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# The Direct Substitution between Government and Private Consumption in East Asia

Yum K. Kwan

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## 2.1 Introduction

An important issue in the design of fiscal policy is the substitutability between government and private consumption. If the private sector derives utility from government-provided goods and services and regards private and government consumption as close substitutes, an increase in government consumption will be offset by a corresponding decrease in private consumption, rendering the size of the fiscal multiplier relatively small and even potentially negative. On the other hand, if private and government consumption are complements, an expansionary fiscal policy will be relatively effective in stimulating aggregate demand as private consumption will reinforce the initial fiscal impulse. While it is easy to give examples of *individual* private and government goods that are substitutes or complements, it is an empirical question whether *aggregate* private and government consumption are substitutes or complements for a particular economy during a certain period. The purpose of this chapter is to empirically study the substitutability issue for nine East Asian countries—the four northeast countries: China, Hong Kong, Japan, and Korea, and the five southeast countries: Indonesia, Malaysia, Philippines, Singapore, and Thailand.

Traditional macroeconomic models assume that government consumption works through its impact on private consumption through wealth

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effect or interest rate effect. Private consumption is crowded out either because the consumers may feel poorer as a result of negative wealth effect or they may be induced to postpone consumption in response to deficit-financed government spending. Bailey (1971) and Barro (1981) first suggest incorporating government consumption into the representative agent decision problem, making the public sector part of the general equilibrium system. The idea is that many government goods are to some extent substitutes for private consumption goods. Moreover, government purchases may also serve as useful inputs to the private production function so that government consumption can be productive. This is in contrast to the traditional models in which government consumption are regarded as purely wasteful or unrelated to private consumption or production. In recent theoretical literature, the interaction between government and private consumption has been assigned a central role in the study of fiscal policy, in both the neoclassical real business cycle fashion (e.g., Aiyagari, Christiano, and Eichenbaum 1992 and Baxter and King 1993) and the new Keynesian fashion with monopolistic competition, increasing returns, and nominal rigidities (e.g., Devereux, Head, and Lapham 1996 and Ganelli 2003). However, depending on their assumptions about market structure and technology, these models can predict totally different reactions of private consumption in response to government spending shocks.

On the empirical front, a large literature has been developed to estimate the relationship between government and private consumption. Kormendi (1983) and Aschauer (1985) are representative of the earlier approach that relies on estimating a consumption function. Karras (1994), Ni (1995), Evans and Karras (1996), and Fiorito and Kollintzas (2004) are some of the more recent contributions along this approach. Ni's paper also provides a useful survey of the literature. The empirical analysis in this paper follows Amano and Wirjanto (1997, 1998), who make use of the cointegration approach of Ogaki (1992) and Ogaki and Park (1997) to estimate the preference parameter that governs the relationship between government and private consumption. The idea is to exploit the long-run restriction imposed by the intraperiod first-order condition that characterizes the optimal choice of private and government consumption. Ho (2001), Chiu (2001), and Okubo (2003) are some recent contributions along the same line.

The rest of the chapter is organized as follows. Section 2.2 presents the empirical model in detail. We provide a structural interpretation to the cointegrating regression model by deriving it as an equilibrium condition. Section 2.3 provides a brief description of government expenditures in East Asia. The data and empirical results are presented in section 2.4. Section 2.5 concludes.

### 2.2 The Empirical Model

The empirical work in this paper centers around a cointegrating regression that relates the logarithm of private and government consumption ratio,  $C_t/G_t$ , to the logarithm of their relative price  $P_t^g/P_t^c$ :

$$(1) \quad \ln(C_t/G_t) = \alpha + \beta \ln(P_t^g/P_t^c) + u_t$$

where  $\ln(C_t/G_t)$  and  $\ln(P_t^g/P_t^c)$  are both difference-stationary I(1) processes, and  $u_t$  is a stationary I(0) process. Formal statistical evidence for the cointegration property will be provided in the following. The slope parameter  $\beta$  is the elasticity of substitution between private and government consumption. A positive (negative)  $\beta$  means that the two goods are substitutes (complements). One attractive feature of cointegrating regression is that the slope parameters can be estimated consistently without the assumption that the regressors are econometrically exogenous. In equation (1), for example,  $\beta$  can still be estimated consistently even though there may be stationary omitted variables or measurement errors.

