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A STUDY ON U. S. JAPANESE FOREIGN TRADE

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

Daniel R. Hachem, B.A.

Denton, Texas

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Hachem, Daniel, A Study on the U.S. Japanese Foreign Trade. Master of Science (Economics), August 1995, 118 pp., 2 tables, 5 graphs, references, 41 titles.

This research presents an in depth discussion and analysis on U.S. Japanese foreign trade. It is divided into two parts. The first hypothesis states that the appreciation of the dollar in the early eighties is positively correlated with the U.S. trade deficit, especially with Japan. The second hypothesis states that Friedrich Von Hayek's Theory of Social Order applies to the development of capitalism in that country. This can also be divided into two parts, a) this generation of Japanese consumes, saves, and invests differently than previous generations, and b) Japanese consumption and investment patterns follow U.S. consumption and investment patterns with a lag.

The findings seem to support the first hypothesis of this study. However, even though we find evidence to support the argument that there are changes in Japanese consumption and investment patterns, these changes do not follow U.S. consumption and investment patterns.

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CHAPTER I

INTRODUCTION AND BACKGROUND INFORMATION

Introduction

This paper is centered around the argument that free trade between the U.S. and Japan is essential for the prosperity and continued success of both nations. Chapter II, the literature review, consists of three sections. The first section presents an overview of the U.S. trade deficit and the value of the dollar, it also addresses theoretical developments in the areas of monetary theory, exchange rates, and international trade. Here, Tobin's argument that the value of the dollar is positively related to the trade deficit is presented. The second section deals with cultural influences on economic behavior in Japan and presents Friedrich Von Hayek's Theory of Social Order. The third section provides a general overview of consumption theory and investment theory. It is intended to be a theoretical background for the estimation of the consumption and investment functions in the empirical work. Chapter III, the proposed additions to the literature, presents the application of Tobin's argument and an extension of Hayek's Theory of social order to the Japanese case. This chapter also presents the methodology and the equations that will be used to test the two hypotheses. Chapter IV presents the

results of the empirical work introduced in the previous chapter. And finally, Chapter V presents an interpretation of the results and conclusions that can be drawn from this study.

Background

The United States, the youngest of the major industrial countries, was founded by people trying to escape excessive government authority in other countries. The people of the U.S. insisted on a constitution that minimized the concentration of power in the hands of the national government and adopted a value system centered around individualism, capitalism, and entrepreneurialism. The ideal role of government was to keep a low profile in economic issues and allow the free market to operate as best as possible (Gardner 1988). This is the very opposite of the Meiji Restoration in Japan, which lasted from 1868 to 1945 and gave the Japanese government extensive authority to modernize the economy. The priority of the Meiji Restoration included military power as well as economic strength. Its policies, which contributed significantly to economic growth, included a strong central government, mobility of labor, education, an improved infrastructure, industrial policy and a strong central bank. Another important policy was the introduction and diffusion of foreign technology; western technology and western engineers were brought to Japan and Japanese students were sent to the West. These

policies created an environment conducive to growth and prosperity which lasted until Japan's defeat in World War II (Ito 1992).

Devastated by World War II, Japan, under American occupation, began to rebuild the country and reconstruct the economy. U.S. efforts to open up the Japanese economy to pure competition and laissez faire did not last long. The zaibatsu, business conglomerates which were abolished by U.S. style antitrust laws, were soon replaced by keiretsus. Keiretsus are vertical and horizontal groupings of firms around a financial parent firm, they dominate the Japanese market. The homogeneous Japanese culture seemed to reject concepts of pure competition and free markets without government intervention, and chose to adopt a capitalist system tailored to Japanese society. In the late fifties, Japan's economy showed tremendous improvement and growth, in the seventies Japan's economic success was carried abroad and became international in scope (Gardner 1988). This growth has persisted until the early 1990's. There is also strong evidence as suggested by Ito that Japan's success after World War II is simply a continuation of the economic growth that started during the Meiji Era (Ito 1992).

The Japanese government has been very active in the development of the industrial sector and the economy as a whole. Its role has been to facilitate the business environment for companies and firms in a paternalistic way.

The government policy has been centered around two major elements, macroeconomic policy and industrial policy. Macroeconomic policy, which is controlled by the Finance Ministry, includes fiscal and monetary policy. The Ministry of Finance regulates interest rates, protects banks from insolvency, and ensures that bank lending activities support industrial policy. However, because of recent measures, these activities have become more indirect and subtle. The Japanese tax system is structured to encourage savings. The postal savings bank, the largest collector of deposits in Japan, allows individuals to deposit up to \$13,000 tax free annually (Gardner 1988). Industrial policy is conducted mainly by the Ministry of International Trade and Industry (MITI) and to some extent by the Economic Planning Agency (EPA). It consists of three major components: international trade policies, indicative planning, and administrative guidance.

The hypotheses of this study attempt to establish two major points, the first is that the value of the dollar is positively correlated with the U.S. Japanese trade deficit. The second hypothesis is that economic prosperity in Japan is closely related to the development of Capitalism in that country. In working with these hypotheses a great deal of weight is given to the differences in cultures and social structures of both the U.S. and Japan. The focus here is on the fact that some of the problems in U.S.-Japanese trade

can be directly linked to two different economic systems that have grown in two different directions over the years. It is important to note that the differences presented in this chapter cannot be eliminated or eradicated by utilizing political or economic pressures but rather by allowing the two countries to pursue their own economic interests.

The empirical work is divided into two parts, the import-export analysis and the U.S. and Japanese consumption and investment analyses. The import-export analysis consists of an import model, an export model, and a trade deficit model. The expectation here is that there exists a positive relationship between the value of the dollar and the U.S. imports, a negative relationship between the value of the dollar and U.S. exports, and a positive relationship between the value of the dollar and the U.S.-Japanese trade deficit. This part of the empirical work is critical in determining whether to accept or reject the first hypothesis. The U.S. and Japanese consumption and investment analyses are divided into two sections, consumption analysis and investment analysis for each country. The expectation here is that there are changes in Japanese consumption and investment and these changes are expected to be similar to those of the U.S. during the last three decades. This part of the empirical work is critical in determining whether to accept or reject the second hypothesis.

CHAPTER II

LITERATURE REVIEW

Chapter Overview

The purpose of this chapter is to present a discussion of the literature review and past studies related to this paper. The first two sections discuss various works on the U.S. trade deficit, the value of the dollar, and international monetary theory. These two sections form the basic framework upon which the first hypothesis is based. The second two sections discuss cultural influences on economic behavior in Japan and Friedrich Von Hayek's theory of social order, as well as how these two sections are combined to form the second hypothesis of this study. The third two sections present an overview of consumption theory and investment theory and are intended to be a theoretical background for the estimation of the consumption and investment functions in the next chapter. Chapter III, the proposed additions to the literature, presents the methodology and the models that are used to test the two hypotheses.

The U.S. Trade Deficit and the Value of the Dollar

A major problem the U.S. is facing is the trade deficit, especially with Japan (Emmott 1989). Husted (1992) conducted a study on the recent history of U.S. external

imbalances by testing for a long-run equilibrium relationship between U.S. exports and imports for goods and services. Using various assumptions as the basis of his empirical work, which focuses on cointegration models along the lines of Granger (1986) and Engle and Granger (1987), Husted finds evidence that the U.S. current account is nonstationary and thus the U.S. is violating its intertemporal budget constraint. Also, Husted finds evidence that the current deficits are not sustainable and that they could grow without limit. He also concludes that the two series were and remain cointegrated, but that in 1983, the long run relationship between the two shifted. Hypotheses concerning the exchange rate and the U.S. trade deficit are considered among the most important theories of macroeconomic protection. An overvalued currency makes it difficult for domestic firms to compete with imports. Tobin (1991) suggested that the U.S. trade deficit is caused by the fact that there is a high level of demand for foreign goods in the U.S. and that the best method to cut that demand is by raising prices. He also suggests that the appreciation of the dollar in 1982-85 is what caused the trade deficit to become so large.

Two empirical studies related to Tobin's argument that the appreciation of the exchange rate would decrease the trade deficit are Ceglowski (1989) and Nakibullah (1993). In the first study, Ceglowski uses 19 industries in the U.S. to

analyze the effects of the real exchange rate and the real interest rate on domestic sales, exports and imports. The results show that trade is exchange rate responsive in a number of industries. These industries include textiles, apparel, lumber, furniture, paper, chemicals, rubber and plastics, stone, clay and glass, machinery, electrical machinery, and instruments. On the other hand, a few industries seemed to be insensitive to exchange rate fluctuations, these industries include fabricated metals, petroleum and coal. Ceglowski concludes: "...the real exchange rate is a significant factor in most industry exports and non-durable imports. But, with the exception of lumber and furniture, it is relatively less important in the demand for durables imports, as judged by the size of real exchange rate elasticities." In the second study, Nakibullah analyzes the relationships between the U.S. budget deficit and real exchange rates, and between real exchange rates and domestic traded goods production. His results show that changes in the output of tradables and non-tradables are not statistically significantly correlated with changes in the real exchange rate. Also, it is seen that there is a negative correlation between the real exchange rate and changes in traded goods.

Issues in Monetary Theory and International Trade

The monetary approach to the balance of payments holds that the balance of payments should be analyzed by looking

at the supply and demand of money in a certain country. The supply of money can be expressed by the following equation (Appleyard and Field, 1992),

$$M_s = a(BR+C) \quad (2-1)$$

where: M_s is the money supply

BR is the reserves of commercial banks

C is the currency held by the nonbank public

a is the money multiplier

The demand for money can be expressed by the following equation (Appleyard and Field, 1992),

$$M_d = f[Y, P, i, W, E(P^*)] \quad (2-2)$$

where: M_d is the money demand

Y is the price level of real income in the economy

P is the price level

i is the interest rate

W is the level of real wealth

$E(P^*)$ is the expected percentage change in the price level

The money market is said to be in equilibrium when the quantity of money supplied equals the quantity of money demanded (Appleyard and Field, 1992),

$$M_s = M_d \quad (2-3)$$

or,

$$a(BR+C) = f[Y, P, i, W, E(P^*)] \quad (2-4)$$

In the case of fixed exchange rates and with the focus on the money supply, an increase in the money supply would cause people to have greater cash balances than they wish, this change will have several effects on the balance of payments. First, excess cash balances will cause individuals to spend more money on goods and services. If the economy is at full employment, this will cause the prices of goods and services (P in equation 2) to increase. If the economy is not at full employment, the level of real income (Y in equation 2) will rise. Also, if part of the new real income is saved, wealth (W in equation 2) will increase. It is important to note that there exists a negative relationship between the interest rate and the money demand (i in equation 2). The reason behind this relationship is that an increase in interest rates will cause individuals to reduce their demand for money in order to purchase interest earning assets. Now the question is, how do these changes affect the balance of payments? An increase in the price level will lead to larger imports, as home goods become relatively more expensive than foreign goods. This effect will also make it more difficult to export to other countries. An increase in the level of real income will lead to an increase in spending, some of this spending will be on imports. An increase in the level of real wealth will allow individuals to purchase more of all goods, exported and imported goods. Second, excess cash balances can affect the private capital

account in the BOP. Since holding financial assets is considered an alternative to holding cash balances, it can be assumed that the excess cash balances will be used to acquire financial assets. This will cause their price to increase and interest rates to decrease.

In the case of an excess demand for money, the adjustment process will work in reverse. A decrease in the money supply will cause an excess demand for money, individuals will reduce spending on goods and services which means that the demand for imports will fall. Also income and the price level will fall. The decrease in prices will cause exports to increase and imports to decrease. Therefore, the current account moves into a surplus. In addition, cash balances can be increased by selling off holdings of financial assets. This will lead to a surplus in the balance of payments. If the central bank chooses to buy the excess supply of foreign exchange at the fixed exchange rate, international reserves will be flowing into the country and causing the money supply to increase, and the balance of payments surplus will be eliminated.

The analysis presented above has assumed a fixed exchange rate. In the case of flexible exchange rates, the balance of payments deficits and surpluses will be eliminated by changes in the exchange rate. Assuming that M_s equals M_d , and that the monetary authorities increase the supply of money, thus creating an excess supply of money,

this will cause individuals to increase their spending on goods and services and on financial assets. The increase in spending will cause an increase in imports, a possible decrease in exports, and an increase in purchases of financial assets from foreign citizens. These factors will lead to what is known as an incipient deficit. This balance of payments deficit will cause the value of the currency to depreciate relative to other currencies. This depreciation will cause Y , P , and W to rise and i to fall. These changes will bring about an increase in the demand for money and thus the excess supply of money will be absorbed by the growing money demand.

In the case of an excess demand for money the process will work in reverse. This excess demand will cause goods and services expenditures and financial assets sales to increase. These factors will lead to what is known as an incipient surplus. This BOP surplus will cause the value of the currency to appreciate relative to other currencies. This appreciation will cause Y , P , and W , to decrease and i to increase, and this will bring about the adjustment process. In short, the difference between the fixed exchange rate and the flexible exchange rate case is that in the first case a balance of payments deficit (surplus) occurs, whereas, in the second case a depreciation (appreciation) of the currency occurs.

The monetary theory with flexible exchange rates will

be extended to a two country framework. In order to do this, it is necessary to introduce the quantity theory of money and purchasing power parity. The quantity theory of money is expressed by the simple formula presented by Irving Fisher (Mishkin 1986),

$$MsV = PY \quad (2-5)$$

where: Ms is the money supply

V is the velocity of money

P is the price level

Y is the level of real output

This formula states that the total spending in the economy is equal to the cost of goods and services produced and sold. By using the concept behind this theory, equation 2 can be expressed in a more general functional way (Appleyard and Field, 1992),

$$Md = kPY \quad (2-6)$$

where: Md is the money demand

P is the price level

Y is the level of real output

k is a constant. It is supposed to include i , W , $E(P^*)$ and other factors.

In a state of equilibrium (equation 3), Ms can also be expressed as,

$$Ms = kPY \quad (2-7)$$

Purchasing Power Parity states that commodities tend to have

the same price worldwide when measured in the same currency. Many believe that this argument is true in the case where markets are working well nationally and internationally, they argue that arbitrage will quickly erase any price differences between geographic locations. If goods and services follow purchasing power parity, then the absolute level of the exchange rate would be the price of the foreign currency such that traded goods and services have the same price in both countries when measured in the same currency.

