

A Comparative Analysis of the Intertemporal Relationship Between Government Expenditure and Revenue : The
Experiences of China, Hong Kong, Singapore, and Taiwan
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A COMPARATIVE ANALYSIS OF THE INTERTEMPORAL RELATIONSHIP
BETWEEN GOVERNMENT EXPENDITURE AND REVENUE:
THE EXPERIENCES OF CHINA, HONG KONG, SINGAPORE, AND TAIWAN

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I. Introduction

The intertemporal response of the total fiscal budget to unanticipated changes in either government expenditures or revenues depends on the characteristics of the fiscal system and the budgetary process through which demands for expenditure & tax changes, are articulated and voiced by various lobbying groups, the public, & bureaucrats. Political economists have advanced a number of alternative hypotheses about the intertemporal relations between innovations in government revenues and expenditures. A full range of possible patterns have been postulated: that revenue changes tend to precede, be contemporaneous with, or lag behind expenditure changes.

Fiscal synchronization occurs when expenditure changes are balanced by concurrent revenue changes. There are various types of models that predict such behaviour. Musgrave (1966) describes such a model based on the benefit approach that yields Pareto preferred outcomes. Meltzer and Richards (1981) develop an alternative model based on public choice principles that admits non-Pareto preferred results. Synchronization need not be contemporaneous: the model by Barro (1979) allows the budgetary changes to be balanced in a present value sense.

When revenues lead expenditures then presumably revenue constraints have an independent institutional presence that can affect total expenditures. Friedman (1974, 1978) argues that in the political sphere government tends to spend what it receives plus as much more as it can get away with. Wagner (1976) and Buchanan and Wagner (1977, 1978) argues that the ease with which governments can raise revenues through deficit spending as opposed to taxes because of fiscal illusion effects is a more important determinant of government expenditure growth. Recently, supply side economists like Roberts (1978) have advanced the idea that tax changes can lead government expenditures in the same direction, not only up but also down.

The case of expenditures leading revenues suggests a process whereby revenues are considered as gradually adjusting to expenditures. Peacock and Wiseman (1961, 1979) were among the earliest to recognize that increases in government spending brought about by crisis conditions tend to lower revenue constraints permanently. More generally, if the configuration of political power is sufficient to approve expenditure increases or decreases, then that decision is likely to be matched by appropriate changes on the revenue side. The rehabilitation of the Ricardian Equivalence argument by Barro (1974, 1978) that deficit spending financed by government debt which entail future taxes are fully capitalized by the current generation directly challenges the fiscal illusion effects emphasized by Wagner and Buchanan. Although Barro does not provide a theory of the determinants of the size of the government, his analysis unmistakably suggests that the intertemporal relationship runs from expenditures to revenues and not the reverse.

In this paper we explore the intertemporal relations between innovations in government revenues and expenditures in China, Hong Kong, Singapore, and Taiwan. Since these four societies are extremely different both in terms of the nature of the political and economic systems and the purpose and conduct of their economic policies, it would be interesting to examine whether differences exist in the intertemporal relations between government expenditures and revenues, and, if so, how so. Such information may shed light on the interface between politics and economics in each of these societies. It can also provide a fresh challenge to political economists whose theories have been developed largely on the basis of material from developed countries. This is particularly interesting because three of these four societies have been universally acclaimed to be among the most successful development miracles of the postwar period.

Section II describes the data that are used in the analysis. Simple statistics describing the time series patterns of government expenditures and revenues, aggregate output or income, and their cross correlations are also provided for each society. Section III discusses the method that is used to identify the intertemporal relationships between government expenditures and revenues. The main results are reported. Section IV concludes the main findings and discusses some problems of interpretation.

