OECD DEVELOPMENT CENTRE

Working Paper No. 87
(Formerly Technical Paper No. 87)

ALTERNATIVE EXPLANATIONS OF THE TRADE-OUTPUT CORRELATION IN THE EAST ASIAN ECONOMIES

by

Colin I. Bradford Jr. and Naomi Chakwin

Research programme on:
Globalisation and Regionalisation

OECD OCDE

August 1993
OCDE/GD(93)132

Technical Paper N°87

"Alternative Explanations of Trade-Output Correlation in the East Asian Economies", by Colin I. Bradford jr. and Naomi Chakwin. Produced as part of research programme on Globalisation and Regionalisation, August 1993

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This study was undertaken at the OECD Development Centre. The views expressed in this paper are those of the authors alone and do not represent those of the OECD nor its Member countries. We thank Gerard Adams, Alice Amsden, William H. Branson, Chung Lee and Joseph Ramos for helpful comments on an earlier draft and Thomas Doan and Tom Maycock at Estima for econometric assistance. The usual disclaimer applies.

RÉSUMÉ

Un bon nombre de pays asiatiques ont pu suivre l'exemple du Japon et développer, en un temps relativement court, des économies industrielles sophistiquées. Hong Kong, la Corée du Sud, Singapour et Taiwan, en particulier, se sont fait connaître comme les "Quatre Tigres" de l'Asie, grâce à leur vitalité et à leur importance sur les marchés internationaux. Les économistes ont été impressionnés non seulement par le rythme de l'industrialisation, mais aussi par la relative équité qui, dans ces pays, a accompagné la croissance.

Ce document analyse des modèles structurels de remplacement représentant différents schémas théoriques pour un développement en Asie de l'Est. On utilise une analyse autorégressive structurelle avec des données d'échantillon comprenant Hong Kong, le Japon, la Corée du Sud, Singapour et Taiwan, pour la période 1969-89. Cette technique a été choisie parce qu'elle permet de différencier les hypothèses structurelles.

Le premier modèle testé est un modèle de croissance de la production axée sur l'exportation. Dans cette simulation, on estime que les exportations ont un effet stimulant direct sur l'économie. En ce sens, les exportations de produits manufacturés sont présentées comme une variable exogène. Cependant, dans le second modèle, c'est l'investissement que nous définissons comme exogène. Dans cette version d'une croissance de la production axée sur l'investissement, c'est celui-ci qui stimule l'économie.

Dans ses conclusions, ce document montre que la notion de croissance de la production axée sur l'exportation ne correspond pas véritablement à l'expérience de développement de l'Asie de l'Est. Dans les deux modèles, c'est la variable investissement qui est susceptible d'expliquer les variations de la croissance de la production pour les pays étudiés.

SUMMARY

A number of Asian countries have been able to follow the example of Japan and develop sophisticated industrial economies in a relatively short time. Specifically, Hong Kong, South Korea, Singapore and Taiwan have become known as the "Four Tigers" of Asia due to their strength and importance in international markets. It is not only the pace of industrialisation but the relative equity which has accompanied growth in these countries that has fascinated economists.

This paper analyses alternative structural models which represent different theoretical frameworks for development in East Asia. A structural vector-autoregressive technique is used with panel data comprising Hong Kong, Japan, South Korea, Singapore and Taiwan, for the period 1969-89. This technique has been chosen because it can discriminate between structural hypotheses.

The first model tested is a model of export-led output growth. In this exercise exports are allowed to have a direct stimulating effect on the economy. In this sense, manufacturing exports are proposed as an exogenous variable. However, in the second model we specify investment as exogenously determined. In this version of investment-led output growth it is investment that stimulates the economy.

The findings of this paper do not support the notion of export-led output growth as an accurate description of the East Asian development experience. In both models investment is the causal variable explaining variations in output growth in the sample countries.

PREFACE

The causes of the dynamic growth and development of Korea, Taiwan, Hong Kong and Singapore have been the subject of intense analytical work in economics in order better to understand the success of these East Asian newly industrializing economies (NIEs). The acceleration of manufactures exports which has accompanied rapid rises in East Asian output has been generally attributed to a pattern of export-led growth presumed to follow from an outward orientation derived from import liberalization and exchange rate reform.

