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6 Fiscal Policies and International Financial Markets

Alan C. Stockman

6.1 Introduction

The development of international financial markets over the past several years (like the development of domestic markets in the United States) is proceeding at a record pace. Trade in foreign stocks has risen dramatically in the United States and other countries, as have trades in foreign corporate and government bonds; domestic corporations issue debt denominated in foreign currencies and sold on foreign markets. Trade in forward and futures markets has risen and the markets have proliferated. Futures markets on indexes of assets have been formed; options trade has skyrocketed. Finally, currency swaps (and interest rate swaps), which permit virtually any state-contingent arrangements, have become commonplace.

These developments raise many questions. What is the source of demand for these assets? Why have these markets developed now and not earlier? What new opportunities for corporations and individuals do these markets offer? This paper discusses one major issue raised by these developments: the impact of sophisticated international financial markets on the effects of government policy. Specifically, this paper concentrates on the international effects of fiscal policies. One important question the paper does *not* address is the nature of the transition from a world with less developed to one with more developed international financial markets. Instead, the paper compares two worlds: one with and one without sophisticated international asset markets.

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The paper employs several models to make this comparison; the conclusion that these markets affect the results does not depend on a specific model of fiscal policy.

International financial markets permit individuals to trade over time and across prospective states of the world. By borrowing or lending with their counterparts in other countries, individuals can, for example, try to eliminate fluctuations in consumption caused by seasonal or cyclical variations in domestic output. The extent of their success in this endeavor depends, in equilibrium, on the timing of similar output fluctuations in other countries. Intertemporal trade is one function of asset markets. In a world of uncertainty, they have a second function: asset markets permit individuals to hedge against unwanted risk. If domestic output is low in one state of the world and high in another, individuals can choose a portfolio of assets with a positive return in the former state and a negative return in the latter state. Future states of the world can be treated analogously to future periods of time. The extent to which domestic individuals can succeed in smoothing their consumption across states depends, in equilibrium, on the pattern of output across states in other countries.

Consider a world with two countries that are identical except for endowments. Country A receives an endowment of a perishable good X and country B receives a perishable good Y. Identical, infinite-lived, risk-adverse individuals inhabit these countries. Each has an instantaneous utility function $U(x) + U(y)$, where x and y are consumptions of goods X and Y. In a stationary equilibrium, country A exports to B half of its endowment of X and imports half of country B's endowment of Y. Now introduce a simple government policy: the government of the domestic country imposes a lump-sum tax on domestic residents and uses the proceeds to make lump-sum ("foreign aid") transfer payments to residents of the other country. The results of this policy, according to the method of comparative statics on the model's equilibrium, would be that wealth is redistributed. Domestic wealth falls and foreign wealth rises, so domestic consumption of each good falls and foreign consumption rises. Had this government policy been perfectly anticipated, the results would have been the same in the absence of international financial markets. The results would also be the same, in the absence of international financial markets, if individuals had been *uncertain* about future government policies. Because everyone in the domestic country is identical by assumption, it is impossible to sell on domestic markets the risk inherent in uncertainty about future policy.

Suppose that, in this example, there are international financial markets in noncontingent claims, that is, simple borrowing and lending are allowed. Uncertainty about future government policy in the domestic country will induce risk-averse, expected-utility-maximizing domestic individuals to self-insure by saving. Suppose the policy is imposed, randomly, in some periods and not in others. Individuals will consume less X and Y and save more in periods without the policy, that is, in periods when the government does not tax them to provide foreign aid. They will dissave in periods with the policy in order to mitigate its effects. Foreigners will consume more in periods without the policy, in anticipation of possible foreign-aid receipts in some future period, and save in periods with the foreign aid. The size of the change in consumption immediately following the imposition of the government policy is smaller in the presence of borrowing and lending because loan markets permit consumption smoothing. The magnitude of these changes in saving and consumption, and of any associated change in interest rates, depends on how expectations of future policy change over time (which in turn depends on the stochastic process governing the policy), the curvature of the utility function, and so forth. Clearly, some self-insurance possibilities are present because of international capital markets, though noncontingent claims are inferior to contingent claims for this purpose.

Complete contingent claims would eliminate the effect of the actual policy on consumption in this example. Because all individuals have the same information and agree upon the relevant probability distributions in this example, they will choose to trade in claims, prior to the realization of the policy, that "undo" the income transfer from any potential policy. Because only the domestic government may impose this policy, foreigners are wealthier than domestic residents and will consume more every period, regardless of whether the domestic government actually makes the transfers. Given the initial probabilities (at date 0) that the government will make transfers of particular sizes in various time periods, actual imposition of a transfer has no effects whatsoever. Introduction of complete international financial markets, therefore, has major implications regarding the effects of this policy.

The treatment of government policy as uncertain and exogenous deserves some comment. The assumption of exogeneity is inessential, though it corresponds to questions economists frequently ask, such as, "What would be the effects of a rise in taxes?" Government policy might well be the outcome of a political equilibrium with inputs such as lobbying, voting, and exogenous shifts in opportunities, which operate through political institutions that constrain bureaucrats, politicians, lobbyists, and voters. Generally, such a model will have elements of randomness attached to its inputs, so that resulting policies will be stochastic. Policy can then be treated as a stochastic process (that might be correlated with stochastic processes on other disturbances to the economy). Lucas (1976) and Cooley, LeRoy, and Raymon (1984a,b) have argued that the assumption of rational expectations requires the stochastic process on policy to be specified as part of the environment of constraints under which individuals maximize utility.[1] Lucas applied this argument to the investment tax credit and other policies; Cooley, LeRoy, and Raymon have applied the argument to policy on the growth rate of the money supply; Stockman and Dellas (1986) have applied it to tariffs; and Stockman and Hernandez (1987) have applied it to exchange controls. Rather than changing government policy in a way that individuals thought was impossible when they maximized utility, the economist is constrained to consider changes in policies that correspond to the probability distributions that are part of a fully specified economic environment that is known to individuals when they make their choices.[2]

Without international financial markets (and abstracting from differences across individuals within a country), the treatment of government policies as outcomes of a stochastic process has no effect on equilibrium allocations (though it may affect prices). Given the treatment of future government policy as part of the stochastic environment facing individuals when they make choices, the availability of international financial markets in state-contingent claims can have major effects on the results of policies.

When government policies are not simply redistributions, financial markets will not simply "undo" the policies. Generally, pure social gains and losses from policies will be shared among participants in financial markets. Distortions introduced by policies, however, cannot be eliminated by financial markets: the substitution effects of policies will continue to operate. In Stockman and Dellas (1986), for example, the effects of tariffs are examined in a world with complete international asset markets. In a two-country, two-good world with trade due to differing endowments, a small tariff raises consumption of the exportable good and improves welfare in the absence of financial markets. With these markets, however, a tariff reduces consumption: consumption of both goods is lower with a domestic tariff and no foreign tariff than with a foreign tariff and no domestic tariff. The existence of contingent assets, therefore, has a major impact on the positive implications of the theory. The results obtain from the ability of these assets to eliminate income effects of changes in policy (as individuals spread wealth optimally across prospective states of the world), leaving substitution effects in place. Rosen's (1985) survey of implicit contracts in labor economics makes a similar point about optimal contractual arrangements.

The following sections of this paper present these examples in which the effects of fixed policy in an open economy are altered by the existence of sophisticated international financial markets. Section 6.2 examines a change in government spending under the assumptions that this spending is productive and that nondistorting taxes are varied to maintain a balanced budget. Section 6.3 examines changes in distorting taxes holding fixed the government's budget deficit. Finally, section 6.4 examines changes in the budget deficit in an overlapping-generation model without Ricardian equivalence.

6.2 Government Spending and International Financial Markets

This section discusses the effects of increases in domestic government expenditures, financed by increases in lump-sum taxes on domestic residents, in a two-country world with complete contingent international asset markets, and contrasts the results with those in the absence of these markets.

Government spending can serve a variety of roles. The effects of fiscal policy differ depending upon the type of government expenditures analyzed. This section develops a simple illustrative model of the international effects of changes in productive government expenditure (e.g., on infrastructure). A key element of the model is that this productive expenditure does not affect all goods in the same way. The effects of a change in government spending are shown to depend on the availability of international asset markets.

