U.S.-CHINA BILATERAL TRADE
1972 - 1992

THESIS

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Jianxin Zhang, B.A., M.A.
Denton, Texas
August, 1994
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The main task of this thesis is to investigate economic implications of U.S.-China trade. The study period covers from 1972 to 1992. Data are available from International Financial Statistics, Survey of Current Business, Statistical Yearbook of P.R.China. Various hypotheses are employed to explain the basis and gain of trade, the impact of trade on both economies, and the major determinants of bilateral trade flows.

This thesis contains five parts: I. Introduction; II. Outlook; III. Theoretical Analysis; IV. Empirical Study; and V. Conclusion.

The major findings of this thesis are that both countries have gained advantages from trade and have also faced some unpleasant problems; several widely recognized theories serve as good approaches to understand these issues; the time series distributed lag models are helpful in explaining the determinants of trade flows.
I wish to thank the members of my thesis committee Professors Steven Lee Cobb, Michael A. McPherson, Michael Redfearn and Margie A. Tieslau in the Department of Economics at University of North Texas (UNT). They gave me many detailed comments, suggestions and corrections for different aspects of this thesis. Without their assistance, it would have been truly impossible for me to complete this thesis.

I wish to thank Dr. Lee W. Miller, who was a professor of the Department of English at UNT, for checking the grammar for the first draft of this thesis in the summer 1993. His cheerful promise gave me the confidence necessary to write my first paper of this length in English.

I wish to thank Professor Fang Chonggui in the Department of Economics at Fudan University. The Chinese materials he carefully gathered and sent to me made the preparation for this thesis progress more smoothly.

I also wish to thank the Department of Economics at UNT for granting me a teaching assistantship.

Finally, I will thank my wife Shuzhen for her help in my daily life; I will not forget that my son Haochi (Joseph) received the honor of special student in his school though I had little time to take care of his first grade study.
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CHAPTER I

INTRODUCTION

Chapter Overview
This chapter introduces the reader to the study undertaken. This chapter includes: the importance of the problem, objectives and methodology; and the structure.

Importance of the Problem
As early as 1774, Adam Smith, the father of political economy, in his The Wealth of Nations, pointed out that although China had been one of the richest countries in the world, it had long seemed to be stationary (Smith 1774, 89). One of the major reasons was that "the Chinese have little respect for foreign trade" (Smith 1774, 680). Adam Smith went on to say that if China were to trade with other countries, it could expand its market, increase greatly its manufactures, improve greatly the productivity of its manufacturing industry, learn the art of using and constructing all machines which are now used in other countries, as well as gaining the other improvements of art and industry which are practiced in other parts of the world (Smith 1774, 679-81). So, Adam Smith implied that foreign trade could be the major driving force in China's economic development.
Chinese people, especially intellectuals, recognized Adam Smith's analyses as soon as *The Wealth of Nations* was introduced into China in the last decade of the nineteenth century. But, trade between China and the developed countries always failed to occur for numerous reasons. A new open-door policy and practice since 1978 seems to be the most successful one in China's modern history, and U.S.-China trade is one of the most prominent parts of it. Thus, it is very important to investigate the economic implication of U.S.-China trade in order to answer the question: to what extent does the practice of China's trade with developed countries, especially with the U.S., conform with the modern economic theory and Adam Smith's supposition on China?

President Nixon's historic visit to Shanghai, China, in 1972 ended the twenty-one-year confrontation between the U.S. and China. Since then, U.S.-China two-way trade has emerged. Since the Carter administration first established formal diplomatic and economic relations in 1979 and granted China Most-Favored-Nation (MFN) status in 1980, U.S.-China trade has accelerated. China has become a new market for U.S. products, capital, modern managements, and advanced technologies. The U.S. has been a valuable marketplace for China's raw materials and products, especially China's traditional labor-intensive products. Since 1979, the U.S. has been ranked China's third trade partner behind Japan and
the European Community. In 1992, the share of U.S.- China trade has accounted for about 4 percent of U.S. world trade (see table 3 in chapter 2). At the same time, the trading structure between the two countries has been transformed from raw materials to manufactured goods and from labor intensive products to capital intensive products, which is one of the signs of a more mature trade pattern.

Since the U.S. and China have different political settings and they are at very different stages of economic development, many issues related to trade are confusing. Although the volume of U.S.- China trade represents a relatively small percentage (about 4 percent) of U.S. world trade, the trade issue has been one of the most heated topics in the political arena of the U.S. Every June, the U.S. president has to make the serious decision whether or not Most-Favored-Nation status (MFN) should be extended to China. Then many businessmen, politicians and governmental officials gather in Washington to debate about the President’s decision. The heavily debated topics include the balance, nature, policy, and future of U.S.- China trade. This debate has become more and more intense in recent years.

Therefore, it is necessary for us to comprehend economic implications and foundation of U.S.- China trade, and it is important to provide a reliable base to understand the emotional debate surrounding trade practices.
Objectives and Methodology

In recent years, several books have concentrated on discussing practices, policies and negotiations in U.S.-China trade relations. Three books have been published in the area of U.S.-China trade. They are U.S.-China Trade - Problems and Prospects (1988), edited by Eugene K. Lawson; The China Venture - America’s Corporate Encounter with the People’s Republic of China (1989) written by Journalist and businessman Christopher Engholm; U.S.-China Trade (1982) written by Rosalie L. Tung. In addition, some books have discussed China’s foreign trade policy and practice. The most recent published book is Foreign Trade and Economic Reform in China (1991) written by economist Nicholas R. Lardy; Another book is The Political Economy of China’s Special Economic Zones (1990) written by George T. Crane. These articles and books provide first-hand information and materials related to U.S.-China trade and economic relations. Every year, especially since 1989, U.S. Congress has recorded many documents about U.S.-China trade from U.S. government officials and interested participants. In contrast with these published books, articles and U.S. government documents, this thesis will employ the theory of economics to explain the basis, the impact, and implication of U.S.-China trade, and to identify theoretically and econometrically major determinants of trade flows between the U.S. and China.
First, U.S.-China trade has existed for more than twenty years, and some special characteristics of U.S.-China trade in this period should be exhibited. So, the primary contribution of this thesis is to explore such characteristics as the trend of the trade volume and trade patterns. Also, since normal diplomatic and economic relations between the two countries are the direct prerequisite of U.S.-China bilateral trade, and it is still under uncertainty, this thesis will show the evolution of these relations and its nature.

Second, U.S.-China two-way trade is typical of trade between a developed country and a developing country, between a capital-abundant country and a labor-abundant country. One of the purposes of this thesis is to distinguish advantages and negative impacts of trade on both economies; and it analyzes this case as a special application of some basic theorems of international economics.

Third, from two extreme opposites: an individual market system and a central planning system, the U.S. and China have both stepped into mixed-economic systems, although with different forms and different political settings. As Sino-American relations have become normal since 1980, China has introduced more and more elements of market system and has gradually become a new member of the global market. The availability of statistical data from various sources,
although incomplete, allows this author to perform econometric estimations and to help understand determinants, the trend, and the nature of U.S.-China trade. This thesis will classify major determinants of trade flows, such as the growth of national income in the U.S. and in China, fluctuations of the exchange rate, changes in the price levels of the U.S. and China, and the situation of bilateral economic and diplomatic relations between the two countries. Through various model specifications, econometric estimations, and test techniques, effects of these determinants on China's exports to the U.S. and China's imports from the U.S. will be assessed.

Alternatively, this thesis combines different approaches in economics, that are "political arithmetick" (words from a book title of William Petty 1655) of political economy (chapter 2), theoretical method (chapter 3) and econometric method (chapter 4), to investigate different aspects of U.S.-China trade and to provide the whole image of U.S.-China trade.

Structure

Accordingly, this thesis is divided into five chapters. The first chapter is an introduction and the last chapter is a conclusion. The second chapter shows the volume of U.S.-China trade, discusses phases of trade; and also reveals the trade structure. In other words, the second chapter shows the history, evolutions, and the present
situation of U.S.- China trade and hence provides a background for the further analysis.

The third chapter gives the theoretical analysis for some issues related to U.S.- China trade. These issues include the basis of and the gain from U.S.- China trade, general determinants of bilateral trade flows, and effects of U.S.- China trade on the income distribution.

One of the major hypotheses in chapter 3 is about China's export function and China's import function. The fourth chapter employs econometrics to test this hypothesis and empirically examines the impact of some factors on trade flows. Model specifications will be built, and finally estimation will be interpreted.
CHAPTER II

OUTLOOK: VOLUME, PHASE AND STRUCTURE OF U.S.- CHINA TRADE

Chapter Overview

This chapter introduces the general background of U.S.- China trade. This chapter includes: the volume of U.S.- China Trade; three phases of Sino-American Trade 1950-93; Commodity Structures of U.S.- China Trade.

The Volume of U.S.- China Trade

Since the normalization of diplomatic and economic relations between the United States and China in 1979, U.S.- China bilateral trade has made a tremendous progress. As table 1 indicates, according to statistics of the U.S. Department of Commerce and the World Bank (see table 1), in 1979 the total real value (1987 U.S. dollars) of merchandise trade between the two nations was about $3,420 million, while in 1992 the total real value of trade reached $28,805 million, which is more than eight-fold increase. In 1992, the total real value of U.S. direct exports to China, including wheat, cotton yarn, chemical fertilizers, industrial machinery, aircraft, computers and other scientific instruments, and autos, reached $6,475 million, and the total real value of U.S. imports from China (and
trans-imports from Hong Kong and other trading partners),
including crude oil, gasoline, silk apparel and other

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Sources: Serial A come from U.S. statistical sources.  
Serial B come from China's statistical sources.  

Note: The calculation of constant 1987 dollars of data is based on U.S. overall GDP deflator index provided by the World Bank: World Tables, various editions.

textile products, toys, footwear, and electric appliances, were $22,330 million.
The first characteristic of U.S.-China trade in this period is that the growth of the trade volume is much more rapid than the growth of GDP of either country. After its prosperity in the 1950s and 1960s, the U.S. economy has entered a long run low growth period since the late 1970s. From 1979 to 1992, the average annual growth of real GDP (1987 U.S. dollars) in the U.S. is only 2.3 percent, according to statistics from the World Bank (see table 2). By contrast, after a long, painful struggle as well as with a very low level of economic base, China began its economic vitalization only since the end of the Cultural Revolution. In 1978 China announced its aim to launch economic reform, and in 1980 the U.S granted China Most-Favored-Nation (MFN) status. Under favorable domestic and international environments, it is possible for China to achieve the great economic progress. Two major strategies of economic reform in China are introducing elements of market system and opening up to the world.

As table 2 shows, between 1979-92, the average annual growth of real GDP in China reached more than 7.3 percent. The high growth of national income is highly correlated with the high growth of trade flows. The econometric estimation in chapter 4 of this thesis will show that there is very high income elasticity for China's exports with respect to its trading partner (the U.S.). In short, the growth of U.S.-China trade is not only much higher than the growth of
GDP in the U.S. but also higher than the growth of GDP in China.

On the other hand, in the past two decades, U.S.- China bilateral trade grew faster than multilateral trades of either country. The growth of U.S.- China trade has been quicker than both the growth of U.S. world trade and the growth of China’s world trade, though it has a more important place in China than in the U.S. As table 2 implies, according to statistics of the U.S. and the World Bank from 1979 to 1992, the average annual growth of total real value of U.S.- China trade is almost 25 percent; the annual average growth of real value of China’s imports from the U.S. was about 17.8 percent, and the annual average growth of real value of China’s exports to the U.S. was about 32.2 percent. Over the same period the average annual growth of real value of the U.S. world trade in merchandise is about 3.9 percent and the average rate of growth of real value of China world trade in merchandise is about 11.6 percent.

The third characteristic of trade between the two countries is that the trade value of each country has shared an increasing part in its world trade. Before the U.S. traded with China, China gained modern electric products, steel, machinery, transport equipment, chemicals, and advanced technologies mainly from Japan and Western European countries and imported farm products from Canada
and Australia. In 1970, the share of Japan-China trade reached 21 percent of China's world trade and the share of West European-China trade accounted about 26 percent (State

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<td>20.0</td>
<td>1.3</td>
<td>-1.3</td>
<td>16.9</td>
</tr>
<tr>
<td>1992</td>
<td>28.2</td>
<td>20.3</td>
<td>5.1</td>
<td>2.0</td>
<td>19.1</td>
</tr>
</tbody>
</table>

Sources: Same as table 1.
Note: Data of serial A of U.S.-China trade and U.S. world trade are calculated based on statistical sources in the U.S.; data of serial B of U.S.-China trade and China's world trade are calculated based on statistical sources in China. The calculation of growth of real U.S. GDP is based on 1987 U.S. dollars and the calculation of growth of real China's GDP is based on 1987 Chinese yuan.

Statistical Bureau of P.R. China 1989 and 1990). Since 1971, the U.S. has gradually captured more and more of China's global trade. According to statistical data from China, the share of U.S.-China trade in China's world trade
has risen from 3.13 percent in 1975 to 10.47 percent in 1991 shown in table 3. Since 1979 the U.S. has jumped to the position of China's third largest trading partner, just behind Japan and Hong Kong.

From the view of the U.S., during the past five years, the importance of U.S.-China trade in U.S. global trade is also increasing. In 1992, the real value of U.S.-China trade shared about 3.4 percent of real value of U.S. world trade whereas in 1979 it only shared 1 percent of U.S. world trade (see table 3). According to U.S. statistical sources, among U.S. major trading partners, in 1979 the total real value of U.S.-China trade ranked last while by 1992 China had risen to fifth place behind Germany, Canada, Japan and Mexico (Survey of Current Business June, 1993, 76-78).

China's exports have more importance in U.S. market because Hong Kong and other countries or areas have transported a large amount of China's products to the U.S. in recent years. According to China's statistics, in 1992 the U.S. was China's largest exports market, with at least 8.8 percent of China's global exports going to U.S. market (see table 3). In 1992, about five percent of U.S. world imports came from China, which ranked fifth in that category, behind Canada, Japan, Mexico, and Germany (Survey of Current Business June, 1993, 78).

Although the volume of U.S.-China trade has become a significant part of China's world trade, as well as an
increasing part of U.S. world trade in recent years, the volume of U.S.-China trade still is a very small part of U.S. world trade. This fact simply implies that U.S.-China trade has had a more important place in China than in the U.S., or it has exerted much more influence on China’s economy than on U.S. economy.