II. Data Description

The various periods that I study are 1950-84 for China, 1960-84 and 1947-84 for Hong Kong, 1960-84 for Singapore, and 1951-84 for Taiwan. For Hong Kong figures for two periods are given because data on aggregate output for the pre-1960 period are crudely imputed and is subject to considerable measurement errors. In what follows, expenditures and revenues mean government budgetary expenditures and revenues, respectively; output is a variable used to measure total value of output produced or income received, but the exact definition varies for each society. For precise definitions of each variable used and data source see Appendix.

To obtain simple descriptive statistics of the various time series of interest, I regressed separately the logarithmic value of real government expenditures, real government revenues, and real aggregate output or income against a linear time trend. Correction was made for first-order serial correlation in the residuals. The coefficient of the linear time trend variable gives an estimate of the growth rate of the dependent variable. Table 1 shows that expenditures and revenues grew at about the same rate as output in China. Expenditures and revenues grew faster than output by one to two percentage points in Hong Kong and Taiwan, and by two to three percentage points in Singapore. The relative size of the public sector evidently expanded more rapidly in Singapore than in either Hong Kong or Taiwan. The distinction between public and private sectors is not as relevant for China because of the vast differences in the economic system. The figures, however, do suggest that the amount of resource that are directly

allocated by the central government has remained quite stable overtime relative to the size of the economy. In general, as a largely planned socialist state, China is the most interventionist and Hong Kong's free enterprise system is by far the least interventionist. Singapore and Taiwan are somewhere in between.

Table 1

Fluctuations of the various time series can be measured by the root mean squared error term obtained from the linear time trend regressions. Figures in Table 1 show that as a whole fluctuations in expenditures, revenues, and output tend to be significantly greater in China than elsewhere. This reflects the vast economic and political changes that took place during that period. Residual variation in output are quite small in Hong Kong for 1960-84, While that for Singapore and that for Taiwan, are about one-third that of China. Both expenditures and revenues tend to have higher relative residual variation than output in all four societies. The root mean squared error measures for expenditure & for revenue are about twice as large as those for output in China, Hong Kong, and Taiwan. For Singapore this figure is somewhat higher at 3 or 5 times, respectively, for revenue and expenditure. Note also that except for Singapore, the magnitude of the relative residual variation in expenditures and revenues are about the same, with a slight tendency for fluctuations in expenditures to exceed revenues in China and Taiwan, and the opposite tendency to occur in Hong Kong. In Singapore, the extent to which fluctuations in expenditures exceed revenues is much greater.

Information about the contemporaneous correlation between the fluctuations of the various time series was obtained by calculating the simple correlation coefficient between the residuals of the linear time trend regressions. The residual correlations between expenditures and revenues are very high, exceeding 0.9 in China, but at somewhat lower levels - , just over 0.7 - in Hong Kong, Singapore, and Taiwan. The residual correlations between expenditures and output and between revenues and output are about 0.6 for China, 0.5 for Hong Kong and Singapore, and 0.3 for Taiwan.

III. Estimation Method and Results

To discover the precedence in the innovations in government expenditures and revenues the notion of Granger causality put forth by Granger (1969) and Sims (1972) is used. The use of the term causality has been criticized by Leamer (1985) because the procedures establish merely statistical precedence. Since our study is basically data exploration, we shall follow Leamer's suggestion and refer to it as precedence rather than causality. The basic approach consists of estimating the equations

$$(1) \quad E_t = (a_j E_{t-j} + (b_j R_{t-j} + u_t$$
$$(2) \quad R_t = (c_j E_{t-j} + (d_j R_{t-j} + v_t$$

where $E(u_t)=E(v_t)=0$, $E(u_t^2)=s_u^2$, $E(v_t^2)=s_v^2$. $E[utvs] = E[vtvs] = 0$ for $t \neq s$, and $E[utvs] = 0$ for all t and s . If $k = m$ and $l = n$ then both equations can be estimated by

ordinary least squares, otherwise using the seemingly unrelated method can improve the efficiency of the estimates. When the estimated coefficients b_j 's on the lagged variables are statistically significant as a group then there is causality from R to E. Similarly, significance of the estimated c_j 's as a group implies causality from E to R.

