Derivation of the Dynamic Model of the Permanent and Temporary Employment and Also of Their Output

Md. Sharif Hossain
Faculty of Economics, Kyushu University

https://doi.org/10.15017/3000229

出版情報：経済論究. 105, pp.93-113, 1999-11-30. 九州大学大学院経済学会

Derivation of the Dynamic Model of the Permanent and Temporary Employment and Also of Their Output

Md. Sharif Hossain

Abstract

Nowadays, Statistics and Econometrics have become inevitable in the field of Business Cycles study as well as in almost every field of social and economic research. Not only in social and economic research, but in the field of engineering and also in the field of medical science, Statistics and Econometrics are widely applicable. In Statistics, Econometrics and Business Cycle studies, different tools and procedures have been developed that are capable of elegant analysis of various phenomenon in different field of research. Basically, Econometrics can be thought of as a combination of economic theory, mathematical economics, statistics, and mathematical statistics with computing as vehicle of estimation. And Business Cycle study can be thought as a part of Economics, Statistics, and Econometrics, in which field theoretical and mathematical tools both are of paramount importance.

The main concern of mathematical economics is to express theory in mathematical form (equational form) without regarding to measurability or empirical verification of the theory.

Econometrics is mainly interested in the empirical verification of the mathematical form of economic theory. But, it is to be born in mind that econometric principle can be applied in almost all fields of human life. Industrial and business sectors play the dynamic role in the total process of economic growth. The generation and sustenance of economic growth especially in the early stage of most developed and developing countries are to a large extend determined by the performance of industrial sector and also in business sector. Especially, Business Cycle studies are widely applicable in the field of industrial and business sector to make decision about the economic activities at the present time and also for future time. Business cycles, periods of high economic activity followed by those of unsatisfactory performance have been on increasing concern to the general people, especially to those involved in industry, business and government.

Economic instability of the develpoed and developing countries reduces not only the degree of certainty about the future but also personal and managarial freedom. Managers and public officials are constantly urged to make "economic" decisions which should be prove to be correct in the long term. In order to do so, decision makers need to possess a basic understanding of the factors which cause economic fluctuations and most of all, how to anticipate and to analyze

changes in economic activity. The Business Cycle study enables us to find the factors which are responsible for the economic fluctuations. On the basis of the forecasting results, desirable decisions can be made about output, employment, costs, shipments etc. But they might not be able to make precise forecasts about the future, they can neverthless observe and describe general economic patterns.

In the field of industrial sectors, businessmen can bring benefits through introducing the forecasting concepts and techniques and hence from the explanations of business cycles.

In industrial sector for economic growth it is much more important to make decision about output, employment, costs and also for shipments at the present time and also for future. In 1989 Frank de Leeuw has been provided a theoretical model to make decision about output, employment, shipments, etc on the basis of the pioneering work of Holt, Modigliani, Muth and Simon's (1960).

But from the Frank de Leeuw's (1989) methodology, we can not make decision, or we can not find the efficiency of the permanent and temporary employment seperately. That is why, the principle purpose of this paper is to modify his developed cost function in order to make decision, or to find the efficiency of the permanent and temporary employment seperately. The modification has been done for the orders model, and also for the shipments model. Finally, in order to make decision on the basis of the forecasting results, the dynamic models of the permanent and temporary employment and also of their output have been derived. The dynamic models have been derived, by minimizing the discounted sum of present and future cost function and then using the reduced form equations system.

For the empirical verification of the theoretical construct another attempt has been made to simulate a Jpanese quarterly data. Simulations have been done only for the shipments model, but for the orders model, data are not available, that is why we are unable to simulate the data on the basis of the orders model.

Finally, for the empirical verification of the theoretical construct of this study, a set of economical data has been collected from the Nekkei Electronic Data System Year book.[1]

1 The first and foremost words of thanks from me are for my reverend teacher Professor Chikayoshi Saeki who provided me for the higher study about Econometrics at the Faculty of Economics, Department of Economic Engineering of Kyushu University in Japan.

I express my deep indebtness to my honorable teacher Dr. A.B.M.A. Sobhan Miah, Professsor, Department of Statistics, Jahangirnagar University, Savar, Dhaka, Bangladesh, for his vigilant encouragement during the entire phase of the work.

I also acknowledge my gratefulness to my honorable tutor Mr. Sadayuki Takii, who has completed the Ph.D. degree from the Faculty of Economics, Department of Economic Engineering of Kyushu University, Japan, for his hearty and sincere co-operations.

I like to express my thanks to my friend Most. Noor-E-Shahreen Tuly for her valuable advice.

At last I gratefully acknowledge the financial support of (MONBUSHO) Japanese Government for a research at Faculty of Economics, Department of Economic Engineering, Kyushu University, Japan.

Contents :

1 Introduction

The study of business cycle[2] has been greatly influnced by the work of Wesley C. Mitchell in his 1913 book titled "Business Cycles" and "Measuring Business Cycles"- major collaboration effort with Arthur F. Burns and Wesley C. Mitchell.

In 1920 Wesley C. Mitchell and other helped to organize the National Bureau of Economic Research (NBER). This independent, nonprofit organization maintains an active and continuing interest in business cycle analysis.

A business cycle is usually measured from peak to peak. According to the Department of Commerce, for a period of economic fluctuations to be classified as business cycle, it should be at least fifteen months long with any significant upward or downword movement in economic activity being at least five months in duration. In business cycles, there are different causes for peak. Many economists have investigated the causes of peaking in a business cycles. Some of them are given below ;

(1) Boom periods, when demand has risen above the long-term trend, causing capacity constraints. (2) Demand shocks, which are caused by sudden lessening demand. (3) Supply shocks, which are caused by curtailment of supplies or other disruptions. (4) Price shocks, which are created by movement outside normal supply and demand relationships and (5) Credit crunches, where financial distress is reflected in lessened availability of money and credit.

In business cycle analysis one of the most important approaches is a index of leading economic indicator approach[3]. The index of leading economic indicator approach is perheps the least theoretical tools, that are usually applied in a business cycle.

The index which appears most in the news to indicate future trends in the level of economic activity or in the health of the economy is the "index of leading economic indicators." Its

2 The business cycles are defined as the continuous economic expansion or development uniterrupted by "ups" and "downs". A business cycle consists of four parts, which are as (1) Expansionary Phase (2) Peak (3) Contractionary Phase (4) and Trough. The upward-sloping segment is labeled as the expansionary phase, the lower portion of which is usually also referred to as the recovery. When the expansionary phase ends, the economy reaches the "peak" followed by the "contractionary" phase often define as the recesion or "recessionary phase". The loewest point of performance of the economy is called the "trough"

3 Let us consider two economical variables X and Y. Then the variable X is said to be a leading indicator of the variable Y, if the correlation between Y_t(present value of Y), and $X_{t-i}(i \geq 1$, past value of X), is much higher than the correlation between X_t(present value of X), and $Y_{t-i}(i \geq 1$, past value of Y), that is if, $Corr(Y_t, X_{t-i}) > Corr(X_t, Y_{t-i})$, where, $i \geq 1$, then X is said to be a leading indicator of the variable Y, and vice versa.

purpose is not to measure the strength of the economy but to predict a change in the trend of business activity. Due to data collection problems and the complexity of the economy, it can at best be interpreted to give warning signals that changes in business activity may be in the making, not that they actually will take place.

Now, the National Bureau of Economic Analysis has many time series that are analysed for relevancy. It has grouped these time series into series that exhibit the characteristics of leading, coincident or lagging indicators.

To analyze the business economy the Bureau used many different time series, the time series were classified as to their usefulness in predicting business cycles peaks and troughs.

Now, the classifications provided time series categories by leading indicators, coincident indicators and lagging indicators. Leading indicators that were most capable of predicting peaks and troughs in advance. Coincident indicators for time series, whose changing values take place at the time of a peak, or trough and the lagging indicators whose action lags that of the leading and coincident indicators.