Consider a two-country world in which the domestic country is endowed with a tradeable good X and the foreign country is endowed with a tradeable good Y. There is a representative, risk-averse, expected-utility-maximizing individual in each country who has instantaneous utility function $U(x) + V(y)$. Purchases or consumption of X require(s) a productive input to reduce "transactions costs" that use up real resources. They may include costs of shipping the good to its location of consumption, costs of consuming the good, or costs of household production such as preparation, and so forth. It is simplest to assume that X, besides being a consumption good, is a productive input into this "transactions" activity. X can be used privately by an individual to produce transactions services, or it can be used by the government to produce a public good that has a positive marginal product for transactions services. One might think of X as a system of roads and bridges, police and security services, courts to enforce criminal law, or other productive public goods. These public goods interact with private production of transactions services and lower private costs of a given volume of transactions. Let g be the level of government expenditure on these items (and neglect all other government spending). Individuals who wish to consume x_0 units of X must purchase $x_0\theta(g)$ units of X, where $\theta - 1 > 0$ of the goods are used for transactions services and the rest are consumed. The productivity of government expenditures motivates the conditions $\theta' < 0$ and $\theta'' > 0$.

The representative individual in the domestic country maximizes expected utility of consumption of X and Y in each state of the world z, $x(z)$, and $y(z)$, given the exogenous probability distribution $F(z)$ on states. So he maximizes

$$(1) \qquad \sum_{t=0}^{\infty} \beta^t \int U[x(z_t)] + V[y(z_t)]\, dF(z_t),$$

subject to the budget constraint,

$$(2) \qquad \sum_{t=0}^{\infty} \int p(z)\bar{X} - p(z)\theta(z)x(z) - q(z)y(z) - p(z)g\, dz_t,$$

where $\bar{X}$ is the (state-independent) endowment of good X, and $p(z_t)$ and $q(z_t)$ are domestic present-value state prices of X and Y at date t. For example, if z_{0t} is a possible value of z at date t, then $p(z_{0t})$ is the present-value (period zero) price of X in state z_0 at date t in the domestic country. The time subscripts on the functions inside the integral have been suppressed. This formulation permits complete markets within the country. In the absence of complete international financial markets, state prices may differ across countries. For simplicity, I abstract from all uncertainty except that which enters through future government policy. The state vector can be written as

$$(3) \qquad z = (g, g^*),$$

where g and g^* are the levels of government expenditure in the two countries. The public-good aspects of government spending do not extend outside national boundaries, by assumption, so θ depends only on g, and θ^* depends only on g^*; these functions will be written $\theta(g)$ and $\theta^*(g^*)$.

The representative individual in the foreign country has a similar maximization problem, though his utility function may be different and his budget constraint is different. He maximizes

$$(4) \qquad \sum_{t=0}^{\infty} \beta^t \int U^*[x^*(z_t)] + V^*[y^*(z_t)]\, dF(z_t),$$

subject to

$$(5) \qquad \sum_{t=0}^{\infty} \int q^*(z_t)\bar{Y} - p^*(z_t)\theta^*(z_t)x^*(z_t) - q^*(z_t)y^*(z_t) - p^*(z_t)g^*\, dz_t,$$

where asterisks denote foreign variables. While foreign and domestic state prices may differ in the absence of complete international financial markets, arbitrage in the goods market on a state-by-state basis guarantees that the relative price of X in terms of Y in each state is equal across countries, that is, $p(z)/q(z) = p^*(z)/q^*(z)$ for every z.

In the absence of international financial markets, equilibrium requires that in whatever state materializes, world supply and demand are equated for each good, that is,

$$\bar{X} = \theta(g)x + \theta^*(g^*)x^* + g + g^*, \quad (6)$$

$$\bar{Y} = y + y^*.$$

In addition, equilibrium in domestic asset markets (and similarly in foreign asset markets) requires that demands and supplies of state-contingent assets are equal. Because everyone is alike within a country, there are no net trades on these domestic asset markets. However, the equilibrium conditions can be used to price assets, that is, to find the prices at which individuals are satisfied with zero net trades. If asset prices differ across countries so that for some z, $p(z) \neq p^*(z)$ or $q(z) \neq q^*(z)$, then there are private gains from trade on international asset markets.

Necessary conditions for utility maximization in each country and equilibrium conditions in the goods markets give three equations, for each date t, in domestic consumption of each good and, with the normalization $q = 1$, the relative price p. These are (with time subscripts suppressed):

$$U'(x) = p\theta V'(y), \quad (7a)$$

$$U^{*\prime}[(\bar{X} - \theta x - g - g^*)/\theta^*] = p\theta^* V^{*\prime}\,(\bar{Y} - y), \quad (7b)$$

$$p\bar{X} = p\theta x + y + pg. \quad (7c)$$

Foreign allocations can then be determined from equilibrium conditions.

Using the last equation to eliminate the price, the system reduces to two equations in two unknowns. Comparative statics can be used to determine the effects of changes in government spending in either country. An increase in government spending may move the economy toward or away from the socially efficient level of spending. An increase in government spending in the domestic country raises domestic consumption of X by $|x\theta' dg|$ for any given gross domestic purchases of X; the cost is dg units of X. The socially optimal level of X is, therefore, implicitly given by $x\theta' = -1$. Similarly, the socially optimal level of foreign government spending is given implicitly by $x^*\theta^{*\prime} = -1$. The analysis of changes in government spending is simplified by consideration of changes in g or g^* around the socially optimal points.[3] The results of total differentiation[4] are then

$$dx = [1/\pi 1\pi 5 - \pi 2\pi 4)]\,(\pi 3\pi 5\, dg - \pi 2\pi 6\, dg^*), \quad (8a)$$

$$dy = [1/(\pi 1\pi 5 - \pi 2\pi 4)]\,(\pi 1\pi 6\, dg^* - \pi 3\pi 4\, dg), \quad (8b)$$

where

(9) $$\pi 1 \equiv (\bar{X} - \theta x - g)U''(x) - \theta U(x) < 0,$$
$$\pi 2 \equiv -y\theta V''(y) - \theta V'(y) \gtrless 0,$$
$$\pi 3 \equiv y\theta' V'(y) < 0,$$
$$\pi 4 \equiv -\theta(\bar{X} - \theta x - g)U^{*\prime\prime}(x^*)/\theta^* - \theta U^{*\prime}(x^*) \gtrless 0,$$
$$\pi 5 \equiv y\theta^* V^{*\prime\prime}(y^*) - \theta^* V^{*\prime}(y^*) < 0,$$
$$\pi 6 \equiv y\theta^{*\prime} V^{*\prime}(y^*) < 0.$$

The sign of $\pi 2$ depends on the elasticity of the domestic marginal utility of consumption of imports. If $r_y \equiv -yV''/V' = 1$, then $\pi 2 = 0$. In that case, a rise in domestic government expenditures unambiguously increases domestic consumption of exportables and reduces the foreign consumption of that good. Even with a separable utility function $(U + V)$, the increase in domestic government spending may affect domestic imports. For example, if r_y and $r_x^* \equiv -x^*U^{*\prime\prime}/U^{*\prime}$ are both equal to one, then $\pi 2 = 0$ but $\pi 4 > 0$, so a rise in domestic government spending increases domestic imports as well as consumption of exportables. For small enough r_x^*, imports will fall with an increase in government spending. A rise in foreign government spending leaves domestic consumption of exportables unchanged if $r_y = 1$, and increases or decreases x as r_y is greater than or less than 1. If r_y is close to 1, then an increase in foreign government spending unambiguously raises domestic imports. The effects of changes in government spending frequently depend on the curvature of the utility functions, even when the utility functions are separable. As I will show below, these ambiguities in the theory are removed once complete international financial markets are introduced.

With complete international financial markets, state prices are equated across countries and equilibrium conditions for assets help determine allocations in goods markets as well as asset prices. World supply of each good in each state (and time) must equal demand, so the previously stated equilibrium conditions must hold for each z (and t). The equilibrium conditions, together with the necessary conditions for utility maximization, imply that, for every z,

(10) $$V^{*\prime}[\bar{Y} - y(z)] = \phi V'[y(z)],$$

(11) $$U^{*\prime}\{[\bar{X} - x(z)\theta(g) - g - g^*]/\theta^*(g^*)\}$$
$$= \phi U'[x(z)]\, \theta^*(g^*)/\theta(g),$$

where ϕ is the ratio of the marginal utility of wealth of the representative foreign individual to the marginal utility of wealth of the representative domestic individual, i.e., the multiplier on equation (5) divided by the multiplier on equation (2).[5] Note that ϕ is a function of the probability distribution $F(z)$, but it does not depend on realized values of g or g^*. Equations (10) and (11) imply that, with complete international asset markets, consumption of y is independent of realizations of z. An econometrician examining time-series or cross-sectional data would see no response of y to observed changes in z. This contrasts with the ambiguous conclusions in the absence of any international asset markets.

