The Chinese Economy: Analyses of Selected Problems

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C H I N A ' S E C O N O M Y

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Table of Contents

Gregory C. Chow
February 1983

Chapter 1

HOW A MARKET ECONOMY WORKS

1.1 SOME IMPORTANT QUESTIONS IN ECONOMICS

This is a book about the Chinese economy. It will describe and explain how the Chinese economy works. In order to determine what phenomena about the Chinese economy to describe, we first have to state what the important economic questions are. In other words, we need to know what the science of economics studies. We will therefore begin by discussing the subject matter of economics and the important questions one should ask about an economy.

According to China's Statistical Year Book, 1981 (p. 20) the national income of the People's Republic of China (PRC) was 388.7 billion yuan RMB (the Chinese monetary unit) in 1981. With a population of about 1 billion, this amounted to about 390 yuan per person. At the official exchange rate of 1.9 yuan to one U.S. dollar, the per capita national income would have been $205 in 1981. This figure is only a very rough indicator of the output per person in China for the purpose of comparison with the United States because the concepts of national income are different, the exchange rate may not accurately reflect the ratio of the puchasing powers of the currencies in the two countries and, more importantly, because in a less developed country, a larger fraction of consumption is derived from home production which is not recorded in the national income statistics. Be that as it may, national income per capita in the United States in 1981 was $10,237, about 50 times the corresponding Chinese figure. Our first question is, "What explains the quantity of output per person in a country?" Why is one country rich and another country poor?

The output in a country depends on the natural resources, accumulated physical resources (stock of physical capital goods) and human resources (stock of human capital) available. In most cases, the endowment of natural resources is the least important. One can think of examples such as Japan today and England before

World War II which have limited natural resources but are very rich. Today, a small country can be rich by simply having a large deposit of oil, but many rich countries still do not have plenty of natural resources. Even the quantity of agricultural output alone, not to speak of the entire output of an economy, does not depend mainly on the amount of land available. For example, China has .27 acre of cultivated cropland per capita, as compared with .12 acre in Taiwan, and yet agricultural output per capita in Taiwan is greater than in China -- Taiwan is more than self-sufficient in agriculture while China is not. Perhaps the most important is the quality and quantity of human resources available. At the end of World War II, much of the physical capital of West Germany and Japan was destroyed, but these two countries have succeeded in rebuilding their economies which are among the most productive in the world. An important reason for their success is the human capital available in these two countries, in terms of managerial, scientific, and technical personnel as well as the skilled and hardworking labor force. Another is the way their economic institutions are organized.

Besides the three kinds of factors of production mentioned in the last paragraph, the output of a country depends on how these factors are put together in production. The type of technology used to combine these factors into products is important. Having an abundance of land and other natural resources, of machinery and buildings, and of skilled labor and technical personnel is not sufficient for a high level of output if outmoded technology is employed. One hastens to point out that if there is skilled labor and good technical personnel, it is unlikely to find outmoded technology being employed in production. But even with sufficient qualified personnel, it takes time to organize and to adopt a suitable kind of technology. If one were to move the physical facilities of a modern corporation like IBM to China, and try to form an organization with a group of qualified people, it would take time, if ever, for these people to organize themselves and adopt the technology to function like the IBM Corporation.

Qualified individuals and sufficient physical resources do not automatically become modern enterprises. One cannot build an IBM, or a Princeton University, by simply duplicating its physical plants and qualified personnel. An entire economy with many economic enterprises is that much harder to reproduce by simply having the required sources.

As important as technology, if not more so, is the kind of economic institutions which a country adopts to produce its products. The economic institutions determine how different productive units will coordinate in producing the goods that a country needs. A market economy represents one set of economic organizations, and a centrally-planned economy represents another. These two types of economic organizations have two different sets of rules in determining what kinds of goods to produce, how people are organized to produce them, and who will get to use the products. What to produce, how to produce, and how to distribute the products are among the important questions in economics. In other words, production and distribution are two of the important subjects in economics.

The ultimate aim of production is consumption, either by individuals or by the government. Some of the output produced during a given period is used for consumption during the same period, while the remainder will be used for future consumption. The latter may be durable consumer goods that can be used in the future, or may be capital goods which can be used to produce more consumption or capital goods in the future. How a society decides on the fractions of output devoted to consumption and to capital accumulation is another important question. By devoting a larger fraction of current output to capital accumulation, a country can be expected to grow more rapidly. Part of the process of economic development takes the form of capital accumulation. Another part, let us not forget, takes the form of the accumulation of human capital. Still other parts are the adoption of more advanced technology and the improvement of economic organizations.

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Chapter 2

HOW THE CHINESE ECONOMY WORKS

2.1 MODEL OF A CENTRALLY PLANNED ECONOMY

This chapter describes and explains the working of the Chinese economy as of the early 1980's. In China major economic decisions are made by the central economic planners, while market forces also play their part. To understand the Chinese economy, one needs to know how a centrally planned economy works. In this section we will discuss an abstract model of a centrally planned economy. The economic institutions of this model are very similar to the Chinese economic institutions from 1959 to 1977. Economic institutions in China have changed rapidly since 1978 and are still changing. In the next section we will discuss a second model, which is a modification of the first model, by introducing certain elements of a market economy. The second model can explain the working of the Chinese economy as of the early 1980's.

A word about economic theory is in order before we proceed. In the last paragraph we have referred to a first model and a second model. A model is an abstract construct which incorporates certain important elements from reality. The economic reality of any country is very complicated. To understand it we select certain important features from it and use them to construct a hypothetical economy which is our model. The model is good if its behavior corresponds closely to the behavior of the actual economy which the model is constructed to explain. It is impossible and wasteful to include all the elements of a complicated reality in a model in order to understand it. To understand the Chinese economy, it is impossible and unnecessary to describe every farm, every factory, every restaurant, every farmer, every worker, every factory manager, every economic planning bureau and every economic planner, etc., in China. The above information would take billions of pages to describe -- China has more than a

billion people (all consumers), each having certain special economic characteristics, and millions of farms, etc. Most of this information is not essential for understanding the Chinese economy. In constructing a model or a theory, one simplifies the complicated reality by selecting certain important elements and studies the properties of the abstract system containing only these elements. The reader will remember that the model of a market economy constructed in Chapter 1 helps us understand a market economy. Although that model does not fully describe any actual market economy, it provides a good explanation of the working of any economy which allows consumers to choose their consumption and savings and private enterprises to compete in the marketplace. In a similar fashion we will construct two models, or a model in two steps, in sections 2.1 to 2.3 to explain the working of the Chinese economy.

In Chapter 1 we started with a model of a highly competitive market economy where the consumers decide what to buy in the market and a large number of enterprises in each industry compete in their production of outputs and the employment of inputs. In such a world, the government should provide law and order but need not participate in any economic activities; it has to collect some taxes to pay for the police. We later modified this model by introducing monopolistic practices, external effects of private production on the society, lack of knowledge, public goods, etc., to which government economic activities can be directed. In this chapter we will start from the other extreme by constructing a model in which the central economic planners make almost all decisions concerning consumption, production of outputs, employment of inputs, distribution of income, and investment. Note that in a centrally planned economy these same economic problems have to be solved as in a market economy, except that the methods for solving them are different.

for some reason, the planning authority sets the price of electricity below its social cost, it would induce a profit-maximizing enterprise to waste electricity. Similarly, if the price of electricity is set too high, the enterprise should be producing a larger quantity of output by using more electricity and it does not, leading to underutilization (see Problem 8). Thus, even if all enterprises were allowed to retain all their profits and to choose their outputs and inputs freely, the arbitrary setting of input prices would lead to inefficient production (see Problems 9).

We now summarize the way the Chinese economy functions as of 1983. It is mainly a centrally-planned economy but contains important elements of a market economy. It can be considered a mixed economy with emphasis on central planning. The central planning authority controls directly or indirectly most productive resources, including land and capital goods in the farms and factories. It assigns production targets to the production units in agriculture and in industry, supplies inputs to them, controls the prices of most products and regulates the incomes and consumption of the population through the setting of purchase prices of farm products and the wage rates for workers, and the operation of a rationing system. The working of such a centrally-planned economy was modelled in sections 2.1 and 2.2. The elements of a market economy introduced since 1978 include a small private sector, in which small private enterprises sell their products and services in free markets, and a set of institutional reforms in agriculture and industry, which make the government production units behave more like enterprises in a market economy. The institutions introduced in agriculture have made the farm families behave much like private farms, but the industrial enterprises after the reform do not behave like private enterprises in a market economy. Improvements in productivity from 1980 to 1983 were apparently much greater in agriculture than in industry. Further economic reforms are being introduced, as

we will discuss in the next section. As of 1983 the Chinese economy is a mixed economy with a large element of central planning, but with an expanding private sector and a continuing institutional reform for government enterprises, which may further incorporate elements of enterprise management of a market economy.

2.4 POSSIBLE DIRECTIONS OF ECONOMIC REFORMS

As this book is being written in 1983, economic reforms in China continue. What directions can these reforms take? What directions are likely to be taken? The first question is easier to answer, for it amounts to examining the possible economic institutions which might be introduced. The second question is more difficult because to answer it we have to predict the future actions of the Chinese political leaders.

The easier question first. The possible directions of economic reforms can be conveniently viewed as leaning either toward more central command or toward more decentralized decision-making and the use of market forces. The Chinese themselves have viewed the central issue of economic reform in this way. Volumes have been written in China, from 1979 to 1983, which discuss the issues of regulating the economy by central planning or by market forces, what should be regulated by central planning and what by the market, etc. The reader of this book, up to the last section, will realize how a completely centrally-planned economy and a competitive market economy solve the important economic problems of production, distribution, and capital formation. The reader will also appreciate that in any actual economy both government planning and free markets are used to solve the basic economic problems. In the Chinese case, since we have already examined a model of an almost completely centrally-planned economy in sections 2.1 and 2.2, we will now discuss the possible directions toward a market economy.

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Chapter 3

A G R I C U L T U R E

3.1 INTRODUCTION

In section 1.1 of this book we asked, "What explains the quantity of output per person in a country?" "Why is one country rich and another country poor?" We pointed out that the output of a country depends on the natural resources, physical capital, human capital, technology, and economic institutions. The relation between output and the various inputs and technology is summarized by a production function. To produce a given output a productive unit can choose from different combinations of inputs and technology. The economic institutions affect how this choice is made, and whether the choice is efficient.

In this chapter we will try to explain how output of the agricultural sector is determined. The explanation will be given in both aggregate terms and in terms of the economic institutions which affect the productivity of the agricultural sector. That is to say, it is given at both the macroeconomic and the microeconomic levels. At the macro level we will study the aggregate production relations for the agricultural sector in China. In section 3.2 we will discuss the concept of a production function which is used to summarize the relation between output and the various inputs. In section 3.3 the production function will be used to explain the change in agricultural output in China in the three decades following 1952. The change in agricultural output will be explained by the changes in the various inputs and in technology. Do the aggregate data show that Chinese agriculture has been modernized? Section 3.4 deals with the role which the agricultural sector plays in economic development. How much saving has the agricultural sector contributed? How much investment has gone into the agricultural sector?

After studying the output of agriculture in aggregate terms we will examine more closely the economic institutions and policies which have influenced the change in agricultural productivity. Some facts concerning the organization and functioning of the communes will be presented in section 3.5, including the production and distribution of output and the distribution of income. The distribution of income is found to be unequal among different production units and regions. The determination of purchase prices under the system of compulsory purchase of agricultural products is the subject of section 3.6. How compulsory purchase under the commune system affects agricultural output is analyzed in section 3.7. Section 3.8 deals with the reforms in agriculture introduced since 1978 and their economic effects.

3.2 THE PRODUCTION FUNCTION

To understand productivity in agriculture, in industry, or in any other sector of an economy, one can use the concept of a production function. In section 1.5 we have introduced this concept and given an example in equation (1.10),

$$x_2 = x_3^{.5} x_4^{.5} \tag{3.1}$$

where x_2 is the quantity of cloth produced and x_3 and x_5 are respectively the quantities of labor and machines used as inputs. In general a production function

$$y = f(x_1, x_2, \ldots, x_k) \tag{3.2}$$

is a mathematical relationship showing the quantity y of output which can be produced by using x_1 units of the first input, x_2 units of the second input, etc., and x_k units of the k-th input, under the assumption that k different kinds of inputs are used.

3.7 AN ECONOMIC ANALYSIS OF COMPULSORY PURCHASE

To understand the economic effects of the system of compulsory purchases, it is useful to contrast it with a system of voluntary purchases at market prices. Such a system prevailed in the early 1950's before compulsory purchases were instituted. We will apply the tools introduced in Chapter 1 to study the determination of price and output in Chinese agriculture in the early 1950's when the system of free markets and privately owned farms prevailed. How the institution of compulsory purchases under the commune system affects agricultural output can then be understood by comparison with the results of a market system.

To begin our analysis, let us make some simplifying assumptions. These assumptions are made to bring out the most important aspects of the economic problem so that we can understand the essence of the situation without being confused by minor complications and details. First, let us deal with only one product. This product may be rice, wheat, or cotton, for example. It may be a group of products such as food grains. Secondly, we consider only two prices, the procurement price (without making the distinction for an above-quota procurement price) and the market price. Third, we consider only one market by ignoring the transportation and distribution costs of bringing the product from the rural producers to the rural and urban consumers. (We can extend our analysis to deal with a rural and an urban market by using two demand curves for these markets. See Problem 14.) One market price is assumed to prevail in the market and regional differences will be ignored.

In the first instance consider a market system where the farmer-producers can sell directly to the consumers without being intervened by government procurement. From the discussion of Chapter 1 we can use a supply curve to describe the quantities which the private farmers would supply at different prices and a demand curve to describe the quantities which the consumers would buy at different prices.

When the price is higher the farmers can supply more; they need a higher price to cover the higher marginal cost incurred when producing a larger quantity of output. When the price is higher the consumers will buy less; they will substitute other goods to maximize their well-being. The price of the product will be determined by the intersection of the supply curve S and the demand curve D, as shown by the value p in Figure 3.2, the quantity of output being q.

Before introducing government procurement, let us elaborate on certain aspects of the determination of price and output in Chinese agriculture under the market system when land is privately owned and when labor is freely mobile. Consider the economics of the individual farms. The aggregate supply curve S in Figure 3.2 is obtained by adding the quantities which all the farms will supply at any given price, or by adding horizontally the supply curves of the individual farms. The supply curve of each farm is its marginal cost curve. To give a numerical illustration, let the total cost of producing output x be

$$C = 5.0 + .2x^2 \tag{3.30}$$

and the marginal cost be

$$MC = .4x \ . \tag{3.31}$$

The <u>average cost</u> or cost per unit is then

$$AC = C/x = 5.0/x + .2x \ . \tag{3.32}$$

The marginal cost and average cost curve are drawn in Figure 3.3. If the market price is 2 per unit the farm will supply 5 units to maximize its profit. This quantity is obtained by equating the marginal cost .4x to 2, yielding x=5. The total revenue of the farm is 10 and its total cost, according to the above formula, is also 10. The farm is making zero profit, but it earns enough to cover all costs, including costs of labor, land, equipment, and other inputs. If the