In studying the indicators, we have to develop a feeling about the predictive values of a particular time series in a particular situation. Necessarily, we shoud try to come up with the best indicator for use in a particular situation. A look at the indicators used by Bureau of Economic Analysis will show how these indicators are used and that possibly not all indicators must be used. If one can eliminate any variables, one can simplify the forecasting procedures necessary to provide answers. This elimination can result in a more effective method rather than elimination for the purpose of simplification.

Moore and Shiskin (1967) developed and applied the indicator system. This system was re-appraised by Zarnowitz and Bochan (1977).

In recent years, a lot of works have been done in the field of business cycles and economic indicators (see for example, Auerbach (1982), Beveridge, S. and C.R. Nelson (1981), Blinder, A. S. (1986), Boehm, E. A. and G. H. Moore (1984), Braun. P. and V. Zarnowitz (1989), Dawid, A. P. (1984), De, Leeuw, F. (1989), Diebold, F. X. and G. D. Rudebusch (1989), Foma, E. F. and M. R. Gibbons (1984), Garton (1982), Gordon (1986), Granger, C. W. J. (1969), Hall, R. E. (1986), Hamilton (1989), Higgins, B. (1979), Holmes, R. A. (1986), Hymans, S. H. (1973), Khan, G. A. (1985), Kinal, T. and K. Lahiri (1988), Klein, P. A. ed (1990), Kling, J. L. and D. A. Besseler(1989), Kling (1987), Koch and Rasche (1988) Koopmans, T. C. (1947, 1960), Lahiri, K. (1981, 1988), Layton, A. P. and G. H. Moore (1989), Layton, A. P. (1986, 1987), Mankiv (1984, 1986), Mengarelli, G. (1986), Mishkin (1981), Moore, G. H. (1969, 1985, 1986), Neftci, S. N.(1982), Nelson, C. R. and C. I. Plosser (1982), Niemira, M. P. (1982, 1986), Palash, C. I. and C. J. Radecki (1985), Sims (1980), Stekler, H. O. and M. Sehepsman (1973), Stock, J. H. and M. W. Watson (1988, 1989), Weeker, W. E (1979), Zarnowitz, V. and G. H. Moore (1982), Zarnowitz, V. (1979). Zarnowitz, V. and C. Boschan (1975), Zellner, A.

and C. Hong (1989),)

The current research on leading indicators can be classified into three broad categories.

One : New concepts and methods using recent developments in economic theory and time series analysis are being developed that can help to rationalize or test the existing system of leading and coincident indicators.

Two : More appropriate methods to calculate the forecasting records of leading indicators are being developed. A closely related area of research deals with probabilistic definition of turning points.

Three : Concurrently, we are seeing developments of new indicators around the world. Some of these are imaginative applications of the esixting LEI technology; others are exploring new techniques.

Now, as early detection of business cycle turning points has always been a major concern to policy makers, business men and inventors.

Zarnowitz and Moore (1982) developed a growth rate rule to signal recession and screen out false signals. This type of signal detection from leading indicators does not give an explicit probability statement expressing the forecaster's degree of certainty regarding an upcoming turning point. Salih Neftci (1982) suggested a method using time series analysis and the theory of optimum stapping to calculate the probability of a cyclical turning point. Michael Niemira goes through a step-by-step guide to the Neftci methodology, and demonstrates the usefulness of the probability method for forcasting turning points in international economic cycles. Roywebb compares the relative predictive power of Neftci's sequential probability rule, the vector autoregressive (VAR) model and a naive rule in detecting cyclical expansion and contraction.

He found that it is difficult to forecast the stage of the business cycle more accurately than by using an uniformative naive indicator. However, those results are tentative because of the short time interval considered.

Neftci methodology, while providing a significant extension of the Zarnowitz. Moore approach does not predict the date on which the turning point is likely to occur.

Weeker (1979) suggested an approach that permitted statements as to the probability of a turning point on any date or any group of dates under consideration. By using the Monte carlo Simulations future paths of the time series are repeatedly generated for the event "time until the next turning point". This approach, however needs a workable definition of turning point, which is by no means a trivial problem. Kling (1987) has extended this framework to debias the probability assessments following the prequential principle of Dawid (1984).

Given the small sample of postwar turning points, the Weeker-Kling methodology of debiasing probability assessments over turning point dates based on stochastic simulation seems to be particular promising and potentially save researchers from unhealthy data-mining.

By using a similar procedure Arnold Zellner and Chansik Hong (1989) have generated forecasts for turning points in annual growth rates for eighteen countries during 1974-85. Using Bayesian principles, they demonstrate that optimal turning point forecasts can be very sensitive to asymmetry in the loss structure.

In business cycle analysis, theoretical basis for leading indicator is also a most important technique to make decision about business acitivities. Frank de Leeuw (1989) provided a convincing theoretical basis for leading indicators in order to make decision about employment, output and shipments. Using the dynamic production theory framework he illustrated the response of orders, average hours and other indicators to shock in demand in production and in expectations.

Following the work of Frank de Leeuw's (1989) we can not make decision or we can not find the efficiency of the permanent and temporary employment seperately if they work together in a factory. That is why, we are very much interested to modify his developed cost function in order to make decision or in order to find the efficiency of the permanent and temporary employment seperately. The modification has been done for the orders model and also for the shipments model. Then by minimizing the discounted sum of present and future cost function, the dynamic models are obtained on the basis of the reduced form equations system. Then using these dynamic models we can forecast the results to make decision about the permanent and temporary employment and also of their output.

Thus it is very much important and interesting for the empirical verification of the theoretical construct. Therefore, for the empirical verification of the theoretical construct, we simulate a Japanese quarterly economical data. Simulations have been done only for the shipments model, but for the orders model data are not available in our hand, that is why we are unable to simulate the data on the basis of the orders model.

Simulations have been done for the following two cases ;

Case One : Sensitivity to parameter(s) change, Case Two : Step change in expected shipments.

Next, we describe the methodology in details in order to obtain the dynamic model for the shipments model. Then from the analogous property, we can derive the dynamic model for the orders model.

2 Modification of the Frank de Leeuw's (1989) Developed Cost Function

2.1 Introduction

The index of leading indicators contain the following most important time series,

(1) New Orders, Consumer Goods and Materials, (2) Contract and Orders, Plant and Equipment, (3) Housing Units Authorized by Building Permits, (4) Average Weekly Hours of Production

Workers, Manufacturing, (5) Vendor Performance, Percentage of Companies Receiving Slower Deliveries, (6) Stock Prices, Index, (7) Change in Sensitive Materials Price, Percent, (8) Money Supply, (9) Initial Claims for Unemployment Insurance, (10) Change in Business and Consumer Credit Outstanding, (11) Change in Manufacturing Inventories on Hand and on Order

Each of time series can be justified by one of five rationals. The five rationals are as, (1) Production Time, (2) Ease of Adaptation, (3) Market Expectations, (4) Prime Movers and, (5) Change-Versus-Levels. It is also possible to justify more than one series by one of five rationals.[4]

The first three of rationals directly affect the business decision about production, order, employment and inventories.

In 1989, Frank de Leeuw has provided a theoretical model of leading indicators to explore these three rationals that incorporate them. From the Frank de Leeuw's (1989) methodology we can make decision about overall output, employment and shipments. But, we can not make decision about the permanent and temporary employment and also of their output from the Frank de Leeuw's (1989) methodology. That is why the principle purpose of this research is to extend his methodology in order to make decision or to find the efficiency of the permanent and temporary employment seperately.

Next, we pass on to describe the methodology in order to obtain the dynamic model of the permanent and temporary employment and also of their output.

2.2 Methodology

In this section we described a model of a cost minimizing firm in order to have a deeper understanding of the efficiency of the permanent and temporary employment seperately. It describes the short-run behavior of a business that forms expectations about demands and shipments and that attempt to minimize the costs of meeting those demands and shipments. Costs are associated with the following factors.

(1) The Level of Permanent Employment, (2) The Level of Temporary Employment (3) The Change in Permanent Employment, (4) The Change in Temporaray Employment, (5) Departures of Average Hours from Some Normal Levels of Permanent Employment, (6) Departures of Average Hours from Some Normal Levels of Temporary Employment, (7) Dapartures of the

4 Production Time : The meaning of production time is that, for many goods it takes time as months or as even years between the decision to produce and actual production.