Table 3. Share of U.S.-China Trade 1972 -- 1992 (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Share in US World Trade</th>
<th>Share in China World Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Exports</td>
</tr>
<tr>
<td>1972</td>
<td>0.09</td>
<td>0.13</td>
</tr>
<tr>
<td>1973</td>
<td>0.57</td>
<td>1.02</td>
</tr>
<tr>
<td>1974</td>
<td>0.46</td>
<td>0.81</td>
</tr>
<tr>
<td>1975</td>
<td>0.22</td>
<td>0.28</td>
</tr>
<tr>
<td>1976</td>
<td>0.14</td>
<td>0.12</td>
</tr>
<tr>
<td>1977</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>1978</td>
<td>0.36</td>
<td>0.56</td>
</tr>
<tr>
<td>1979</td>
<td>0.59</td>
<td>0.92</td>
</tr>
<tr>
<td>1980</td>
<td>1.03</td>
<td>1.66</td>
</tr>
<tr>
<td>1981</td>
<td>1.10</td>
<td>1.51</td>
</tr>
<tr>
<td>1982</td>
<td>1.13</td>
<td>1.35</td>
</tr>
<tr>
<td>1983</td>
<td>0.95</td>
<td>1.06</td>
</tr>
<tr>
<td>1984</td>
<td>1.10</td>
<td>1.34</td>
</tr>
<tr>
<td>1985</td>
<td>1.37</td>
<td>1.76</td>
</tr>
<tr>
<td>1986</td>
<td>1.33</td>
<td>1.37</td>
</tr>
<tr>
<td>1987</td>
<td>1.48</td>
<td>1.38</td>
</tr>
<tr>
<td>1988</td>
<td>1.77</td>
<td>1.56</td>
</tr>
<tr>
<td>1989</td>
<td>2.12</td>
<td>1.58</td>
</tr>
<tr>
<td>1990</td>
<td>2.25</td>
<td>1.22</td>
</tr>
<tr>
<td>1991</td>
<td>2.78</td>
<td>1.49</td>
</tr>
<tr>
<td>1992</td>
<td>3.40</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Sources: Same as table 1.
Note: Data for calculation of U.S.-China trade in U.S. world trade come from statistical sources in the U.S.; data for calculation of U.S.-China trade in China world trade come from statistical sources in China. Calculation is based on U.S. overall GDP deflator index (constant 1987 dollar) provided by the World Bank.
Besides the merchandise trade, the capital flow from the U.S. to China has been one of importance in U.S.-China trade relations. Since 1978, China has opened many areas as special zones to attract direct foreign investment for joint-ventures and to process export-oriented enterprises. Over the same period, China has borrowed a large amount of money from international monetary organizations, such as the World Bank, the International Monetary Fund, the Asia Development Bank and other banks in foreign nations to finance its imports of foreign capital, advanced technologies and basic economic projects such as the railroad, power plant. Now, the U.S. has become one of China’s largest foreign investors, along with Germany and Japan. According to China’s statistics, by the end of 1991, U.S. companies have committed investment of $5300 million for more than 2000 projects with China (U.S.-China joint venture) (Zhen-yu 1992, 15). According to U.S. statistics, in 1992 the current value of American direct investment in China is $469 million (Survey of Current Business July, 1993, 121).

Phases of Sino-American Trade

The development of U.S.-China trade relations from 1950 to the present can be described as occurring in three phases: the 1950-71 embargo period; the 1972-79 informal trade relations period; the 1980-94 normal trade relations period (with the unconditional MFN status). Since Clinton’s
new administration announced in June 1993 that it will attach additional political or human right conditions on China's MFN status for the coming term 1995-96, U.S.-China trade is expected to step into a new and more complicated period.

1950-71 China's internal closed-door and external embargo period

Prior to the outbreak of the Korean War on June 25, 1950, China was subject to controls equivalent to those imposed on the Soviet Union and Eastern Europe. Although the U.S. government did not recognize the Chinese new regime, there was a small volume of trade between the two countries. According to statistics from Hong Kong, in 1950, in nominal terms, the total value of U.S.-China trade was $238.12 million which is higher than the trade level of 1972 (Editorial Board of the Almanac of China's Foreign Economic Relations and Trade 1984, 903). And in the following three years there still was a small volume of bilateral trade.

By July 1, 1950 the U.S. Commerce Department stopped issuing validated licenses for exports to China. In November, 1950, when China sent its troops to North Korea, the U.S. Commerce Department imposed transport restrictions against China and required validated licenses for all exports to China under the authority of The Export Control Act of 1949. At the same time, China become subject to foreign assets control regulations issued by the U.S.
Treasury Department under the authority of The Trading with The Enemy Act of 1917 (U.S. Congress 1979, Serial 96-63, 3). This marked the beginning of the total embargo period. Pursuant to section 5 of The Trade Agreement Extension Act of 1951 in the U.S., U.S. president withdrew MFN treatment from China and other countries controlled by the world communist movement. During this period there was no direct trade relation between the two nations besides 1950-53 mentioned above.

Thus, during this period, the U.S and China remained in a state of hostility. China had to adopt the self-reliance policy (or so-called closed-door policy) especially after China - the Soviet Union relations were broken in the late 1950s.

1972-79 trade period without formal economic and diplomatic relations  It must be admitted that during the U.S. embargo or China’s close-door period, although Chinese people suffered from a lot of economic and political troubles, China’s economy still made an incredible achievement. The living condition of the majority of Chinese peasants and workers, especially of these citizens who lived in the large cities, were improved and the economic power of the nation was enhanced compared with the level before 1949. However, contrasted with the outside world, the gap between China and the developed countries in areas of science, technologies and production seemed to be enlarged.
In April, 1971 President Nixon announced his intention to relax the U.S. embargo on China. In the following month, the U.S. Treasury Department removed the control on the use of dollars in transactions with China. In February, 1972, President Nixon visited China and signed The Shanghai Communiqué with China’s Prime Minister Zhou En-Lai. That meant the normalization of relations between the two countries and the end of the embargo period. However, at the same time, in the U.S., China still was placed in the same category as the Soviet Union and some East European countries for export control purposes under The Export Administration Act of 1969. Under this act, U.S. president has complete discretionary authority to impose restrictions on exports from the U.S., except for taxing exports which is forbidden by the Constitution; all exports were placed under license; goods that could be exported freely were put under general license and those not on this required a special license (Baldwin and Richardson 1974, 234).

During this period the volume of U.S.- China two-way trade increased modestly every year. According to China’s statistics (see table 1), the real value of U.S. exports to China rose to $1765.1 million in 1974 from $159.1 million in 1972, and the real value of U.S. imports from China rose to $247.9 million in 1974 from $80.2 million in 1972. From 1975 to 1977, because of China’s domestic troubles, the real value of U.S.- China trade fell to a very low level. In 1976 and in
1977 (respectively) the real value of U.S. - China trade only exceeded the level of 1972. In 1977, the real value of U.S. exports to China was $295.3 million and the real value of U.S. imports from China was $350.6 million.

The year of 1978 seemed to be a turning point for China. In that year (or officially in 1979) China claimed to begin economic reform. In some senses China’s economic reform can be regarded as a new experiment of Keynesianism in a new social and economic setting. The domestic fiscal deficit policy (or the expansionary monetary and fiscal policy) and the foreign trade deficit policy are the two sub-products of Keynesianism in China. China’s statistics show that in 1978 China suffered from its first large trade deficit, not only in U.S.- China trade since 1972, but also in China’s world trade since 1950. Since then, U.S.- China trade has increased dramatically. According to statistics of both countries (as table 1 implies), in 1979 the total real value of U.S.- China trade increased about 85 percent; the real value of U.S. exports to China increased about 92 percent and the real value of U.S. imports from China increased 70 percent. In 1978 and 1979 China accumulated about $1,600 million trade deficit (in the term of current U.S. dollars) in the U.S.- China trade.

1980-94 trade period with formal diplomatic relations and the unconditional MFN status

On January 1, 1979, the U.S. and China formally instituted diplomatic relations. An
agreement on trade relations between the U.S. and China was signed on July 7, 1979. The basic wish of the agreement on trade relations of the two nations is to develop further economic and trade relations between both countries on the basis of principles of equality and mutual benefit as well as nondiscriminatory treatment. Accordingly, on February, 1980, the U.S. government granted China MFN status. In September, 1992, President Bush lengthened China’s MFN status for the next two years (1993-94). So, from 1980 to 1994 China has been granted MFN status every year. American companies and their exports goods also have benefitted from China’s reciprocal non-discriminatory treatment.

Generally, the extension of China’s MFN status reduced the average duty on imports from China from a column 2 rate of about 23 percent to a column 1 rate of about 5-6 percent and gave enterprises and businessmen of both countries a great incentive to engage in trade with other country. As a result, during this period, U.S.-China trade developed very quickly. According to U.S. statistics (as table 1 suggests), in 1992 the total real value of trade between the U.S. and China was $28805.4 million and it is nearly 16 times that of 1978; the real value of U.S. exports to China was $6457.2 million and it is about 5 times that of 1978; the real value of U.S. imports from China was $22330.2 million and it is 42.9 times that of 1978.
To sum up, since 1979 U.S.-China two-way trade has entered a normal period. The crackdown of Tiananmen Square in China in June 1989 shocked many American people. Although the U.S. government has renewed China's MFN treatment every year including the year 1993-94, the debate over the granting of China's MFN status and economic relations between the two nations has become more and more intense. As a result of this debate, in May, 1993, President Clinton enunciated a conditional renewal of China's MFN status in 1995.

In fact, the decision of President Clinton is not very surprising because some issues of U.S.-China trade have been dominated by ideologies of both China and the U.S. rather than by economic advantages. In the term of the U.S. institutions, right from the beginning, China's MFN treatment has been different from MFN status of other market nations and trading partners. The trade agreement between China and the U.S. and China's MFN status are subject to some acts and registrations including The U.S. Trade Act of 1974 and some special amendments of this act. These requirements and amendments contain a handful of conditions and procedures for granting and extending China's MFN status although the major linkage with the granting and extending China's MFN status is specified to be the freedom of emigration requirement. However, the decision of the Clinton Administration has created instability for U.S.-
China trade relations and it also will be a sign that the 1980-94 trade period with the unconditional MFN status may terminate.

The evolution of U.S.-China trade relations shows that, before 1972, trade relations between the two countries were dominated by conflicts of different ideologies and world policies. Since 1972, both China and the United States have broken out of some preconceived political values and entered into an irreversible new area in economic and trade relations. Thus, bilateral trade relations are now partially guided by direct interests or advantages of both countries. On the other hand, because the two countries have different social and economic systems and in different stages in the economic development process, there are many existing and potential conflicts that may directly or indirectly interfere with their bilateral economic and trade relations.

Commodity Structures of U.S.-China Trade

Since the normalization of trade relations between the U.S. and China in 1980, not only has the total volume of trade between the two countries expanded rapidly but also the commodity composition of trade has experienced dramatic change over years.

According to the standard international trade classification (SITC), China's Statistical Bureau divides total commodities in trade into two large groups. The first
group is titled primary goods, which includes five items: food and live animals; beverages and tobacco; non-food raw materials; mineral fuels, lubricants and other related materials; animal and vegetable oils, and fats and waxes. The second group is named manufactured goods, which also includes five items: chemicals and related products; light and textile industry products, rubber and minerals; machinery and transport equipment; miscellaneous products; and products not classified elsewhere (State Statistical Bureau of P.R. China 1989 and 1990).

Structure of U.S. exported goods to China In 1981, in nominal terms, the total value of U.S. exported goods to China was $4,757 million and in 1988 it reached $6,631 million (current U.S. dollars). This increased value period is ascribed largely to the growth in exported manufactured goods.

As table 4 shows, the current value of U.S exported primary goods to China had decreased gradually over years. In 1981 it remained $3,247 million and it had gradually fallen to a level of $972 million in 1987. In 1988 it had been back to a low level of $1,963 million. Major U.S. exported primary goods are food (grain) and non-food raw materials (rubber, cork, and timber). The current value of grains was about 56 percent and 37 percent of the total value of U.S. exported primary goods to China in 1981 and in 1988 respectively. In other words, grain has been the most
important U.S. exported primary goods to China since 1981. Cork and timber have become the second-most important category of U.S. exported goods. In 1988 it shared 33 percent of total value of that category.

Although China imported less and less primary goods from the U.S. since 1981, China still has been one of the largest foreign markets for U.S. agricultural products including wheat, corn, soybeans, cotton, and tobacco because U.S. world exports of agricultural goods declined over years. In 1989, China ranked the eighth largest foreign market for U.S. agricultural goods. Among U.S. exports of agricultural goods to China, wheat has been the largest portion, and it has increased gradually through the 1980s (U.S. Congress 1990, Serial 101-107, 370).


<table>
<thead>
<tr>
<th>Year</th>
<th>Primary Goods</th>
<th>%</th>
<th>Manufactured Goods</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>$3247</td>
<td>68%</td>
<td>$1510</td>
<td>32%</td>
</tr>
<tr>
<td>1982</td>
<td>$2867</td>
<td>65%</td>
<td>$1507</td>
<td>35%</td>
</tr>
<tr>
<td>1983</td>
<td>$1110</td>
<td>40%</td>
<td>$1660</td>
<td>60%</td>
</tr>
<tr>
<td>1984</td>
<td>$1389</td>
<td>34%</td>
<td>$2648</td>
<td>66%</td>
</tr>
<tr>
<td>1985</td>
<td>$1091</td>
<td>21%</td>
<td>$3999</td>
<td>79%</td>
</tr>
<tr>
<td>1986</td>
<td>$671</td>
<td>14%</td>
<td>$4046</td>
<td>86%</td>
</tr>
<tr>
<td>1987</td>
<td>$972</td>
<td>20%</td>
<td>$3859</td>
<td>80%</td>
</tr>
<tr>
<td>1988</td>
<td>$1963</td>
<td>29%</td>
<td>$4668</td>
<td>71%</td>
</tr>
</tbody>
</table>


During the same period, the current value of U.S exported manufactured goods to China has enlarged greatly. As table 4 shows, in 1988 it expanded to $4,668 million.
which was more than triple its value in 1981. Two major items in this category are machinery and transport equipment, and chemicals and related products. In 1988, the value of chemicals and related products was $2,111 million and occupied over 45 percent of U.S. exports of manufactured goods, whereas in 1981 it was only $531 million. Manufactured fertilizer has been one of the important items among the U.S. exported chemicals and related products. The value of machinery and transport equipment amounted to $1,749 million which was about 38 percent of that category (the highest level in 1986 was $2,567 million in this period whereas in 1981 it was only $256 million).

The above shows clearly that products exported to China by the U.S. can be redivided into three larger categories: (1) natural resources such as cork and timber; (2) capital intensive products including wheat, cotton, fertilizer, and machinery; (3) advanced technology such as aircraft, chemicals, computer and scientific instruments. China can gain many advantages from the importation of these three categories. This thesis will show that this alternative classification, which is different from the SITC standard, is of useful for the further theoretical analysis.

Structure of U.S. imports of goods from China

According to China's statistics, in 1981, the total current value of goods the U.S. imported from China was only $1,543 million and in 1988 it rose to $3,380 million (current U.S.)
dollar). As table 5 suggests, the volume of U.S imports of primary goods from China has varied from year to year but there have been no large fluctuations. In 1981 it was $622 million, and in 1988 it was $830 million. The volume of U.S imports of manufactured goods from China has enlarged greatly. In 1981 it was only $921 million, but in 1988 it expanded to $2,550 million. Obviously, the increased value of U.S. imports of goods from China in this period may be attributed mainly to the growth of U.S. imports of manufactured goods.

Table 5. Commodity Composition of U.S. Imports from China 1981 -- 1988
(Millions of U.S. Current Dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Primary Goods</th>
<th>%</th>
<th>Manufactured Goods</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>622</td>
<td>40%</td>
<td>921</td>
<td>60%</td>
</tr>
<tr>
<td>1982</td>
<td>751</td>
<td>42%</td>
<td>1048</td>
<td>58%</td>
</tr>
<tr>
<td>1983</td>
<td>574</td>
<td>33%</td>
<td>1149</td>
<td>67%</td>
</tr>
<tr>
<td>1984</td>
<td>917</td>
<td>38%</td>
<td>1516</td>
<td>62%</td>
</tr>
<tr>
<td>1985</td>
<td>882</td>
<td>38%</td>
<td>1457</td>
<td>62%</td>
</tr>
<tr>
<td>1986</td>
<td>660</td>
<td>25%</td>
<td>1972</td>
<td>75%</td>
</tr>
<tr>
<td>1987</td>
<td>791</td>
<td>26%</td>
<td>2246</td>
<td>74%</td>
</tr>
<tr>
<td>1988</td>
<td>830</td>
<td>25%</td>
<td>2550</td>
<td>75%</td>
</tr>
</tbody>
</table>


particularly, in recent years, products from the textile industry have become the largest part of U.S. imports from China. According to U.S. statistics, in 1991, the current value of U.S. textile imports has risen to $3,751 million from $150 million in 1979. China has become the largest exporter in quantity (rather than in dollar value) among the U.S. textile suppliers. American consumers,
especially less affluent Americans, welcomed to import China's low-price products.