To determine the relation between increases in government spending and allocations, the second equation can be totally differentiated (with ϕ held fixed). Letting $\gamma(z) = 1 + x(g)\theta'(g)$ and $\gamma^*(z) = 1 + x^*(z)\theta^{*\prime}(g^*)$, the result is:

$$(12) \quad (-U''\theta/\theta^* - U''\phi\theta^*\theta)\, dx(z) = (-\theta' U'\theta^* \phi/\theta^2 + \gamma U^{*\prime\prime}/\theta^*)dg + (U'\theta^{*\prime}\phi/\theta + \gamma^* U^{*\prime\prime}/\theta^*)\, dg^*.$$

The coefficient on $dx(z)$ is positive. At the socially optimal g and g^*, $\gamma = \gamma^* = 0$. In that case, small changes in g or g^* have no first-order effects on economic efficiency, the coefficient on dg is positive, and the coefficient on dg^* is negative. An increase in domestic government spending raises domestic consumption of exportables, while an increase in foreign government spending reduces it. Because these results are obtained in the neighborhood of the social optimum, changes in g and g^* have no income effects. Therefore, an increase in domestic government spending reduces foreign imports, while an increase in foreign government spending raises them.[6] These results on the effects of changes in productive government expenditure in the presence of sophisticated international financial markets contrast with the ambiguous effects obtained in their absence.

6.3. Distorting Taxes

Section 6.2 assumed that taxes were lump sum. This section examines the effects of changes in distorting taxes with and without sophisticated international financial markets. As in section 6.2, the results illustrate that any effects of policy that operate through redistribution of wealth are eliminated by complete international financial markets. This section applies that principle to a tax on consumption. The tax might take the form of value-added tax or an income tax with various effective deductions or credits for saving. This section uses a two-country model similar to the one in section 6.2, but simplified to include only two time periods (the extension to more is straightforward) and a single consumption good that is endowed to both countries. When the timing of endowments differs across countries, there is an obvious role for financial markets: borrowing and lending will facilitate intertemporal smoothing of consumption. Suppose that in the first period the home endowment is small and the foreign endowment is large and that this is reversed in the second period. Then the home country will borrow from the foreign country in the first period and repay its loans in the second period.

This section will examine the effects of a temporary increase in domestic consumption taxes in the first period under several assumptions about accompanying changes required by the government's budget constraint. In the absence of international financial markets other than those for simple, noncontingent loans, a tax increase has a substitution effect and an income effect. Starting from a situation of equal taxation in the two periods, a rise in first-period domestic taxes, with a lump-sum refund of the tax revenue, reduces the domestic demand for loans and lowers the interest rate at which the domestic country borrows. A small increase in taxes reduces first-period consumption and raises second-period consumption. These results are changed in the presence of complete international financial markets.

Assume the representative individual in the domestic country maximizes

$$E[U(c,\ 1 - L) + \beta U(c',\ 1 - L')], \tag{13}$$

where c and L are consumption and leisure, one unit of time is available each period, and primes denote second-period variables. For simplicity, it will be assumed that $U_{12} = 0$ (which does not affect the main results but reduces the algebra involved). Output, y, is a stochastic function of labor inputs: $y = \alpha L$, where α is a positive random variable. Similarly, second-period output is $y' = \alpha' L'$. The government taxes consumption at a rate τ. Define $T \equiv 1 + \tau$. Denote the present value of the state price of goods in state z by $p(z)$. Initially, assume that changes in government spending accompany changes in taxes and that such spending is neutral (it is useless or it affects utility in a separable way). Changes in g and tax revenue are equal. Then the budget constraint facing the representative domestic individual is:

$$\int \alpha L - Tc + p(\alpha' L' - T'c')\, dz = 0, \tag{14}$$

where

$$z \equiv (\alpha, \alpha^*, T, T^*, \alpha', \alpha^{*\prime}, T', T^{*\prime}) \tag{15}$$

indexes states of the world, with asterisks denoting foreign variables. Implicitly, c, L, c', L', and p are functions of z.

The foreign country has an analogous description that will not be repeated here. In the absence of state-contingent international assets, but with noncontingent international loan markets, the budget constraint can be simplified, reflecting the zero net trades on internal asset markets due to the representative agent assumption. The budget constraint with only noncontingent international loans is effectively

$$\alpha L - Tc + p(\alpha' L' - T'c') = 0, \tag{16}$$

where $p \equiv R^{-1}$ is the inverse of 1 plus the interest rate on default-free loans.

Equilibrium conditions are:

$$\alpha L + \alpha^* L^* = c + c^* + g + g^*, \tag{17a}$$

$$\alpha' L' + \alpha^{*\prime} L^{*\prime} = c' + c^{*\prime} + g' + g^{*\prime}. \tag{17b}$$

Together with the necessary conditions for utility maximization by individuals in each country who choose consumption and leisure in each period, this generates a set of equations with a solution that depends on the concavity of utility and the relative sizes of various exogenous terms. The main elements of the solution for this case (with only noncontingent international loans) can be illustrated by assuming that labor supplies are fixed at unity, so countries receive stochastic endowments, α and α^*. Then the model reduces to two equations in c and R:

$$U_1(c) = TR\beta E(U_1\{[\alpha' + R(\alpha - Tc)]/T'\}/T'), \tag{18}$$

$$U^*_1(\alpha + \alpha^* - g - g^* - c) = T^* R\beta E(U^*_1\{[\alpha^{*\prime} - R(\alpha - Tc)]/T^{*\prime}\}/T^{*\prime}). \tag{19}$$

Equation (18) follows from maximization of equation (13) subject to equation (16), and equation (19) follows from the analogous foreign maximization problem along with equation (17) and the balanced-budget assumption. Recall that government spending varies with tax revenue: $dg = cdT + (T - 1)dc$.

Consider a realization of α and α' for which $c + g < \alpha$ in equilibrium. This would happen if, for example, the countries are identical *ex ante,* if (α, α^*) and $(\alpha', \alpha^{*\prime})$ are independently drawn, $g = g^*$, and the realized value of α^* exceeds that of α. Then the domestic country is a net borrower in the first period. Differentiation of equations (18)–(19) shows that (as long as $c - \alpha$ is not too large) an increase in first-period domestic taxes reduces private consumption but has an indeterminate effect on aggregate demand and the interest rate because of the increase in government purchases. Second-period consumption,

$$c' = [\alpha' + R(\alpha - Tc)]/T', \tag{20}$$

is also indeterminate. It depends on the direction of the interest rate change and the magnitudes of the substitution and wealth effects.

The effects of a consumption tax are changed when individuals have access to complete international financial markets. Then the equilibrium conditions (17) must hold on a state-by-state basis. These conditions, and the necessary conditions for utility maximization in each country, imply

(21) $$U^*_1[\alpha L(z) + \alpha^* L^*(z) - g - g^* - c(z)]$$
$$= \phi U_1[c(z)]\, T^*/T,$$

(22) $$U_1[c(z)]/U_2[1 - L(z)] = T/\alpha,$$

(23) $$U^*_1[\alpha L(z) + \alpha^* L^*(z) - g - g^* - c(z)]/$$
$$U_2^*[1 - L^*(z)] = T^*/\alpha^*,$$

and

(24) $$\pi(z) U_1[c(z)]/p(z)T = \text{arbitrary constant}$$

for all z. In these equations, ϕ is the ratio of the foreign marginal utility of wealth to the domestic marginal utility of wealth (a ratio of multipliers on the wealth constraints), and the constant in equation (24) is arbitrary because one of the state prices can be normalized without loss of generality. The first three sets of equations (for each z), (21)–(23), determine production, trade, and consumption, and equation (24) then determines state prices. Another set of equations, identical in form to these, describes the solution for equilibrium in the second period.

