primarily attributable to the assumption that the incremental capital-ouptut ratio remains unchanged. However, it is expected that the ratio would increase slightly between now and 1980 because of the continued encouragement of more sophisticated industries and the emphasis on larger flood control and transportation projects in remote areas as China gains more experiences in the task of industrialization. The annual rate of growth of industry would tend to decline from 8.5 percent in the period 1965–70 to 8.0 percent in 1980 due to changes in incremental capital-ouput ratio in both heavy and light industry. An increase in incremental capital-output ratio requires more capital per output, thereby reducing the projected value derived from the compound rate of growth of 6.4 percent. An explanation for such changes in incremental capital-output ratio requires further detailed research on the productivity of industrial output.

VI. CONCLUSION

The share of NDP in the tripartite economy changes as the economy develops. Findings shown in Table 1 are consistent with those of Kuznetz, Chenery and Taylor. The general law of economic development is applicable to the economy of Mainland China. However, there are some unique differences in the explanatory variable between China and other countries. The differences, reflecting the reality of the Chinese economy, are as follows:

(1) China has been in the stage of autarchy. Hence the role of foreign trade has not been a major factor in economic development;

(2) Investment, as a component of NDP, has played a prominent role in both industry and agriculture in terms of supply rather than demand.

The relationship between agriculture and industry shows not only that transfer of surplus labor from agriculture to industry has taken place but also that a decline in the capital-output ratio has been recognized. The supply of chemical fertilizer and productive facilities to agriculture is as important as the supply of foodgrains output and productive capacities to industry. Thus investment contributes to theenhancement of general productive capacities in both industry and agriculture.

The supply and demand in the interdependent model is found to be highly consistent in 1980 in the context of overall development, indicating that assumptions underlying projected values of selected variables appear to be reasonable while recognizing some limitations. This study further suggests a type of future research on sectoral change and interdependence between industry and agriculture on a disaggregate level when the Chinese government would release more economic data in the future.

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