In short, from the view of the U.S., major U.S. imported goods are consumer goods: petroleum, cloth and garments, footwear, toys, gift items and food. These products would be more costly for U.S. consumers if they were produced in the U.S. From the view of China, these exported products were products of specific natural resources, such as petroleum, and of labor-intensive industries including agriculture and light industries such as processed food and live animals, cloth, garment, footwear, and toys and gift items.

So, it is obvious that in the past decade, according to the SITC standard, both China and the U.S. have imported a decreasing volume of primary products and an increasing volume of manufactured goods from each other. With an alternative classification mentioned earlier, in the same period, from the U.S., China has imported more and more products which relate to specific natural resources and advanced technologies, and are produced by capital-intensive industries; from China, the U.S. has imported more and more goods which relate to China's natural resources and are manufactured or processed by labor-intensive industries. This trend has become a basic trading pattern between the U.S. and China in recent years.
Summary

Since 1979 U.S.- China trade has made a tremendous progress as indicated by the fact that the growth of the trade volume is much more rapid than the growth of GNP of both countries, U.S.- China bilateral trade has been the fastest growing in the multilateral trade of both countries, and the growth of U.S.- China trade has been more rapid than both the growth of U.S. world trade and the growth of China’s world trade.

The direct prerequisite of U.S.- China trade is the normalization of diplomatic and economic relations between the two countries. Because of the conflict of ideologies and world policies, there were no trade relations between the two countries for a quite long time. In 1971 leaders of both countries broke out of their conventional values and opened a new era of economic relations between the two countries. Since 1980, the open door policy in China and China’s MFN status have accelerated the trade volume between the two countries. Although practices of bilateral trade are now mainly guided by direct interests or advantages of both countries, trade relations between them are still heavily dominated by some preconceived political values, and thus there is an uncertainty.

The investigation of commodity structures of U.S.- China trade shows that in the past decade, both China and the U.S. have imported a decreasing volume of primary
products and an increasing volume of manufactured goods from each other. With an alternative classification, during the same period, from the U.S., China has imported more and more products which relate to specific natural resources and advanced technologies, and are produced by capital-intensive industries; from China, the U.S. has imported more and more goods which relate to China's natural resources and are manufactured or processed by labor-intensive industries. This trend has become a basic trading pattern between the U.S. and China in recent years. The fact behind this trend is the development of China's economy and the reciprocal benefit to both countries.
CHAPTER III

THEORETICAL ANALYSIS OF U.S.- CHINA TRADE

Chapter Overview

In this chapter, first, some impacts advantages and disadvantages) of U.S.- China trade on economies of both countries are identified; then, several widely-recognized theories in economics or international economics are applied to analyze some prominent aspects of U.S.- China trade. These theories include Adam Smith's absolute advantage theory and Ricardo's comparative advantage theory; import and export functions which are analogous to the Keynesian income theory and the purchasing power parity theory; and the Stolper-Samuelson theorem.

Impacts of U.S.- China Trade On Economies of Both Countries

The U.S. is the leading developed country in the world, and the fact of the U.S.- China trade itself means that China gets acknowledgement from the U.S. That is very important for China to engage in international affairs including multilateral trade, especially with the developed countries. On the other hand, from the view of its role or influence in international affairs and its potential economic growth, China is one of the leading developing
countries in the world. The normal diplomatic and economic relationship between China and the U.S. also should be one of the mainstays for the U.S.'s world strategy.

So, in this sense, although policy makers of both China and the U.S. are guided by their own ideologies, they have to weigh heavily the political and diplomatic importance of U.S.-China trade.

However, besides diplomatic considerations, the top incentive for both countries to develop trading relations ought to be economic advantages. Both the U.S. and China have taken many economic advantages from bilateral trade although major advantages seem related to different facets of the U.S. or China's economy. Also, it should not be ignored that there are some existing or potential negative consequences of U.S.-China trade on both economies.

1. Impacts of U.S.-China Trade on China's Economy

There are three leading advantages for China from U.S.-China trade: access to new technology and management skills, creation of new industries, and stimulation of economic growth.

Access to New Technologies The basic fact is that because of foreigners' encroachment, domestic wars, and the closed-door policy since the 1840s, China has been far behind the advanced countries in modern technologies and production techniques. Chinese people have realized that the modernization of science and technology is the key to
China's modernization ambition in the end of this century.

The U.S. is one of the high technology countries. Trading with the U.S. and taking investment from the U.S., Chinese can gain access to more advanced technologies, advanced equipment and facilities, and new management skills. From the U.S., China has imported many advanced facilities and types of equipment (which relate to almost all areas such as textile, auto, communication, medicine, electric, steel, mineral exploitation, aircraft, aeronautics) and introduced many advanced production assembly lines, as well as bought many technological patents. Compared with technologies that are introduced from Japan and other Western countries, technologies from the U.S. have a relatively higher level and a wider range.

Especially since the U.S. and China agreed to prolong the policy of cooperation in science and technology in May 1991, more and more U.S. modern technologies are being introduced into China with the flow of U.S. products and capital. It is estimated that by the end of the Cultural Revolution, compared with the modern technology in the world (mainly in the developed countries), China's technology may be at the level of the 1950s and 1960s (many of them came from the Soviet Union). A more than ten-year period of high technology introduction or importation from the U.S. (also from other developed countries) has enhanced the level of technology of China from the level of the 1950s and the
1960s to the level of the late 1970s and the early 1980s. This means that China had gained or saved about twenty-years’ time and expense in scientific and technology research, and the gap has been narrowed.

Creation of new industries The U.S. is a consumer-oriented country, and incomes and living standards of most Americans are much higher than that of Chinese. American people demand many high quality consumer's products, for example, cloth, baggage, toys, and gift items. In this respect, no any other country in the world can compete with the U.S. Therefore, China's enterprises can produce these export-oriented products with relatively large economies of scale. Otherwise, these enterprises can not survive since there is only a little effective demand at home for these products because of China's low levels of income and living standards. So, U.S. imports have brought about more production and employment opportunities for China's new industries. With the development of China's economy and increases in Chinese income and living standards, more and more products from these industries will be consumed by China's domestic markets.

Stimulation of economic growth In the process of China's modernization, there have been many bottlenecks such as in food, energy, transportation, communication and raw materials. These bottlenecks check the development of China's economy. From the U.S., China has imported a large
volume of grains, cotton, fertilizer, chemicals, timber and paper, and machinery tools. China also has introduced substantial amounts of American capital into areas of production of transportation means, offshore oil and internal coal exploration. Many of these products serve as a solution to the scarcity of some basic primary materials and to existing bottlenecks.

On the other hand, China and the U.S. are at different stages of economic development, and they have different priorities. Broadly, there are different economic systems in both countries. So, trade between the two countries has some unavoidable disadvantages for both countries. For China, there have been two major existing or potential problems caused by U.S.-China trade: threat to domestic industries and pressure for economic system changes.

**Threat to Capital-Intensive and High-tech Industries**

New products, especially new consumer durable goods such as radio, television, audio, camera, and autos which are imported from the U.S. and other developed countries, have brought about great and new enjoyment for Chinese people. Compared with China’s domestic products, many imported products have relatively low prices without tariffs or with low tariff rates. At present China’s factories are unable to produce high quality consumer durable products, and goods produced by China’s domestic factories can not compete with American products. Because many state-owned enterprises and
all of collective-owned factories have stepped into the market system (although to the different extent), the market condition, the demand for their products and the supply of the same products, are vital for their survival and for their profits. Actually, a lot of consumer goods are supplied by China’s domestic enterprises, and these enterprises are responsible for a majority of employment and government revenues. In China it is widely believed that if there is no protection from the Chinese government the imported products from the U.S. and other developed countries would eventually destroy these domestic industries. Therefore, contrary to their initial wishes, many American companies have found it very hard to export their products, especially manufactured consumer goods, to China because of high duty and other restrictions.

Pressure for Economic System Changes Another big concern of U.S.-China trade for China has been the high pressure for economic system change. China’s economic reform has been going on for a dozen years. It is believed by the Chinese government and many Chinese people that economic reform is related to interests of all people and should be a peaceful and long-run process. A key to successful reform is that everyone should be better than before and nobody would be worse off than before after completing every step of reform. So, to some extent, interests of some groups, especially that of the retired, the middle-age workers, and
employees of public sectors, still relate to the traditional economic and administrative system rather than the competitive market system. However, American companies urgently need a completely competitive market system, a fine legal system and even a new political system with which they are familiar. Compared with foreign companies from other advanced countries, such as Japan and Germany, American companies and the U.S. government are much more demanding for changes in China’s economic and political systems.

Since China has taken many advantages from exporting labor-intensive products to the U.S., and from introducing advanced technology and importing capital-intensive products, and since China hopes continuously to do so, the request from American companies and their government have to be considered seriously. This means that under such pressure China has to speed up the process of economic reform, and interests of many people, especially workers, may be sacrificed. On the other hand, if the acceptance of requests from the U.S. and the reform are beyond the limitation of these people’s tolerance, U.S.- China trade relations will be harmed and China’s reform process will be slowed down. If China is to trade with the U.S., the Chinese government and Chinese people have to take more risks for changes of economic systems.

2. Impacts of U.S.- China Trade on U.S.’s Economy

From the view of the U.S., major gains from U.S.- China
trade include: importation of gap-filling natural resources, employment promotion, and low cost to consumers.

**Importation of Gap-filling Natural Resources** The U.S has relatively plentiful natural resources. But, it still has to import some of the necessary resources such as petroleum and petroleum-related products from other countries to fill the gap between the domestic supply and demand. In fact, since 1979, China has become one of the steady sources for U.S imports of petroleum and petroleum related products.

**Employment Promotion For Some Industries** In recent years, the developed countries including the U.S. have been faced with a new round of adjustment for their economic and industrial structures because of the quick improvement of technology and the end of cold war between the West and the East. China is a new and potential huge market for the Western-countries including the U.S. Many U.S. products (for both consumption and production) are new for Chinese, although some of them already are not very competitive in markets of the U.S. and other developed countries. American companies have exported many manufactured products including high value technology products such as civil airplanes, computers, machinery tools, autos, telecommunication equipment, agricultural machinery, construction, and mining equipment to China. Some of these U.S. exported products seemed to be surplus of supply in the America's domestic
market and some of them less competitive in the international market. For example, the American auto industry including three big companies (General Motors, Ford and Chrysler) suffered huge losses during the period of 1989-91 due to weak demand and significant price cutting in attempts to maintain respective market shares (Industry Survey January 1992, A-75). China’s organized autos-purchasing can partially or occasionally alleviate the high pressure from the domestic and international markets on the American auto industry. China also has become the biggest purchaser of U.S. civil airplane and the related products in recent years. In fact, some of other American domestic industries have faced the same problem. At the same time, American farmers have produced many surpluses of agricultural products such as wheat and soybean. Thus, China’s purchase has a function to maintain these U.S. manufacturing and agriculture industries and provide tens of thousands of jobs for American workers although it is hard to say that U.S.- China bilateral trade has resulted a net U.S. jobs creation.

**Low Cost to U.S. Consumers** The U.S. has imported many manufactured products from China, including ordinary consumer products such as cloth, garments, footwear, toys, and baggage. Many of these products are traditional Chinese products but are improved by new materials and the modern technology. The quality of these products is high but prices
of these products are very low relative to the level of American's income or the price level of the same products produced by the U.S. or imported from other countries or areas. Therefore, America's consumers, especially less affluent families, can get many benefits from these imports.

On the other hand, some negative impacts of U.S.-China trade on U.S. economy can not be avoided although as mentioned above, U.S.-China trade has had less influence on American economy than on China's economy simply by the fact that the volume of U.S.-China trade is a very small percentage of U.S. world trade. Two major concerns are threat to labor employment in labor-intensive industries and outflow of America domestic capital.

**Threat to labor-intensive industries** As it has been shown, many U.S. imported products, such as textiles, and earthen tableware, came from China's labor-intensive industries. The wage level of these industries in China are much lower than that of the same industries in the U.S. For example, in 1979 the wage of Chinese workers in footwear industries was only one-twentieth of the wage paid to U.S. shoe workers. So, these industries found it hard to compete with the large amount of China's exported products whereas there has been a strong incentive for American retailers, stores and marketing firms to import these low cost products (U.S. Congress 1979, Serial 96-63. 316). In fact, Chinese textile products have become the biggest purchase of the
U.S. from China. As a result of these imports the related American industries have been injured and workers in these industries have lost their jobs. As early as 1979, the American Footwear Industries Association complained that because of a large amount of imported China’s footwear, the American domestic footwear industry was projected to drop to record levels, and 17 thousand out of 400 thousand jobs were lost between the first half of 1976 and the first half of 1979 (U.S. Congress 1979, serial 96-63, 316).

In fact, before China traded with the U.S., the U.S. market already was penetrated by low-cost labor products of newly industrializing countries since the early 1980s. China’s trading with the U.S. strengthened this trend. So, at the beginning of U.S.- China trade, the U.S. Administration and the Congress already recognized that labor-intensive industries would be threatened severely by the likely emergence of China as a major exporter of labor-intensive products. The U.S. government also already has taken strong actions to control China’s textile exports to the U.S.

It should be noted that the limit of toleration of American workers for China’s exports seems to be higher than that of Chinese people for U.S. exports. One of the reasons is that in the U.S. there are welfare systems (such as social security, medicare, and medicaid) to ensure the basic living condition and medical treatment of Americans while
China has no economic capability to build such a welfare system. In fact it has been hard for China to assure all people a living.

**Outflow of Domestic Capital**

Capital outflow to other countries has been one of the serious problems facing to U.S. economy. Costs of labor, lawsuit, environmental protection, taxes and health insurance of American companies have become higher and higher. So, American capital has to seek profit opportunities abroad. On the other hand, China has created a relatively favorable investment environment to attract foreign capital including American capital. One of the import policies in China is that a foreign company can be licensed to export its products to China along with an investment in China. As a result, in recent years, American companies have overcome many difficulties and taken a large risk to invest capital into China, and American companies have become the top foreign investor in China.

One of the short-run outcomes of U.S. capital outflow abroad are that American workers will lose more and more employment opportunity and profits of domestic capital will increase as well as the wage of American workers will be down. As Clinton suggested in presidential election speech, American companies not act like American companies since they export jobs rather than products (Clinton July 13, 1992, Democratic National Convention, New York).
Analysis of U.S.-China Trade Basis and Gain

The tremendous progress of U.S.-China in the past two decades implies that there is a strong basis of trade between the two nations. Also, facts show that both countries have gained great advantages from bilateral trade. Basically, the absolute advantage theory and the comparative advantage theory can be applied to explain the basis and gains of U.S.-China trade.