Assuming that the quantity theory of money and purchasing power parity hold, a model for two countries, A and B is presented below (Appleyard and Field, 1992). It is important to note that a major assumption here is that $M_s = M_d$. The analysis begins with the following equation,

$$P_A = eP_B \quad (2-8)$$

where: P_A is the price level in country A (the home country)

e is the real exchange rate

P_B is the price level in country B (the foreign country)

e can be expressed as,

$$e = P_A/P_B \quad (2-9)$$

using the quantity theory of money for country A,

$$M_{sA} = kAPAY_A \quad (2-10)$$

for country B,

$$M_{sB} = kBPBY_B \quad (2-11)$$

dividing (10) by (11) we get,

$$M_sA/M_sB = (kAPAYA)/(kBPBYB) \quad (2-12)$$

this is also equivalent to,

$$M_sA/M_sB = [(kAYA)/(kBYB)]e \quad (2-13)$$

then e is equal to,

$$e = (kBYBMsA)/(kAYAMsB) \quad (2-14)$$

Two strong and obvious conclusions can be drawn from this last expression. The first is that changes in the relative money supplies are major determinants of changes in the exchange rate. That is, an increase in M_sA faster than M_sB will cause country A's currency to depreciate. Likewise, a decrease in M_sA relative to M_sB will cause country A's currency to appreciate. The second conclusion is that e will fall when Y_A rises, meaning that the home currency will appreciate. And a rise in Y_B will cause a depreciation of country A's currency.

Given the above model and discussion on monetary theory and exchange rates, it is very easy to see how monetary manipulation of exchange rates can take place. Monetary protectionism refers to attempts to alter exchange rates through the manipulation of monetary policy in the hopes of promoting a balance of payments objective. To avoid this form of protectionism, many concepts have been suggested: a monetary constitution, a gold standard for exchange rates, and a fixed exchange rate system. The argument in this paper

is that money growth should be handled very carefully; targeting price level and general economic stability, and interfering in exchange rate cases only in emergencies as determined by monetary authorities.

Bilson (1987) proposed an exchange rate intervention strategy as an alternative to conventional protectionist policies. He argues that traditional protectionist measures such as tariffs, quotas, and other barriers to trade, will lead to deterioration in international commerce. He also argues that his alternative structured program of intervention will allow for a higher degree of exchange rates and interest rates stability. On the other hand, Mussa (1987) argues for an equilibrium approach to trade. He states that under floating exchange rates and protection: "The inflow of foreign assets (or a reduction in foreign debts) associated with a trade surplus and a positive average level of protection in one period must generally be offset by an outflow of foreign assets (or an increase in foreign debts) associated with a trade deficit and negative average level of protection in some earlier or subsequent period." This conclusion supports the Tobin argument.

Cultural Influences on Economic Behavior in Japan

Economic prosperity and success allowed Japan to compete in the international market and become one of the world leaders in international trade. Issues and concerns in international economics today are centered around the U.S.-

Japanese relationship and the future of the two countries. Japan's prosperous industries and competitive companies presented a new challenge to European and American businesses. In the late 1980s, America has become the world's largest net debtor, and Japan has become America's and the world's largest net creditor. Between 1985 and 1988, the value of the Yen more than doubled against the dollar. Not even the world stock market crash of October 1987 could derail the Japanese economy in the 1980s (Emmot 1989).

Despite the fact that Japan has excelled in industrial organization and managerial techniques, its macroeconomic and international policies have been geared towards protectionism and nationalism. The current trend in international economics is the opening up and integration of world economies in the hopes of more efficient productivity and a higher standard of living. If Japan continues to protect its industries from international competition it is very likely that it will soon find itself unable to compete with other countries. The reasoning behind this argument is that other countries are currently in the process of forming economic blocks that will allow them to produce more efficiently; an example would be the European Union or the North American Free Trade Agreement (NAFTA) passed by Congress in December 1993. Also, today's young Japanese are the first generation to have been brought up in affluence. Their attitudes and behavior towards work and leisure are

very different from those of previous generations. In Japan they are called Shinjinrui which means "new humans". These and other events today constitute a major threat to future Japanese competitiveness. Thus, it is important for the Japanese government to realize that such policies are harmful not only to the world community but also to Japan itself. In Free to Choose (1990), Milton and Rose Friedman address the problem of protectionism and tariffs and ask a very important question: what are the Japanese going to do with all the dollars they will get from the U.S.? Also, according to the authors, free trade will create greater economic interdependence among countries and that can be an important factor in world peace.

Another problem with the Japanese economy is its keiretsu system which diminishes the powers of the market, competition, and efficiency. Today there are many kinds of firms involved in keiretsus: manufacturing, banking, financial, etc... The family parent is the major entity in the system, and everything else is secondary. The parents set their results and the rest is distributed to other members of the keiretsu. According to T. Boone Pickens (1992), the system is like a pyramid. There are cases where cross ownership exists among keiretsus; that means that changes in management cannot occur unless the cross ownership wants it. It is important to realize that such a system is not based on economics but rather on loyalties and

priorities, and would be very difficult if not impossible to maintain in the face of free international trade. Thus, on the one hand Japan cannot continue to isolate itself due to increased cooperation and on the other hand Japanese corporate structure, based on the keiretsus, cannot function in the free international market. One conclusion can be drawn here, change is inevitable. In the words of Pickens (1992), " It's been said that Japan should put its practices more in line with international practices. My response is, if they don't, then the Japanese are not going to have dominance in the 21st century. You can't build a wall around your economy".

In the sixties and seventies, the relative youth of Japan's population was a big advantage. Only 5% to 8% of the population was over 65. However, that is changing; according to the Economic Planning Agency, in 1995, 14% of the population would be over 65. That figure is expected to increase to 16.2% in 2000, 18% in 2005, and 23.5% in 2020 (Emmott 1989). In any country, people over 65 typically spend more than they save, they also receive transfer payments from other people. Three major forecasts were presented to measure the impact of demographic changes on the savings rate. The first method was done by applying official estimates of the change in the ages to official statistics on present savings, the second method was done by using an equation for savings variables developed by

professor Charles Horioka at Kyoto University, and the third method was done by using Barclays de Zoete Wedd's equation for the variables that determine savings. The results were as follows:

	<u>1995</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>
Method 1:	-1.4%	-1.9%	-2.8%	-2.9%
Method 2:	-0.2%	-5.4%	-11.6%	-18.2%
Method 3:	+1.2%	-6.3%	-17.1%	-28.7%

Source: Barclays de Zoete Wedd.

There is a big difference between these numbers, but it seems that they all agree that the aging of Japan's population will result in declining rates of savings after the year 2000.

One of the main studies on the role of protectionism on U.S. - Japanese trade was done by Staiger, Deardorff, and Stern (1988). In this paper, the authors analyze the effects of protection on the factor content of Japanese - American foreign trade. Using the Michigan Model of World Production and Trade, which was developed originally to analyze the economic effects of the Tokyo Round, the authors assess the distortions and harms of protection on both countries. The conclusion reached in this study is that Japanese protectionist policies tend to create greater distortionary effects than those of the U.S. and that the distortions

brought about by Japanese and American commercial policy can be largely related to non-tariff barriers (NTB's). This study also ranks the relative gainers in Japan and the U.S. from the pre-Tokyo round tariffs, the results are included in the appendix. The authors warn that their results are not to be taken quantitatively but rather descriptively and suggestively.

Friedrich Von Hayek's Theory of Social Order

Friedrich Von Hayek's Theory of Social Order points to a very common but erroneous belief that our social institutions and laws can be restructured by simply replacing them with newer and better ones. Hayek argues that our social order came into existence by a long and continuous process of social evolution, not by planning and inventing certain policies, rules, and laws. This process started thousands of years ago and will continue to evolve as long as society exists. What Hayek means here is that knowledge, habits, emotional attitudes, and behavior in general have been handed down from generation to generation. One of the examples of social evolution that Hayek uses is the wearing away of a footpath, where individual action can produce a beneficial but unplanned outcome. The creation of a footpath is nobody's invention or plan, it evolves from self interested individuals trying to take a short cut. Thus, changing our social order in a realistic way can only be done through an evolutionary process; that is, improving

and expanding our current order. This is where liberty plays an important role in Hayek's philosophy. Liberty and individualism are the means for society to achieve progress. It is liberty that allows individuals to criticize our social order and suggest new ways to improve and expand, allowing the social evolutionary process to move at a faster pace.

Applying Hayek's theory of social order to the Japanese case, it becomes very interesting to test whether this process of evolution can be applied to Capitalism in Japan. That is, does this generation of Japanese consume, save and invest any differently than the previous generations? and if so, can Japanese consumption and investment patterns be related to the development of the capitalist system in a way similar to that of the U.S.? These questions make up the second hypothesis of this study and will be addressed in the next chapter.

Consumption Theory

The purpose of this section is to provide an overview of consumption theory and present the consumption function that will be used to test the two hypotheses of this study. The specification of a consumption function has been a subject of great controversy in macroeconomic literature. Empirical studies have tested many consumption functions with different explanatory variables and have reached different conclusions. Perhaps the most important question

about the subject is whether consumption is related to income and if it is, how can this relationship be modeled?

The Absolute Income Hypothesis, introduced by J. M. Keynes in *The General Theory*, holds that real consumption is a function of real income. This can be written as,

$$C = a + bY_d \quad (5-1)$$

where: C is consumption

Y_d is disposable income

This simple and straight forward consumption function has been subjected to many empirical tests. Even though it was generally accepted at first, later on it turned out to have a major inconsistency. According to the theory, the Marginal Propensity to Consume (MPC) must lie between 0 and 1 and must be less than the Average Propensity to Consume (APC). Empirical studies seemed to support the argument that the MPC lies between 0 and 1, but failed to confirm that it is always less than the APC. This inconsistency led to further research on consumption and led to the development of alternative theories.

Duesenberry (1949) introduced the Relative Income Hypothesis, which states that consumer spending-saving decisions are based on relative income and not on absolute income. He argued that the ratio of saving to disposable

income (S/Y_d) is a function of current disposable income relative to the highest disposable income Y_d^* previously reached. That is, if disposable income decreases below a previous peak level, consumers would defend their position by reducing savings, and (S_t/Y_{dt}) would fall. On the other hand, if Y_{dt} were to increase at a steady rate, consumption would adjust itself to the new high level of disposable income and (S_t/Y_{dt}^*) would be constant. The Relative Income Consumption Function can be stated algebraically as,

$$S_t/Y_{dt} = a(Y_{dt}/Y_d^*) + b \quad (\text{saving function})$$

$$C_t/Y_{dt} = 1 - S_t/Y_{dt} \quad (\text{consumption function})$$

So,

$$C_t/Y_{dt} = 1 - [a(Y_{dt}/Y_d^*) + b] \quad (5-2)$$

where: S_t is savings in period t

Y_{dt} is disposable income in period t

Y_d^* is previous peak disposable income

a is a constant > 0

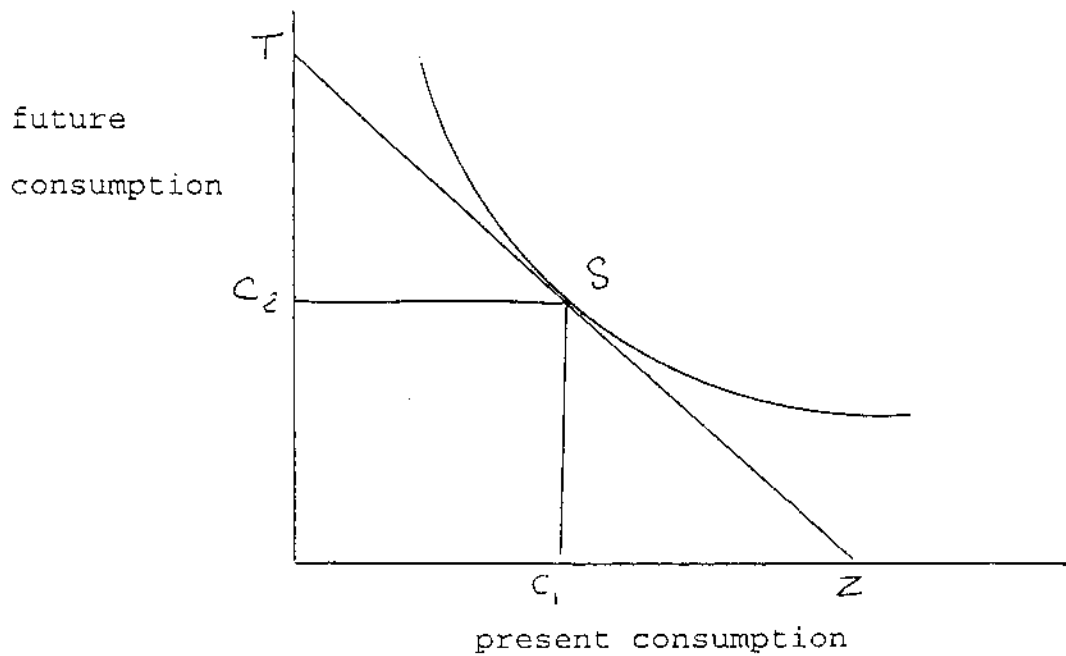
b is a constant $< \text{or} = 0$

Duesenberry concluded that growth in income fluctuates and since consumption responds to these short run fluctuations with a lag, it is easy to lose sight of the overall picture.

On the other hand, if we look at the big picture (long run), it is clear that consumption fluctuates in proportion with income. This hypothesis failed to explain differences in consumption patterns in the prewar and postwar periods, and this led to the development of what is often referred to as the Life Cycle Permanent Income Hypothesis.

The Life Cycle Permanent Income Hypothesis (LCPIH) was introduced by Friedman (1957) as the Permanent Income Hypothesis (PIH) and by Ando and Modigliani (1963) as The Life Cycle Hypothesis (LCH). The two theories are very similar except for their treatment of wealth. Friedman uses permanent income as a proxy for wealth, whereas, Ando and Modigliani define wealth and use that definition in the estimation process. The Permanent Income Hypothesis states that permanent consumption is a function of permanent income. Friedman argues that in the short run, consumption and income can fluctuate randomly due to transitory factors and unexpected events. In the long-run, however, these fluctuations will smooth out and the long run relationship between consumption and income will become apparent.

The following is a model of the Permanent Income Hypothesis, it begins with the consumption of the household and goes on to construct the consumption function. Figure 5-1 represents a household consumption function in a two period setting.



