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An Example of Using the BVAR Model and Not Violating the "Lucas Critique:"

An Explanation of the Recent Korean Economic Boom*

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This paper presents a historical analysis of the effects of the favorable exogenous economic environment of 1985-1986 on the 1985-1986 Korean economic boom, by using a BVAR model that allows time varying coefficients. The analysis demonstrates the empirical validity of the "Lucas Critique:" an abrupt change in the economic environment induces changes in people's behavior, and thus a reduced-form model does not help forecast the future. This paper shows how one may overcome the "Lucas Critique" in using a BVAR model to measure the effects of possible structural changes on economic variables, as long as a historical event is the focus of the analysis. This paper addresses the issue of the quantitative significance of the Lucas Critique that was not fully resolved in Miller and Roberds and thus must be viewed as a substantial improvement upon Miller and Roberds.

I. Introduction

The purpose of this paper is two-fold. One is to demonstrate

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we do not have any available data, then we cannot use the BVAR model of this paper to forecast future fluctuations and at the same time overcome the "Lucas Critique." Thus this paper is again another example of demonstrating the empirical validity of the "Lucas Critique."

Section II describes the economic environment in which the 1985-1986 Korean economic boom occurred. The values of the three exogenous variables — the value of the dollar, the international interest rates, and the oil prices — have continued to decline for about two years. This phenomenon was quite unusual and is known as the "Three Lows" in Korea. Section II then introduces the time-varying BVAR model. Section III defines both the price effects of the "Three Lows" on the Korean economy and the effects of structural changes on the Korean economy. It is demonstrated that the effects of structural changes are measured so as not to violate the "Lucas Critique." This section also argues that the moving average (MA) representations calculated at various points in time exhibit the possibility of structural changes. Section III then calculates the price effects and the effects of the structural changes. Section IV concludes the paper.

II. Description of the Data for the Korean Economy and the Specification of the BVAR Model

The Euro-dollar rate, the price of oil (Arab light) and the value of the dollar relative to the value of the yen were the most important exogenous variables for the 1985-1986 Korean economic boom. The values of all three variables have declined since the first quarter of 1985. Moreover, in 1986, the declines were beyond the usual fluctuations of the previous five years, and this phenomenon was coined by the Koreans as the "Three Lows." Many people in Korea believe that the "Three Lows" have caused high growth rates for the real GNP, exports, and imports, and also stable WPI for 1985 and 1986.

This paper attempts to verify whether the economic boom was purely due to the price effects (the decline in the prices of the dollar, oil and foreign financial assets). For that purpose, we use a BVAR model which allows time varying coefficients. The BVAR model is specified as follows[1]:

variables affect the endogenous variables both contemporaneously and after a few periods.

Because θ_t varies over time, the BVAR model — equations (1) and (2) — takes into account the possibility that people's behavior will change in response to changes in environment (X_t). In the BVAR model of this paper, the time varying coefficient vector θ_t represents people's behavior.[5]

III. Price Effects and the Effects of Structural Changes

This section assumes that the continuous decline in the value of the dollar, the international interest rates, and oil prices during 1985-1986 has caused two effects on the Korean economy: First, the decline in the values of the three exogenous variables does have a price effect on the Korean economy even if the changes in the prices do not change the pattern of people's behavior. For instance, in equation (1) with a fixed value of θ_t, Y_t will be different in response to different values of X_t. Second, since the pattern of changes in X_t for the past two years was quite unusual, θ_t may change. In other words, people's behavior may be of a different pattern, which can be viewed as changes in the model structure. Thus the changes in X_t induce the effects of structural changes (changes in θ_t) on the Korean economy.

In this paper, those effects are defined by using the following three forecasting experiments.

Experiment A: This experiment assumes that the values of X_t in 1985: I are maintained through 1986: IV. That is, there are no changes in exogenous prices. This experiment then forecasts the values of Y_t from 1985: II to 1986: IV, based on the data up to 1985: I.

Experiment B: Assuming that X_t assumes the actual values of

[5] The random walks specification for θ_t is used in Sims; Doan, Litterman and Sims; Miller and Roberds among others. This specification is general enough to capture the systematic changes in people's behavior under a changing environment. For example, a permanent change in tax policy will induce a permanent change in parameter values in an investment function as in Lucas; Sargent (pp. 344-345).

meant to capture that change. The differences in the forecasts in Experiments B and C are due to the effects of structural changes.