Ease of Adaptation : The meaning of ease of adaptation is that, certain dimensions of economic activities have lower costs of short-run variation with other. For example, it takes lower costs of the weekly average labor hours, than the permanent employment in a factory.

Market Expectations : The meaning of market expectations is that some time series tend to reflects or especially sensitive to anticipation about future economic activities.

Prime Movers : The view that fluctuations in economic activities are driven basically by a few measurable forces, such as monetary policy and fiscal policy.

Change-Versus-Levels : The view that change in time series generally turn from up to down before levels.

Stock of Inventories from Some Normal Multiple of Sales, (8) Departures of Unfilled Orders from Some Normal Multiple of Output

It is convenient to deal seperately with a firm that produce solely to order (and hence no finished goods inventories), and a firm that produce solely for stock (and hence no new or unfilled orders)

The costs facing the first type of firm for each time period, is represented by the following cost equation,

$$C(t)=b_0+b_1[PE(t)\times \bar{H}_1]+b_2[TE(t)\times \bar{H}_2]+b_3[PE(t)(H_1(t)-\bar{H}_1)]^2+b_4[TE(t)(H_2(t)-\bar{H}_2)]^2+ b_5[\bar{H}_1(PE(t)-PE(t-1))]^2+b_6[\bar{H}_2(TE(t)-TE(t-1))]^2+b_7[U(t)-c_1Q_1(t)-c_2Q_2(t)]^2 \quad (1)$$

And a firm that produce to stock and has no unfilled order faces an analogous cost function, which is as follows,

$$C(t)=a_0+a_1[PE(t)\times \bar{H}_1]+a_2[TE(t)\times \bar{H}_2]+a_3[PE(t)(H_1(t)-\bar{H}_1)]^2+a_4[TE(t)(H_2(t)-\bar{H}_2)]^2+ a_5[\bar{H}_1(PE(t)-PE(t-1))]^2+a_6[\bar{H}_2(TE(t)-TE(t-1))]^2+a_7[J(t)-c_3S(t)]^2 \quad (2)$$

where,

$C(t)$=Costs of production in period t, $PE(t)$=Permanent employment in period t, $TE(t)$= Temporary employment in period t, $H_1(t)$=Average hours of the permanent employment in period t, $H_2(t)$=Average hours of the temporary employment in period t, $\bar{H}_1$=Normal or minimum cost level of $H_1(t)$, $\bar{H}_2$=Normal or minimum cost level of $H_2(t)$, $U(t)$=Unfilled orders at the end of period t, $Q_1(t)$=Quantity of output of the permanent employment in period t, $Q_2(t)$ =Quantity of output of the temporary employment in period t. $J(t)$=Inventories at the end of period t. $S(t)$=Shipments at the end of period t.

b_0-b_7 and a_0-a_7=Costs parameters that depend on technology on market conditions such as wage rates, recruitment costs, and on laws affecting such production elements as overtime hours and unemployment insurance.

The firm's problem is to minimize the discounted sum of present and future costs,

$$DSC(t)=\sum_{i=0}\frac{C(t+i)}{(1+r)^i} \quad (3)$$

subject to the following three constraints (for the orders model),

(1) A short-run production function for the permanent employment at time t,

$$Q_1(t)=c_4[PE(t)\times H_1(t)] \quad (4)$$

(2) A short-run production function for the temporary employment at time t,

$$Q_2(t)=c_5[TE(t)\times H_2(t)] \quad (5)$$

(3) An unfilled order identity

$$U(t)=U(t-1)+N(t)-Q_1(t)-Q_2(t) \quad (6)$$

For the shipments model the three constraints are as follows,

(1) A short-run production function for the permanent employment at time t,

$$Q_1(t)=c_6[PE(t)\times H_1(t)] \tag{7}$$

(2) A short-run production function for the temporary employment at time t,

$$Q_2(t)=c_7[TE(t)\times H_2(t)] \tag{8}$$

(2) Stock of finished goods inventories identity

$$J(t)=J(t-1)+Q_1(t)+Q_2(t)-S(t) \tag{9}$$

where,

$N(t)$=Quantity of new orders in period t and r is the discount rate.

Next, we move to explain about the minimization procedure. At first we discuss the minimization procedure for the shipments model in details in order to obtain the dynamic model, and then analogously we try to derive the dynamic model for the orders model.

2.3 Minimization Procedure for the Shipments Model in Order to Obtain the Dynamic Models

The minimization procedure for the shipments model, involves the following steps,

Step One : At first we put the value of $J(t)$ in equation (2), then we have the following cost equation,

$$C(t)=a_0+a_1[PE(t)\times \bar{H}_1]+a_2[TE(t)\times \bar{H}_2]+a_3[PE(t)(H_1(t)-\bar{H}_1)]^2+a_4[TE(t)(H_2(t)-\bar{H}_2)]^2+ a_5[\bar{H}_1(PE(t)-PE(t-1))]^2+a_6[\bar{H}_2(TE(t)-TE(t-1))]^2+a_7[J(t-1)+Q_1(t)+Q_2(t)- S(t)-c_3S(t)]^2 \tag{10}$$

Step Two : From equation (7) and (8), we can furher write as follows,

$$H_1(t)=\frac{Q_1(t)}{c_6PE(t)},\ H_2(t)=\frac{Q_2(t)}{c_7TE(t)} \tag{11}$$

Step Three : Now putting the value of $H_1(t)$ and $H_2(t)$ in equation (10), then we have the following cost equation,

$$C(t)=a_0+a_1[PE(t)\times \bar{H}_1]+a_2[TE(t)\times \bar{H}_2]+a_3\left[PE(t)\left(\frac{Q_1(t)}{c_6PE(t)}-\bar{H}_1\right)\right]^2+a_4\left[TE(t)\left(\frac{Q_2(t)}{c_7TE(t)}-\bar{H}_2\right)\right]^2+a_5[\bar{H}_1(PE(t)-PE(t-1))]^2+a_6[\bar{H}_2(TE(t)-TE(t-1))]^2+ a_7[J(t-1)+Q_1(t)+Q_2(t)-S(t)(1+c_3)]^2 \tag{12}$$

This is the firm's cost function at the present time period t.

Step Four : From the analogous property, the firm's cost function for future periods $(t+1)$, $(t+2)$ and so on, can be written as follows ;

For $(t+1)$,

$$C(t+1)=a_0+a_1[PE(t+1)\times \bar{H}_1]+a_2[TE(t+1)\times \bar{H}_2]+a_3\left[PE(t+1)\left(\frac{Q_1(t+1)}{c_6PE(t+1)}-\bar{H}_1\right)\right]^2+ a_4\left[TE(t+1)\left(\frac{Q_2(t+1)}{c_7TE(t+1)}-\bar{H}_2\right)\right]^2+a_5[\bar{H}_1(PE(t+1)-PE(t))]^2+a_6[\bar{H}_2 (TE(t+1)-TE(t))]^2+a_7[J(t)+Q_1(t+1)+Q_2(t+1)-S(t+1)(1+c_3)]^2 \tag{13}$$

for $(t+2)$ is,

$$C(t+2)=a_0+a_1[PE(t+2)\times\bar{H}_1]+a_2[TE(t+2)\times\bar{H}_2]+a_3\left[PE(t+2)\left(\frac{Q_1(t+2)}{c_6PE(t+2)}-\bar{H}_1\right)\right]^2+$$
$$a_4\left[TE(t+2)\left(\frac{Q_2(t+2)}{c_7TE(t+2)}-\bar{H}_2\right)\right]^2+a_5[\bar{H}_1(PE(t+2)-PE(t+1))]^2+a_6[\bar{H}_2$$
$$(TE(t+2)-TE(t+1))]^2+a_7[J(t+1)+Q_1(t+2)+Q_2(t+2)-S(t+2)(1+c_3)]^2 \tag{14}$$

and so on.