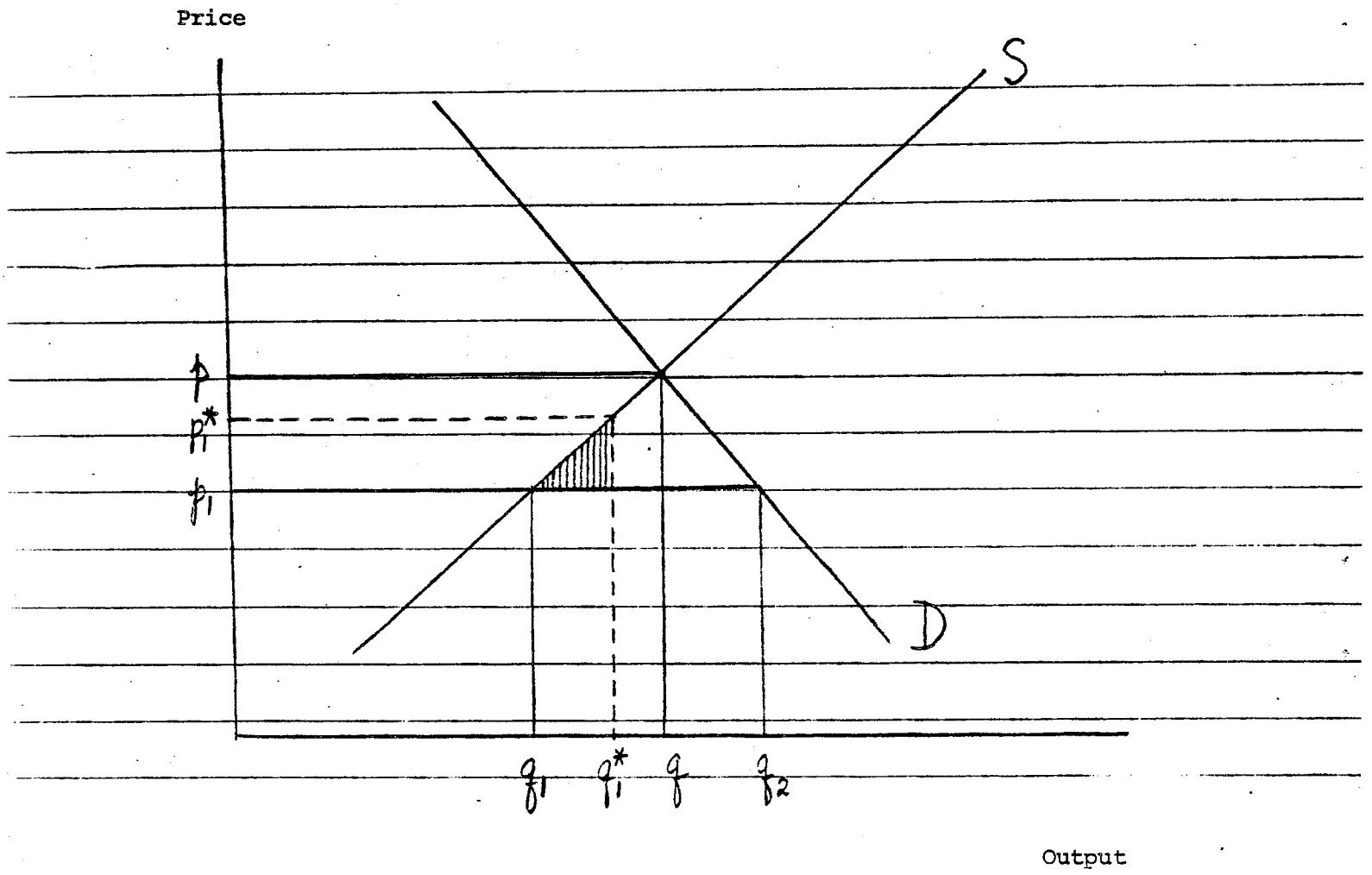

Figure 3.2. Determination of Price and Output in Chinese Agriculture

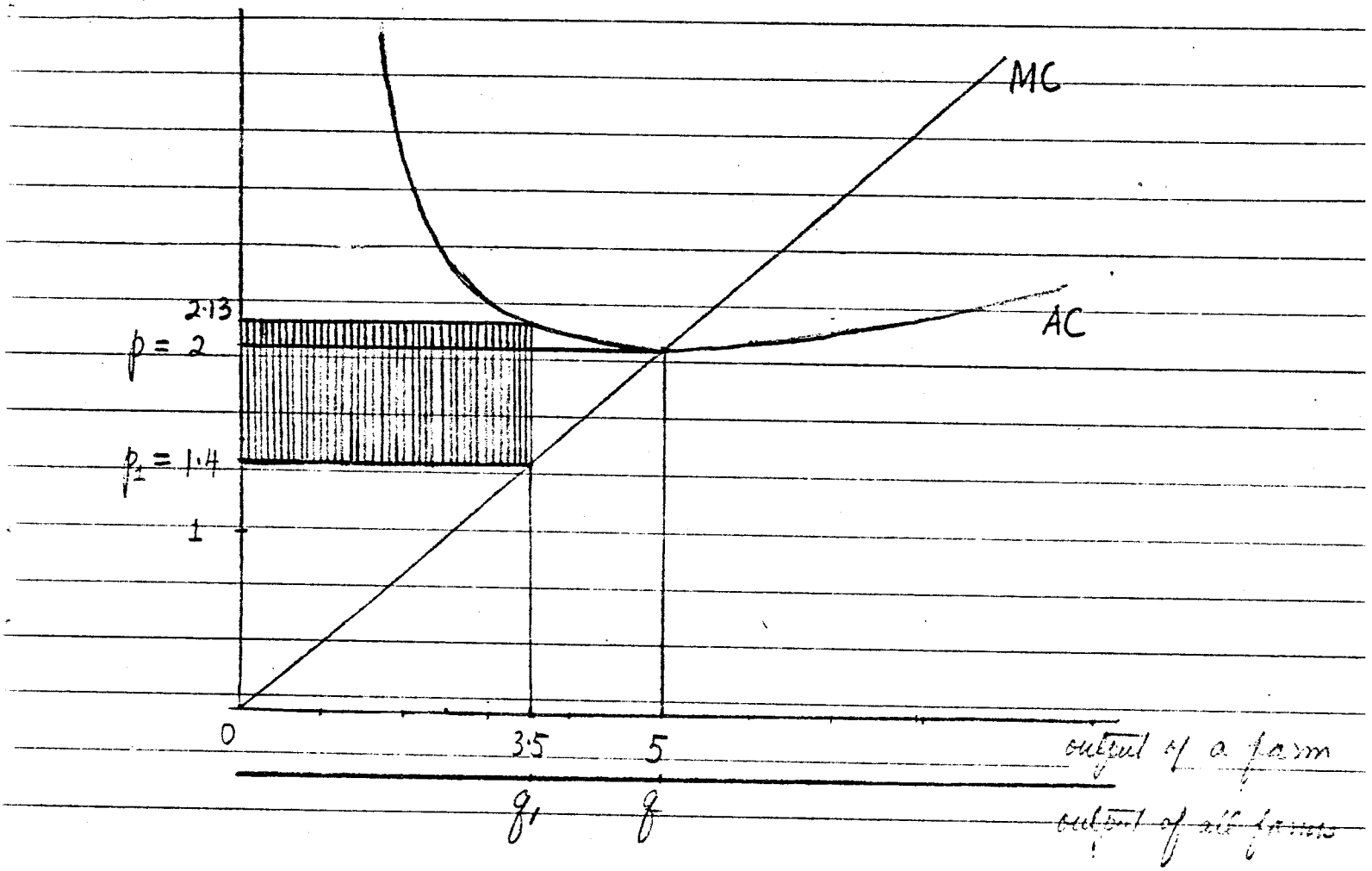

Figure 3.3. Marginal and Average Cost of an Individual Farm

market price is greater than 2 the farm will make a profit; if less than 2 the farm will incur a loss. For example, if price is 1.4 output will be 3.5. Average cost will be 2.13. The loss will be (2.13-1.4)(3.5)=2.55 as given by the shaded area in Figure 3.3. Figure 3.3 explains what makes up the supply curve of Figure 3.2.

When there are many farms in competition with one another, the equilibrium market price p given by Figure 3.2 is such that the farms will be making no profits if all inputs are paid by their market prices. The economics of a typical farm is given in Figure 3.3 where, at p=2, average cost equals price and profit is zero. The conclusion of zero profit might be puzzling to the reader at first glance. Some farms are endowed with better land. One would think that the profits would be higher for these farms. A moment's reflection reveals that this is not the case if we include the higher rent of the land as a part of the cost. If the farmer rents a better piece of land from a landowner, he will have to pay a higher rent. To the extent that the better piece of land enables the farm to earn more income, the landowner can demand a higher rent for it because some other farmers will be willing to pay a higher rent in order to produce more output. If the farmer owns this piece of land himself he should consider the extra income of his farm not as profit, but as a higher rent paid to himself to be included in his cost. He should do so because he could rent out the land for which some other farmers would be willing to pay more in order to have a larger output. A system which prevents the payment of higher rent for better land through the market is economically inefficient because it prevents the land from being transferred to its most productive use as measured by the willingness of people to pay for it.

Let the curves S and D of Figure 3.2 represent the supply and demand curves for an agricultural product in China under the market system prevailing in the early 1950's. The price p is an equilibrium price. In general, the farms do not make extra profits if the costs of all inputs are accounted for. Food is supplied to the urban population through the market. If the farms are adjacent to an urban

area, perhaps the farmers can supply to the nearby urban population directly. Otherwise, there are merchants who transport the food to the urban areas. Now suppose that the government wants to take over the distribution of food through a system of compulsory purchase. The purpose is to supply food more cheaply to the urban population. Consider two cases. In case A the government simply institutes compulsory purchase without changing the system of private ownership of individual farms. In case B the government reorganizes the farms into communes, directs the activities of the production units, and prevents the transfer of land and the mobility of labor among the production units. What are the economic consequences in the two cases? In both cases we assume that the government will pay a compulsory purchase price below the price which would prevail in a free market. This is a main feature of compulsory purchase.

Consider case A. Let the compulsory purchase price be p_1 in Figure 3.2, which is below the market price p. If the farmers do not receive directions from the government and are autonomous in their decisions, as in the case of China in the early 1950's, they will supply a smaller quantity q_1. If the government sells the quantity q_1 to the urban population at the same price p_1 (ignoring transportation and distribution costs), there will be a quantity q_2-q_1 of unsatisfied demand. The demand curve tells us that at the price p_1 the consumers will demand q_2, but the government only has the quantity q_1 available. This requires rationing. The government will issue a limited number of ration coupons which have to be used to purchase the available quantity q_1 of supplies. If the government sells q_1 to the consumers at a price even lower than p_1, the urban unsatisfied demand will even be larger because at a lower price the consumers would desire even more. How will the unsatisfied demand be met? It will not be if the farmers cannot sell directly to the urban consumers.

Still under case A, assume that the government pays a procurement price p_1 but orders the farmers to deliver a quantity q_1^* larger than q_1. From our discus-

sion in section 1.5, the supply curve S shows the marginal costs which the farmers have to pay in producing different quantities of output. For example, when the farmers produce the quantity q_1, the marginal cost is p_1, or it costs p_1 to produce an extra unit. When the farmers are ordered to produce the quantity q_1^*, the marginal cost is p_1^*, which is higher than the purchase price p_1 paid by the government. The concepts of total cost and marginal cost are applicable no matter whether an enterprise is privately run or government directed. It will cost something to produce the outputs. (Of course, if the government arbitrarily raises or lowers the prices of the inputs to a producer, the cost from the producer's viewpoint will be affected, but there is still a marginal cost curve for the operation of the enterprise.) When output exceeds q_1 the marginal cost is higher than p_1. The more the farmers are asked to produce to sell at the price p_1, the more money they lose. The amount they lose by selling the extra quantity $q_1^*-q_1$ is given by the shaded area of Figure 3.2. This area equals the sum of the areas of the small rectangles. Each small rectangle shows the loss (the difference between the extra cost and the price) associated with a small amount of output. If we approximate the shaded area by a triangle, the total loss from producing the quantity $q_1^*-q_1$ is $\frac{1}{2}(q_1^*-q_1)(p_1^*-p_1)$. Thus the government is directing the farmers to operate at a loss in producing the output $q_1^*-q_1$.

It is very difficult, if not impossible, for the government to direct the farmers to sell the quantity $q_1^*-q_1$ to its purchasing departments at a purchase price p_1 below the marginal cost. The farmers will resist because it is a losing proposition. The more they sell to the government the more money they lose. As the quantity q_1^* is increased or the point q_1^* is moved to the right, the area of the shaded triangle or the amount of the loss will be larger. Therefore, it is difficult to force an increase in the supply of a product without increasing its price to pay for the marginal cost. The fact that the Chinese government found it necessary to raise its purchase prices, as shown in column 2 of Table 3.13,

in order to increase agricultural outputs is a testimony to this basic law of supply in economics: in order to increase supply it is necessary to raise the price. In terms of Figure 3.2, if the government insists on paying a procurement price of p_1 and wants to purchase q_1^*, it is unlikely to succeed and may end up in obtaining a smaller quantity than q_1^*.

We have just explained why it is difficult to direct the farmers to sell at a price below marginal cost, or below the price given by the supply curve. It is even more difficult if the farmers are incurring a loss in the entire operation. We know that selling the extra quantity $q_1^*-q_1$ shown in Figure 3.2 is a losing proposition, but the farmers may make enough money in selling the quantity q_1 to make up for this loss. Whether the entire operation yields a profit or a loss depends on whether total revenue is larger or smaller than total cost, or whether purchase price is larger than or smaller than average cost. For the situation of Chinese agriculture prevailing in the early 1950's, the farmers were in general not making extra profits if the costs of all inputs including land are properly included. In other words, at the level of output q determined by the market system, average costs for most farms equal market price p and profits are zero, as shown in Figure 3.3. To direct the farmers to sell at a price p_1 below the market price p will mean a net loss in the entire operation, where the costs are computed by using the market prices of all the inputs. The loss is the smallest when total output is q_1; any extra output will yield a greater loss.

How could the government direct the farmers to operate at a loss and to sell below marginal cost? By changing the prices of the inputs in the cost calculations. This leads to case B where the government not only sets the quantity and price of compulsory purchase but changes the system of agricultural production from private ownership in the early 1950's to a commune system. Under this system land is assigned and labor becomes immobile. From the viewpoint of the accounting of a

production team, land has no cost because it cannot be rented out to other producers who would appraise its economic value in alternative use. Labor has no cost because laborers are not allowed to go elsewhere to earn a competitive wage. By abolishing the markets for land and labor, the government has no way to evaluate their economic costs. Under a market system the price of an input equals the amount other users are willing to pay, which is the value of its marginal product. By not being charged an appropriate rent for the land it uses, a production team under the commune system may be showing a positive income in its accounts even when it is operating at a loss if an appropriate rent is subtracted. Note that in the accounts of the production units under the commune system as shown in Table 3.11, the costs of using land and labor are not included as costs.

The economic consequences of not including the costs of land and labor in the economic calculations of a production unit under the commune system are serious. In section 3.5 we have pointed out that the immobility of labor or the absence of a market for labor services prevents the laborers from moving to the farms where their marginal products are higher, thus increasing national output. Similarly, if land cannot be transferred to alternative producers who are willing to pay a higher rent because they can find a more productive use for it, agricultural output will be reduced. A poorly managed production team having the good fortune of being assigned a fertile piece of land may still produce enough to earn an income according to the accounts of Table 3.11, but the land could be made more productive if another team is allowed to rent it. How can production units be economically efficient if they have no conception of, and are not required to pay for, the costs of some of its inputs? The government is able to direct the production units to produce at a loss in the true economic sense (defined by including the economic costs of all inputs) because the production units are not asked to account for the true costs of the inputs. The society cannot avoid

paying for these costs in the form of lost outputs which could have been produced by the efficient use of these inputs.

One aspect of the misuse of farmland in China has been generally recognized. In the 1960's the Chinese government directed many communes to convert farmland producing commercial crops such as cotton, peanuts, and sugar crops to the production of food grain. There was a sizeable economic loss in this conversion because the land suitable for the production of commercial crops (as discovered by the farmers under a market system) was not suitable for producing grain. The output of grain per hectare turned out to be low in general after the conversion. The value of the commercial crops which were sacrificed was often much higher than the value of the grain produced, leading to large economic losses. The failure to allow specialization in agriculture and its economic consequences have been studied by Lardy (1983) and Lyons (1983). This mistake has been partly corrected, as evidenced by the increases in acreage allotments to and in the purchase prices of selected commercial crops (see columns 5, 6, and 7 of Table 3.13). I mention this misdirected policy here to suggest that if the farmers had had to pay an appropriate rent for the land they used, they could not have afforded to, and the government would have had more difficulty in directing them to, convert high-valued commercial-crop land to the production of grain at a loss. In terms of Figure 3.3, if rent is excluded from the total cost, the average cost curve will be lowered and the production unit might even show a profit. For example, the total cost of equation (3.30) may be changed to $2+.2(x)^2$ and the average cost of equation (3.32) to $2/x + .2x$ (see Problem 12).

Even when some inputs are not appropriately priced under the commune system, each production unit still performs its cost calculations using the misguided data. It still has a marginal cost curve where the cost figures are calculated by using whatever prices of the inputs which it has to pay. Its marginal cost is still an increasing function of output. If the government pays a compulsory

purchase price below the unit's marginal cost, the more it produces the more money it loses, or the less income it earns. As in case A, it is difficult for the government to direct the production units to increase output without paying a higher price for it, because no unit wants to produce more and get less for it. The economic law of supply remains valid in case B. Again, let S represent the supply curve of all producers under the commune system and ignore the possible effects of the misguided cost data in the calculation of marginal costs of the individual production units. If the compulsory purchase price p_1 is below the market price p, the government would find it difficult to direct the production units to produce the quantity q of output which would result if the producers could sell directly to the consumers in free markets. Even in case B the production units will produce more if they can sell directly to the consumers at a higher price than under the system of compulsory purchase.

To summarize our findings concerning compulsory purchase under the commune system, let us refer to Figure 3.2. Under a market system where producers can sell directly to consumers and the prices of all inputs, including rent for land use and wage for labor services, are determined in the markets, the price p and the output q of an agricultural product available in the market are determined by the intersection of a supply curve S and a demand curve D. Such a system prevailed in China in the early 1950's. The Chinese government decided to take over the distribution of major agricultural products from the producers to the consumers by instituting a compulsory purchase system. At the same time production was organized under the commune system and the markets for land and labor were abolished so that there was no longer a market rent for land and a market wage for labor. A main objective of instituting such a system was to enable the government to deliver as much output to the urban consumers as before while paying a lower price for it. Assume that, immediately after the institutional changes, the

government directed the farmers to produce the same output q shown in Figure 3.2 and paid a compulsory purchase price p_1 (below the market price p) for it. If the farmers' previous incomes had just covered all costs, so that both the total revenue and the total cost of all farmers had equaled $p \times q$, the farmers as a group would now be operating at a loss which equals total cost $p \times q$ minus total revenue $p_1 \times q$, or $(p-p_1) \times q$.

However, under the new system the production units did not recognize the loss because they did not include rent as a part of the cost. The fixed cost in equation (3.30) might be reduced from 5 to 2 when rent is excluded, for example. Under the new accounting system the production units as a group managed to earn a positive income as shown in Table 3.11. When the use of land incurred no cost and when labor became immobile, these valuable resources could not be efficiently used and productivity was most likely reduced. In other words, to produce the same output q as before more inputs were needed under the new system. In the meantime the production units were directed to produce extra units below their marginal costs. They would resist because the more they produced the smaller their income. (If the purchase price had been above marginal cost, the production teams would have volunteered to produce more in order to earn more income, and the purchase would not have been compulsory.) This analysis applies to the behavior of the production team as a unit, without considering the system of payment to the individual farmers by work-points which adversely affected their incentives and further reduced productivity.