Naomi Chakwin elsewhere has used vector autoregression (VAR) techniques to test whether exports were indeed causal to output growth in ten newly industrializing countries from different regions of the world. The results, surprisingly, were negative. This paper provides two additional dimensions to that research. First, here the analysis focuses only on the four extremely successful East Asian cases mentioned above and Japan.

Second, the paper examines an alternative hypothesis: that investment is causal to output growth. This alternative formulation involves the notion that dynamic growth of output occurs as a result of high levels of investment and rapid structural change in the composition of output whose growth, in turn, results in high exports. It is an idea of growth-led exports as opposed to export-led growth, which suggests a supply- rather than demand-driven process.

The results of the analysis, whether carried out within the framework of a structural model of export-led output growth or investment-led growth, reveal that investment is substantially stronger than exports as a causal variable on output.

This Technical Paper is a complement to a companion work, *The East Asian Development Experience*, by Colin Bradford (an OECD Document on Sale), which provides a broader and more historical context for this paper.

Jean Bonvin
OECD Development Centre
July 1992

I. INTRODUCTION

This paper examines the trade-output correlation using two alternative structural VAR models. The first specification is based on an outward-oriented export-led output growth hypothesis and the second specification is based on the notion of investment-led output growth. The evidence presented from both models supports the role of investment in explaining variations in output.

Economic performance in the East Asian economies has been highly successful, even "hyper"-successful (Pack and Westphal, 1986), as three decades of evidence demonstrate (Bradford, 1993). More specifically, Hong Kong, Japan, South Korea, Singapore and Taiwan have become development prototypes. The outstanding pace of their development has led to an extensive debate and considerable empirical work directed toward understanding the causes of the East Asian development experience. The bulk of the empirical research has sought to explain output growth in terms of export growth. Consequently, the statistical relationship between export growth and output growth has been well studied and documented.[1] This stylized fact has at times dominated the debates in the field of development economics. Despite the extensive literature, it has not been clear whether exports have been the causal[2] variable in output growth.

This paper centers on two possible interpretations of the trade-output correlation. The more established view is that increases in exports cause output expansion. Reasons for this phenomenon are usually based on trade and exchange rate reforms which allow external demand to be more effectively transmitted to the export-goods sectors and the more efficient utilization of given resources that results from trade liberalization. In this approach exports are considered exogenous and responsive to world demand. A second approach is centered on the role of investment in determining output growth. This hypothesis maintains that it is investment variations that cause variations in output growth by increasing productive capacity in the economy. Exports are considered to be a passive endogenous variable that respond to changes in current or expected future output. Increased export activity then becomes the result of expanded export capacity created by new investment rather than due to trade liberalization.

These alternative hypotheses are explored using reduced-form structural models to examine causality in the five East Asian economies. Bernanke (1986) and Sims (1986) specifically developed this technique to discriminate between structural hypotheses.

The results provide evidence that exports have not been the causal factor in the output growth of these economies. Investment is more important in explaining variations in output. In both models, evidence demonstrates that investment is in fact the exogenous variable. We conclude that the customary view of the trade-output correlation is significantly displaced by the investment-led output hypothesis.

The paper is organized as follows: Section II identifies the variables to be analyzed and discusses the analytical methodology employed. Section III specifies the export-led model as the causal explanation of the export-output correlation. Section IV examines the alternative investment-led output explanation, and Section V provides a summary and conclusions.

II. VARIABLE SELECTION AND ANALYTICAL METHOD

Before exploring alternative specifications of the two different structural models, the relationship between four variables is tested. These variables are chosen for the following reasons:

(a) dynamic exports (X) have been the fundamental distinguishing feature of the development experience in the five East Asian cases, regardless of whether they are thought to be demand-driven or supply determined;

(b) investment (I) has a long history in the literature as a primary determinant of output and growth;

(c) the dynamic exporting experience of these five economies has consisted primarily of exporting manufactured goods. The productivity of manufacturing sectors (D) is presumed to be higher than other sectors and a significant contributor to output growth; and

(d) output or GDP growth (Y) has also been highly dynamic in the development experience of the East Asian economies and is the dependent variable in the specification of both models.