Step Five : Now, we put the value of $C(t)$, $C(t+1)$, $C(t+2)$ and so on , in equation (3), then we have the following discounted sum of present and future cost function,

$$DSC(t)=a_0+a_1[PE(t)\times\bar{H}_1]+a_2[TE(T)\times\bar{H}_2]+a_3[PE(t)(H_1(t)-\bar{H}_1)]^2+a_4[TE(t)(H_2(t)-$$
$$\bar{H}_2)]^2+a_5[\bar{H}_1(PE(t)-PE(t-1))]^2+a_6[\bar{H}_2(TE(t)-TE(t-1))]^2+a_7[J(t-1)+$$
$$Q_1(t)+Q_2(t)-S(t)(1+c_3)]^2+\frac{1}{1+r}[a_0+a_1[PE(t+1)\times\bar{H}_1]+a_2[TE(t+1)\times\bar{H}_2]+$$
$$a_3\left[PE(t+1)\left(\frac{Q_1(t+1)}{c_6PE(t+1)}-\bar{H}_1\right)\right]^2+a_4\left[TE(t+1)\left(\frac{Q_2(t+1)}{c_7TE(t+1)}-\bar{H}_2\right)\right]^2+a_5[\bar{H}_1$$
$$(PE(t+1)-PE(t))]^2+a_6[\bar{H}_2(TE(t+1)-TE(t))]^2+a_7[J(t)+Q_1(t+1)+Q_2(t+1)-$$
$$S(t+1)(1+c_3)]^2+\frac{1}{(1+r)^2}[a_0+a_1[PE(t+2)\times\bar{H}_1]+a_2[TE(t+2)\times\bar{H}_2]+$$
$$a_3\left[PE(t+2)\left(\frac{Q_1(t+2)}{c_6PE(t+2)}-\bar{H}_1\right)\right]^2+a_4\left[TE(t+2)\left(\frac{Q_2(t+2)}{c_7TE(t+2)}-\bar{H}_2\right)\right]^2+a_5[\bar{H}_1$$
$$(PE(t+2)-PE(t+1))]^2+a_6[\bar{H}_2(TE(t+2)-TE(t+1))]^2+a_7[J(t)+$$
$$Q_1(t+1)+Q_2(t+1)+Q_2(t+2)-S(t+1)+Q_1(t+2)-S(t+2)(1+c_3)]^2+.... \tag{15}$$

The minimization procedure will face the following two type of problems. We have to over come these problems in order to obtain the dynamic model to make desirable decision about the permanent and temporary employment and also about their output for the shipments model. The problems and their solutions are also described below;

First Kind of Problems : The first one is that, the solution involved new shipments in future periods - which are fully unknown to us, but at the time the decision about output and also for the employment have to be made. Actually, we do not know the value of the new shipments in near future or in future. That is why, in order to solve the problem, we substitute the actual new shipments in future by the expected new shipments that is $ES(t+i)$, instead of $S(t+i)$ $(i=0, 1, 2,......)$

Second Kind of Problems : The second problem is one that, in principle, this procedure will produce an infinite number of equations that have to be solved even have to obtain current-period output and employment. To deal with this problem without sacrificing anything essential, we add three assumptions that amount to impossing the expectation that the firm will reach equilibrium condition at the end of two periods. First, the firm assumes that the stock of inventories of finished goods is equal to c_3 times of the amount of shipments by the end of time period $(t+2)$. The seecond, the firm assumes that average hours is equal to normal hours by the end of period $(t+2)$ for the permanent and temporary employment, and the third is, c_1 times output of permanent employment is equal to the c_2 times output of the temporary employment at the end of period $(t+2)$.

Mathematically, these assumptions can be written as follows;

$$J(t+2)=c_3S(t+2),\quad H_1(t+2)=\bar{H}_1,\quad H_2(t+2)=\bar{H}_2,\quad c_1Q_1(t+2)=c_2Q_2(t+2) \tag{16}$$

These assumptions may shorten or lengthen some of the adjustment paths in the model compared with the far more complex case of adjustment taking three or more periods. They do not, however, force the adjustment to an exogenous change to take only two periods. They are merely a way of simplifying the calculations that the firm makes each period by having them on knows data and on expectations up to two periods ahead.

The generalizations about leads and lags suggested by solutions under these simplifying assumptions would probably be almost identical for more general solution of the model.

Step Six : Under these assumptions the equation of discounted sum of present and future cost function (15) can be written as follows,

$$\begin{aligned}DSC(t)=&a_0+a_1[PE(t)\times\bar{H}_1]+a_2[TE(t)\times\bar{H}_2]+a_3\left[\frac{Q_1(t)}{c_6}-PE(t)\bar{H}_1)\right]^2+a_4\left[\frac{Q_2(t)}{c_7}-\right.\\&\left.TE(t)\bar{H}_2)\right]^2+a_5[\bar{H}_1(PE(t)-PE(t-1))]^2+a_6[\bar{H}_2(TE(t)-TE(t-1))]^2+a_7[J(t-1)+\\&Q_1(t)+Q_2(t)-ES(t)(1+c_3)]^2+\frac{1}{1+r}[a_0+a_1[PE(t+1)\times\bar{H}_1]+a_2[TE(t+1)\times\\&\bar{H}_2]+a_3\left[\frac{Q_1(t+1)}{c_6}-PE(t+1)\bar{H}_1\right]^2+a_4\left[\frac{Q_2(t+1)}{c_7}-TE(t+1)\bar{H}_2\right]^2+a_5[\bar{H}_1\\&(PE(t+1)-PE(t))]^2+a_6[\bar{H}_2(TE(t+1)-TE(t))]^2+a_7[J(t-1)+Q_1(t)+Q_2(t)-\\&ES(t)+Q_1(t+1)+Q_2(t+1)-ES(t+1)(1+c_3)]^2+\frac{1}{(1+r)^2}[a_0+a_1[m_1[(1+c_3)\\&ES(t+2)-J(t-1)-Q_1(t)-Q_2(t)+ES(t)-Q_1(t+1)-Q_2(t+1)+ES(t+1)]]+\\&a_2[m_2[(1+c_3)ES(t+2)-J(t-1)-Q_1(t)-Q_2(t)+ES(t)-Q_1(t+1)-Q_2(t+1)+\\&ES(t+1)]+a_5[m_1[(1+c_3)ES(t+2)-J(t-1)-Q_1(t)-Q_2(t)+ES(t)-Q_1(t+1)-\\&Q_2(t+1)+ES(t+1)]-\bar{H}_1PE(t+1)]^2+a_6[m_2[(1+c_3)ES(t+2)-J(t-1)-\\&Q_1(t)-Q_2(t)+ES(t)-Q_1(t+1)-Q_2(t+1)+ES(t+1)]-\bar{H}_2PE(t+1)]^2]\end{aligned} \tag{17}$$

Step Seven : We will take the partial derivatives of the equation (17) with respect to $PE(t)$, $PE(t+1)$, $TE(t)$, $TE(t+1)$, $Q_1(t)$, $Q_1(t+1)$, $Q_2(t)$, and $Q_2(t+1)$, and then equating to zero, we have the following system of equations,

$$\begin{aligned}&A_{11}PE(t)+A_{12}PE(t+1)+A_{13}TE(t)+A_{14}TE(t+1)+A_{15}Q_1(t)+\\&A_{16}Q_1(t+1)+A_{17}Q_2(t)+A_{18}Q_2(t+1)=M_1\end{aligned} \tag{18}$$

$$A_{21}PE(t)+A_{22}PE(t+1)+A_{23}TE(t)+A_{24}TE(t+1)+A_{25}Q_1(t)+A_{26}Q_1(t+1)+A_{27}Q_2(t)+A_{28}Q_2(t+1)=M_2 \quad (19)$$

$$A_{31}PE(t)+A_{32}PE(t+1)+A_{33}TE(t)+A_{34}TE(t+1)+A_{35}Q_1(t)+A_{36}Q_1(t+1)+A_{37}Q_2(t)+A_{38}Q_2(t+1)=M_3 \quad (20)$$