The budget line is TZ and its slope is:

$$\begin{aligned} OT/OZ &= [Y_2 + Y_1 (1+i)] / [Y_1 + Y_2 / (1+i)] \\ &= 1 + i \end{aligned} \quad (5-3)$$

The optimum combination of C_1 and C_2 is where the budget line is tangent to an indifference curve, point S. Looking at the graph, it is obvious that the budget line is determined by Y_1 , Y_2 , and i . Consumption, on the other hand, does not depend on these three variables but rather on the budget line TZ and its slope. Consumption, OC_1 depends on i and $[Y_1 + Y_2 / (1+i)]$. The second expression can be called household wealth, V_1 , and thus, it can be stated that the Permanent Income Consumption Function is a function of wealth and interest rates,

$$C_1 = f(V_1, i) \quad (5-4)$$

Friedman uses permanent income, Y_p , in place of wealth, V_1 , in the consumption function. Y_p in period 1 is equal to:

$$Y_{p1} = [iY_1 + (iY_2/1+i)] \quad (5-5)$$

He also introduces the concept of permanent consumption, C_p , and defines it as a function of permanent income. If receipts in period 1 were greater than permanent income, part of Y_1 must be saved so as to maintain the equality $V_1 = V_2$. On the other hand, if receipts in period 1 were less than permanent income, the household will borrow money without reducing V_2 . So, the household consumption function can now be written as:

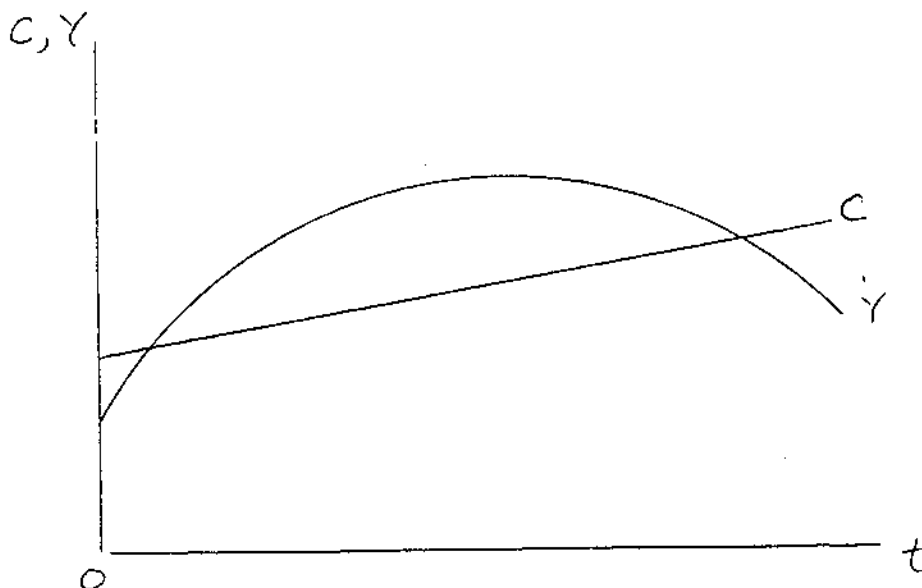
$$C_{p1} = h(Y_{p1}, i) \quad (5-6)$$

Equation (5-4) can be seen as a special case of equation (5-6) with the difference being that (5-4) is a consumption function for a two year period, where as, equation (5-6) does not have a time horizon. There are many different versions of this consumption function; these versions vary with the assumptions used by the researchers.

The Life Cycle Hypothesis starts with an assumption similar to Friedman's equation (5-4), which states that consumption can be written as:

$$C_t = f(V) \quad f'(V) > 0 \quad (5-7)$$

This says that an individual's consumption is an increasing function of his wealth. As stated above, the major difference between the Permanent Income and the Life Cycle Hypotheses is that Modigliani and Ando use wealth as part of the equation rather than estimating it by using permanent income. The Life Cycle Hypothesis can best be explained by figure 5-2.



Consumption is represented by line C, it increases steadily over time. Income is represented by line Y, it starts below consumption at earlier years, then goes over consumption and reaches a peak during middle or late working years, and finally declines sharply after retirement. So, the Life Cycle Consumption Function can be written as:

$$C_t = aV_t \quad (5-8)$$

The definition of V_t (for $t=0$) used by Ando and Modigliani is as follows:

$$V_t = A_0 + Y^1_0 + \sum (Y^1_t / (1+i)^t) \quad (5-9)$$

where: Y^1_0 is current nonproperty income

Y^1_t is nonproperty income the individual
expects at $t=0$ to earn t years from now

T is the remaining years of life

i is the rate of discount (assumed to be
the same for all periods)

A_0 is net worth

By defining the average expected labor income in time zero,
 Y^e_0 , as:

$$Y^e_0 = 1/(T-1) \sum [Y^1_t / (1+i)^t] \quad (5-10)$$

Ando and Modigliani rewrite the wealth equation at time zero
as:

$$V_0 = A_0 + Y^1_0 + (T-1)Y^e_0 \quad (5-11)$$

and use it as the form of the aggregate consumption
function:

$$C_0 = \alpha Y^1_0 + \alpha(T-1)Y^{e0} + \alpha A_0 \quad (5-12)$$

Ando and Modigliani assume that Y^{e0} is the same as current income except for a scale factor,

$$Y^{e0} = B Y^1_0 \quad 1 > B > 0 \quad (5-13)$$

So, the estimates of the consumption function as reported by Ando and Modigliani (1964) are as follows:

$$C_t = 0.7 Y^1_t + 0.06 A_{t-1} \quad (5-14)$$

Note that the coefficient of Y^1_t , derived from equations (5-12) and (5-13), is $\alpha[1+B(T-1)]$ and the coefficient of A_{t-1} is α . Also, T is assumed to be 38 (Ott, Ott, and Yoo 1983).

Hall (1978) and Flavin (1981) test the Life Cycle Permanent Income Hypothesis and reach different conclusions. Hall finds that there is little evidence that consumption can be predicted from its own past values; only consumption at period $t-1$ was relevant in predicting consumption at period t . He also finds that disposable income and stock prices (wealth) have little values in explaining consumption. Hall's overall conclusion is that there is little evidence against the LCPIH and goes on to suggest that consumption should be treated as an exogenous variable

in forecasting models. Flavin takes an alternative approach to testing the Life Cycle Permanent Income Hypothesis, her consumption model is based on the assumption that current income provides information about future income and can be seen as an indicator of changes in permanent income. She finds that consumption is related to income and therefore concludes that there is enough evidence to reject the LCPIH.

More recent studies on consumption include Mariger and Shaw (1993), Leung (1994), and Wolfson (1994) . Mariger and Shaw argue that previous studies using panel data from the Panel Study of Income Dynamics (PSID) have produced biased results which often led to the rejection of the Life Cycle model. This biasedness is attributed to unanticipated macroeconomic disturbances which cause forecast errors to be correlated with lagged information in a cross section of families in the PSID data. This bias has a tendency to be more severe the shorter the panel length, this helps explain the different conclusions reached by Altonji and Siow (1987) and Hall and Mishkin (1982). Both studies use the PSID data, Hall and Mishkin use only three years of data on consumption changes and find enough evidence to reject the Life Cycle Model. Where as Altonji and Siow use ten years of data and fail to reject the LCM. Mariger and Shaw build their own panel data model to test the Life Cycle Hypothesis, using PSID. Their results (obtained from longer sample periods) seem to confirm Altonji and Siow (1987) and support the LCM.

Leung (1994) incorporates the concept of uncertain lifetime into the Life Cycle Hypothesis. His work is based on Yaari (1965). Yaari's model (case A) cannot have an interior solution which lasts until the maximum lifetime. That is the individual cannot have positive savings throughout his lifetime, savings will be exhausted before he reaches his maximum lifetime. At this stage (savings = 0) his consumption will equal to his non interest income. Leung's empirical results show that many consumers will exhaust their wealth ten years after retirement and that savings will be depleted earlier the higher the discount rate, the lower the degree of risk aversion and the lower the wealth to income ratio. These results clearly contradict the LCPIH.

Wolfson (1994) addresses consumption theory from a Keynesian perspective. He argues that because the role of habit is a major component of consumption, consumption can be treated as a variable which depends on a moving average of past and current income rather than on current income alone. This view seems to be closer to Friedman's Permanent Income Hypothesis than the traditional Keynesian analysis. Wolfson suggests that the similarity between Keynes' analysis and Friedman's Permanent Income Hypothesis allows the traditional Keynesian consumption function to be rewritten as,

$$C^D = C_0 + cY = C^* + c(Y - Y^*) \quad (5-15)$$

where: Y^* is expected income

$C^* = C_0 + cY^*$ is quantity consumed when
actual income is equal to expected income

$Y - Y^*$ is transitory income (or a shock to
income)

and

$$C^s = c(W) \quad (5-16)$$

where: W is wealth

Wolfson rejects the assumption that only short term expectations influence consumption. He argues that if wealth is considered to be a determinant of consumption, then long term expectations and uncertainty which are relevant to investment demand (see discussion on Wolfson's investment function in the next section), must also be relevant to the evaluation of wealth. When these two factors, uncertainty and long term expectations, are taken into consideration, equation (1) can be rewritten as an extended version of the consumption function,

$$\begin{aligned}
 & \quad + \quad + \quad + \quad - \quad + \quad - \\
 C^D &= c[Y, W, (E,U), w, P^c] \\
 & \quad + \quad + \quad + \quad - \quad + \\
 &= c[Y, W, (E,U), w/P^c] \quad (5-18)
 \end{aligned}$$

Where: Y is real income
 W is real aggregate wealth
 E is the long term expectations
 U is the uncertainty
 w is the money wage
 P^c is the price level of consumption goods
 w/P^c is the real wage

Two consumption functions will be used in chapter III to estimate U.S. and Japanese consumption. The first is similar to the one used by Hall (1978) and is as follows,

$$C_t = C_{t-1} + DY_t + DY_{t-1} + DY_{t-2} + DY_{t-3} + \\ DY_{t-4} + e \quad (5-19)$$

Where: C is consumption
 DY is disposable income

The second is a simplified version of (5-19), in the sense that current and lagged disposable income are excluded from the model,

$$C_t = C_{t-1} + e \quad (5-20)$$

The estimation of the equations above will help us determine whether consumption in the U.S. and Japan can be explained

or predicted from lagged consumption and lagged income. This will also help us determine if the Life Cycle Permanent Income Hypothesis applies to this study, and if so, can we conclude as Hall (1978) does that consumption can be treated as an exogenous variable?

Investment Theory

The purpose of this section is to provide an overview of investment theory and present the investment function that will be used to test the two hypotheses of this study. Net investment is defined as the time rate of change of the stock of capital,

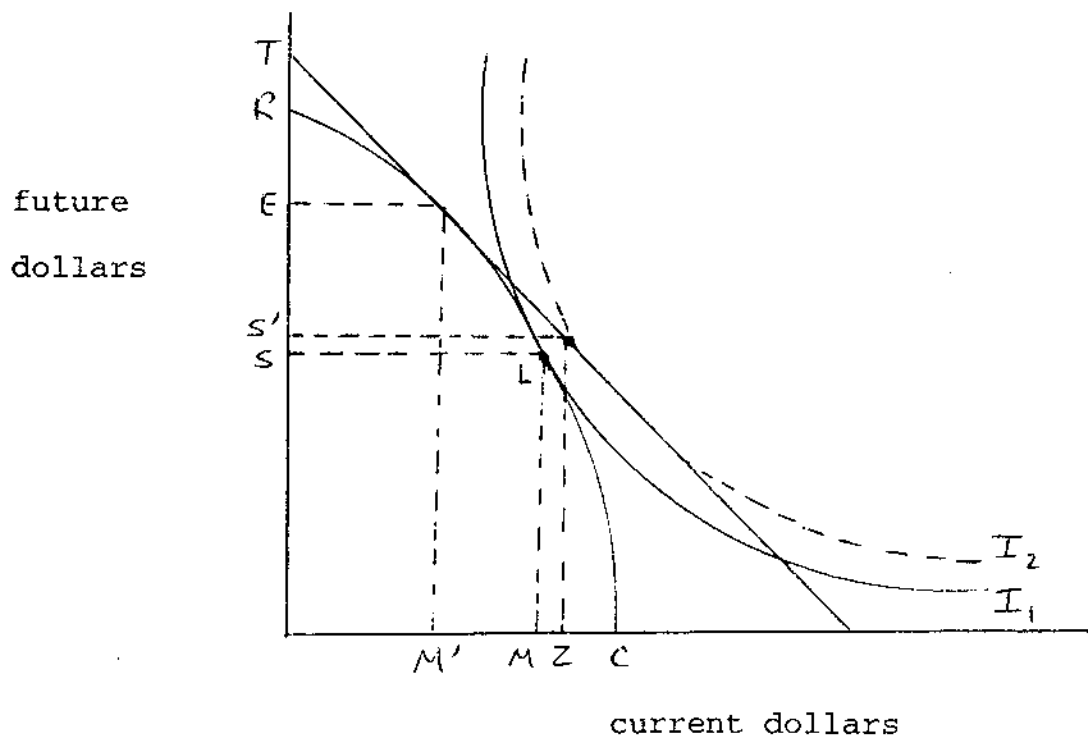
$$IN = dK/dt \quad (6-1)$$

According to this definition, changes in the desired stock of an asset will affect the individual's investment decisions. If we let K be the actual stock of an asset and K^* be the desired (or optimum) stock of that asset, the decision to invest can then be viewed as a function of the difference between K and K^* . So, it is important to attempt to explain how K^* is determined and what causes it to change.

Modern investment theory combines microeconomic foundations with aggregate investment theory to form the aggregate investment function. This is done by the theory of the demand for a flow of capital goods based on the profit maximizing theory of the firm and a lag stock adjustment hypothesis. The model begins with the firm's

demand for a flow of capital services. And since the acquisition of these capital services is not independent of the firm's stock of capital goods, we assume that the flow of capital services is proportional to the stock at hand. So, changing the rate of capital services can be accomplished by changing the size of the capital stock.

Figure 6-1 is a graphical representation of the theory of the firm.



RC is the firm's production function, it represents all the combinations of present and future incomes the firm can produce with its current revenues OC. I1 and I2 are the utility functions of the owners of the firm, they represent the owners' satisfaction level. If credit is excluded from our analysis, point L would be the optimum, since I1 would be the highest indifference curve tangent to the production possibilities line and the point of tangency is L (note that in this case CM is the amount invested). However, a more realistic analysis would include credit in the model and that would cause the firm to maximize the utility of the owners by investing CM' of its current revenues and borrowing MM' and paying the owners OZ of current income and OS' of future income. This would place the owners at indifference curve I2. This is the equivalent to maximizing the present value of the flow of net proceeds (PVR) to the firm (current revenues less gross investment).

$$PVR = OM' + OE/(1+i) \quad (6-2)$$

Given access to the capital markets, maximizing PVR is the same as maximizing utility. This is the foundation of the neoclassical models.

Assuming that the firm produces one homogenous output, Y, and has only two inputs, capital, K, and labor, N, the firm's production function can be written as:

$$Y_t = F(N_t, K_t) \quad (6-3)$$

also, if we let:

p_t be the price of a unit of output

w_t be the wage rate

q_t be the price of a unit of capital

I be the gross investment in capital

T be taxes

the net proceeds can be defined as:

$$R = pY - qI - wN - T \quad (6-4)$$

The value of the firm can then be defined as the present value of the anticipated stream of net proceeds (at $t=0$) and written as:

$$V = \int_0^{\infty} e^{-it} (pY - qI - wN - T) dt \quad (6-5)$$

Now we need to derive the optimum capital stock. This can be done by maximizing (6-3) subject to the following constraints:

$$F(Y, K, N) = 0 \quad (6-3a)$$

$$I_t = \delta K_t + dK/dt \quad (6-6)$$

and

$$IN = dK/dt = K'(t) = I(t) - \delta Kt \quad (6-6a)$$

where: δ is the rate of economic depreciation
and δKt is economic depreciation.