So far equation (1) is treated as a pure statistical relationship between the consumption ratio of private and government goods and their relative prices. It is possible to provide the equation a structural interpretation by deriving it as an equilibrium condition, following the ideas of Ogaki (1992), Ogaki and Park (1997), and Ogaki and Reinhart (1998). Assume that the representative consumer values two goods, private and government, according to an expected lifetime utility function subject to stationary preference shocks:

$$(2) \quad U = E_t \left[ \sum_{j=0}^{\infty} \delta^j u(C_{t+j}^*) \right]$$

where

$$(3) \quad C_t^* = [\phi \varepsilon_t C_t^{1-(1/\sigma)} + (1 - \phi) v_t G_t^{1-(1/\sigma)}]^{1/[1-(1/\sigma)]}$$

( $\varepsilon_t, v_t$ ) are random preference shocks that are assumed to be strictly stationary, have unit means, and finite variances. The stationarity assumption amounts to say preferences are stable in the long run. The period utility function is assumed to possess the usual properties  $u' > 0$  and  $u'' < 0$ . ( $\phi, \sigma$ ) are preference parameters that characterize the representative agent's utility function:  $\phi$  is the relative weight assigned to private goods and  $\sigma$  is the substitution parameter that measures the curvature of the indifference curves. Given time separability of the utility function, the optimal consumption bundle will have to satisfy the equality between marginal rate of substitution and relative price:

$$(4) \quad \frac{\partial U / \partial G_t}{\partial U / \partial C_t} \equiv \frac{v_t (1 - \phi) G_t^{-1/\sigma}}{\varepsilon_t \phi C_t^{-1/\sigma}} = \frac{P_t^g}{P_t^c}.$$

Taking logarithm and rearranging yields

$$(5) \quad \ln\left(\frac{C_t}{G_t}\right) = -\sigma \ln\left[\frac{(1-\phi)}{\phi}\right] + \sigma \ln\left(\frac{P_t^g}{P_t^c}\right) - \sigma \ln\left(\frac{v_t}{\varepsilon_t}\right)$$

Stable preferences implies that the residual term,  $-\sigma \ln(v_t/\varepsilon_t)$ , is stationary and hence equation (5) should be a cointegrating regression, provided that log consumption ratio,  $\ln(C_t/G_t)$ , and log price ratio,  $\ln(P_t^g/P_t^c)$ , are both I(1) processes. In other words, the stable preferences assumption, together with the consumer optimality condition in equation (4), imposes a cointegration restriction on the movements of the log consumption ratio and the log price ratio series. Equation (5) provides a structural interpretation to equation (1), which can be regarded as the reduced-form equation with parameters and residuals related to their structural counterpart via the relationships

$$(6) \quad \alpha = -\sigma \ln\left[\frac{(1-\phi)}{\phi}\right], \beta = \sigma, u_t = -\sigma \ln\left(\frac{v_t}{\varepsilon_t}\right).$$

Notice that equation (5) is a theoretical demand equation, whereas equation (1) is an empirical equation describing the equilibrium quantities and prices. Just like the classical supply-and-demand simultaneous equation model, interpreting equation (1) as the demand equation requires identification assumption. In general, to identify the demand equation, we need variability from the supply side and the demand side should be relatively stable. Since the supply side has to do with production, which is subject to technological improvement, it is reasonable to expect the quantity-supplied series should be highly persistent, which can be modeled as a stochastic trend. The demand side, on the other hand, has to do with taste and it is reasonable to expect preference shocks are relatively stable in comparison with technological shocks. In the context of demand analysis, Ogaki (1992) has shown formally that the assumptions of stable preferences and a stochastic trend in the quantity supplied are sufficient to ensure identification of a cointegrating demand equation like equation (1).

In the theoretical analyses of Bailey (1971) and Barro (1981), followed by the empirical work of Kormendi (1983), Aschauer (1985), and Evans and Karras (1996), among many others, the effective consumption is specified as a weighted average of private and government consumption:

$$(7) \quad C_t^* = C_t + \theta G_t.$$

In this setup each unit of government goods is equivalent to  $\theta$  units of private goods, irrespective of the current consumption level of the two goods. In other words, the indifference curves for the two goods are linear, which corresponds to the extreme case of  $\sigma = +\infty$  in the CES aggregator function in equation (3). Clearly this is an empirically restrictive assumption, albeit a convenient one for analytical tractability.

### 2.3 Government Expenditures in East Asia

Table 2.1 reports a summary of the government expenditures by economic type (in percentage of GDP) for the Asian countries studied in this paper, together with the corresponding figures for the United States for comparison. The data source is World Bank (2004), which in turn is based on the primitive data in the *IMF Government Financial Statistics Yearbook*. Total government outlays are comprised of government purchase of goods and services, wages and salaries for government employees, public capital investment, transfer payments, and interest payments of outstanding government debts. In terms of total outlays, the governments of the Asian countries are comparable in size to that of the United States, except for the Malaysia government, which stands out as the outlier of the group. The pattern of government expenditures among the Asian countries is more heterogeneous. Japan and Korea seem to differ from the rest of the Asian countries and their government expenditure patterns are broadly comparable to that of the United States. The governments of Hong Kong and the five ASEAN countries, on the other hand, spend relatively more on goods and services and on government employee payroll. Table 2.1 also reveals that the Asian governments devote a considerable amount of resources on capital investments, presumably most are on public infrastructure and, for the five ASEAN countries, also on national enterprises. This is in sharp contrast to the United States in which public investment is only 1 percent of GDP. Among the heavy public investors, the Indonesian government