The economic consequences of introducing compulsory purchases under the commune system are the following. First, output is less than the quantity q under the market system because it is difficult to force the production units to produce when the purchase price p_1 is below marginal cost. Second, whatever the level of output that is actually produced (which is somewhere between q_1 and q),

the true economic cost is higher than before because of the inefficient use of land and labor. Third, even if the government were able to obtain the same output q under the new system, if this output is sold to the urban consumers at the below-market price p_1, there will be a shortage of q_2-q units and a rationing system is required. Therefore, the above system of taxing the farmers has undesirable economic consequences.

Let us assume, somewhat unrealistically, that the government manages to obtain the same output q as under the market system. The tax obtained by compulsory purchase is $(p-p_1)\times q$. If the government wanted to extract the amount $(p-p_1)\times q$ from the farmers, a much better system would be to charge the farmers an appropriate rent for the use of the land. The appropriate rent could be decided by allowing a free market for land rentals, that is by allowing different producers to compete for renting any piece of land. The government could collect rent for all the land in China instead of paying a lower compulsory price for the farm products. The market price and output under this system would be respectively p and q, the same as under the market system. The government could use the rent to finance economic development. This would avoid the first two undesirable economic effects of compulsory purchase under the commune system as stated in the last paragraph. If under the present accounting system which excludes the cost of land the production units have sufficient incomes to cover other costs, the average cost (excluding rent) of producing q units must be equal to or below p_1; otherwise the production units would be operating at a loss. Let this average cost be $p_0 \leq p_1$. The rental value of all land used for producing q units is $(p-p_0)\times q$, where p is the average cost including rent of producing q units. With $p_0 \leq p_1$ this rental value must be at least $(p-p_1)\times q$, which is the amount of tax revenue under the compulsory procurement system.

3.8 AGRICULTURAL REFORMS AND THEIR EFFECTS

Changes in agricultural policies in China since 1978 consisted of institutional reforms as well as changes in the structure of prices. The major institutional reform in agriculture, as discussed in Chapter 2, amounts to converting the compulsory purchase from an item affecting the marginal cost to an item affecting the fixed cost of a producing unit. A producing unit will be reluctant to produce a quantity of output for sale at a price below its marginal cost. It will try to reduce output when the purchase price is below marginal cost. On the other hand, if it is asked to surrender a fixed amount as a lump-sum tax and if it is allowed to sell additional units at a price above marginal cost, it will increase output until price equals marginal cost.

Again Figure 3.2 can be used to depict the economics of compulsory purchase before the recent institutional reforms. Let S be the supply curve of all production units calculated by using the input prices which they have to pay and which may be different from market prices. Assume that the compulsory purchase price is p_1 but the government somehow succeeds in procuring the quantity q_1^* from the producers who are making a loss in producing the quantity $q_1^*-q_1$. The producers will try to reduce the purchase quota to q_1 but the government is persuasive. Now if the government does not monopolize the purchase of agricultural products and allows the producers to sell their products in rural markets, the producers will try to produce more than q_1^* units. In fact, they will produce q units where the supply curve S and the demand curve D intersect at output q and price p. (Here we ignore the shifts in the demand curve which depends on the price which the government charges the consumers for the quantity q_1^*. There will be no shift if the government charges the market price p.) By producing the additional $q-q_1^*$ units, the producers will raise their income because price is above marginal cost. By allowing the sale of agricultural products in free markets, the government

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Chapter 4

INDUSTRY

4.1 AN AGGREGATE INDUSTRIAL PRODUCTION FUNCTION

The development of industry has been a major aim of Chinese economic policy since the establishment of the People's Republic of China. In this chapter we will study industrial production in China. Following the exposition of agricultural production in Chapter 3, we will examine aggregate production relations in sections 4.1 and 4.2. Facts concerning the composition of industrial output will be presented in section 4.3. The organization of a large industrial enterprise will be studied in section 4.4. Planning and operation of a large industrial enterprise are the subject of section 4.5; the structure of wages and prices will be discussed in section 4.6. Questions of production efficiency will be investigated in section 4.7. Reforms of Chinese industry and their economic effects will be discussed in the conclusion section.

In section 3.4 it was pointed out that, from 1952 to 1980, national income contributed by industry increased from 11.5 billion to 220.8 billion 1952 yuan and gross industrial output value increased from 34.3 billion to 646.7 billion 1952 yuan. The former increase amounts to an exponential rate γ of .1055 or an annual increase of 11.13 percent. The latter increase amounts to an exponential rate γ of .1049 or an annual increase of 11.06 percent. Note that the ratio of gross output to net income remained constant, being (34.3/11.5)=2.98 in 1952 and (646.7/220.8)=2.93 in 1980. Note also that the gross industrial output figure is obtained by about triple counting. The materials in various stages and final outputs are added together. Can aggregate industrial output be explained by the increase in labor and capital alone, assuming a constant production function? This question will be answered in this and the following sections. If the answer is affirmative, the observed increase in aggregate industrial output can be attributed quantitatively to the increases in labor and capital. This explanation

will enhance our understanding of the effect of capital formation on industrial production.

To estimate an aggregate production function explaining gross industrial output value, one should employ all major inputs including labor, capital, and materials. To explain value added by industrial production, which excludes the values of the materials used, one needs to include as inputs only labor and capital. Since data on the materials used are difficult to obtain, we hope to find a relation between value added in industry and the two major inputs, labor and capital. However, data on value added in constant prices are not readily available. If a Cobb-Douglas production function is employed, and if value added can be assumed to be proportional to gross output value as the data of the last paragraph suggest, one can estimate the elasticities of value added with respect to labor input and capital input. We will employ aggregate data to estimate a production function in this section, assuming that the elasticities of output with respect to labor and capital sum to one. In the next section we will reestimate the elasticities of output with respect to the labor and capital inputs without making the above assumption, thereby checking the validity of the assumption. In the process of analyzing the aggregate data, we will explain and illustrate the method of regression analysis which is an important tool for studying quantitative relations.

Let us formulate the hypothesis that value added Y^* in Chinese industry is related to labor inputs X_1 and capital inputs X_2 by a Cobb-Douglas production function which is homogenous of degree one.

$$Y^* = \alpha^* X_1^{\beta} X_2^{(1-\beta)} \tag{4.1}$$

If value added Y^* is proportional to gross industrial output value Y, or $Y = cY^*$, equation (4.1) can be used to explain gross industrial output value

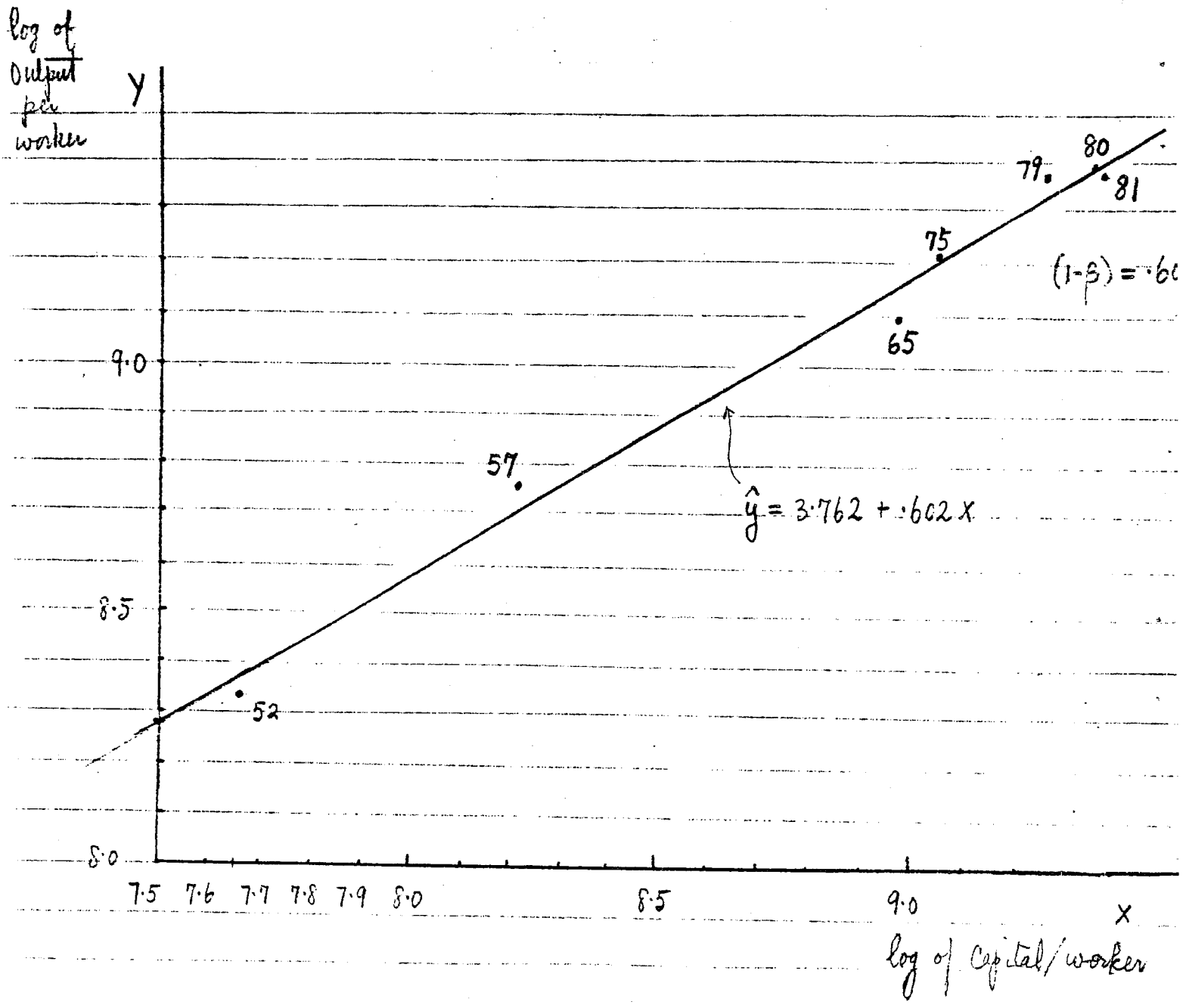

Figure 4.1. Regression of Gross Output per Worker on Capital per Worker in State-owned Industrial Enterprises

"The system of economic administration practiced in our country today was adopted from the Soviet Union in the early 1950's. The particular characteristic of this administrative system is to stress the extremely centralized leadership of the economy by the state. The state directs and manages the affairs of state-owned enterprises, large or small. The state transmits to the enterprises its authoritative planning targets. It centrally organizes the distribution of material inputs required by the enterprises. It centrally manages the purchases and sales of their products. It centrally determines the prices of commodities. It takes a large fraction of the profits of the enterprises and subsidizes their losses. It approves the funds requested by the enterprises for capital construction and expansion. Under this administrative system an enterprise is not a self-propelling entity but rather a bead of the abacus of the state administration, lacking a necessary sense of independence and a strong economic motivation. In the meantime the regulatory functions of the market have been abolished. Enterprises have neither initiative nor authority to produce according to the need of the market, resulting unavoidably in the disconnection between production and the need of society and in an economy operating out of proportion. Under such a system the society lacks an automatic regulatory mechanism. It cannot prevent the economy from getting out of proportion and, when it happens, has no way to discover and correct the problem."

Earlier in this paper Zhou (1982, pp. 38-39) describes some of the undesirable consequences of the Chinese system of central planning.

"Our productive capacity is underutilized. We have excess of inventories. There are many people waiting for job assignments. All these are manifestations of the malfunctioning of our productive system. Let us compare our rates of capacity utilization and of unemployment with those of a capitalist economy. Many of our enterprises use about 3 to 4 sevenths of their capacities. The rate of utilization of metal lathes in the entire country was 54.6 percent in 1977 and 55.6 percent in 1978. During the Great Depression in the United States the rate of capacity utilization was 42 percent in 1932 (the worst year), 52 percent in 1933, 53 percent in 1931, and 58 percent in 1934, but was always above 65 percent in other years. Certain material in our country was imported in

large quantity while its inventory was accumulating. For example, the inventory of steel was 12.0 million tons at the end of 1976, 12.6 at the end of 1977, 15.5 at the end of 1978, and 18.65 million tons at the end of June 1979, an amount sufficient for use in eight months. The steel inventory is less than the amount used in 90 days in Rumania and is about the amount used in one month in Japan.

"Early in 1979 the number of people requesting job assignments was 20 million. During the Great Depression in the United States the highest unemployment rate was 24.9 percent in 1933, followed by 23.6 percent in 1932, 21.7 percent in 1937, 20.1 percent in 1935, 16.9 percent in 1936, 15.9 percent in 1931, and 8.7 percent in 1930. In the 1950's the highest unemployment rate in the United States reached 6.8 percent in 1958, the lowest being 2.5 percent in 1954. At the beginning of 1979 the total number of workers and staff in the labor force was 94.99 million. The 20 million waiting for jobs constituted a large fraction of this total. In many enterprises in our country, the fractions of labor hours actually utilized are low. The average for Beijing in 1978 was 84.3 percent and the average for the enterprises under the Third, Fourth, and Fifth Machine-Building Ministries was only 74.5 percent. Our economy was subject to large fluctuations. Total gross agricultural and industrial output value increased 54.8 percent in 1958 and 36.1 percent in 1959; it decreased 38.2 percent in 1961 and 16.6 percent in 1962. Gross agricultural output value decreased 13.6 percent in 1959 and 12.6 in 1960. ..."

How to make the Chinese economy efficient remains an unsolved problem today. In the next section we report on the reforms of Chinese industry since 1979 and their economic effects.

4.8 ECONOMIC REFORMS IN INDUSTRY AND THEIR EFFECTS

Chinese economic planners have recognized some of the economic problems described in the last section. They realized that industrial production was overly centralized. A front-page article in The New York Times (August 31, 1980) entitled

"Peking Congress Meets to Adopt Economic Change, New Leaders" reports:

> "With words and phrases such as 'profit,' 'increased competition' and 'market forces' echoing through the Great Hall of the People, Chinese leaders met today in what they said would be a historic session of the National People's Congress to transfer governmental power to a new generation of leaders and further loosen central control of the economy. ...
>
> "It was the third annual session of the Fifth Congress--each congress lasts five years--and the first to which both foreign journalists and diplomats have been invited for 20 years. ...
>
> "As Chairman Hua sipped tea, Deputy Prime Minister Deng, next to him, puffed cigarettes, and 3,478 other deputies shuffled papers on the podium and in the 10,000-seat auditorium, Deputy Prime Minister Yao Yilin, who is in charge of the State Planning Ministry, said the economy 'as a whole is becoming livelier' after decades of stagnation. He said sluggish growth in agricultural production and light industry was finally being overcome, adding that the experiments of free enterprise, factory autonomy, local decision-making and competition would be greatly expanded in the next two years.
>
> "In a speech that often sounded like one made in Japan or other government-guided free-enterprise economies, Mr. Yao said, 'Regulation of the economy through the market will be carried out under the guidance of the state plan.' He added that expanding experiments in competition 'give expression to the principle of regulation through planning combined with the regulation of the market.'
>
> "By the end of June, he said, 6,600 industrial enterprises that had been allowed to make local and market decisions had produced in value 45 percent of the output of all state-run industries, surpassing in profits and income those factories run under the old system of state quotas."

As indicated in the statement of Deputy Prime Minister Yao quoted above, economic reforms in Chinese industry consisted of both a change in policy toward increasing the output of light industry and a change in economic institutions. During the second annual session of the Fifth Congress in 1979, a resolution

proposed by the State Council was passed to achieve a higher rate of growth in light industry than in heavy industry during the period of economic adjustment. In 1979 the State Council promoted the growth of light industry by providing it with increasing supplies of energy, materials, working capital, and foreign exchanges. In 1980 the State Council gave light industry additional favorable treatment and encouraged the development of collectively-owned enterprises for light industry. As a result since 1979 light industry grew much more rapidly than heavy industry (see Table 4.2). From 1979 to 1981 the proportion of total gross industrial output value produced by light industry increased from 43.1 percent to 51.5 percent, while the proportion produced by heavy industry decreased from 56.9 percent to 48.5 percent (see Table 4.3).

Institutional reforms in Chinese industry have been discussed by Ma Hong (1982), Wang Haibo and Wu Jiajien (1982), and William Byrd (1983), among others. Industrial reforms started in late 1978 with six pilot firms in the Sichuan Province. By June 1980 6,600 industrial enterprises were involved, as reported in the New York Times article quoted above. In April 1981 a campaign was launched to promote "economic responsibility systems." By the end of 1981 80 percent of state-owned industrial enterprises were involved. Ma (1982, pp. 80-88) discusses the following five aspects of industrial reforms.

First, autonomy of industrial enterprises was promoted. The enterprises were given certain discretionary powers regarding the use of retained profits, production planning, sales of output, experimentation with new products, expenditures of funds, capital expansion, and personnel administration. In addition to the more than six thousand industrial enterprises involved in the national experiment, in 1980 eighty some enterprises were selected by their provincial government administrations to operate independently, being responsible for their own profit and loss and only paying a tax to the government rather than surrendering most of the pro-

fits. The enterprises participating in the national experiment had to surrender 87 percent of their profits, retaining only 10 percent for themselves, with 3 percent used for repaying debt and other prescribed expenditures.

Second, an "economic responsibility system" was introduced. Ma (1982, p. 82) points out that the system allowing the six thousand enterprises the "autonomy" to retain a small fraction of their profits did not completely solve the problem of efficiency for three reasons. First, some enterprises gave up trying hard because of the policy to raise every year the amount of their profits to be submitted to the government. Second, only the highly profitable enterprises and not the ones having small or negative profits were allowed to participate in the experiment of enterprise autonomy. Third, the distribution of a part of the profits as bonuses to the workers did not follow the principle of equating a worker's income with the result of his labor, but rather retained the practice of the "iron rice bowl" and equal compensation irrespectively of work. These are the reasons which made it necessary to introduce the economic responsibility system.