So, we form the Lagrangian,

$$L = \int [e^{-it} R(t) + \Gamma_0(t) F(Y, N, K) + \Gamma_1(t) (K' - I + \delta K)] dt \quad (6-7)$$

$$L = \int f(Y, N, I, K, K', \Gamma_0, \Gamma_1, t) dt \quad (6-8)$$

where: $K' = dK/dt$

The Euler conditions necessary for a maximum of the present value of the firm are as follows,

$$\partial f / \partial Y = e^{-it} p + \Gamma_0(t) (\partial F / \partial Y) = 0 \quad (6-8a)$$

$$\partial f / \partial N = -e^{-it} w + \Gamma_0(t) (\partial F / \partial N) = 0 \quad (6-8b)$$

$$\partial f / \partial I = -e^{-it} q + \Gamma_1(t) = 0 \quad (6-8c)$$

$$\begin{aligned} \partial f / \partial K - (d/dt) (\partial f / \partial K') = \\ \Gamma_0(t) \partial F / \partial K + \delta \Gamma_1(t) - d/dt \Gamma_1(t) = 0 \end{aligned} \quad (6-8d)$$

$$\partial f / \partial \Gamma_0 = F(Y, N, K) \quad (6-8e)$$

$$\partial f / \partial \Gamma_1 = K' - I + \delta K = 0 \quad (6-8f)$$

The condition for the optimal growth of capital is expressed by equation (6-8d). The marginal productivity condition for labor can be derived by combining (6-8a) and (6-8b),

$$\Gamma_0(t) \partial F / \partial N = e^{-it} w$$

$$\Gamma_0(t) \partial F / \partial Y = -e^{-it} p$$

$$(\partial F / \partial N) / (\partial F / \partial Y) = -(\partial Y / \partial N) = -(w/p)$$

$$\partial Y / \partial N = w/p \quad (6-9)$$

So, the marginal product of labor is equal to the real wage.

The marginal productivity condition for the services of capital is obtained from (6-8a), (6-8c), and (6-8d). First, from (6-8c) we get an expression for $\Gamma_1(t)$:

$$\Gamma_1(t) = -e^{-it} q \quad (6-10)$$

Substituting this into (6-8d), we get:

$$\begin{aligned} \Gamma_0(t) \partial F / \partial K - \delta e^{-it} q + d/dt(e^{-it} q) &= 0 \\ = \Gamma_0(t) \partial F / \partial K - \delta e^{-it} q + (-ie^{-it} q + e^{-it} q') &= 0 \\ = \Gamma_0(t) \partial F / \partial K - e^{-it} q (\delta + i - q'/q) &= 0 \quad (6-11) \end{aligned}$$

Combining (6-11) and (6-8a) we get the marginal productivity condition for capital services:

$$\Gamma_0(t) \partial F/\partial K = e^{-it}q (\delta + i - q'/q)$$

$$\Gamma_0(t) \partial F/\partial Y = -e^{-it}p$$

$$\begin{aligned} (\partial F/\partial K)/(\partial F/\partial Y) &= - \partial Y/\partial K = \\ &= - q [\delta + i - (q'/q)] / p = - c/p \end{aligned}$$

$$\partial Y/\partial K = q [\delta + i + (q'/q)] = c/p \quad (6-12)$$

c is the implicit rental value per unit of capital, and is equal to,

$$c = [\delta + i + (q'/q)] \quad (6-13)$$

So, equation (6-12) states that the firm will reach an equilibrium level of capital stock when the marginal product of capital $p(\partial Y/\partial K)$ is equal to its implicit rental value c . That is,

$$p (\partial Y/\partial K) = q [\delta + i + (q'/q)] \quad (6-14)$$

The interpretation of equations (6-13) and (6-14) is that the rent on a unit of capital must cover the opportunity

cost of lending the funds used to buy it (i) plus the economic depreciation (δ) less the expected rate of capital gains per period due to a rise in the unit price of capital goods.

When we introduce taxation into this model, the user cost or the implicit rental value of capital services becomes,

$$\begin{aligned}
 c &= \{[(1-u)R + \delta - (q'/q)(1-gu)](1-k-uz)q\} / 1-u \\
 &= q\{[(1-u)R + \delta - (q'/q)(1-gu)](1-k-uz)\} / 1-u
 \end{aligned}$$

(6-15)

where: R is the before tax rate of return (R allows for the deductibility of interest payments)

u is the corporate tax rate

g is the differential tax rate applicable to capital gains income

k is the rate of tax credit per dollar of asset

z is the present value of depreciation deductions

q is the prices per unit of capital

$[(1-u)R]$ is the discount rate (the after tax rate)

$[(1-u) c(t)]$ is the stream of values of rentals of capital services (the after tax stream)

$q(1-k-uz)$ is the acquisition cost per unit, it can also be written as $q - qk - quz$. In words, this equation states that the acquisition cost per unit is equal to the price per unit of capital, q , less than the tax savings via the investment tax credit, qk , and the savings through depreciation deductions which sum to the price of the asset, quz .

Comparing (6-13) with (6-15), we can see that the corporate tax affects the cost of capital because of the tax treatment of depreciation, the deductibility of interest (R not equal to i), the investment tax credit, and the preferential treatment of capital gains (g not equal to 1). That is, the corporate tax would be neutral in its effect on investment if capital gains, g , were taxed at some rate different than income. If interest payments were not deductible and the present value of tax savings through depreciation deductions and the investment tax credit under tax laws were the same as the present value of the tax savings from deducting depreciation, then the user cost of capital reduces to,

$$c = q(i+\delta) \quad (6-16)$$

So, it is clear that the user cost of capital is sensitive to the tax treatment of income from capital.

The question now is how does the corporate tax rate affect c . If we assume that R is constant, a decrease in corporate tax would increase the cost of capital if tax depreciation and credits are greater than economic depreciation. This would also reduce the cost of capital if the present value of economic depreciation exceeds the present value of tax depreciation plus the investment tax credit. If on the other hand, the after tax rate of return $[(1-u)R]$ is constant, a fall in the corporate tax rate will reduce c as long as the present value of tax depreciation plus investment tax credit is less than the cost of the capital asset.

When it comes to empirical work, two issues related to the optimum stock of capital, K^* , remain unresolved. These are, which production function (regarding the assumptions about σ) and which rate of return, R , need to be used. Jorgenson (1967) argued that $\sigma=1$ and used a constant rate of return in his study. Even though his assumption that $\sigma=1$ was challenged by Eisner and Nadiri (1968), several studies seemed to confirm his assumption, Jorgenson and Stephenson (1968) and Bischoff (1969).

Before we can address the issue of net investment and present the neoclassical investment function, we need to introduce the Constant Elasticity of Substitution (CES)

production function. The equation for the CES production function is,

$$Y = \tau[\delta K^{-\phi} + (1-\delta)N^{-\phi}]^{-1/\phi} \quad (6-17)$$

where: Y is output

τ is the scale parameter

ϕ is the substitution parameter

($\phi = 1/\sigma - 1$, where σ is the elasticity of substitution and is > 0)

δ is the distribution parameter

Note that $\tau > 0$ and $0 < \delta < 1$. The marginal product of capital is,

$$\partial Y / \partial k = (Y/K)^{1+\phi} \tau^{-\phi} \delta \quad (6-18)$$

In order to find the optimum stock of capital (K^*) of the firm using the CES production function, we plug equation (6-18) into (6-14) and get,

$$p[(Y/K)^{1+\phi} \tau^{-\phi} \delta] = c \quad (6-19)$$

$$K^* = A(p/c)^{\sigma} Y \quad (6-19a)$$

where $A = (\tau^{\phi} \delta^{-1})^{-\sigma}$ and is a constant.

Now we define net investment and derive the neoclassical investment function by using the CES production function. Net investment can be defined as $K^*t - K^*t-1$ and can be written as,

$$\begin{aligned} INT_t &= I_t - \delta K^*t-1 \\ &= M_0(K^*t - K^*t-1) + M_1(K^*t-1 - K^*t-2) \dots \quad (6-20) \end{aligned}$$

where: M 's represent the proportion of investment orders
 δK^*t-1 represents replacement investment

Net investment is equal to,

$$IN = dK^* \quad (6-21)$$

Assuming that the elasticity of factor substitution (σ) is equal to 1, The optimum stock is,

$$K^* = A(p/c)Y \quad (6-22)$$

and net investment can be written as,

$$dK^* = d[A(p/c)Y] \quad (6-23)$$

which is equal to,

$$dK^* = IN = Yd(Ap/c) + (Ap/c)dY \quad (6-24)$$

Since gross investment is equal to net investment plus depreciation (equation 6-6), we can write the neoclassical investment function as (Ott, Ott, and Yoo 1983),

$$I = Yd(Ap/c) + (Ap/c)dY + \delta K \quad (6-25)$$

Recent studies on the investment function include Wolfson (1994) and Stevens (1994). Wolfson argues that firms use the current interest rate and long run expectations to calculate the present value of investment. Uncertainty is negatively correlated with investment; the higher the uncertainty level the more likely firms are going to remain liquid. In equilibrium, the role of uncertainty in the investment process makes the net present value (NPV) of the marginal piece of investment goods equal to zero. So, according to Wolfson, the demand for investment depends on the price of capital, long run interest rates, and expectations. This can be written as,

$$I^D = I [P^k, r^L, E(U)] \quad (6-26)$$

where: P^k is the price of new capital goods

r^L is the long term interest rate

E is the expected profits from new capital

modified by the level of uncertainty.
 This is also known as the marginal
 efficiency of capital (MEK).

Where the supply can be written as,

$$I^s = I(W) \quad (6-27)$$

where: W is wealth

He argues that I_0 in the traditional Keynesian investment function, $I = I_0 - kr$, contains almost all the factors affecting investment. These include the price of capital, expectations, and wealth from the supply side.

Stevens argues that the capital stock variables in investment functions are inaccurate. This is due to the fact that $K(0)$, the initial real capital stock, is implicitly a component of every measure of capital stock in the equation and it is almost impossible to obtain an accurate measure of $K(0)$. Stevens goes on to introduce a method to correct the problem, he starts with the following equation,

$$K(t) = I(t) + (1-\delta) K(t-1) \quad (6-28)$$

where: $K(t)$ is the measure of the real capital
 stock at time t

$I(t)$ is the real rate of investment at time
 t

δ is the rate of depreciation of capital
 stock

By successive backward substitution for $K(t-1)$, equation (6-28) can be rewritten as,

$$K(t) = \sum [I(t-i)(1-\delta)^i] + K(0)(1-\delta)^t + e \quad (6-29)$$

where: e is the error term

Stevens uses equation (6-29) as an error-free substitute for the capital stock variable for the following investment function,

$$I(t) = \alpha + \beta Q(t) + \tau K(t) + e \quad (6-30)$$

where: $I(t)$ is investment

$Q(t)$ is output

$K(t)$ is capital stock

e is the error term

Despite the fact that $K(0)$ is inaccurate, equation (6-29) allows us to obtain unbiased estimates for α , β , and τ . Substituting (6-29) into (6-30), we get,

$$I(t) = \alpha + \beta Q(t) + \tau [WS(t) + K(0)(1-\delta)^t] + e \quad (6-31)$$

where: $WS(t)$ is the weighted sum of past investment rates in equation (6-27)

Equation (6-31) can be rewritten as a linear regression equation,

$$I(t) = \alpha + \beta Q(t) + \tau WS(t) + \tau K(0)(1-\delta)^t + e \quad (6-31a)$$

In equation (6-31a) there is no measurement error in any of the regressors, $WS(t)$, $(1-\delta)^t$, $Q(t)$. So, this approach will improve the estimation of investment functions by eliminating problems associated with $K(0)$. Stevens applies this method to Stevens and Lipsey (1992) and shows that the method outlined above improved the results substantially.

Two versions of Equation (6-31a) will be used in the estimation of the U.S. and Japanese investment functions in Chapter III. The first version includes the index of industrial production as a measure of output, where as the second version includes disposable income. The investment functions for both countries will be examined and compared to determine if there are any similarities in investment patterns between the U.S. and Japan.

Conclusion

This chapter provides the literature review for this research and serves as a background for the presentation of the two hypotheses and the empirical work. The rest of the

paper is centered around the models and data that are used to test the two hypotheses of this study.

CHAPTER III

PROPOSED ADDITIONS TO THE LITERATURE

Introduction

This chapter presents the two hypotheses of this study. The models that are used to test these hypotheses as well as the expected results are also included. This is followed by a brief discussion on data collection.

The Hypotheses

The first proposition is based on James Tobin's argument. That is the appreciation of the dollar in the early eighties is positively correlated with the trade deficit. To test this hypothesis, the main economic variables that are needed are U.S. exports, U.S. imports, U.S. exports to Japan, U.S. imports from Japan, the value of the dollar, and the value of the dollar versus the Yen. Model (1.1), the import model, and model (1.2), the export model, test the relationship between the value of the dollar and U.S. imports and U.S. exports. Model (1.3), the trade deficit model, tests the relationship between the U.S.-Japanese trade deficit and the value of the dollar (measured against the Yen). The three models cover the time period of 1975-91. The import model,

$$M = B_0 + B_1D + B_2GNP + B_3POL + e \quad (1.1)$$

where: M is real U.S. imports
 D is the real effective exchange rate
 GNP is the real U.S. GNP
 POL is a dummy variable -
 0 for a Democratic administration
 1 for a Republican administration
 e is the error term

For this model we need to test the following hypothesis,

H0: There is no empirical relationship between the value of the dollar and U.S. imports.

Specifically, $B_1=0$.

Ha: There is an empirical relationship between the value of the dollar and U.S. imports.

Specifically, $B_1>0$.

In model (1.1), we can expect a positive correlation between the dependent variable, U.S. imports and the independent variables, the value of the dollar and U.S. GNP. Model (1.2),

$$X = B_0 + B_1D + B_2IIP + B_3POL + e \quad (1.2)$$

where: X is real U.S. exports

D is the real effective exchange rate

IIP is the index of industrial production
for industrialized countries

POL is a dummy variable -

0 for a Democratic administration

1 for a Republican administration

e is the error term

For this model, we need to test the following hypothesis,

H₀: There is no empirical relationship between the
value of the dollar and U.S. exports.

Specifically, $B_1=0$.

H_a: There is an empirical relationship between the
value of the dollar and U.S. imports.

Specifically, $B_1<0$.

In model (1.2), we can expect a negative correlation between
the dependent variable, U.S. exports, and the independent
variables, the value of the dollar and foreign GNP. The
trade deficit model,

$$TDJ = B_0 + B_1DY + B_2UGNP + B_3JGNP + B_4POL \quad (1.3)$$

where: TDJ is U.S. exports to Japan less U.S.
imports from Japan

DY is the real U.S. dollar versus Yen

UGNP is real U.S. GNP

JGNP is the real Japanese GNP

POL is a dummy variable -

0 for a Democratic administration

1 for a Republican administration

e is the error term

For this model, we need to test the following hypothesis,

H₀: There is no empirical relationship between the value of the dollar and the U.S.-Japanese trade deficit. Specifically, $B_1 = 0$.