**Table 2.1** Government expenditure by economic type 1991–2000 (% of GDP)

|                       | Goods and services | Wages and salaries | Interest payments | Subsidies and other current transfers | Capital expenditure | Total |
|-----------------------|--------------------|--------------------|-------------------|---------------------------------------|---------------------|-------|
| Northeast Asia        |                    |                    |                   |                                       |                     |       |
| Hong Kong             | 7.2                | 4.4                | 0.0               | 4.7                                   | 4.2                 | 20.5  |
| Japan <sup>a</sup>    |                    | 2.3 <sup>b</sup>   | 3.1               | 9.0                                   | 2.5                 | 16.9  |
| Korea <sup>a</sup>    | 5.1                | 2.2                | 0.5               | 8.2                                   | 2.9                 | 18.9  |
| Southeast Asia        |                    |                    |                   |                                       |                     |       |
| Indonesia             | 4.1                | 2.3                | 2.1               | 3.9                                   | 6.9                 | 19.3  |
| Malaysia <sup>a</sup> | 10.6               | 6.5                | 3.7               | 5.0                                   | 4.8                 | 30.6  |
| The Philippines       | 9.2                | 5.6                | 4.4               | 2.8                                   | 2.5                 | 24.5  |
| Singapore             | 9.8                | 5.0                | 1.3               | 2.4                                   | 5.0                 | 23.4  |
| Thailand              | 9.4                | 5.4                | 0.7               | 1.3                                   | 6.5                 | 23.4  |
| United States         | 5.0                | 1.9                | 3.1               | 12.3                                  | 1.0                 | 23.3  |

Source: World Bank (2004) for countries other than Hong Kong. Hong Kong figures are compiled from the *Hong Kong Annual Digest of Statistics*, various years.

<sup>a</sup>Figures are annual average of 1991–2000, except for Japan (1981–90), Korea (1991–97) and Malaysia (1991–97).

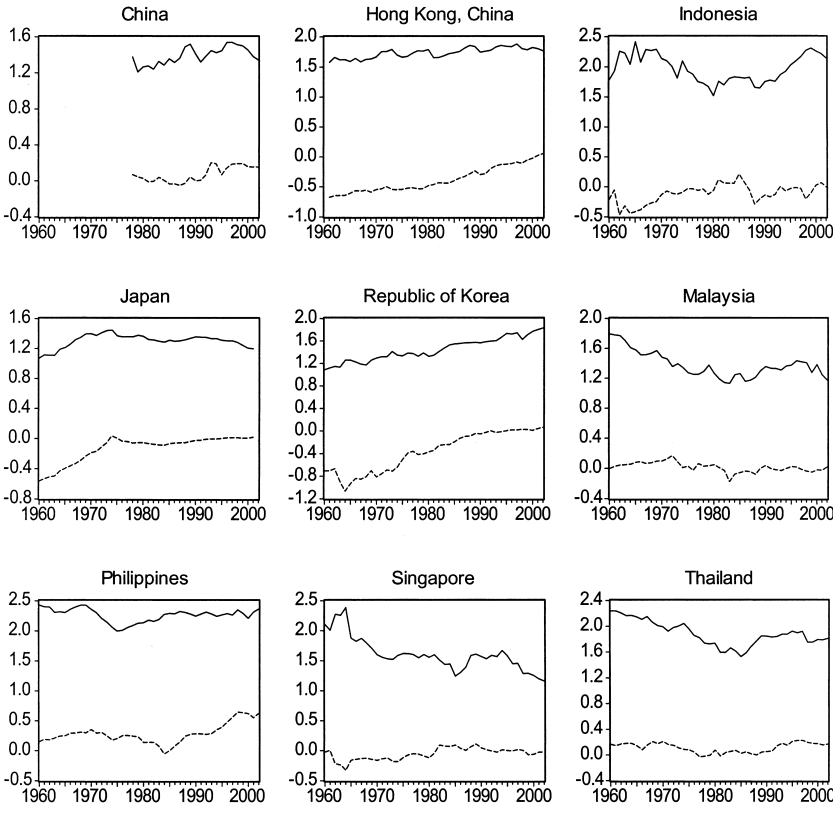
<sup>b</sup>For Japan, the figure for goods and services and wages and salaries is the sum of the two components.

stands out as the largest by devoting 6.9 percent of GDP to public investment, followed by Thailand (6.5 percent), Singapore (5.0 percent), and Malaysia (4.8 percent). Another noteworthy component is transfer payments. The transfer payments of the Asian governments are all relatively low compared with the corresponding U.S. figure of 12.3 percent, with Japan and Korea registering the highest government transfers in the 8 to 9 percent range, and Thailand reporting the lowest transfers of only 1.3 percent of GDP. Clearly the low transfers in the ASEAN countries and Hong Kong reflect the relatively underdeveloped social security system and other formal welfare schemes.

