

A Service of

ZBW

Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Yap, Josef T.

Working Paper Macroeconomic Impact of a Tariff Reduction: A Three-Gap Analysis with Model Simulations

PIDS Discussion Paper Series, No. 1997-03

Provided in Cooperation with: Philippine Institute for Development Studies (PIDS), Philippines

Suggested Citation: Yap, Josef T. (1997) : Macroeconomic Impact of a Tariff Reduction: A Three-Gap Analysis with Model Simulations, PIDS Discussion Paper Series, No. 1997-03, Philippine Institute for Development Studies (PIDS), Makati City

This Version is available at: https://hdl.handle.net/10419/187322

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



WWW.ECONSTOR.EU



Macroeconomic Impact of a Tariff Reduction: A Three-Gap Analysis With Model Simulations

Josef T. Yap

DISCUSSION PAPER SERIES NO. 97-03

The PIDS Discussion Paper Series constitutes studies that are preliminary and subject to further revisions. They are being circulated in a limited number of copies only for purposes of soliciting comments and suggestions for further refinements. The studies under the Series are unedited and unreviewed.

The views and opinions expressed are those of the author(s) and do not necessarily reflect those of the Institute.

Not for quotation without permission from the author(s) and the Institute.



February 1997

For comments, suggestions or further inquiries please contact: The Research Information Staff, Philippine Institute for Development Studies

3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines

Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: publications@pidsnet.pids.gov.ph

Or visit our website at http://www.pids.gov.ph

MACROECONOMIC IMPACT OF A TARIFF REDUCTION: A THREE-GAP ANALYSIS WITH MODEL SIMULATIONS

Josef T. Yap^1

1.0 Introduction

Philippine development policy in the past decade has been inexorably linked to the framework popularly known as the Washington consensus, a term coined after the world's de facto capital. This framework, which was given a sense of formality by Washington based think tanks and multilateral agencies, is grounded on the belief that Victorian virtue in economic policy--free markets and sound money--is the key to economic development (Krugman, 1995). The clearest evidence of this policy thrust is the intention of the government to slash tariffs to a uniform 5 percent level by the year 2004. This timetable is contained in our commitment to AFTA and also in the recent Manila Action Plan presented during the APEC leaders meeting.

The arguments for liberalizing trade have been largely confined in the microeconomic sphere with efficiency considerations being the primary focus. So far there has been no comprehensive discussion of the potential macroeconomic effects of these tariff adjustments. This paper attempts to consolidate the key issues involved in the debate.

The impact of trade liberalization revolves around its effect on macroeconomic balances. Thus it would be useful to situate our analysis within the three-gap framework as formalized by Bacha (1990) and applied to the Philippine case by Lim (1990). A more elaborate treatment is provided by Taylor (1994). The interplay of a savings constraint, foreign exchange constraint and fiscal constraint will determine the macroeconomic effects of a reduction in tariffs.

In the next section we develop the model of the three gaps following closely the methodology of Bacha. Using the model we discuss the potential macroeconomic effects of a tariff reduction in Section 3. In Section 4 we then attempt to quantify these

¹Research Fellow, PIDS. The author would like to acknowledge the excellent research assistance of Yvainne Y. Yacat. The usual disclaimer applies.

effects using a smaller version of the PIDS Annual Macroeconometric Model. Section 5 concludes the paper.

2.0 The Three Gaps²

Bacha's model is an exercise in the maximization of investment (as a proxy for the output growth rate), in a fix-price one-period model, subject to a number of equality and inequality constraints. The equality constraints are the balance between income and absorption, the balance of payments identity, the government budget constraint, and the equality between the flow supply and the flow demand of money. These give rise to the incorporation of the various macroeconomic gaps into the analysis.

2.1 Savings Gap

From the basic national accounting identity which shows the equality between income and absorption, we can write:

$$I = (Y - C) + (M - X)$$
(1)

where I is fixed capital formation, Y is domestic output (GDP), C is (private plus government) consumption, M is imports of goods and non-factor services, and X is exports of goods and non-factor services.

From the balance of payments, the excess of imports over exports is equal to foreign transfers, i.e., the difference between net capital inflows, F, and net factor services **to** abroad, J:

 $M - X = F - J \tag{2}$

Replacing (2) and (1),

I = (Y - C) + (F - J).