H_a: There is an empirical relationship between the value of the dollar and the U.S.-Japanese trade deficit. Specifically, $B_1 > 0$.

In model (1.3), we can expect a positive correlation between the dependent variable, the U.S.-Japanese trade deficit and the independent variables, the value of the dollar and the Japanese GNP, and a negative correlation between the dependent variable and the independent variable, U.S. GNP.

The second proposition is based on Friedrich Von Hayek's Theory of Social Order. Japan adopted capitalism and its institutions in 1945; the system is still at an early stage of development. Thus, the drive to achieve economic prosperity at the costs of protectionism,

nationalism, and the Keiretsu system points to an early and simple form of capitalism. In time, this system will evolve and change, and as Japanese capitalism becomes more sophisticated we will see a shift in policies towards free market economics, individualism, and the promotion of international trade. From that perspective, it can be seen that these changes will have major effects on individual behavior, causing changes in patterns of investment, consumption, and savings. It is very possible that these changes will resemble changes in investment, consumption, and savings in the U.S. after World War II. To observe this process, today's twenty-to-thirty year olds are the first generation of Japanese to have been brought up in affluence. Their attitudes towards spending, borrowing, saving, leisure, and work are different from their parents'; in Japan they are called Shinjinrui. An example of institutional change would be changes in the role of the MITI over the years. In the fifties and sixties it used to be a regulatory and licensing muscle to guide industry; its role today has become somewhat of an information broker. To test this hypothesis, the main economic variables that are needed are, consumption, investment, private wealth, interest rates, income, GNP, and capital stock for both the U.S. and Japan. The testing for this hypothesis is divided into two parts.

The first part is consumption analysis, the first

section includes models (2.1.a) and (2.1.b) applied to both the U.S. and Japan and covers the time period of 1965-91.

$$C_t = B_0 + B_1 C_{t-1} + B_2 DY_t + B_3 DY_{t-1} + B_4 DY_{t-2} + B_5 DY_{t-3} + B_6 DY_{t-4} + e \quad (2.1.a)$$

$$C_t = B_0 + B_1 C_{t-1} + e \quad (2.1.b)$$

where: C is consumption

DY is disposable income

For model (2.1.a), we need to test the following hypothesis,

H₀: There is no empirical relationship between consumption and income.

H_a: There is an empirical relationship between consumption and income.

In this model, we can expect a positive correlation between consumption and income. For model (2.1.b), we need to test the following hypothesis:

H₀: There is no empirical relationship between consumption at time t and consumption at time t-1,

specifically, $B_1 = 0$.

Ha: There is an empirical relationship between consumption at time t and consumption at time $t-1$, specifically, $B_1 > 0$.

For this model, we can expect a positive relationship between the two variables. The second section is a graphical representation of U.S. and Japanese consumption.

The second part is investment analysis, the first section includes models (2.2.a) and (2.2.b) applied to both the U.S. and Japan and covers the time period of 1965-91.

$$I = B_0 + B_1 IIP + B_2 WS + B_3 DEP \quad (2.2.a)$$

$$I = B_0 + B_1 DY + B_2 WS + B_3 DEP \quad (2.2.b)$$

where: IIP is the index of industrial production

DY is disposable income

WS is $\sum [I_{t-1} (1-\delta)^i]$

DEP is $(1-\delta)^t$

For these models, we need to test the following hypotheses,

H0: There is no empirical relationship between investment and IIP (disposable income in 2.2.b).

Ha: There is an empirical relationship between investment and IIP (disposable income inn 2.2.b).

Here, we can expect positive correlations between investment and IIP and investment and disposable income. The second section is a graphical representation of both U.S. and Japanese investments.

Data Collection

The data for this study was obtained mainly from the International Monetary Fund (IMF) International Financial Statistics (IFS), the National Accounts Statistics (NAS), and the Economic Report for the President. The data has a base year of 1985. All nominal data was converted to real data by using the Consumer Price Index (CPI) as the divisor.

Summary

The two hypotheses presented above can be summed up as follows,

- 1)-The appreciation of the dollar in the early eighties is positively correlated with the trade deficit, especially with Japan.
- 2)-Friedrich Von Hayek's Theory of Social Order applies to the development of capitalism in Japan. That is,
 - a)-This generation of Japanese consumes, saves, and invests differently than previous generations.
 - b)-Japanese consumption and investment patterns follow U.S. consumption and investment patterns

with a lag.

The results of the models for these hypotheses and an analysis of findings are presented in the next two chapters.

CHAPTER IV

RESULTS OF EMPIRICAL WORK

Chapter Overview

This chapter reports the results of the models discussed in the previous chapter. The results of the import, export, and trade deficit models are presented and analyzed first. This is followed by the results of the consumption and investment analyses. Interpretations and discussions are also included in this chapter. Because of problems with autocorrelation, models (2.2.a) and (2.2.b) for Japan and models (2.1.a), (2.1.b), and (2.2.a) for the U.S. were estimated by using the Maximum Likelihood method, these models are marked by the symbol *. All the other models were estimated by using Ordinary Least Squares.

The results of the import, export, and trade deficit models are presented in the next section. These models are expected to support the argument that the appreciation of the dollar in the early eighties is positively correlated with the U.S. trade deficit, especially with Japan. This analysis will help us determine whether to accept or reject the first hypothesis of this study.

Results of the Import, Export, and Trade Deficit Models

The results of the import model, model (1.1), are as follows,

$$M = -2.528 + 0.003 D + 0.150 GNP - 0.216 POL$$

$$(0.63) \quad (0.004) \quad (0.01) \quad (0.12)$$

Where standard errors are in parentheses. B0, the intercept, is -2.528. B1, the coefficient for the value of the dollar, is 0.003. B2, the coefficient for GNP, is 0.150. B3, the coefficient for the dummy variable POL, is -0.216. The model has an $R^2 = 0.94$. To determine whether these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2>0$

H04: $B_3=0$

Ha4: $B_3 \text{ not } = 0$

At the 95% significance level with 13 degrees of freedom, The critical value is 2.160 for a two tailed test and 1.771

for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	-4.026	2.160	sufficient evidence to reject H0
B1	0.699	1.771	fail to reject H0
B2	12.691	1.771	sufficient evidence to reject H0
B3	-1.869	2.160	fail to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

Ha: At least one of the parameters is non zero

The test statistic used to test this hypothesis is an F-statistic, the F value for the import model is 71.32. At the 95% significance level with $v_1 = 3$ and $v_2 = 13$ degrees of freedom, the critical value is 3.41. Since the F value is greater than the tabulated value, we can conclude that at least one of the coefficients is nonzero and thus, the model is useful in predicting U.S. imports.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The statistic used to test this hypothesis is the Durbin-Watson (D-W) statistic. The D-W statistic for this model is 1.365. The rejection region for positive autocorrelation is $d < d_L, \alpha/2$. $d_L, 0.05$ with $k=3$ degrees of freedom is 0.90. The rejection region for negative autocorrelation is $(4-d) < d_L, \alpha/2$. $(4-d) = 2.635$. Since $d > 0.90$ and $(4-d) > 0.90$, we fail to reject the null hypothesis.

Since we failed to reject the null hypothesis for B1, the parameter for the value of the dollar, we can conclude that there is no evidence to support the argument that the value of the dollar is positively correlated with U.S. imports. According to the F test and the D-W test, we can also conclude that the model is useful in predicting U.S. imports and that there is no evidence of first order autocorrelation in the residuals.

The results of the export model, model (1.2), are as follows,

$$\begin{array}{cccc}
 X = 1.878 - 0.014 D + 0.019 IIP - 0.054 POL \\
 (0.71) \quad (0.005) \quad (0.005) \quad (0.15)
 \end{array}$$

Where standard errors are in parentheses. B0, the intercept, is 1.878. B1, the coefficient for the value of the dollar is

0.014. B_2 , the coefficient for the index of industrial production for industrialized countries, is 0.019. B_3 , the coefficient for the dummy variable POL, is -0.054. The model has an $R^2 = 0.75$. To determine whether these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } =0$

H02: $B_1=0$

Ha2: $B_1 < 0$

H03: $B_2=0$

Ha3: $B_2 > 0$

H04: $B_3=0$

Ha4: $B_3 \text{ not } = 0$

At the 95% significance level with 13 degrees of freedom, the critical value is 2.160 for a two tailed test and 1.771 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	2.635	2.160	sufficient evidence to reject H0
B1	-2.665	1.771	sufficient evidence to reject H0

B2	3.736	1.771	sufficient evidence to reject H0
B3	-0.358	2.160	fail to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

Ha: At least one of the parameters is non zero

The F value for the export model is 13.332, whereas the critical value is 3.41. So, we can conclude that at least one of the coefficients is nonzero and thus, the model is useful in predicting U.S. exports.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The D-W statistic for this model is 1.199. $d_L, 0.05$ with $k=3$ degrees of freedom is 0.90 and $(4-d)=2.801$. Since $d > 0.90$ and $(4-d) > 0.90$, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null hypothesis for B1, the parameter for the value of the

dollar, we can conclude that there is enough evidence to support the argument that the value of the dollar is negatively correlated with U.S. exports. According to the F test and the D-W test, we can also conclude that the model is useful in predicting U.S. exports and that there is no evidence of first order autocorrelation in the residuals.

The results for the trade deficit model, model (1.3), are as follows,

$$\begin{aligned}
 \text{TDJ} = & 0.846 + 0.058 \text{ DY} - 0.069 \text{ UGNP} + \\
 & (0.35) \quad (0.02) \quad (0.01) \\
 & 0.0005 \text{ JGNP} - 0.157 \text{ POL} \\
 & (0.0001) \quad (0.04)
 \end{aligned}$$

where standard errors are in parentheses. B_0 , the intercept, is 0.846. B_1 , the coefficient for the value of the dollar versus the yen, is 0.058. B_2 , the coefficient for the U.S. GNP, is 0.069. B_3 , the coefficient for the Japanese GNP, is 0.0005. B_4 , the coefficient for the dummy variable POL, is 0.157. The model has an $R^2=0.91$. To determine whether these relationships are statistically significant, we test the following hypotheses,

H_0 : $B_0=0$

H_1 : $B_0 \text{ not } =0$

H02: $B1=0$

Ha2: $B1>0$

H03: $B2=0$

Ha3: $B2<0$

H04: $B3=0$

Ha4: $B3>0$

H05: $B4=0$

Ha5: $B4 \text{ not } = 0$

At the 95% significance level with 12 degrees of freedom, the critical value is 2.179 for a two tailed test and 1.782 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	2.408	2.179	sufficient evidence to reject H0
B1	2.626	1.782	sufficient evidence to reject H0
B2	-4.933	1.782	sufficient evidence to reject H0
B3	4.174	1.782	sufficient evidence to reject H0
B4	-3.921	2.179	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H0: B1 = B2 = B3 = B4 = 0$$

Ha: At least one of the parameters is a non zero

The F value for the model is 29.75, whereas the critical value is 3.26. So, we can conclude that at least one of the coefficients is non zero and thus, the model is useful in predicting the U.S.-Japanese trade deficit.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The D-W statistic for this model is 2.057. $d_L, 0.05$ with $k=4$ degrees of freedom is 0.78 and $(4-d)=2.801$. Since $d > 0.78$ and $(4-d) > 0.78$, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null hypothesis for B_1 , the coefficient for the value of the dollar as measured against the yen, we can conclude that there is enough evidence to support the argument that the value of the dollar (versus the yen) is positively correlated with the U.S.-Japanese trade deficit. According to the F test and the D-W test, we can also conclude that the model is useful in predicting the U.S.-Japanese trade deficit and that there is no evidence of first order

autocorrelation in the residuals.

The results of the consumption and investment analyses are presented in the next two sections. The expectation here, is that there are similarities in U.S. and Japanese consumption and investment patterns, and that these similarities follow a lag. This analysis will help us determine whether to accept or reject the second hypothesis of this study.

Results of the Consumption Analysis

The OLS results of the consumption model (2.1.a) for the U.S. are as follows,

$$\begin{aligned}
 C_t = & 0.505 + 0.965 C_{t-1} + 0.156 DY_t - 0.080 DY_{t-1} - \\
 & (0.61) \quad (0.09) \quad (0.08) \quad (0.11) \\
 & 0.033 DY_{t-2} - 0.087 DY_{t-3} + 0.072 DY_{t-4} \\
 & (0.11) \quad (0.11) \quad (0.08)
 \end{aligned}$$

Where standard errors are in parentheses. B0, the intercept, is 0.505. B1, the coefficient for consumption at time t-1, is 0.965. B2, the coefficient for disposable income at time t, is 0.156. B3, the coefficient for disposable income at time t-1, is 0,080. B4, the coefficient for disposable income at time t-2, is 0.033. B5, the coefficient for disposable income at time t-3, is 0.087. B6, the coefficient for disposable income at time t-4, is 0.072. The model has an R²=0.99. To determine if these relationships are

statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2>0$

H04: $B_3=0$

Ha4: $B_3>0$

H05: $B_4=0$

Ha5: $B_4>0$

H06: $B_5=0$

Ha6: $B_5>0$

H07: $B_6=0$

Ha7: $B_6>0$

At the 95% significance level with 20 degrees of freedom, the critical value is 2.086 for a two tailed test and 1.725 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	0.824	2.086	fail to reject H0
B1	10.544	1.725	sufficient evidence to reject H0
B2	1.873	1.725	sufficient evidence to reject H0
B3	-0.707	1.725	fail to reject H0
B4	-0.292	1.725	fail to reject H0
B5	-0.781	1.725	fail to reject H0
B6	0.903	1.725	fail to reject H0

To test the global usefulness of the model we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

Ha: At least one of the parameters is nonzero

The F value for the model is 340.015, whereas the critical value is 2.60. So we can conclude that at least one of the coefficients is nonzero and thus, the model is useful in predicting U.S. consumption.

To test whether disposable income has a significant role in the estimation of the U.S. consumption function, we test the following hypothesis,

$$H_0: B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

Ha: At least one of the coefficients is nonzero

The F statistic is 1.026, whereas the critical value is 2.71. So, we fail to reject the null hypothesis and conclude that there is no evidence that at least one of the parameters above is nonzero.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: positive or negative first order
autocorrelation

Since one of the independent variables in this model is a lagged dependent variable, the Durbin-h test is used instead of the Durbin-Watson test. The Durbin-h statistic for this model is 5.87. The rejection region at the 5% level is $h > 1.645$. So, we have sufficient evidence to reject the null hypothesis.