The major difficulty lies in specifying the proper lag structures for the two equations. Previous studies utilizing the Granger test have shown that test results are often sensitive to alternative specifications. Because the annual data series that is used in the analysis here are rather short, the use of complex procedures is likely to be an unnecessary overkill and is therefore not taken up. Instead we search for the simplest lag structure for each equation, starting from $k = l = m = n = 1$, that would yield residuals which do not indicate any serial correlation.

Since the Granger test requires the data to be stationary, new series were constructed by taking first-differences of the logarithmic values of the revenue and expenditure series. The new series were regressed against time and a constant. If the coefficient on time was insignificant the variable was considered stationary. It turned out that all data series were stationary after first-differencing.

One possible problem affecting the intertemporal relation between expenditures and revenues stems from business cycles. There may be a tendency for expenditures and revenues to vary inversely over the business cycle. This tendency may be a result of countercyclical fiscal policies and should be taken into account in testing for statistical precedence. The one-period lagged output variable may be entered into the regression as an additional control.

Equations (1) and (2) were estimated both with and without the lagged output variable. The residuals were calculated from each regression and used in estimating a first-order autoregression on the residuals. The results from these tests do not support the existence of any significant serial correlation. All estimated regression results are given in Tables A1 to A4 in the Appendix. All the equations were found to have no serial correlation in the residuals after lagging each right-hand variable one-period.

Tables 2 and 3 give t-statistics on the relevant right hand variables. The figures in Table 2 correspond to those regressions which do not include a lagged output variable and Table 3 to those which do. Since all relevant right hand variables are only lagged one-period using t-statistics are sufficient to test for the presence of intertemporal relations among the variables. Results from Table 2 show that expenditure innovations precede revenue innovations in Hong Kong and the reverse intertemporal relationship exists in Singapore. A significant result is that there is no strong evidence for the presence of any statistical intertemporal relationship between expenditures and revenues in both China and Taiwan. Upon controlling for output we find from Table 3 that the results are unchanged for Hong Kong, but for Singapore there is now evidence of

intertemporal feedback between expenditures and revenues. There is also now some marginal evidence from Table 3 that innovations in revenues may precede expenditures in China.

[Table 2](#)

[Table 3](#)

IV. Concluding Discussion

The evidence in the previous section suggest that the intertemporal relations between government expenditures and revenues varies considerably across societies.

Taiwan exemplifies the classic textbook case whereby changes in government expenditures are met by concurrent changes in government revenues. A number of factors have facilitated this. Among them is the determination to avoid inflation by a government which is stable and has complete authority. This has resulted in a conservative budgetary policy with few deficits except for certain times in the 1950's. The ability to hold down military expenditures, which amounts to over 50 percent of total government expenditures, and other social expenditures has been a signal success in preventing a rapid growth in the size of government.

Taiwan's main revenue source is indirect taxes which account for 70 to 80 percent of total government revenue. Given such a revenue structure it is extremely difficult to increase government revenues without seriously impinging on the conditions necessary for efficient production and capital formation in the private sector. There is already a belief that the current system of commodity taxes and tariffs are detrimental to efficiency in allocation and are probably regressive on income distribution. Hence, the unwillingness to run budget deficits and the limitations on sustained revenue increases have prompted the government in Taiwan to live well within its means. This has meant that neither innovations in expenditures nor in revenues has been translated into permanent future increases in either revenues or expenditures, as the case may be.

Whether all this can continue into the future is somewhat in doubt. Kuo (1983) believes that government revenues may slow down along with the growth of the economy, while the requirements for government expenditures may increase with the need for more social welfare and infrastructural construction. Therefore, the reliance on more public bonds to finance government spending becomes unavoidable. It would be interesting to see whether this shift to debt financing would result in a more rapid growth of government spending as postulated by Buchanan and Wagner (1977).