When income is at its potential level, Y^{*}, and private consumption is given exogenously, equation (3) yields the savings constrained level of investment--written as IS--and, hence, the

²The derivation of the three gaps is largely lifted from Bacha (1990), pp. 280-286.

2

(3)

savings-constrained potential growth rate of output, if ICORs are assumed to be constant.

The savings gap is thus written as

$$IS = (Y^* - C) + (F - J)$$
(4)

The sources of potential investment are "internal savings" and foreign transfers. If equation 4 is written as

$$IS = (Y^* - C - J) + F$$
 (5)

then we have national savings and foreign savings. Bacha chooses to use (4) and not (5) for one basic reason. And this is that interest rate variations and workers remittances, which are the main source of changes in J in the short-run are not under the control of the government. These variations are exogenous to the policy making process of the developing country, the same as with capital inflows. Thus, foreign transfers, F - J, are a decision variable beyond the control of policy makers.

The right hand side of (4) can further be decomposed as: $IS = S_p^* + (T - G) + (F - J)$ (6)

where S_p^* is potential private savings and (T - G) is the primary budget surplus in the current account.

2.2 Foreign exchange gap

To derive the foreign exchange constraint, we start from (2). Assume that imports can be divided into two types: complementary capital goods imports, M_k , and other imports, M_o . Define net exports, E, as the difference between exports and other imports:

$$E = X - M_{o}$$
(7)

and let M_k be given by:

$$M_{k} = m \cdot I, \qquad (8)$$

where 0 < m < 1 is the import content of investment.

Replacing (7) and (8) into (2) and resnurring terms, one

gets

$$I = (1/m) [E + (F - J)].$$
 (9)

E, cannot surpass a critical assumption that the level of net exports, E, cannot surpass a critical value, E^{*}, given by world demand the foreign exchange constrained level of investment--which is written as IE--is given by:

$$IE = (1/m) [E^* + (F - J)].$$
(10)

Since m < 1, a comparison of (6) with (10) immediately yields the Chenery result that foreign transfers have a bigger impact on the growth rate of foreign-exchange constrained economies than on savings-constrained ones.

2.3 Fiscal gap

The basis of this constraint is the dependence of private investment on government investment in such a way that as a maximum its value is

$$I_{p} = k \cdot I_{g}, \quad k > 0. \tag{11}$$

Equation 11 expresses the idea that late-comer development is characterized by a central role for government investment, in infrastructure and basic industries, which sets an upper limit for profitable private investment to occur. If we let

$$I = I_p + I_q \tag{12}$$

and substitute (12) and (11) into (3) and decompose total savings we obtain

$$I_{g} = (S_{p} - I_{p}) + (T - G) + (F - J).$$
(13)

Bacha then makes the critical assumption that there does not exist a market for government bonds which leaves money expansion as the only alternative for domestic financing of government budget deficits. In particular this means that if private savings is a slack variable then it is only through seignorage that the government is able to capture this excess savings. Seignorage is assumed to be a function of two variables: the rate of inflation,

p and the propensity to hoard, h. We thus have:

$$S_{p} - I_{p} = dH/P = f(p, h)$$
 (14)

where dH is the variation in nominal money holdings and P is the price level.

Replacing (14) in (13) and the result in (12) and also replacing (11) in (12) the fiscally constrained level of investment--written as IT--is given by

$$IT = (1 + k) [f(p,h) + (T - G) + (F - J)]$$
(15)

Equations (6), (10) and (15) represent the savings constraint, foreign exchange constraint and fiscal constraint respectively.

3.0 Policy Analysis

To facilitate the analysis of specific policy issues we graph the constraints in I and (F - J) space. It is clear that 1/m and (1 + k) are both greater than one and thus IT and IE have steeper slopes than IS. The relative positions of IT and IE are then determined based on m and k.

m is the capital goods import content of investment while 1/(1 + k) is the government share of investment. Thus if the capital goods import content of investment is greater than the government share of investment (m > 1/[1 + k]) then 1/m < (1 + k) and vice-versa.

Over the past five years m ranged from 0.3 to .45 while 1/(1 + k) ranged from .2 to .25. Hence we can safely set 1/m to be less than (1 + k) making IT steeper than IE. Bacha states that this condition applies to a small private oriented developing economy like Taiwan while the case where 1/m > (1 + k) corresponds to a large developing country where industrialization is both state-led and relatively advanced, such as Brazil. Our results are consistent with this characterization.