According to the absolute advantage theory, trade between the two countries will occur if one country has the absolute advantage in one good and another country has the absolute advantage in another good and the absolute advantage comes from the unique productive endowment. So, the absolute advantage theory provides a tool to understand U.S.-China trade basis of noncompetitive goods which relate to the natural resource and advanced technology as well as other unique endowments. For example, some major China exported products, such as petroleum and petroleum-related products, are related to natural resources. Although the U.S. has many of its own petroleum resources, the quantity of petroleum-related products produced is not enough to meet the high level of demand in petroleum-related products. So, for the U.S., these imported products are gap-filling noncompetitive imports. Some of the U.S. leading exported goods to China also take a great absolute advantage from natural resources, such as cork and timbers, since the U.S.
has the most plentiful forest resource in the world. For China, these imported products also are gap-filling noncompetitive imports. The U.S also sold many patents and many manufactured products. These patents are of high technology, and in many cases, these manufactured products are the outcome of high technology. So, in these cases, the U.S. has taken a great advantage from its endowment of technology and for China these technology and high-tech products are noncompetitive imports. The difference of these different endowments are that for a country the endowment of technology can change while the endowment of natural resources is hard to change.

However, for many categories of manufactured goods, the comparative advantage theory can explain the trade basis between China and the U.S. This is because, although from the view of production of many commodities, the U.S. has absolute advantages and China has absolute disadvantages, it is true that in China, some industries have higher productivity than others. For example, in China, the productivity of the textiles industry is higher than that of the steel industry. In 1989, the overall labor productivity of textile industry was 17,267 Chinese yuan per person-year (1980 constant price) which is higher than the labor productivity of the metal industry (14,629 Chinese yuan per person-year) (State Statistical Bureau of P.R. China 1991, 424). On the other hand, although compared with China, the
U.S. has a very high productivity and has an absolute advantage in production, the productivity of some industries is lower than that of others. For example, in the U.S., the productivity of the textile industry is much lower than that of the steel industry. For example, in 1991, hourly earnings of primary and fabricated metal industries was $12.265 (the current U.S. dollar), which was much higher than that of textile industries, $6.75 - $8.3 (Business Statistics 1963-91, 55). Obviously, the U.S. has a comparative advantage in the production of steel and China has a comparative advantage in the making of cloth. Because of differences of the relative cost, both countries have incentives to trade; and as the result of trade both countries can reduce their labor cost for given consumption goods. So, even though there is an absolute disadvantage for China, the comparative advantage still provides a basis for trade between the U.S.-China.

Analysis of Determinants of U.S.-China Bilateral Trade Flows

This section combines the Keynesian income model and other theoretical analyses such as the purchasing power parity (PPP) theory to investigate general determinants of trade flows between the U.S. and China. The important economic determinants of trade flows between the U.S.-China include real national incomes in the U.S. and in China respectively, the exchange rate (the U.S. dollar against the
Chinese yuan), price levels of both countries. In addition, the normal relationship between the two countries also will be taken into account.

**Real National Income** In the open Keynesian income model, the aggregate export and the aggregate import are two important determinants of the equilibrium level of a nation's income. Analogously, imports and exports are specified as two functions separately: import function and export function. The import demand of a country is a function of relative prices or the real exchange rate and its real income whereas the export demand of a country is a function of relative prices and its trade partner's real income (Caves, Frankel, and Jones 1990, 384).

From the view of real national income in the import function, in the short run, a nation's imports positively depend upon the level of its real income. When real income rises, consumers increase their spending on both domestic and imported goods. So, when real income rises, demand for imports (foreign products) will increase. In addition, there is an amount of autonomous imports which depends on such factors as tastes and preferences for foreign goods as opposed to domestic products. The level of autonomous imports is independent of income.

From the view of real national income in the export function, sometimes, exports are specified as being autonomous or independent of the country's current level of
real national income in the short run. Since a nation's exports are dependent on the purchasing power of other countries and the purchasing power of other countries is determined by the level of their real incomes, a nation's exports are more likely to be determined by other countries' real incomes than by home income. (Hall, Robert E and John B. Taylor 1986, 243-46; Appleyard and Field 1992, 554-570).

Hence, in the case of U.S.-China bilateral trade, the real value of China's imports from the U.S. is directly determined by real income in China; the real value of China's exports to the U.S. is directly determined by real income of the U.S. These arguments generally supported by the evidence (statistical data) shown in table 1 and table 2 in chapter 2, since not only the real value of China's imports from the U.S. are positively related to real income in China but also the real value of China's exports to the U.S. are positively related to real national income in the U.S.

As was already mentioned in chapters 2, there are some characteristics about real income levels of and trade flows between the two countries. Two of them are as follows. First, although both the real GDP in China and China's imports from the U.S. increased for most years, the average annual growth of China's imports (17.8 percent in 1979-92) was much higher than the average annual growth of real GDP in China (7.3 percent in 1979-92). Second, both the real GDP
in the U.S. and China exports to the U.S. increased for most years, however, the average annual growth of China's exports (32.2 percent in 1979-92) was much higher than the average annual growth of real income in the U.S. (2.3 percent in 1979-92). At the same period, the average growth of China's exports to the U.S. was much higher than the average growth of China's imports from the U.S.

These characteristics imply that China's imports from the U.S. seemed not to be "regularly" related to China's real income and China's exports to the U.S. also seemed not to be "regularly" related to real income in the U.S. Here, the word "regularly" means the general quantitative relationship between the income level and trade flows. For example, according to some empirical works for the bilateral trade, for some major developed and developing countries (not including China), estimated income elasticities of imports or exports, which indicate percentage of the growth in imports or exports that will occurs as a nation's income growth, are usually below 2 (Houthakker and Magee 1969; Gonzalez and Velez 1992) while for China, estimated income elasticities of imports or exports are very high (see chapter 4). Obviously, U.S.- China bilateral trade seems to be an exception.

However, these seeming departures from the regularity do not mean that the general theory mentioned above is not valid. These deviations do tell people that there may be
some special factors which heavily indirectly influence trade flows and thus should be considered.

As a developing country, China's basic trade policy is export promotion and import substitution. One big event that really makes China's trade policy work and thus influences heavily trade flows is the foreign investment including American investment in China. Thus, it is necessary to examine more closely the relationship of China's trade policy, growth of real income, the foreign investment especially American investment and trade flows.

There are two categories of the foreign investment in China. The first is the direct investment from international corporations and private enterprises; the second is the indirect investment such as loans from the world's financial organizations and banks of foreign countries. The fact is that China's economic growth has been stimulated not only by the domestic expending monetary and fiscal policies but also by the foreign investment. Since the foreign investment in China has served to stimulate domestic economic growth and is partially guided by China's trade policy such as the trade balance, export promotion and import substitution, there has been a significant impact of the foreign investment on trade flows between China and the U.S.

The foreign investment in China definitely stimulates the economic growth or increase in real income in China. However, there are two opposite influences of the foreign
investment on China's imports from the U.S. First, from the view of China's import substitution policy, there has been a negative relationship between the foreign investment and China's imports from the U.S. An increase in the foreign investment will allow a decrease in imports because the foreign investment including American investment in China eventually can build China's capacity to produce goods which otherwise have to be imported from the U.S.

Second, from the view of China's foreign investment policy, there is a positive relationship between the foreign investment especially American investment and China's imports from the U.S. The fact is that the Chinese government encourages the U.S. companies to invest in China's industries, especially some high-tech industries. As long as these companies commit their investment in China they would be licensed to export their products to China. Under this circumstance, an increase in investment will allow an increase in China's imports from the U.S.

There are also both positive and negative influences of the foreign investment on China's exports to the U.S. First, because of China's export promotion policy, the foreign investment would accelerate China's exports to the U.S. A large amount of the direct investment from Hong Kong, Taiwan, South Korea and the U.S. has been introduced to build export-oriented enterprises and many of their products have been exported to the U.S. So, when the direct
On the other side, there also is a negative influence of the foreign investment on China's exports to the U.S. and to other countries. In China, capital is a relatively scarce good compared with labor, land and other materials. One of the important roles of the foreign direct investment is to shift the domestic capital supply curve and to promote employment of other productive factors and finally to reach a new equilibrium with a high income level. So, when the foreign direct investment increases, the immediate or direct effect may be a decrease in exports because the new formation of capital would absorb more domestic materials. Some foreign investment, especially the indirect investment, has been used as the construction of capital stock such as the industry of energy, facility of transportation (high way and subway). So, when the foreign investment increases, the domestic demand will increase, and as a result of it China's exports will decrease.

Thus, the fact that the relationship between real income and imports or exports in the case of U.S.- China trade have some deviation from the regularity does not mean that the economic theory is generally invalid. This fact just indicate that some assumptions of the existing economic theory should be modified in the case of U.S.- China trade.

Firstly, one major assumption of the import function is
that the import demand will influence the price of imported products and thus influence the supply of imported products. Something is different in China's setting. The fact is that for their own reasons the Chinese government imposed relatively higher taxes on the imported goods from the U.S. and it also controlled flows of imported goods through various policy measures, imports from the U.S. certainly would be checked to some extent as real income in China increases. However, if China encourages the foreign investment the growth of China's imports from the U.S. still would be greater than the growth of real GDP in China. Simply said, the foreign investment would stimulate China's imports from the U.S. and other trade partners. Second, one implied assumption of export function is that exports of a nation are supposed to be produced by domestic country's resources including the domestic labor and the domestic capital. This implied assumption has only partially hold in China's setting since U.S. imports from China are partially produced by China's domestic resources and partially are produced by the foreign investment. Among the foreign investment in China, the U.S. is one of the major investors as it was mentioned in chapter 2.

It is hard to separate the contribution of China's domestic resources to China's exports to the U.S. from the contribution of foreign resources or American resources to China's exports to the U.S., but one thing is clear: since
a large amount of foreign capital is invested in China to produce products which are exported to the U.S. market, the growth of China's exports to the U.S. is expected to be incredibly larger than the growth of real GDP in the U.S.

**Exchange Rate** The real exchange rate is another major determinant of trade flows between the trade partners. In the case of U.S.-China trade, the real exchange rate is defined as units of real value of the U.S. dollar per unit of real value of the Chinese yuan. The theoretical background of the concept of the real exchange rate is the purchasing power parity (PPP) theory.

According to the PPP theory, the market equilibrium exchange rate is determined by the relative prices of goods and services between countries (Machlup 1939 and 1940). The absolute version of PPP theory supposes that commodities tend to have the same price worldwide when measured in the same currency. Thus, arbitrage will quickly eliminate any price differences between different geographical locations. More realistic, the relative version of PPP theory suggests that if the price level in the home country are increasing faster or slower than the price level in the trade partner, the home currency is expected to depreciate or appreciate. Given an initial base period exchange rate, the equilibrium rate at some later date will reflect the relative rates of the price change in both countries. Thus, the ratio of the new exchange rate to the old exchange rate should be equal.
to ratio of the price index in the home country divided by the price index in the partner country (Appleyard and Field 1992, 506).

The PPP theory is subject to two major limitations. First, it is based on the proposition that fluctuations in the relative price levels of different countries are dominant determinants of balance-of-payments relationship whereas actually there are many other sources of disequilibrium (Snider 1958, 263). Second, when figuring out the equation of two ratios suggested by the PPP theory, it is hard to determine which year’s exchange rate is an equilibrium market rate and if price indexes used exactly show changes in prices of trade goods.

However, the most important thing is that the PPP theory points out a close relationship between the market exchange rate and price levels of trade partners and provides a theoretical base to build the concept of the real exchange rate. Since the real exchange rate combines fluctuations of price levels of both countries and the exchange rate, before the real exchange rate is derived, it is necessary to consider impacts of these two elements (the price levels and the exchange rate) on U.S.-China trade flows separately first.

The foreign exchange rate is simply the price of one currency in terms of another. This price can be viewed as the result of the interaction of forces of supply and demand
for the foreign currency in an particular period of time. An increase in domestic demand for the foreign currency is represented by a rightward shift in the demand, which causes the equilibrium exchange rate to increase. Since it now takes more units of domestic currency to buy a unit of foreign exchange, the domestic currency has depreciated. In a similar fashion, an increase in the supply of foreign currency would lead to an appreciation of the domestic currency to a lower equilibrium exchange rate.

In the past decade, the value of the Chinese yuan against the U.S. dollar has depreciated dramatically. In other words, the dollar has become stronger and stronger in China. In 1979, officially, in China’s foreign exchange market, China’s foreign exchange rate was 0.34 U.S. dollar per Chinese yuan and in 1992 it was only about 0.18 U.S. dollar per Chinese yuan. Actually, the non-official foreign exchange rates were much lower than the recorded official rate in the past years. The most important reason for the depreciation of China’s foreign exchange rate is that the Chinese yuan has not been recognized as a measure in the international transactions yet, and the U.S dollar is one of the leading measures for China’s international transaction. China’s open-door policy not only has increased greatly flows of international transactions but also has created a lot of other needs for the U.S. dollar. For example, every year several thousand students have gone to the U.S. and
other developed countries and brought many U.S. dollars from home to foreign countries for tuition and living expenses. Higher demand for the U.S. dollar in China has created a very high market value of the U.S. dollar against the Chinese yuan. So, although the purchasing power for goods of the U.S. dollar in China’s market, the international market, and U.S. market are relatively low, and the purchasing power of the Chinese yuan in China’s domestic market is relatively high, the value of the Chinese yuan against the U.S. dollar still become very low.

Because changes in the exchange rate in China were so large, the exchange rate is expected to be one of the significant forces to influence the volume of trade in turn. If the theory mentioned above is true, other things being equal, when the Chinese yuan depreciates, China’s exports to the U.S. would rise and China’s imports from the U.S. would fall. That is, there is a positive relationship between China’s foreign exchange rate and China’s exports to the U.S., and a negative relationship between China’s foreign exchange rate and China’s imports from the U.S.

One implicit assumption of above analysis is that of price levels of trade partners (both China and the U.S.) are supposed to be stable. In fact, it is more realistic to suppose that price levels of both countries would increase over years. As the price theory suggests, since imports are substitutes for domestic goods, prices of imports will be
positively related to an increase in the domestic price level relative to the price level of the trade partner. This means that, if the price level of trade partner is held to be a constant and the price level of domestic products (import substitutes) rises so that the relative price ratio (the domestic price level to the trade partner’s price level) is increased, the demand for imports increases.

Exports also are assumed to be influenced by changes in the domestic price level relative to prices in the rest of the world. The relationship between the price level and exports is negative: the higher the domestic price level relative to the foreign price level, the lower will be the rest of the world’s demand for a country’s exports. Since the degree of substitution between domestic and foreign goods are different, the import demand for different goods in a country would have different responsive to changes in relative prices.

Since 1978, China has suffered from the continuous high inflation. As implied in table 6, from 1973-86, the average inflation rate in China is only about 2 percent whereas from 1987-92, it is as high as 9 percent. If the price level of the world market or the U.S market is constant or has little change, the result of the rise in China’s domestic price level would be an increase in the cost of exported products and thus a decrease in the volume of exports. At the same time, price of imported goods would become relatively
cheaper and thus the volume of imports would increase. Accordingly, there should be a positive relationship between China's price level and China's imports from the U.S. and a negative relationship between the price level and the volume of exports to the U.S.

It should be noted that, increases in China's domestic price level play different roles for China's exports in different cases. If the joint-venture enterprises or export-oriented firms use more China's domestic factors and resources, the inflation will increase the cost of production and thus decrease the growth of products and exports. If they use more imported materials for processing products and the price level of international market is constant, they would continuously expand their productions and exports. On the other hand, increases in the domestic price level seem to encourage China's imports from the U.S. for both the joint-venture enterprises and China's domestic factories.