Singapore presents an entirely different picture even though its government has generally been interventionist as in Taiwan. The most striking result is that innovations

in government revenues appears to have a permanent effect on government expenditures. Normally the Singapore Government shows a small surplus in its fiscal budget. Offsetting this, various Statutory Boards run a small deficit. About 80 percent of government revenues are derived from taxes which is approximately evenly divided between direct and indirect taxes. Interestingly more than a quarter of government expenditures goes into servicing the public debt. Of the four societies which we study, Singapore is the only one that has a substantial bond issue. However, looking at the budgetary figures alone, one may not get the impression that the Singapore Government finances expenditures by debt because additions to the outstanding public debt is not considered as part of government current revenue. One has to look at the accounts of the Development Fund to understand what really happens.

The expenditures of the Development fund is financed chiefly by borrowing from the Central Provident Fund, which is restricted to investing almost exclusively in government securities. In other words the government can resort to an easy and cheap source of funding. Ostensibly the government is running a budget surplus, when in fact it is accumulating a large public debt. This feature of the system makes it possible for the government to expand expenditures with minimal restraint, so long as contributions to the Fund exceed withdrawals. For the same reason it also means that government has been able to allow increases in revenues to pass on into permanent increases in expenditures. Indeed one of the early arguments for establishing the Fund was that it would place more resources at the disposal of the Government. Since the Fund has only been established for about 30 years, contributions to the Fund have grown rapidly over time and in recent years have amounted to as much as one-third of total government revenues.

The Singapore case therefore exhibits, in substance if not in form, the kind of effects associated with deficit financing that has been emphasized by Buchanan and Wagner (1977). The present state of affairs cannot continue forever in Singapore. Over time contributions to the Fund would tend to equal withdrawals and this drying out of easy and cheap funds could result in significant problems of fiscal and monetary adjustment. Recent hints by the Singapore Government to alter the terms governing contributions and withdrawals from the Fund in face of the current economic crisis is hardly surprising.

The monetary and fiscal set up in Hong Kong is in fact quite similar to that in Singapore. The only difference is that there is no Central Provident Fund in Hong Kong. As a consequence, the Hong Kong government does not have access to a cheap an easy source of funds. Throughout the entire postwar era the Hong Kong government budget have seldom been in deficit and there has been very little reliance on public debt issue to finance government expenditures. It is not surprising that unlike Singapore, innovations in revenues have not been translated into permanent changes in expenditures. Even government land sales which from time to time brings in large sums of revenue for the Hong Kong Government have not resulted in permanent changes in expenditure

behaviour.

In both Hong Kong and Singapore there is evidence for innovations in government expenditures to be transformed into permanent changes in revenues, a result that differs significantly from results in Taiwan. One would postulate that differences in the politico-economic structures in these three societies may account for some of the variations. In particular, I would draw attention to the fact that indirect taxes constitute 70-80 percent of total government revenues in Taiwan. The corresponding figures are 40 percent in Singapore and 25 percent in Hong Kong. To the extent that it is more costly to raise revenues through indirect taxation without serious hampering the conditions for economic efficiency then the present findings should come as no surprise.

China represents a somewhat different case. Given that its economy is largely planned then one would anticipate that changes in revenue and expenditures should be concurrently affected, especially in view of the fact that most of its revenues are direct contributions from economic enterprises and units. The evidence does not refute this interpretation. Although there is some slight support for the idea that revenue changes may have permanent effects on government expenditure. Since the economic reforms of 1979 a greater reliance on using debt financed spending has taken place. In the 1980's debt and borrowings have been around 6 percent of total revenues. However, in view of the rather different nature of the statistics that is reported in China as compared to elsewhere, some caution is probably in order.