Figure 1 shows the relative positions of IS, IE and IT. For values of (F - J) greater than (F - J)', the savings constraint is binding while for values less than (F - J)'', the fiscal constraint is binding. The foreign exchange constraint is binding for (F - J)'' < (F - J) < (F - J)'. It is clear that the effects of a tariff

reduction would depend on the initial value of (F - J).

What is the macroeconomic impact of a reduction in tariffs? First, we have to determine the reaction of the surplus in the primary account (T - G) particularly the level of taxes T. Lower tariffs should lead to lower tax revenues unless the increased volume of imports will compensate to maintain the level of T. The latter is considered unlikely and hence (T - G) should decline. This shifts both IS and IT downward (Figures 2 and 3) leading to a decrease in I for all relevant values of (F - J).

Meanwhile, a reduction in tariffs should lead to an increase in m in the case of the foreign exchange constraint. This results in a clockwise rotation of IE (Figure 4) to IE' for (F - J) > 0which causes a fall in I for all relevant values of (F - J). The value of E^{*} also declines due to an increase in M_o and IE settles down to IE".

The key result then is that a tariff reduction makes the macroeconomic constraints more restrictive **leading to an unambiguous fall in investment** and consequently a lower GDP growth rate. Other notable results are:

1. The range where the foreign exchange constraint is binding widens after the reduction in tariffs. This result is intuitive since the increase in imports will put a strain on existing foreign exchange resources. Thus the focus of policies should shift towards the trade sector away from increasing domestic savings mobilization and enhancing the efficiency of public investment. Most likely there will pressure on the exchange rate and the BSP must move decisively to prevent debilitating speculative attacks on the peso.

2. The decline in investment is smallest when the economy is under a savings constraint. This follows from the relative slopes of the various constraints. The comparative fall in investment when the economy is under a fiscal constraint and foreign exchange constraint is an empirical question, but because of the double movement in the foreign exchange constraint the reduction in investment is likely larger under the latter.

3. At relatively high levels of foreign transfers, the savings constraint, is birding and this seems to be the case for the Philippines at present.

What are the possible policies to counteract the fall in investment?

The most obvious remedy would be to compensate for the loss of tariff revenue. This increases the importance of the Comprehensive Tax Reform Package of the government especially in the area of tax administration.

Even if there is no compensation for the loss in tariff revenue, the level of investment can be maintained if there is an increase in foreign transfers. Again based on the relative slopes of the constraints, the required increase in (F - J) is largest when the savings constraint is binding and smallest when the fiscal constraint is binding.

The composition of foreign transfers, however, is quite important. Less emphasis should be placed on increasing the inflow of OCW remittances because of its attendant social costs and portfolio investment, because of its volatility. Instead foreign direct investment should be encouraged. Hopefully the move towards a low uniform tariff will improve the business climate thus attracting more foreign direct investment.

The determinants of foreign direct investment become critical in this case. If macroeconomic stability is the most important consideration of foreign businessmen, as some studies show (see De Jong and Vos, 1994 for a survey) then the widening trade and fiscal deficits should be a great cause of concern. It may be that the deterioration in macroeconomic imbalances will offset the positive signals of the tariff reduction.

Another key assumption of the three-gap model is the constancy of the ICOR. The reduction in tariffs is aimed at enhancing the efficiency of the economy and this assumption may be unrealistic. Thus, instead of remaining a constant the ICOR may fall following the program of trade liberalization.

If the value of ICOR depends more on the uniformity of tariff rather than the level itself, then the government must rethink its choice of five percent given the revenue implications. It may be that the ICOR is invariant within a specified range of tariff levels (say below 15 percent) and it that case the government can push for the limit and opt for a higher level of uniform tariffs.

÷ 7

4.0 Model Simulations

A smaller macroeconometric model was estimated for this paper. The objective of the simulation exercises is not to determine the precise macroeconomic effects of the reduction in tariffs but whether the conditions for a decline in investment are satisfied after a change in the tariff structure. These center on the impact of a reduction in tariffs on the government deficit and the trade balance.

The details of the model are presented in the Appendix. It is a standard demand-driven model estimated using annual data from 1967-1994. The main policy variables are the exchange rate, money supply and government spending. The latter two variables feed mainly through the interest rate.