In order to test the trade-output correlation in this study, GDP (Y), manufacturing productivity (D), gross fixed investment (I) and goods and services exports (X) are analyzed using 1987 constant price annual data that are in log form and fitted with three-year lags. This *World Table*[3] data spans 1969 to 1989 and is in panel form with a time trend and dummy for each country. The time trend term is a block diagonal matrix of trends for each country. This allows the model to capture the movement of the observations in the sample countries over the sample period fully. The dummy variables are introduced to account for the heterogeneity of the intercept terms. The sample consists of Hong Kong, Japan, South Korea, Singapore and Taiwan. First, we examine the relationship among the four variables.

Table 1. **Tests of Marginal Predictive Power of Row Variables for Column Variables**

	D	Y	I	X
D	.0000000	.4720666	.3228471	.0172626
Y	.0846100	.0000000	.0003651	.1486173
I	.1978546	.0065038	.0000000	.6794242
X	.0050122	.0069185	.0002614	.0000000

Entry (i,j) is the significance level of the F-test of the hypothesis that 3 lags of variable i can be excluded from the regression predicting variable j. A low value indicates rejection of this hypothesis.

Table 1 shows that output is predicted by both exports and investment at the

.01 level. Investment predicts no other variable, but exports also predict manufacturing productivity and investment (as well as output) at the 0.01 level. It is surprising that manufacturing productivity is not predicted by investment. Manufacturing productivity, however, does predict exports at the 0.05 confidence level. Also output predicts investment at the 0.01 level. In Table 2 the conditional contemporaneous correlation of investment with output is higher than that of any other variable with output and reflects the highly significant interaction between investment and output in Table 1. These two tables illustrate the need to develop two different model specifications, as both investment and exports appear to influence output.

Table 2. Correlation Matrix of Residuals

	D	Y	I	X
D	1.00	.38589	.36830	.27134
Y		1.00	.72068	.54667
I			1.00	.22975
X				1.00

The next step to is to develop a model or class of multivariate time series models which will serve to estimate the structural system. Usually, the first step in econometric estimation is to determine a structural model, i.e., a set of parameters derived from economic theory. Generally speaking, some variables are specified to be determined simultaneously while other variables are predetermined. Econometrically, the aim is to obtain estimates for the parameters of both simultaneously determined endogenous variables and predetermined exogenous variables. The method of obtaining these estimates is through reduced form coefficients, providing that the model can be exactly or over identified. This process is accomplished by satisfying the necessary rank and order conditions. Sims (1980) has raised questions concerning the implications of the restrictions necessary for identification. Specifically, he argues that the conditions required for identification are econometric qualifications that are not necessarily based in theory and therefore are "incredible". Due to these criticisms we employ vector autoregression (VAR) techniques to estimate these models and ascertain causality instead of using the standard simultaneous equation techniques.

The use of VARs is a novel technique in some fields of economics but has been known in the fields of applied macroeconomics and econometrics[4] for over a decade. Sims (1980) pioneered this methodology of using a multivariate autoregressive system in which no *a priori* theoretical restrictions are placed on the variables. The results can then be evaluated to see if the theory corresponds to the data. More precisely, the method used in this paper is a structural VAR system. Sims (1986) and Bernanke (1986) developed this technique to counter criticisms of the implied recursive structure in an unrestricted VAR. In place of the recursive structure, a set of theoretically based restrictions is used here to identify a structural VAR. This

can be thought of as similar to identification in a simultaneous system but not as rigidly defined. Since we are using reduced forms the term "reduced form equation" and "equation" are used interchangeably. X, I, D, and Y are the residuals of the variables in the system.

III. A MODEL OF EXPORT-LED OUTPUT GROWTH

The first restriction or structure used to identify model 1 is placed on exports. The residual from the export-reduced form equation[5] (1) is assumed to disturb all other variables of the system according to the strength of the contemporaneous correlation of the other variables with the export residual. The VAR technique uses only the reduced form residuals of the system, not the variables themselves. Therefore, it puts no restrictions on the forecastable part of the variable. The export residual enters every equation but other system variables are not allowed to interact with the export residual. In this sense exports are exogenous. Specifically, exports are allowed to affect D, Y, and I directly. This specification rests on the idea that exports have a direct stimulating influence throughout the economy, but no shocks from other residuals affect exports directly. Therefore, export residuals are specified as a structural disturbance.