Because the price level of the U.S. will directly influence the dollar value or the dollar purchasing power and thus the exchange rate, it should be considered.

The impact of changes in price level on U.S.-China trade flows would become more complicated when prices of goods and services are changing in either China or the U.S. (or both). It is hard to know changes in relative costs of China's exported goods to the U.S. China's imported goods
from the U.S. by simply looking at changes in the exchange rate and failing to take the new level of prices of both countries into account. For example, if the dollar

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<td>1985</td>
<td>95.1</td>
<td>90.7</td>
</tr>
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<td>1986</td>
<td>97.1</td>
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<td>1987</td>
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<td>1988</td>
<td>103.3</td>
<td>112.7</td>
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<tr>
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<td>1990</td>
<td>111.7</td>
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</tr>
<tr>
<td>1992</td>
<td>115.1</td>
<td>148.7</td>
</tr>
</tbody>
</table>

Sources: Price indexes (U.S. overall GDP deflator index and China's overall GDP deflator, 1987=100): the World Bank: World Table, various editions; Nominal exchange rate: International Monetary Fund: Financial Statistics, various editions. Real exchange rate: calculated with the formula specified by this paper.

Note: The nominal exchange rate is units of the current U.S. dollar per current Chinese yuan.

depreciates by 10 percent against the Chinese yuan, but the price level in China falls relative to U.S. prices by 10 percent, the relative cost of China's goods and services remains the same because the real exchange rate has no
changed. In this case, one would not expect U.S. imports from China to decline even though the U.S. dollar had depreciated. So, not only theoretically but also practically, it is necessary to build the real exchange rate.

The real exchange rate embodies changes of prices in the two countries and current exchange rate in calculation. In U.S.-China trade situation, the real exchange rate would be calculated as follows:

\[ RE_t = E_t \times \frac{CP_t}{UP_t} \]  

where \( RE_t \) -- real exchange rate;
\( E_t \) -- current (or nominal) exchange rate;
\( CP_t \) -- China's prices index (1987=100);
\( UP_t \) -- U.S.'s prices index (1987=100);
\( t \) -- time index.

As table 6 indicated, during the first eight years (1973-80), current exchange rates increased over the period except 1976 but real exchange rates decreased at the same period. This is because inflation rates in China were higher than ones in the U.S. during this period. From 1981 to 1992, both current exchange rates and real exchange rates decreased. However, from 1981-86, current exchange rates were higher than real exchange rates, which reflects the fact that inflation rates in the U.S. were higher than ones in China during this period. From 1988-92, current exchange
rates were lower than real exchange rates, which reflects the fact that inflation rates in the U.S. were lower than ones in China during this period.

The fact shown in table 6 indicates that when the real value of the Chinese yuan depreciates, the relative prices of China's products respect to U.S. products would become more cheaper for U.S. consumers, then the demand from the U.S. would increase, and China's exports would increase. At the same time, U.S. products would become more expensive for China's consumers since per unit of the Chinese yuan can change a less amount of the U.S. dollar than before; thus, China's imports from the U.S. would decrease. So, the great depreciation of the real value of the Chinese yuan against the real value of the U.S. dollar probably is one of major factors which can explain why the growth of China's imports from has been much lower than the growth of China's exports to the U.S. during the period of 1972-92.

Diplomatic Relations and Domestic Political Incidents

Besides the economic factors mentioned above, the relationship between the U.S. and China, which is sometimes supposed to a noneconomic factor, should be taken into account, since this factor is very important for bilateral trade flows between the U.S. and China. With normal relations, both countries enjoyed MFN status and trade each other with relatively low terms of trade. Chapter 2 of this paper specified that in 1979 China and the U.S. established
formal diplomatic and economic relations and in early 1980 the U.S. granted MFN status to China. Since then, U.S.-China trade has experienced a great jump. Another important fact is that trade relations between the U.S.-China especially China's MFN status have been under the question especially in recent years.

In addition, since 1971, several domestic incidents in China in 1975-76, in 1982-83 and 1989-90, have had visible large negative impacts on the volume of trade flows between the two countries. As table 1 and table 2 in chapter 2 imply, China's domestic political incidents and China's trade relations with the U.S. apparently have influenced the volume of trade flows between China and the U.S. However, because trade policies of China and the U.S. have had no fundamental change after both governments established formal diplomatic and economic relations in 1979, and because, usually, U.S. economic sanctions on China were quickly withdrawn after China's situation seemed to become normal, these domestic events and changes of trade relations have had a very short negative influence on trade flows.

In short, it can be expected that statistically only the normalization of relations between the two countries definitely have had positive impacts on trade flows while China's domestic incidents only created some disturbances for the normal progress.
Analysis of Effects of U.S.-China Trade on Income Distribution

As was mentioned earlier, one of the results of U.S.-China trade is that some U.S. companies have maintained more employment because of exporting to China but some of them have lost employment due to China's exported products. And in China, many joint-ventures have developed very quickly because they exported their products to the U.S. while the state-owned enterprises face the threat of U.S. exported products. There is an understandable background for China's high duty on U.S. manufactured and high-tech products, and for U.S. high tariffs on China's labor-intensive products. The Stolper-Samuelson theorem gives us a clear theoretical structure to understand these economic phenomena and economic implications of trade policies of both countries.

According to the Stolper-Samuelson theorem, one of the natural results of factor price equalization between trading countries is that with full employment both before and after trade takes place, the increase in the price of the abundant factor and the fall in the price of the scarce factor because of trade implies that owners of the abundant factor will find their real incomes rising and owners of the scarce factors will find their real income falling (Stolper and Samuelson 1941, 58-73).

For example, suppose that before U.S.-China trade, wages of American employees in a labor-intensive industry
such as footwear industry were relatively high and the price of capital was relatively low. After China and other trade partners exported more labor-intensive products to the U.S., and the U.S. exported more capital-intensive products such as steel and machinery, the price of labor in the U.S. falls. Consequently, real income of capital must rise, since the interest level is rising faster than the price of steel and the price of cloth is falling. Similarly, the price of labor must fall faster than the price of cloth. With the rising of interest rates, the wage of labor must fall even faster than the cloth price so that the change in the price of cloth is equal to the average change in costs of factor used in production. Since the price of steel is rising and the price of labor is falling faster than the price of cloth, real income of labor must be falling.

In China, using the same reasoning, results will be that real income of labor in labor-intensive industries will increase and real income of capital in capital-intensive industries will decline. Because of the nature of China's distribution system, that is, the level of capital income in one industry closely related to the level of labor income in this industry, the real labor income of capital-intensive industry will decline.

Therefore, it is not surprising that in the U.S. capital intensive industries and owners of capital have strongly preferred to trade with China with low duties
whereas labor-intensive industries and the labor unions have had to oppose to trade with China or lobby the Congress to impose higher tariffs on China’s exported textile products. For example, it was mentioned earlier that in the debate of China’s MFN status, U.S. exporting and importing companies strongly supported to renew China’s MFN status while the labor unions and some industries such as the footwear industry in the U.S. seriously opposed China’s MFN status.

In China, capital-intensive state-owned enterprises have been sacrificers of U.S. exported capital-intensive product, so, the government has had to use high duty to protect them. On the other hand, the Chinese government has actively encouraged labor-intensive firms to export their products. In fact, since American products have different impacts on China’s market, China’s interest groups have had different responses to or attitude toward U.S. exports and the open-door policy.

**SUMMARY**

The top incentive for both the U.S and China to develop trade relations is their mutual economic advantages, although these major advantages relate to different facets of economies in the U.S. or China.

For China, three leading advantages from U.S.-China trade are access to new technology and management skills, creation of new industries, and stimulation of economic growth. On the other hand, for China, two major existing or
potential problems caused by U.S.-China trade are threat to domestic industries and pressure for economic system changes.

Major gains for the U.S. from the U.S.-China trade include the importation of gap-filling natural resources, the increase in employment for some industries, and the low cost to consumers. Two negative impacts of U.S.-China trade on U.S. economy are threat to labor employment in the labor-intensive industries and outflow of America domestic capital.

There is a strong basis of trade between the two nations. Adam Smith had already analyzed that one of the major reasons for China's standstill was that the Chinese did not respect foreign trade whereas international trade is the major driving force required for China's economic revitalization. His absolute advantage theory has its own merit in explaining the basis of noncompetitive products trading, which relates to natural resources and advanced technologies as well as other unique endowments, between the two countries. Ricardo's comparative advantage approach provides a more general tool to understand the basis, the gain, and the pattern of U.S.-China trade.

Major determinants of trade flows between the two countries are real national income in the U.S. and in China, the real exchange rate which combines fluctuations of price levels of both countries and the current exchange rate (the
U.S. dollar against the Chinese yuan). Behind greatly increases in trade flows especially China's exports to the U.S., the foreign investment including Americans' investment in China played a significant role. In addition, normal relations between the two countries especially MFN status create the favorable condition for bilateral trade whereas the future of such relations still has been under the question. So, the status of such relations can be treated as one of the major determinants of U.S.- China trade flows.

Furthermore, the Stolper-Samuelson theorem gives us a clear theoretical structure to comprehend effects of U.S.- China trade on distribution and economic implications of trade policies of both countries.
CHAPTER IV

EMPIRICAL STUDY OF U.S.- CHINA TRADE

Chapter Overview

This chapter empirically investigates determinants of aggregate trade flows between China and the U.S. As mentioned in chapter 3, major determinants of import and export flows are national income in the U.S. and in China, the exchange rate (the U.S. dollar against the Chinese yuan) and the price levels of both countries. Since U.S.- China trade has exerted more influence on China's economy than on U.S. economy, the emphasis of this empirical work will be placed on China. This chapter includes: 1. scope of this empirical work; 2. model specification; 3. data selection and source; 4. estimation, tests and interpretations; 5. summary.

Scope of This Empirical Work

In the area of the international trade, there are several favored topics of empirical analysis such as Marshall-Lerner conditions, the purchasing power parity hypothesis, the impact of exchange rate variability on trade, determinants of trade flows (or income and price elasticities), the Heckscher-Ohlin theorem, and the impact of terms of trade on the trade balance.
The empirical work of this paper is restricted to investigate the general impact of determinants of trade flows between the U.S. and China on the basis of annual data. This is not only because the space of this paper is limited, but also because some data series on China’s foreign trade, including U.S.-China trade and China’s domestic economic activities, are not available or are incomplete. Thus, empirical testing of many theorems of international trade is not possible.

This empirical work also is subject to several other limitations. First, although some data series are available, in many cases, only annual data rather than quarterly or monthly data are provided. Hence, the number of observations available is relatively small. For example, the complete data series of U.S.-China trade flows, including China’s exports to the U.S. and China’s imports from the U.S. are only available on an annual basis from 1972-92. As a result, only twenty-one observations are available. If monthly data were available, the sample would contain more than two hundred observations - which is a relatively large sample. With such small sample sizes, certain time series techniques, such as polynomial lag, are inappropriate.

Second, although China has introduced more and more market elements since 1979, the nature of some recorded variables is still problematic because they seem to be closely related to the central economy in China. For
example, changes in exchange rates (the U.S. dollar against the Chinese yuan) were basically under the control of China's central government until January 1994. The behavior of China's imports from the U.S. or China's exports to the U.S. also have been under the control of both governments to a certain extent over this period. Consequently, these variables would not respond well to other variables in a market system. Analysis performed with these variables may lead to biased parameter estimates if these variables truly are not exogenous.

Third, some major data series, such as imports and exports, are not consistent across different statistical sources. For example, as table 1 and 2 of chapter 2 showed, U.S. figures report that the U.S. had a large trade deficit in U.S.- China trade; at the same time, Chinese figures report that China had a large trade deficit. Obviously, these data may confuse users. The empirical work of this paper uses, first, data provided by organizations such as the World Bank and the International Monetary Fund, second, data provided by U.S. statistical sources, and finally, data provided by Chinese statistical sources.

In short, the empirical work of this chapter has two major limitations. First, there are many topics relevant to empirical work in the area of the international trade, but this paper is limited to testing the general impact of determinants of trade flows. This issue is related to one of
the topics of theoretical analysis in chapter 3. Second, the empirical work of this paper is restricted to econometric techniques applicable to annual data. The focus of this empirical study is to try to apply modern econometric techniques to the case of U.S.-China trade, and to pave the way for future research.

This author has not found any empirical work on U.S.-China trade in any major economic theoretical or applied publications (including most recent ones). However, with respect to the impact of national income, the price levels and exchange rates on bilateral trade flows of other countries, there is a great deal of empirical work in major publications (for example, Houthakker and Magee 1969; Goldstein and Khan 1985; Warner and Kreinin 1983; Marquez 1988; Marquez and Mcneilly 1988; Gonzalez and Velez 1992; et al). Most of the empirical tests in these papers focused on static models, and some only focused on one side, for example the export side or the import side, of a nation's bilateral trade. This chapter proposes a distributed lag model to investigate both sides of China’s bilateral trade with the U.S. In addition, a dummy available, which represents the status of diplomatic and economic relations between the U.S. and China, will be added to the model specification.

Model Specifications

As mentioned in chapter 3, a nation’s exports are
determined by the real national income of its trading
partner and the real exchange rate (units of foreign
currency per unit domestic currency), and, a nation’s
imports are determined by its own real national income and
the real exchange rate. Consequently, a nation’s export and
import functions are defined as follows:

\[
CX = f \left( UY, RE \right) \tag{1}
\]

\[
CM = f \left( CY, RE \right) \tag{2}
\]

When export and import functions above are applied to
the case of U.S - China trade, definitions of these terms
are as follows:

\[
CX \text{ -- real value of China’s exports to the U.S.;}
\]

\[
CM \text{ -- real value of China’s imports from the U.S.;}
\]

\[
CY \text{ -- real national income or real GDP in China;}
\]

\[
UY \text{ -- real national income or real GDP in the U.S.;}
\]

\[
RE \text{ -- real exchange rate (units of real value of the}
U.S. dollar per Chinese yuan ).}
\]

As mentioned in chapter 3, the variable RE (the real
exchange rate) in equations (1) and (2) combines changes of
the price levels in both China and the U.S., and the
exchange rate. For empirical analysis, it is more convenient
to construct a real exchange rate index (REI) or a real
currency value index (Gonzalez and Velez 1992; Appleyard and
Field 1992, 503) as follows:

\[
REI_t = \frac{RE_t}{E_t} \times 100 = \frac{E_t \times CP_t}{E_p \times UP_t} \times 100. \tag{3}
\]
Recall that the algebraic definition of the real exchange rate specified in chapter 3 is as follows:

\[ \text{RE}_t = \frac{\text{CP}_t}{\text{UP}_t} \times \text{E}_t \]  

---(4)---

where \( \text{E} \) -- nominal or current exchange rate;

\( \text{RE} \) -- real exchange rate, such as units of the U.S. dollar per Chinese yuan;

\( \text{REI} \) -- real exchange rate index;

\( \text{CP} \) -- price level in China;

\( \text{UP} \) -- price level in the U.S.;

\( b \) -- base year index such as the year of 1987;

\( t \) -- time index.

It can be found in equation 3 that in the base year the real currency value index (the \( \text{REI}_b \)) must equal 100 since \( \text{E}_b \) equals \( \text{E}_t \), \( \text{CP}_b \) equals \( \text{CP}_t \), and \( \text{UP}_b \) equals \( \text{UP}_t \). In other years, the \( \text{REI} \) would fluctuate around 100 as long as changes in the price levels of the two countries are different.