Since we failed to conclude that there is no evidence of first order autocorrelation in the model above, we estimate the model again using the Maximum Likelihood method. The ML estimates of the consumption model (2.1.a*) for the U.S. are as follows,

$$C_t = 1.318 + 0.853 C_{t-1} + 0.128 DY_t - 0.020 DY_{t-1} + \\ (0.98) \quad (0.14) \quad (0.07) \quad (0.08) \\ 0.007 DY_{t-2} - 0.042 DY_{t-3} + 0.013 DY_{t-4}$$

(0.08) (0.08) (0.07)

Where standard errors are in parentheses. B_0 , the intercept, is 1.318. B_1 , the coefficient for consumption at time $t-1$, is 0.853. B_2 , the coefficient for disposable income at time t , is 0.128. B_3 , the coefficient for disposable income at time $t-1$, is -0.020. B_4 , the coefficient for disposable income at time $t-2$, is 0.007. B_5 , the coefficient for disposable income at time $t-3$, is -0.042. B_6 , the coefficient for disposable income at time $t-4$, is 0.013. The final estimate of ρ is 0.544. To determine if these relationships are statistically significant, we test the following hypotheses,

$H_{01}: B_0 = 0$

$H_{a1}: B_0 \text{ not } = 0$

$H_{02}: B_1 = 0$

$H_{a2}: B_1 > 0$

$H_{03}: B_2 = 0$

$H_{a3}: B_2 > 0$

$H_{04}: B_3 = 0$

$H_{a4}: B_3 > 0$

H05: $B_4=0$

Ha5: $B_4>0$

H06: $B_5=0$

Ha6: $B_5>0$

H07: $B_6=0$

Ha7: $B_6>0$

At the 95% significance level with 20 degrees of freedom, the critical value is 2.086 for a two tailed test and 1.725 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	1.340	2.086	fail to reject H0
B1	6.047	1.725	sufficient evidence to reject H0
B2	1.714	1.725	fail to reject H0
B3	-0.246	1.725	fail to reject H0
B4	0.088	1.725	fail to reject H0
B5	-0.528	1.725	fail to reject H0
B6	0.181	1.725	fail to reject H0
Rho	3.358	2.086	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

Ha: At least one of the parameters is nonzero

Since this model was estimated by using the Maximum Likelihood method, the Wald test is used instead of the F test. The Wald test used for this model and the rest of the models in this paper is as follows,

$$W = (Rb-r)' [R(X'X)^{-1}R']^{-1} (Rb-r) / ms^2$$

This version of the test is distributed as the F ratio with m, T-K degrees of freedom. The Wald statistic for this hypothesis is 758.138. At the 95% significance level, the critical value is 2.57. Since the Wald statistic is greater than the tabulated value, we can conclude that at least one of the coefficients is nonzero and thus, the model is useful in predicting U.S. consumption.

To test whether disposable income has a significant role in the estimation of the U.S. consumption function, we test the following hypothesis,

$$H_0: B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

Ha: At least one of the parameters is non zero

The Wald statistic for this hypothesis is 1.5312. At the 95% significance level, the critical value is 2.68. Since the

Wald statistic is less than the tabulated value, we fail to conclude that at least one of the parameters is non zero and thus, disposable income is not useful in predicting U.S. consumption. In order to determine if lagged disposable income has a significant role in the estimation of the consumption function for the U.S., we also test the following hypothesis,

$$H_0: B_3 = B_4 = B_5 = B_6 = 0$$

H_a : At least one of the parameters is nonzero

The Wald statistic for this hypothesis is 0.2158, whereas the critical value is 2.84. So, we fail to reject the null hypothesis and fail to conclude that at least one of the parameters is non zero and thus, lagged disposable income is not useful in predicting U.S. consumption.

To test for autocorrelation, we test the following hypothesis,

H_0 : No first order autocorrelation

H_a : Positive or negative first order
autocorrelation

Since one of the independent variables in this model is a lagged dependent variable, the Durbin-h test is used instead of the Durbin-Watson test. The Durbin-h statistic for this

model is 1.249. The rejection region at the 5% level is $h > 1.645$. So, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null hypothesis for B_1 , the coefficient for C_{t-1} , and failed to reject the null for the other parameters, we can conclude that C_{t-1} has a major role in explaining C_t . Note that the t -ratio for B_2 , the parameter for DY_t , is very close to the critical value, 1.714 as compared to 1.725 (at the 90% significance level with a critical value of 1.325, the parameter becomes statistically significant). Based on the Wald test for the parameters for disposable income, we fail to conclude that at least one of the five parameters is non zero and thus, disposable income does not have a significant role in the estimation of the U.S. consumption function. According to the Wald test and the Durbin-h test, we can also conclude that the model is useful in predicting U.S. consumption and that there is no evidence of autocorrelation in the residuals.

The OLS results of the consumption model (2.1.b) for the U.S. are as follows,

$$C_t = 0.739 + 0.994 C_{t-1}$$

$$(0.50) \quad (0.022)$$

Where standard errors are in parentheses. B_0 , the

coefficient for the intercept, is 0.739. B_1 , the coefficient for consumption at time $t-1$, is 0.994. The model has an $R^2=0.99$. To determine whether these relationships are statistically significant we test the following hypotheses,

$H_{01}: B_0=0$

$H_{a1}: B_0 \text{ not } = 0$

$H_{02}: B_1=0$

$H_{a2}: B_1>0$

At the 95% significance level, the critical value is 2.060 for a two tailed test and 1.708 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B_0	1.474	2.060	fail to reject H_0
B_1	44.996	1.708	sufficient evidence to reject H_0

To test for autocorrelation, we test the following hypothesis,

H_0 : No first order autocorrelation

H_a : Positive or negative first order
autocorrelation

The Durbin-h statistic for this model is 2.629. Since

$t > 1.645$, we conclude that we have sufficient evidence to reject the null hypothesis.

Since we failed to conclude that there is no evidence of first order autocorrelation in the model above, we estimate the model again using the Maximum Likelihood method. The ML estimates of the consumption model (2.1.b*) for the U.S. are as follows,

$$C_t = 1.241 + 0.971 C_{t-1}$$

(0.80) (0.04)

Where standard errors are in parentheses. B_0 , the intercept, is 1.241. B_1 , the coefficient for consumption at time $t-1$, is 0.971. The final estimate of ρ is 0.529. To determine whether these relationships are statistically significant, we test the following hypotheses,

$H_01: B_0 = 0$,

$H_{a1}: B_0 \text{ not } = 0$

$H_02: B_1 = 0$

$H_{a2}: B_1 > 0$

At the 95% significance level, the critical value is 2.060 for a two tailed test and 1.708 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	1.549	2.060	fail to reject H0
B1	27.650	1.708	sufficient evidence to reject H0
Rho	3.245	2.060	sufficient evidence to reject H0

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The Durbin-h statistic for this model is 1.052. Since $h < 1.645$, we fail to reject the null hypothesis.

This model seems to support the argument that C_{t-1} is an important predictor of C_t for the U.S. According to the Wald test and the Durbin-h test, we can conclude that the model is useful in predicting U.S. consumption and that there is no evidence of autocorrelation in the residuals.

The results of the consumption model (2.1.a) for Japan are as follows,

$$\begin{aligned}
 C_t = & 16.273 + 0.753 C_{t-1} + 0.377 DY_t - 0.262 DY_{t-1} + \\
 & (18.36) \quad (0.10) \quad (0.07) \quad (0.09) \\
 & 0.050 DY_{t-2} - 0.044 DY_{t-3} + 0.052 DY_{t-4} \\
 & (0.09) \quad (0.09) \quad (0.07)
 \end{aligned}$$

Where standard errors are in parentheses. B_0 , the intercept, is 16.273. B_1 , the coefficient for consumption at time $t-1$, is 0.753. B_2 , the coefficient for disposable income at time t , is 0.377. B_3 , the coefficient for disposable income at time $t-1$, is -0.262. B_4 , the coefficient for disposable income at time $t-2$, is 0.050. B_5 , the coefficient for disposable income at time $t-3$, is -0.044. B_6 , the coefficient for disposable income at time $t-4$, is 0.052. The model has an $R^2 = 0.998$. To determine if these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2>0$

H04: $B_3=0$

Ha4: $B_3>0$

H05: $B_4=0$

Ha5: $B_4>0$

Ha6: $B_5=0$

Ha7: $B_5>0$

H07: $B_6=0$

Ha7: $B_6>0$

At the 95% significance level with 20 degrees of freedom, the critical value is 2.086 for a two tailed test and 1.725 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	0.886	2.086	fail to reject H0
B1	7.594	1.725	sufficient evidence to reject H0
B2	5.133	1.725	fail to reject H0
B3	-2.872	1.725	fail to reject H0
B4	0.538	1.725	fail to reject H0
B5	-0.467	1.725	fail to reject H0
B6	0.771	1.725	fail to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

Ha: At least one of the parameters is nonzero

The F value for this model is 2,240.361. At the 95%

significance level, the critical value is 2.60. So, we can conclude that at least one of the coefficients is nonzero and thus, the model is useful in predicting Japanese consumption.

To test whether disposable income has a significant role in the estimation of the consumption function for Japan, we test the following hypothesis,

$$H_0: B_2 = B_3 = B_4 = B_5 = B_6 = 0$$

H_a : At least one of the parameters is non zero

The F value is 5.684. At the 95% significance level, the critical value is 2.71. So, we fail to reject the null hypothesis. In order to determine if lagged disposable income has a significant role in the estimation of the consumption function for Japan, we also test the following hypothesis,

$$H_0: B_3 = B_4 = B_5 = B_6 = 0$$

H_a : At least one of the parameters is non zero

The F statistic for this hypothesis is 2.99, whereas the critical value is 2.87. So, we find sufficient evidence to reject the null hypothesis.

The Durbin-h test for autocorrelation is -0.43. Since $h < 1.645$, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null hypotheses for the parameters of C_{t-1} and DY_t , we can conclude that consumption at time $t-1$ and current disposable income have a significant role in explaining Japanese consumption. According to the two F tests and the Durbin-h test, we can also conclude that disposable income does have significant role in the estimation of the Japanese consumption function, the model is useful in predicting Japanese consumption, and there is no evidence of autocorrelation in the residuals.

The results of the consumption model (2.1.b) for Japan are as follows,

$$C_t = 63.100 + 0.100 C_{t-1}$$

$$(18.23) \quad (0.01)$$

Where standard errors are in parentheses. B_0 , the intercept, is 63.100. B_1 , the coefficient for consumption at time $t-1$, is 0.1. The model has an $R^2 = 0.996$. To determine whether these relationships are statistically significant, we test the following hypotheses,

$H_0: B_0=0$

$H_a: B_0 \text{ not } = 0$

$H_{02}: B_1=0$

Ha2: $B_1 > 0$

At the 95% significance level with 25 degrees of freedom, the critical value is 2.060 for a two tailed test and 1.708 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	3.511	2.060	sufficient evidence to reject H0
B1	83.223	1.708	sufficient evidence to reject H0

The Durbin-h test for autocorrelation is 0.07, and since this value does not fall in the rejection region, we fail to reject the null hypothesis.

This model seems to support the argument that C_{t-1} is an important predictor of C_t for Japan. According to the F test and the Durbin-h test, we can conclude that the model is useful in predicting Japanese consumption and that there is no evidence of autocorrelation in the residuals.

This analysis is extended to include a graphical representation of U.S. and Japanese consumption. The graph, which is included in the appendix, points to the following,

1)-There seems to be some similarities in patterns for the period of 1965-73. After that period, the two lines followed different patterns; Japanese consumption declined twice, in 1975 and again in 1985, whereas, U.S. consumption continued

to rise steadily.

2)-Japanese consumption increased at a faster pace than U.S. consumption for the years of 1965-75. After that period, Japanese consumption fell sharply.

These two points seem to support the argument that there are changes in consumption patterns for Japan. However, these changes do not follow a pattern similar to that of the U.S. with a lag as was suggested earlier in the paper.

Results of the Investment Analysis

The OLS results of the investment model (2.2.a) for the U.S. are as follows,

$$I = -2.802 + 0.104 \text{ UIIP} + 0.027 \text{ WS} - 2.096 \text{ DEP}$$

$$(7.12) \quad (0.013) \quad (0.13) \quad (8.46)$$

Where standard errors are in parentheses. B0, the intercept, is - 2.802. B1, the coefficient for the index of industrial production, is 0.104. B2, the coefficient for WS, is 0.027. B3, the coefficient for DEP, is -2.096. The model has an $R^2=0.95$. To determine if these relationships are statistically significant, we test the following hypotheses,

H01: B0=0

Ha1: B0 not = 0

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2<0$

H04: $B_3=0$

Ha4: $B_3<0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	-0.394	2.069	fail to reject H0
B1	8.074	1.714	sufficient evidence to reject H0
B2	0.203	1.714	fail to reject H0
B3	-0.248	1.714	fail to reject H0

To test the global usefulness of the model, we test the following hypothesis,

H0: $B_1 = B_2 = B_3 = 0$

Ha: At least one of the parameters is nonzero

The F statistic for this model is 143.3, whereas the

critical value is 3.03. Therefore, we have sufficient evidence to reject the null hypothesis.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The Durbin-Watson statistic for this model is 0.865. d_L , 0.05 with $k=3$ degrees of freedom is 1.08 and $(4-d)=2.92$. Since $d < 1.08$, we can conclude that we have sufficient evidence to reject the null hypothesis.

Since we failed to conclude that there is no evidence of first order autocorrelation in the model above, we estimate the model again using the Maximum Likelihood method. The ML estimates of the investment model (2.2.a*) for the U.S. are as follows,

$$I = 7.399 + 0.0005 IIP - 0.024 WS - 0.631 DEP$$

$$(23.02) \quad (0.0006) \quad (0.41) \quad (23.77)$$

B_0 , the intercept, is 7.399. B_1 , the coefficient for the index of industrial production, is 0.0005. B_2 , the coefficient for WS, is 0.024. B_3 , the coefficient for DEP, is 0.631. The final estimate of ρ is 0.857. To determine

if these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2<0$

H04: $B_3=0$

Ha4: $B_3<0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	0.321	2.069	fail to reject H0
B1	0.761	1.714	fail to reject H0
B2	-0.059	1.714	fail to reject H0
B3	-0.027	1.714	fail to reject H0
Rho	8.657	2.069	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

H_a : At least one of the parameters is nonzero.

The Wald statistic is 1.0070 and the critical value at the 95% significance level is 3.01. So, we fail to reject the null hypothesis and conclude that the model is not useful in predicting U.S. investments.

To test for autocorrelation, we test the following hypothesis,

H_0 : No first order autocorrelation

H_a : Positive and negative first order autocorrelation

The Durbin-Watson statistic for this model is 1.835. $d_L, 0.05$ with $k=3$ degrees of freedom is 1.16 and $(4-d)=2.165$. Since $d > 1.16$ and $(4-d) > 1.16$, we fail to reject the null hypothesis.