The economic responsibility system has two important and related components. First, in the relation between the state and the enterprise, the responsibility is given to the enterprise in the form of a lease, allowing the result of a successful operation to turn into distributable profits. The system began in Shandong province and soon became fairly widespread in that province. According to a survey of thirteen cities and districts in 1981, some 1,352 out of 1,850 state-owned enterprises on or above the county administrative level were operating under this system, including 410 (or 93 percent) of the 440 enterprises formerly reporting a loss. In the city of Jinan leasing was practiced in five levels, from the city to the bureaus, from the bureaus to the enterprises, from the enterprises to the shops, then to the work teams in the shops, and to the workers in the teams. Essentially the unit at each level retains most of the earnings after

paying a fixed sum to the level above. Ma (1982, p. 83) suggests that payment for the lease should be reasonable and should remain the same for several years. We have pointed out in section 2.5 that increasing the rent when profit increases would convert a lump-sum tax to a profit tax and destroy the incentive effects of the lease. Under the economic responsibility system an enterprise has much discretion in using its profits for reinvestment, to augment the welfare fund, or as bonuses, and the practice varies from place to place. The second component of the economic responsibility system is to pay the worker according to the result of his labor. When circumstances permit workers are paid by piece rates. When paid by hourly rates the workers would ideally receive different amounts of bonuses according to the quality of their work.

The third aspect of economic reforms is to increase the role of markets. After fulfilling its responsibility to the government an enterprise can sometimes sell its products in the market. Government monopoly of commerce and the distribution of materials and final products was beginning to be modified by the increasing use of markets which by 1981 handled about 15 percent of industrial output by its gross output value.

Fourth, a number of counties and cities have streamlined their system for administering the industrial enterprises under their control. In 1981 some 125 counties and cities in 25 provinces already undertook administrative changes. Qing yuan county in Quangdong province adopted the changes fairly early. It had administered its seventeen state-owned industrial enterprises employing some six thousand workers and staff by eight bureaus. Authority had been divided among the bureaus. The bureau in charge of production had had no authority on personnel, finance, and material supplies, while the bureaus in charge of the latter functions had had no authority over production. The operation of an enterprise had been handicapped by having to deal with many bureaus. Qing yuan county instituted administrative reforms in 1979 by abolishing the bureaus and delegating to its

economic commission the authority over personnel, finance, material supplies, production, and sales. All directives from the ministries above to the individual enterprises need to go through only the economic commission. The commission in turn gave the enterprises certain discretion concerning the disposition of retained profits, the use and addition of capital equipment, the planning of production, the sales of products above quota, the giving of bonuses, and the hiring and disciplining of workers. These administrative changes appeared to yield positive economic results as the total profits of all industrial enterprises in this county more than doubled in 1979.

Fifth, the establishment of collectively-owned enterprises was encouraged, reversing the previous trend to convert collectively-owned enterprises to state-owned enterprises. While both types of enterprises could be controlled by the government through the assignment of production quotas and the control of material supplies, the profits of state-owned enterprises, except for the part retained, constitute revenues of the state budget. More importantly, a group of citizens can take the initiative to establish a collectively-owned industrial enterprise subject to the regulation of the government. Collectively-owned enterprises accounted for 40 percent of the increase in total gross industrial output value in 1980. They are responsible for 90 percent of the output value of the handicraft industry which is over 50 percent of the output value of all light industry.

To summarize, institutional reforms in Chinese industry since 1979 have consisted of giving over 6000 state-owned enterprises some autonomy in their operations, granting some enterprises essentially a lease under the "economic responsibility system" to operate more or less on their own, extending the role of the markets, and encouraging the expansion of usually small collectively-owned enterprises. In addition, the administration of the state-owned enterprises in certain counties and cities has been streamlined to avoid the division of authority by

many bureaus. Can we find evidence of increase in productivity resulting from these reforms?

Consider the trend of the index of gross industrial output value as shown in column 1 of Table 4.1. The growth of 100 in 1952 to 1,734.4 in 1979 amounted to an exponential growth rate of .1057. The growth of 1,734.4 in 1979 to 1,962.7 in 1981 amounted to an exponential growth rate of .0618, much lower than the former rate. Some of the reduction in the growth rate of industrial output since 1979 may be due to the change in policy to expand the agricultural sector at the expense of heavy industry. Furthermore the expansion of light indudstry at the expense of heavy industry may slow down the increase in total gross industrial output value because gross output of heavy industry probably involves more double counting and contains more products with little economic value as judged by the user. If we consider national income generated by industry as shown in column 3 of Table 3.5, we find the increase from 11.5 billion yuan in 1952 to 153.6 in 1979 to imply an exponential rate of .0960, whereas the increase from 153.6 in 1979 to 171.9 in 1981 implies an exponential rate of .0563, much smaller than the former rate. Note that these figures are in current yuan. The general ex-factory price index of industrial products increased slightly from 82.9 in 1979 to 83.6 in 1981 while it had decreased from 113.2 in 1952 to 82.9 in 1979, making the comparison in constant prices even more unfavorable for the period after 1979.

To measure productivity one should observe not merely output but the ratio of output to inputs. One such measure is labor productivity or output per unit of labor. According to column 3 of Table 4.1, output per person in state-owned industrial enterprises increased hardly at all from 1979 to 1981 while it had increased significantly from 1952 to 1979. However, this measure ignores the possible effect of capital. A better way to detect possible changes in productivity is to examine the residuals in a production function explaining output by

the relevant inputs. If the residuals for the years 1979 to 1981 are large and positive, the output in these years are higher than what can be predicted by a stable relation between output and inputs, suggesting that some other factors have contributed to the large outputs. Using the data given in (4.29) and the regression equation

$$\hat{y} = 2.52183 + .52401\, x_1 + .53468\, x_2 \qquad (4.44)$$

estimated in section 4.2, where y, x_1, and x_2 denote respectively the natural logarithms of industrial output, labor, and capital of state-owned enterprises, we find the predicted values $\hat{y}$ for 1979, 1980, and 1981 to be respectively 7.416, 7.512, and 7.579. The observed values y for these three years are 7.453, 7.516, and 7.546, yielding the residuals .037, .004, and -.033. These residuals are extremely small as compared with the standard error of regression s=.04674 given by (4.38), and one residual is even negative. Therefore there is no evidence that the outputs in the years 1979 to 1981 were higher than can be accounted for by the labor and capital inputs, using a production function estimated for the period 1952 to 1981.

However, the above analysis fails to include materials as an input in the production function. It might be argued that more output was produced in 1979 to 1981 than before in relation to the amounts of labor, capital, and current inputs. Byrd (1983, p. 331) considers the quantity of output in relation to current inputs. He writes, "There was a perceptible decrease in the estimated ratio of current input consumption to gross output value of Chinese state industry between 1975 and 1978, and in each of the three years 1979, 1980, and 1981. The ratio fell from o.650 in 1978 to .0632 in 1981, a reduction of almost 3 percent." He then suggests that "the ratio of 'real' input consumption to gross output value was between 4 and 7 percent" by assuming that the prices of agricultural products

used as inputs in the state-owned industrial sector increased by 10 to 20 percent. It would be preferable to include all relevant inputs in the production function to evaluate possible changes in productivity. Byrd's estimate would require a closer examination in view of the fact that the estimated ratio of current input consumption to gross output value decreased perceptibly between 1975 and 1978, before the introduction of institutional reforms in Chinese industry.

The crude analyses of productivity in Chinese industry presented above serve to demonstrate the method involved rather than providing precise results. It appears difficult to find evidence from aggregate data to show an increase in productivity as a result of the reforms in Chinese industry. Disaggregate data can show the economic effects of certain reforms. For example, in Shandong province, which led the introduction of the "economic responsibility system," the coal industry was budgeted to have a loss of 13.57 million yuan in 1981. After the system was introduced in March 1981 a loss was turned to a profit of .57 million in April and a profit of 9.02 million in May and June, according to the Public Daily of July 30, 1981, as quoted by Ma (1982, p. 83). Perhaps more conclusive results can be found by analyzing disaggregate data. It may also be true that certain reforms have yielded positive economic results in the sectors or regions adopting them while the reforms as a whole might not have yielded sizable effects on aggregate industrial output in China.

We will conclude this section by considering the economic effects of industrial reforms from the theoretical point of view. Our discussion of the operation of Chinese industry in sections 4.5 and 4.7 has pointed to certain elements in the previous system of central planning which had an adverse effect on economic efficiency. Since the reforms are aimed at granting the enterprises more discretionary power and allowing some of them to operate as independent economic entities while extending the role of the markets, they are in the right direction for the purpose of correcting the harmful effects of overcentralized economic planning. The

ultimate success of the reforms will depend on whether the following questions will be satisfactorily answered.

First, while it is encouraging to see the markets gradually expand, covering some 15 percent of industrial output in 1981, the question is whether they will be extensive enough to provide outlets for the products of, and furnish the inputs used by, the majority of industrial enterprises. If the prices of substantial fractions of the outputs and inputs are determined by the market, enterprises can be producing products of economic value by employing inputs in an economically efficient manner. To depend on administrators to evaluate the outputs and supply the required inputs of industry has been shown by the Chinese experience to be economically inefficient.

Second, perhaps as a corollary to the first, will labor, land, and capital equipment be paid their proper economic values when used as inputs in industrial production? If markets for these factors of production are established, wages and rents determined by the market will measure their economic costs. If not, it would be difficult to find other means of determining their economic costs which are required by the enterprises to perform efficient calculations.

Third, will the managers and workers of industrial enterprises be provided sufficient incentives to produce the best products most efficiently? The economic responsibility system, if practiced by the majority of enterprises, will provide a satisfactory answer to this question. This system has shown remarkable results when applied to agriculture where farm households can operate as independent economic units receiving all the profits of farming after paying a fixed amount to the government. This system has been extended to small industrial enterprises. The question is whether large industrial enterprises are allowed to operate in this fashion. If so, how much of the profits can be freely used by the managers and workers of the enterprises.

Besides the size of the enterprise, an important difference between industry and agriculture is that many essential inputs of industrial production have to be supplied from outside. It would not be economically efficient to allow an industrial enterprise to keep all its profits after a lump-sum payment to the government if its inputs are also cheaply supplied by the government and its outputs are sold at high prices determined by the government. Production in agriculture is simpler, the major inputs being the labor of the farmers, the land, some equipment, and current inputs such as fertilizers. Once an independent farm household is asked to pay a fixed amount dependent on the productivity of the land it uses, the profit of the farm will largely reflect its efficiency rather than the possibly low costs of the material inputs. In the case of a large industrial enterprise, its profit can measure efficiency only if its outputs and inputs are properly priced. Without extensive markets for these products, therefore, it may be undesirable to let certain large industrial enterprises operate under the economic responsibility system.

Our last remark is supported by some experience in Chinese industry. In 1981 many small factories were established in the rural areas to produce sugar, cigarettes, wine, soap, and leather products using the materials supplied locally (see Ma and Sun, 1982, p. 199). Some of these enterprises were considered economically inefficient and they were said to take away the supply of materials from the presumably more efficient factories in the cities. If free markets for both the material inputs and the final products were established, alleged inefficient production by the small rural factories could hardly occur. For example, if a large urban factory can really produce cigarettes more efficiently than a small rural factory, it can afford to pay a higher price (in addition to transportation costs) for the tobacco and the growers of tobacco will find it more profitable to sell to it than to a small rural factory, or to set up their own small factories

to produce cigarettes. If an urban cigarette factory cannot afford to buy tobacco in a rural market, perhaps it is less efficient than the small rural factories. Without markets for outputs and inputs, it is difficult to measure efficiency and it might be inefficient to allow large industrial enterprises to operate under the economic responsibility system.

A third major difference between agriculture and state-owned industry is that the livelihood of the members of a production unit in agriculture depends on the output of the unit whereas the incomes of the managers and workers of a state-owned industrial enterprise are hardly affected by its output or profit. The purpose of the responsibility system is to make the incomes of the managers and workers dependent on the productivity of the enterprise (see Problem 15).

An optimistic observer can hope that, in the 1980's, free markets in China will greatly expand and the economic responsibility system will be extended to a large number of industrial enterprises. The Chinese government will continue to practice economic planning to a significant extent, but it has recognized the shortcomings of centralized economic planning and has decided to supplement planning with the regulation by markets. It has also decided to encourage the establishment of collectively-owned enterprises. If the market sector is allowed to grow, if the prices of most outputs and inputs are determined by market forces, and if more collectively-owned and state-owned enterprises can operate as a lessee from the government under the economic responsibility system, efficiency in Chinese industry and in the Chinese economy as a whole can be expected to improve in the 1980's.

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Chapter 5

C O N S U M P T I O N

5.1. TRENDS IN PER CAPITA CONSUMPTION

Economists in China agree that the main objective of all socialist economic activities is to satisfy the people's consumption needs. (See Ma and Sun, 1982, P. 10, and Yang, 1982, p. 543.) They recognize that among the major causes of the distortions in the economic structure existing in China today are the over-emphasis on developing heavy industry at the expense of agriculture and light industry and the excessively high rate of accumulation at the expense of consumption (see Ma and Sun, 1982, p. 7). While heavy industry greatly expanded from 1952 to 1978, per capita consumption in China advanced only slowly. After 1978 consumption has increased more rapidly. We will elaborate on these two statements in this section.

To examine the trends in per capita consumption in China, it will be informative to treat urban and rural consumption separately. As we have pointed out in section 4.6, real wage of all state-owned enterprises in China was about the same in 1981 as in 1957. Average wage was 637 yuan in 1957 and 812 yuan in 1981. Deflated by the cost of living index of staff and workers, they become 503 and 500 1950-yuan respectively (see Table 4.5). In 1977 the real wage of all state-owned units was only 602/1.437 or 419 1950-yuan, not much higher than the 446/1.155 or 386 1950-yuan in 1952. As column 1 of Table 4.5 shows, the wage rate was held low for over two decades up to 1977 and was allowed to increase from 1978 to 1980 when economic policy was changed to expand the production of consumer goods. The above data on wages might be interpreted to mean that per capita consumption of urban workers and their family members was held practically constant for over two decades terminating in 1977.

The data of Table 4.5 have been used by Yang (1982, p. 553) to point out that average real wage in China declined between 1957 and 1978. "In 1978, the average money wage in all state-owned units was 644 yuan, which was higher than the 1957 average wage of 637 yuan by 1.1 percent ... . The cost of living index (inclusive of items traded in markets) of staff and workers increased by 11.3 percent during the same period. Accordingly the 644 yuan in 1978 was equivalent to 578.6 yuan in 1957." Yang's conclusion is the same as the one we have reached in the last paragraph. The only minor discrepancy is on the increase in the cost of living index of 11.3 percent quoted by Yang, as compared with the increase from 126.6 in 1957 to 144.7 in 1978, or 14.3 percent according to the data of Table 4.5.

It is necessary to reconcile the data quoted in the last two paragraphs with the index of annual consumption per capita for non-agricultural residents given in column 9 of Table 3.7. The latter index, according to its source, Almanac of China's Economy, 1981, p. 985, is "at comparative prices, 1952=100," and is "calculated by dividing private consumption expenditure (excluding services) from available national income by mean population of the year." This index increased from 126.3 in 1957 to 136.5 in 1965, to 181.1 in 1975, and to 214.5 in 1979. From 1957 to 1975 the average money wage of all state-owned units shown in column 1 of Table 4.5 decreased from 637 yuan to 613 yuan while the cost of living index of staff and workers shown in column 5 of Table 4.5 increased from 126.6 to 139.5. From 1957 to 1975 how could the index of per capita consumption of non-agricultural residents increase from 126.3 to 181.1, or by 43.4 percent?

The main explanation for the index of per capita consumption expenditure to increase when the average real wage declined is the increase in the ratio of the number of wage earners to the total urban population. According to Rawski (1979, pp. 29-30):

"Available information on employment rates among urban residents is compiled in Table 2-4. The population-weighted average of employment rates for four major urban areas during the 1950's is calculated at 33.3 percent, which is nearly identical with the figure of 32.6 percent compiled from a national sample survey conducted in 1956. It can therefore be assumed with reasonable confidence that approximately 33 percent of urban residents were employed in 1957. ...

"Repeated campaigns to resettle idle town dwellers in the countryside and the emergence of new employment opportunities for urban housewives in neighborhood industries lead to the expectation that both employment rates and participation rates should be higher in urban areas for the 1970's than for the 1950's. This expectation is confirmed by the data in Table 2-4, which show that employment rates in Nanking and Shanghai jumped from about 33 percent to more than 50 percent between the late 1950's and the mid-1970's. Survey results summarized in Table 2-4 show that urban employment rates of 50 percent or higher are common except in mining centers, where women find only limited employment opportunities, and in cities performing unspecified 'special functions.' On the basis of these data, an employment rate of 50 percent can be assumed for urban residents in 1975. ..."

Thus the increase from 33 percent to 50 percent of urban population employed would by itself raise the wage income per person by a factor of 50/33 or 51.5 percent. From 1957 to 1975 real wage decreased from 637/1.266 or 503 1950-yuan to 613/1.395 or 439 1950-yuan according to Table 4.5. These two factors combined yield a factor of (50/33)×(439/503) or 1.32 for the ratio of real wage per urban population between 1975 and 1957. Taking into account possible errors in the quoted figures, we can conclude that the increase in per capital consumption of the non-agricultural residents by approximately 43 percent between 1957 and 1975 is due mainly to the increase in the ratio of employed to total urban population by over 50 percent combined with a small reduction in the real wage rate.