$$A_{41}PE(t)+A_{42}PE(t+1)+A_{43}TE(t)+A_{44}TE(t+1)+A_{45}Q_1(t)+A_{46}Q_1(t+1)+A_{47}Q_2(t)+A_{48}Q_2(t+1)=M_4 \quad (21)$$

$$A_{51}PE(t)+A_{52}PE(t+1)+A_{53}TE(t)+A_{54}TE(t+1)+A_{55}Q_1(t)+A_{56}Q_1(t+1)+A_{57}Q_2(t)+A_{58}Q_2(t+1)=M_5 \quad (22)$$

$$A_{61}PE(t)+A_{62}PE(t+1)+A_{63}TE(t)+A_{64}TE(t+1)+A_{65}Q_1(t)+A_{66}Q_1(t+1)+A_{67}Q_2(t)+A_{68}Q_2(t+1)=M_6 \quad (23)$$

$$A_{71}PE(t)+A_{72}PE(t+1)+A_{73}TE(t)+A_{74}TE(t+1)+A_{75}Q_1(t)+A_{76}Q_1(t+1)+A_{77}Q_2(t)+A_{78}Q_2(t+1)=M_7 \quad (24)$$

$$A_{81}PE(t)+A_{82}PE(t+1)+A_{83}TE(t)+A_{84}TE(t+1)+A_{85}Q_1(t)+A_{86}Q_1(t+1)+A_{87}Q_2(t)+A_{88}Q_2(t+1)=M_8 \quad (25)$$

Step Eight : The system of equatins (18-25) can be written with the following matrix form,

$$\begin{pmatrix} A_{11} & A_{12} & A_{13} & A_{14} & A_{15} & A_{16} & A_{17} & A_{18} \\ A_{21} & A_{22} & A_{23} & A_{24} & A_{25} & A_{26} & A_{27} & A_{28} \\ A_{31} & A_{32} & A_{33} & A_{34} & A_{35} & A_{36} & A_{37} & A_{38} \\ A_{41} & A_{42} & A_{43} & A_{44} & A_{45} & A_{46} & A_{47} & A_{48} \\ A_{51} & A_{52} & A_{53} & A_{54} & A_{55} & A_{56} & A_{57} & A_{58} \\ A_{61} & A_{62} & A_{63} & A_{64} & A_{65} & A_{66} & A_{67} & A_{68} \\ A_{71} & A_{72} & A_{73} & A_{74} & A_{75} & A_{76} & A_{77} & A_{78} \\ A_{81} & A_{82} & A_{83} & A_{84} & A_{85} & A_{86} & A_{87} & A_{88} \end{pmatrix} \begin{pmatrix} PE(t) \\ PE(t+1) \\ TE(t) \\ TE(t+1) \\ Q_1(t) \\ Q_1(t+1) \\ Q_2(t) \\ Q_2(t+1) \end{pmatrix} = \begin{pmatrix} M_1 \\ M_2 \\ M_3 \\ M_4 \\ M_5 \\ M_6 \\ M_7 \\ M_8 \end{pmatrix} \quad (26)$$

$$\Longrightarrow AE=M \quad (27)$$

$$\Longrightarrow E=A^{-1}M \quad (28)$$

where, $m_1=\frac{c_2}{c_6(c_1+c_2)}$, $m_2=\frac{c_1}{c_7(c_1+c_2)}$ the coefficients A_{ij}, $(i, j=1, 2, 3, 4, 5, 6, 7, 8)$ are the function of the parameters a_i, c_i $(i=1, 2, 3, 4, 5, 6, 7)$, average hours $\bar{H}_i$ $(i=1, 2)$ and the discount rate r and M_i's(i=1,2,....8) are the function of the parameters a_i, c_i $(i=1.2,...7)$, expected shipments, inventories and the discount rate r.

Step Nine : From the equation (28) we can find the solution for $PE(t)$, $PE(t+1)$, $TE(t)$, $TE(t+1)$, $Q_1(t)$, $Q_1(t+1)$, $Q_2(t)$, and $Q_2(t+1)$.

Step Ten : Putting the value of $PE(t)$, $TE(t)$, $Q_1(t)$ and $Q_2(t)$ in equations (7), (8) and (9) we can find the solutions for $H_1(t)$, $H_2(t)$ and $J(t)$.

The solution for $PE(t)$, $TE(t)$, $Q_1(t)$ and $Q_2(t)$ represents the firm's final decisions for these variables. The solution for $PE(t+1)$, $TE(t+1)$, $Q_1(t+1)$ and $Q_2(t+1)$ reprsents plans, still subject to alternation in the next period when this period $PE(t+1)$, $TE(t+1)$, $Q_1(t+1)$ and

$Q_2(t+1)$ becomes $PE(t)$, $TE(t)$, $Q_1(t)$ and $Q_2(t)$.

Now, in order to forecasting the economic activities about $PE(t)$, $TE(t)$, $Q_1(t)$ and $Q_2(t)$, we have to express these variables as the dynamic model. The dynamic model of these variables can be obtained by using the reduced form equations system.

Then using the reduced form equations system to the equations (18-25), we can obtain the following dynamic models of the permanent and temporary employment and also of their output for the shipments model.

$$PE(t)=X_0+X_1PE(t-1)+X_2TE(t-1)+X_3U(t-1)+X_4ES(t)+X_5ES(t+1)+X_6ES(t+2) \quad (29)$$

$$TE(t)=Y_0+Y_1PE(t-1)+Y_2TE(t-1)+Y_3U(t-1)+Y_4ES(t)+Y_5ES(t+1)+Y_6ES(t+2) \quad (30)$$

$$Q_1(t)=U_0+U_1PE(t-1)+U_2TE(t-1)+U_3U(t-1)+U_4ES(t)+U_5ES(t+1)+U_6ES(t+2) \quad (31)$$

$$Q_2(t)=V_0+V_1PE(t-1)+V_2TE(t-1)+V_3U(t-1)+V_4ES(t)+V_5ES(t+1)+V_6ES(t+2) \quad (32)$$

where, the coefficients X_i, Y_i, U_i and V_i $(i=0, 1, 2, 3, 4, 5, 6)$ are the function of the parameters a_i, c_i $(i=1, 2, 3, 4, 5, 6, 7)$, average hours $\overline{H}_i$ $(i=1, 2)$ and the discount rate r.

Using the same procedure, we can obtain the dynamic model for the orders model. Thses derived equations can be used in forecasting the economic acitivities as an alternative to the leading indicator approach for the orders model and also for the shipments models. On the basis of the forecasting results we can make decision about the permanent and temporary employment and also about the output of the permanent and temporary employment.

For the empirical verification of the theoretical construct, we calculated the expected shipments for future periods, on the basis of the adaptive expectation hypothesis. Next we turn to simulate the data.

3 Simulation the Data on the Basis of the Dynamic Model

In the previous section theoretically we have derived the dynamic model of the permanent and temporary employment and also of their output for the shipments model. But for the empirical verification of the theoretical construct, in this section another attempt has been made to simulate the Japanese quarterly economical data. Simulations have been broken into two sections;

(I) : Sensitivity to parameter(s) change (II) : Step change in expected shipments.

In both sections, simulations have been done, after reducing the seasonal affect from the quarterly data. We removed the seasonal affect on the basis of the moving average process.