MODEL 1

$$X = u_1 \quad (1)$$

$$I = ß_1 Y + ß_2 X + u_2 \quad (2)$$

$$D = ß_3 I + ß_4 X + u_3 \quad (3)$$

$$Y = ß_5 D + ß_6 X + u_4 \quad (4)$$

Equation (2) is the investment equation which is assumed to be affected by Y and X. Anticipated increases in output and exports change investment behavior. In this case, the reduction of the anti-export bias achieved by trade liberalization would increase output and export expectations. Therefore, investment should respond to both of these variables. The manufacturing productivity equation (3) postulates that I and X affect D. Productivity changes in manufacturing are assumed to occur through changes in productive capacity due to investment. Also, changes in productive processes come from learning and exposure to international best practice through trade. This allows for increased marginal productivity in the export sector due to re-allocation and increased investment in plant and equipment. Finally, equation (4), output is permitted to respond to D and X. In the export-led model, exports stimulate the economy. Given the reallocation effects of liberalization, productivity rises and leads to increases in competitiveness and output. Therefore, shocks to both exports and manufacturing productivity should affect output.

Results of this estimation are contained in Tables 3 and 4. These tables question the robustness of the export-led model.

Table 3 is the decomposition of the forecast error variance of output from the structural model. The various contributions to output from manufacturing productivity, investment, exports and output shocks can be decomposed. For each period 100 per cent of output is explained by shocks from the variables, i.e., the sum total of period one D, Y, I and X equals 100. Depending upon the importance that variable has in explaining output, the decomposition will be large or small. For example, the first period manufacturing productivity explains 17 per cent of the forecast error variance of output, investment 44 per cent and exports 22 per cent. GDP explains only 18 per cent of its own forecast error. The investment channel appears to be the strongest especially in the first three periods explaining more than 40 per cent of output variation. This means that output is better predicted by including the information contained in investment than by itself. Given the specification, one might expect the contribution from export shocks to be greater than that of investment, especially since investment affects output only through productivity. Despite this model specification making exports exogenous, the analytical evidence demonstrates that investment is exogenous in this model.

Table 3. **Decomposition of the Forecast Error Variance in the Export-led Model**

Decomposition of the Variance of Output

Residual of Variable	D	Y	I	X
Year 1	16.9990	17.8034	43.6781	21.5193
Year 2	16.4140	20.2409	38.0331	25.3119
Year 3	16.1292	19.8767	37.9599	26.0341
Year 4	16.6557	19.7487	37.7337	25.8618
Year 5	19.1677	19.4322	36.6924	24.7076
Year 6	19.9370	19.1544	36.5551	24.3534

Entries show percentage of forecast variance of Y at different horizons attributable to residuals from the reduced form estimated equations associated with each of the column variables. Year 1 is the contemporaneous year.

To determine the directional effect these variables have on output, an impulse response function of output can be used. Sims (1980) argues that the best descriptive device for understanding the inherent system dynamics is the analysis of the system's response to random shocks. This response has become known as an impulse response function. The random shocks are positive residuals of one standard deviation unit in each equation in the system and may be interpreted as elasticities. The idea is to calculate the moving average representation (MAR) and trace the response of the variables in the system to an unanticipated shock of one standard deviation. Although the impulse response functions use almost the same information set as the decompostions, they relate the information differently. Table 4 is the response of output to shocks from the positive residuals in the system variables. From this table we can observe the direction of the system in Table 3.

Table 4. **Impulse Responses of the Export-led Growth Model**

Responses of Output to Residual Shocks from Each Variable

Residual of Variable	D	Y	I	X
Year 1	1.1275	1.3051	2.0442	1.4349
Year 2	1.1012	1.2516	1.4019	1.4249
Year 3	-.1140	.1177	.3564	.4603
Year 4	.3274	.0540	-.0921	.0541
Year 5	.7537	.3153	-.3374	-.0354
Year 6	.4327	.0519	-.2713	-.570

Responses show the dynamic response of Y to a one-standard deviation shock in the estimated equations associated with each of the column variables. All entries are multiplied by 10^2. Year 1 is the contemporaneous year.