It was rather difficult to introduce a tariff variable into the model due to the unavailability of time series for tariffs for commodity imports measured on a macroeconomic scale. Hence an improvised variable was created using data on trade taxes and merchandise imports. An aggregate tariff t was generated using trade taxes, TT, which are assumed to be equal to the aggregate tariff rate t multiplied by import prices Pm and imports of goods in real terms, M:³

$$TT = t \cdot Pm \cdot M$$

(16)

The tariff variable was calculated using available historical data from 1975 to 1995. A graph of t is shown in Figure 5. The behavior of t is erratic although there is a distinct decline in its value in 1995 from its value in 1975. One reason for the erratic movement may be the use of the HCV system for valuing our imports which leads to a certain degree of arbitrariness in computing the value of taxes on imports. With the scrapping of HCV in favor of a intermediate transaction value system, we can assume t to decline at a uniform rate towards 5 percent in the year 2004.

The variable t appears in three equations of the model. It affects the wholesale price index by adding to the cost of imports, Pm (see equation 6 of the appendix). The aggregate tariff thus influences both the price level and the rate of inflation. By

'The aggregate tariff t is equivalent to the variable TARF in the macroeconometric model.

affecting the cost of imports it also impacts on the level of import demand and the trade deficit (equations 4 and 5 of the appendix).

Equation 16 shows how t will affect the government deficit in the macroeconometric model since the variable TT is used in determining total tax revenue of the government (equations 20 and 26 of the appendix). A decline in t will thus lead to opposing effects on TT, upward due to an increase in M and downward due to the fall in t itself.

In the simulation process we assume t to be maintained between 10 percent and its 1995 value of 13.5 percent for the period 1996-2004. This represents the baseline solution. For the "shock" run, t is allowed to decline at a uniform rate toward 5 percent in 2004.

The results for key variables are shown in Figures 6 to 8. A reduction in the tariff level leads to greater demand for imports (Figure 6) justifying the movements of the IE constraint. As a consequence, the trade deficit widens (Figure 7) putting pressure on the exchange rate.

The rise in the volume of imports does not compensate for the reduction in the tariff level and as a result the fiscal balance also deteriorates (Figure 8). (In the actual simulations the surplus in the primary account is reduced.) This implies that the condition for more restrictive IT and IS constraints is satisfied and all the issues discussed in Section 3 become relevant.

It could be argued that the three-gap framework is a oneperiod model and is not consistent with the dynamic structure of the macroeconometric model. The latter, however, is a series of one-period adjustments and the simulation results show that the fiscal balance deteriorates on a consistent basis following the fall in the tariff level.

5.0 Concluding Remarks

Efficiency considerations could be incorporated in the empirical analysis by adding the production sector which is present in the full version of the macroeconometric model. To account for the microeconomic effects of a reduction in the tariff level the coefficients of key variables (presumably the price indices) must be adjusted. This is equivalent to modifying the ICOR. The degree of adjustment, however, requires further research beyond the scope of this study.

The BOP sector is also important since it was shown that an influx of foreign capital could compensate for the fall in tariff revenue. An equation for foreign direct investment should be estimated which would include variables representing macroeconomic stability and the potential returns to investment (that would vary with the tariff level), the familiar risk-return trade-off. It can then be determined whether the increase in potential profit following the more open trade regime will offset the effects of greater macroeconomic instability and induce a greater flow of foreign direct investment.

Even without more precise empirical results, several important implications arise from the previous discussion. First the government must make an attempt to compensate for the reduction in tariff revenue by increasing tax effort in other areas. Second, the exchange rate policy will become extremely important following the fall in the tariff level. Finally, the government must develop a more coherent program to increase the level of foreign direct investment.

References

- Bacha, E. L. (1990) "A Three-Gap Model of Foreign Transfers and the GDP Growth Rate in Developing Countries," Journal of Development Economics 32.
- De Jong, N. and R. Vos (1994) "Theoretical and Empirical Approaches to Direct Foreign Investment: A Survey of the Literature," ISS Working Paper Series on Money, Finance and Development No. 57. The Hague: Institute of Social Studies.
- Krugman, P. (1995) "Dutch Tulips and Emerging Markets,"Foreign Affairs, 74 (4), July/August.
- Lim, J. Y. (1990) "An Application of Bacha's Three-Gap Model: The Case of the Philippines," *The Philippine Review of Economics and Business* XXVII No.1 (June).
- Taylor, L. (1994) "Gap Models," Journal of Development Economics 45.