Total differentiation of equations (21)–(24) yields the effects of a high realization of domestic taxes in the first period, compared to another state with a lower realization of domestic taxes. This comparison, across alternative realizations of taxes, requires that ϕ be held fixed, because ϕ is a function only of the probability distributions and other parameters of the model, not of subsequent realizations of random variables. Note that if L and L^* are fixed, so that the model is one with endowments, then equation (21) alone, along with the government budget constraint, determines the effect of a change in taxes on consumption. In that case, an increase in T lowers domestic consumption and may raise or lower foreign consumption depending on the magnitude of the substitution effect in the domestic country from the tax. The change in T, however, leaves second-period consumption *unaffected* in each country. This result contrasts with the implication of the model without state-contingent international asset markets.

With endogenous production, domestic and foreign output move in the same direction, regardless of whether output rises because of the increased demand by the government or falls because of the reduced demand by domestic individuals.[7] (This result is, however, sensitive to the assumption that utility is separable in goods and leisure.) Unlike the case in which international financial markets are limited to non-contingent bonds, a change in taxes and government spending in the first period leaves output in each country unaffected in the second period.

The assumption that government spending has no effect on marginal utilities of other goods is extreme. Kormendi (1983) and Aschauer

(1985) have estimated that roughly one-third of government consumption can be treated as if it were private consumption. It is straightforward to examine the implications of the model of government spending is a direct substitute for private spending. Consider the extreme case in which instantaneous utility depends on leisure and on $c + g$, the sum of private and government consumption. As long as g is below the level of consumption that would be chosen privately, this is equivalent to a lump-sum transfer to the public of the revenue obtained from the consumption tax. (Individuals effectively obtain this transfer by reducing private expenditure on the good as government expenditure rises.) Assume also that the countries are identical *ex ante*. In this case, an increase in first-period domestic taxes unambiguously reduces output in each country, reduces domestic consumption, and raises foreign consumption.[8] Intuitively, complete international capital markets eliminate the direct income effects of the policy but leave the substitution effect. Higher consumption taxes reduce domestic demand in the first period. If world output were unchanged, as in the endowment model, then consumption in the foreign country would unambiguously rise. Foreign individuals attempt to spread this gain to current leisure as well as to future consumption and leisure. Asset trades have previously guaranteed that any increase in consumption of goods or leisure, not due to a substitution effect, will be shared by foreign and domestic individuals. The net results are an increase in foreign consumption and decreases in output in each country associated with the fall in domestic consumption. In this case, an increase in government spending and taxes has a contractionary effect on output in each country, a contractionary effect on domestic consumption, and an expansionary effect on foreign consumption.

6.4 Budget Deficits without Debt Neutrality

In this section I build upon the work by Frenkel and Razin (1986) on the international transmission of budget deficits. Frenkel and Razin apply Blanchard's (1985) model of uncertain lifetimes to analyze the international implications of fiscal policies, and they demonstrate that, in the absence of Ricardian equivalence, government budget deficits may increase domestic aggregate demand but can be transmitted *negatively* to the rest of the world, decreasing foreign aggregate demand. This section takes the Frenkel-Razin model as a point of departure and introduces complete international financial markets, subject to the natural limitation that the unborn cannot trade in these markets. The results indicate that in the presence of these asset markets, the effects of deficits on the current account and other variables is very different than in their absence.

I follow the setup of Frenkel and Razin. There are two countries with representative individual consumers (in equal numbers) and two governments. A single good is endowed to these two countries, and the endowments follow an exogenous stochastic process. The description of the two countries is identical: each country is essentially described by Blanchard's model. Foreign variables are denoted with an asterisk. Individuals face a fixed probability of death in each period, regardless of age, denoted $(1 - \sigma)$, where σ is the survival probability. They contract with life insurance companies that collect an individual's assets and liabilities upon his death. Yaari (1965) discusses the equivalence between these companies and a set of annuity and bond markets. A transversality condition requires that the limit (as the length of life goes to infinity) of the present value of net assets is nonnegative, so an individual does not borrow an unrestricted amount in the expectation that the life insurance company will bail him out when he dies. Insurance companies are perfectly competitive and operate costlessly so that insurance premiums are proportional factors equal to the probability of death. Under these assumptions, and with α_t denoting the present value price of a good at date t, α_{t-1}/α_t is 1 plus the one-period interest rate at $t - 1$; σ^{t-1}/σ^t is 1 plus the life insurance premium at $t - 1$; and the gross interest rate (including the insurance premium) faced by an individual is $(\alpha_{t-1}\sigma^{t-1}/\alpha_t\sigma^t)^{-1}$. The discount factor is fixed at δ, and utility is time separable and instantaneously logarithmic; individuals maximize expected utility. Following Blanchard (1985), aggregate consumption is then

$$(25) \qquad C_t = (1 - \sigma\delta)\, W_t,$$

where W_t is aggregate wealth, which equals discounted disposable personal income (discounted with the gross interest rate) minus private debt. In general, in the Frenkel-Razin analysis, the probabilities of death, discount rates, and so forth may differ across countries. It will be convenient here, though, to focus on the simplest case in which all these parameters are equal across countries.

Governments in each country finance an exogenous stochastic process of spending, which has no effect on production or any marginal rates of substitution or marginal utilities, with either taxes or debt. The government, which lives forever, discounts at a rate that does not incorporate an insurance premium. The present value of spending plus initial government debt equals the present value of taxes.

The equilibrium condition in the world goods market at $t = 0$ is

$$(26) \qquad (1 - \alpha\sigma)\, W_0 + (1 - \alpha^*\sigma^*)\, W_0^* + g_0 + g_0^* = y_0 + y_0^*.$$

Domestic and foreign wealth at date zero are, in the Frenkel-Razin model,

(27) $$W_0 = y_0 - \tau_0 + PV_0\,(y - \tau) + B_{g0} - B_0,$$

(28) $$W_0 = y_0^* - \tau_0^* + PV_0(y^* - \tau^*) + B_{g0}^* + B_0,$$

where $PV_0\,(x)$ denotes the present value at date 0 of subsequent values of x, using the gross private discount factor, B_g is government debt at date 0 (so that future tax liabilities and government debt are both included in wealth), and B_0 is net indebtedness at $t = 0$ of the domestic consumers to foreign consumers. To keep matters as simple as possible, assume that this initial private indebtedness is zero, that government debt is equal in each country, that current government spending is equal in each country, and that the probability distribution of future government spending is the same in the two countries.

Following Frenkel and Razin, dates after $t = 0$ are assumed to have, with probability 1, some constant levels of government spending, taxes, and outputs (which, while they are constant for $t = 1, 2, 3, \ldots$, may differ from the values at $t = 0$). Then the present value function is $PV_0(x) = x_1\sigma R/(1 - \sigma R)$, where x is the future ($t = 1, 2, \ldots$) value of x and R is an average present-value price. Equations (26)–(28) then determine R and wealth in each country for given values in each country of government spending, initial government debt, taxes, output, and initial private indebtedness.

Now consider a tax cut financed by increased government borrowing in the domestic country at $t = 0$. Assume that the foreign government has a balanced budget and that the domestic government budget was balanced prior to the tax cut. The government budget constraint implies that $d\tau_0 + Rd\tau_1/(1 - R) = 0$, because taxes are raised in all future periods (equally) to offset the current tax cut. Using this fact, differentiation of equations (26)–(28) implies that the tax cut reduces R, that is, raises the interest rate, raises domestic wealth, and lowers foreign wealth (see Frenkel and Razin 1986).

Consider now an extension of this analysis to incorporate complete international financial markets. The results above apply to a world in which individuals can trade on annuity markets with other residents of the same country (recall that the "insurance companies" are essentially annuity and bond markets), but they are unable to trade in contingent *international* financial markets.[9] In particular, suppose that it is possible to trade assets whose returns are contingent on the level of domestic taxes, and other assets whose returns are contingent on foreign taxes. Then the risk of tax changes in either country can be shared internationally. Generations who are not yet born are unable to trade on these markets. In the absence of state-contingent international financial markets, domestic wealth (of currently living individuals) rises and foreign wealth falls from a cut in domestic taxes, while the reverse results from a cut in foreign taxes. In either case, the wealth of the unborn in the country with the tax cut also falls. Starting from this situation, domestic and foreign individuals can agree on mutually beneficial exchanges in which domestic individuals make payments if there is a cut in domestic taxes and receive payments if there is a cut in foreign taxes. For simplicity, assume that the probability distributions of future taxes are identical in the two countries. Because it is also assumed that tastes, horizons, government spending, and wealth are the same in the two countries, this makes the two countries symmetric *ex ante,* and these payments will equal exactly half of the tax cuts. Similarly, individuals in each country gain expected utility from sharing the risk of the subsequent tax increases associated with a current tax cut. With the symmetry assumptions, all individuals, regardless of nationality, will share in the higher future domestic taxes associated with a tax cut; this occurs through liabilities that will be exchanged prior to the realization of policy. Domestic and foreign individuals can share the risks by exchanging obligations so that half of any tax cut (or increase) gets paid to (by) individuals in the other country (who, like domestic individuals, are liable for taxes for each year they are alive, but only those years).