The data on the impulse response of output shows that exports are positive for four periods and investment for three. This means that the strong investment effect on output disappears after three years, but the weaker export effect is slightly more persistent. Interestingly, manufacturing productivity becomes negative in period 3 and then becomes positive again. Because productivity changes are usually permanent, we interpret this as being a temporary decrease in manufacturing productivity due to structural change in the economy. An example might be the implementation of new technology which requires a learning period before productivity increases.

Overall this analysis suggests two things. First, export shocks are important for output but not as important as investment in this model. Based on this evidence, investment is Granger causally prior to exports. This result is based on the condition that the best forecast of output is formed from lagged values of investment and output rather than from output alone. Second, these estimates suggest that we need to construct a more robust model to "explain" output in the East Asian economies.

IV. A MODEL OF INVESTMENT-LED OUTPUT GROWTH

The problem now is to reconcile the large amount of previous empirical research demonstrating the high correlation between exports and output with the result that export shocks do not matter. We know from Table 1 and Table 2 that investment is both a better predictor of output than exports and more closely correlated with output. If we assume that investment is the strategic variable and exports are passive and correlated with output only through investment, a different model can be developed. In this way, the trade-growth correlation can be seen as a correlation between investment and output so that the strong correlation of exports and output reflects primarily the collinearity between trade and investment. There has been more support for this position recently. Some particularly important work in this area has been DeLong and Summers (1992, 1991) and Scott (1989). Specifically, DeLong and Summers present extensive empirical evidence that real investment in plant and equipment causes output growth, whereas Scott (1989) maintains that it is the undertaking of investment that creates opportunities for output growth. His theoretical framework leads to the conclusion that investment explains output growth in the long run.

We estimate a four-variable system similar to the export-led output-growth model above using the same methodology. That is, the model is a reduced form structural model in which the same notation applies.

MODEL 2

$$I = u_1 \tag{5}$$

$$D = ß_1 I + u_2 \tag{6}$$

$$Y = ß_5 I + ß_6 D + u_4 \tag{7}$$

$$X = ß_2 I + ß_3 D + ß_4 Y + u_3 \tag{8}$$

In this model investment is the exogenous variable that affects all other variables in the system. Specifically, investment enhances productivity in manufacturing, increases the capacity to produce exports and output. Therefore, in equation (5) investment (I) is the structural disturbance that is assumed to disturb all other system variables. This equation functions in the same way as the export equation (1) functioned in the export-led model. I is allowed to affect the other equations in the system but D, X, Y do not enter into I.

In equation (6), productivity in manufacturing is assumed to be affected solely by investment. Therefore, manufacturing productivity is affected only by investment disturbances. Investment is postulated as increasing capacity in the higher

productivity manufacturing sectors for export. Equation (7) relates I and D to output so that the shocks from both D and I have an impact on output (Y). Increments in output are conceived as dependent upon increases in supply capacity and increases in productivity in manufacturing.

Equation (8) is the export function in which all system disturbances are permitted to affect X. In this way we capture the impact of any shocks from D, I, and Y to exports. Hence, exports, rather than inducing growth as previously formulated, are affected by the supply-augmenting aspect of investment in this model. Specifically, this model posits that increases in manufacturing productivity accompany investment and structural change, thereby increasing output (equation 7) and exports (equation 8). This is a growth-led exports formulation rather than an export-led growth structural relationship.

Table 5. **Decomposition of the Forecast Error Variance**

Decomposition of the Variance of Output

Residual of Variable	D	Y	I	X
Year 1	1.6789	46.3832	51.9379	.000
Year 2	1.2302	50.0993	48.1025	.5679
Year 3	1.2549	49.2921	48.5615	.8915
Year 4	1.7184	48.8233	48.5512	.9071
Year 5	2.7855	46.7569	49.5896	.8681
Year 6	3.4416	45.5944	50.1106	.8534

Entries show percentage of forecast variance of Y at different horizons attributed to residuals from the reduced form estimated equations associated with each of the column variables. Year 1 is the contemporaneous year.