## 2.4 Empirical Results

We use annual data for 1960 to 2002 from the *World Development Indicators* (World Bank 2004) whenever possible to ensure crosscountry compatibility. Missing or erroneous entries are reconstructed from local sources. Private and government consumption are taken to be the relevant expenditure series from the National Income and Product Accounts (NIPA). The consumption ratio,  $C_t/G_t$ , is calculated from the constant price private and government consumption series. The two price series,  $P_t^g$  and  $P_t^c$ , are simply the respective implicit price deflators constructed by dividing the nominal series by the constant price counterpart.

We begin by examining the time series properties of the log consumption ratio series,  $\ln(C_t/G_t)$ , and the log price ratio series,  $\ln(P_t^g/P_t^c)$ . Figure 2.1 depicts the two series for all nine Asian countries. The strong persistency and comovements of the two series are clearly discernable from the plots, giving an initial impression that they are likely to be I(1) and cointegrated. Table 2.2 reports formal panel unit root test results. It is well known that unit root tests have low power and the problem may be even worse for our application as we have short time series. To better utilize sample information, we pool the nine countries' data to perform panel unit root tests, which have been shown to be more powerful than the individual time series version. All three panel unit root tests draw the same conclusion: the unit root null hypothesis is not rejected for the level series but is strongly rejected for the first differenced series. This shows that the log consumption ratio and the log price ratio series are indeed I(1). Moreover, the asymmetry of the  $p$ -values for the level series in the IPS test and the ADF-Fisher chi-square test suggest that log consumption ratio is the less integrated series—in the sense that it has a weaker random walk component—than the log price ratio. This has important implications to the specification of the cointegrating regression. It is well known that cointegrating regression is not invariant to normalization choice—deciding which variable to put on the left-hand side as the regressand—and different choices may imply dif-



Solid = log consumption ratio  $\ln(C_t / G_t)$   
 Dashed = log price ratio  $\ln(P_t^* / P_t^c)$

**Fig. 2.1 Private and government consumption ratio and relative price**  
 Notes: Solid = log consumption ratio  $\ln(C_t / G_t)$ ; dashed = log price ratio  $\ln(P_t^* / P_t^c)$ .

ferent estimates for the same parameter. For example, instead of running regression equation (1), we could have run the reverse regression with the log price ratio normalized as the regressand to obtain an estimate of  $(1/\beta)$ . In finite sample the estimates from the direct and reverse regressions may be far from being reciprocal to each other and they can also have drastically different statistical properties. According to Ng and Perron (1997), in the context of cointegrating regression, it is preferable to put the less integrated series as the regressand and the more integrated series as the regressor. Applying the Ng-Perron rule, this means that designating the log consumption ratio series as the regressand as in equation (1) is indeed the right choice.

**Table 2.2** Panel unit root tests

|                       | $\ln(C/G)$          | $\Delta \ln(C/G)$   | $\ln(P_g^s/P_c^c)$  | $\Delta \ln(P_g^s/P_c^c)$ |
|-----------------------|---------------------|---------------------|---------------------|---------------------------|
| IPS W-statistic       | 0.6551<br>(0.2562)  | 15.2985<br>(0.0000) | 0.6002<br>(0.7258)  | 14.0852<br>(0.0000)       |
| ADF-Fisher Chi-square | 20.3887<br>(0.3114) | 196.183<br>(0.0000) | 15.7766<br>(0.6081) | 178.734<br>(0.0000)       |
| PP-Fisher Chi-square  | 18.0178<br>(0.4545) | 262.871<br>(0.0000) | 18.6922<br>(0.4110) | 270.737<br>(0.0000)       |

*Notes:* P-values are in parentheses.  $H_0$ : Each country follows an individual unit root process.  $H_1$ : At least one country's process is trend stationary. Exogenous variables: individual effects, individual linear trends. Cross-sectional units: China, Hong Kong, Indonesia, Japan, Korea, Malaysia, The Philippines, Singapore, and Thailand. Time period: China 1978–2002; other countries 1960–2002. IPS = IM, Pesaran, and Shin (2003). ADF-Fisher and PP-Fisher are Maddala and Wu (1999) Fisher-type tests constructed by combining the  $p$ -values from individual augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit-root tests.