Strictly speaking, unlike Experiments A and B, Experiment C is not a forecasting exercise. Rather, it is an ex post "fitting" exercise. Notice that this approach of analyzing the effects of abrupt changes in X_t on the Korean economy does not violate the "Lucas Critique," only because the analysis were about past data. If the analysis were about the effects on future Y for which we do not have any data, then the best alternative would be Experiment B, which has the possibility of violating the "Lucas Critique."

In order to see if carrying out Experiment C is worthwhile, we calculated the moving average representations (MAR) at 1985: I, 1985: IV, and 1986: III.[6] The MARs in Appendix A-C show that there may have been a structural change in the Korean economy between 1985: IV and 1986: III.[7] If that is the case, then Experiment B alone would not fully capture the effects of changes in X_t on the Korean economy.

The results of the experiments are compared with the actual data in Figures 1-4 and Tables in Appendix D. These figures show that Experiment B cannot explain the 1985-1986 Korean economic boom. One may argue that this is exactly what happened in Miller and Roberds: Conditional forecasts cannot explain actual data during a substantial policy (and/or environment) change because conditional forecasts ignore potential future variation in the model coefficients. Experiment C, however, explains the actual data quite well, which testifies the empirical validity of the "Lucas Critique."

IV. Conclusion

This paper shows an empirical example using a BVAR model while not violating the "Lucas Critique." The results in this paper

[6] MAR evaluates $\frac{\partial \log y_{t+i}}{\partial \log x_t}$, $i = 1, \ldots 24$. If x_t is Eurodollar rate, $\frac{\partial \log y_{t+i}}{\partial x_t}$.

[7] MARs are shown in respective figures in Appendix A-C. These figures show that the effects of the exogenous shocks on the economy do not easily dissipate over time. This is consistent with Nelson and Plosser; Campbell and Mankiw to list only a few. The charts in Doan, Litterman and Sims also exhibit similar responses.