The value of the \( \text{REI} \) depends upon three ratios: the ratio of the exchange rate in the base year against the exchange rate in the current year; the ratio of price level in the current year against the price level in the base year in the U.S.; and the ratio of price level in the current year against the price level in the base year in China. Like the real exchange rate, the \( \text{REI} \) is sensitive to fluctuations in the nominal exchange rate, changes in the relative price levels in China and the U.S. and serves the same purpose in
correcting for the potential correlation in fluctuations of the exchange rate and changes in the price levels. Equation 3 can be substituted into equations 1 and 2 to yield:

\[ CX = f ( UY, REI ) \quad --(5) \]

\[ CM = f ( CY, REI ) \quad --(6) \]

From equation 5 and equation 6, two simple logarithmic-linear regressions can be constructed, for ease of interpretation (i.e., in the logarithmic model, each parameter is an elasticity) (Pindyck and Rubinfeld 1991, 102). The log-export equation with the expected signs on parameters is:

\[ (+) \quad (-) \]

\[ LCX_t = \alpha_0 + \alpha_1 UY_t + \alpha_2 REI_t + \epsilon_t \quad --(7) \]

where the parameter on \( LUY \) represents U.S. income elasticity of demand for China's products (China's exports to the U.S.). The positive sign on this parameter indicates that when real national income in the U.S. increases, the demand for China's products (China's exports to the U.S.) will increase, and vice versa. The parameter on \( LREI \) represents the real exchange rate index elasticity. The negative sign on this parameter indicates that when the REI decreases, China's exports to the U.S. will increase, and vice versa.

The log-import equation with the expected signs on parameters is:

\[ (+) \quad (+) \]

\[ LCM_t = \alpha_0 + \alpha_1 LCY_t + \alpha_2 REI_t + \mu_t \quad --(8) \]

where the parameter on \( LCY \) represents China's income
elasticity of demand for U.S. products (China's imports from the U.S.). The positive sign on this parameter indicates that when real national income in China increases, the demand for U.S. products (China's imports from the U.S.) will increase, and vice versa. The parameter on LREI represents the real exchange rate index elasticity. The positive sign on this parameter indicates that when the REI increases, China's imports from the U.S. will increase, and vice versa.

As pointed out in chapter 3, favorable diplomatic and economic relations between the U.S. and China have created a favorable environment for trade between the two countries. Hence, a dummy variable can be added to the model to reflect the status of diplomatic and economic relations between the two countries. With the inclusion of the dummy variable, equation 7 and equation 8 become:

\[
LCX_t = \alpha_0 + \alpha_1 LUY_t + \alpha_2 LREI_t + \alpha_3 D_t + \epsilon_t \tag{7a}
\]

\[
LM_c = \beta_0 + \beta_1 LCY_t + \beta_2 LREI_t + \beta_3 D_t + \mu_t \tag{8a}
\]

where \(D\) takes on a value of one during the period in which diplomatic and economic relations between China and the U.S were favorable (the period from 1979 to 1992), and takes on a value of zero otherwise (the period from 1972 to 1978). It is hypothesized that if China and the U.S. have favorable economic and diplomatic relations, the level of trade (both China's exports to the U.S. and China's imports from the
U.S.) would increase. Thus, it is expected that there will be a positive sign on parameter of D.

Since regressions are based on time series regressors, the problem of autocorrelation may be encountered in this analysis. This is because series of observations of some variables which occur in successive time periods are mutually dependent in many cases. In other words, when the value of a variable in one period is correlated with the value of this variable in the another period, first-order autocorrelation exists in data. One possible reason for autocorrelated errors in the time series data is the sluggishness in data caused by slow rates of adjustment in variables across time. As a result of first-order autocorrelation in data, estimation based on OLS will be inefficient.

The presence of first-order autocorrelation in the model violates one of the ideal conditions of the classic linear regression model, namely, that the error term for different observations is statistically independent. With this regard, besides OLS, the generalized least squares (GLS) technique and distributed lag models, such as the Koyck lag model and the partial adjustment model (these models will be specified later), will be employed in this analysis.

**Data Selection and Sources**

In order to estimate the above equations, data on seven
regressors and one dummy variable are needed. The first two regressors are the real value of China's merchandise imports from the U.S. and the real value of China's merchandise exports to the U.S. The nominal value of these series are provided by both U.S. statistical sources (1972-92) and Chinese statistical sources (1973-92). The real value of China's imports and exports can be calculated with the formula as follows:

\[ RM_t \text{ (or } RX_t \text{)} = M_t \text{ (or } X_t \text{)} \cdot \frac{P_t}{100} \]  

where \( RM \) -- real value of imports;
\( RX \) -- real value of exports;
\( M \) -- nominal value of imports;
\( X \) -- nominal value of exports;
\( P \) -- price index;
\( t \) -- time index.

The price index in equation 9 will be defined later. Since the recorded values of these two series (especially the value of China's exports to the U.S.) are very different across the two statistical sources it may be a good idea to run regressions on both data series and compare estimation results. But, estimation in this paper will rely on data series reported in U.S. statistical sources.

The third and fourth regressors are related to national income levels in the U.S. and in China. The value of gross domestic product (GDP) of both countries is provided by the World Bank. To eliminate influences of
changes in the price levels or inflation rates of both countries, real GDP based on the constant price of 1987 are employed in this analysis.

The next regressor is the exchange rate. In China, the U.S. dollar is the most important currency among the foreign exchanges. The usual way to express the exchange rate in China is in terms of units of the Chinese yuan per U.S. dollar, rather than units of the U.S. dollar per Chinese yuan. China’s statistical source and the International Monetary Found provide this data. For convenience, this expression is transformed into units of U.S. dollar per Chinese yuan. Hence, a decrease in the foreign exchange rate in China means a depreciation of the Chinese yuan, and an increase in the foreign exchange rate in China means an appreciation of the Chinese yuan. In China, the exchange rate was basically controlled by the central bank until the end of 1993. Only the official exchange rate record is obtainable. Actually, before January 1, 1994, there were four types of exchange rates in China. In addition to the official rate, three additional types were: the official adjusted rate, the market rate, and the black market rate. Regressions of this paper will use the official exchange rate (the average rate in the period) published by the International Monetary Fund. The reason for this choice is that other three series are not available or are incomplete over the time period of this analysis.
The fifth and sixth regressors are the price levels in the U.S. and in China. Since China's recorded price series, including the consumer price index and whole price index, are incomplete, the overall GDP deflator (1987=100) of both countries provided by the World Bank will be used in calculating the real value of imports and exports, the real exchange rate and the REI.

The last independent variable is the dummy variable which represents the status of diplomatic and economic relations between China and the U.S. Although there was an increasing level of trade between China and the U.S. over the period from 1972 to 1978, there were no formal diplomatic and economic relations between them. The value of the dummy variable over this period is defined as zero. Since 1979, there have been formal diplomatic and economic relations between the U.S. and China, and the value of the dummy variable from 1979 to 1992 is defined as one. It should be noted that China's domestic political incidents, such as in 1975-76, 1982-83 and 1989-90, have had visible negative impacts on the volume of U.S.-China trade as shown in the table 1 and table 2 in chapter 2. These incidents did not reverse normal relations between the two countries, and therefore, there is no reason to build an additional dummy variable into the model for them. However, one still should be cautious in explaining estimation results for the dummy variable because to a certain extent these incidents
and others actually have had some negative influences on relations between the two countries.

**Estimation, Tests and Interpretations**

As far as the procedure of estimation is concerned, first, ordinary least squares (OLS) will be employed to estimate static export models (equation 7 and equation 7a) and static import models (equation 8 and equation 8a). Some econometric techniques will be used to evaluate estimation results and test for potential problems. After problems are found, appropriate remedies including the Cochrane-Orcutt iterative procedure, the maximum likelihood estimation (MLE), and distributed lag models will be used to correct these problems.

From the view of the static analysis, China’s export and import equations will be regressed on a 21-year period and a comparison will be made of estimation results of the simple regression without the dummy variable and the extended regression with the dummy variable. From the view of the static analysis, because the time-series data are available only on an annual basis, dynamic models will be restricted to only a one-year lag. There is little doubt that estimation might be improved and that results might be more convincing if estimation were based on quarterly or monthly data.

As far as the presentation of estimation results and explanation are concerned, the following is divided into two
parts: the first is the static analysis, the second is the dynamic analysis in the time-series data for trade flows.

1. Static Analysis of China's Export and Import Functions

Static Analysis of China's Export Function

Regression 7.1 below shows estimation results of the simple form of China's export function (equation 7) on the time series data from 1972-92.

\[ LCX_t = -135.79 + 69.25LU_{t-1} - 0.56LREI_{t-1} \]

\[ (-3.60) \quad (4.27) \quad (-0.80) \]

\[ \text{Adj.} R^2 = 0.9315 \quad DW = 0.4848 \quad (7.1) \]

T statistics are given in parentheses. Regression 7.1 indicates that the U.S. income elasticity of demand for China's exports is 69.25 and the REI elasticity is -0.56. The parameter on \( LUY \) has the expected positive sign and is statistically significant at the one percent level. The parameter on \( LREI \) has the expected negative sign and but is statistically insignificant at the one percent level. The value of the adjusted R-squared for regression 7.1 is 0.9315, which means that equation 7 explains 93.15 percent of variations in China's exports to the U.S. over this period.

However, from an econometric viewpoint, regression 7.1 is clearly unsatisfactory. In a one-tailed test for first-order autocorrelation, the critical lower and upper bounds of the Durbin-Watson statistic (DW) are \( d_L = 1.125 \) and \( d_U = 1.538 \) (the number of regressors including the constant term and the number of observations are 3 and 21 respectively).
The Durbin-Watson statistic (DW), .4697, is higher than zero and lower than \( d_L \). Therefore, it can be concluded that there is positive first-order serial correlation in the residuals at the five percent level and thus the goodness of fit and tests of hypotheses are not reliable.

Regression 7.2 shows estimation results of China's export equation using the MLE technique. The number of iterations is 4. The final estimated Rho statistic and its standard error are .80465 and .12957 respectively. This procedure is used to correct for serial correlation in the errors. However, DW statistic (.8614) in regression 7.2 is still lower than \( d_L \) (1.125), thus, the null hypothesis that there is no serial correlation is rejected at one percent level.

\[
\begin{align*}
\text{LCX}_t &= - 108.89 + 57.59 \text{LUY}_t - 1.02 \text{LREI}_t \\
&(-3.46) \quad (4.16) \quad (-1.71)
\end{align*}
\]

\[
\text{DW} = .8614 \quad -(7.2)
\]

Estimation results shown in regressions 7.1 and 7.2 indicate that model 7 likely is inadequate. One possible reason is that the dummy variable which represents the status of diplomatic and economic relations between the two countries has not been added to the model.

Regression 7a.1 is the estimation result of China's exports function (equation 7a) with the dummy variable included for the time series data from 1972-92.
\[
\text{LnCX}_t = -116.98 + 59.02 \text{LnUY}_t - .13 \text{LnREI}_t + .97 D_t \\
(-4.12) \quad (4.80) \quad (-.26) \quad (3.96)
\]

\[
\text{Adj.} R^2 = .96228 \quad \text{DW} = .838 \quad --(7a.1)
\]

As shown in regression 7a.1, coefficients of LUY and D have expected positive signs and are statistically significant at the one percent level; the coefficient of LREI has the expected negative sign but is statistically insignificant at the one percent level. Regression 7a.1 also has a very high value of the adjusted R-squared, .96228.

However, the goodness of fit and tests of hypotheses in regression 7a.1 are not reliable. With a one-tailed test, the Durbin-Watson statistic (DW), .968, is lower than \( d_L = 1.026 \), so, it can be concluded that there is first-order serial correlation in the residuals at the five percent level. Since first-order serial correlation is present, a correction in the model is necessary.

\[
\text{LCX}_t = -103.98 + 54.51 \text{LUY}_t - .79 \text{LREI}_t + .63 D_t \\
(-3.62) \quad (4.32) \quad (-1.43) \quad (2.32)
\]

\[
\text{DW} = 1.25524 \quad --(7a.2)
\]

Regression 7a.2 shows estimation results of the export equation (equation 7a) with the MLE technique. The number of iterations is 4. The final estimated Rho statistic and its standard error are .72835 and .14952 respectively. In regression 7a.2, estimation results are improved as evidenced by the relatively high DW statistic, 1.21204. However, the DW statistic is within the range of \( d_L = 1.026 \) and \( d'' = 1.669 \), and thus, it can be concluded that the
result of one-tailed test for first-order autocorrelation is inconclusive.

Two basic conclusions can be drawn from estimation results of China's static export function. First, the critical problem for estimation of the simple model (equation 7) is the presence of first-order autocorrelation. With the maximum likelihood estimation (MLE), the resulting estimation in simple model is still not good enough to correct for first-order autocorrelation.

Second, to improve the specification of the model, one dummy variable has been introduced into the model specification, that is, the extended model (equation 7a) has been built. Although the DW statistic with OLS or the MLE is higher with this extended model than the previous one, the resulting estimation of the extended model is still not free of first-order autocorrelation.

In the case of the presence of serially correlated errors when using OLS, efficiency is lost and estimation standard errors are not reliable. One potential explanation for this unsatisfactory result is that since 1978, China has begun economic reforms to open itself up to the world; more dynamic elements have been incorporated into its economic system. So, dynamic model should be built to estimate these relationships.

Static Analysis of China's Import Function Since some aspects of estimation of China's import (or U.S.
export) equation are parallel to that of China's exports (or U.S. import) equation, presentation of the empirical work of this section will be simplified.

Regression 8.1 is the estimation result of the simple form of China's import function (equation 8) on the time series data from 1972-92.

\[
LCM_t = -55.06 + 5.95LCY_t + 4.59LREI_t \\
(-3.70) \quad (4.78) \quad (3.48)
\]

\[
\text{Adj.} R^2 = .718 \quad \text{DW} = 1.1042 \quad \text{--(8.1)}
\]

Regression 8.1 indicates that China's income elasticity of demand for China's imports from the U.S. is 5.95 and the real currency value index elasticity is 4.59. Parameters of LCY and LREI have expected positive signs and are statistically significant at the one percent level. However, the regression does not fit very well as evidenced by the relatively low value of the adjusted R-squared, .718. Equation 8 explains only about 71.8 percent of variations in China's exports to the U.S. over this period.

Like the case of the static export model, the result of estimation of the static import model is also unsatisfactory. In a one-tailed test, the Durbin-Watson statistic (DW), 1.1042, is lower than \( d_L \) (1.125). It can be concluded therefore that there is significant first-order serial correlation in the residuals at the five percent level. Thus, the goodness of fit and tests of hypotheses are not reliable.
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\[ \text{LCM}_t = -54.47 + 5.93\text{LCY}_t + 4.49\text{LREI}_t \]
\[ (-3.51) \quad (4.54) \quad (3.23) \]

\[ \text{DW} = 1.0166 \quad --(8.2) \]

To correct for serial correlation, the import equation is estimated with the MLE technique. Estimation results of equation 8 with the MLE technique are shown in regression 8.2. The number of iterations is 2. The final estimated Rho statistic and its standard error are .42311 and .19772 respectively. Estimation results are not improved because of the lower DW statistic. The DW statistic (1.0166) is lower than \( d_L \) (1.125) and \( d_U \) (1.538).