Given these financial trades that result in asset market equilibrium, a tax cut in either country increases wealth of currently living individuals in both countries. Their wealth can be expressed as

$$W_0 = W_0^* = y_0 - (\tau_0 + \tau_0^*)/2 + PV_0[y - (\tau + \tau^*)/2] + B_{g0}, \tag{29}$$

where $y = y^*$ in each period and $B_{g0} = B_{g0}^*$. All individuals currently alive gain equally from a domestic tax cut. With the symmetry assumptions, the tax cut has no effect on the current account, though the interest rate rises due to the increase in aggregate demand. The rise in the interest rate reduces the quantity demanded to the level of the fixed supply of goods and, in equilibrium, the current consumption of each individual is unaffected.

The currently unborn in the domestic country suffer a fall in wealth from a domestic tax cut at date zero. The loss cannot be shared with the currently unborn in the foreign country because none can participate in financial markets. The increased debt sold by the domestic government at date zero, when it cut taxes, was purchased in equal amounts by both foreign and domestic individuals. Therefore, the increased domestic government debt is distributed throughout the world. As currently living individuals age and die, they sell debt to new generations. As older individuals sell debt to younger ones, the life-cycle path of consumption is tilted: the young consume less and the old consume more. This tilting is permanent and raises the real interest rate. The higher real interest rate, in turn, lowers the present value of future labor income and tends to reduce wealth. On the other hand, the additional government debt enters positively into wealth. Domestic individuals who were born after the tax cut differ from foreign individuals born after the tax cut in one respect: the former must pay the higher domestic taxes. Consequently, whether foreign wealth rises or falls in the new steady state, domestic wealth is smaller than foreign wealth. Essentially, world wealth includes government bonds but does not include the full present value of the taxes associated with those bonds. This, alone, raises world wealth. But although the bonds are held by foreign as well as domestic individuals, only the latter pay the higher taxes in the future. Therefore, at the original interest rate, foreign wealth rises and domestic wealth may rise or fall. The tilting of consumption as the additional debt is passed across generations raises the interest rate and lowers the present value of any given income stream, so the higher interest rate reduces wealth in each country. Combining these two effects, a domestic tax cut has an indeterminate effect on steady-state wealth in each country, though foreign wealth rises by more (or falls by less) than domestic wealth.

The international impact of a domestic tax cut in the short run and during the transition to a new steady state is markedly different in the presence of complete international financial markets, though the steady-state effects are not altered in kind. Although this example has assumed complete markets, one may expect that similar results apply to a world in which asset markets are more limited but still offer some opportunities for state-contingent trade. The presence of money and nominal bonds, for example, would introduce an asset with a state-contingent real return.

6.5 Conclusions

This paper has presented examples of changes in the international effects of fiscal policies that can result from the existence of sophisticated international financial markets. The examples have assumed complete markets. In many historical circumstances, it would be unrealistic to assume that these markets were available to individuals either directly or indirectly through multinational corporations or financial intermediaries. However, the rapid development of these markets makes it useful to examine their effects. The proper model for any empirical application would depend upon whether those markets are available in that time period or set of countries. The complete markets framework is a useful benchmark case. While the assumption of complete markets is unrealistic, so is the more common assumption that there are no markets for contingent claims. For many purposes, it is not clear that economists should have much confidence in the implications of theoretical models, or interpretations of economic statistics, that ignore these markets.

International financial markets remove some of the ambiguities associated with opposing income and substitution effects, lead to models with stronger predictions, and in some cases reverse the effects of policies. These markets also tend to eliminate intrinsic dynamics that would otherwise occur through asset accumulation. (Dynamics could still be extrinsic or occur through other channels.) This is probably desirable, given that variations in real exchange rates exhibit very little dynamics and, instead, seem to be associated with "news."

The examples in this paper have treated policy as exogenous. A model that explains why particular economic policies are chosen by the political process could be incorporated into the examples. Because gainers and losers from economic policies are affected by financial markets, the model of policy formulation will also be affected.

There are many other fiscal policies, besides those examined above, whose effects would be altered by the ability of households to trade in financial markets. Personal and corporate income taxes, with provisions for miscellaneous deductions, credits, and exclusions, may have very different effects in the presence of financial markets than without them. The effects of increased uncertainty about future taxes—overall levels, the cross-sectional distribution of taxes, and the timing of taxation—will be affected by the ability of individuals to use financial markets to hedge this risk. The issue of changes in uncertainty raises an important question: Which variations in government policy can be hedged by financial markets and which cannot? With rational expectations and complete markets, individuals could hedge against *all* changes in future policies—including changes in "policy regimes." Which, if any, changes in policy (or "rules" or "regimes") are individuals *un*able to insure against? For example, could a decision maker in government choose to make policy decisions diverge systematically from the probability distribution governing these policies that is implicit in financial markets? Or would these implicit probability distributions always incorporate the possibility that the decision maker would attempt to make decisions in this way? These are not academic, metaphysical issues, but substantive questions that are directly related to the effects of fiscal (and other) policies in the presence of contingent international financial markets.

Notes

1. I do not want to take a stand on whether Cooley, LeRoy, and Raymon are expanding on Lucas's point or are, as they believe, in disagreement with some of what Lucas says.

2. This does not imply that individuals have perfect knowledge of all parameters in the model. It does imply, though, that individuals "know that they don't know" certain things.

3. Given foreign consumption of X and foreign government spending, domestic consumption is maximized by g such that $x\theta' =$ minus 1. Andrew Abel has correctly pointed out in his comments to this paper that while the world social optimum is characterized by $x\theta' = x^*\theta^{*\prime} =$ minus 1, this may not be the optimum for either country individually. Changes in g or g^* around some other value that might describe the equilibrium of a policy game between the two countries involve additional ambiguities in the results. The additional terms reflect changes in the distortion caused by not having government spending at the optimal level for the world.

4. Substitution of equation (7c) into equations (7a) and (7b) gives:

$$(\bar{X} - \theta x - g)\, U'(x) = \theta V'(y) y,$$

$$(\bar{X} - \theta x - g)\, U^{*\prime}\,[(\bar{X} - \theta x - g - g^*)/\theta^*] = y\, \theta^* V^{*\prime}(\bar{Y} - y).$$

Recall that $\theta = \theta(g)$ and $\theta^* = \theta^*(g^*)$. Total differentiation gives:

$$\begin{bmatrix} (\bar{X} - \theta x - g)U'' - \theta U' & -\theta(yV'' + V') \\ (\bar{X} - \theta x - g)\dfrac{\theta}{\theta^*} V^{*\prime\prime} - \theta U^* & -\theta^*(V^{*\prime} - yV^{*\prime\prime}) \end{bmatrix} \begin{bmatrix} dx \\ dy \end{bmatrix}$$

$$= \begin{bmatrix} \theta' y V' + (x\theta' + 1)V' & 0 \\ (x\theta' + 1)V^{*\prime} + (\bar{X} - \theta x - g)\dfrac{x\theta' + 1}{\theta^*} V^{*\prime\prime} & y\theta^* V^{*\prime} + \dfrac{V^{*\prime\prime}}{\theta^*}(\bar{X} - \theta x - g)(1 + \theta^{*\prime} x^*) \end{bmatrix} \begin{bmatrix} dg \\ dg^* \end{bmatrix},$$

which reduces to equations (8) and (9) if $x\theta' = X^*\theta^{*\prime} = 1$.

5. Letting λ and λ^* be the domestic and foreign marginal utilities of wealth, necessary conditions for maximization of equation (1) subject to equation (2) include, for every z and t,

$$\beta^t U'[x(z)] = \lambda\, p(z)\, \theta(g),$$
$$\beta^t V'[y(z)] = \lambda\, q(z).$$

Similarly, the foreign maximization problem yields necessary conditions

$$\beta^t U^{*\prime}[x^*(z)] = \lambda^*\, p^*(z)\, \theta^*(g^*),$$
$$\beta^t V^{*\prime}[y^*(z)] = \lambda^*\, q^*(z).$$

Dividing these equations, noting that state prices are equated internationally so $p(z) = p^*(z)$ and $q(z) = q^*(z)$, and using equilibrium conditions to eliminate $x^*(z)$ and $y^*(z)$, yields equations (10) and (11), where $\phi \equiv \lambda^*/\lambda$.