Since we failed to reject the null hypotheses for all the parameters in this model, we can conclude that the three variables, index of industrial production, weighted sum, and

depreciation are statistically insignificant in explaining U.S. investments. According to the Wald test and the D-W test, we can also conclude that the model is not useful in predicting U.S. investments and that there is no evidence of autocorrelation in the residuals.

The results of the investment model (2.2.b) for the U.S. are as follows,

$$I = -28.174 + 0.087 \text{ DY} + 0.548 \text{ WS} + 33.007 \text{ DEP}$$

$$(11.21) \quad (0.04) \quad (0.20) \quad (12.40)$$

Where standard errors are in parentheses. B_0 , the intercept, is -28.174. B_1 , the coefficient for disposable income, is 0.087. B_2 , the coefficient for WS, is 0.548. B_3 , the coefficient for DEP, is 33.007. The model has an $R^2 = 0.84$. To determine if these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2 < 0$

H04: $B_3 = 0$

Ha4: $B_3 < 0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	-2.514	2.069	sufficient evidence to reject H0
B1	2.370	1.714	sufficient evidence to reject H0
B2	2.694	1.714	fail to reject H0
B3	2.662	1.714	fail to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

Ha: At least one of the parameters is non zero

The F statistic is 41.321 and the critical value at the 95% significance level is 3.03. So, we have sufficient evidence to reject the null hypothesis and conclude that at least one of the parameters is non zero and thus, the model is useful in predicting U.S. investment.

The D-W statistic is 1.295. $dL_{0.05}$ with $k=3$ degrees of freedom is 1.08 and $(4-d)=2.705$. Since both d and $4-d$ are greater than 1.08, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null hypotheses for the parameters for the intercept and disposable income, we can conclude that disposable income has a significant role in explaining U.S. investments. According to the Wald test and the D-W test, we can also conclude that the model is useful in predicting U.S. investments and that there is no evidence of autocorrelation in the residuals.

The OLS results of the investment model (2.2.a) for Japan are as follows,

$$I = 3569.570 + 11.171 \text{ JIIP} - 0.433 \text{ WS} - 3501.567 \text{ DEP}$$

(800.01)	(1.30)	(0.10)	(841.61)
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Where standard errors are in parentheses. B_0 , the intercept, is 3569.570. B_1 , the coefficient for the index of industrial production, is 11.171. B_2 , the coefficient for WS, is -0.433. B_3 , the coefficient for DEP, is -3501.567. The model has an $R^2=0.94$. To determine if these relationships are statistically significant, we test the following hypotheses,

H_0 : $B_0=0$

H_a : $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2<0$

H04: $B_3=0$

Ha4: $B_3<0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	4.462	2.069	sufficient evidence to reject H0
B1	8.564	1.714	sufficient evidence to reject H0
B2	-4.174	1.714	sufficient evidence to reject H0
B3	-4.161	1.714	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

H0: $B_1 = B_2 = B_3 = 0$

Ha: At least one of the coefficients is nonzero

The F statistic for this model is 122.917, whereas the critical value is 3.03. So, we have sufficient evidence to

reject the null hypothesis.

To test for autocorrelation, we test the following hypothesis,

H0: No first order autocorrelation

Ha: Positive or negative first order
autocorrelation

The Durbin-Watson statistic for this model is 0.666. $dL, 0.05$ with $k=3$ degrees of freedom is 1.08 and $(4-d)=3.33$. Since $d < 1.08$, we find sufficient evidence to reject the null hypothesis.

Since we failed to conclude that there is no evidence of first order autocorrelation in the model above, we estimate the model again using the Maximum Likelihood method. The ML estimates of the investment model (2.2.a*) for Japan are as follows,

$$I = 670.314 + 11.362 \text{ IIP} - 0.080 \text{ WS} - 778.875 \text{ DEP}$$

$$(795.6) \quad (1.64) \quad (0.10) \quad (864.2)$$

Where standard errors are in parentheses. B_0 , the intercept, is 670.314. B_1 , the coefficient for the index of industrial production, is 11.362. B_2 , the coefficient for WS, is -0.080. B_3 , the coefficient for DEP, is -778.875. The final estimate of Rho is 0.901. To determine if these

relationships are statistically significant, we test the following hypotheses,

H01: $B_0 = 0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1 = 0$

Ha2: $B_1 > 0$

H03: $B_2 = 0$

Ha3: $B_2 < 0$

H04: $B_3 = 0$

Ha4: $B_3 < 0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	0.843	2.069	fail to reject H0
B1	6.913	1.714	sufficient evidence to reject H0
B2	-0.803	1.714	fail to reject H0
B3	-0.901	1.714	fail to reject H0
Rho	10.726	2.069	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

H_a : At least one of the parameters is non zero

The Wald statistic is 132.8854 and the critical value at the 95% significance level 3.01. So, we find sufficient evidence to reject the null hypothesis and conclude that the model is useful in predicting Japanese investments.

The D-W statistic is 1.206. $d_L, 0.05$ with $k=3$ degrees of freedom is 1.16 and $(4-d)=2.794$. Since both d and $4-d$ are greater than 1.16, we fail to reject the null.

Since we found sufficient evidence to reject the null hypothesis for B_1 , the parameter for IIP, we can conclude that the index of industrial production is statistically significant in explaining Japanese investments. The Wald test indicates that the model is useful in predicting Japanese investments. The D-W test indicates that there is no evidence of autocorrelation in the residuals.

The OLS results of the investment model (2.2.b) for Japan are as follows,

$$I = 3569.904 + 0.435 \text{ DY} - 0.450 \text{ WS} - 3578.685 \text{ DEP}$$

(762.87)	(0.05)	(0.10)	(806.38)
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Where standard errors are in parentheses. B_0 , the intercept is 3569.904. B_1 , the coefficient for disposable income, is 0.435. B_2 , the coefficient for WS, is -0.450. B_3 , the coefficient for DEP, is -3578.685. The model has an $R^2=0.95$. To determine if these relationships are statistically significant, we test the following hypotheses,

H01: $B_0=0$

Ha1: $B_0 \text{ not } = 0$

H02: $B_1=0$

Ha2: $B_1>0$

H03: $B_2=0$

Ha3: $B_2<0$

H04: $B_3=0$

Ha4: $B_3<0$

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	4.680	2.069	sufficient evidence to reject H0
B1	9.065	1.714	sufficient evidence to reject H0

B2	-4.499	1.714	sufficient evidence to reject H0
B3	-4.438	1.714	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3 = 0$$

H_a : At least one of the parameters is nonzero

The F statistic for this model is 134.890, whereas the critical value is 3.03. So, we fail to reject the null hypothesis.

To test for autocorrelation, we test the following hypothesis,

H_0 : No first order autocorrelation

H_a : Positive or negative first order
autocorrelation

The Durbin-Watson statistic for this model is 0.782. $d_L, 0.05$ with $k=3$ degrees of freedom is 1.08 and $(4-d)=3.218$. Since $d < 1.08$, we find sufficient evidence to reject the null hypothesis.

Since we failed to conclude that there is no evidence of first order autocorrelation in the model above, we

estimate the model again using the Maximum Likelihood method. The ML estimates of the investment model (2.2.b*) for Japan are as follows,

$$I = 1044.75 + 0.542 \text{ DY} - 0.162 \text{ WS} - 1577.71 \text{ DEP}$$

$$(857.4) \quad (0.08) \quad (0.11) \quad (984.8)$$

Where standard errors are in parentheses. B0, the intercept, is 1044.75. B1, the coefficient for disposable income, is 0.542. B2, the coefficient for WS, is -0.162. B3, the coefficient for DEP, is 1577.71. The final estimate of Rho is 0.9195. To determine if these relationships are statistically significant, we test the following hypotheses,

H01: B0=0

Ha1: B0 not = 0

H02: B1=0

Ha2: B1>0

H03: B2=0

Ha3: B2<0

H04: B3=0

Ha4: B4<0

At the 95% significance level with 23 degrees of freedom, the critical value is 2.069 for a two tailed test and 1.714 for a one tailed test.

<u>Beta</u>	<u>t-test</u>	<u>C.V.</u>	<u>Conclusion</u>
B0	1.218	2.069	fail to reject H0
B1	6.479	1.714	sufficient evidence to reject H0
B2	-1.462	1.714	fail to reject H0
B3	-1.602	1.714	fail to reject H0
Rho	12.105	2.069	sufficient evidence to reject H0

To test the global usefulness of the model, we test the following hypothesis,

$$H_0: B_1 = B_2 = B_3$$

Ha: At least one of the parameters is non zero

The Wald statistic is 153.308 and the critical value at the 95% significance level is 3.01. So, we find sufficient evidence to reject the null hypothesis and conclude that at least one of the parameters is non zero and thus, the model is useful in predicting Japanese investments.

The D-W statistic is 1.361. $d_L, 0.05$ with $k=3$ degrees of freedom is 1.16 and $(4-d)=2.639$. Since, both d and $4-d$ are greater than 1.16, we fail to reject the null hypothesis.

Since we found sufficient evidence to reject the null

hypothesis for the parameter for disposable income , we can conclude that disposable income is statistically significant in explaining Japanese investments. According to the Wald test and the D-W test, we can also conclude that disposable income is useful in predicting Japanese investments and that there is no evidence of autocorrelation in the residuals.

This analysis is extended to include a graphical representation of U.S. and Japanese investment. The graph, which is included in the appendix, points to the following,

1)-There seems to be some similarities in patterns during the period of 1965-75. After that period, the two lines followed different patterns.

2)-Japanese investments increased at a faster pace than U.S. investments during the years of 1965-74. After that period, Japanese investments declined twice, the first time was in the mid seventies and the second time was in the early eighties..

These two points seem to support the argument that there are changes in Japanese investment patterns. However, these changes do not follow a pattern similar to that of the U.S. with a lag as was suggested earlier in this study.

CHAPTER IV

INTERPRETATIONS OF THE RESULTS

Analysis of Findings

The coefficient for the value of the dollar in the import model, model (1.1), was not statistically significant. Therefore, we can conclude that there is no evidence to support the argument that the value of the dollar is positively correlated with U.S. imports. The coefficient for the value of the dollar in the export model, model (1.2), was statistically significant. Therefore, we can conclude that there is enough evidence to support the argument that the value of the dollar is negatively correlated with U.S. exports. The coefficient for the value of the dollar as measured against the yen in the trade deficit model, model (1.3), was statistically significant. Therefore, we can conclude that there is enough evidence to support the argument that the value of the dollar (versus the yen) is positively correlated with the U.S.-Japanese trade deficit.

The results reported in the previous chapter and summarized above, support the first hypothesis of this study. Based on the three models, we can conclude that while imports did not respond to the appreciation of the dollar, exports and the U.S.-Japanese trade deficit did. This seems

to support James Tobin's argument that the current U.S. trade deficit with Japan can be attributed to the appreciation of the dollar in the early eighties.

The only coefficient that was significant for the U.S. consumption model (2.1.a) was that of C_{t-1} . Therefore, we can conclude that C_{t-1} has a major role in explaining U.S. consumption. The Wald test for the parameters of disposable income indicates that there is insufficient evidence to conclude that at least one of the five parameters is non zero and thus, disposable income does not have a role in the estimation of the consumption function for the U.S. Also the Wald test for the parameters of lagged disposable income indicates that there is insufficient evidence to conclude that at least one of the four parameters is non zero and thus, lagged disposable income does not have a significant role in the estimation of the consumption function for the U.S. The coefficient for C_{t-1} in the U.S. consumption model (2.1.b) was statistically significant. Therefore, we can conclude that C_{t-1} is an important predictor of C_t . The coefficients for C_{t-1} and DY_t were the only significant coefficients in the Japanese consumption model (2.1.a). Therefore, we can conclude that C_{t-1} and DY_t have a major role in explaining Japanese consumption. The F test for the parameters of disposable income indicates that at least one of the five parameters is non zero and thus, disposable income has a role in the estimation of the consumption

function for Japan. Also, the Wald test for the parameters of lagged disposable income indicates that at least one of the four parameters is non zero and thus, lagged disposable income has a role in the estimation of the consumption function for Japan. The coefficient for C_{t-1} in the Japanese consumption model (2.1.b) was statistically significant. Therefore, we can conclude that C_{t-1} is an important predictor of C_t for Japan.

Consumption analysis for the U.S. and Japan seems to indicate the following,

- 1)-Consumption cannot be treated as an exogenous variable for both countries, as was suggested by Hall (1978).
- 2)- C_{t-1} has a major role in explaining C_t for both countries.
- 3)-Disposable income (current and lagged) has a significant role in the estimation of the consumption function for Japan but not for the U.S.
- 4)-The consumption graph seems to support the argument that there are changes in Japanese consumption patterns over time. However, there seems to be no evidence of similarities in lags.

None of the coefficients for the U.S. investment model (2.2.a) were significant. Therefore, we can conclude that all the variables in this model have no role in explaining U.S. investments. The coefficient for disposable income for the U.S. investment model (2.2.b) was significant.

Therefore, we can conclude that disposable income has a significant role in explaining U.S. investments. The coefficient for the index of industrial production in the Japanese investment model (2.2.a) was significant. The coefficient for disposable income for the Japanese investment model (2.2.b) was significant. Therefore, we can conclude that both disposable income and the index of industrial production have a role in explaining Japanese investments.

Investment analysis for the U.S. and Japan seems to indicate the following,

- 1)-Disposable income is a better predictor of investment than the index of industrial production for the U.S. Both disposable income and the index of industrial production are important predictors of investments for Japan.
- 2)-The weighted sum and the depreciation variables introduced by Stevens (1994) are statistically insignificant in explaining investment in both models for both countries.
- 3)-The investment graph seems to support the argument that there are changes in Japanese investment patterns. While U.S. investment continued to rise, Japanese investment in U.S. dollars began to decline after 1974. Also, as was the case with the consumption graph, there seems to be no evidence of any similarities in lags.

Based on the consumption and investment analyses, we can conclude that even though we found evidence of changes in Japanese consumption and investment patterns, these changes do not conform to the expectations addressed earlier in this study. That is, there is no evidence of any lags in the similarities and thus, we find no evidence to support the second hypothesis of this study. So, we can conclude that while U.S. and Japanese patterns do not mimic each other (due to social and cultural differences), there are some similarities in patterns which cannot be ignored and require further investigation.

The two issues addressed in this study are considered to be important issues in the area of U.S.-Japanese trade. The findings presented here, support the argument that exchange rates have a major role in the trade imbalance between the two countries. From a policy perspective, it is important to realize that attempts to pressure the Japanese government into changing its policies or using monetary policy for purposes of protectionism are counterproductive and often harmful approaches to dealing with the problem. It is my view, as was argued in this paper from the beginning, that free trade is the policy that would best serve the interests of both the U.S. and Japan. Despite the difficulties and dissension that is present today in U.S.-Japanese relations, it is important to realize that the future holds very successful and promising relations between

Japan, the U.S. and the whole world. Cooperation among countries is a crucial task and we will see more of that as countries experience with international trade and free market economics.