Concerning the consumption rate of Chinese peasants, Yang (1982, pp. 549-552) presents four sets of evidence to suggest a widening of the gap between the con-

5.2 HOUSEHOLD EXPENDITURE PATTERNS

In the last section we discussed the changes in total consumption per capita through time. In this section we study the composition of family consumption expenditures at the same time among different groups of consumers. The former is an example of time-series analysis. The latter exemplifies a cross-section analysis. It is of interest to examine how households increase their expenditures on different kinds of consumption goods as their total consumption expenditure increases. Such studies of consumer expenditure patterns originated over a hundred years ago. As Houthakker (1957, p. 532) writes:

> "Few dates in the history of econometrics are more significant than 1857. In that year Ernst Engel (1821-1896) published a study on the conditions of production and consumption in the Kingdom of Saxony, in which he formulated an empirical law concerning the relation between income and expenditure on food. Engel's law, as it has since become known, states that the proportion of income spent on food declines as income rises. Its original statement was mainly based on an examination of about two hundred budgets of Belgian laborers collected by Ducpétiaux. Since that date the law has been found to hold in many other budget surveys; similar laws have also been formulated for other items of expenditure.
>
> "With the formulation of Engel's law an important branch of econometrics took its start, though it was not until our days that consumption research was placed on a sound theoretical and statistical basis. ... His successful attempt to derive meaningful regularities from seemingly arbitrary observations will always be an inspiring example to the profession, the more so because in his day economic theory and statistical techniques were of little assistance in such an attempt. ..."

Econometrics is the art and science of using statistical methods for the measurement of economic relations. Our study of production relations in Chinese industry presented in sections 4.1 and 4.2 is an econometric study. Our present task is to study the relations between total consumption expenditures of Chinese households and expenditures on food and other major consumption categories.

Table 5.2 CONSUMPTION EXPENDITURE PER CAPITA AND ITS COMPONENTS BY PROVINCE, 1981 (yuan)

	Province	1 Total Expenditure	2 Food	3 Clothes	4 Housing and Fuel	5 All other Items
	Total	190.81	113.83	23.57	29.26	24.15
1	Beijing	312.99	163.11	36.00	58.43	55.45
2	Tianjin	249.17	126.42	37.49	51.50	33.76
3	Hebei	164.66	85.93	23.48	28.07	27.18
4	Shanxi	147.78	85.86	23.88	17.70	20.34
5	Inner Mongolia	177.12	110.74	24.77	16.08	25.53
6	Liaoning	258.50	139.06	35.88	41.60	41.96
7	Jilin	246.07	152.39	34.04	28.94	30.70
8	Heilongjiang	175.23	101.98	29.97	19.08	24.20
9	Shanghai	389.85	198.10	43.25	95.86	52.64
10	Jiangsu	225.54	128.22	25.80	42.64	28.88
11	Zhejiang	266.46	147.01	31.75	54.96	32.74
12	Anhui	193.26	117.90	21.49	30.79	23.08
13	Fujian	199.25	123.50	19.98	31.34	24.43
14	Jiangxi	194.17	117.99	20.52	36.35	19.31
15	Shandong	178.95	89.56	27.03	31.69	30.67
16	Henan	165.57	89.08	24.51	28.64	23.34
17	Hubei	183.78	114.75	22.58	25.90	20.55
18	Hunan	207.59	135.98	23.06	27.87	20.68
19	Guangdong	266.05	157.72	21.32	50.26	36.75
20	Guangxi	171.45	115.93	14.93	20.22	20.37
21	Sichuan	184.07	121.21	20.65	22.51	19.70
22	Guizhou	162.51	105.16	18.93	23.48	14.94
23	Yunnan	137.75	91.83	15.90	16.75	13.27
24	Shaanxi	148.46	92.10	18.82	18.88	18.66
25	Gansu	135.23	92.99	16.37	12.28	13.59
26	Qinghai	153.48	103.43	18.90	14.91	16.24
27	Ningxia	141.68	89.06	20.11	13.22	19.29
28	Xinjiang	168.58	98.98	35.08	15.21	19.31

Source: Statistical Yearbook of China, 1981 (pp. 445-446).

Data on per capita consumption expenditure of Chinese peasants and its four major components, food, clothing, housing and fuel, and all other items for 28 provinces and municipalities (with the exception of Tibet) are found in Table 5.2. The data are based on a sample survey of 18,529 farm households conducted in 1981 and is reported in China's Statistical Yearbook, 1981 (pp. 441 and 445-446). Observations for the 28 provinces permit us to examine how per capita expenditures on the four categories of consumption change as total consumption expenditure changes. We have plotted the four types of expenditures against total expenditure in Figures 5.1, 5.2, 5.3, and 5.4 respectively, where the axes are measured in logarithmic scale. Each data point is marked by a number corresponding to the province or municipality shown in Table 5.2, with 1 for Beijing, etc. These figures indicate that the relations between the logarithms of the four categories of expenditures and the logarithm of total expenditure are approximately linear. Therefore, for each category j (j=1,2,3,4) we can postulate a regression relation

$$\log y_{ij} = \alpha_j + \beta_j \log x_i + \varepsilon_{ij} \qquad (i=1,\ldots,28) \qquad (5.1)$$

where y_{ij} denotes per capita consumption expenditure in the i^{th} province for the j^{th} consumption category, x_i denotes per capita total consumption expenditure in the i^{th} province and β_j is the elasticity of demand for the j^{th} consumption category with respect to total expenditure. ε_{ij} is the residual pertaining to the i^{th} province in the regression for the j^{th} consumption category; it is assumed to be a random drawing from a normal frequency distribution with mean zero and standard deviation σ_j (see Figure 4.2 for a normal distribution and review sections 4.1 and 4.2 for regression analysis).

Using the 28 observations provided in Table 5.2 and plotted in Figures 5.1 to 5.4, we estimate the four regression equations by the method of least squares and obtain the results for

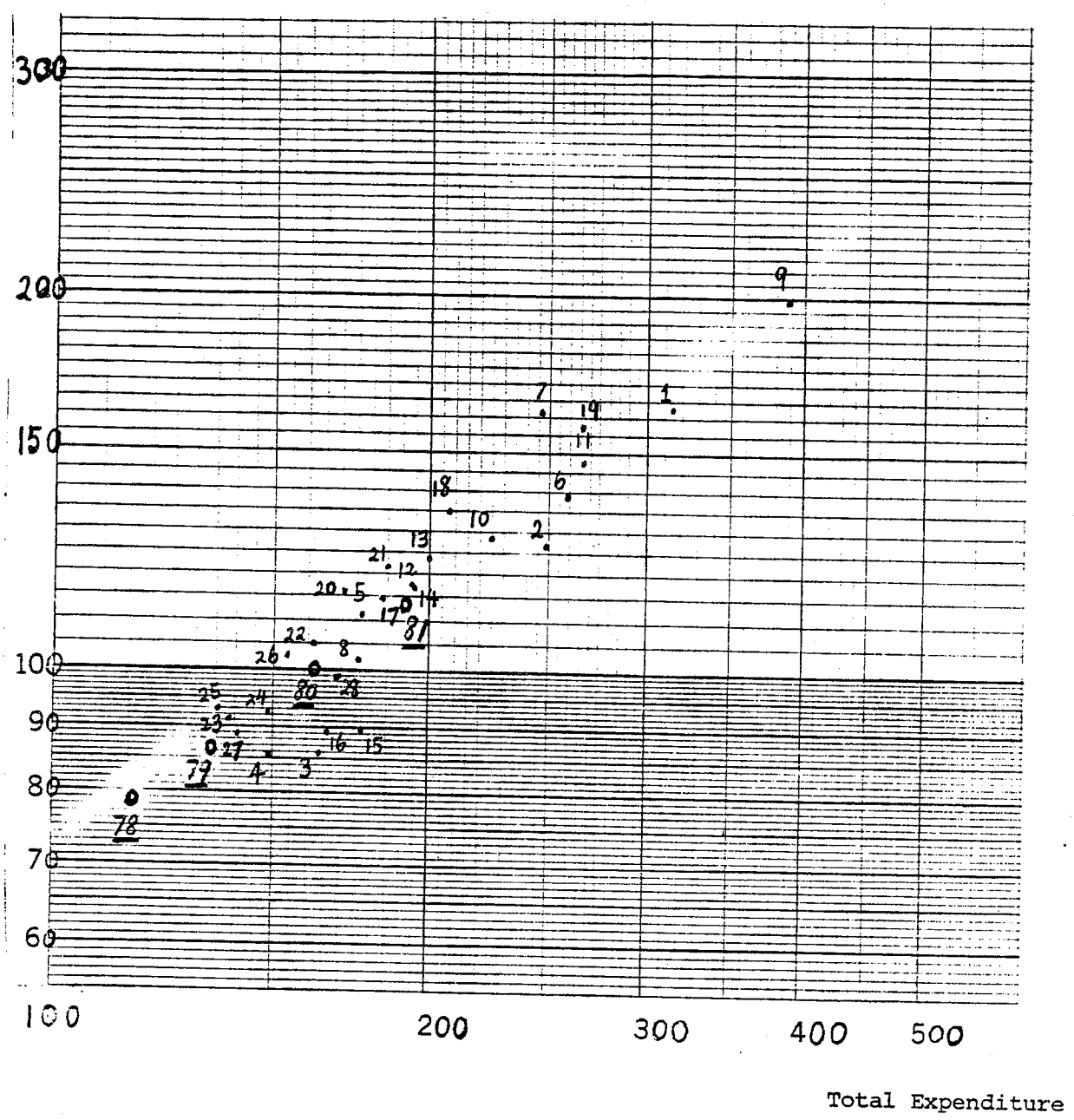

Figure 5.1 - Relation Between Per Capita Food Expenditure and Total Expenditure of Peasants by Province - Sample Survey, 1981

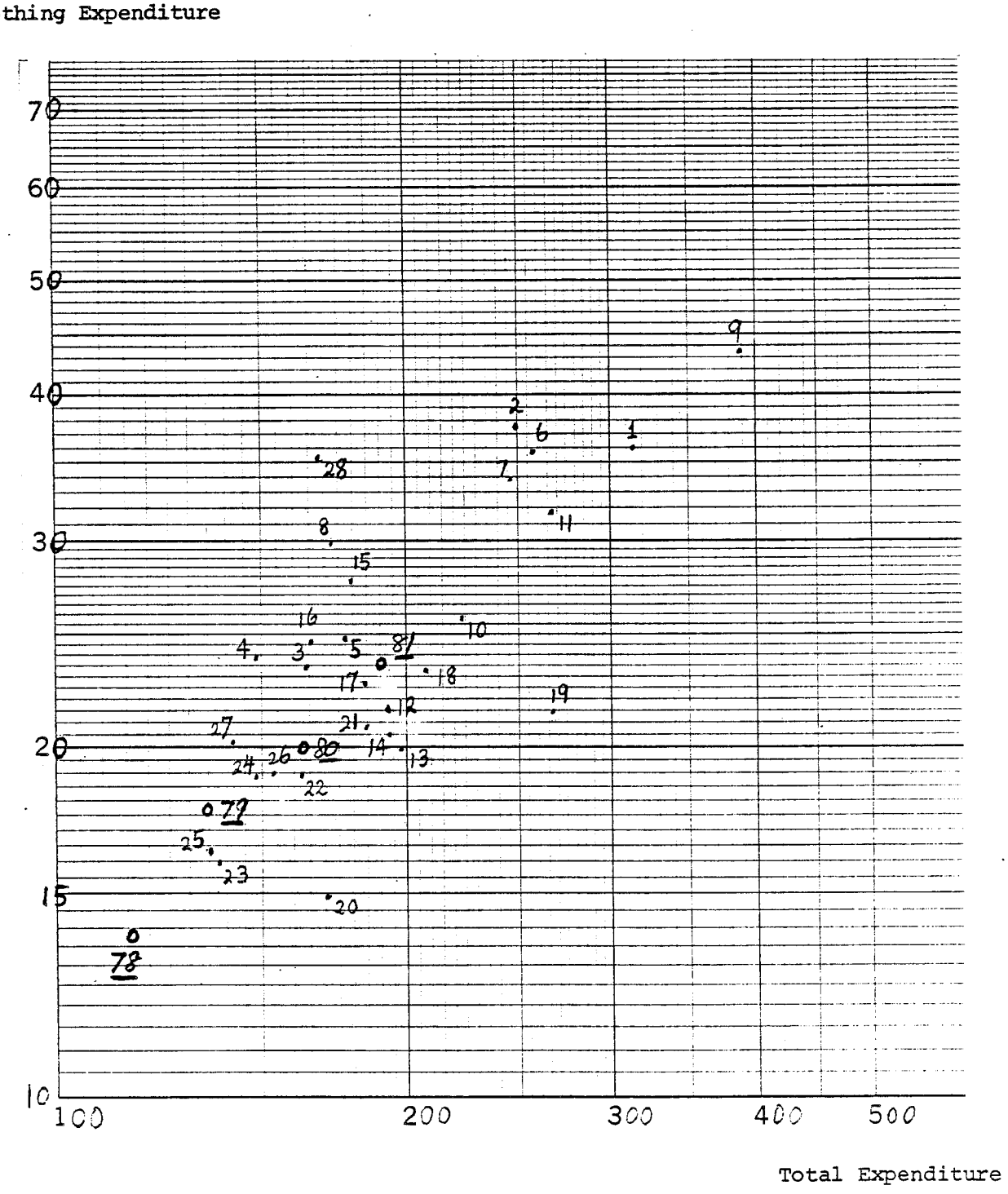

Figure 5.2 - Relation Between Per Capita Clothes Expenditure and Total Expenditure of Peasants by Province - Sample Survey, 1981

Housing and
Fuel Expenditure

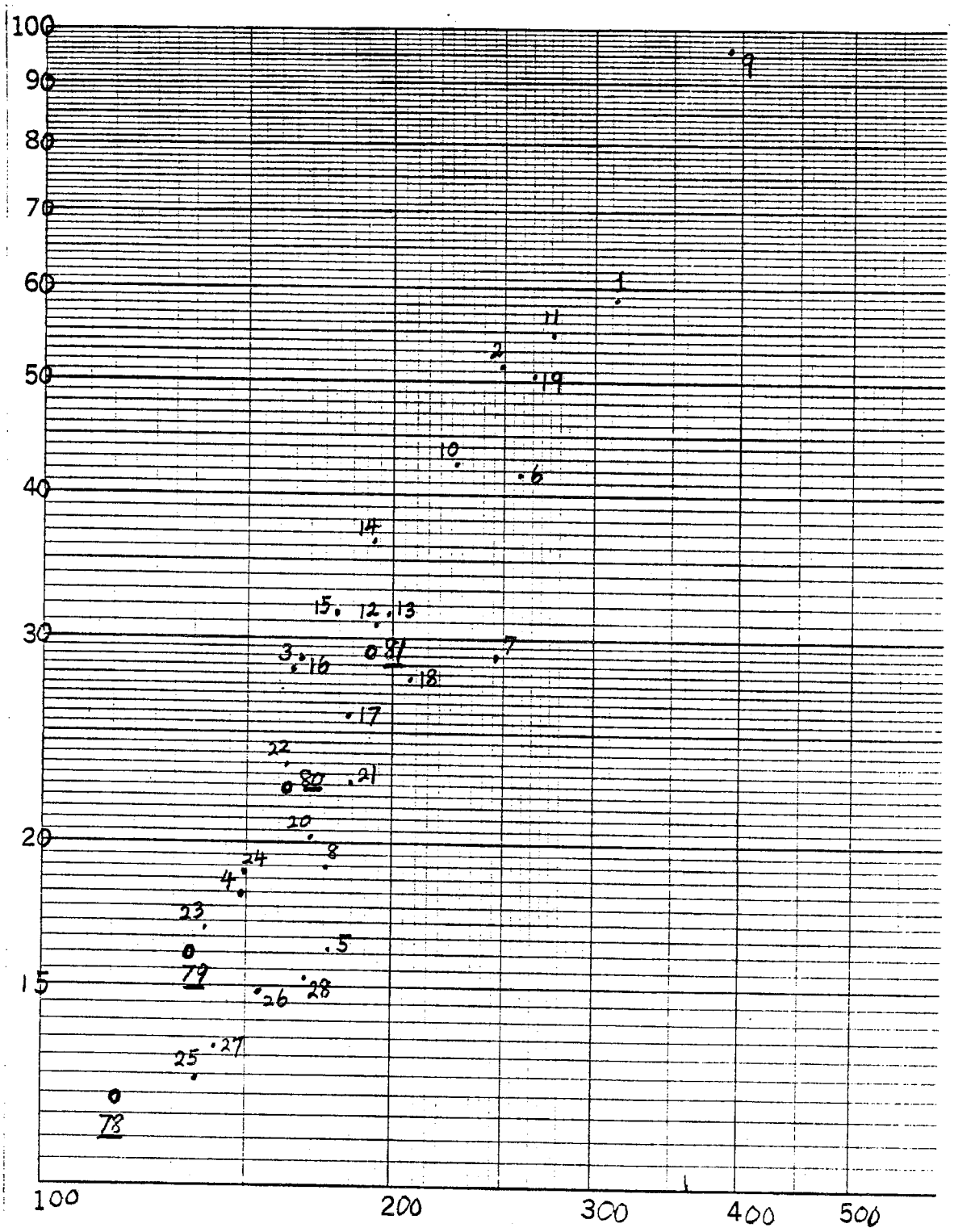

Figure 5.3 - Relation Between Per Capita Expenditure on Housing and Fuel and Total Expenditure of Peasants by Province - Sample Survey, 1981