Estimation results shown in regressions 8.1 and 8.2 indicated that the simple import model likely is inadequate. One possible reason is that the dummy variable \( D \) has not been added to the model.

Regression 8a.1 is the estimated result of China's export function (equation 8a) with the dummy variable included for the time series data from 1972-92.

\[ \text{LCM}_t = -46.76 + 4.80\text{LCY}_t + 4.32\text{LREI}_t + 1.05D_t \]
\[ (-3.50) \quad (4.10) \quad (3.74) \quad (2.58) \]

\[ \text{Adj.R}^2 = .78588 \quad \text{DW} = 1.6533 \quad --(8a.1) \]

Coefficients of \( \text{LCY}_t \), \( \text{LREI}_t \), and \( D_t \) have the expected positive signs and are statistically significant at the one percent level. The problem is still the presence of serial correlation in the residuals. With a one-tailed test, the Durbin-Watson statistic (DW), 1.6533, is between the critical lower and upper bounds (\( d_L = 1.026 \) and \( d_U = 1.669 \)).
Thus, it can be concluded that the test for the presence of first-order serial correlation in the residuals at the five percent level is inconclusive.

\[
\text{LCM}_t = -47.36 + 4.88 \text{LCY}_t + 4.35 \text{LREI}_t + 1.01 \text{D}_t \\
(-3.43) (4.03) (3.64) (2.36)
\]

\[
\text{DW} = 1.29297	ag{8a.2}
\]

Regression 8a.2 shows estimation results of extended import equation, 8a, with the MLE technique. The number of iterations in regression 8a.2 is 4. The final estimated Rho statistic and its standard error are 0.8177 and 0.21749 respectively. Estimation results are not improved because of the lower DW statistic. The DW statistic (1.29297) is within the range of \( d_L (1.026) \) and \( d_U (1.669) \), thus, the result of a one-tailed test is still inconclusive.

Two basic conclusions can be drawn from estimation results of China’s import models (equation 8 and equation 8a) on data from 1972-92. First, the critical problem for estimation of the simple import model (equation 8) is the presence of first-order autocorrelation. With the maximum likelihood estimation (MLE), the resulting estimation of the simple model is still not good enough to correct for first-order autocorrelation.

Second, in an attempt to improve estimation results of the model, one dummy variable has been introduced into the model specification; that is, the extended import model (equation 8a) has been built. Although the DW statistic is
higher in this model than in the previous one, the resulting estimation of the extended model with OLS is still not free of first-order autocorrelation. With the maximum likelihood estimation (MLE), the DW statistic is lower than the previous one. So, it is necessary to incorporate dynamic elements contained in the time series data of 1972-92 into the appropriate dynamic model.

In sum, generally, because of the presence of serial correlation, estimation with OLS or the MLE is inefficient and the resulting estimated standard errors are not reliable, the static export and import models are thus generally unacceptable, although models with the dummy variable D are introduced. Hence, the dynamic analysis for both China’s export function and China’s import function has to be called for.

One thing that probably should be noted here is that it will be found later that with respect to signs and magnitudes of estimated coefficients and the fitness of regressions (the value of the R-squared), estimation results from static models for both China’s exports and imports are basically the same as the ones from estimation of dynamic models.

2. Dynamic Analysis of Export and Import Functions

Various methods of time series analyses have been developed in econometrics. Several popular techniques are simple time lags, partial adjustment models, the Koyck
distributed lag or Geometric lag model (Koyck 1954), and the
Almon lag or polynomial distributed lag model (Almon 1962).

It is difficult to build dynamic time-series models for
China's imports and China's exports, because, unlike some
economic theories such as the income and consumption theory,
there is no existing well-proven dynamic theory which is
related to the export and import functions. Establishing
such theory is obviously beyond the scope of this paper.

However, it is reasonable to assume that current
changes in one variable would require some time to exert
influences on other variable(s) in subsequent period(s). For
example, changes in the current real national income in
China (or the U.S.) or changes in current exchange rates and
the current price level with respect to both China and the
U.S., probably would influence China's (or U.S.) imports
from its trading partner not only in the current year but
also in the following year. Also, China's (or U.S.) imports
from its trading partner in the current period would be
closely related to China's (or U.S.) imports in the previous
period. If this is so, the omission of lagged independent or
dependent variable(s) would lead to the wrong model
specification and might create the serial correlation
problem observed previously in estimation. Thus,
specifications of time series models probably should include
lagged independent or dependent variable(s). This is the
overall reason to employ the dynamic analysis here.
Among various dynamic models, the Koyck distributed lag and the partial adjustment model are chosen. One of the common features of these two models is that they have an equivalent version with a lagged dependent (or endogenous) variable. The following combines both the Koyck lag model and the partial adjustment model and generates export and import models with a lagged endogenous variable. Since these two models have provided well-known methods to investigate the functional relationships of the time series data, and this paper focus on the application of these approaches, some aspects of technical details of these two approaches will be omitted here.

From the view of the distributed lag model, it is assumed that the impact of U.S. real national income and the REI are expected to spread out over a number of different time periods. In other words, changes in current real national income in the U.S. and the REI not only would have some impacts in the current year, but also would have some impacts in the following years. So, the appropriate export model for China can be defined as a distributed lag model as follows:

\[
LCX_t = \alpha + \alpha_1LUY_t + \alpha_2LUY_{t-1} + \ldots + \alpha_kLUY_{t-k} + \beta_1LREI_t + \beta_2LREI_{t-1} + \cdots + \beta_kLREI_{t-k} + \gamma_1D_t + \gamma_2D_{t-1} + \ldots + \gamma_kD_{t-k} + \epsilon_t \tag{11}
\]

Obviously, with OLS, estimation of equation 11 will be problematic. First, the lagged variables LUY, and LREI will
be correlated with errors and hence estimated parameters are biased. Second, estimated coefficients of independent variables are unlikely to have steadily decreasing pattern of coefficients. Third, the number of estimated coefficients, or the lagged independent variables, will decrease the number of degree of freedom of the model. Actually, for a small sample case with the distributed lag model, there will not be enough degrees of freedom.

To avoid these problems, the above distributed lag model can be simplified. It is assumed that coefficients of distributed lag model decrease geometrically, that is:

$$\alpha_i = \alpha_0 \lambda^i, \beta_i = \beta_0 \lambda^i \text{ and } \gamma_i = \gamma_0 \lambda^i$$

$$0 < \lambda < 1$$   --(11.1)

If equation 11.1 is substituted in equation 11, equation 11.2 is built as follows:

$$LCX_t = \alpha + \alpha_0 (LUX_t + \lambda LUX_{t-1} + \ldots + \lambda^k LUX_{t-k})$$
$$+ \beta_0 (LREI_t + \lambda LREI_{t-1} + \ldots + \lambda^k LREI_{t-k})$$
$$+ \gamma_0 (D_t + \lambda D_{t-1} + \ldots + \lambda^k D_{t-k}) + \epsilon_t$$   --(11.2)

After multiplying both sides of equation 11.2 by $\lambda$ and lagging one period, and then subtracting the resulting equation from equation 11.2, a new equation, the Koyck distributed lag function for China's exports, is as follows:

$$LCX_t = \alpha + \lambda LCX_{t-1} + \alpha_0 LCY_t + \beta_0 LREI_t + \gamma_0 D_t + \epsilon_t$$   --(12)

With the same reasoning and procedure, the Koyck distributed lag function for China's imports is as follows:

$$LCM_t = \delta + \lambda LCM_{t-1} + \delta_0 LCY_t + \Gamma_0 LREI_t + \theta_0 D_t + \mu_t$$   --(13)
The partial-adjustment model and the Koyck distributed lag model for China's exports and imports can develop the same final versions respectively, although they have different starting points. From the view of the partial-adjustment model, it is assumed that exporters in the U.S. or in China will anticipate some changes in the demand for their products. It is defined that LCX, is the log of China's desired exports (real value) in the current period and LCX, is proportional to LUY, LREI, and D, thus,\[
LCX, = \delta LUY, + \xi LREI, + \gamma D, \tag{14}
\]
Assume (LCX, - LCX,_) , the actual change in China's exports, to be (LCX, - LCX,_) , a difference of the desired change, hence:
\[
LCX, - LCX,_1 = \theta (LCX, - LCX,_) \tag{15}
\]
or\[
LCX, = \theta \delta LUY, + \theta \xi LREI, + \theta \gamma D, + (1-\theta) LCX,_, \tag{16}
\]
With some replacement, the partial adjustment model for China's export will be as follows:\[
LCX, = \alpha_1 LUY, + \alpha_2 LREI, + \alpha_3 D, + \alpha_4 LCX,_, + \epsilon, \tag{17}
\]
With the same reasoning and procedure, the partial adjustment model for China's import will be as follows:\[
LCM, = \beta_1 LCY, + \beta_2 LREI, + \beta_3 D, + \beta_4 LCM,_, + \mu, \tag{18}
\]
It is easily found that the final form of the Koyck distributed lag model for China's exports (equation 12) is the same as the final form of the partial adjustment model for China's exports (equation 17), and the final form of the Koyck distributed lag model for China's imports (equation 18).
13), is the same as the final form of the partial adjustment model for China’s imports (equation 18), although they are derived from different assumptions or starting points.

In the above lagged endogenous variable structure (for both the Koyck distributed lag model and the partial adjustment model), the direct implication is that the one-year lagged dependent variable, \( LCX_{t-1} \), is added as one of the new regressors in China’s export model; the one-year lagged dependent variable, \( LCM_{t-1} \), is added as one of the new regressors in China’s import model. Thus, China’s exports to the U.S. in the current year is a function of China’s exports lagged one year (\( LCX_{t-1} \)), the current real national income in the U.S. (\( LYU_t \)), and the current real currency value index (\( LREI_t \)). The addition of China’s lagged exports (or imports) means that changes in China’s exports to the U.S. (or China’s imports) in the current year are expected to be associated with changes of in China’s lagged exports (or China’s imports). In addition to assumptions specified above, another possible reason for using the model with an endogenous lagged variable is that the trade behavior or transactions of goods between the two countries could be supposed to always be behind production since the production process changes slowly. So, it can be expected that the current level of China’s exports to the U.S. (or China’s imports from the U.S.) would be closely related to the previous year’s level.
Before employing the above models with a lagged endogenous variable added to data, two important issues should be noted. First, as mentioned earlier, because data are provided annually, the number of observations of these data is relatively small. The analysis of trade flows between the U.S. and China also would be restricted by the one year lag on data of 1972-92. In other words, the exogenous variable will be only lagged one period (one year), although higher order lags are generally allowed as well.

Second, since a lagged dependent variable is used, the DW test is biased against the finding of first-order autocorrelation. Thus, as suggested by Durbin (Durbin 1970, 410-420), Durbin's h test will be used to test for the presence of first-order autocorrelation.

Dynamic Analysis of China's Export Function The specification of the Koyck or the partial adjustment model built on the model 7a is as follows

\[ \text{LCX}_t = \alpha_0 + \alpha_1 \text{LCX}_{t-1} + \alpha_2 \text{LUY}_t + \alpha_3 \text{LREI}_t + \alpha_4 D_t + \epsilon_t \]  

The following regression 12.1 is the estimated result of equation 12 with the MLE. The number of iterations in regression 12.1 is 2.

\[ \text{LCX}_t = -51.96 + .72 \text{LCX}_{t-1} + 24.73 \text{LUY}_t + .38 \text{LREI}_t + .22 D_t + \epsilon_t \] 
\[ \quad (\text{1.51}) \quad (\text{6.94}) \quad (\text{3.65}) \quad (\text{1.28}) \]

\[ \text{Adj.} R^2 = .993 \quad \text{DW} = 1.882 \quad \hat{g} = 0.059 \]  

\[ \text{--(12.1)} \]
To test for serial correlation, Durbin's h test is applied. Durbin's h statistic is defined as follows:

$$h = \hat{\theta} \times \left[ \frac{T}{1 - T[\text{Var}(\beta)]} \right]$$  --(12.1)

where \(\text{Var}(\beta)\) is the square of the standard error of the coefficient of the lagged endogenous variable in regression 12.1, \(T\) is the number of observations, and \(\hat{\theta}\) is the estimated value of \(\theta\) (the parameter of \(\hat{\theta}_{\tau_i}\)) from the regression of \(\hat{\theta}_i\) against \(\hat{\theta}_{\tau_i}\):

$$\hat{\theta}_i = \hat{\beta} \times \hat{\theta}_{\tau_i} + \epsilon$$  --(12.2)

or \(\hat{\theta} = (2 - \text{DW})/2\) since \(\text{DW}\) approximately equals \(2(1 - \hat{\theta})\).

In regression 12.1 \(\hat{\theta}\) is 0.059 and thus Durbin's h statistic is .2979. Durbin's h statistic is less than the critical value of the normal distribution at the five percent level (1.64 for a one-tailed test), thus, the null hypothesis that there is no serial correlation cannot be rejected at the ninety-five percent level of confidence, whereas the DW test is inconclusive in rejecting the null hypothesis of zero serial correlation in the residuals at the five percent level. This indicates that first-order autocorrelation is corrected for and this model with an endogenous lagged variable seems to be more appropriate for China's exports to the U.S.

From estimation of the lagged endogenous variable model (regression 12.1), it can be found that the coefficient of \(\text{LCX}_{t-1}.72\), has the expected positive sign and is
statistically significant at the one percent level. This indicates that changes in China's exports lagged one year have a significant impact on China's exports to the U.S. in the current year. The coefficient of $\text{LUY}_t$, 24.74, has the expected positive sign and is statistically significant at the one percent level. This indicates that changes in real GDP in the U.S. in the current year have a significant impact on China's exports to the U.S. in the current year. The coefficient on the dummy variable $D_t$, .22, has the expected positive sign but is statistically significant only at the twenty percent level. The coefficient of $\text{LREI}_t$, .40, has an unexpected positive sign but is statistically insignificant even at the twenty percent level.

Thus, the basic conclusion is that among the four independent variables, changes in real GDP in the U.S. is a major determinant of China's exports to the U.S. and in the short run, a one percent increase in U.S. real GDP would lead to about a 24 percent increase in China's exports to the U.S., other things being equal. Impacts of lagged exports and normal economic and diplomatic relations between the two countries on current exports are relatively smaller.

In addition, estimation of this model is much better than the previous ones of static models as is evidenced by the adjusted $R^2$, .993, which is relatively high. This means that this specification can explain 99.3 percent of sampling variation in China's exports to the U.S.
Dynamic Analysis of China's Import Function

The specification of the Koyck distributed lag or the partial adjustment model built on China's import function is as follows:

\[
LCM_t = \beta_0 + \beta_1 LCM_{t-1} + \beta_2 LCY_t + \beta_3 LRE_t + \beta_4 D_t + \mu_t \tag{13}
\]

The following regression 13.1 is the estimated result of equation 13 with the MLE. The number of iterations is 4.

\[
LCM_t = 35.00 + .14 LCM_{t-1} + 3.75 LCY_t + 3.26 LRE_t + .54 D_t \\
(-2.72) (3.24) (2.94) (1.17)
\]

\[
Adj. R^2 = .7715 \quad DW = 1.13 \quad \hat{g} = .20658 \quad (13.1)
\]

To test for serial correlation, Durbin's h test is applied. In regression 13.1 \(\hat{g}\) is 0.20658 and thus Durbin's h statistic is 1.22729. Since Durbin's h statistic is less than the critical value of the normal distribution at the five percent level (1.64 for a one-tailed test) the null hypothesis that there is no serial correlation cannot be rejected at the ninety-five percent level of confidence, whereas the DW test is inconclusive in rejecting the null hypothesis of no serial correlation in the residuals at the five percent level. So, this model with a lagged endogenous variable seems to be a more appropriate for China's imports from the U.S.