Figure 1
DIAGRAM OF THREE-GAP MODEL





.











. . .

15.

.







APPENDIX

The estimated equations for the macroeconometric model are shown in Table A.1. The specifications follow closely those of the larger model; hence, for a more detailed discussion of the equations once could refer to Reyes and Yap (1993) or Constantino, Yap et al (1990).⁴

OLS estimation was used and the residuals were checked for stationarity using the Augmented Dickey-Fuller statistic. This is a rather weak test considering the small number of observations but no alternative is available. Those equations where the ADF statistic is not reported are those where the null hypothesis of a unit root could not be rejected.

Meanwhile, the goodness-of-fit measures are presented in Table A.3. In general, the ADF statistics indicate that the key behavioral equations are valid regressions while the statistics of fit show that the model tracks the variables rather well. The mean absolute percentage error and the RMSPEs are below five percent for the important variables like GDP, CP and prices. One notable observation is that the statistics-of-fit are only marginally better for the smaller model when compared with the larger model.

⁴Reyes, C. M. and J. T. Yap (1993), "Re-estimation of the PIDS Macroeconometric Model" Manuscript.

ī.

Constantino, W. M., J. T. Yap, R. Q. Butiong and A. S. dela Paz (1990 "An Annual Macroeconometric Model for the Philippines," in ASEAN Link - An Teonometric Study edited by Y. Nakamura and J. T. Yap. Singapore: Longman, 1990.

Table A.1

LIST OF BEHAVIORAL EQUATIONS

(Figures in parentheses are relevant T-statistics)

1. Private Consumption Expenditures

.

۰.

= -109721.40 + 0.099 * (GNP - TOTTAX / (CPI / 100)) CP (3.90) (7.79)+ 5488.22 * POP + 1.033* (MS + LAG1(MS)) / (2 * (7.43)(7.08) (CPI / 100)) +0.351 * LAG1(CP) (3.84)ADF Test Stat: -3.09 $R^2 =$ 0.9989 5% critical value: -2.997 -0.27941 DH <u>---</u> 1968 - 1994 YEAR: F-stat = 6179.85

2. Investment in Durable Equipment

IDER = 9836.66 + 0.148 * MGDS - 610.17 * INFL -(2.85) (5.33) (3.12)

> 635.62 *(TBILL - INFL) + 0.21 * (CONSPR + (2.84) (2.81)

> (CGOVN/(PCGOV/100))) + 0.338 * LAG1(IDER) (2.14)

R²	=	0.944	ADF Test Stat:	-5.55
DH	=	2.16	5% critical value:	-3.02
F-sta	at =	81.55	YEAR:	1970 - 1994

3. <u>Private Construction</u>

CONSPR = 6754.92 + 0.126 * (GDP - LAG1(GDP)) (1.97) (2.69) 160.35 *(TBILL - INFL) - 308.23 * INFL (0.695) (1.26) + 0.258 * (CGOVN/(PCGOV/100)) + 0.717 * LAG1(CONSPR) (1.85) (3.96)

$R^2 =$	0.933	ADF Test Stat:	-4.28
DH =	-1.53	5% critical value	-3.01
F-stat =	67.81	YEAR:	1970 - 1994

4. Merchandise Imports

MGDS = 105232.50 - 76109.96 * (PMGDS / PGNP) * (1 + TARF) + (2.47) (3.03) 0.476 * (GDP - LAG1(GDP)) + 8.27 * (NFA/PGNP) + (4.25) (1.36) 0.932 * LAG1(MGDS) + (1.36) $R^{2} = 0.98 \qquad ADF Test Stat: -3.55 + C^{2} + C^{2$

DH =0.17725% critical value:-3.02F-stat =243.60YEAR:1975 - 1994

5. Import of Services MSV = 1172.21 + 0.024 * MGDS + 0.820 * LAG1(MSV) (0.84) (2.53) (0.09) $R^2 = 0.91$ F-stat: 127.22 DH = 0.18 YEAR: 1968 - 1994

6. Log of Wholesale Price Index

. .