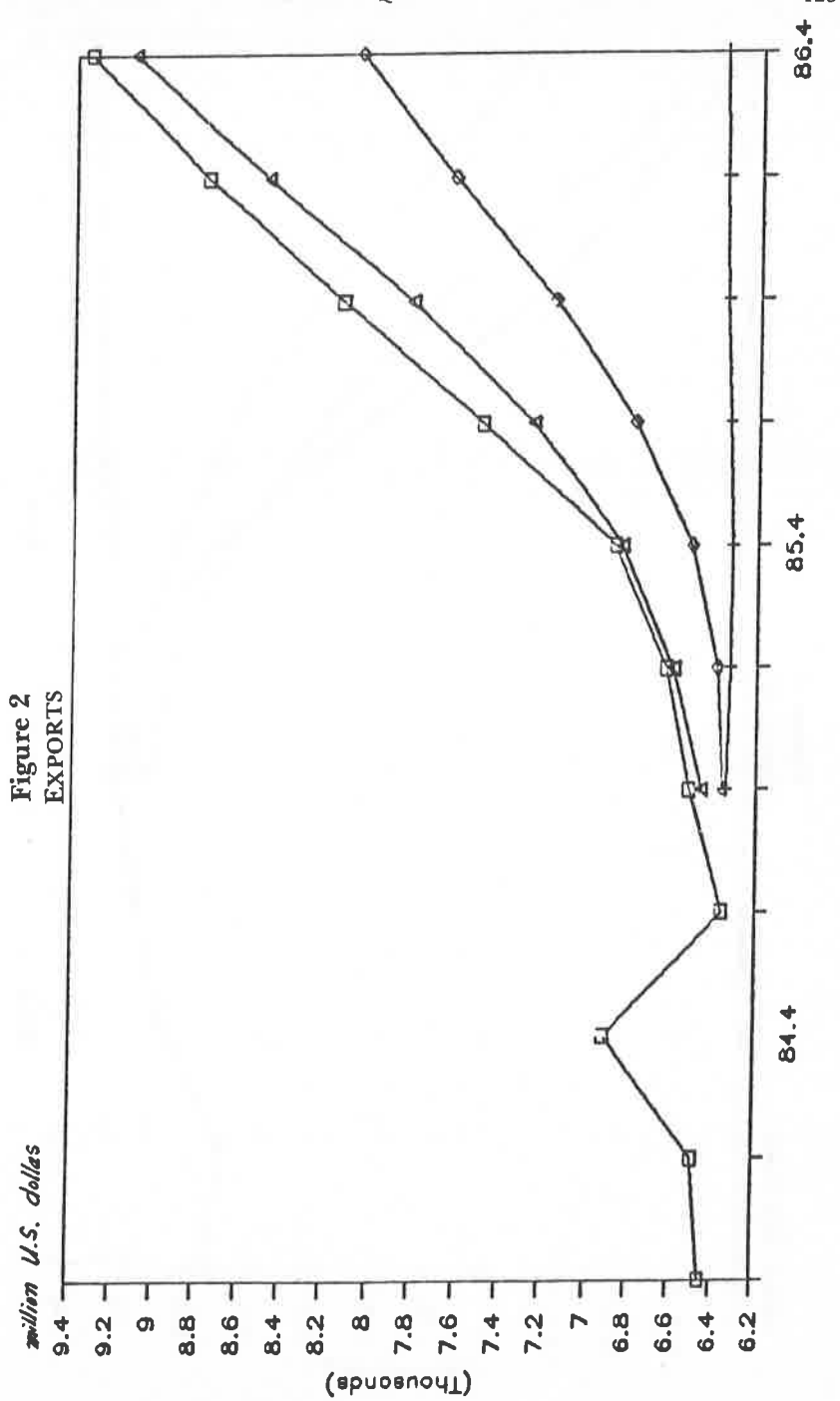
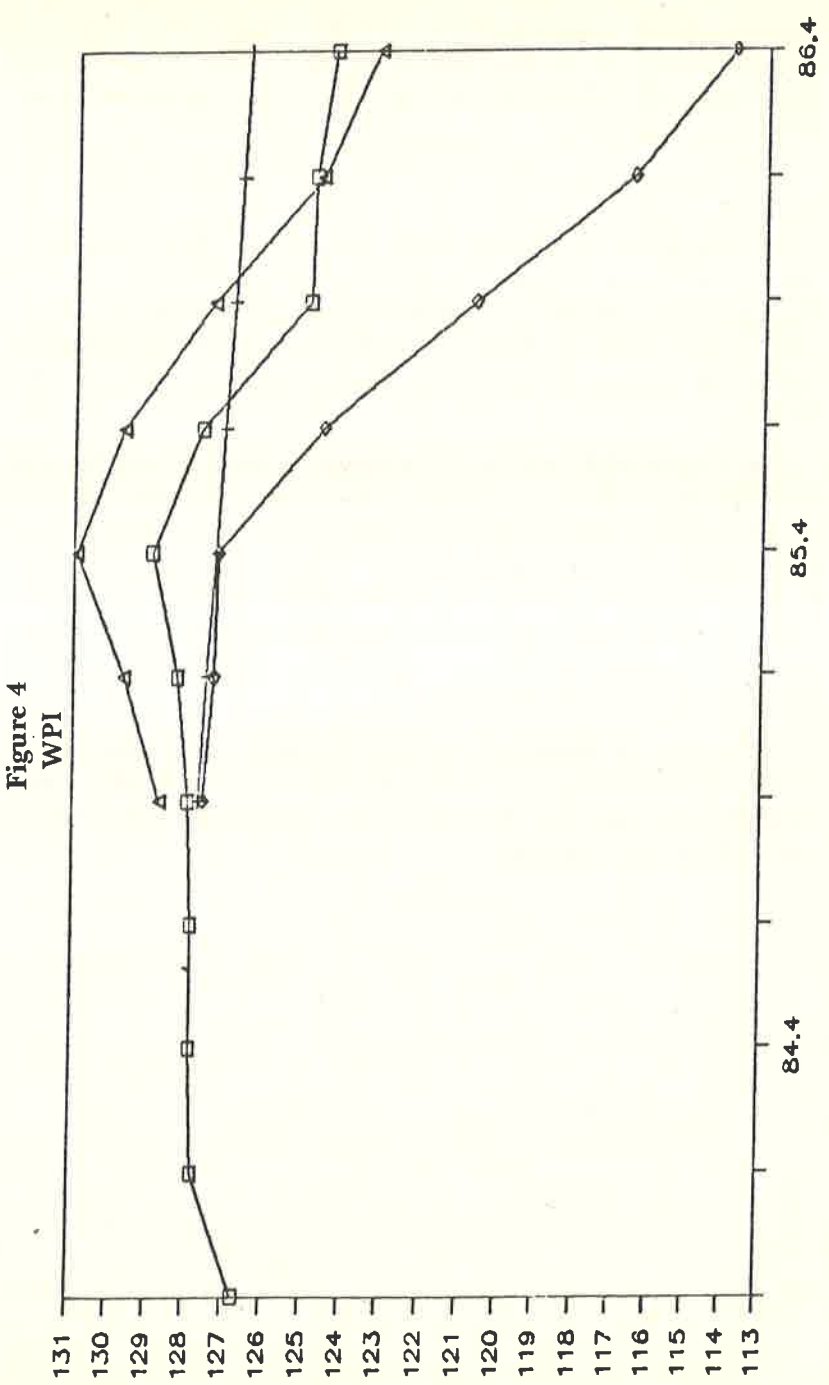


