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1. Introduction

The development of international financial markets over the past several years (like the development of domestic markets in the U.S.) is proceeding at a record pace. Trade in foreign stocks has risen dramatically in the U.S. 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 why did they not develop 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 more developed international financial markets. Instead, the paper compares two worlds: one with and one without sophisticated international asset markets. 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-averse 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 the country B 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 an economist using 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 is allowed. Uncertainty about future government policy in the domestic country will induce risk-averse, expected-utility-maximizing domestic individuals to self-insure by saving. They 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 dissave 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 changes 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, etc. 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 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, subsequently, 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 (1985) have applied it to tariffs, and Stockman and Hernandez (1985) 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 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. The next three sections of the paper present examples of these effects on fiscal 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: substitution effects of policies will continue to operate. In Stockman and Dellas (1985), 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 present three examples in which the effects of fixed policy in an open economy are altered by the existence of sophisticated international financial markets. Section 2 examines a change in government spending under the assumptions that this spending play is productive and that nondistorting taxes are varied to maintain a balanced budget. Section 3

examines changes in distorting taxes holding fixed the government s budget deficit. Finally. section 4 examines changes in the budget deficit in an overlapping-generation model without Ricardian-equivalence.

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 to those in the absence of these markets.

Government spending can serve a variety of roles. and 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 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. etc. 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 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

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

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) and q(z) are domestic present-value state prices of X and Y at date t. e.g. 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

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

subject to

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

where stars 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. i.e. $p(z)/q(z) = p^*(z)/q^*(z)$ for every z.

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

$$(6) \qquad \begin{aligned} X &= \theta(g)X - \theta^*(g^*)x^* - g - g^* \\ \bar{Y} &= y - y^* \end{aligned}$$

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)

$$U'(x) = p\theta V'(y). \tag{7a}$$

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

and

$$p\bar{X} = p\theta x + y - pg . \tag{7c}$$

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 are then[4]

$$dx = (1/(\pi 1\pi 5 - \pi 2\pi 4))(\pi 3\pi 5\, dg - \pi 2\pi 6\, dg^*). \tag{8a}$$

and

$$dy = (1/(\pi 1\pi 5 - \pi 2\pi 4))(\pi 1\pi 6\, dg^* - \pi 3\pi 4\, dg). \tag{8b}$$

where

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

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 one. If r_y is close to one, 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 function is 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,

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

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

where ϕ is the ratio of the 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 (5) divided by the multiplier on (2).[5] Note that ϕ is a function of the probability

distribution F(z). but does not depend on realized values of g or g*. (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.

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

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

The coefficients 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.

3. Distorting Taxes

The previous section 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 the previous section, the results illustrate that any effects of policy that operate through redistributions 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 the last section, 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 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 stars 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 loans markets, the budget constraint can be simplified. The simplification reflects the zero net trades on internal asset markets due to the representative agent assumption. The budget constraint with only noncontingent international loans is effectively

$$(16) \qquad \alpha L - Tc - p(\alpha' L' - T'c') = 0,$$

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

Equilibrium conditions are

$$(17a) \qquad \alpha L + \alpha^* L^* = c + c^* + g + g^*,$$

and

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

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:

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

and

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

(18) follows from maximization of (13) subject to (16), and (19) follows from the analogous foreign maximization problem along with (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 (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

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

$$(22) \qquad U_1(c(z)) / U_2(1-L(z)) = T/\alpha.$$

$$(23) \qquad U^*_1[\alpha L(z)+\alpha^* L^*(z)-g-g^*-c(z)] / U_2^*(1-L^*(z)) = T^*/\alpha^*. \text{ and}$$

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

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 the last equation 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 (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 (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 (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 noncontingent 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 if 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, and 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 result is 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.

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 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. which 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 his 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 premia 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 one plus the one-period interest rate at t-1, σ^{t-1}/σ^t is one 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, aggregate consumption is then

$$C_t = (1-\sigma\delta)\, W_t \tag{25}$$

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

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

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

and

(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, I 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 one, some constant levels of government spending, taxes, and outputs (which, while they are constant for t=1,2,3,..., 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_1 is the future (t=1,2,...) value of x and R is an average present-value price. (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 dountry 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 (26)-(28) implies that the tax cut reduces R, i.e. raises the interest rate, raises domestic wealth, and lowers foreign wealth (see Frenkel and Razin).

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 I have 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

$$(29) \qquad W_0 = W_0^* = y_0 - (\tau_0 + \tau_0^*)/2 + PV_0(y - (\tau + \tau^*)/2) + B_{g0}.$$

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.

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 z#Z::IA::: 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 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 unable 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

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1. I do not want to (or need to, in this paper) 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 if maximized by g such that $x\theta'=-1$. Andrew Abel has correctly pointed out in his comments that while the world social optimum is characterized by $x\theta' = x^*\theta^{*\prime} = -1$, 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 (7c) into (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

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

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

which reduces to (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 (1) subject to (2) include, for every z and t,

$$\beta^* U'(x(z)) = \lambda\, p(z)\, \theta(g)$$

and

$$\beta^* V'(y(z)) = \lambda\, q(z).$$

Similarly, the foreign maximization problem yields necessary conditions

$$\beta^* U^{*\prime}(x^*(z)) = \lambda^* p^*(z) \theta^*(g^*)$$

and

$$\beta^* V^{*\prime}(y^*(z)) = \lambda^* q^*(z).$$

Dividing these equations, noting that state prices are equated internationally so $p(z) = p^*(z)$ and $q(z) = q^*(z)$, and using equlibrium conditions to eliminate $x^*(z)$ and $y^*(z)$, yields (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 magitude 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 (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 (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.

$$\alpha U_{11}(Tdc - cdT) = - TU_{22}dL - U_2dT$$

$$\alpha U_{11}(Tdc^* - cdT^*) = -TU_{22}dL^* - U_2dT^*$$

$$\alpha(dL-dL^*) = T(dc - dc^*) - c(dT - dT^*)$$

$$T^*U_{11}(Tdc - cdT) - U_1dT^* = TU_{11}(Tdc^* - cdT^*) - U_1dT.$$

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

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

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

and

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

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).

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