The decompositions from this structural model shown in Table 5 are quite different from the decompositions in Table 3. In period one, investment (I) explains 52 per cent of the forecast error variance of output in period one compared to output which explains 46 per cent of output variations. The average of the six periods for investment is 49.5 per cent and for output 47.8 per cent. Therefore investment is strongly exogenous in this system. Although investment was found to be exogenous in the export-led model the magnitude here is striking. Clearly, the information contained in I is a better predictor of output than D, X or even Y itself. Also striking in this model is that X contains almost no information for output. Exports explain less than 1 per cent of output variations and manufacturing productivity explains between 1 and 3 per cent of output variations.

Table 6. **Impulse Responses of the Investment Growth Model**

Responses of Output to Residual Shocks from in Each Variable

Residual of Variable	D	Y	I	X
Year 1	.3401	1.7876	1.8916	.0000
Year 2	.1696	1.6390	1.4385	.2582
Year 3	-.0939	.3709	.5317	.2054
Year 4	.2422	.0321	-.2381	.0546
Year 5	.3834	.0671	-.6349	-.0019
Year 6	.3101	-.626	-.4859	.0313

Responses show the dynamic response to Y to a one-standard deviation shock in the estimated equations associated with each of the column variables. All entries are multiplied by 10^2. Year 1 is the contemporaneous year.

The impulse responses in Table 6 illustrate the direction of the effect of I for output. We have virtually the same structural dynamic pattern as that in Table 4. The system dies down after 3 periods except D which has a negative third period and then increases. This indicates the same structural dynamics are prevalent in both systems and is reassuring given that the same sample and sample period were used in both models. The major difference is that I shocks are overwhelmingly the most important in predicting output in this system, and X shocks are unimportant. Y responds to its own shocks, I shocks and only weakly to D and X. This can be interpreted as giving a primary role to I in understanding output variations in these Asian economies.

V. CONCLUSION AND SUMMARY

In this study a variant of the VAR methodology was used to consider two alternative explanations of the trade-output correlation in the East Asian economies. This approach was used to shed light on the causal dynamics in these countries. The first model examined the export-led output-growth hypothesis in which exports are treated as the exogenous variable. The second model focused on the investment-led output-growth hypothesis in which investment is specified to be exogenous. We found no support for the export view and significant support for the investment view.

In the first model, even though exports were specified to be exogenous, investment was found to be exogenous and had a strong, positive impact on output. The effects of export shocks were shown to not impact directly nor solely on output. Although the largest part of output variation is accounted for by investment shocks, the other variables do have some effect on output. Interestingly, exports did not seem to operate in the short run through manufacturing productivity. This presents two possibilities: 1) that the lag time needed for the beneficial externalities to influence productivity is more a medium or long term phenonemon; 2) these beneficial externalities may be better captured by investment, due perhaps in part to imports of capital goods adapted to country specific needs. Examples are learning and spillovers from technological innovation. Even in the export-led output-growth formulation, the results indicate that investment, not exports, is Granger causally prior in this system specification of the East Asian economies.

In the second model, we allowed investment to operate as exogenous affecting all variables in the system. The result was that investment explains the largest part of output fluctuation in this sample. But more surprisingly, export shocks carry almost no information for output in this specification and, hence, do not play any role in explaining output variation. This amounts to a rejection of the export-led output-growth hypothesis. Interestingly, investment does not operate through manufacturing productivity in this model either. The main conclusion is that output fluctuations are Granger caused by investment rather than exports.

The reasons for consistently high output growth of the East Asian economies are complex, but these results suggest that theories which treat exports as exogenous do not capture the primary causal relationship that explains the output performance of these economies. Therefore, we conclude that the trade-output correlation masks the investment-output correlation, with the primary causality being from investment to output-growth in the East Asian economies. Even under the export-led formulation, investment proves to be more exogenous than exports. The empirical results from applying the investment-led output-growth structural model to the data panel clarify the direction of causality from investment to output and substantiate its primacy over exports as a causal variable in determining output in the five East Asian economies.

Since investment is specified here as affecting productive capacity, the results seem to emphasize the importance of changes in the supply side relative to the demand side. Investment increases productive capacity and the supply of output which includes the supply of exports. This relative importance of supply-led elements over demand-inducing processes focuses more attention on internal economic variables than external variables in causing and explaining output growth in East Asia.