The results are suggestive. They indicate that the political and economic cost of raising revenues may determine the extent to which revenue changes will be translated into permanent expenditure changes. The use of debt to finance spending makes it easier for government to expand, whereas the reliance on indirect taxation to support spending is much more difficult. The ability of government to prevent changes in expenditures to be translated into permanent changes in revenue has been more successful in China and Taiwan than in Hong Kong and Singapore, presumably because the rules of the game in the budgetary processes are different. It should be emphasized that these concluding observations are meant to stimulate thought and further investigation. They are not definitive conclusions. Some progress, however, has been achieved in identifying the salient features of the intertemporal relationship between government expenditures and revenues.

Appendix

China: All data series are obtained from *Statistical Yearbook of China 1985*.

Hong Kong: Expenditure and revenue data are obtained from *Estimates of Revenue and Expenditure*. The output variable used is gross domestic product and is obtained from Ho (1975) for the years 1947-60 and from *Estimates of Gross Domestic Product* for the years

1961-85. The gross domestic product deflator is used to obtain real values for expenditure and revenue.

Singapore: All data series are obtained from *Yearbook of Statistics*.

Taiwan: All data series are obtained from *Statistical Yearbook of the Republic of China*.

[Table A1](#)

[Table A2](#)

[Table A3](#)

[Table A4](#)

References

Barro, R. J., "Are Government Bonds Net Wealth?" *Journal of Political Economy*, November 1974

_____, "Comment from an Unreconstructed Ricardian," *Journal of Monetary Economics*, August 1978

_____, "On the Determination of the Public Debt," *Journal of Political Economy*, October 1979

Buchanan, J. M. and R. W. Wagner, *Democracy in Deficit*, Academic Press, New York, 1977

_____, "Dialogues Concerning Fiscal Religion," *Journal of Monetary Economics*, August 1978

Estimates of Gross Domestic Product, Census and Statistics Department Hong Kong (various years from 1961 to 1985)

Estimates of Revenue and Expenditure, Government Information and Services Department, Hong Kong (various years)

Friedman, M., *An Economist's Protest*, Thomas Horton & Co., New Jersey, 1972

_____, "The Limitations of Tax Limitations," *Policy Review*, Summer 1978

Granger, C. W. J., "Investigating Causal Relationships by Econometric Models and Cross Spectral Methods," *Econometrica*, July 1969

Ho, H. C. Y., *The Fiscal System of Hong Kong*, Croom Helm, London, 1979

Kuo, S. W. Y., *The Taiwan Economy in Transition*, Westview Press, Boulder, Colorado, 1983

Leamer, E. E., "Vector Autoregressions for Causal Inference?" in K. Brunner and A. H. Meltzer, eds., *Understanding Monetary Regimes*, Carnegie-Rochester Conference Series on Public Policy, Vol. 22, North-Holland, Amsterdam, Spring 1985

Meltzer, A. H. and S. P. Richards, "A Rational Theory of the Size of Government," *Journal of Political Economy*, October 1981

Musgrave, R. A., "Principles of Budget Determination," in H. A. Cameron and W. Henderson, eds., *Public Finance: Selected Readings*, Random House, New York, 1966

Peacock, A. T. and J. Wiseman, *The Growth of Public Expenditure in the United Kingdom*, National Bureau of Economic Research, Princeton University Press, Princeton, New Jersey, 1961

_____, "Approaches to the Analysis of Government Expenditure Growth," *Public Finance Quarterly*, January 1979

Roberts, P. C., "Idealism in Public Choice Theory", *Journal of Monetary Economics*, August 1978

Sims, C., "Money, Income, and Causality," *American Economic Review*, September 1972

Statistical Yearbook of the Republic of China, Directorate General of Budget, Accounting and Statistics, Executive Yuan, The Republic of China (various years)

Statistical Yearbook of China 1985, State Statistical Bureau, The People's Republic of China

Wagner, R. E., "Revenue Structure, Fiscal Illusion, and Budgetary Choice," *Public Choice*, Spring 1976

Yearbook of Statistics, Chief Statistician, Department of Statistics, Singapore (various years)