Table 2.3 reports panel estimation results for equation (1) with country-specific fixed effects. The cointegration property of equation (1) is confirmed by the two panel cointegration tests: the null hypothesis of no cointegration is decisively rejected by Kao's (1999) ADF test, but the null of cointegration cannot be rejected according to the McCoskey and Kao (1998) LM test. Turning to the elasticity of substitution between private and government consumption—the coefficient of  $\ln(P_g^s/P_c^c)$ —it can be seen that the estimates are all significantly positive, ranging between 0.57 and 1.05 with small standard errors, and varying across different estimation methods and sample periods. The empirical results suggest that on average private and government consumption in East Asia are substitutes with an elasticity of substitution midway between 0.5 and 1.

We also estimate an unrestricted version of equation (1) as a simple specification check:

$$(8) \quad \ln\left(\frac{C_t}{G_t}\right) = \alpha + \beta_1 \ln(P_t^s) + \beta_2 \ln(P_t^c) + u_t$$

Equation (1) is a restricted version of equation (8) with  $\beta_1 + \beta_2 = 0$ . Estimates of  $\beta_1$  and  $\beta_2$  that are similar in magnitude but opposite in sign provide evidence in favor of the restriction and hence equation (1). As can be seen from table 2.3, the pattern of the parameter estimates is in general supportive of equation (1); and the evidence is especially strong when all nine Asian countries are included in the sample for the period 1978 to 2002 (panel B). According to the fully efficient DOLS estimates, government and private consumption in East Asia from 1978 to 2002 have a substantial degree of substitutability with an elasticity of substitution around 1, implying a Cobb-Douglas aggregator function for equation (3).

From a policy perspective, the panel estimate may not be of much prac-

**Table 2.3** Panel cointegrating regressions

|  | Regressors         |                    |                     | Cointegration test  |                    |
|--|--------------------|--------------------|---------------------|---------------------|--------------------|
|  | $\ln(P_t^s/P_t^c)$ | $\ln(P_t^s)$       | $\ln(P_t^c)$        | ADF                 | LM                 |
| <i>A. 8 Asian countries (excluding China), 1960–2002</i> |                    |                    |                     |                     |                    |
| OLS  | 0.5722<br>(0.0614) |                    |                     | -5.5516<br>[0.0000] | 0.6516<br>[0.2573] |
| OLS  |                    | 0.7975<br>(0.0639) | -0.8847<br>(0.0698) | -4.3753<br>[0.0000] | 2.4090<br>[0.0080] |
| DOLS   | 0.7555<br>(0.0651) |                    |                     |                     |                    |
| DOLS   |                    | 1.0132<br>(0.0607) | -1.1132<br>(0.0646) |                     |                    |
| <i>B. 9 Asian countries (including China), 1978–2002</i> |                    |                    |                     |                     |                    |
| OLS  | 0.6373<br>(0.1064) |                    |                     | -6.8337<br>[0.0000] | 0.5369<br>[0.2957] |
| OLS  |                    | 0.5958<br>(0.1361) | -0.5718<br>(0.1709) | -6.7290<br>[0.0000] | 0.4498<br>[0.3264] |
| DOLS   | 1.0589<br>(0.0999) |                    |                     |                     |                    |
| DOLS   |                    | 0.9740<br>(0.1250) | -0.9073<br>(0.1591) |                     |                    |

*Notes:* Regressand =  $\ln(C_t/G_t)$ . *P*-values are in square brackets. All regressions include country-specific fixed effect (unreported). DOLS = Kao and Chiang (2000) panel dynamic OLS. The regression is augmented with one lead and one lag of the first difference of the regressors (unreported). ADF = Kao (1999) panel ADF test for the null hypothesis of no cointegration. The lag length in the test regression is chosen by the Schwarz criterion. LM = McCoskey and Kao (1998) panel LM test for the null hypothesis of cointegration.

tical relevance, as it tells us little about any individual country. Table 2.4 therefore reports cointegrating regression results for the nine Asian countries individually. We also report the corresponding results for the United States for comparison. To check robustness, we try three different estimation methods that are all asymptotically efficient procedures for estimating cointegration regressions. The three methods are Phillips and Hansen’s (1990) fully modified ordinary least square (FM-OLS), Park’s (1992) canonical cointegrating regression (CCR), and Stock and Watson’s (1993) dynamic ordinary least squares (DOLS). In general the parameter estimates are stable across the three estimation methods. Comparing the DOLS estimates of the elasticity of substitution across countries, Malaysia and Thailand come up with the highest values of 1.66 and 1.51, respectively, which are comparable to the value of 1.5 of the United States. On the other extreme are Indonesia and Singapore for which the negative elasticities of substitution of -0.92 and -1.76, respectively, imply that private and government consumption are strong complements. The four northeast Asian countries, China, Hong Kong, Japan, and Korea, share a moderate elas-