6. If $\gamma \neq 0$ then the coefficient on dg includes an additional term. This term is negative if $\gamma > 0$, reflecting an inefficiently large g, or positive if $\gamma < 0$, reflecting a suboptimal g. A change in g away from the social optimum increases the magnitude of the inefficiency and lowers consumption of X in both countries. Similarly, a change in g toward the optimum reduces the inefficiency and raises consumption of X in both countries. This is evident from the fact that

the coefficients on dg and dg^* in equation (12) have terms involving γ or γ^* with signs opposite to those of γ and γ^*. These results illustrate that any income effects from efficiency gains or losses are shared internationally.

7. This result follows directly from equations (21)–(23), which imply that

$$\phi U_2(1 - L)/\alpha = U_2^*(1 - L^*)/\alpha^*.$$

Given α and α^* (and ϕ), L and L^* move together.

8. Modifying the model so that utility depends on $c + g$, necessary conditions for utility maximization, equilibrium conditions, and government budget constraints $g = (T - 1)c$ and $g^* = (T^* - 1)c^*$ imply, in the case with (*ex ante*) identical countries.

$$\alpha U_{11}(Tdc + cdT) = -TU_{22}dL + U_2 dT,$$
$$\alpha U_{11}(Tdc^* + cdT^*) = -TU_{22}dL^* + U_2 dT^*,$$
$$\alpha(dL + dL^*) = T(dc + dc^*) + c(dT + dT^*),$$
$$T^* U_{11}(Tdc + cdT) + U_1 dT^* = TU_{11}(Tdc^* + cdT^*) + U_1 dT.$$

Using the first two equations to eliminate dc and dc^* and solving for dL and dL^* gives

$$\frac{dL}{dT} = \frac{dL^*}{dT} = \frac{U_2}{2\alpha^2 U_{11} + 2TU_{22}} < 0,$$

$$\frac{dc}{dT} = \left[\frac{U_2}{\alpha T U_{11}}\right]\left[\frac{2\alpha^2 U_{11} + TU_{22}}{2\alpha^2 U_{11} + 2TU_{22}}\right] - \frac{c}{T} < 0,$$

$$\frac{dc^*}{dT} = \left[\frac{-U_2}{\alpha U_{11}}\right]\frac{U_{22}}{2\alpha^2 U_{11} + 2TU_{22}} > 0.$$

9. An alternative story consistent with the previous analysis is that individuals do not have rational expectations about possible changes in policy, instead attributing zero probability to a tax cut.

References

Aschauer, David. 1985. Fiscal policy and aggregate demand. *American Economic Review,* 75 no. 1 (March): 117–27.

Blanchard, Olivier. 1985. Debt, deficits, and finite horizons. *Journal of Political Economy* 93, no. 21 (April): 223–51.

Cooley, Thomas F., Stephen Leroy, and Neil Raymon. 1984a. Econometric policy evaluation: Note. *American Economic Review,* 74 no. 3:467–70.

———. 1984b. Modeling policy interventions. University of California, Santa Barbara. Mimeo.

Frenkel, Jacob A., and Assaf Razin. 1986. Fiscal policies in the world economy. *Journal of Political Economy* 94, no. 3 (June). 564–94.

Kormendi, Roger. 1983. Government debt, government spending, and private sector behavior. *American Economic Review,* 73, no. 5 (December): 994–1010.

Lucas, Robert E. 1976. Econometric policy evaluation: A critique. In *The Phillips curve and labor markets,* ed. K. Brunner and A. H. Meltzer. Carnegie-Rochester Conference Series on Public Policy, a supplement to the *Journal of Monetary Economics,* vol. 1: 19–46.

Rosen, Sherwin. 1985. Implicit contracts: A survey. *Journal of Economic Literature,* (September): 1144–76.
Stockman, Alan C., and Harris Dellas. 1986. Asset markets, tariffs, and political risk. *Journal of International Economics* 21, no. 3–4 (November): 199–214.
Stockman, Alan C., and Alejandro Hernandez D. 1987. Exchange controls, capital controls, and international financial markets. *American Economic Review* (forthcoming).
Yaari, Menahem E., 1965, Uncertain lifetime, life insurance, and the theory of the consumer. *Review of Economic Studies* 32 (April): 137–50.

Comment Andrew B. Abel

Alan Stockman's paper presents a few simple models to illustrate the important insight that the effects of fiscal policy depend very much on the nature of international financial markets. This general and powerful insight has a long tradition in the international economics literature based on the Mundell-Fleming model and the scores of papers which have extended and refined the original analysis of fiscal policy under fixed and flexible exchange rates. Stockman's paper differs from this tradition both in its mode of analysis and in the economic phenomena on which it focuses. Stockman analyzes the aggregate effects of tax policy in a rational expectations model with maximizing consumers and flexible prices. Rather than focusing on the implications of alternative exchange rate regimes, he focuses on the implications of the degree to which tax liability risk can be diversified internationally.

Fiscal Policy in the Absence of International Insurance

Stockman presents three models in his paper to demonstrate that his general conclusions are robust with respect to various changes in the model. My discussion will focus only on the first of the three models. Furthermore, to make the discussion simple, I will analyze a very special case of this model. Since the intertemporal aspects of the model do not drive the results, I will dispense with them and analyze a one-period world economy. The representative domestic consumer has the utility function

$$\ln x(z) + \ln y(z), \tag{1}$$

where $x(z)$ is the domestic consumption of the domestic endowment good (say good X) in state z and $y(z)$ is the domestic consumption of the foreign endowment good (say good Y) in state z. In order to consume

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one unit of good X, a domestic consumer must purchase θ units of good X; a foreign consumer must purchase θ^* units of good X to consume one unit of this good.

The domestic government purchases $g \geq 0$ units of good X, and the foreign government purchases $g^* \geq 0$ units of good X. Each government finances its purchases by lump-sum taxes on its own residents. Government purchases are useful in allowing consumers to transform expenditure on good X into consumption of good X. In particular, $\theta = \theta(g)$, $\theta' < 0$, $\theta'' > 0$, and $\theta^* = \theta^*(g^*)$, $\theta^{*\prime} < 0$, $\theta^{*\prime\prime} > 0$. Stockman's major conclusion continues to hold if θ and θ^* are invariant to g and g^*, respectively, but I retain his assumption that government spending is useful in order to comment on Stockman's presentation of the socially optimal fiscal policy.

Let $p(z)$ be the domestic country's terms of trade in state z. More precisely, $p(z)$ is the price of good X in terms of good Y. Finally, let $\bar{X}$ and $\bar{Y}$ be the endowments of the representative domestic and foreign consumers, respectively.

The assumption of logarithmic utility implies that domestic consumers will allocate their disposable income $p(z)(\bar{X} - g)$ to equate the expenditure on good X, $p(z)\theta(g)x(z)$, to the expenditure on good Y, $y(z)$. Therefore,

$$x(z) = (\bar{X} - g)/(2\theta), \tag{2}$$

$$y(z) = p(z)\theta(g)x(z). \tag{3}$$

Since the residents of each country equate the expenditure on good X and the expenditure on good Y, it must be the case that worldwide private expenditure on X, $p(z)(\bar{X} - g - g^*)$ is equal to worldwide private expenditure on Y, $\bar{Y}$. Therefore, we obtain

$$p(z) = \bar{Y}/(\bar{X} - g - g^*). \tag{4}$$

Substituting equation (4) into equation (3), and the resulting equation into equation (2), yields

$$y(z) = (\bar{Y}/2)[1 + g^*/(\bar{X} - g - g^*)]. \tag{5}$$

Now consider an increase in g. Domestic (real) private expenditure on good X, θx, falls in response to the increase in g. In addition, the terms of trade improves ($p(z)$ increases), and, if $g^* > 0$, domestic consumption of good Y increases.