In both sections, the simulations have been done with the following different cases;

(1) $a_1=a_2=.....=a_7=c_1=c_2=c_3=c_6=c_7=1$, (2) $a_1=a_2=1$ and $a_3=.....=a_7=5$ and $c_1=c_2=c_3=c_6=c_7=1$ (3) $a_1=a_2=a_3=.....=a_7=5$ and $c_1=c_2=c_6=c_7=c_3=1$ (4) $a_1=a_2=a_3=.....=a_7=c_1=c_2=c_6=c_7=1$ and $c_3=5$ (5) $a_1=a_2=a_3=.....=a_7=c_1=c_2=c_3=1$ and $c_6=c_7=5$ (6) $a_1=a_2=a_3=.....=a_7=c_1=c_2=1$ and $c_3=c_6=c_7=5$ (7) $a_1=a_2=c_1=c_2=1$ and $a_3=.....=a_7=c_3=c_6=c_7=5$

To simulate the data on the basis of the shipments model, at first we have to calculate the value of the coefficients of the dynamic system of equations in all cases. The value of the coefficients of the dynamic models are also calculated by using the Mathematica Program. The calculated

3.1 Estmated Values of the Coefficints of the Dynamic Models

Table No. 1 :

	X_0	X_1	X_2	X_3	X_4	X_5	X_6
Case1	−0.0863365	0.758284	−0.229828	−0.0564729	0.104925	0.0141755	0.003732
Case2	−0.0172673	0.758248	−0.229828	−0.0564729	0.104925	0.0141755	0.003732
Case3	−0.0863365	0.758284	−0.229828	−0.0564729	0.104925	0.0141755	0.003732
Case4	−0.0863365	0.758248	−0.229828	−0.0564729	0.298734	0.0387945	0.011196
Case5	−0.0750159	0.74824	−0.273826	−0.0143851	0.0284258	0.000672412	0.000032
Case6	−0.0750159	0.74824	−0.273826	−0.0143851	0.0845885	0.00198446	0.000098
Case7	−0.0150032	0.74824	−0.273826	−0.0143851	0.0845885	0.00198446	0.000098
	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
Case1	−0.0786981	−0.19096	0.758248	−0.0514767	0.0956422	0.0129214	0.003401
Case2	−0.0157396	−0.19096	0.758248	−0.0514767	0.0956422	0.0129214	0.003401
Case3	−0.0786981	−0.19096	0.758248	−0.0514767	0.0956422	0.0129214	0.003401
Case4	−0.0786981	−0.19096	0.758248	−0.0514767	0.272304	0.0353622	0.010205
Case5	−0.0683791	−0.227517	0.74824	−0.0131124	0.0259109	0.0006129	0.0000299
Case6	−0.0683791	−0.227517	0.74824	−0.0131124	0.0771048	0.00180889	−0.000089
Case7	−0.0136758	−0.227517	0.74824	−0.0131124	0.0771048	0.00180889	0.000089
	U_0	U_1	U_2	U_3	U_4	U_5	U_6
Case1	−0.0745325	1.92521	−1.4976	−0.039537	0.769368	0.0418522	0.001780
Case2	−0.0149065	1.92521	−1.4976	−0.039537	0.769368	0.0418522	0.001780
Case3	−0.0745325	1.92521	−1.4976	−0.039537	0.769368	0.0418522	0.001780
Case4	−0.0745325	1.92521	−1.4976	−0.039537	2.26536	0.0123776	0.00534283
Case5	−0.0232889	8.5628	−9.21583	−0.0494883	0.0999418	0.00070159	−0.000010
Case6	−0.0232889	8.5628	−9.21583	−0.0494883	2.96756	0.00211512	−0.000031
Case7	−0.00465779	8.5628	−9.21583	−0.0494883	2.96756	0.00211512	−0.000031
	V_0	V_1	V_2	V_3	V_4	V_5	V_6
Case1	−0.0745325	−1.36511	2.11207	−0.39537	0.769368	0.0418522	0.001780
Case2	−0.0149065	−1.36511	2.11207	−0.39537	0.769368	0.0418522	0.001780
Case3	−0.0745325	−1.36511	2.11207	−0.39537	0.769368	0.0418522	0.001780
Case4	−0.0745325	−1.36511	2.11207	−0.39537	2.26536	0.123776	0.005342
Case5	−0.0232889	−8.40049	9.39389	−0.494883	0.989418	0.00070159	−0.000010
Case6	−0.0232889	−8.40049	9.39389	−0.494883	2.96756	0.00211512	−0.000031
Case7	−0.00465779	−8.40049	9.39389	−0.494883	2.96756	0.00211512	−0.000031

3.2 Changing Estimated Values of the Variables from Period to Period

Table No. 2 :

Cases		91: I II III IV	92: I II III IV	93: I II III IV	94: I II III IV	95: I II III IV	96: I II III IV
Case1	PE	+ 0 − −	− + + +	+ + + 0	− − + +	− − − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − +
	Q_1	− − − −	− + + +	+ + + +	+ + + +	+ + + +	0 + + +
	Q_2	+ + + +	− − − −	− − − −	+ + + −	− − − −	− − + +
	J	+ + + +	0 − − −	− − − −	− − − −	− − − −	+ + − −
	H_1	− − − −	0 − + +	+ + + +	0 + + +	+ + + 0	0 + + +
	H_2	0 0 0 −	− − − −	− − − 0	0 + + 0	0 0 0 0	0 0 + +
Case2	PE	+ 0 − −	− + + +	+ + + 0	− − + +	+ − − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − −
	Q_1	− − − −	− + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Q_2	+ + + +	− − − −	− − − −	+ + + −	− − − −	− − + +
	J	+ + + +	0 − − −	− − − −	− − − −	− − − −	− − + +
	H_1	− − − −	− 0 + +	+ + + +	0 + + +	+ + + 0	0 + + +
	H_2	0 0 0 −	− − − −	− − − 0	0 + + 0	0 0 0 0	0 0 + +
Case3	PE	+ 0 − −	− + + +	+ + + 0	− − + +	+ − − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − +
	Q_1	− − − −	− + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Q_2	+ + + +	− − − −	− − − −	+ + + −	− − − −	− − + +
	J	+ + + +	0 − − −	− − − −	− − − −	− − − −	− − + +
	H_1	− − − −	− 0 + +	+ + + +	0 + + +	+ + + 0	0 + + +
	H_2	0 0 0 −	− − − −	− − − 0	0 + + 0	0 0 0 0	0 0 + +
Case4	PE	+ − − −	− − 0 +	+ + − −	− + + +	+ 0 − −	− + + +
	TE	+ + + +	− − − −	− − − −	− 0 − −	− − − −	− − + +
	Q_1	0 − − −	− − − +	+ + − +	+ + + +	+ + + +	+ + + +
	Q_2	+ + + −	− − − −	− − − −	+ + + +	− − − −	+ + + +
	J	+ + − −	− − − −	− − − −	+ + + +	+ − + +	+ + + +
	H_1	0 − − −	− − − 0	+ 0 0 0	+ + + +	+ + + +	+ + + +
	H_2	0 − − −	− − − 0	0 0 0 0	+ + + +	+ 0 0 0	+ + + +
Case5	PE	+ 0 − −	0 + + +	+ + + 0	− − − +	+ 0 − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − +
	Q_1	− − − −	− + + +	+ + + +	− + + +	+ + + +	+ + + −
	Q_2	+ + + +	0 − − −	− − − −	+ + − −	− − − −	− − − +
	J	+ + − −	− − − −	− − − −	+ + + +	+ − 0 −	+ + + +
	H_1	− − − −	− + + +	+ + + +	0 0 + +	+ + + +	0 + + −
	H_2	0 + + +	0 − − −	− − − −	0 0 0 −	− − − −	0 0 0 +
Case6	PE	+ 0 − −	0 + + +	+ + + 0	− − − +	+ + − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − +
	Q_1	− − − −	− + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Q_2	+ + + +	− − − −	− − − −	+ + + −	− − − −	− − + +
	J	+ + − −	− − − −	− − − −	+ + + +	+ + + +	+ + + +
	H_1	− − − −	− + + +	+ + + +	0 + + +	+ + + +	+ + + 0
	H_2	0 0 0 0	− − − −	− − − 0	0 + + −	− − 0 0	0 0 + +
Case7	PE	+ 0 − −	− + + +	+ + + 0	− − 0 +	+ + − −	− − − −
	TE	+ + + +	+ − − −	− − − −	− − − −	− − − −	− − − +
	Q_1	− − − −	− + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Q_2	+ + + +	− − − −	− − − −	+ + + −	− − − −	− − + +
	J	+ + − −	− − − −	− − − −	+ + + +	+ + + +	+ + + +
	H_1	− − − −	− + + +	+ + + +	0 + + +	+ + + +	+ + + 0
	H_2	0 0 0 0	− − − −	− − − 0	0 + 0 −	− − 0 0	0 0 + +

+ : indecates the increasing values
− : indicates decreasing values
0 : indicates no changes

values of the coefficients are also presented with the Table no 1. Now using the estimated coeffcients we also estimated the value of the permanent and temporary employment, and also of their output, average hours, and inventories in all cases by using the RATS (Regressin Analysis for Time Series) Program. On the basis of the estimated values we calculated the changing value of the variables from period to period. These changing values of the variables are presented with the table no 2.