**Table 2.4** Individual cointegrating regressions

|                 | FM-OLS             |                     | CCR                |                     | DOLS               |                     |
|-----------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|
|                 | Intercept          | $\ln(P_g^*/P_c^*)$  | Intercept          | $\ln(P_g^*/P_c^*)$  | Intercept          | $\ln(P_g^*/P_c^*)$  |
| Northeast Asia  |                    |                     |                    |                     |                    |                     |
| China           | 1.3334<br>(0.0161) | 0.6699<br>(0.1452)  | 1.3335<br>(0.0161) | 0.6691<br>(0.1513)  | 1.3526<br>(0.0216) | 0.6524<br>(0.2136)  |
| Hong Kong       | 1.8645<br>(0.0245) | 0.3242<br>(0.0556)  | 1.8656<br>(0.0259) | 0.3269<br>(0.0575)  | 1.8772<br>(0.0260) | 0.3424<br>(0.0468)  |
| Japan           | 1.3063<br>(0.0204) | 0.2962<br>(0.1026)  | 1.3064<br>(0.0192) | 0.2986<br>(0.0758)  | 1.3329<br>(0.0119) | 0.4149<br>(0.0780)  |
| Korea           | 1.6748<br>(0.0297) | 0.5770<br>(0.0594)  | 1.6755<br>(0.0300) | 0.5778<br>(0.0591)  | 1.6468<br>(0.0177) | 0.5233<br>(0.0331)  |
| Southeast Asia  |                    |                     |                    |                     |                    |                     |
| Indonesia       | 1.8534<br>(0.1038) | -0.9809<br>(0.5449) | 1.8574<br>(0.1030) | -0.9273<br>(0.5090) | 1.8613<br>(0.0449) | -0.9243<br>(0.2614) |
| Malaysia        | 1.3427<br>(0.0255) | 1.6028<br>(0.3979)  | 1.3421<br>(0.0257) | 1.6218<br>(0.4106)  | 1.3420<br>(0.0193) | 1.6601<br>(0.3488)  |
| The Philippines | 2.2307<br>(0.0423) | 0.0458<br>(0.1288)  | 2.2334<br>(0.0421) | 0.0328<br>(0.1333)  | 2.2179<br>(0.0361) | 0.0707<br>(0.1207)  |
| Singapore       | 1.4852<br>(0.0556) | -1.9452<br>(0.4855) | 1.4836<br>(0.0563) | -1.9716<br>(0.5069) | 1.4933<br>(0.0371) | -1.7679<br>(0.3586) |
| Thailand        | 1.7239<br>(0.0684) | 1.3858<br>(0.5139)  | 1.7241<br>(0.0646) | 1.3841<br>(0.4778)  | 1.7057<br>(0.0440) | 1.5149<br>(0.3447)  |
| United States   | 1.4284<br>(0.0291) | 1.5373<br>(0.2304)  | 1.4298<br>(0.0292) | 1.5155<br>(0.1677)  | 1.3818<br>(0.0184) | 1.5078<br>(0.1642)  |

*Notes:* Standard errors in parentheses. Time period: China 1978–2002; other countries 1960–2002. FM-OLS = Fully modified OLS; CCR = Canonical cointegrating regression; DOLS = Dynamic OLS. FM-OLS and CCR use Andrews' automatic bandwidth selection method in computing the long-run variance matrix. DOLS includes one lead and one lag of the first difference of the regressors in the augmented regression.

ticity of substitution ranging from 0.41 in Hong Kong to 0.65 in China. The Philippines, on the other hand, has a numerically small and statistically insignificant elasticity of substitution of 0.07, indicating little substitution in private and government consumption.

Indonesia and Thailand provide an interesting case of contrast. The estimated elasticity of substitution between private and government consumption is -0.92 for Indonesia and 1.51 for Thailand. Government consumption is a strong substitute to private consumption in Thailand, implying that a fiscal contraction that makes government goods relatively more expensive will induce substantial expansion in private consumption, thereby offsetting or even outweighing the negative impact of the fiscal contraction on aggregate demand. The Indonesian government consumption, in contrast, is a strong complement to private consumption, implying that a fiscal contraction that makes government goods relatively more expensive will generate a large negative income effect that outweighs the substitution

effect, leading to a concomitant contraction in private consumption expenditure that further depresses aggregate demand. These predictions about the two economies' reaction to fiscal austerity seem to be consistent with what have been observed during the 1997 Asian financial crisis.