The findings of this study do not answer all the questions raised earlier in the paper, and in some cases the results themselves seem to raise new questions and new suggestions. Further research on the subject is necessary, especially on consumption and investment analyses. The following is a list of some of the major issues which might require further investigation,

- 1)-Is there a consumption function which can be used to estimate both U.S. and Japanese consumption or does each country require a different consumption model?
- 2)-Is there an investment function which can be used to estimate both U.S. and Japanese investments or does each country require a different investment model?
- 3)-Why were the coefficients for weighted sum and depreciation statistically insignificant for all the investment models for the two countries?
- 4)-Can Friedrich Von Hayek's Theory of Social Order be established (without a lag), and in the case of other countries?
- 5)-Can Friedrich Von Hayek's Theory of Social Order be applied to the case of socialist, communist, and capitalist

systems?

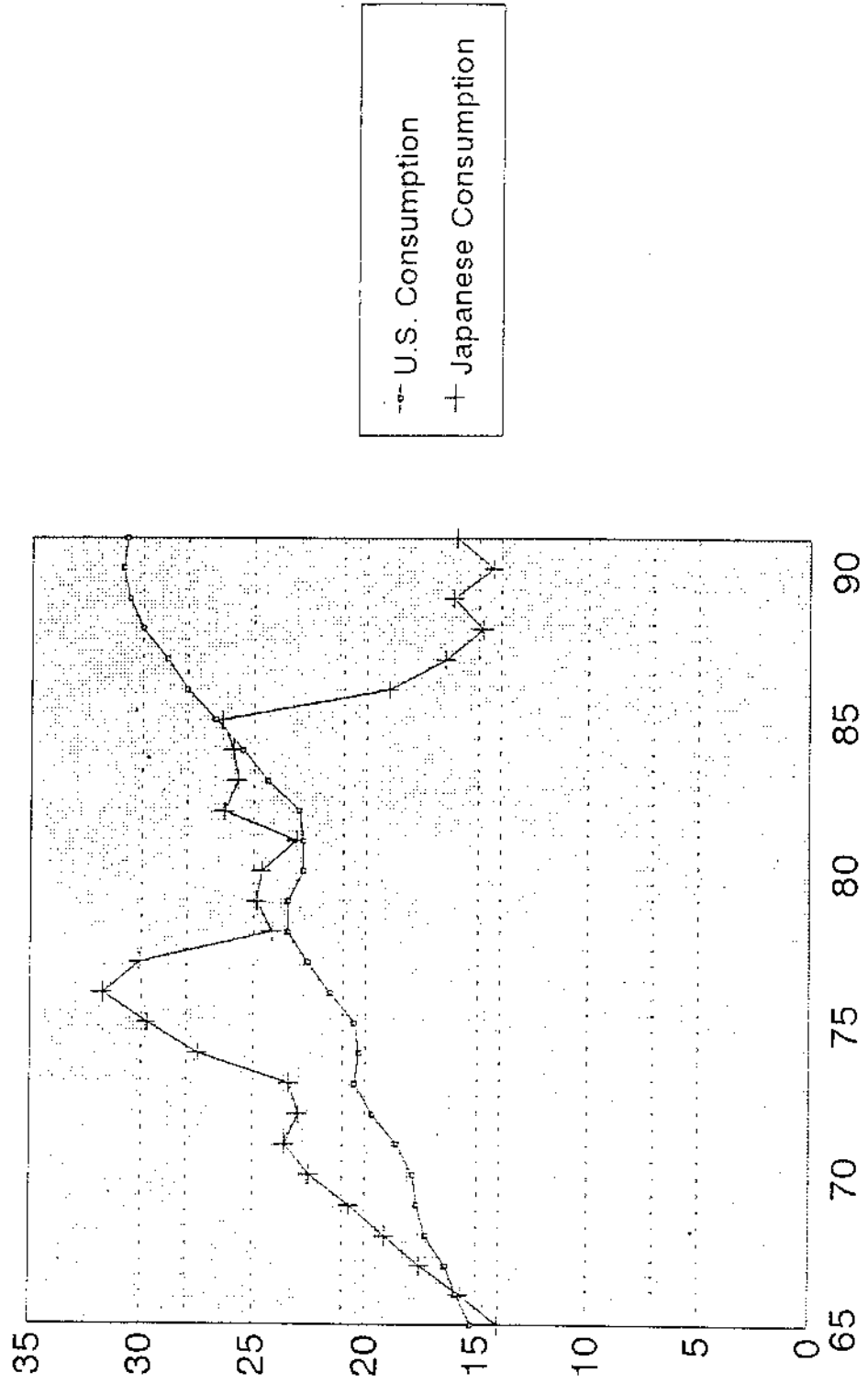
6)-Does the application of different econometric methods yield similar or different results?

APPENDIX

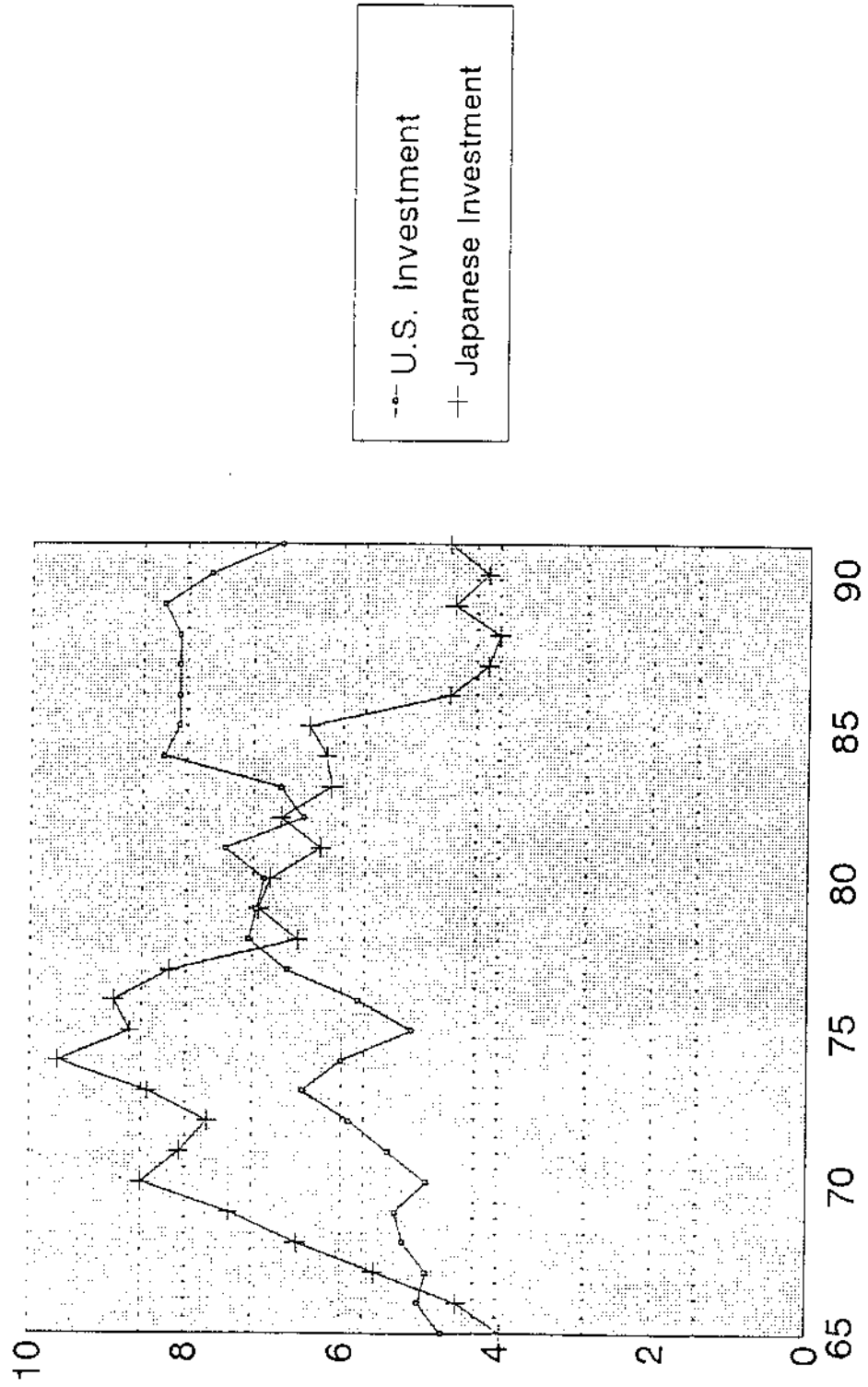
Table 1: Ranking of Relative Gainers in Japan and the U.S. from Pre-Tokyo Round Tariffs and Approximations of NTBs - (Scenario 7)

Ranking	Japanese Factors	U.S. Factors
1	Farm workers	Operatives
2	Service workers	Craftsmen
3	Prof., Tech., Adm.	Sales workers, Clerical
4	Laborers, except farm	Laborers, except farm
5	Sales workers, Clerical	Prof., Tech., Adm.
6	Capital	Service workers
7	Scientists, Engineers	Scientists, Engineers
8	Craftsmen	Capital
9	Operatives	Farm workers

U.S.-Japanese Consumption in \$



U.S.-Japanese Investment in \$



REFERENCES

- Altonji, Joseph G. and Siow, Aloysius. "Testing the Response of Consumption to Income Changes with (Noisy) Panel Data". Quarterly Journal of Economics. 102 (May, 1987): 293-328.
- Appleyard, Dennis and Field, Alfred. International Economics. Boston: Irwin, 1992.
- Ando, A. and Modigliani, F. "The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests". American Economic Review. 53 (March, 1963): 55-84.
- Ando, A. and Modigliani, F. "The Life-Cycle Hypothesis of Saving: Aggregate implications and tests - (Correction)". American Economic Review. 54 (March, 1964): 111-13.
- Bilson, John F. O. "Foreign Exchange Intervention as an Alternative to Protectionism". Chapter 19 in The New Protectionist Threat to World Trade edited by Dominick Salvatore. New York: North-Holland, 1987: 408-423.
- Blinder, Alan. "There are Capitalists, then there are the Japanese". Business Week. 25 #3181 October 8, 1990.
- Butler, Eamonn. Hayek: his Contribution to the Political and Economic Thought of our Time. New York: Universe Books, 1983.
- Ceglowski, Janet. "Dollar Depreciation and U.S. Industry Performance". Journal of International Money and Finance. 8 (1989): 233-251.
- Cohen, Stephen D. Uneasy Partnership. Cambridge: Ballinger Publishing Company, 1990.
- Cooper, Richard N. The International Monetary System. Cambridge: The MIT Press, 1987.
- Duesenberry, J. Income, Saving and the Theory of Consumer Behavior. Cambridge: Massachusetts: Harvard Press, 1949.
- Emmott, Bill. The Sun Also Sets. New York: Simon and Schuster Inc., 1989.

- Engle, Robert and Granger Clive. " Co-Integration and Error Correction: Representation, Estimation and Testing". Econometrica 55 (1987): 251-276.
- Flavin, Marjorie A. "The Adjustment of Consumption to Changing Expectations About Future Income". Journal of Political Economy. 89 (October, 1981): 974-1009.
- Friedman, Milton. A Theory of the Consumption Function. Princeton, N.J.: Princeton, 1957.
- Friedman, Milton and Friedman, Rose. Free to Choose. San Diego: Harcourt Brace Jovanovich Publishers, 1990.
- Gardner, Stephen H. Comparative Economic Systems. Chicago: The Dryden Press, 1988.
- Granger, Clive. "Developments in the Study of Cointegrated Economic Variables". Oxford Bulletin of Economics and Statistics 48 (1986): 213-228.
- Gray, John. Hayek on Liberty. New York: Basil Blackwell Ltd., 1984.
- Hall, Robert. " Stochastic Implications of the Life Cycle - Permanent Income Hypothesis: Theory and Evidence". Journal of Political Economy. 86 (August, 1978): 971-87.
- Hall, Robert and Mishkin Frederic. "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households". Econometrica. 50 (March, 1982): 461-82
- Husted, Stephen. "The Emerging U.S. Current Account Deficit in the 1980's: A cointegration Analysis". Review of Economics and Statistics. 74 (February 1992): 159-65.
- Ito, Takatoshi. The Japanese Economy. Cambridge, Massachusetts: MIT Press, 1992.
- Leung, Siu F. "Uncertain Lifetime, the Theory of the Consumer, and the Life Cycle Hypothesis". Econometrica. 62 (September, 1994): 1233-39.
- Lincoln, Edward J. Japan's Unequal Trade . Washington: The Brookings Institution, 1990.
- Mansfield, Edwin. Managerial Economics. New York: W.W. Norton and Company, 1990.

- Mariger, Randall P. and Shaw Kathryn. "Unanticipated Aggregate Disturbances and Tests of the Life-Cycle Consumption Model Using Panel Data". The Review of Economics and Statistics. 75 (February, 1993): 48-56.
- Mishkin, Fredric S. The Economics of Money, Banking, and Financial Markets. Boston: Little, Brown and Company, 1986.
- Mussa, Michael. "Average Protection and Economic Policy". Chapter 18 in The New protectionist Threat to World Welfare edited by Dominick Salvatore. New York: North-Holland, 1987: 389-406.
- Nakibullah, Ashraf. "Comovements of Budget Deficits, Exchange Rates, and Outputs of Traded and Non-Traded Goods". Economic Enquiry. 31 (1993): 298-313.
- Nau, Henry R. The Myth of America's Decline. New York: Oxford University Press, 1990.
- Ohta, Takeshi. "International Perspective: Japan's Financial Role in the 1990's". Business Economics 26 (January 1991): 21-24.
- Ott, David J., Ott, Attiat F., and Yoo Jang H. Macroeconomic Theory. Lanham, MD: University Press of America, 1983.
- Sato, Kazuo. "Indicative Planning in Japan". Journal of Comparative Economics. 14 (Dec. 1990): 625-647.
- Staiger, Robert W., Deardorff, Alan V., and Stern, Robert M. "The Effects of Protection on the Factor Content of Trade". Review of Economics and Statistics 70 (August 1988): 475-482.
- Stevens, Guy V. G. "Measurement error in the Capital Stock and its effect on the Investment Function". Applied Economics. 26 (January, 1994): 21-26.
- Stevens, G. V. G. and Lipsey R. E. "Interactions Between Domestic and Foreign Investment". Journal of International Money and Finance. 11 (1992): 40-62.
- Tobin, James. "The Adam Smith Address: On Living and Trading with Japan: U.S. Commercial and Macroeconomic Policies". Business Economics 26 (January 1991): 5-16.
- Wilkinson, Endymion P. Japan Vs. the West. New York: Penguin Books, 1990.

Wolfson, Paul. "A Simple Keynesian Model with Flexible Wages: A Succinct Synthesis". Journal of Macroeconomics. 16 (Winter, 1994): 129-56.

"T. Boone Pickens on Japan and U.S. Energy Policy" Dallas Morning News. February 9, 1992.