LWPI = 2.56 + 0.406 * LOG(PMGDS * (1 + TARF)) + (1.74) (2.13) 0.253 *log (TL/GNP) - 4.03 *(K46/LAG1(K46)01) (1.38) (2.71) + 0.339969* LAG1(LWPI) ((2.23)

 R^2 =0.992F-stat:584.71DH=2.45YEAR:1975 - 1994

: 21

7. Implicit Price Index for Gross National Product

PGNP = 1.49 + 0.114 * WPI + 0.614 * LAG1(PGNP) (7.69) (1.37) (6.03) $R^2 = 0.997$ F-stat: 4003 YEAR: 1968 - 1994 DH = 2.27

Consumer Price Index 8.

CPI = 0.950 + 0.085 * WPI + 0.737 * LAG1(CPI) (8.59) (0.74) (4.29) F-stat: 2773.25 $R^2 = 0.995$ YEAR: 1968 - 1994 DH = 2.37

Implicit Price Index for Government Consumption 9.

PCG = -0.296 + 0.061 * WPI + 0.917 * LAG1 (PCG)(0.23) (3.68) (16.30) .

R ²	=	0.998	F-stat:	4861.84
DH	=	0.52	YEAR:	1968 - 1994

10. Implicit Price Index for Government Construction

PCGOV = 1.16 + 0.163 * WPI + 0.446 * LAG1(PCGOV) (0.83) (7.37) (5.24) F-stat: 2849.99 $R^2 = 0.995$ YEAR: 1968 - 1994 DH = 1.94

11. Implicit Price Index for Merchandise Imports

PMGDS = 0.643 + 104.32 * PMDOL * ER(0.74) (99.81) F-stat: 9961.31 $R^2 = 0.998$ DW = ; 1.72 1970 - 1994 YEAR:

12. Direct Tax

DTAX = -2922.81 + 0.051 * GNP * (PGNP / 100) + 0.560 *(1.55) (3.78) (3.76)

LAG1(DTAX) + 21246.96 * DUM94 (5.11)

R ²	=	0.996	F-stat:	1514.995
DH	=	0.14	YEAR:	1975 - 1994

13. <u>Total Taxes</u>

TOTTAX = 2850.57 + 0.856 * TAXREV + 0.213 * LAG2(TOTTAX)(2.33) (10.26) (1.89) R² = 0.998 F-stat: 4995.065 DH = 1.64 YEAR: 1975 - 1994

14. Average Interest Rate on 91-Day Treasury Bills

> + 0.322353 * TIME (3.65)

R2=0.80ADF Test Stat:-3.43DH=1.0955% critical value:-3.004F-stat=19.76YEAR:1971 - 1994

15. Capital Consumption Allowance

 $\begin{array}{rcl} \text{KCAR} &=& -13357.42 \ + \ 0.038 \ * \ \text{GDP} \ + \ 0.013 \ * \ \text{LAG1}(\ \text{K46}) \ + \\ & & (3.73) & (4.79) & (2.10) \end{array}$

			1	
R²	=	0.992	ADF Test Stat:	-2.47
DH	=	1.80	5% critical value:	-2.99
F-st	at ≖	858.35	YEAR :	1968 - 1994

16. Merchandise Exports

F-stat = 175.91

XGDS= -15839.05 + 291.57 * (ER / LAG1(ER) - 1) * 100 + (2.54) (2.42)0.151 * MGDS + 0.096 * GNPJAP + 0.652 * LAG1(XGDS) (4.97)(1.76) (2.40) + 31236.75 * DUM80 + 0.218032*(GDP - LAG1(GDP)) (4.03) (2.12)ADF Test Stat: -3.43 $R^2 = 0.976$ 5% critical value: -2.99 -2.25 DH =

YEAR:

.