From estimation of the lagged endogenous variable model as shown in regression 13.1, it can be found that the
coefficient of $LCM_{t-1},.13$, has the expected positive sign and is statistically insignificant even at the twenty percent level. This indicates that changes in China's imports lagged one year have no significant impact on China's imports from the U.S. in the current year. The coefficient of $LCY_t, 3.75$, has the expected positive sign and is statistically significant at the one percent level. This indicates that changes in real GDP in China in the current year have a significant impact on China's imports to the U.S. in the current year. The coefficient of $LREI_t, 3.26$, has the expected positive sign and is statistically significant at the two percent level. This indicates that fluctuations of the price levels and the exchange rate have a significant impact on China's imports from the U.S. The coefficient of the dummy variable $D_t, .54$, has the expected positive sign but it is only marginally significant at the forty percent level. This indicates that normal relations between the two countries has no significant impact on China's imports from the U.S.

Thus, the basic conclusion is that among the four independent variables, changes in real GDP in the U.S., fluctuations in the price levels and the exchange rate have relative large impact on China's imports from the U.S. whereas changes in imports and normal economic and diplomatic relations between the two countries in the previous period do not appear to have a significant impact.
on China's imports in the current year from the U.S. In the short run, a one percent increase in China's real GDP would lead to about a 3.75 percent increase in China's imports from the U.S., other things being equal. In the short run, a one percent increase in the real currency value index would lead to about a 3.26 percent increase in China's imports from the U.S., other things being equal. Impacts of lagged imports and normal relations between the two countries on the current level of China's imports are relatively smaller. In addition, estimation of this model is better than that of static models as is evidenced by the adjusted R² .7715, which is higher than that in static models. This means that this specification can explain 77.15 percent of the sampling variation in China's imports from the U.S.

More Explanation about Estimated Results It is interesting to make some comparisons of dynamic estimated results of China's export equation with that of China's import equation.

First, estimated results are generally consistent with the theoretical analysis that in China's setting, there is a positive relationship between China's exports and real GDP in the U.S. and a positive relationship between China's imports and real GDP in China respectively; changes in real income in the U.S. have a very large impact on China's exports to the U.S. while changes in real income in China have a relatively small impact on China's imports. In other
words, the elasticity of China's exports to the U.S. is very sensitive to the growth of real income in the U.S. Besides China's export promotion policy and trans-export activities by Hong Kong and other countries or areas, one direct possible explanation for this is that, in recent years, with the growth of real GDP in the U.S., more and more Americans have invested their money in China and a large of amount of these investments are in the joint-venture enterprises in which their products are designed for export to the U.S., as analyzed in chapter 3. Thus, in the short run, a one percent increase in real GDP in the U.S. would lead to a significant increase (as high as about 25 percent) in China's exports to the U.S., other things being equal.

On the other hand, increases in real GDP in China would result in relatively small increases in China's imports from the U.S. since China has no such export-oriented investment in the U.S. In other words, the elasticity of China's import is relatively less sensitive to the growth of real income in China. Other factors, for example, the high tariff policy, also should be responsible for such small increases in China's imports from the U.S. However, one important fact is that, compared with other developing countries trading with the U.S., China's income elasticity of demand for China's imports from the U.S. (about 3.75) is still much higher than the same for other U.S. trading partners. For example, Mexico's income elasticity of demand for to Mexico's imports
from the U.S. is only 2.32 based on data from 1960-89 (Gonzalez and Velez 1992).

Second, fluctuations in the REI have significant impacts on China’s imports but have no significant impacts on China’s exports to the U.S. In other words, for the import function, the elasticity of the REI is greater than one (elastic) and for the export function, the elasticity of the REI is less than one (inelastic). In the short run, impacts of changes in the REI on China’s imports are relatively large: other things being equal, a one percent increase in the REI would result in about three percent increase in China’s imports from the U.S. This means although, to some extent, China’s imports are controlled by the central government, the behavior of China’s imports from the U.S. is partly (also heavily) dominated by market elements such as the price levels of the two countries and the exchange rate. This is understandable since through changes in the price levels and the exchange rate, China could take advantage of competition in the international market, including U.S. market. On the other hand, in the short run, impacts of changes in the REI on China’s exports are relatively small: other things being equal, a one percent increase in the REI would result in about 0.4 percent increase (also it is statistically insignificant at one percent level) in China’s exports to the U.S. The possible reason is that the price of China’s labor,
materials, and products are so lower that changes (usually increases) in the price level in China or the depreciation of the Chinese yuan have not exerted more impact to China’s exports or U.S. imports.

Third, changes in China’s lagged exports have a relatively large impact on China’s exports to the U.S. in the current period, and changes in China’s lagged imports have a relatively small impact on China’s imports from the U.S. in the current period. This estimated result is also consistent with the previous explanation that indicated that since many Americans and others built their export-oriented enterprises in China and these enterprises can provide continuous supply (or exported products) to the U.S., China’s exports in the current year would be more closely related to China’s exports in the previous year. But China’s imports from the U.S. actually have no such steady basis.

Fourth, at the relatively low confidence level, that is, at eighty percent, normal economic and diplomatic relations between the U.S. and China have a significant impact on China’s exports from the U.S. whereas they have an insignificant impact on China’s imports to the U.S. From estimated results, it can be found that, other things being equal, as long as relations between the two countries are favorable, the real value of China’s exports will be only a little higher than that during years without favorable relations or without MFN status. This result is quite
disappointing. Usually, people expected that normal relations between the U.S. and China would directly benefit China's enterprises for exporting their products to the U.S. because of China's MFN status. Congress and the President debate seriously China's MFN status every year and recently imposed some human rights conditions on China's upcoming MFN status (1995-96). But, the estimated result suggests that the major source of China's increasing exports came from the growth of real GDP in the U.S., which partly was the result of America's large investment in China. This probably can explain why American businessmen seem to worry about the debate in Congress and the presidential decision about China's MFN status much more seriously than the Chinese government or Chinese people do.

On the other hand, other things being equal, if there are favorable economic and diplomatic relations between China and the U.S., in the short run, the real value of China's imports from the U.S. will be .54 percent higher than that without normal relations, but it is statistically significant only at the forty percent level. This implies that the impact of normal relations between the two countries on China's imports from the U.S. can be ignored. This statistical finding also seems to be very surprising. As mentioned earlier, usually, it is expected that as soon as relations between China and the U.S. became favorable, especially after the U.S. withdrew most of its restrictions
on exported high-tech products to China, the volume of China’s imports would have increased greatly. The estimated result obviously contradicts this claim. The possible explanation for this estimated result may be that China’s government not only has not changed the import (from the U.S.) policy but also has probably put more restrictions on U.S. exported products. If this is so, this finding still confirms the previous result that find that facing the potential large inflow of exported products from the U.S., China will set more restrictions on them to protect its own industries, other things equal. This estimated finding seems to partially be consistent with the complaints from U.S. businessmen who engage in U.S. exporting to China. This also seems to be partially consistent with claims of Congressmen who argued that normal relations between the U.S. and China have not helped Americans to find a new market but has helped the Chinese to open a new market.

It should be noted that although the estimate of the dummy variable in the export model or import model is statistically insignificant at one percent level, generally dynamic import and export models with the dummy variable are still favorable than the simple import and export models for this case. The major reason for this choice is that, as it was mentioned in chapter 3, theoretically, there is a reason to add this dummy variable representing the status of relations between the U.S. and China. Secondly, the
estimates of the dummy variable in the export and import models are still statistically significant at the twenty or forty percent level respectively. Third, for both export and import functions, the estimating results with the dummy variable are better than the estimating results without the dummy variable by the evidence of higher value of the adjusted R-squared and free of first-order autocorrelation in the residuals.

Fifth, the regression of China’s exports to the U.S. fits very well since the value of the adjusted R-squared is very high. The regression of China’s imports from the U.S. does not fit as well since the value of the adjusted R-squared is relatively low. The implication of these estimated results are as follows. First, the behavior of China’s exports to the U.S. seems to be more responsive to the market, and, the independent variables such as real GDP in the U.S., the REI (or the exchange rate and the price levels) in the export function can explain the dependent variable at a very high confidence level. Second, the behavior of China’s imports from the U.S. to a large extent still are controlled by the central government. It is difficult to the predict the behavior of the central government. Since China’s import function has not included an independent variable which can reflect changes in the government’s decision about China’s imports from the U.S., existing independent variables, such as real GDP in China
and the REI, would certainly not explain all of the variation in the dependent variable at a high confidence level.

**Summary**

This chapter presents estimation of equations for China’s exports to the U.S. and for China’s imports from the U.S., mainly on the basis of China’s economic performance. Besides the widely used independent variables such as real national income in the U.S. (in China’s export model) and real national income in China (in China’s import model), the real exchange rate (which combines fluctuations of the price levels of the two countries and the current nominal exchange rate), the dummy variable representing economic relations between the two countries is introduced into model specifications.

Basically, two different econometric techniques, static techniques and distributed lag techniques, are employed. From the point of view of the dynamic model, the lagged endogenous variable models (the Koyck distributed model and the partial adjustment model) are used. Various tests, including the R-squared test, T test, DW test, and Durbin’s h test, are employed to verify the validity of specifications. In addition to OLS, the maximum likelihood estimation technique (MLE) is used to estimated the model which has been correct for first-order autocorrelation problems where needed.
Estimation of simple static export and import models (without the dummy variable) provides unsatisfactory results because of the presence of serial correlation in errors, although the simple static model usually has been used in most of the empirical literatures. In order to provide more satisfactory results, the dummy variable which represents the status of relations between the U.S. and China is introduced into model specifications. Although regressions of extended static models with the dummy variable provide better estimated results, serial autocorrelation still exists in the residuals. So, dynamic models have to be called for.

The overall reason to use dynamic models is that it is reasonable to assume that changes in current real national income in China (or the U.S.) or changes in the current exchange rates and the current price level with respect to both China and the U.S., probably would influence trade flows between the U.S. and China not only in the current year but also the following year. Also, trade flows between the two countries in the current period would be closely related to trade flows in the previous period. So, omission of the lagged independent or dependent variable(s) would lead to the wrong specification.

The common feature of the Koyck distributed lag and the partial adjustment model is that they have an equivalent form with a lagged dependent or endogenous variable. The
direct explanation of final versions of these two models is that besides independent variables which static models already have, China's lagged exports to the U.S. or China's lagged imports from the U.S. are to expected to influence the current level of China's exports to the U.S. or China's imports from the U.S. respectively.

Regressions with a lagged endogenous variable result in relatively satisfactory estimations for both China's export and import functions. The Durbin's h tests indicate that regressions with a lagged dependent variable have no first-order autocorrelation for data from 1972-92 at the ninety-five level of confidence.

Estimation of the lagged endogenous variables models for both China's exports and China's imports shows that almost all of coefficients on the independent variables, such as real income in China or in the U.S., the real currency value index, lagged exports or imports, the status of relations between the two countries have the expected signs although they are statistically significant at different percentage levels of significance.

From the view of estimation of the dynamic export model, real GDP in the U.S. is the major determinant of China's exports to the U.S. Impacts of lagged exports on current exports are relatively smaller. Changes in the real currency value index and the status of relations between the two countries have relatively small impact on current
exports at the relatively low confidence levels.

From the view of estimation of the dynamic import model, real GDP in the China, the price levels and the exchange rate are major determinants of China's imports from the U.S. The status of relations between the two countries and lagged imports have relatively small impacts on China's imports from the U.S. at the relatively low confidence levels. In addition, the export model is much better than the import model with respect to the fitness criteria.

The basic conclusion is that the theoretical analysis on determinants of trade flows in chapter 3, including various hypotheses, are generally supported by these empirical results.
CHAPTER V

CONCLUSIONS

The normalization of U.S.-China economic and trade relations is one of the most important world events in the last quarter of this century. The achievement of U.S.-China trade is shown by the fact that since 1972, especially since 1978, the volume of U.S.-China trade has greatly increased, the trading pattern has gradually become mature and both countries have gained a lot from trade.

Two hundred years ago, Adam Smith predicted that the international trade would be the major driving force for China's economic revitalization. The two decades' experience of U.S.-China trade, as one of the most influential components of China's international trade practice, has proved that Adam Smith's prediction is right. However, because the two countries are at different stages of economic development with different priorities, and because they have different economic systems, trade between the two nations is the "regulated" trade, rather than the free trade to which Adam Smith was devoted. Trade practices of the two countries are "regulated" by political ideologies and the economic protection of both governments. Trade policies of both governments could prohibit, permit, or encourage trade between the two countries, but they usually would not change
the existing basis of trade at least in short run since the
basis of trade between the two countries is related to
endowments of natural resources, technologies, capital and
labor force, and these endowments are results of long run
economic evolutions. In this sense, this thesis found that
some theoretical structures, such as the absolute advantage
theory and the comparative advantage theory, export and
import functions derived from the Keynesian income theory
and the purchasing power parity theory, and the Stolper-
Samuelson theorem, with some modifications, are generally
applicable to explanations of the basis, the gain,
determinants, and other aspects (such as impacts of trade on
the income distribution) of trade between the two countries.
Furthermore, with the theoretical analysis, it is found that
some protection measures of both countries are
understandable because of their solid economic backgrounds.

In China, both the opening to the world and the
transformation to the mixed economic system are in the same
process since 1978. For China, U.S.- China trade is one of
the most important aspects of the practice or experiment of
China’s new theory and new policy. Generally, the dynamic
econometric estimation of this thesis supports hypotheses
which are derived from the economic theory with some
modifications for China’s settings. It is interesting that
not only the theoretical analysis but also estimated results
of U.S.- China trade models which place emphasis on China’s
trade behavior and are as tests of export function and import function exhibit some characteristics which seem not to be consistent with traditional conceptions. First, only dynamic models rather than static models are valid for the case of U.S.-China trade. This implies that trade behaviors, China's economy, and economic and trade relations between the two countries contain more dynamic elements than that of other cases since most of the published empirical works showed that static models usually fit cases investigated. Second, estimated income elasticities including China's income elasticity to China's imports from the U.S. and especially U.S. income elasticity to China's exports to the U.S. are unusually higher than the same categories of other cases. It is found that the foreign investment including American investment in China could be heavily responsible for this special feature. Third, usually it is supposed that the trade behavior especially import behavior in a central economy are dominated by the government decision. However, this paper has showed that major factors of market systems, such as the price levels of both countries and exchange rates have significantly guided China's import behaviors whereas they have no significant impact on China's exports to the U.S. Obviously, related traditional propositions should be modified in explaining these facts.
Thus, U.S.-China trade is a kind of great practice between two great countries with different economic systems and political settings, and hence to some extent is a big challenge to policy makers, to people, to economic and political systems of both countries, and to the economic theory. Both governments and both peoples have broken away from conventional political ideologies to trade with each other for their own interests or for the interest of all human beings.

Moreover, some distinguished economists including J. M. Keynes in 1936 and P. A. Samuelson later believed that the Western society would enter or have entered the mixed economic system; many of China’s scholars and some of U.S. scholars believed or found that a mixed economic system is an appropriate way or structure for China’s economic development. In this sense, the practice of U.S.-China trade paves the way for economists to recognize common and different natures of mixed systems under different social and economic settings.
BIBLIOGRAPHY