What explains the cross-country diversity in the substitution between private and government consumption? In their international study, Evans and Karras (1996) find a statistically significant negative relationship between the share of government expenditure that goes to national defense and the degree of substitutability between private and government consumption. The idea is that the higher is the defense share, the higher is the public goods component in government consumption, which reduces its ability to substitute for private consumption. In table 2.5 we collect together for the nine East Asian countries their national defense expenditure shares, education expenditure shares, and estimated elasticities of substitution between private and government consumption. The entries are sorted by the substitution elasticities for ease of comparison. Apparently neither the education share nor the defense share can explain the empirical pattern of the substitution elasticities for all nine countries. However, the correlation between the defense shares and substitution elasticities is  $-0.24$ , confirming the empirical findings of Evans and Karras (1996). The strong complementarity between private and government consumption in Singapore seems to be testimonial to the Evans-Karras story, in view of the favorable international ratings of the Singaporean education system and other infrastructure, and the government's well-documented role in the country's economic success (e.g., Low 1998 and Krause, Tee, and Yuan 1987). The case of Indonesia may appear to be defiant of the Evans-Karras

**Table 2.5** Government expenditures and substitutability

|                      | Education<br>(% of<br>expenditure) (1) | Defense<br>(% of<br>expenditure) (2) | (1) + (2) | Elasticity of<br>substitution<br>(DOLS estimate) (4) |
|----------------------|--|--------------------------------------|-----------|--|
| Singapore            | 21.0                                   | 26.5                                 | 47.5      | -1.76  |
| Indonesia            | 9.8                                    | 6.6                                  | 16.4      | -0.92  |
| The Philippines      | 15.7                                   | 10.5                                 | 26.2      | 0.07   |
| Hong Kong            | 14.5                                   | 0.0                                  | 14.5      | 0.34   |
| Japan                | 6.2                                    | 4.4                                  | 10.6      | 0.41   |
| Korea                | 18.8                                   | 20.0                                 | 38.8      | 0.52   |
| China                | 2.4                                    | 16.3                                 | 18.7      | 0.65   |
| Thailand             | 21.3                                   | 15.6                                 | 36.9      | 1.51   |
| Malaysia             | 20.4                                   | 11.7                                 | 32.1      | 1.66   |
| Correlation with (4) | 0.07                                   | -0.24                                | -0.12     |  |

*Notes:* The reported expenditure figures are annual average of 1991–95.

*Source:* World Bank (2004) for countries other than Hong Kong. Hong Kong figures are compiled from the *Hong Kong Annual Digest of Statistics*, various years.

explanation: the expenditures on education and defense are only moderate and yet private and government consumption appear to be complements, according to the negative sign of the substitution elasticity. One potential explanation is the well-known fact that the Indonesian government heavily subsidizes the private sector, including fuel, electricity, fertilizer, and other basic goods, and these subsidies are complementary to other goods in the private-consumption bundle; see for example Hill (1996, 1999) and World Bank (2006). When the Indonesian government adjusts these subsidies in tandem with the overall government spending, this will generate the observed comovements of private and government consumption that gives rise to the estimated negative elasticity of substitution.

## 2.5 Conclusion

In this chapter we have estimated the degree of substitution between private and government consumption in nine East Asian countries. On average there is substantial substitutability between private and government consumption, implying there will be direct crowding out of private consumption by government consumption. Such direct crowding-out effect will reinforce the conventional interest rate and wealth effect crowding-out channels to make fiscal policy relatively ineffective in East Asia. We also find that the substitutability between private and government consumption varies among the Asian countries. Government and private consumption turn out to be complements in Indonesia and Singapore, but they are substitutes in other Asian countries with different degrees of substitutability. There is no obvious quantitative variable that can explain each country's empirical estimates, although the share of government expenditure that goes to education and national defense seems to be negatively correlated with substitutability. Future study on this issue will need a more careful examination of each country's institutional details—one will have to understand what sort of government services those public-consumption figures represent—before further conclusion can be drawn.

## References

- Aiyagari, Rao, Lawrence Christiano, and Martin Eichenbaum. 1992. The output, employment and interest effect of government consumption. *Journal of Monetary Economics* 30:73–86.
- Amano, Robert A., and Tony S. Wirjanto. 1997. Intratemporal substitution and government spending. *Review of Economics and Statistics* 79:605–9.
- . 1998. Government expenditures and the permanent-income model. *Review of Economic Dynamics* 1:719–30.
- Aschauer, David. 1985. Fiscal policy and aggregate demand. *American Economic Review* 75 (1): 117–27.