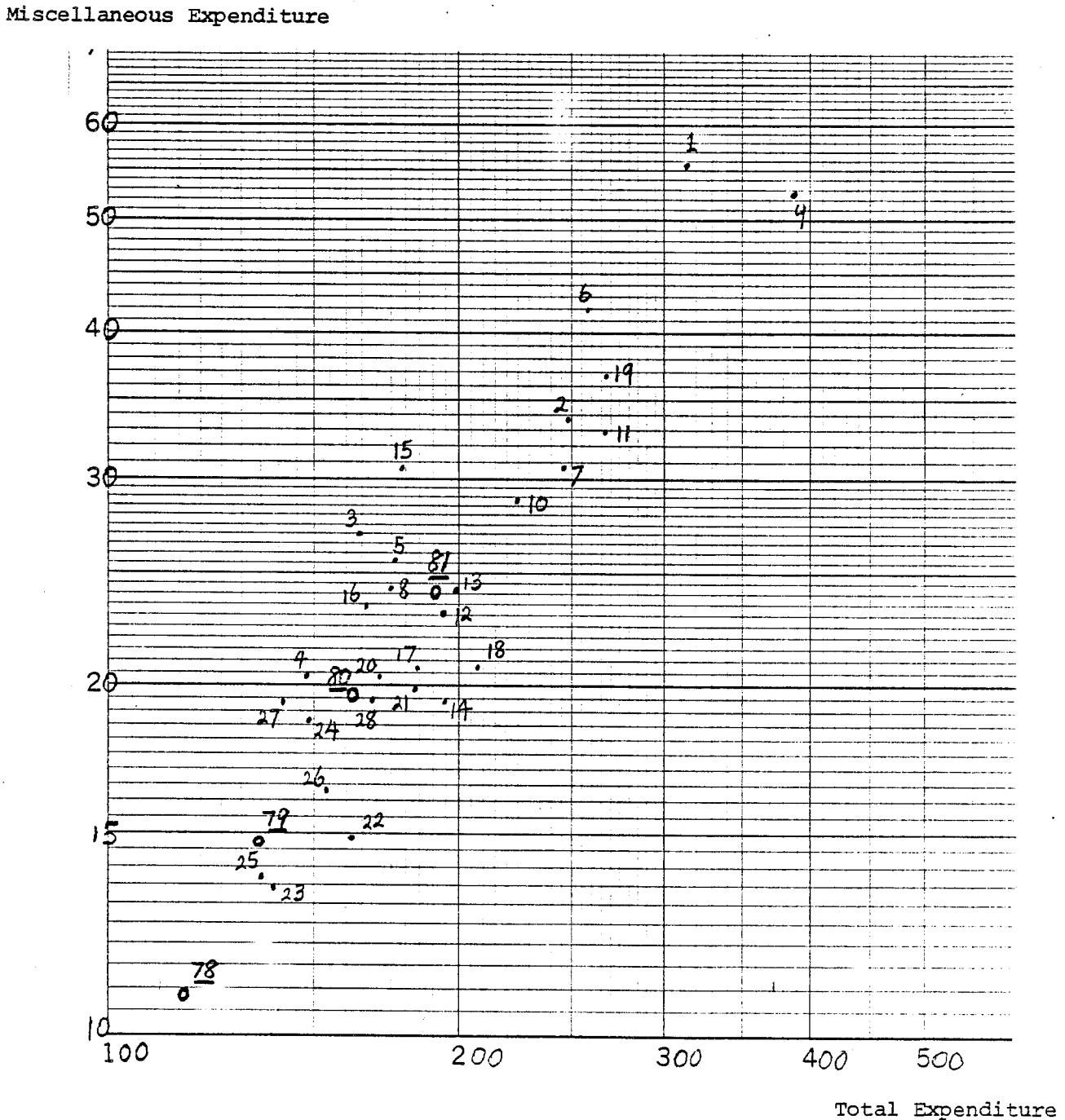

Figure 5.4 - Relation Between Per Capita Miscellaneous Expenditure and Total Expenditure of Peasants by Province - Sample Survey, 1981

Food:

$$\log y_{i1} = \underset{(.313)}{0.587} + \underset{(.059)}{0.790} \log x_i \qquad R^2 = .872, \quad s^2 = .00650 \qquad (5.2)$$

Clothing:

$$\log y_{i2} = \underset{(.760)}{-.962} + \underset{(.144)}{0.789} \log x_i \qquad R^2 = .535, \quad s^2 = .0383 \qquad (5.3)$$

Housing and Fuel:

$$\log y_{i3} = \underset{(.794)}{-6.073} + \underset{(.151)}{1.783} \log x_i \qquad R^2 = .843, \quad s^2 = .0418 \qquad (5.4)$$

Miscellaneous:

$$\log y_{i4} = \underset{(.650)}{-3.378} + \underset{(.123)}{1.248} \log x_i \qquad R^2 = .797, \quad s^2 = .028 \qquad (5.5)$$

where the numbers in parentheses are the standard errors of the corresponding regression coefficients. Thus the total-expenditure elasticities of demand for food, clothing, housing (including fuel) and all other items are estimated to be respectively .79, .79, 1.78, and 1.25 for Chinese peasants, based on a sample survey of 1981.

These estimates, based on cross-section data, are close to the estimates obtained from the time-series data on per capita consumption expenditures by all peasant households surveyed in 1978, 1979, 1980, and 1981 given in Table 5.3. Per capita expenditures on the four consumption categories in the years 1978-1981 are plotted against per capita total expenditure in Figures 5.1 to 5.4 respectively. See the small circles marked with the last two digits of the years 1978-1981 in these figures. One can observe that the regression line fitted to the four time-series observations in each figure has almost the same slope as the

Table 5.3 PER CAPITA CONSUMPTION EXPENDITURES OF PEASANTS' HOUSEHOLDS SURVEYED IN 1978-1981

	1978	1979	1980	1981
Number of farm households surveyed	6,095	10,282	15,914	18,529
Per capita total expenditure (yuan)	116.06	134.51	162.21	190.81
P.c. expenditure on food	78.59	86.03	100.19	113.83
P.c. expenditure on clothing	17.74	17.64	19.99	23.57
P.c. expenditure on housing and fuel	11.95	16.00	22.46	29.26
P.c. expenditure on other items	10.78	14.84	19.57	24.15

Source: Statistical Yearbook of China, 1981 (pp. 441 and 443).

corresponding regression line fitted to the 28 cross-section observations for the year 1981 (see Problem 1). Unfortunately, the Statistical Yearbook of China, 1981 does not contain similar data on urban families for us to perform a similar analysis.

The estimate .79 for total expenditure elasticity of demand for food confirms Engel's law which states that the proportion of income spent on food declines as income rises. Note that we have used total expenditure instead of income. The estimate of income elasticity would be slightly smaller than the estimate of total-expenditure elasticity; it is the product of the latter elasticity and the elasticity of total expenditure with respect to income which is not more than one.

According to our estimate, when total expenditure increases by 1 percent, the expenditure on food increases by .79 of 1 percent, with a standard error of .06. Engel's law states that the income elasticity of demand for food is less than one.

It is interesting to compare our estimates of the four elasticities with the estimates of Houthakker (1957) who has made an international comparison of household expenditures on the same four categories for thirty-three countries using household budget surveys for different periods ranging mainly from the 1920's to the 1950's. Houthakker has found that regression functions which are linear in the logarithms of the variables fit the data well. The data used by Houthakker are mainly expenditures for different families, whereas the data available to us are per capita expenditures for different provinces. Since families with different total expenditures may be different in size, Houthakker has tried to isolate the effect of family size on expenditures by introducing family size as a separate explanatory variable, besides total family consumption expenditure, in the regression of family expenditure for each consumption category. In other words, he has estimated linear regressions of log expenditures for the four categories on log total expenditure and log family size when data on family size are available. When data on family size are not available, he has attempted to adjust the estimates of the elasticities of demand for food. For example, a regression of log food expenditure on log total expenditure based on a survey of families in Shanghai in 1929/1930 has yielded an (unadjusted) estimate of .769 for the total expenditure elasticity of demand (see Table 5.4). Insofar as families with large total expenditures tend to be larger in size, and as family size has a positive effect on food expenditure, the above estimate is too large. The figure .769 is adjusted downward to .617 using a formula given by Houthakker (1957, p. 545). No adjustments for the other three elasticities are made because the estimates of the effects of family size on these consumption goods are less uniform among countries. Our estimates

given in equations (5.2) to (5.5) are based on per capita (and not per family) data and hence the effect of family size is already accounted for (see Problem 2).

Houthakker's estimates of the elasticities for the four expenditure categories with respect to total expenditure are given in Table 5.4. The author concludes his multicountry study by writing:

> "Some final comments are in order. What has been shown is mainly that the elasticities of the four main items of expenditure with respect to total expenditure are similar but not equal, and that the elasticities with respect to family size are rather similar (but also unequal) for food and miscellaneous items, and irregular for clothing and housing. To return to the problem of development planning mentioned in the beginning of the paper: if no data on the expenditure patterns of a country are available at all, one would not be very far astray by putting the partial elasticity with respect to total expenditure at .6 for food, 1.2 for clothing, .8 for housing, and 1.6 for all other items combined, and the partial elasticity with respect to family size at .3 for food, zero for housing and clothing, and -.4 for miscellaneous expenditures. But it would be prudent not to use those guesses for wide extrapolations, and more prudent still to organize a survey and cross-classify the results."

The total expenditure elasticity of demand for food estimated from the survey of Chinese peasants is somewhat higher than the .6 figure suggested by Houthakker. This difference may be explained by the suggestion of Houthakker (p. 547) "that the elasticity for food with respect to total expenditure might be higher for the countries and time periods with lower total expenditure, though the evidence is equivocal." The estimate of elasticity for clothing is somewhat lower, and for housing somewhat higher in the case of the Chinese peasants surveyed in 1981 than the corresponding average figures used by Houthakker just quoted. Two related explanations for the differences can be offered. First, the surveys used by Houthakker are mainly for urban families, and it is reasonable to suppose that

urban people tend to spend more on clothing than the peasants do as their incomes increase. To the extent that people spend less on clothing, they will spend more on other things, including housing. Second, the demand for housing by Chinese farmers is perhaps subject to fewer restrictions than the demand for clothing. The Chinese peasants are relatively free to build their own houses while the supply of clothing may be more limited. Observe that the elasticities for clothing and housing estimated from urban families in Peiping (in 1927) and in Shanghai (in 1929/30) as given in Table 5.4 are much closer to the international averages. The higher elasticity for clothing in Shanghai than in Peiping is noteworthy because the residents of the cultural city of Peiping in the late 1920's were known to dress more modestly than the residents of the cosmopolitan Shanghai. There is no reason to believe, and no evidence to suggest, that the consumption behavior of the Chinese people is very different from that of the other people in the world. In fact, the regularities documented in Table 5.4 and in equations (5.2) to (5.5), with the differences reasonably explained, are encouraging to students in their search for universal laws in economics.

*5.3 UTILITY THEORY OF DEMAND

In the last section we have studied the relation between the demand for one commodity and income (or total expenditure). Such a relation is called an Engel curve, in honor of Ernst Engel (1821-1896). According to the theory of consumer demand expounded in section 1.3, the demand for a commodity is a function of the prices of all commodities and income, as given in equation (1.5). A demand curve is the relation between the demand for a commodity and its own price, holding all other prices and real income constant. In section 1.3 we assumed that the preferences of a consumer are summarized by a set of indifference curves, and derived a demand curve from a set of indifference curves graphically using Figure 1.2.

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July 1983

Chapter 6

NATIONAL INCOME AND CAPITAL FORMATION

6.1 ESTIMATION OF CHINA'S NATIONAL INCOME

Perhaps no other topic has received as much attention from foreign scholars of the Chinese economy in the last three decades as the estimation of China's national income. Since 1980 the State Statistics Bureau of the Chinese government has published its own estimates of Chinese national income in Almanac of China's Economy, 1981; 1982 and Statistical Yearbook of China, 1981, and we have quoted these estimates in Table 3.3. Scholars have yet to digest and evaluate these estimates. Before the appearance of the official figures many attempts had been made to estimate China's national income and its major components. Some of these attempts are discussed in Alexander Eckstein, ed. (1980). A survey chapter of Dwight Perkins (1980, p. 248) in the Eckstein volume compares the estimates of China's gross domestic product (GDP) of Liu and Yeh (1973), Eckstein (1973), Perkins (1975), Swamy (1973), Hidasi (1971), and Field (1980). For the period 1952-1970 these authors respectively have estimated the average annual growth rate of GDP (net domestic product in the case of Swamy and national income in the case of Hidasi) to be 4.1, 4.5, 5.8, 2.6, 6.0, and 5.6 percent.

Perkins (1980) points out that estimates of China's national product were obtained by various authors essentially by combining the outputs of the agricultural, industrial, and the services sectors, and that the sources of the differences among the various estimates of GDP are

(1) differences in the underlying indexes of industrial or agricultural product or both,

(2) differences in the assumptions made about the services sector, and

(3) differences in the (price) weights used to combine the three sectors. More on this point later in this section.

Now that the Chinese official figures from the State Statistical Bureau are available, it would be of interest to compare them with the estimates provided by foreign scholars. It is hoped that in the future more detailed figures concerning China's national income and product will become available. At present the details provided are much less than those found for the national income of the United States as provided by the U.S. Department of Commerce in its monthly Survey of Current Business (see especially the July issues and the Supplements to the Survey on The National Income and Product Accounts).

Column 1 of Table 6.1 provides estimates of Chinese national income in billions of current yuan by the State Statistical Bureau. For the years covered in Table 3.3 the national income figures in Table 6.1 are identical with those of Table 3.3. For all other years I have used the increments in national income provided by Zhang (1981, p. 727) to interpolate, beginning with the 1957 figure of 90.8 and going forward and backward. (The increment of 12.0 billion for 1953 provided by Zhang appears to be too large and is not used in our interpolations backward from 1957 to 1953, leaving the figure 58.9 for 1952 intact. The results of these interpolations agree with the figures given in column 1 of Table 3.3. It is curious why the subtotals of national income for different Five-Year Plan periods given on p. 737 of Zhang do not agree with the corresponding subtotals of column 1, Table 6.1, whether we use 90.8 or 93.5 (see column 1 of Table 3.4) for the national income figure in 1957 to start the interpolations.) To estimate the average rate of growth of national income in constant 1952 yuan from 1952 to 1970, we make the assumption that prices are constant from 1965 to 1970, an assumption supported by the price indices given on pp. 411-412 of Statistical Yearbook of China, 1981. National income in 1952 yuan for 1965 was given in Table 3.3 to be 116.3 billion. National income in 1952 yuan for 1970 is estimated to be 116.3 times (192.6/138.7), the ratio of national incomes in 1970 and 1965 given in Table 6.1,

it does not explain how the price level of the economy is determined. Both limitations are related to the fact that it is a model of aggregate demand, with the consumption function and the investment function explaining how much c_t and j_{1t} will be demanded by the consumers and enterprise managers. It omits the supply side which deals with how much the economy is capable of producing. It keeps no record of the capital stock which helps determine the productive capacity of the economy. It has nothing to say about money and finance, about how inflation may occur, how government investment is financed, and how the financing of government investment may take away resources available for private consumption and enterprise investment. In fact, one major concern of the Chinese government in 1983 is the rapid expansion of the investment j_{1t} by individual enterprises using their discretionary funds. The government has allowed these enterprises to retain part of their earnings which could otherwise be used for government investment j_{2t}. We will present a model which will explain the price level and the financing of government investment in the next section.

6.6 DETERMINATION OF THE PRICE LEVEL AND FINANCING OF GOVERNMENT INVESTMENT

The topics of sections 6.1 to 6.5 belong to macroeconomics while the theory of consumer behavior discussed in Chapter 5 belongs to microeconomics. Microeconomics deals with the behavior of individual economic units including consumers, workers, and enterprises. It explains how their decisions affect the production, consumption, distribution, and the pricing of individual commodities. Macroeconomics deals with economic aggregates, such as national income, total consumption, total investment, total employment, and the general price level (or a price index for all commodities and services). In sections 6.2 to 6.5 we have presented several macroeconomic models. The first task of this section is to explain how the price level is determined.

The quantity theory of money is a good first approximation to how the price level is determined. It is based on the quantity equation

$$Mv = Py \tag{6.74}$$

where M is the quantity of money, P is the price level, y is national income in physical terms or national product, and v is income velocity of circulation. Py is national income or total expenditure during a period in money terms. M is the quantity of money in existence. If money national income Py is 100 billion yuan during a certain year, and if the stock of money M is 20 billion yuan, the income velocity v is 5. This means that on the average each piece of money is used five times during the year to pay for the expenditures totaling Py yuan. The quantity equation is a definition which defines the income velocity $v = Py/M$. Treated as a definition, the quantity equation must hold true in every country every year.

What converts the quantity equation (6.74) from a definition to a theory, called the quantity theory of money, is the hypothesis that for a given economy and for a period as long as several years the velocity v is approximately constant. The theory states that the stock of money M and money income Py are proportional, at least approximately. The quantity theory of money further assumes that the stock of money M is exogenously determined, so that money income Py is determined by the stock of money M, as a first approximation. If, in a period as short as several years when real output y is not changed by very much while M has changed relatively more, P will be approximately proportional to M according to the quantity theory. Thus when output is relatively constant, an increase in M will mainly increase the price level P or create inflation. If output y is determined by some model such as model (6.73) of the last section, and if M is treated as exogenous, the quantity theory (6.74) will determine the price level P.