Figure 2
EXPORTS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85.4
86.4

Figure 4
WPI

Appendix A

MA REPRESENTATIONS
RESPONSES OF VARIABLES TO A 1 PERCENT POINT
RISE IN THE EURO-DOLLAR RATE

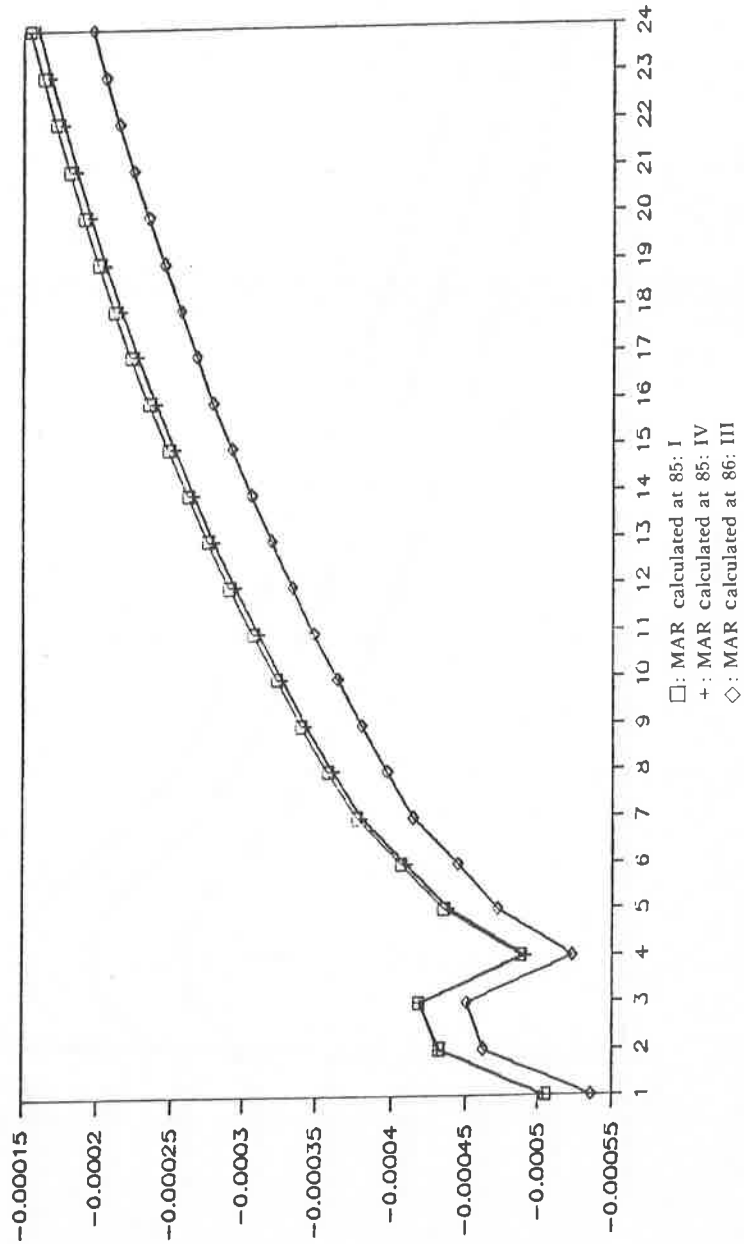


Figure A.1
REAL GNP

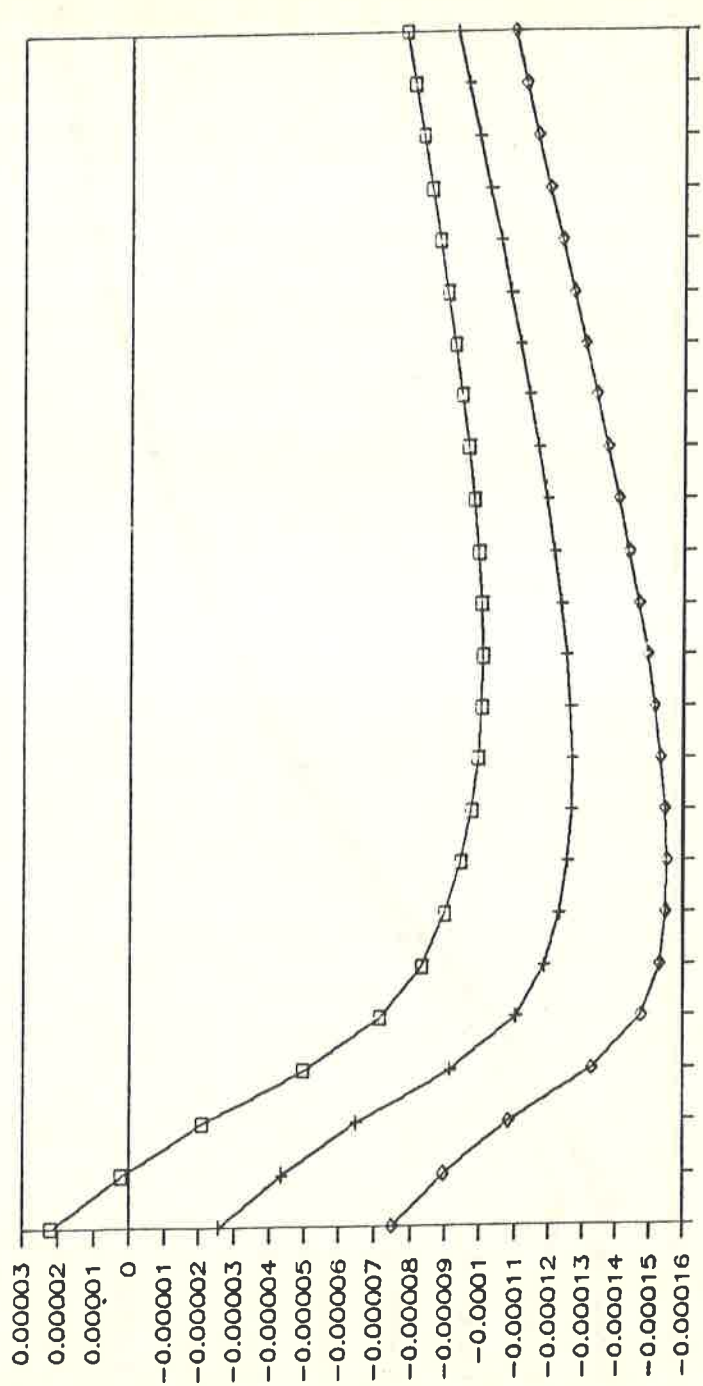
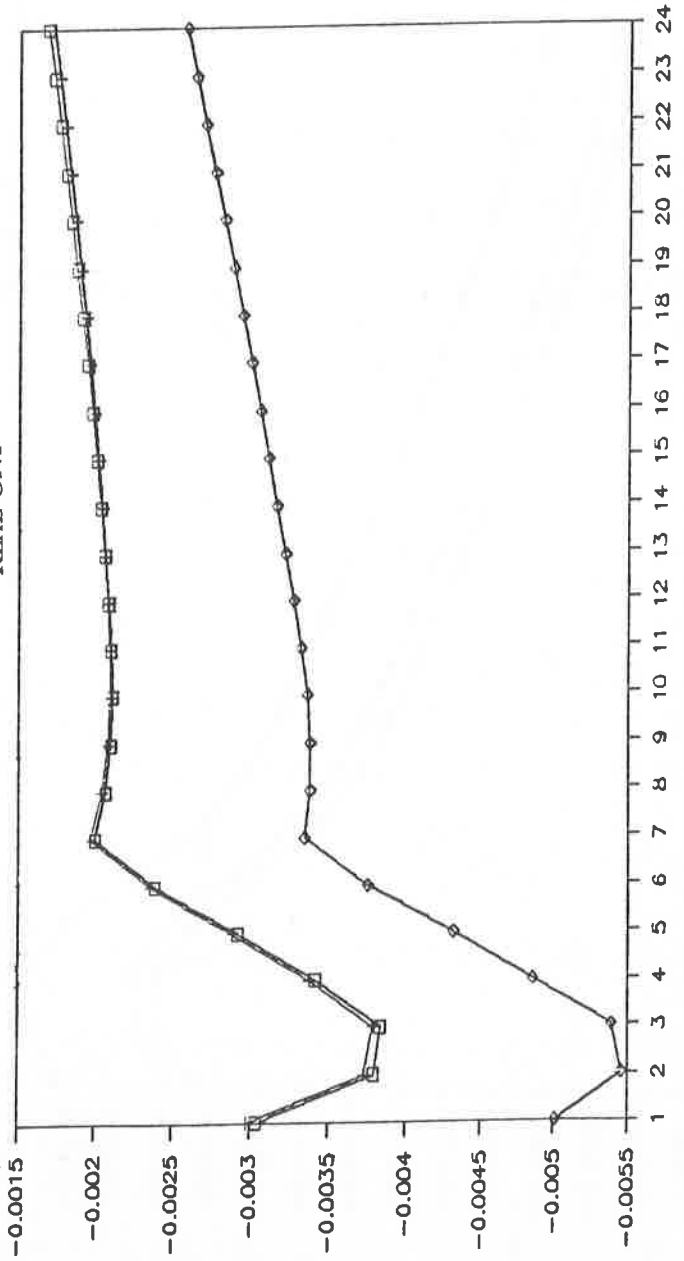