- Bailey, Martin J. 1971. *National income and the price level: A study in macroeconomic theory*. 2nd Edition. New York: McGraw-Hill.
- Barro, Robert J. 1981. Output effects of government purchases. *Journal of Political Economy* 89 (6): 1086–121.
- Baxter, M., and Robert G. King. 1993. Fiscal policy in general equilibrium. *American Economic Review* 83:343–50.
- Chiang, Min-Hsien, and Chihwa Kao. 2002. Nonstationary panel time series using NPT 1.3—A user guide. Center for Policy Research, Syracuse University.
- Chiu, Ru-Lin. 2001. The intratemporal substitution between government spending and private consumption: Empirical evidence from Taiwan. *Asian Economic Journal* 15 (3): 313–23.
- Devereux, Michael, Allen Head, and Beverly Lapham. 1996. Monopolistic competition, increasing returns, and the effects of government spending. *Journal of Money, Credit, and Banking* 28:233–54.
- Evans, Paul, and Georgios Karras. 1996. Private and government consumption with liquidity constraints. *Journal of International Money and Finance* 15 (2): 255–66.
- Fiorito, Riccardo, and Tryphon Kollintzas. 2004. Public goods, merit goods, and the relation between private and government consumption. *European Economic Review* 48:1367–98.
- Ganelli, Giovanni. 2003. Useful government spending, direct crowding-out and fiscal policy interdependence. *Journal of International Money and Finance* 22: 87–103.
- Hill, Hal. 1996. *The Indonesian economy*. Cambridge, UK: Cambridge University Press.
- . 1999. *The Indonesian economy in crisis: Causes, consequences and lessons*. Singapore: Institute of Southeast Asian Studies.
- Ho, Tsung-wu. 2001. The government spending and private consumption: A panel cointegration analysis. *International Review of Economics and Finance* 10: 95–108.
- Im, Kyung So, M. Hashem Pesaran, and Yongcheol Shin. 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115 (1): 53–74.
- Kao, Chihwa. 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics* 90 (1): 1–44.
- Kao, Chihwa, and Min-Hsien Chiang. 2000. On the estimation and inference of a cointegrated regression in panel data. *Advances in Econometrics* 15:179–222.
- Karras, Georgios. 1994. Government spending and private consumption: Some international evidence. *Journal of Money, Credit, and Banking* 26 (1): 9–22.
- Kormendi, Roger. 1983. Government debt, government spending, and private sector behavior. *American Economic Review* 73 (5): 994–1010.
- Krause, Lawrence, Koh Ai Tee, and Lee (Tsao) Yuan. 1987. *The Singapore economy reconsidered*. Singapore: Institute of Southeast Asian Studies.
- Low, Linda. 1998. *The political economy of a city-state: Government-made Singapore*. Singapore: Oxford University Press.
- Maddala, G. S., and S. Wu. 1999. A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics* 61: 631–52.
- McCoskey, S., and Chihwa Kao. 1998. A residual-based test of the null of cointegration in panel data. *Econometric Reviews* 17:57–84.
- Ng, Serena, and Pierre Perron. 1997. Estimation and inference in nearly unbalanced nearly cointegrated systems. *Journal of Econometrics* 79 (1): 53–81.
- Ni, Shawn. 1995. An empirical analysis on the substitutability between private consumption and government purchases. *Journal of Monetary Economics* 36: 593–605.

- Ogaki, Masao. 1992. Engle's law and cointegration. *Journal of Political Economy* 100 (5): 1027–46.
- Ogaki, Masao, and Joon Y. Park. 1997. A cointegration approach to estimating preference parameters. *Journal of Econometrics* 82 (1): 107–34.
- Ogaki, Masao, and Carmen M. Reinhart. 1998. Measuring intertemporal substitution: The role of durable goods. *Journal of Political Economy* 106 (5): 1078–98.
- Okubo, Masakatsu. 2003. Intratemporal substitution between private and government consumption: The case of Japan. *Economic Letters* 79:75–81.
- Park, Joon Y. 1992. Canonical cointegrating regression. *Econometrica* 60:119–43.
- Phillips, Peter C. B., and Bruce Hansen. 1990. Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies* 57:99–125.
- Stock, James, and Mark Watson. 1993. A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica* 61 (4): 783–820.
- World Bank. 1997. *World Development Report 1997—The state in a changing world*. New York: Oxford University Press.
- . 2004. *World development indicators 2004 CD-ROM*. Washington, DC: World Bank.
- . 2006. *Investing for growth and recovery: The World Bank brief for the consultative group on Indonesia*. Washington, DC: World Bank.

## Comment Kiyoshi Mitsui

In most macroeconomic models, evaluation of the effects of fiscal policies requires an understanding of the relationship between government spending and private consumption. This relationship crucially depends on whether private and government consumption are substitutes or complements (in an Edgeworth-Pareto sense). As Amano and Wirjanto (1998) show, when the intertemporal elasticity of substitution for consumption of the composite good is more (less) than the intratemporal elasticity of substitution between private and government consumption, the private and government consumption are Edgeworth-Pareto complements (substitutes). The issue of the intratemporal elasticity of substitution that this study deals with, therefore, has an important policy implication.

Before commenting on this study, I would like to place it in the context of the literature on this issue. The literature can be grouped into two strands from the standpoint of government behavior. In one strand of literature, it is assumed that government consumption is given exogenously. In the other, the government is assumed to behave optimally so that the level of government consumption is determined as the first-best solution.

Studies in the former strand of literature utilize the intertemporal first-order conditions (or Euler equations) of an optimal consumption model. It is often assumed that utility is a function of the effective consumption, which is the linear combination of private and government consumption.