Next, we pass to discuss the empirical results in the case of sensitivity to parameter(s) change, for different cases.

3.3 Empirical Results of Simulations in the Case of Sensitivity to Parameter(s) Change

Experiment One :

In experiment one we assumed that all the parameters value are equal to one and then we estimated the value of all the variables. In this experiment, we found that in all periods the estimated value of the temporary employment is greater than the permanent employment and also the output of the temporary employment is higher than the output of the permanent employment. For this experiment, we can conclude that the temporary employment is more efficient than that of the permanent employment. Changing estimated values from period to period of all the variables are also presented with the table no 2. From the results we see that for increasing estimated values of the permanent employment and also of their output , ths estimated value of the temporary employment and also of their output will be decreased and vice versa. Therefore, we can conclude that for this experiment there is a lead-lagg relationship between the permanent and temporary employment.

From the invenory results we see that for the year 1991 the inventories will be increased for all quarters then the inventories will be decreased from period to period until the year 1995. Then the inventories will be increased for the first quarter and second quarter of the year 1996 and it will be decreased for the third quarter and fourth quarter of the year 1996.

Experiment Two :

In this experiment we increased all the adjustment costs about 5%, then we estimated the value of all the variables. From these estimated results we can conclude that there is no significant differences of the estimated values with compare to the estimated values in experiment one. Hence we can conclude that there is no signigicant effect on the estimated values of the parameters value of a_3, a_4, a_5, a_6 and a_7, the effect is very little on the estimated values.

Experiment Three :

In this esperiment we increased all of the parameters value of "a's" from 1 to 5. Then we estimated the value of all the variables. From the estimated results we see that there is no any difference with compare to the estimated values in experiment 1 at all. This implies that for increasing the value of the different adjustment parameters the effect is same for increasing the value of the parameters a_1 and a_2 but opposite sign. So the effect will be cancelled and hence there is no change of the estimated values with compare to case 1.

Experiment Four :

In this experiment we fixed the value of all the parameters except c_3. We increased the value of c_3 from 1 to 5, and then we estimated the value of all the variables. From the estimated results, we can conclude that if we increase the value of the stock of inventories of the level of shipments, the estimated value of all the variables will be greater with compare to case 1 and 2. Thus we can conclude that the changing value of the parameter c_3 has the great impact on the estimated value of all variables. In this case we also found that the output of the temporary employment is more greater than the output of the permanent employment. Hence we can also conclude that for this case the temporary employment is more efficient than that of the permanent employment.

Experiment Five :

In this experiment we fixed all the parameters value except c_6 and c_7. In this experiment we increased the parameters value of c_6 and c_7 from 1 to 5, and then we estimated the value of all the variables. From the results we can conclude that for increasing value of c_6 and c_7 the estimated value of all the variavles will be increased. Thus we can say that the increasing value of the parameters of c_6 and c_7 has the good impact on the estimated value of all the variables.

Experiment Six :

In this experiment we increased the parameters value of c_3, c_6 and c_7 from 1 to 5, and then we estimated the value of all the variables. From the estimated values we see that the resulting estimates are different as compare to the previous cases. Especially, these increasing value has the great effect on the estimated value of output and hence inventories and average hours. For this case we see that the estimated value of the output of temporary employment is higher than the output of the permanent employment. Hence for this case the temporary employment is more efficient that of the permanent employment.

Experiment Seven :

In this experimet we increased the value of the parameters a_3, a_4, a_5, a_6, a_7, c_6 and c_7, then we estimated the value of all the variables. In this experiment the estimated value of all the variables are same with compare to experiment 6, except the variable $PE(t)$. For this case the estimated value of the permanent employment will be increased.

Next we will pass to simulate the data in the case of step change in expected shipments.

3.4 Simulations in the Case of Step Change in Expected Shipments

Now, we simulate the data on the basis of the shipments model for the step change in expected shipments. For this purpose we assumed that the expected shipments for the periods 1990 : Q3 to 1991 : Q4 are 400, for the periods 1992 : Q1 to 1992 : Q4 we assumed that the expected shipments will be decreased, the decreasing values are 350. And after that we assumed that the expected shipments will be increased for the periods 1993 : Q1 to 1993 : Q4, these increasing values are 375, and again it will be decreased for the periods 1994 : Q1 to 1994 : Q2, the decreasing value will be as 350, again we assumed that the expected shipments will be increased corresponding to the year 1995 : Q1 to 1996 : Q2, the increasing value will be 400 and for the periods 1996 : Q3 to 1997 : Q2 will be 450. Now, for the case of step change in expected shipments we calculated the value of all the variables in all cases. On the basis of the estimated values we also calculated the changing value of all the variables from period to period. These changing values are also presented with the table no 3.

3.5 Changing Estimated Values of the Variables from Period to Period

Table No. 3 :

Cases		91: I II III IV	92: I II III IV	93: I II III IV	94: I II III IV	95: I II III IV	96: I II III IV
Case1	*PE*	+ 0 − −	− + + +	+ + + −	− − − +	+ − − −	− − + −
	TE	+ + + +	− − − −	− − − −	− − − −	− − − −	− − + +
	Q_1	− − − −	− + + +	+ + + +	− + + +	+ + + +	− + + −
	Q_2	+ + + +	− − − −	+ − − −	− − − −	+ − − −	− − + +
	J	+ + + +	− − − −	+ − − −	− − − +	+ − − −	− + + −
	H_1	− − − −	− + + +	+ + + +	− + + +	+ + 0 0	0 + + 0
	H_2	0 0 0 0	− − − −	+ − − −	− 0 0 0	+ 0 0 0	0 0 + 0
Case2	*PE*	+ 0 − −	− + + +	+ + + −	− − − +	+ − − −	− − + −
	TE	+ + + +	− − − −	− − − −	− − − −	+ − − −	− − + −
	Q_1	− − − −	− + + +	+ + + +	− + + +	+ + + +	− + + −
	Q_2	+ + + +	− − − −	+ − − −	− − − −	+ − − −	− − + +
	J	+ + + +	− − − −	+ − − −	− − − +	+ − − −	− + + −
	H_1	− − − −	− + + +	+ + + +	− + + +	+ + 0 0	0 + + 0
	H_2	0 0 0 0	− − − −	+ 0 0 0	− 0 0 0	+ 0 0 0	0 0 + 0
Case3	*PE*	+ 0 − −	− + + +	+ + + −	− − − +	+ − − −	− − + −
	TE	+ + + +	− − − −	− − − −	− − − −	+ − − −	− − + +
	Q_1	− − − −	− + + +	+ + + +	− + + +	+ + + +	− + + −
	Q_2	+ + + +	− − − −	+ − − −	− − − −	+ − − −	− − + +
	J	+ + + +	− − − −	+ − − −	− − − +	+ − − −	− + + −
	H_1	− − − −	− + + +	+ + + +	− + + +	+ + 0 0	0 + + 0
	H_2	0 0 0 0	− − − −	+ 0 0 0	− 0 0 0	0 0 0 0	0 0 + 0
Case4	*PE*	+ 0 − −	− + + +	+ + + −	− − + +	+ − − −	− + + −
	TE	+ + + +	− − − −	+ − − −	− − − −	+ − − −	− − + +
	Q_1	− − − −	− + + +	+ + + +	− + + +	+ + + +	− + + −
	Q_2	+ + + −	− − − −	+ − − −	− − − +	+ − − −	− + + +
	J	+ + + −	− − − +	+ − − −	− − − +	+ − − −	− + + −
	H_1	− − − −	− 0 0 +	+ + + +	− + 0 0	+ + 0 0	0 0 + 0
	H_2	− − − −	− 0 0 0	+ + + +	− + 0 +	+ + 0 0	0 0 + 0