Fiscal Policy in the Presence of International Insurance

Now we consider a world economy with well-developed international financial markets. In this one-period world, there is no scope for international borrowing or lending. The only scope for international financial transactions is the international diversification of fiscal policy risk. A representative domestic consumer will choose state-contingent consumptions $x(z)$ and $y(z)$ to maximize expected utility. The associated Lagrangian is:

$$(6)\quad L = E\{\ln x(z) + \ln y(z) - \mu\,[p(z)\theta(g)x(z) + y(z) - p(z)(\bar{X} - g)]\}.$$

The first-order conditions can be written as

$$(7)\quad p(z)\theta(g)x(z) = \mu^{-1} = y(z).$$

Recalling the budget constraint $E\{p(z)\theta(g)x(z) + y(z)\} = E\{p(z)(\bar{X} - g)\}$, we can use equation (7) to obtain

$$(8)\quad \mu^{-1} = E\{p(z)(\bar{X} - g)\}/2.$$

The terms of trade are the same as in equation (4) so that using equations (4), (7), and (8) we obtain

$$(9)\quad x(z) = E\{1 + g^{*}/(\bar{X} - g - g^{*})\}\,(\bar{X} - g - g^{*})/2\theta,$$

$$(10)\quad y(z) = E\{1 + g^{*}/(\bar{X} - g - g^{*})\}\,\bar{Y}/2.$$

Now consider a large realization of g. As in the absence of international financial markets, real private domestic expenditure on good X, θx, is reduced by an increase in g. However, contrary to the result in the absence of international financial markets, the domestic consumption of good Y is invariant to the realization of g. This example illustrates Stockman's main point. More generally, Stockman's result may be described as follows: International financial markets permit risk sharing of country-specific risks. If (a) the marginal utility of good Y is independent of the consumption of good X, (b) fiscal policy does not drive a wedge between the domestic and foreign prices of good Y, and (c) fiscal policy does not affect the supply of good Y available to the worldwide private sector, then optimal risk sharing implies that domestic and foreign consumption of good Y are each invariant to the realization of fiscal policy.

Regime Changes

Although the fundamental logic of Stockman's result is sound, one might argue with his interpretation of fiscal policy. In Stockman's model, the observed time series of fiscal policy is a sequence of realizations of an exogenous stochastic process. In this view the "policymaker" is extremely ineffectual. Even if we were to untie the policymaker's hands and let him choose the realization of g, his freedom of choice is still limited in the long run. If we are to plausibly maintain the assumption of rational expectations, then the frequency distribution of his choices for g must match the *ex ante* distribution specified in the consumer's maximization problem.

An alternative analysis of fiscal policy using Stockman's model would begin by defining a regime as a stochastic process for g and g^*. A policy regime change would be a change in the stochastic process governing g and g^*. Of course, this merely shifts the problem back one step in a way that I will elaborate below. First, however, I will briefly discuss the effects of a regime change. A change in the stochastic process for g and g^* changes the marginal utility of income. The effects on domestic consumption would appear in equations (9) and (10) by changing $E\{1 + g^*/(\bar{X} - g - g^*)\}$. As an example, suppose that the density function of g depends on the parameter α. In particular, let the density function be written as $f(g - \alpha)$, so that α is simply a location parameter; an increase in α shifts the density function of g to the right by an equal amount. With this specification, an increase in α increases the mean value of g and, since it increases the value of $E\{1 + g^*/(\bar{X} - g - g^*)\}$, it also raises domestic consumption of good Y. This result is qualitatively the same as in the absence of international financial markets, despite the availability of insurance against the realization of fiscal policy. The obvious counterpoint to this is, of course, that if international capital markets provided insurance against regime changes (i.e., changes in α) as well as against realizations under a particular regime, then the international pattern of consumption of good Y would be invariant to fiscal policy. This example underscores Stockman's concluding observation that the effectiveness of fiscal policy depends on the degree of availability of insurance against various changes in policy and/or policy regimes.

A Counterexample

Although the analysis of a regime change in the preceding section seems to illustrate Stockman's main point, it can also be used to construct a counterexample to Stockman's finding that under complete insurance, "[a]n econometrician examining time-series or cross-sectional data would see no response of y to observed changes in z." Consider an economy inhabited by a sequence of one-period-lived cohorts. Each period is described by the model above. In period t, the density functions of g_t and g^*_t are given by $f(g_t - \alpha_t)$ and $f^*(g^*_t - \alpha^*_t)$. The location parameters α_t and α^*_t are deterministic but time varying. Thus, the distributions of g_t and g^*_t change deterministically over time, and the movements in this distribution (i.e., the policy regime changes) are not insurable. If there are international financial markets to share fiscal risk, then, as shown above, periods with a high value of α_t will be periods with a high value of domestic consumption of good Y. In addition, periods with a high value of α_t will on average have high values of g_t so that the covariance of g_t and y_t will be positive rather zero, even though there are perfect international insurance markets.

Optimal Domestic Fiscal Policy

My comments above concern the effects of international risk-sharing on the efficacy of fiscal policy and address the main point of Stockman's paper. I would also like to discuss the question of the optimal level of g in the absence of international financial markets. Stockman states that the socially optimal level of domestic fiscal policy satisfies $x\theta' = -1$. When this condition is satisfied, a one unit increase in g reduces worldwide private expenditure on good X but raises domestic consumption of good X by one unit, for a given level of domestic expenditure on good X, thereby leaving worldwide private consumption of X unchanged. While this condition characterizes the worldwide social optimum, it does not characterize the level of domestic fiscal policy which maximizes domestic welfare. The reason that the domestic welfare-maximizing level of g differs from the level which maximizes worldwide welfare is that an increase in g improves the domestic economy's terms of trade. Substituting equations (2) and (5) into the utility function (1), differentiating with respect to g (assuming that g^* is sufficiently small so that the second-order conditions are satisfied), and using the goods market equilibrium condition $\theta x + \theta^* x^* + g + g^* = \bar{X}$, we obtain the following characterization of optimal domestic fiscal policy from the point of view of the domestic economy:

$$\theta' x = -\theta^* x^* / (\theta x + \theta^* x^*). \tag{11}$$

As the share of the domestic economy in the world economy approaches zero, the right-hand side of equation (11) approaches -1, and hence the characterization of domestically optimal fiscal policy in equation (11) approaches the characterization of socially optimal fiscal policy given by Stockman. To the extent that one would argue that political forces might lead to optimal fiscal policy, the domestically optimal policy described in equation (11) would appear to be the outcome rather than the policy described by Stockman.

Comment Patrick J. Kehoe

The purpose of Stockman's paper is twofold: First, it promotes a type of stochastic comparative statics (SCS) as an alternative to standard

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deterministic comparative statics (DCS). Second, it shows how the degree of completeness of markets, here international financial markets, may be crucial for the SCS results. Stockman accomplishes this through a series of examples that clearly illustrate his points, and I have nothing to add to them. Instead I will expand on his two main themes.

Comparative Statics: Deterministic Versus Stochastic

When we study a dynamic economy, we are often concerned with how the economy will respond to various types of shocks. We would like to perform experiments in which these shocks can be interpreted as taking place in a single economy in real time, that is, calendar time. I argue that there is no logically consistent way to carry out such experiments in a deterministic setting. However, in a stochastic setting such experiments are straightforward.

In a deterministic setting, shocks are classified as either "unanticipated" or "anticipated." With unanticipated shocks we consider an economy in which agents are assumed to know the future with certainty and then we ask what happens if some event unexpectedly occurs. This question is ill-posed, since we solve for an equilibrium conditional on certain assumptions which we then violate in our thought experiment. This makes our experiment internally inconsistent and, hence, nonsensical.

A simple example should make this clear. Consider a world in which Stockman knows that his house will never burn down. Now suppose that it does. What happens? This question is ill-posed because if Stockman knew his house could burn down, he would have had enough sense to have already bought some insurance—or at least a fire extinguisher.

More generally, the logical problem is the following. We start by assuming there is, using Arrow's terminology, a single possible state of the world. Part of this state includes Stockman's house sitting there in fine condition. Given this state we define the natural commodity space and we define preferences over this space. We can then compute equilibrium allocations and welfare for this economy. However, serious problems arise if we attempt to evaluate equilibrium allocations and welfare in some "unexpected" state of the world in which Stockman's house has burned down. Since these allocations are not contained in our original commodity space and our preference order is not even defined over such a point, I have no idea what the word *welfare* means in this context.

In order to avoid a possible misunderstanding, I should expand on one small point. If we simply ignore these logical difficulties and interpret such experiments as if they were conducted in a truly stochastic world, then there are special cases in which we may get the "right" answer. In particular, if in the stochastic world either there is no possibility for sharing risk—because of the market structure or the physical environment—or there is no value in sharing risk—because agents are risk neutral—then we will get the right answer in the analogue deterministic environment in the sense that we will obtain the same numerical values for the consumption allocations either way.