NOTES

1. Marin (1992), Salvatore and Hatcher (1991), Sengupta (1991), Dollar (1991), Harrison (1991) and Chow (1987).

2. Causality is defined from Granger (1969, 1980) and further developed by Sims (1982).

3. Data for Taiwan is taken from the *Taiwan Statistical Data Book*.

4. For further references see *Journal of Econometrics*-1988-3 where the entire issue is devoted to causality.

5. This is referred to in the literature as the "export innovation" but to avoid confusion we will not use the word innovation in this sense.

REFERENCES

Afxentiou, P. and Serletis, A. (1991) "Exports and GDP causality in the Industrial Countries: 1950 - 1985," *Kyklos*, Vol.44:167-179.

Bernanke, B. (1986) "Alternative Explanations of the Money-Income Correlation." *Carnegie-Rochester Conference Series on Public Policy* 25, 49-100.

Blanchard, O. and Watson, T. (1986) "Are Business Cycles All Alike?" in *The American Business Cycle,* edited by R.J. Gordon, NBER.

Bradford, C. (1993) "The East Asian Development Experience." Forthcoming: in *Handbook of Economic Development*, Grilli, E. and Salvatore, D. eds.

___. (1987) "Trade and Structural Change: NICs and Next Tier NICs as Transitional Economies." *World Development*, vol. 15, No. 3, 299-316.

Chakwin, N. (1992) "Exports and Growth: An Empirical Investigation of Growth." Ph.D. Dissertation New School for Social Research.

Chow, P. (1987) "Causality Between Export Growth and Industrial Development: A Comparative Analysis." *Journal of Development Economics* 26, 55-63.

DeLong, J.B., Summers, L.H., (1991) "Equipment Investment and Economic Growth." *The Quarterly Journal of Economics,* No.425, 445-502.

___. (1992) "Equipment Investment and Economic Growth: How Strong Is the Nexus?" *Brookings Papers on Economic Activity* 2, 157-211.

Dollar, D. (1991) "Outward Orientated Developing Economies Really Do Grow More Rapidly, Evidence from 45 LDCs, 1976-85." *Economic Development and Cultural Change*

Granger, C.W.J. (1969). "Investigating Causal Relations by Econometric Models and Cross Spectral Methods." Reprinted in *Rational Expectations and Econometric Practice*, edited by R.E. Lucas and T.J. Sargent, pp. 371-86. London: George Allen and Unwin.

___. (1980) "Testing for Causality: A Personal Viewpoint." *Journal of Economic Dynamics and Control* 2:329-52.

Harrison, A. (1991) "Openness and Growth-A Time Series, Cross-Country Analysis for Developing Countries." World Bank Working Paper-WPS-809.

Journal of Econometrics. 1988. "Causality," Annals 1988-3, Vol. 39. Edited by Dennis J. Aigner and Arnold Zellner.

Marin, D. (1992) "Is the Export-Led Growth Hypothesis Valid for Industrialized Countries?" *Review of Economics and Statistics* 4:678-688.

Pack, H., Westphal, L. (1986) "Industrial Strategy and Technological Change: Theory versus Reality." *Journal of Development Economics* 22:87-128.

Porter, M. E. (1990) *The Competitive Advantage of Nations*. (New York: The Free Press)

Salvatore, D. (1983) "A Simultaneous Equations Model of Trade and Development with Dynamic Policy Simulations." *Kyklos* 36, 66-90.

___ and Hatcher, T. (1991) "Inward Oriented and Outward Oriented Trade Strategies," Journal of Development Studies 27, No.3:7-25.

Scott, M. F. (1989) *A New View of Economic Growth*. (Oxford: Clarendon Press)

Sengupta, J.K. (1991) "Rapid Growth in NICs in Asia: Tests of New Growth Theory for Korea," *Kyklos* 44:561-579.

Sims C. (1986) "Are Forecasting Models Usable for Policy Analysis?" *Quarterly Review-Federal Reserve Bank of Minneapolis*-Winter, 2-16.

___. (1982) "Policy Analysis with Econometric Model." Brooking Papers on Economic Activity 1:107-151.

___. (1980) "Macroeconomics and Reality." *Econometrica* 48, 1-48.