Case5	*PE*	++−−	−+++	+++0	−−−+	+0−−	−−+−
	TE	++++	−−−−	−−−−	−−−−	−−−−	−−++
	Q_1	−−−−	−+++	++++	−+++	++++	+++−
	Q_2	++++	−−−−	−−−−	−−−−	+−−−	−−++
	J	++++	−−−−	+−−−	−−−−	+−−−	−−+−
	H_1	−−−−	−+++	++++	−0++	++++	0++−
	H_2	0+++	−−−−	−−−−	−00−	+−−−	00++
Case6	*PE*	+0−−	−+++	+++0	−−−+	+0−−	−−+−
	TE	++++	−−−−	−−−−	−−−−	+−−−	−−++
	Q_1	−−−−	−+++	++++	−+++	++++	+++−
	Q_2	++++	−−−−	+−−−	−−−−	+−−−	−−++
	J	++++	−−−−	+−−−	−−−−	+−−	−−+−
	H_1	−−−−	−+++	++++	−0++	++++	0++0
	H_2	0000	−−−−	+−00	0000	+000	00++
Case7	*PE*	+0−−	−+++	+++0	−−−+	+0−−	−−+−
	TE	++++	−−−−	−−−−	−−−−	+−−−	−−++
	Q_1	−−−−	−+++	++++	−+++	++++	+++−
	Q_2	++++	−−−−	+−−−	−−−−	+−−−	−−++
	J	++++	−−−−	+−−−	−−−−	+−−−	−−+−
	H_1	−−−−	−+++	0+++	−0++	++++	0++0
	H_2	0000	−−−−	+−00	−000	+000	00++

+ : indecates the increasing values
− : indicates decreasing values
0 : indicates no changes

Next, we will turn to discuss the empirical results of the simulations in the case of step change in expected shipments.

3.6 Empirical Results of Simulations in the Case of Step Change in Expected Shipments

From the estimated values of the permanent and temporary employment, and also of their output, average hours and inventories, we can conclude that for increasing or decreasing value of the expected shipments, the estimated value of all the variables will be increased or decreased. And hence, from the estimated values, we can make a decision, about the number of employment that we have to increased or decreased for increasing or decreasing value of the expected shipments. In the case of step change in expected shipments, we found that the estimated value of the output of the temporary employment is higher than the output of the permanent employment. That is why we can conclude that the temporary employment is more efficient than that of the permanent employment in the case of production.

4 Discussion and Conclusion

Theory based leading indicator is one of the most important traditional approaches in business cycle study in order to make decision about the business acitivities. In 1989, Frank de Leeuw provided a methodology in order to make decision about employment, output and shipments.

This type of work has been done on the basis of the pioneering work of Holt, Modigliani, Muth and Simon (1960). But, from the Frank de Leeuw's (1989) methodology we can make decision about overall employment and output. But, if we like to make decision about the permenant and temporary employment and also about their output seperately, we can't from his developed methodology. That is why, the main purpose of this paper is to modify his cost function, and on the basis of the modified cost function we then obtained the dynamic model of the permanent and temporary employment and also of their output by minimizing the discounted sum of present and future cost function in order to make decision about the permanent and temporary employment and also of their output seperately.

For the empirical verification of the theoretical construct, in this paper another attempt has been made to simulate the Japanese quarterly data. Simulations have been done only for the shipments model. But for the orders model data are not avialable in our hand, hence we could not simulate the data on the basis of the orders model. Simulations have been broken into two sections, which are as,

(I) Sensitivity to Parameter(s) Change, (II) Step Change in Expected Shipments. In both sections, simulations have been done with different cases. The experimental results are also delineated below.

In all cases we estimated the value of the permanent and temporary employment, and also of their output and hence average hours and inventories. From the estimated results we can conclude that the incncasiuy or decneasiuy value of the adjustment cost parameters a_3, a_4,......a_7, have no significant effect on the estimated values of all the variables. This means, for large as well as for small value of these parameters, the effect on the estimated values is very poor. From the estimated values we can also conclude that for increasing or decreasing value of the parameters of c_1, c_2, c_3 c_6 and c_7, has the great impact on the estimated values of all the variables. From the simulation results, we found that in most of cases the estimated value of the output of temporary employment is higher than the output of the permanent employment. That is why, we can conclude that in the case of production the temporary employment is more efficient than that of the permanent employment.

From these estimated values we can conclude that the permanent and temporary employment has the opposite direction and also of their output hence average hours and inventories. This means, that there exist the lead-lagg relationship between these variables.

We have also simulated the data for the step change in expected shipments with different cases. From the simulated results we have observed that for increasing or decreasing value of the step change in expected shipments the estimated value of all the variables will be increased or decreased. Therefore from the estimated results, finally for increasing or decreasing value of the expected shipments, we can decide about the number of employment that we have to increase or decrease.

In both sections, on the basis of the estimated values we calculated the changing estimated values of all the variables from period to period. These estimated values are also presented with the table no 2 and 3. From these tabulated values we can easily understand about the increasing, decreasing and unchanged values of all the variables from period to period.

1. Alan J. Auerbach (1982), "The Index of Leading Indicators: Measurement Without Theory," *The Review of Economic and Statistics*, March, pp. 589-595.
2. De Leeuw, F. (1989), "Leading Indicators and the 'Prime Mover' View," *Survey of Current Business*, Vol 69, August, pp. 9-23.
3. Geoffery H. Moore (1982), "Sequential Signals of Recession and Recovery," *Journal of Business*, Vol 55, No. 1, pp. 57-85.
4. Glenn D. Rudebusch (1989), "Scoring the Leading Indicators," *Journal of Business*, Vol 62, No. 3, pp. 369-391.
5. H. O. Stekler and Martin Schepsman (1973), "Forecasting with an Index of Leading Series," *Journal of the American Statistical Association*, June.
6. Jack W. Wilson, Charles P. Jones (1987), "A Comparing of Annual Common Stock Returns: 1871-1925 With 1926-1985," *Journal of Business*, Vol 60, No. 2, pp. 201-237.
7. James D. Hamilton (1989), "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle," *Econometrica*, Vol. 57, No. 2, pp. 357-384.

item John L. Kling (1987), "Predicting the Turning Points of Business and Economic Time Series," *Journal of Business*, Vol. 60, No. 2, pp. 201-237.

8. John L. Kling, David A. Bessler (1989), "Calibration-Based Predictive Distributions: An Application of Prequential Analysis to Interest Rates, Money, Prices, and Output," *Journal of Business*, Vol. 62, No. 4, pp. 478 -499.
9. John C. Cox, Jonathan E. Ingersoll, Jr., Stephen A. Ross (1979), "Predicting the Turning Points of Business and Economic Time Series," *Journal of Business*, Vol 60, No. 2, pp. 201-237.
10. Koopmans, T. C. (1947), "Measurement Without Theory" *The Review of Economic and Statistics*, Vol. 29 (August), pp. 161-172.
11. Moore, Geoffrey H., (1950), "Statistical Indicators and Cyclical Revivals and Recessions," *Business Cycle Indicators*, Princeton University Press, 1961, Vol. 1, pp. 184-260.

item Moore, Geoffrey H.,(1955), "Leading and Confirming Indicators of General Business Changes," *Business Cycle Indicators*, Princeton University Press, 1961, Vol. 1, pp. 45-109.

Paul D. Koch, Robert H. Rasche, (1988), "An Examination of the Commerce Department Leading-Indicator Approach," *Journal of Business & Economic Statistica*, April, pp. 167-187.

Robert G. King, Charles I. Plosser and Sergio T. Rebelo (1988), "Production, Growth and Business Cycles," *Journal of Monetary Economics*, Vol. 21, pp. 195-232.

Salih N. Neftci (1982), "Optimal Prediction of Cyclical Downturns," *Journal of Economic Dynamics and Control*, Vol. 4, 225-241.

William E. Wecker (1979), "Predicting the Turning Points of a Time Series," *Journal of Business*, Vol. 52, No. 1, 36-50.