Figure A.3
IMPORTS

Appendix B

MA REPRESENTATIONS
RESPONSES OF VARIABLES TO A 1 PERCENT POINT
RISE IN THE PRICE OF OIL (Arab Light)

Figure B.1
REAL GNP



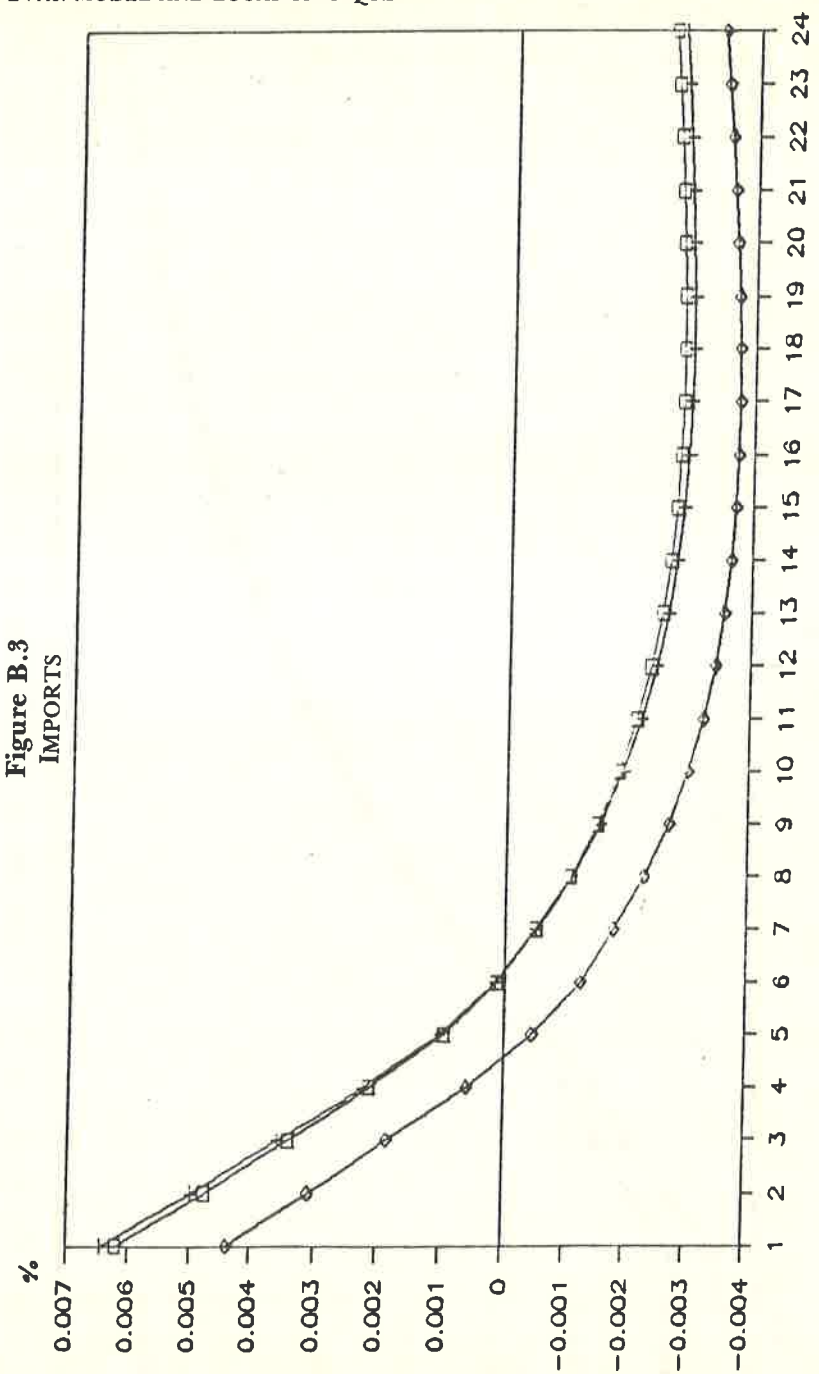


Figure B.3
IMPORTS

Appendix C

MA REPRESENTATIONS
RESPONSES AT VARIABLES TO A 1 PERCENT POINT
RISE IN YEN/$

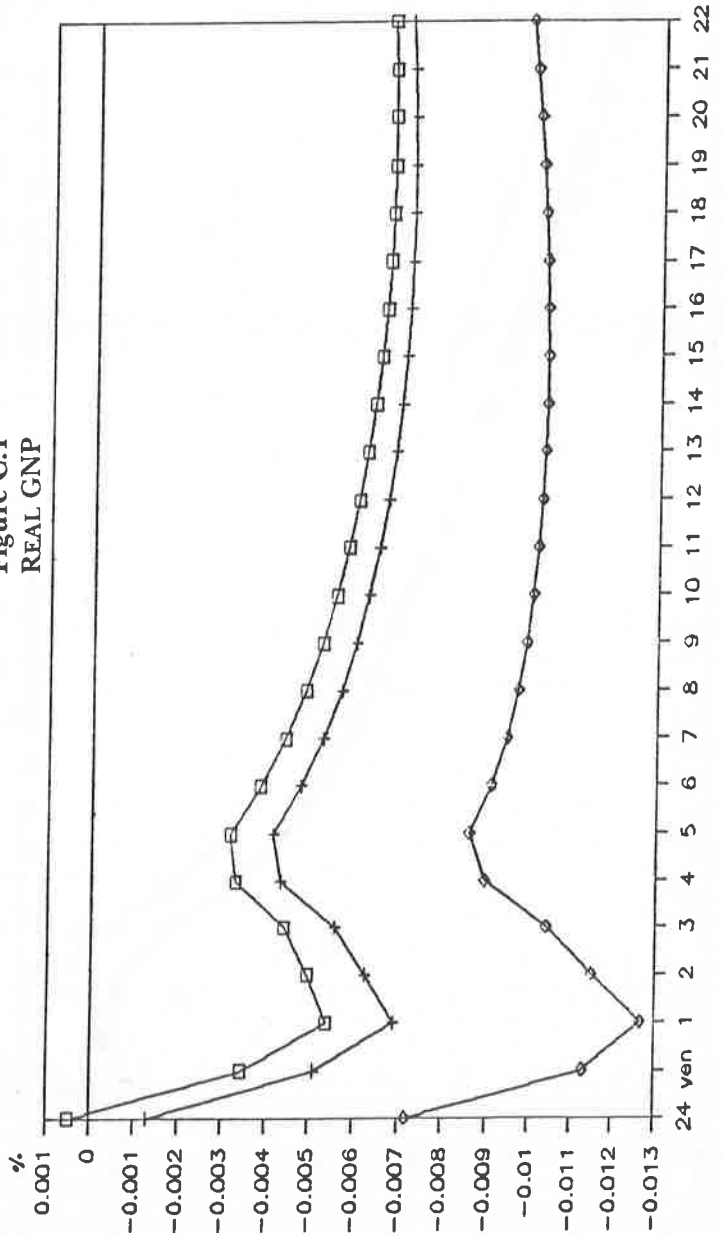


Figure C.1
REAL GNP

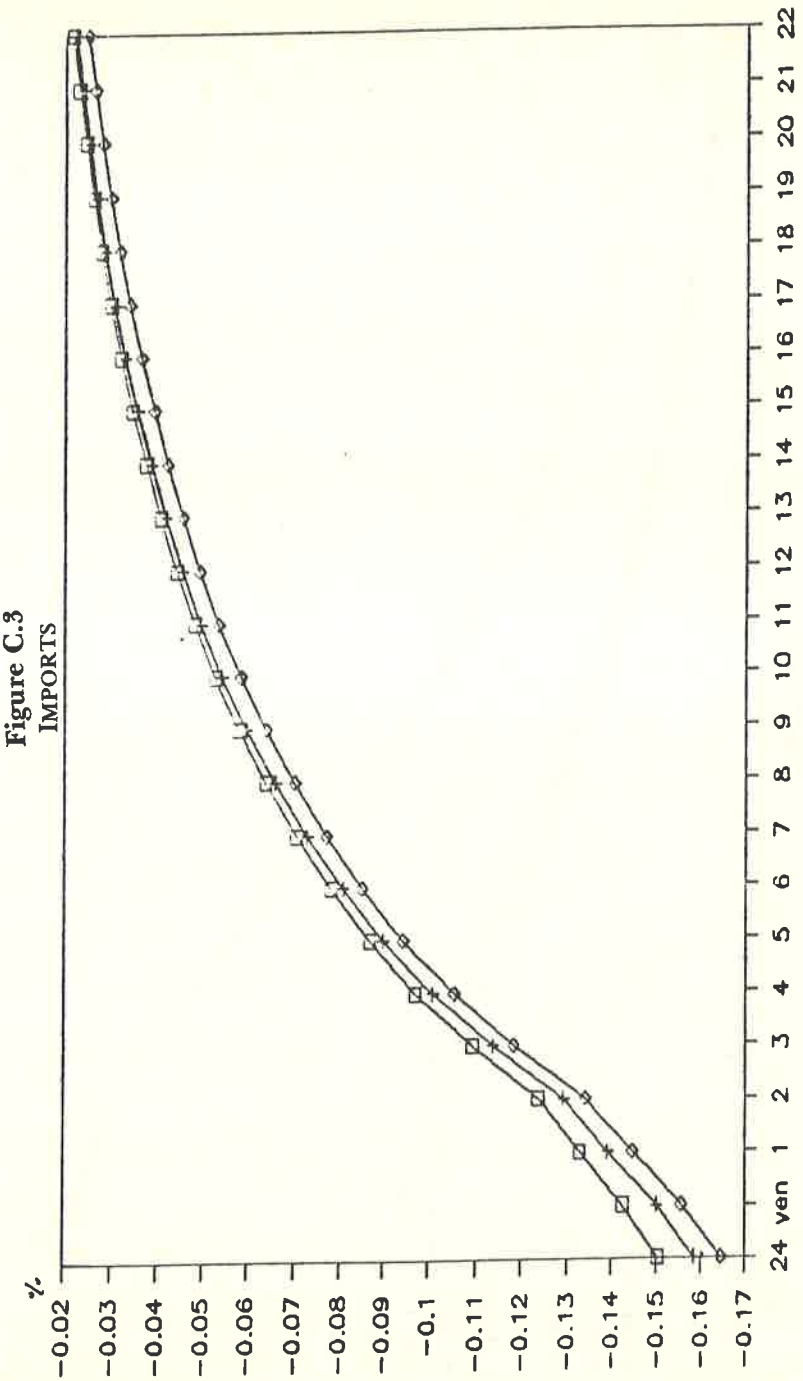