The quantity theory of money as stated in the last paragraph provides a fairly good explanation of the price level and inflation in many countries over many different periods. See Friedman, ed. (1956), for a theoretical and empirical treatment of the quantity theory of money. Inflation has been mainly caused by the creation of too much money. However, two modifications should be made concerning the quantity theory. First, in periods of hyperinflation when the stock of money is increased very rapidly, such as the period 1947-1949 in China, the price level will increase proportionally faster than the stock of money, or the velocity v itself increases. The reason is that people try to get rid of the money they hold as money is losing real purchasing power. In this case inflation is still caused by the creation of too much money, except that the price level increases even faster than the stock of money. See Cagan (1956) for a study of hyperinflation. The second modification is to propose a theory which allows money to influence real output y, rather than having output y determined by a separate model and using the quantity theory (6.74) to determine P, given y and M. Many such theories have been proposed in macroeconomics. One such theory will be presented below.

As a first step we modify the quantity theory (6.74) to form an equation explaining the demand for real money balances M/P. According to (6.74), with v fixed, the demand for money M/P in real terms is proportional to real income y. An explanation for such a relation is that consumers and business enterprises desire to hold a fraction of their incomes or outputs in the form of money. The modification is that as the rate of interest r increases, the demand for real money balance M/P will decrease because the cost of holding money (which equals the interest forgone by holding money rather than an interest-yielding asset) increases. Thus the demand for M/P is a function of both y and r. To simplify our discussion we assume that all money consists of money issued by the government and ignore the creation of money in the form of deposits by commercial banks.

When commercial banks exist, they can create money in the form of bank deposits. The deposits in checking accounts are a part of the stock of money, and sometimes deposits in savings accounts of commercial banks are included as money. (According to accepted terminology in the United States, the stock of money M_2 includes savings deposits in commercial banks, but the stock of money M_1 does not.) We simplify our discussion by assuming that money consists only of government-created money, which is called high-powered money because commercial banks can use it to create money in the form of bank deposits. An equivalent assumption is that the deposits in commercial banks have to be backed by 100 percent high-powered money, so that the banks have no power to create money of their own.

To model the financing of government investment j_{2t}, we assume as in model (6.73) that the only function of the government is to invest and that investment j_{2t} in real terms is financed by a net tax x_t (in constant prices), the issuing of new money $(M_t-M_{t-1})/P_t$ and the issuing of new government bonds. A government bond is assumed to pay an interest of one yuan per year perpetually. If the rate of interest is r, the price of one government bond is 1/r and the value of B government bonds is B/r (see equation 1.51). Since the holding of money and government bonds is a form of wealth to the public, consumption and the demand for money will be positively influenced by the amount of this wealth. Furthermore, investment by enterprises will be negatively influenced by the rate of interest as we have explained in section 1.9. The assumptions introduced in this and the last paragraph will now be incorporated in the model (6.73) to form a new model which can explain the price level P_t and the financing of government investment j_{2t}.

The model is:

1. $y_t = c_t + j_{1t} + j_{2t}$

$$
\begin{aligned}
&2.\quad x_t = \tau_0/P_t + \tau y_t - B_t/P_t + \tau B_t/P_t \\
&3.\quad c_t = \gamma_1(y_t - x_t) + \gamma_2 M_t/P_t + \gamma_3 B_t/P_t + \gamma_4 c_{t-1} \\
&4.\quad j_{1t} = \alpha_1(y_t - x_t) - \alpha_1(y_{t-1} - x_{t-1}) + \alpha_2 r_t^{-1} + \alpha_3 j_{1,t-1} \\
&5.\quad M_t/P_t = \lambda_0 + \lambda_1 y_t + \lambda_2 B_t/P_t + \lambda_3 r_t^{-1} \\
&6.\quad j_{2t} = x_t + (M_t - M_{t-1})/P_t + (B_t - B_{t-1})/r_t P_t \\
&7.\quad P_t - P_{t-1} = \delta_0 - \delta_1(\theta k_{t-1} - y_t) \\
&8.\quad k_t = j_{1t} + j_{2t} + k_{t-1}
\end{aligned}
\tag{6.75}
$$

The first seven equations of this model determine the seven endogenous variables y_t, x_t, c_t, j_{1t}, r_t, B_t, and P_t with j_{2t} and M_t treated as exogenous variables. The last equation determines the capital stock k_t given k_{t-1} once the investments j_{1t} and j_{2t} are known. These equations are explained below.

The first equation is the definition of national income used before. Note that we are considering a closed economy with no imports and exports. The second equation explains net tax x_t in constant prices. τ_0 is the amount of tax in money terms, which is independent of national output y_t. The second term τy_t is the amount of tax in real terms which depends on y_t, τ being the tax rate. If the government has B_t units of bonds outstanding it has to pay out B_t yuan from the tax revenue, accounting for the third term. The fourth term incorporates the tax τB_t received by the government from the bond interest received by the public; this term would vanish if bond interest is nontaxable. The division by P_t in the first, third and fourth terms is to convert them into constant prices. The third equation is as before, except that consumption is positively influenced by the money balance M_t/P_t in real terms and by bond interest B_t/P_t. The fourth equation is also the

same as before, except that the rate of interest r_t has a negative effect on investment.

In the first four equations explaining the four endogenous variables y_t, x_t, c_t, and j_{1t}, we have introduced three other variables P_t, B_t, and r_t which need to be explained. Therefore three more equations are needed. The fifth equation is a demand equation for money, which is a generalization of the quantity theory. Demand for real money balances M_t/P_t is positively influenced by real income y_t and real value of bond interest payment B_t/P_t, and negatively influenced by the rate of interest r_t. Keynes (1936) introduces such an equation as a crucial equation in macroeconomics. Assuming P_t to be constant (and B_t to be constant also), Keynes uses this equation to explain the rate of interest r_t by the stock of money M_t. By contrast, the quantity theory of money assumes that r_t has a small effect on the demand for money and uses this equation to explain the price level P_t by the stock of money M_t. The truth of the matter is that both variables r_t and P_t exist in this equation and that a change in M_t will affect a combination of these variables. Which will be affected more depends on the solution of the entire system of equations in (6.75). More on this point three paragraphs below.

The sixth equation is a government budget constraint. The importance of such a government budget constraint in macroeconomics has been emphasized by Carl Christ (see his 1979 paper for a survey and the references therein). The point is that government spending for investment (and other purposes) has to be financed by taxation or by the increase in government debt (money being non-interest bearing and bond being interest bearing). Government spending can also be financed by borrowing from foreign countries or by reducing the holding of foreign exchanges, but these are ignored in the present model. In the last term of equation 6 (B_t-B_{t-1}) is the number of new bonds issued and the money value of these new bonds is $(B_t-B_{t-1})/r_t$. As Christ points out, if M_t and j_{2t} are treated as exogenous, the

issue of new bonds ($B_t - B_{t-1}$) is endogenously determined by the government budget constraint.

Equation 7 states that the increase in the price level, or inflation, is negatively related to the difference between capacity output θk_{t-1} and actual output. We assume for simplicity that capacity output depends on the capital stock available at the end of the last period. This model fails to incorporate labor as an important factor determining capacity output. An alternative hypothesis is that the rate of change in the money wage rate and accordingly in the price level is negatively related to the unemployment rate. A high rate of unemployment means a large difference between the quantity of labor available and the quantity actually used. In equation 7 we use instead the difference between the quantity of capital available and the quantity actually used. The alternative hypothesis is due to A. W. Phillips (1958) and is known as the Phillips Curve. It is possible to incorporate both labor and capital as factors determining productive capacity. In China, however, for the production of much of the national product, some would consider capital as a more important factor affecting productive capacity because labor is plentiful.

To return to the question as to how much a given change in the money stock M_t will affect P_t relative to r_t or y_t, multiplying equation 5 of model (6.75) by P_t yields

$$M_t = \lambda_0 P_t + \lambda_1 P_t y_t + \lambda_2 B_t + \lambda_3 P_t r_t^{-1}$$

which implies that when M_t increases the right-hand side consisting of $P_t y_t$ and $P_t r_t^{-1}$ must be increased. If λ_3 is very small, the term involving r_t may be dropped, and the effect will be on money income $P_t y_t$. How large is the effect on P_t as compared with y_t depends on how close actual output is to capacity output θk_{t-1}. According to equation 7, P_t will increase less if national output y_t is much

below capacity output. If production is near capacity P_t will increase more. When we have a system of simultaneous structural equations determining several endogenous variables by several exogenous variables, it is necessary to solve for the reduced form to ascertain the effect of any one exogenous variable on each endogenous variable. When the system of structural equations is nonlinear as (6.75) is, the reduced form cannot be solved explicitly. One has to resort to numerical analysis or to linearizing the system. Such matters are treated in Chow (1975), but are too technical to be discussed here.

6.7 MACROECONOMIC RELATIONS IN THE CHINESE ECONOMY

In the last section we have presented a macroeconomic model (6.75) which is capable of explaining fluctuations and growth of an economy. This model consists of three identities or definitions, equations 1, 6, and 8, and five behavioral or institutional equations. Equation 2 is an institutional equation explaining government taxes. Equations 3, 4, 5, and 7 are behavioral, explaining respectively consumption, nongovernment-directed investment, the demand for money, and the adjustment of the general price index. These equations are applicable to a developed, western economy. Can these equations, after appropriate modifications, adequately explain the Chinese macroeconomy in the 1980's? To answer this question properly requires constructing an econometric model of the Chinese economy based on these equations.

An econometric model consists of a system of numerical equations describing the working of certain aspects of an economy. The macroeconomic model (6.75) is not econometric because the numerical values of the parameters τ_0, τ, γ_1, γ_2, etc. are not specified. To construct an econometric model, usually a random residual is added to each structural equation which is not an identity. This is to allow

for the fact that the variable on the left-hand side of the equation is not perfectly explained by the function on the right-hand side, leaving a residual which is assumed to be random by the econometrician. Recall from section 4.2 that the difference between a dependent variable y and the regression function a+bx is also assumed to be a random residual. By the introduction of random residuals the otherwise deterministic equations become stochastic equations, and a deterministic model becomes a stochastic model. Secondly, statistical data and other information are used to estimate the values of the parameters of the stochastic model. Econometric methods will be applied in a similar way as the method of least squares is applied in section 4.2 to estimate the parameters of a regression model which is a basic example of an econometric model. Econometric methods will also help us decide how well the model which we have specified fits the data for a given economy during the period under investigation.

It would be very difficult in 1983 to test the empirical validity of all the structural equations in the model (6.75) for the Chinese economy by econometric methods because the data required are not available. The model is specified for the Chinese economy as of the 1980's. There is yet a very short historical period for observing this economy, even if all statistical data after 1979 are available. Some of the equations, especially the equation for nongovernment-directed investment, are valid only after the economic reforms of 1979-1980. Therefore, instead of using econometric methods systematically we have to piece together institutional information and fragmentary data to judge whether model (6.75) is a reasonable first approximation to the working of the Chinese macroeconomy. Our effort may serve as a first step toward the construction, estimation, and testing of an econometric model for the Chinese economy in the 1980's. Let us reexamine the equations of (6.75) from the viewpoint of Chinese institutions and data.

Equation 1 requires little comment because it is an identity. Chinese official data, such as given in Table 6.1, decompose national income into consumption and capital accumulation. In view of the expansion of nongovernment-directed investment and the concern which it has created in 1983 among Chinese government officials, data on nongovernment investment j_{1t} and government investment j_{2t} might be separately provided in the future, permitting economists to study them.

Equation 2 requires a reinterpretation in the Chinese context. The purpose of this equation is to explain total tax revenue of the government net of any transfer payments from the government to the public. The net tax variable will then be used in equations 3 and 4 to form an after-tax income variable which can explain consumption and nongovernment investment. The idea is that when the government takes away resources from the consumers and nongovernment investors in the form of taxation in order to finance its own investments, the consumers will consume less and the nongovernment investors will invest less. In an economy where all productive resources are owned by the citizen-consumers, all of national income consists of incomes of individual citizens in the form of wages and salaries, rents, and distributed and undistributed profits of corporations which are owned by them. The government can obtain economic resources from the people by taxation, which will reduce the ability of the consumers to consume and the ability of the private investors to invest. In equation 2 the income variable y_t means national income which is the total income of all individual citizens and the net tax variable x_t refers to taxation of the above income by the government net of any transfer payments from the government to the people. This interpretation is essentially valid for the United States in which the government owns some enterprises producing a very small fraction of national output. To apply equation 2 to the United States, the tax variable x_t should include profits of government enterprises. (In the national income account of the United States, "current surplus less subsidies of

government enterprises" is usually negative, meaning that the government enterprises receive more subsidies than the income they earn, leading to an expenditure rather than a revenue for the government.) Here we are assuming that only one equation is used to explain net tax x_t. Otherwise, several equations can be used to explain different components of x_t.

In the Chinese economy most of the productive resources are either state owned or collectively owned rather than individually owned. Almost all farms are collectively owned, except for some state-owned farms. Most industrial enterprises and all large industrial enterprises are state owned; some small enterprises are collectively owned, but they are increasing in number and in importance in the early 1980's. Therefore one cannot assume that national output consists essentially of incomes of individual citizens. Spendable income of the citizens is derived from wages and salaries in the case of workers and staff, distributed income from the communes and income from the farmland separately allotted in the case of farmers (the latter income is increasingly important in the early 1980's), and interest from savings deposits. Before the economic reforms initiated in the late 1970's, one can think of Chinese national income as essentially belonging to the government, except for the wages and distributed farm incomes which the government decided to distribute to the people. To the extent that farmers and operators of small enterprises can earn their own incomes after the economic reforms, the above description has to be modified. Whether one views national income as essentially belonging to the citizens individually except for the tax by the government, or as essentially belonging to the state except for the wage and farm incomes which it decides to distribute, equation 2 can be valid if the net tax variable x_t is interpreted to mean net receipts of the government generated by the economic process producing a national income y_t. For example, if many industrial enterprises are government enterprises, as in the case of China, income from these enterprises

should be a part of x_t. The coefficient τ in equation 2 is no longer a purely tax rate, but an average of tax rates and the ratio of government revenue to national income generated by government enterprises. The last ratio was reduced by the recent decision to allow certain government enterprises to retain a larger fraction of their incomes for their own use and submit a smaller fraction to the government. If one wishes to have more details, several equations can be formulated to replace equation 2, each equation explaining one component of government revenue. The total of these revenues minus government transfer payments and subsidies will be x_t.

Major components of the revenues and expenditures of the Chinese government in 1980 and 1981 are given in Table 6.2. The variable x_t in equation 2 should include revenues of government enterprises, taxes, and other revenues minus farm subsidies, government administration expenditures, and interest expenses; these are resources generated by national production which are taken by the government from private consumption and nongovernment investment. The model (6.75) does not include other government expenditures than investment expenditures which are the first three items of expenditures listed in Table 6.2 plus development expenditures for backward areas. Denote government expenditures (in constant prices) on education, health, science, and defense by g_t. Two equations of model (6.75) are affected by the introduction of g_t. First, equation 1 should include g_t on its right-hand side. Second, equation 6 should include g_t on its left-hand side. For equation 2 we assume that the taxes and other revenues minus farm subsidies and government administration expenses are a linear function

$$\tau_0/P_t + \tau y_t$$

of national income y_t, which accounts for the first two terms on the right-hand side of equation 2. The third term on the right-hand side B_t/P_t represents

Table 6.2 APPROVED CHINESE GOVERNMENT REVENUES AND EXPENDITURES, 1981 AND 1982
(billion yuan)

Revenues	1980	1981
Revenues of enterprises	46.06	34.72
Taxes	54.40	60.90
Loans	3.39	8.00
Other revenues	2.44	2.24
Total	106.29	105.86
Expenditures		
Construction	37.35	33.06
Enterprise renovations and innovations	6.98	5.83
Enterprise working capital	3.72	2.20
Farm subsidies and other expenditures	7.74	7.30
Education, Health and Science	14.83	17.00
Defense	19.33	16.87
Administration	5.78	7.24
Development of backward areas, geological explorations	.50	2.18
Other expenses -- including interest and repayment of foreign loans	4.05	16.90
Total	114.29	108.58

Sources: Figures for 1980 are from People's Daily, Sept. 13, 1980. Figures for 1981 are from Almanac of China's Economy, 1982, Chinese edition, (pp. V-319-320). For the distinction between the final state account, the draft state budget, and the projected state budget, see Almanac of China's Economy, 1981, (pp. 128-138). This table provides the draft state budget, which is the budget approved by the People's Congress. The final account is an after-the-fact statement of results, while the projected state budget is an estimate for the following year.

interest paid by the government on its debt, which should be subtracted from the above figure to form x_t. The last term of equation 2, $\tau B_t/P_t$ represents tax on the interest income from government bonds. It exists for the United States but should be omitted for China where no income tax is levied on such interest income received by Chinese citizens. Again, it is possible to decompose x_t into two components, one representing taxes and the other representing revenues of government enterprises. The latter variable would require another equation to explain.

Equation 3 is a hypothesis about aggregate consumption, explaining it by after-tax income (or in the Chinese context income available to the private sector), money, and bonds held by the public, with a distributed lag relationship captured by the lagged variable c_{t-1}. Such a hypothesis is an assumption about the aggregate <u>demand</u> for consumption goods by the people, given their income and monetary assets. It is possible that in a centrally-planned economy the total quantity of consumer goods made available is determined mainly by government policy which is independent of consumer demand. In such a situation the demand equation 3 cannot explain the total quantity of consumer goods produced which is determined by the supply controlled by the government. However, even in such situation, a consumption function such as equation 3, if expressed in money terms, can explain consumption expenditures in current prices. Given the level of money income, if the consumers decide to spend so many dollars to buy consumer goods and if the government only allows c_t units of consumer goods to be produced, the net effect is for the consumption function to determine the price level P_t because it determines total consumption expenditure $P_t c_t$ and c_t is fixed by the government. For the Chinese economy in the 1980's I believe that the consumption function represented by equation 3 is essentially valid for two reasons. First, the Chinese government considers the demand of the consumers in determining the production of consumer goods which it supplies. Second, a sizable fraction of consumer goods,

including many agricultural products and products of light industries, are produced at the discretion of the individual farmers and individually- or collectively-operated enterprises which will produce to satisfy the demand of the Chinese consumers. At least equation 3 is a promising hypothesis to be tested statistically when more data become available.