An example of such a stochastic environment is a representative agent Lucas-tree economy, that is, a pure exchange economy populated by agents who have identical preferences and who, for every possible realization of uncertainty, have identical endowments. In such a model, no matter how we conduct our experiments, and no matter what we assume about markets, the equilibrium will always be "don't trade and eat your own fruit." This may be a useful model for studying asset prices, but it is not very useful for studying trade. As soon as we add a little heterogeneity to this environment—either in preferences or in endowments—how we conduct our thought experiments and what we assume about market structure become crucial. (For an analysis of how such experiments work in a Lucas model with heterogenous agents, see Backus and Kehoe [1987].)

Finally, some may attempt to salvage DCS experiments as reasonable approximations to SCS experiments in which the shocks under consideration occur "rarely." However, they cannot be salvaged. For example, an SCS experiment in an economy where there is a small positive probability of a house burning down will typically be vastly different from a DCS experiment in an economy where there is a zero probability of a house burning down.

With the other type of deterministic shocks—the anticipated shocks—we consider two distinct settings for some economically exogenous variable. For each setting, we solve for a separate perfect foresight equilibrium and then compare the endogenous variables, prices, and allocations across the equilibria. From this description it is clear that these comparisons cannot be interpreted as taking place in a single economy in real time. Rather, for economies specified at the country level, they should be interpreted as cross-country experiments. Thus, even though they are internally consistent, they are useless for many of the thought experiments we want to consider.

In a stochastic setting, it is straightforward to model shocks that take place in real time. The basic algorithm for conducting consistent experiments involving a shock to an exogenous variable is the following:

1. Consider an economy in which agents place a positive probability on at least two values of this variable.
2. Compute one equilibrium in which agents engage in all mutually beneficial trades and in which their expectations are confirmed.

3. Draw different time paths of realizations of the exogenous stochastic variables.
4. Compare equilibrium prices and allocations across these realizations.

In this setup we can compute cross-moments between any variables of interest. (For interesting examples of this algorithm, see Svensson [1985] and Stockman and Svensson [1985].)

For some variables, such as endowments or productivity, these experiments have a straightforward interpretation. However, for government policy variables the interpretation is less clear. In his paper, Stockman models government policies as exogenous stochastic variables. The policy experiments he considers are comparisons across realizations of these processes. How should we interpret such experiments? That depends on the underlying model of government behavior.

Suppose that we assume a government is a single administration that chooses a policy function to maximize its objectives. This function will have as arguments the state variables of the economy which include, among other things, all exogenous stochastic variables. As in Stockman's model, government policy will follow a stochastic process. However, there are some differences. Basically, we have pushed the exogenous uncertainty back to a deeper level: back from the level of an institution called the government to the more primitive level of agents' tastes and technology. As a result, policy introduces no new randomness into the economy. Of course, if we introduce shocks into the government objective function, government policy will add to the randomness. However, if we start building a model of these shocks, we will end up with them being functions of the original primitive shocks. Government policy will again introduce no new randomness. I will discuss the implication of this in a moment. For now, simply realize that in this interpretation we are investigating the operating characteristics of the economy under a single policy regime, where I define a *regime* to be a particular policy function of the government. Note that although we can give the word *regime* many reasonable definitions, I will use it in the concrete sense just described.

Suppose now, however, that we are interested in comparing outcomes across regimes. One way to do this is to specify two different objective functions for the government and then solve for two equilibria. In the first equilibrium, agents correctly believe that with probability 1 the government maximizes the first objective function; in the second equilibrium, agents correctly believe that with probability 1 the government maximizes the second objective function. Although we can compare the operating characteristics of these two regimes, we cannot interpret comparisons across these equilibria as real-time experiments for the same reasons as before.

There is, however, an alternative to this type of experiment. Suppose that the government is composed of a sequence of administrations with possibly differing objective functions. Suppose, for simplicity, that there are only two possible administrations and that for some as-yet-to-be-specified process the government switches randomly between them. Then, for each administration we can solve for a policy function, and we can solve for a single equilibrium and consistently compare across these regimes. As far as I know, this is the *only* way to compare regimes consistently in a way that can be interpreted as taking place in a single economy in real time. (For a good exposition of these ideas, see Cooley, LeRoy, and Raymon [1984].)

Since the main point of Stockman's paper is to show how the degree of completeness of markets can affect SCS results, he does not need to develop a deep model of government behavior. However, the nature of the underlying model is important for two reasons: it clarifies the possible interpretations of Stockman's experiments, and it helps us think about what financial markets we need in order to have complete markets.

In Stockman's model, the fundamental uncertainty is in government policy itself. In this setup, to have complete markets Stockman needs securities that pay off as functions of government policy. With casual reading, we may leave Stockman's paper with the mistaken impression that if we do not see securities that explicitly depend on government policies, then we necessarily have incomplete markets. With more careful reading, however, we realize that this is simply because Stockman took a useful shortcut in modeling government behavior. With a deeper model of government behavior, government policy will itself be a function of other stochastic variables, such as productivity. In this case, to have complete markets we do not need securities that depend on government policy directly; we only need to have enough securities that are correlated with the primitive stochastic elements.

Market Completeness and Stochastic Comparative Statics

Stockman's second purpose is to investigate how the degree of completeness of international financial markets affects the results of SCS. To show this, Stockman conducts experiments in two polar regimes: one with complete international financial markets and another with no international financial markets. The punchline of these examples is that the results may differ widely across the regimes.

Loosely speaking, the intuition for these examples is as follows. With complete markets, optimal behavior by agents involves eliminating all diversifiable income effects, while with incomplete markets, agents are artificially constrained so that they cannot eliminate all of these effects. In both cases, however, substitution effects remain. Then for a given

SCS experiment, if the substitution effects go in the opposite direction of the income effects, it is possible to have experiments that have opposite signs in the two cases. Basically, the income effects due to incomplete markets need to swamp the substitution effects.

Since Stockman's examples illustrate these points clearly, I will concentrate on answering this question: Why should we be interested in knowing how the completeness of markets affects SCS results?

A reason Stockman seems to favor is that the increasing sophistication of financial markets in countries like the United States means that we are moving from a regime of less complete markets to one of more complete markets. Thus, wisdom gleaned from the earlier stages of market development may soon prove faulty. I am not that comfortable with this motivation.

Another reason, which I find more appealing, is that this analysis may give us insight into which traditional trade theory results obtained using deterministic models will be overturned once we switch to stochastic models. This is because DCS results often are very similar to SCS results with incomplete markets. Basically, both get the income effects wrong in the same direction. Thus, if the completeness of markets overturns an SCS experiment under incomplete markets, it may also overturn the analogous DCS experiment.

A final reason is that Stockman's paper is the beginning of a research project that investigates the effects of incomplete markets more broadly. If this is true, then I would like to add a word of caution. We have learned from Harris and Townsend (1981) that in terms of thinking about what it means for government policy to be optimal, there is a world of difference between an environment in which incomplete markets are simply imposed and one in which markets are as complete as they can be, given the informational-spatial-communication structure.

If we are not careful, we may end up analyzing what Ed Prescott calls a "chicken model." The analysis of such a model goes something like this: First, assume that the private sector wants chickens but can't make them. Next, assume that governments can make chickens. The amazing policy result is that in equilibrium the government should make chickens and supply them to the private sector. I hope we have more exciting things to work on than this.

Of course, Stockman has not fallen into the chicken coop. Rather, he has provided us with a series of thought-provoking examples.

References

Backus, David K., and Patrick J. Kehoe. 1987. Trade and exchange rates in a dynamic competitive economy. Federal Reserve Bank of Minneapolis, Research Department working paper 348.

Cooley, Thomas F., Stephen LeRoy, and Neil Raymon. 1984. Modeling policy interventions. University of California, Santa Barbara. Mimeo.
Harris, Milton, and Robert M. Townsend. 1981. Resource allocation under asymmetric information. *Econometrica* 49:33–64.
Stockman, Alan C., and Lars E. O. Svensson. 1985. Capital flows, investment, and exchange rates. National Bureau of Economic Research, working paper 1598.
Svensson, Lars E. O. 1985. Money and asset prices in a cash-in-advance economy. *Journal of Political Economy* 93 (October): 919–44.

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