Figure C.3
IMPORTS

Appendix D

Table D.1.

REAL GNP

(Billion Korean Won)

	Actual Data	Experiment A	Experiment B	Experiment C
85: I	12,924.8			
II	13,029.0	13,107.2	13,112.1	13,263.0
III	13,185.6	13,286.5	13,298.3	13,597.3
IV	13,474.6	13,452.8	13,473.1	13,932.4
86: I	14,156.0	13,612.5	13,678.9	14,323.1
II	14,569.8	13,764.9	13,906.6	14,754.6
III	15,068.5	13,910.2	14,148.7	15,216.3
IV	15,140.2	14,048.0	14,379.4	15,655.3

Table D.2.

EXPORTS

(Million U.S. Dollars)

	Actual Data	Experiment A	Experiment B	Experiment C
85: I	6,363.2			
II	6,524.2	6,344.9	6,363.0	6,463.4
III	6,631.9	6,327.7	6,393.0	6,600.4
IV	6,879.0	6,323.9	6,518.2	6,846.0
86: I	7,501.0	6,340.1	6,789.0	7,265.6
II	8,140.0	6,359.5	7,173.1	7,824.6
III	8,769.8	6,368.2	7,640.1	8,494.5
IV	9,333.6	6,375.4	8,066.0	9,126.2

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