Equation 4 is an equation explaining the investment j_{1t} by enterprises which have the discretion to expand productive capacity to satisfy demand for profit. Such an equation works well for the American economy (see Chow, 1967 and 1968). If the managers of certain Chinese enterprises are allowed to retain a substantial portion of the profits and are given sufficient discretion to invest, they will behave in the same way as managers of enterprises in the United States and other western countries. In China, during a period of rapid economic reform in the early 1980's, the price system and the tax system were not working properly in many areas, leading to investment by enterprise managers which might have been socially undesirable. For example, if an enterprise pays a lower-than-market price for an important material used in production, pays a lower-than-market rent for the use of its capital equipment (possibly in the form of a levy by the government), or receives a higher-than-market price for its product because of government protection or price regulation, it may earn a high profit and decide to invest a large fraction of the retained profit. The expansion of such an enterprise may be socially undesirable because its profitability is not the result of its economic efficiency but of the distortion of the price system. In 1983 articles appeared in Chinese newspapers and journals criticizing the large capital investments undertaken by enterprises at their own discretion. The problem of socially undesirable investments deserves a careful investigation. If socially undesirable investments occur because prices do not reflect social cost, the solution to this problem is to improve the price system. If the price system functions propertly, it is dif-

ficult to argue against letting the profitable enterprises expand their productive capacity. A main objective of the economic reform of 1980-1981 to allow the enterprises more autonomy in their decisions is to promote economic efficiency in production and investment. Economic efficiency would not result without letting prices be determined by the forces of demand and supply. If prices are so determined, profitable firms are by and large efficient firms producing to satisfy market demand and should be allowed to expand. In the meantime investment j_{2t} undertaken by the government will take care of the capital accumulation required by the economy but neglected by the individual enterprises. More on this topic in the next section.

Concerning equation 4, the interest rate variable r is intended to reflect the cost and availability of credit which affects investment according to the theory presented in section 1.9. When the rate of interest is lowered, the same stream of future earnings will have a higher present value according to equation (1.50). Therefore, an investment project costing an amount larger than the previously calculated present value of its future net earnings may now be undertaken because of the larger present value calculated by a lower interest rate. To put this in another way, if the enterprise can borrow the money from a bank to pay for the cost of this investment project, a lower interest rate may make the same future net earnings from the project more than cover the future payments to the bank and thus make the project profitable. As we have pointed out in section 1.9, a main function of banks is to obtain funds from the savings of individual citizens and to lend them to enterprises for investment purposes. In a market economy the rate of interest is determined partly by the demand for and the supply of loanable funds. The demand for loanable funds comes mainly from business investment as explained by equation 4. The supply of loanable funds comes mainly from the savings of consumers, which is the difference between their after-tax income and their consumption, with consumption explained by equation 1. Both demand and

supply are functions of the rate of interest. One might therefore choose to modify our model by introducing the rate of interest as an additional variable in equation 3 and introducing private savings $(y-x_t-c_t)$ as an additional variable to reflect the availability of credits in equation 4.

In 1980, as a part of the economic reform to allow enterprises more autonomy, the Chinese banking system began to play a more active role in obtaining savings deposits from the public and extending loans to enterprises for working capital and for investment purpose. Table 6.3 presents the balance sheet of the Chinese banking system at the end of 1979, 1980, and 1981. Note that savings deposits in cities and towns increased from 20.256 billion yuan at the end of 1979 to 35.414 billion at the end of 1981, while deposits in rural areas increased from 20.371 to 27.840 billion. Furthermore, outside of the banking system deposits in rural credit cooperatives increased from 21.588 billion at the end of 1979 to 31.961 billion at the end of 1981 (see Almanac of China's Economy, 1982, Chinese edition, pp. V-330, V-331). Savings deposits by the nongovernment sector were gaining importance in the early 1980's in providing funds for investment purposes. Observe also that loans to urban collective and individual enterprises increased from 5.751 billion at the end of 1979 to 9.915 billion at the end of 1981. These enterprises are only a small part of all enterprises which can use their own discretion to expand their productive capacity.

In 1980 interest rates paid to personal savings deposits of urban and rural residents were 2.88 (percent per annum) on demand deposits, 4.32 on deposits for six months, 5.40 on deposits for five years. The interest rate on loans to state-owned industrial and commercial enterprises and to urban collective enterprises was 5.04 percent per year. It was 4.32 percent on loans to make downpayments on the purchases of farm and sideline products, and to state farms and agricultural communes and brigades to meet production costs and to provide working capital.

Table 6.3 BALANCE SHEET OF CHINA'S BANKING SYSTEM

(100 million yuan)

Credit Funds	End of 1979	End of 1980	End of 1981
Deposits	1,340.04	1,658.64	2,032.97
Deposits by enterprises	468.91	573.09	701.46
Deposits by the treasury	148.68	162.02	194.94
Capital construction funds	131.30	171.75	229.15
Deposits by government departments	184.88	229.45	274.88
Savings deposits in cities and towns	202.56	282.49	354.14
Deposits in rural areas	203.71	239.84	278.40
Deposits by international monetary institutions	---	---	54.05
Currency in circulation	267.71	346.20	396.34
Bank working funds	427.88	477.33	497.05
Bank surplus	49.45	27.19	17.22
Others	77.52	80.63	50.23
Total	2,162.60	2,624.26	3,047.86
Credit Funds Used			
Loans	2,039.63	2,414.30	2,764.67
To industrial production enterprises	363.09	431.58	508.85
To supply and marketing enterprises	242.12	236.03	241.24
Commercial loans	1,232.25	1,437.02	1,639.13
Short, medium term loans for buying equipment	7.92	55.50	83.73
To urban collective and individual enterprises	57.51	78.29	99.15
To finance downpayments on purchases	6.98	7.88	7.39
To state farms	6.86	9.40	16.75
To rural communes and brigades	122.90	158.60	168.41
Gold purchases	12.16	12.16	12.04
Foreign exchange purchases	20.58	-8.47	62.18
Balances with International Monetary Fund	---	36.04	38.74
Money advanced to the Ministry of Finance	90.23	170.23	170.23
Total	2,162.60	2,624.26	3,047.86

Sources: 1979 and 1980 figures are from Almanac of China's Economy, 1981 (p. 997). 1981 figures are from Almanac of China's Economy, 1982, Chinese edition (p. V-331).

It was 2.16 percent on loans to communes and brigades for buying production equipment or for constructing hydroelectric power stations, and on loans to credit cooperatives. (See Almanac of China's Economy, 1981, pp. 662-663, for the above interest rates.) Besides using the rates of interest to regulate deposits and loans, the Chinese banking system has discretion to select the kinds of enterprises to which loans will be extended. For a description of China's banking system see the 1982 article by the Research Institute of Finance and Banking of the People's Bank of China. The availability of credits supplied by the banking system could be an additional variable affecting investment in equation 4.

Equation 5 of the model (6.75) is a demand-for-money equation. The demand for money is a subject which has been extensively studied in the United States and other western countries. One may introduce some distributed lag mechanism to equation 5, or change the functional form to linear in the logarithms (see Chow, 1966), but the basic hypothesis is valid that the demand for real money balances depends positively on real income and negatively on the rate of interest. The same should be true for China. The hypothesis that the demand for real money balances M/P is proportional to real income y constitutes the quantity theory of money. This theory implies that when y changes slowly, an increase in M will essentially lead to an increase in the price level P or to inflation. Many economics officials of the Chinese government appear to believe in this theory because after signs of inflation in 1980 the State Council issued in early 1981 a directive ordering the strict control of the supply of money (see Almanac of China's Economy, 1982, Chinese edition, p. V-326). This directive was followed seriously. Chinese officials probably remembered the inflation in China in 1947-1949 which was caused by the creation of money.

Observe from Table 6.3 that currency in circulation increased from 26.771 billion yuan at the end of 1979 to 34.620 billion at the end of 1980, or by 29.3

percent; it increased to 278.40 billion at the end of 1981, or by a much slower rate of 16.1 percent. The general retail price index increased from 138.6 in 1979 to 146.9 in 1980, or by 6.0 percent; it increased to 150.4 in 1981, or by a much slower rate of 2.4 percent (see Statistical Yearbook of China, 1981, p. 411, for the price data). The general price index of living costs of staff and workers increased from 147.4 in 1979 to 158.5 in 1980, or by 7.5 percent; it increased to 162.5 in 1981, or by only 2.5 percent. Both price indices are less comprehensive than an index of the general price level, and currency in circulation is only a part of the supply of money, though a large part in China, but there is no question that the above data support the quantity theory of money. The price level increased at a faster rate in 1980 when the stock of money increased faster; it increased at a slower rate in 1981 when the stock of money increased more slowly.

Equation 6 is a form of the government budget constraint. When government expenditure g_t other than investment expenditures j_{2t} is added to its left-hand side, equation 6 states that government expenditures have to be financed by taxes and other revenues x_t, the increase in money supply or the increase in government bonds. The Chinese government understood such a relationship well in 1981 when it tried to slow down the increase in the stock of money. It announced that the expenditures on capital construction j_{2t} should be reduced in 1981 and succeeded in doing so. Note in Table 6.2 that approved construction expenditures were reduced from 37.35 billion in 1980 to 33.06 billion in 1981 while expenditures for enterprise renovations and innovations were reduced from 6.98 to 5.83 billion. By the way, approved defense expenditures went down from 19.32 to 16.87 billion while expenditures on education, health, and science went up from 14.83 to 17.00 billion. Table 6.2 shows that government deficit as approved by the People's Congress was 114.29 minus 106.29 or 8 billion in 1980, and it was only 108.58 minus 105.86 or 2.72 billion in 1981, with total approved government expenditure reduced from

114.29 to 108.58 billion. The reduction in government deficit $j_{2t}+g_t-x_t$ in 1981 enabled the stock of money to increase by a smaller amount. Government bonds were also used to finance deficits. In 1980 and 1981, while the approved budget deficits were respectively 8 and 2.72 billion, the actual deficits were respectively 12.75 and 2.544 billion (see Statistical Yearbook of China, 1981, p. 405). The Chinese government was more successful in reducing its deficits than the American government during the same period.

Shen and Chen (1982, pp. 644-645) write:

> "The large deficits in 1979 and 1980 and the consequent growth of the money supply played a large part in pushing up prices of various commodities, with detrimental effects for the national economy and political stability.
>
> "Late in 1980 the State Council studied the financial and economic situation and decided to take measures to achieve a rough budget balance and a credit balance. ...
>
> "China's basic budget policy is to maintain an annual balance between revenues and expenditures with a little surplus. ...
>
> "Deficits have occurred several times. There have been two kinds of budget deficits. One kind was the objective result of wars and natural disaster; the 1950 deficit was of this kind. The other kind was due to subjective errors--in particular, rashness; the deficits that occurred after 1956 were of the second kind.
>
> "In 1956, carried away with the tremendous successes we had achieved in socialist transformation and construction, we quickened the speed of construction. That year our investments in capital construction increased by more than 50 percent and our expenditures and agricultural loans exceeded their planned levels. As a result we incurred a budget deficit of 1,800 million yuan and a deficit in bank credit. ..."

Equation 7 and equation 5 both contribute to the explanation of the price level. When the stock of money increases, money income tends to increase according to the quantity theory of money and equation 5. For a given increase in money income price increases more if real income y increases less. Real income cannot

increase substantially if it is already close to capacity output. In such a situation price will increase more according to equation 7. Equation 7 can be improved by using a better index for capacity output than θk_{t-1}. For example, a production function can be used so that both the quantity of capital and the quantity of labor (at least skilled labor) available would jointly determine capacity output. One might question the explanation of the price level implicit in model (6.75) on the ground that the Chinese government still controls the prices of many commodities in China in the early 1980's. To the extent that many prices are not controlled and that government officials would be under pressure to raise the prices they control when demand exceeds supply, the explanation of the price level by means of an economic model built upon a set of tested economic behavioral relations is a valid procedure.

Equation 8 is an identity or a definition. It should be applicable to any country. However, when all capital goods are aggregated into one variable k_t and when all investments are grouped in either j_{1t} or j_{2t}, the conceptual problems in the statistical measurement of these variables may be serious. Especially in an economy where many prices are administratively determined, it is difficult to measure the quantities of different capital investments. An expensive investment project may produce a small amount of capital if measured by its productivity. One solution to the problem of too much aggregation is to disaggregate. In China investment and capital stock in agriculture may be separately treated. Much of the investment in agriculture is government directed and belongs to j_{2t}, but in the future one may find the separation of a component of j_{1t} for agriculture desirable. The statistical measurement of different components of capital stock in China deserves our serious attention.

In the above I have proposed a system of eight equations to describe the working of the Chinese macroeconomy. These equations are useful definitions or hypotheses about economic behavior which have been tested empirically in other

parts of the world and which seem to be valid for China as well from the crude examination of the Chinese institutions and data in this section. Therefore they are submitted here as a set of working hypotheses on the Chinese macroeconomy in the 1980's. It is hoped that they will be refined, modified, and improved in the future, and an improved version of these equations will serve as the basis of a macroeconometric model of the Chinese economy.

Just to whet the reader's appetite, I present below a consumption function of the form (6.18) and an investment function of the form (6.24) which comprise the simple multiplier-accelerator model of section 6.3. These functions are estimated by the method of least squares using the annual data from 1953 to 1981 given in Table 6.1, the data for 1952 serving as the initial values of the lagged endogenous variables. Consumption is defined as national income minus investment (or capital accumulation). In the econometric literature other methods than least squares have been suggested when a right-hand side variable (national income in our case) is endogenous, but we cannot deal with this technical problem here. Furthermore, note that all data are in current prices whereas data in constant prices might be considered more appropriate. We use capital letters to denote variables in current prices.

The consumption function so estimated is

$$\begin{aligned} C_t &= -.7323 + .2294\, Y_t + .7261\, C_{t-1} \qquad R^2 = .9910 \\ &\quad (2.8817)\ (.0724)\quad (.1219) \qquad\qquad s^2 = 35.299 \end{aligned} \tag{6.76}$$

where standard errors of the estimated coefficients are in parentheses and s^2 denotes the variance of regression residuals. Note that the intercept is very small as compared with its standard error. The two coefficients are very large as compared with their standard errors. The R^2 is also very high but this is to be expected when an endogenous variable is explained by its own lagged value.

The investment function is

$$I_t = \underset{(2.0870)}{2.1744} + \underset{(.0845)}{.7549}(Y_t - Y_{t-1}) + \underset{(.0376)}{.8496}\, I_{t-1} \qquad R^2 = .9697, \quad s^2 = 35.170 . \tag{6.77}$$

If we replace the variable ΔY_t by two separate variables Y_t and Y_{t-1}, the resulting investment function is

$$I_t = \underset{(2.9789)}{1.0922} + \underset{(.0933)}{.7359}\, Y_t - \underset{(.1279)}{.7059}\, Y_{t-1} + \underset{(.1484)}{.7755}\, I_{t-1} \qquad R^2 = .9700, \quad s^2 = 36.190 . \tag{6.78}$$

The freely estimated coefficient of Y_{t-1} is approximately the negative of the coefficient of Y_t, as implied by the acceleration principle.

One might be amazed to find how well the consumption function (6.18) and the investment function (6.24) of the multiplier-accelerator model of section 6.3 fit the Chinese data from 1953 to 1981. These functions have been justified by rational economic behavior on the part of individual consumers and enterprise managers who are in a position to make their consumption and investment decisions. One might point out that consumption and investment in China from 1953 to 1981 were largely determined by the Chinese government which was sometimes driven by political forces. The consumption function may still work because the Chinese consumers were able to determine partially their consumption expenditures out of their incomes and because the Chinese economic planners were planning total consumption based on the national income available. The investment function may still work because the Chinese enterprise managers submitted their investment plans to accumulate capital to meet the need for producing certain output and because the Chinese economic planners were influenced by the plans so submitted or made their own investment plans in a similar fashion. These behavioral justifications aside, one may simply point out that there are basic empirical relations between consump-

tion and income and between capital stock and income as postulated by the Harrod-Domar model. The consumption function is based on the first relation with a distributed lag. The investment function is the first difference of the second relation with a lag. Therefore they work for China. Macroeconomic relations are aggregates which hide a lot of things. To study the behavior of individual economic units more thoroughly one has to resort to microeconometrics.

6.8 COMPOSITION OF CAPITAL INVESTMENT

A chapter on national income and capital accumulation in China would not be complete without describing briefly the composition of investment that has been undertaken by the Chinese government. Partial information is contained in Table 6.4 on the composition of investment by state-owned units, which excludes investment by collective units in towns and in rural communes. Note first that the official data in Table 6.4 show a distinction between the value of newly increased fixed assets and the value of total investment. The latter is usually smaller than the former. The difference is explained on p. 518 of Statistical Yearbook of China, 1981. "The purchases of equipment, tools and instruments which do not accord with the standard for fixed assets, training expenses, ..., investment on abandoned projects and some other expenses ... are not counted in newly added fixed assets." This seems to imply that some investment activities do not lead to economically useful assets. Concerning the financing of investment, note the substantial financing from the national budget (compare the 39.5 billion figure for 1979 with the government expenditures on construction for 1980 and 1981 in Table 6.2), but the increasing portion financed by self-raised funds of local authorities and enterprises. The data on investment by sectors of the economy are interesting and self-explanatory.