1968 - 1994

- 17. GDP =CP + (CGN /(PCG / 100)) + IDER + CONSPR + CGOVN / (PCGOV/100) + XGDS + XSV + IINV + BREEDR - MGDS - MSV + STATD
 - 18. GNP = GDP + NFIA
 - 19. DEFNEW = CGN + CGOVN TOTTAX
 - 20. TRADET = TARF * MGDS * (PMGDS / 100)

21. TRADENEW = XGDS - MGDS

- 22. INFL = (CPI / LAG1(CPI) 1) * 100
- 23. KGR = K46 / LAG1 (K46) 1
- 24. K46 = LAG1(K46) + (CGOVN / (PCGOV / 100)) + CONSPR + IDER + IINV + BREEDR - KCAR
- 25. WPI = EXP(LWPI)
- 26. TAXREV = DTAX + TRADET

Table A.2	
List of Endogenous Varia	bles

-

Variable Name	Variable Description	
CP	Personal Consumption (Real; Million P)	
IDER	Investment in Durable Equipment (Real; Million P)	
CONSPR	Private Construction (Real; Million P)	
MGDS	Merchandise Imports (Real; Million P)	
MSV	Import of Services (Real; Million P)	
LWPI	log of Wholesale Price Index (1978=100)	
PGNP	Implicit Price Index for Gross National Product (1985=100)	
CPI .	Consumer Price Index (1985=100)	
PCG	Implicit Price Index for Covernment Consumption (1985=100)	
PCGOV	Implicit Price Index for Government Construction (1985=100)	
PMGDS	Implicit Price Index for Merchandise Imports (1985=100)	
DTAX	Direct Tax (Million P)	
TOTTAX	Total Taxes (Million P)	
TBILL	Average Interest Rate on 91-Day Treasury Bills	
KCAR	Capital Consumption Allowance (Real; Million P)	
XGDS	Merchandise Exports (Real; Million P)	
GDP	Gross Domestic Product (Real; Million P)	
GNP	Gross National Product (Real; Million P)	
DEFNEW	Fiscal Deficit (Million P)	
TRADET	Taxes on International Trade (Million P)	
TRADENEW	Trade Deficit (Real; Million P)	
TNFL	Inflation Rate based on CPI	

Variable Name	Variable Description
KGR	Growth Rate of K46
TAXREV	Tax Revenues (Million P)
K46	Capital Stock (Million P)

List of Exogenous Variables

Variable Name	Variable Description		
BREEDR	Breeding Stock and Orchard Development (Real, Million P)		
CGN	Government Consumption (Nominal; Million P)		
CGOVN	Government Construction (Nominal; Million P)		
DUM80	Dummy Variable for XGDS		
DUM94	Dummy Variable for DTAX		
ER	Exchange Rate		
GNPJAP	Gross National Product of Japan (Real; Billion Yen)		
IINV	Increase in Stocks (Real; Million P)		
MS	Money Supply, end of year (Million P)		
NFA	Net Foreign Assets (Million P)		
NFIA	Net Factor Income from Abroad (Real; Million P)		
PMDOL	Implicit Dollar Price for Imports (1985=100)		
POP	Population (Millions)		
STATD	Statistical Discrepancy (Real; Million P)		
TARF	Tariff		
TIME	Time Period		
TL	Total Liquidity, end of year (Million P)		
XSV	Export of Services (Real; Million P)		

.

.

27

.

Table A.3. MODEL VALIDATION (1976 to 1994)

Variable	MAPE	RMSPE	THEIL
Behavioral			
CP	1.95	2.56	0.0121
IDER	12.40	15.12	0.0621
CONSPR	14.04	18.70	0.0842
MGDS	10.79	14.27	0.0636
MSV	13.38	14.67	0.0787
LWPI	1.09	1.35	0.0068
PGNP	6.30	8.24	0.0337
CPI	7.38	9.65	0.0395
PCG	3.48	4.39	0.0198
PCGOV	8.76	10.67	0.0465
PMGDS	1.18	2.03	0.0140
DTAX	10.30	12.79	0.0282
TOTTAX	4.40	5.38	0.0164
TBILL	19.26	25.74	0.1238
KCAR	8.47	9.83	0.0500
XGDS	8.52	10.70	0.0511
Identities			
GDP	3.21	4.92	0.0227
GNP	3.27	5.05	0.0228
DEFNEW	69.47	118.43	0.1455
TRADET	10.79	13.86	0.0538
TRADENEW	43.43	74.58	0.1176
INFL	194.48	674.91	0.3038
KGR	20.37	28.32	0.0716
TAXREV	5.08	6.39	0.0160
WPI	6.24	7.76	0.0416

. •

Variable	MAPE	RMSPE	THEIL
K46	2.27	2.69	0.0128

.

Notes:

۰.

(1) MAPE - Mean Absolute Percentage Error

(2) RMSPE - Root Mean Square Percentage Error

-